



DESIGN ASSURANCE ENGINEERING
Wireless Transceiver Bluetooth Test Report



FCC ID: A94422914 IC: 3232A-422914

Test Type: Emissions Immunity

Product Type: Wireless Speaker

Product Name/Number: Model Number: 422914
FCC ID: A94422914
IC: 3232A-422914

Prepared For: Design Assurance Engineering Department,
Bose Corporation

Test Results: Pass Fail

Applicable Standards: FCC CFR 47 Part 15 Subpart C
Industry Canada RSS-247 Issue 2
Industry Canada RSS-GEN Issue 4

Report Number: EMC.422914.17.108.1

	Print Name	Signature	Date
Prepared By:	Bryan Cerqua	<i>Bryan Cerqua</i>	April 18, 2017
Electrical Engineer Review* By:	Michael Royer	<i>Michael Royer</i>	April 18, 2017

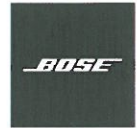
* Since every test result is separately reviewed after its completion, the electrical engineer review indicated above represents a higher level review to ensure this report lists and contains all applicable and appropriate requirements.

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 of the reviewer to ensure the A2LA advertising policy is followed.



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1. Test Report Summary

Product Information:

Description:

The EUT is a battery powered wireless speaker that contains Bluetooth/BLE radio integrated circuit.
The EUT does not operate while being charged.

The following three samples were used for testing:
SN2 (connectorized unit) for conducted RF measurements.
SN1, SN3 (normal samples) for radiated measurements.

Setup (Cables and Accessories):

Radiated emission and power line conducted emission were performed with the EUT playing IEC pink noise over the BT link. EUT is not sold with a power supply so when necessary a Bose part number 745559-0030 power supply was used for charging

EUT Antenna Description:

The antenna is a PCB etch antenna with maximum antenna gain of 1.84dBi, non-removable.

Software / Firmware:

The firmware installed in the EUT during testing was version 0.7.21.524
The test utility software used during testing was Polycomm, version 0.2.0.0 and CSR Blue Suite version 2.6.2.

Scope:

This report covers EMC standards / requirements.

FCC 15B, FCC 15.247, RSS 247 (issue 2), RSS Gen (issue 4)

Test Objective:

Verify product meets all applicable EMC requirements.

Results:

Product complies with all applicable EMC requirements. All results represent worst-case final emissions.

Conclusions:

The device under test (D.U.T.):

meets all test standards listed in 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	Bryan Cerqua	<i>Bryan Cerqua</i>	April 18, 2017
Testing Engineer/Technician	Karl Klemm	<i>[Signature]</i>	April 18, 2017



Test Standards

Emissions:

	Standard
<input checked="" type="checkbox"/>	FCC Part 15C (15.247)
<input checked="" type="checkbox"/>	Canada RSS-247 (issue 2)
<input checked="" type="checkbox"/>	Canada RSS-GEN (issue 4)

Environmental Conditions

Ambient:

Temperature:	22±4°C
Humidity:	30-60%RH
Mains Voltage:	<input checked="" type="checkbox"/> 120VAC

2. DTS Bandwidth (6 dB)

Requirement:

FCC 15.247 (a) (2)

IC RSS-247 5.2 (1)

The minimum 6 dB bandwidth shall be at least 500 kHz

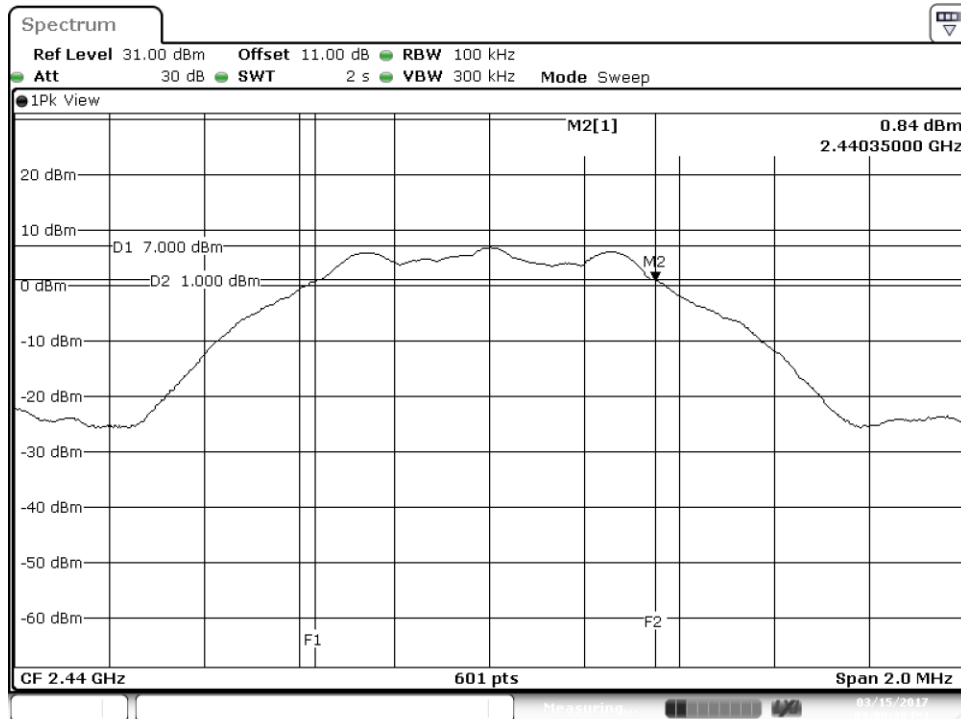
Test Procedure:

The transmitter output is connected to a spectrum analyzer, RBW = 100 kHz, the markers are positioned 6 dB down from the peak. The 6 dB BW is the difference between the two markers.

Test Results:

6 dB Bandwidth Summary Table (BLE)						
Channel	Frequency (MHz)	Mode	DTS BW (kHz)	Limit (kHz)	Margin (kHz)	Result
Low	2402	BLE	716.7	500	-216.7	Pass
Middle	2440	BLE	716.7	500	-216.7	Pass
High	2480	BLE	710.0	500	-210.0	Pass

Representative screen shot showing how the measurement was made.



3. 99% Bandwidth

Requirement:

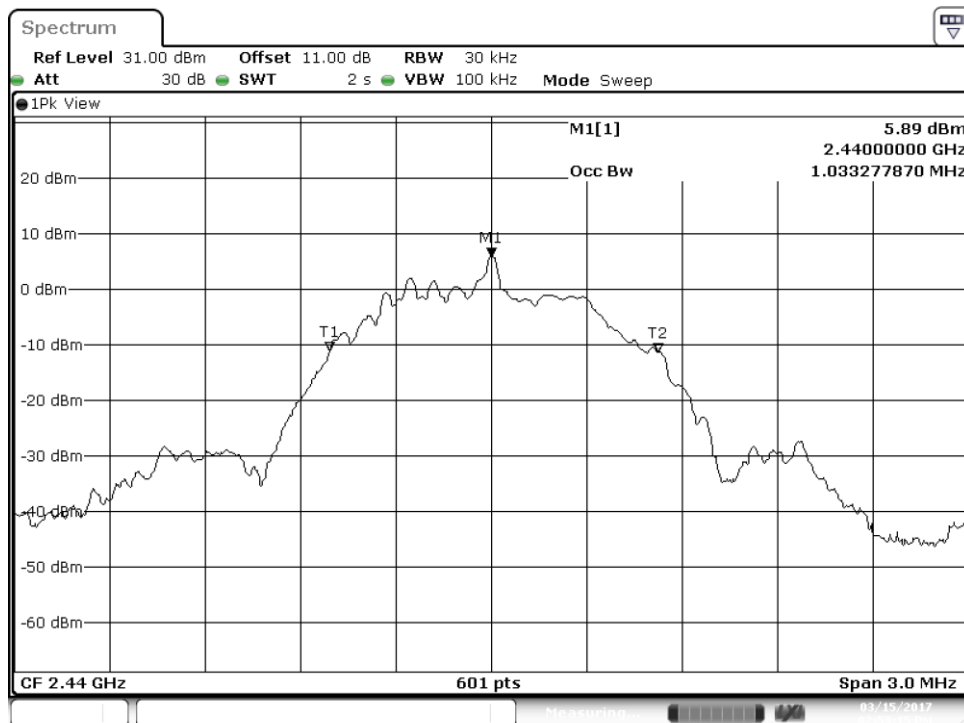
None: For reporting purposes, only.

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.

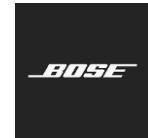
99% Bandwidth Summary Table (BLE)			
Channel	Frequency (MHz)	Mode	99% Bandwidth (kHz)
Low	2402	DH5	1028.3
Middle	2440	DH5	1033.3
High	2480	DH5	1033.3

Representative screen shot showing how the measurement was made.



Plot2 99 Percent BW BLE 2440 MHz

Date: 15.MAR.2017 14:59:15



4. 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 DTSs 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:

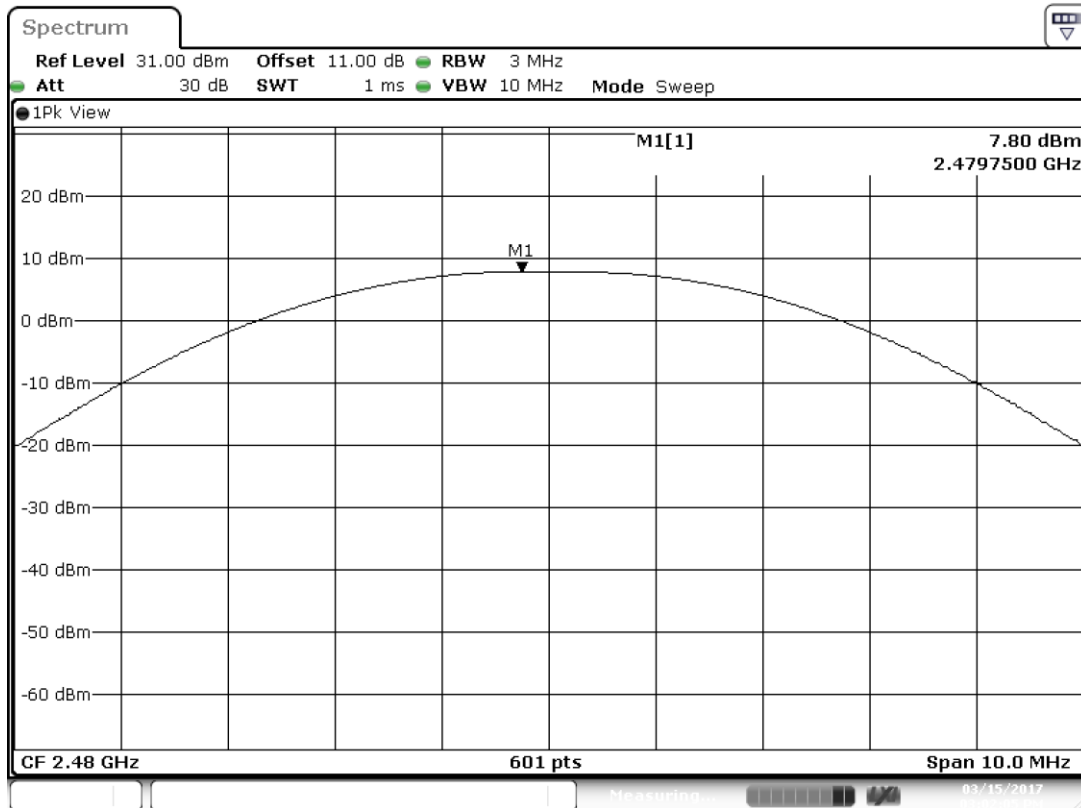
The EUT is controlled via the USB port with CSR's Blue Suite software which is used to set the test modes of the Bluetooth device. The EUT antenna is disconnected. A temporary test connector is mounted to the PCB. An 8 inch u.FL to SMA adapter cable with 1 dB loss was used for all conducted measurements. To compensate for the cable loss, the reference level offset feature of the spectrum analyzer was used. 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 in both basic and enhanced data rates.

Test Results:

Output Power Summary Table (BLE)						
Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2402	5.82	0	30	24.18	Pass
Middle	2440	6.92	0	30	23.08	Pass
High	2480	7.80	0	30	22.20	Pass



Conducted power measurement (Representative screen shot, 2480 MHz)



Plot3 BLE Power 2480 MHz
Date: 15.MAR.2017 15:02:05

* Reference level offset = u.FL to SMA cable + 10 dB Pad = 11 dB

5. Power spectral density

Requirements:

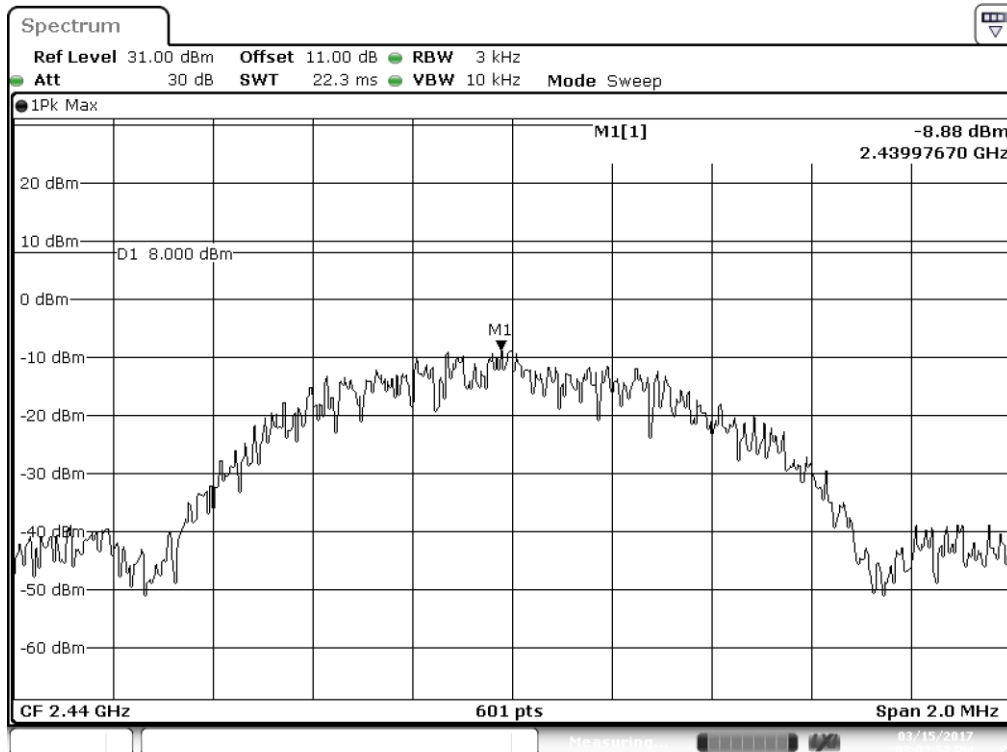
FCC 15.247 (e), IC RSS-247 5.2 (2)

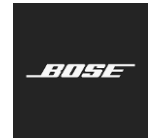
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Results:

Power Spectral Density Summary Table (BLE)					
Channel	Frequency (MHz)	PSD (dBm)	Limit (dB)	Margin (dB)	Result
Low	2402	-10.06	8	18.06	Pass
Middle	2440	-8.88	8	16.88	Pass
High	2480	-7.92	8	15.92	Pass

Power spectral density measurement (Representative screen shot, 2440 MHz)





5. 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.

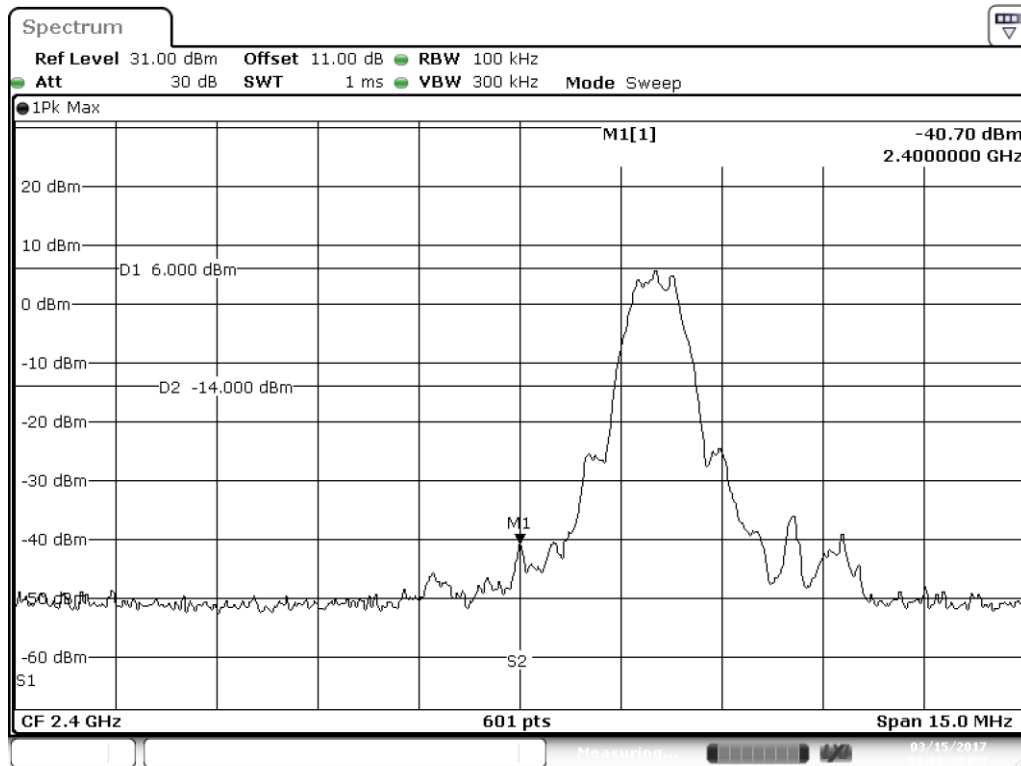
Note: Antenna gain outside of the operating band was assumed to be 0 dBi. The conducted spurious readings are for additional information as the radiated readings take precedence.



Spurious Band-edge Emissions

Lower band edge

Lower Band Edge (BLE)						
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
Low	2402	BLE	46.70	20	26.70	Pass

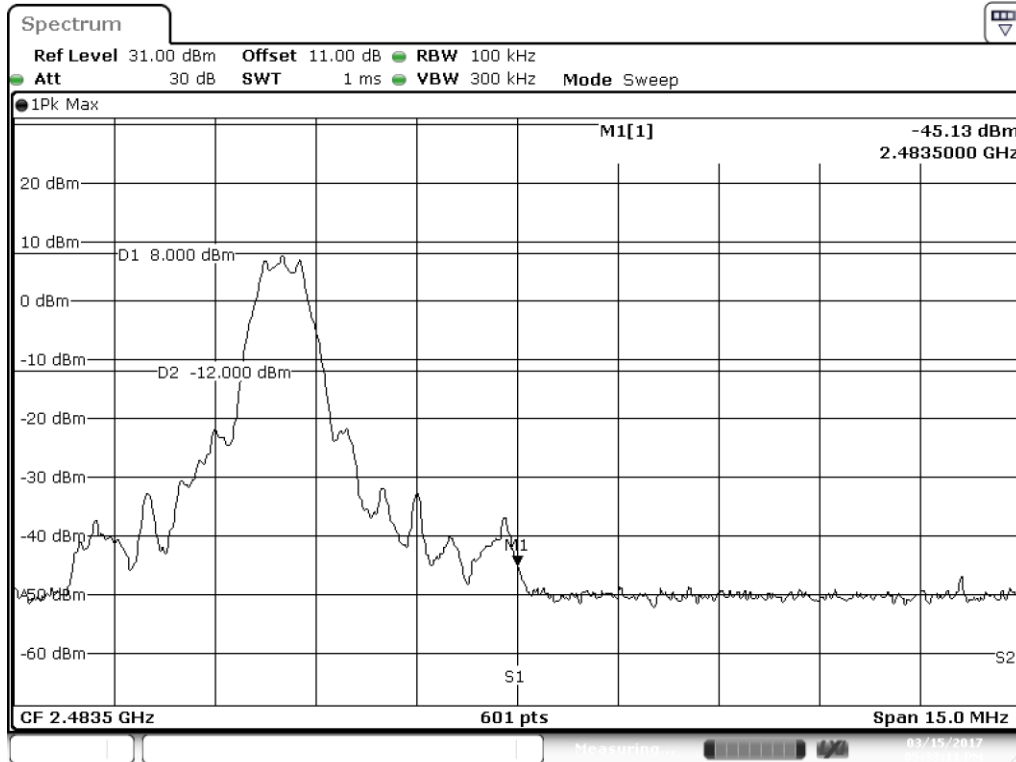


Plot1 Lower Band Edge BLE PK 2402 MHz

Date: 15.MAR.2017 15:03:42

Upper band edge

Upper Band Edge (BLE) (Peak Detector)						
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
High	2480	BLE	53.13	20	33.13	Pass



Plot1 Upper Band Edge BLE Peak 2480 MHz
Date: 15.MAR.2017 17:33:11

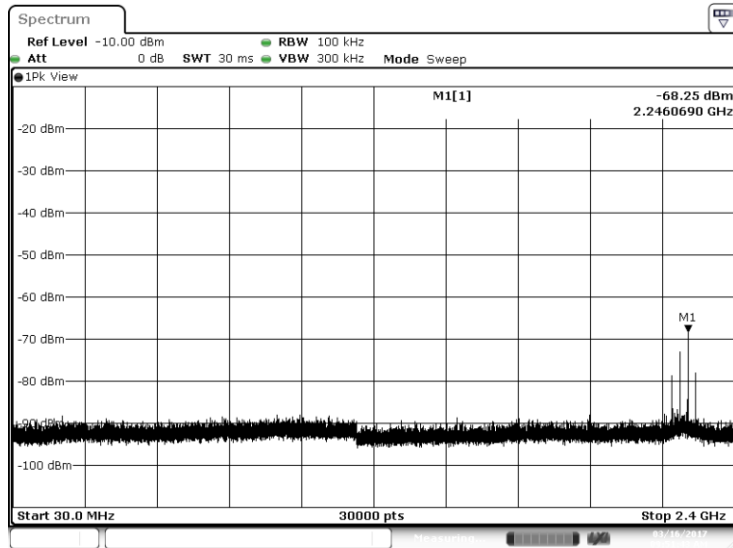
Conducted spurious emissions (pre-screen)

For these readings, a 2.4 GHz band notch filter and 10 dB Pad was used to protect the EMI receiver from overload. The 10 dB Pad provides impedance matching when transmitting into the 2.4 GHz notch filter. The conducted measurement is converted into an equivalent E field value, a narrower RBW = 100 kHz was used for this pre-screen. Later in section 6 of this report the required radiated measurements will be done using a RBW = 1 MHz.

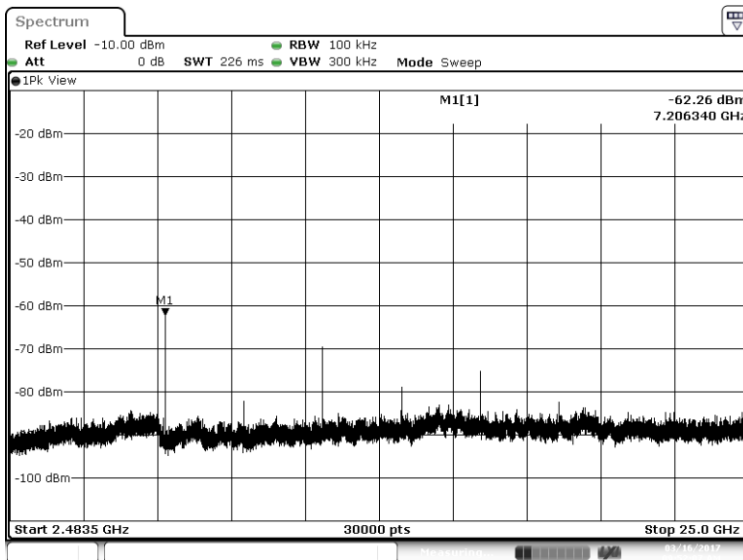
Basic rate (DH5) 1 Mbps showed highest worst case emissions.

Low channel (2402 MHz)

Spurious Summary Table (BLE)											
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 2400	BLE	-68.2	1.0	10.0	0.0	-57.2	37.98	74	36.02	Pass
Low	2483.5 To 25000	BLE	-62.3	1.0	10.0	0.0	-51.3	43.97	74	30.03	Pass



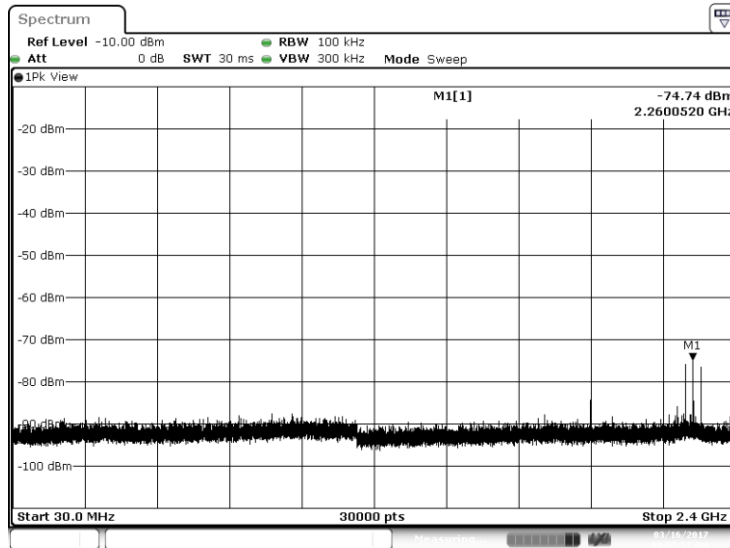
Plot1 BLE 2402 MHz Peak Band 1
Date: 16.MAR.2017 09:51:42



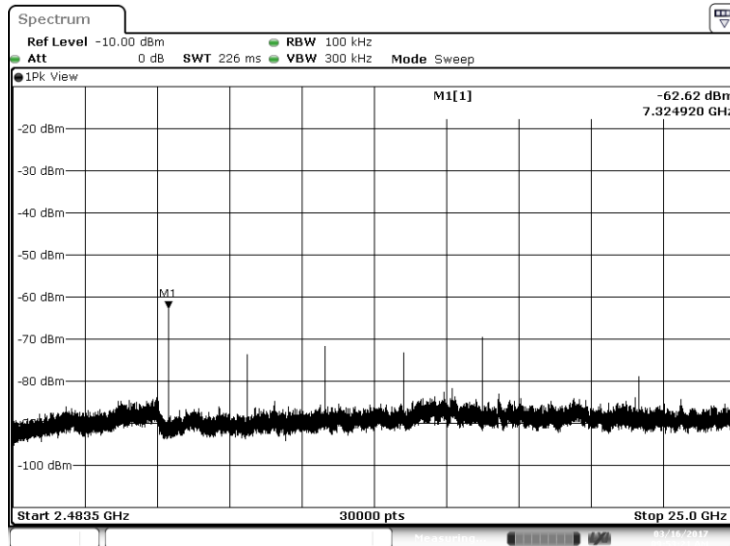
Plot2 BLE 2402 MHz Peak Band 2
Date: 16.MAR.2017 09:52:07

Mid channel (2442 MHz)

Spurious Summary Table (BLE)											
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Result
Mid	30 To 2400	BLE	-74.7	1.0	10.0	0.0	-63.7	31.49	74	42.51	Pass
Mid	2483.5 To 25000	BLE	-62.6	1.0	10.0	0.0	-51.6	43.61	74	30.39	Pass



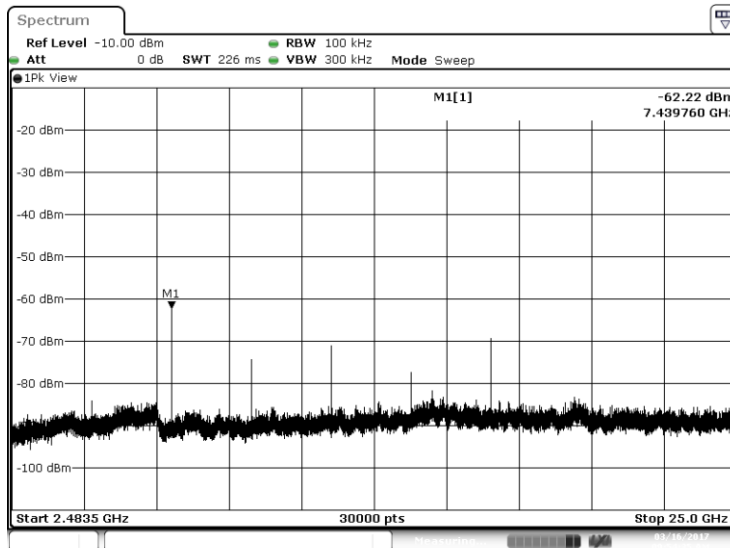
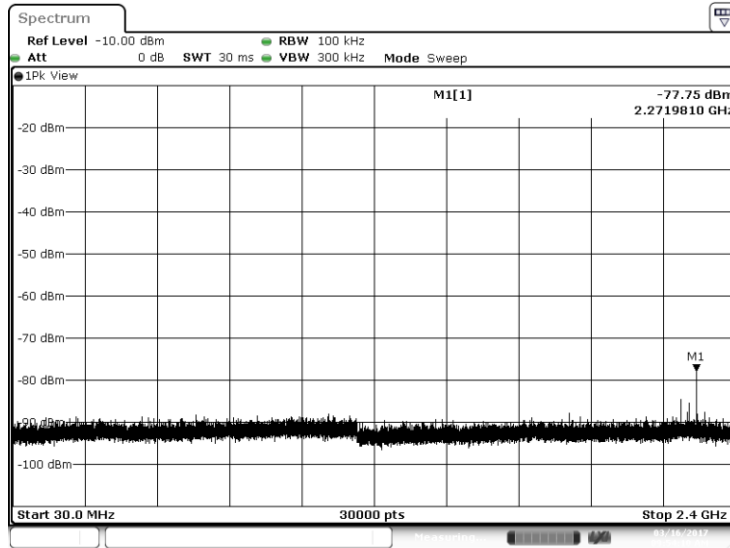
Plot1 BLE 2442 MHz Peak Band 1
Date: 16.MAR.2017 09:52:56



Plot2 BLE 2442 MHz Peak Band 2
Date: 16.MAR.2017 09:53:21

High channel (2480 MHz)

Spurious Summary Table (BLE)											
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Result
High	30 To 2400	BLE	-77.7	1.0	10.0	0.0	-66.7	28.48	74	45.52	Pass
High	2483.5 To 25000	BLE	-62.2	1.0	10.0	0.0	-51.2	44.01	74	29.99	Pass





6. Radiated Emissions

Requirements:

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

In any of the restricted bands defined in FCC part 15.209(a) & 15.205(a) the field strength at a distance of 3 meters shall not exceed 54dB μ V/m (average) or 74dB μ V/m (peak)

Test Setup:

The EUT is placed in a standard ANSI C63.10 test setup. Standard gain horn antennas with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the harmonics.

For band edge measurements, the EUT is operated with hopping active in addition to hopping stopped while operating on the lowest and highest frequencies. 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. 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. The measurement distance is 3 meters.

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 1 GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013. An average detector was used and a duty cycle correction factor was added, BLE duty cycle with maximum is 60 %. Actual usage use case duty cycle is less than 5 %.

Radiated emissions below 1 GHz

EUT operated in Bluetooth mode playing pink noise at maximum volume paired with iPod.
BLE is actively beaconing (transmitting) out on the 3 BLE advertising channels.

Vertical and Horizontal antenna polarizations combined.

(SN3)



Date: 31.MAR.2017 09:43:35

FCC 15B Class B Product (Residential) @ 3 Meters									
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)
215.500	38.10	41.60	43.5	N/A	5.4	N/A	360	H	1.5

Marker 2: Peak is below the QP limit, no measurement performed.

EUT is being charged (reported battery state is 30%)

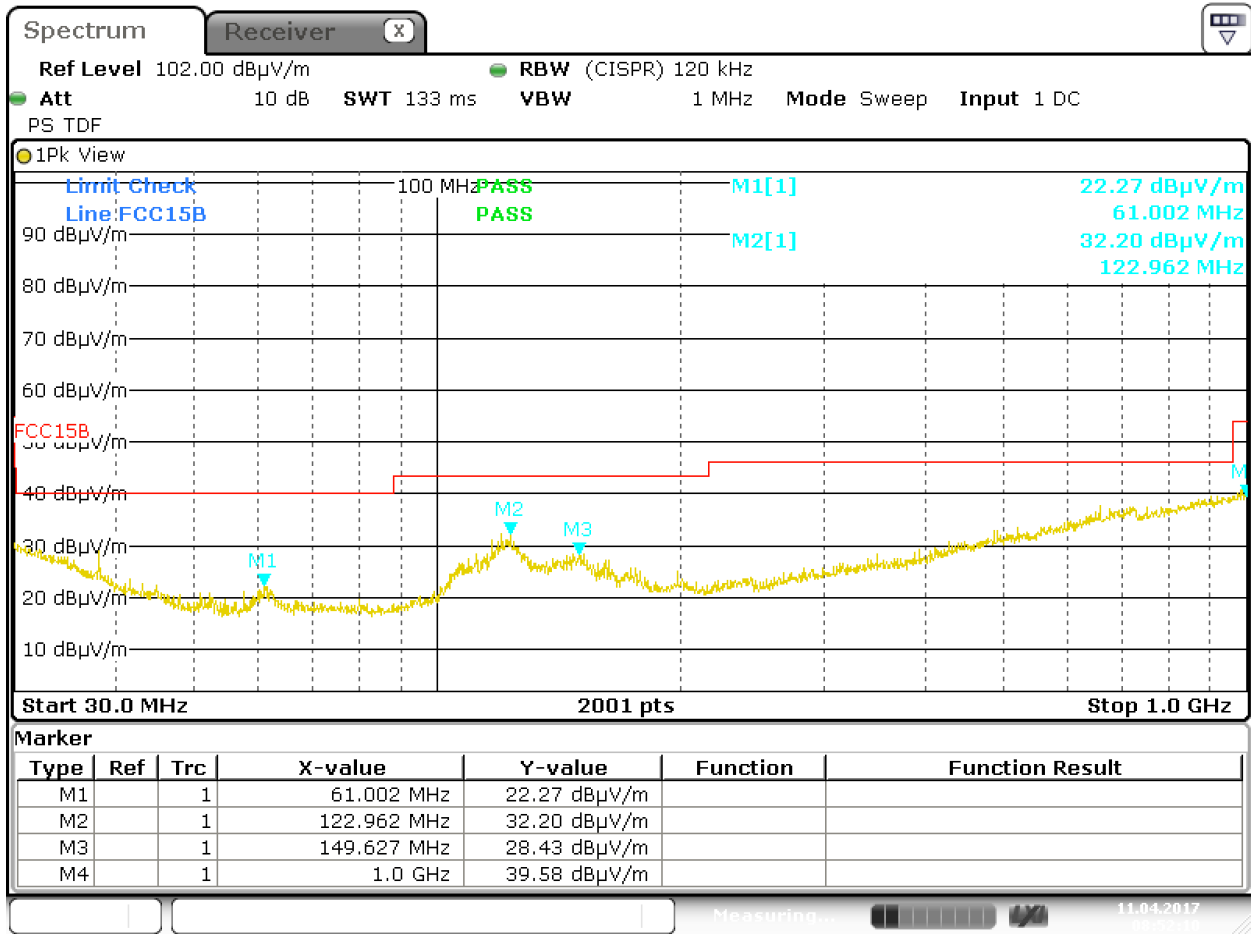
EUT does not operate while being charged.

Supporting equipment: Bose USB 5V one amp power supply, model 329679

Power supply is plugged into 120VAC 60 Hz.

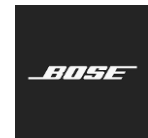
SN3:

Vertical and Horizontal antenna polarizations combined.



Date: 11.APR.2017 08:52:11

FCC 15B Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes / Mode
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
122.960	20.90	32.80	43.5	N/A	22.6	N/A	360	V	1.0	Charging mode (Bose champ type power supply)



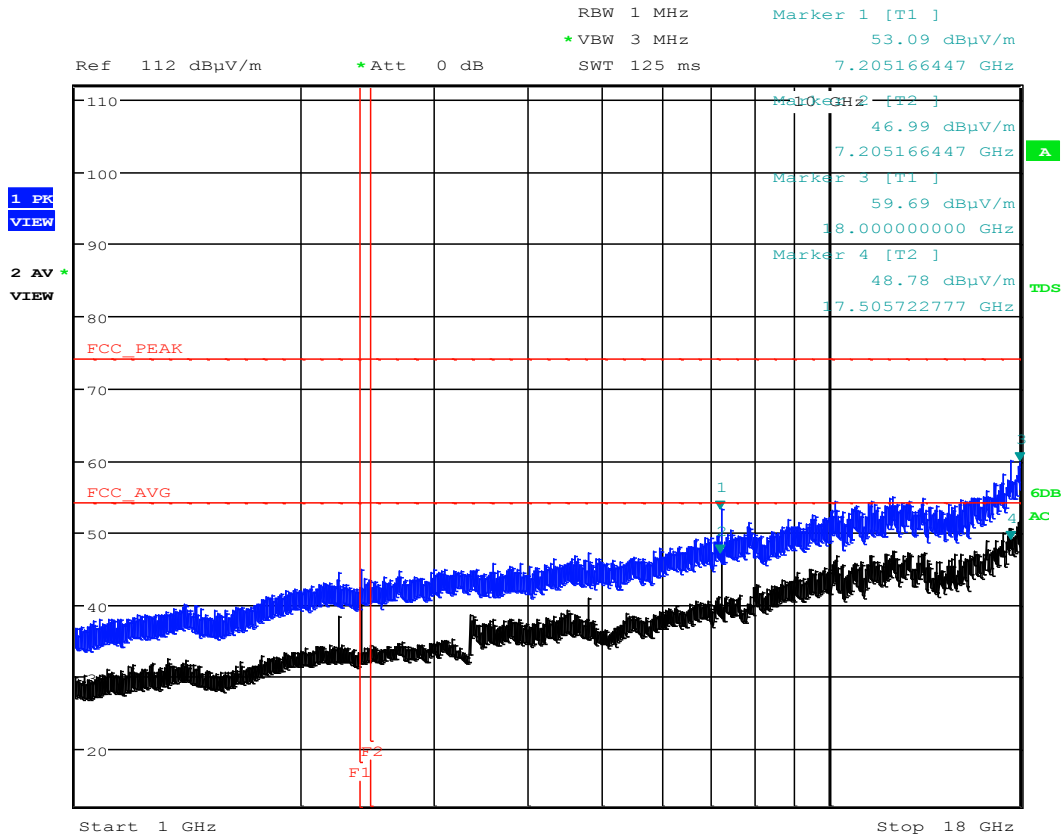
Transmitter harmonics & spurious above 1 GHz

For these readings, a notch filter was used to protect the external preamp from overload. For the plots capturing the entire frequency range the EUT was measured with hopping active as well as on the low, middle and high frequencies.

Vertical and Horizontal antenna polarizations combined.

EUT X Orientation, (BLE TX on 2402 MHz)

1 to 18 GHz



VHAP BLE 2402 1 18G

Date: 18.APR.2017 10:52:10

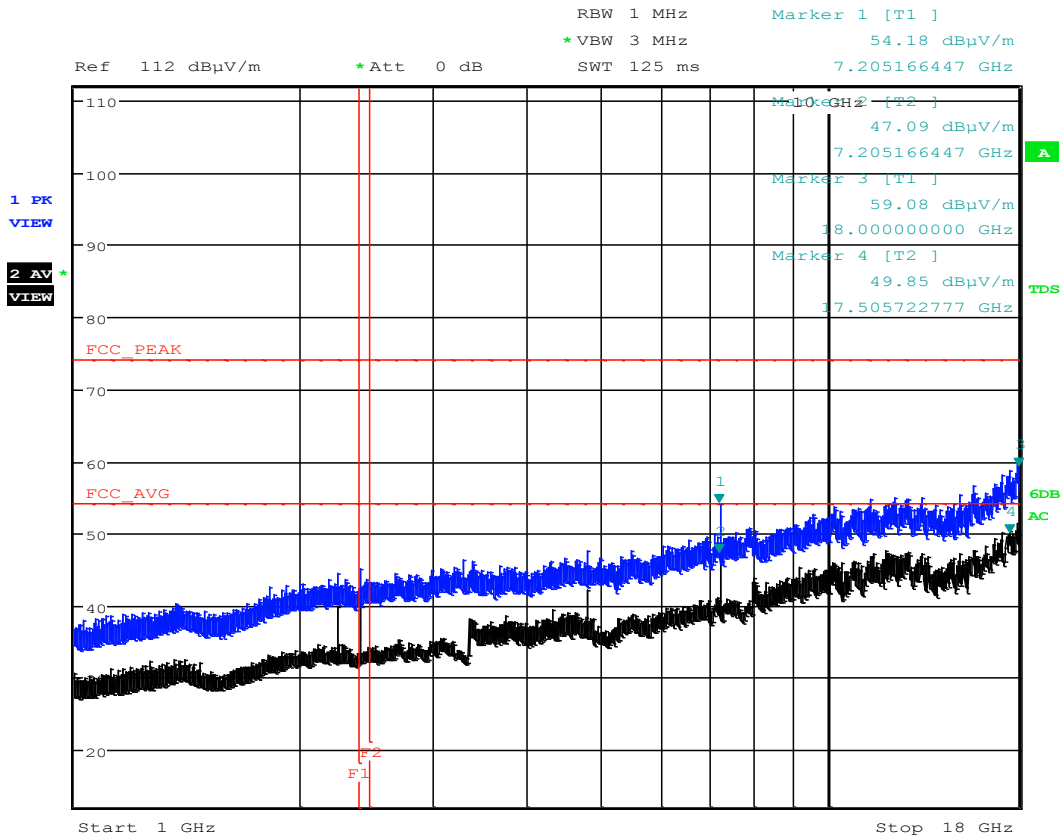
Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
 Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report



Vertical and Horizontal antenna polarizations combined.

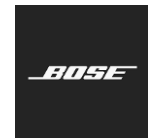
EUT Y Orientation, (BLE TX on 2402 MHz)

1 to 18 GHz



VHAP BLE 2402 1 18G Edge Y
Date: 18.APR.2017 11:14:35

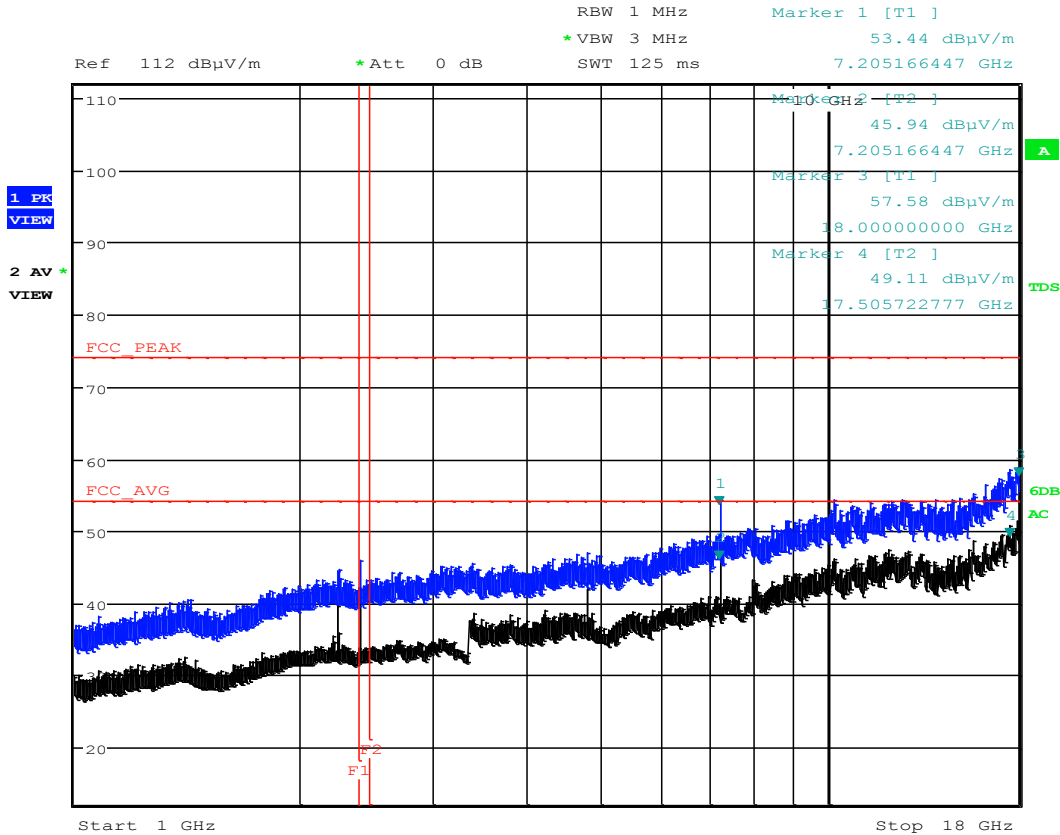
Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report.



Vertical and Horizontal antenna polarizations combined.

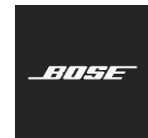
EUT Z Orientation, (BLE TX on 2402 MHz)

1 to 18 GHz



VHAP BLE 2402 1 18G UP Z
 Date: 18.APR.2017 11:07:06

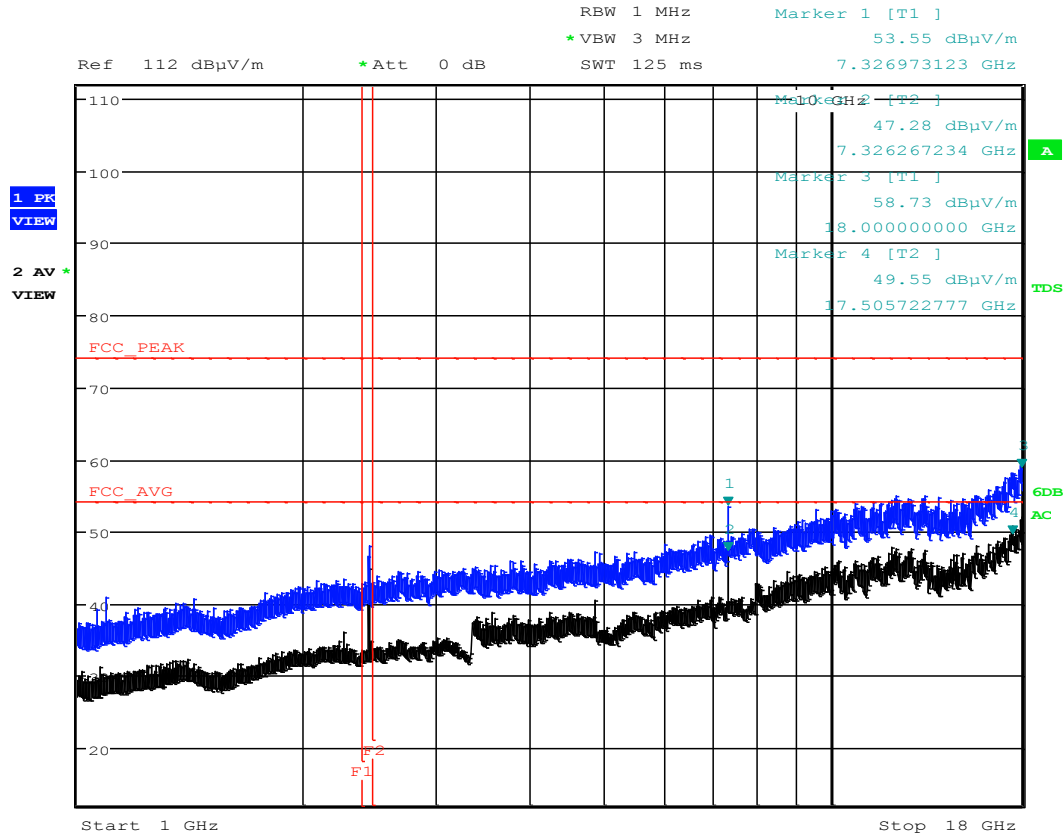
Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
 Frequencies at marker 2 is the 3rd harmonic and will be measured later in this report



Vertical and Horizontal antenna polarizations combined.

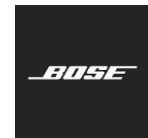
EUT X Orientation, (BLE TX on 2442 MHz)

1 to 18 GHz



VHAP BLE 2442 1 18G Flat X
 Date: 18.APR.2017 11:24:04

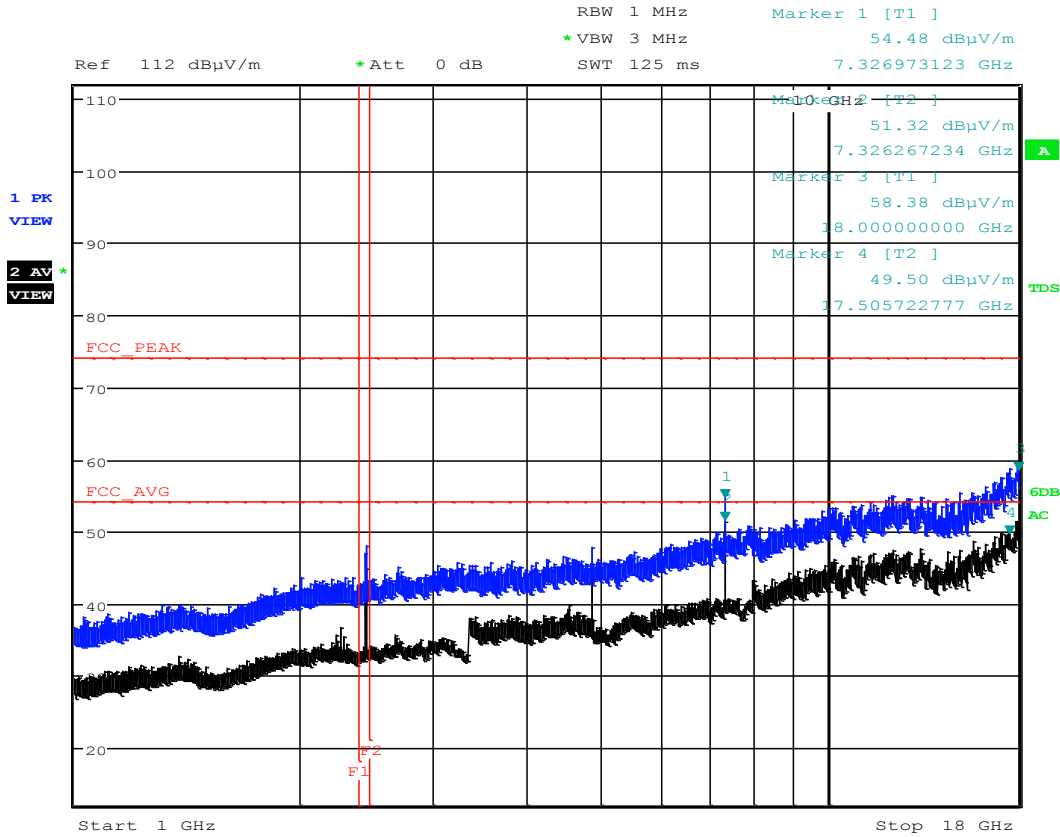
Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
 Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report



Vertical and Horizontal antenna polarizations combined.

EUT Y Orientation, (BLE TX on 2442 MHz)

1 to 18 GHz



VHAP BLE 2442 1 18G Edge Y

 Date: 18.APR.2017 11:32:58

Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.

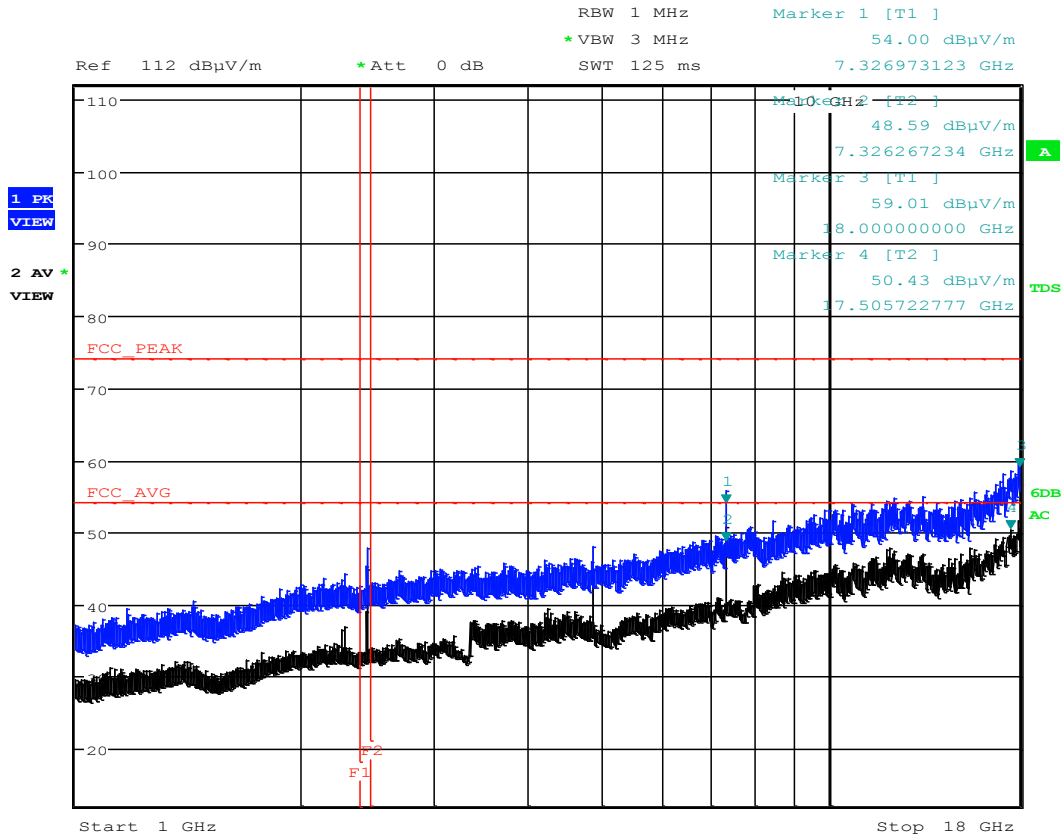
 Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report



Vertical and Horizontal antenna polarizations combined.

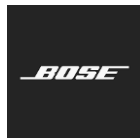
EUT Z Orientation, (BLE TX on 2480 MHz)

1 to 18 GHz



VHAP BLE 2442 1 18G UP Z
 Date: 18.APR.2017 11:37:31

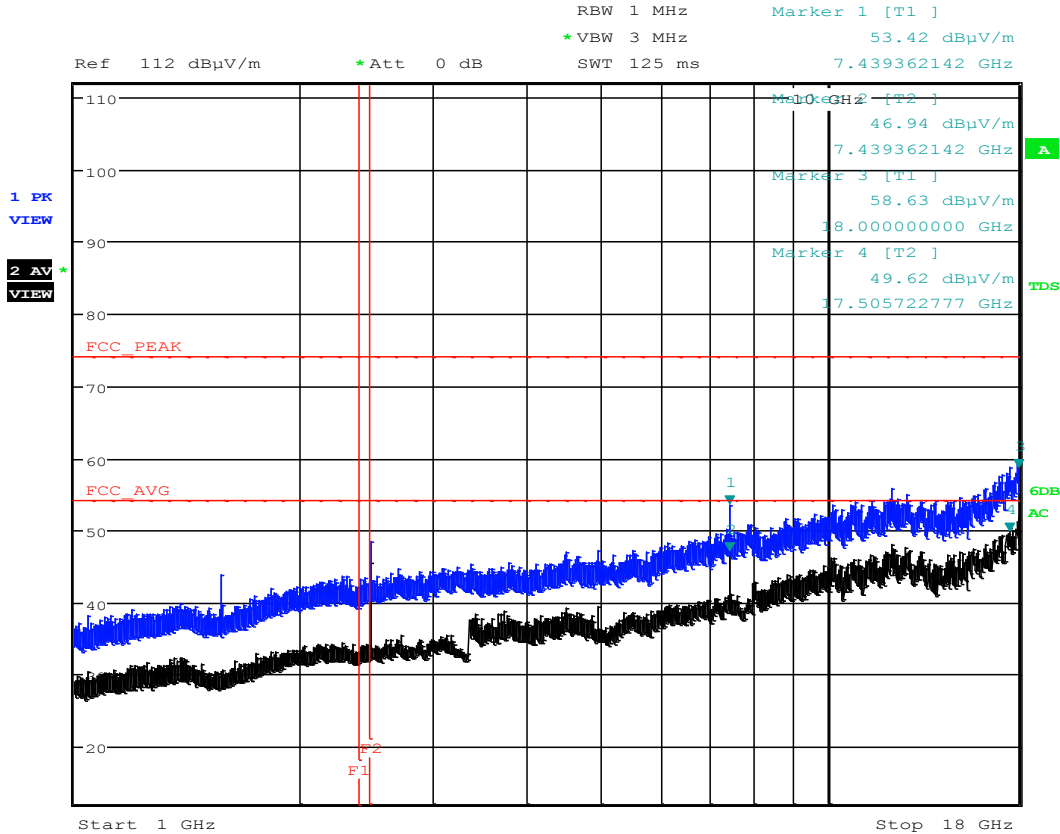
Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
 Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report



Vertical and Horizontal antenna polarizations combined.

EUT X Orientation, (BLE TX on 2480 MHz)

1 to 18 GHz



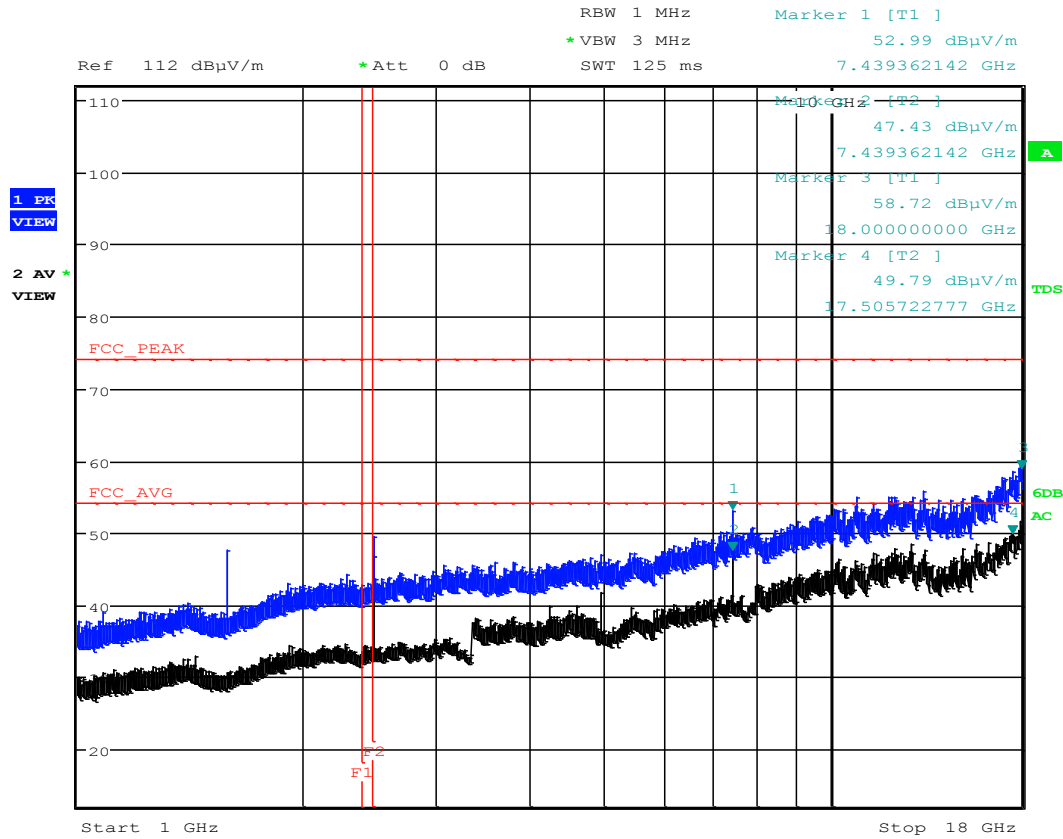
VHAP BLE 2480 1 18G Flat X
Date: 18.APR.2017 11:44:22

Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report

Vertical and Horizontal antenna polarizations combined.

EUT Y Orientation, (BLE TX on 2480 MHz)

1 to 18 GHz

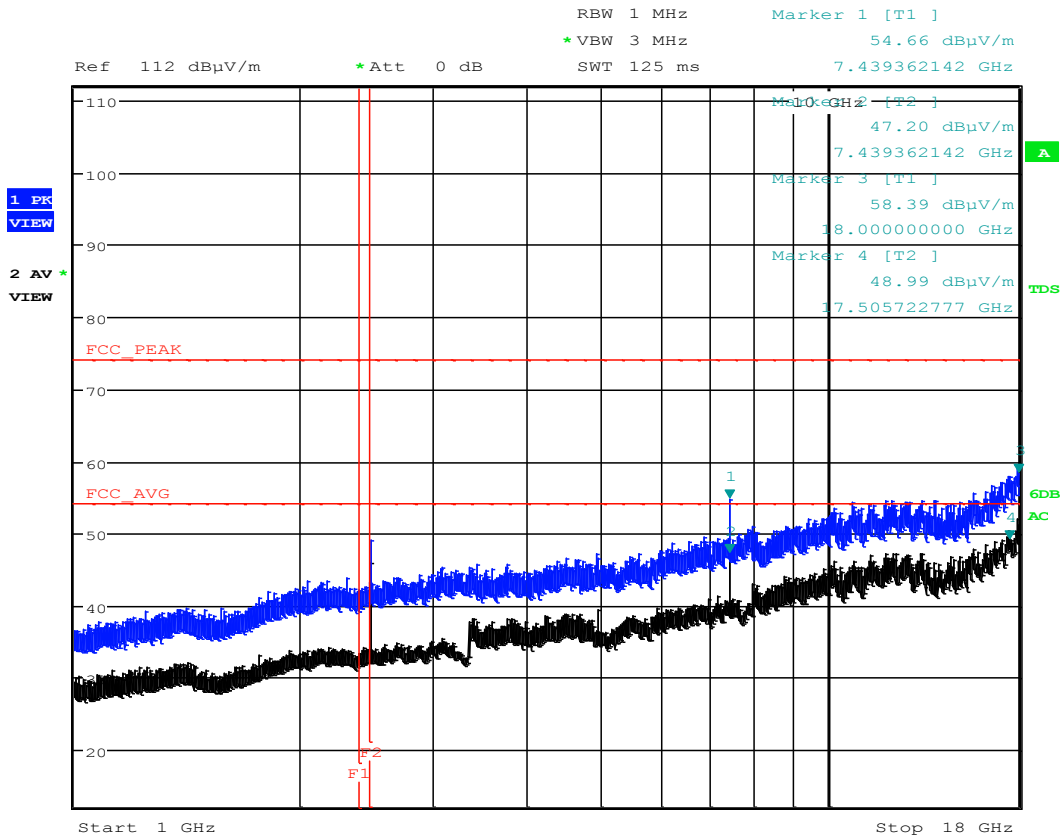


VHAP BLE 2480 1 18G Edge Y
Date: 18.APR.2017 11:51:58

Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report

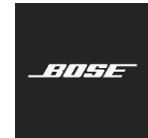


Vertical and Horizontal antenna polarizations combined.
 EUT Z Orientation, (BLE TX on 2480 MHz)
 1 to 18 GHz



VHAP BLE 2480 1 18G UP Z
 Date: 18.APR.2017 11:57:38

Frequencies between the F1 and F2 vertical lines are the fundamental attenuated by the 2.4 GHz notch filter.
 Frequencies at marker 1 is the 3rd harmonic and will be measured later in this report



3rd harmonic measurements performed in analyzer in receiver mode (R&S ESU)

Measurement time = 1 second

Note: FCC 15.205 restricted band for 3rd harmonics: 7.25 to 7.75 GHz.

For fundamental frequencies between 2417 & 2480 MHz have 3rd harmonics in the FCC 15.205 restricted band.

FCC 15B Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBμV/m) QP/AVG*	Measured Amplitude (dBμV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz.
			Limit (dBμV/m) QP/AVG*	Limit (dBμV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
7206.000	41.10	53.70	54.0	74.0	12.9	20.3	269	V	0.203	BLE TX on 2402 MHz. (On edge, Y orientation)
7206.000	40.80	53.20	54.0	74.0	13.2	20.8	284	H	0.197	BLE TX on 2402 MHz. (On edge, Y orientation)
7326.000	42.40	54.80	54.0	74.0	11.6	19.2	247	V	0.172	BLE TX on 2442 MHz. (On edge, Y orientation)
7326.000	42.10	54.60	54.0	74.0	11.9	19.4	271	H	0.197	BLE TX on 2442 MHz. (On edge, Y orientation)
7440.000	42.50	54.60	54.0	74.0	11.5	19.4	171	V	0.172	BLE TX on 2480 MHz. (On edge, Y orientation)
7440.000	40.24	54.60	54.0	74.0	13.8	19.4	129	H	0.223	BLE TX on 2480 MHz. (On edge, Y orientation)

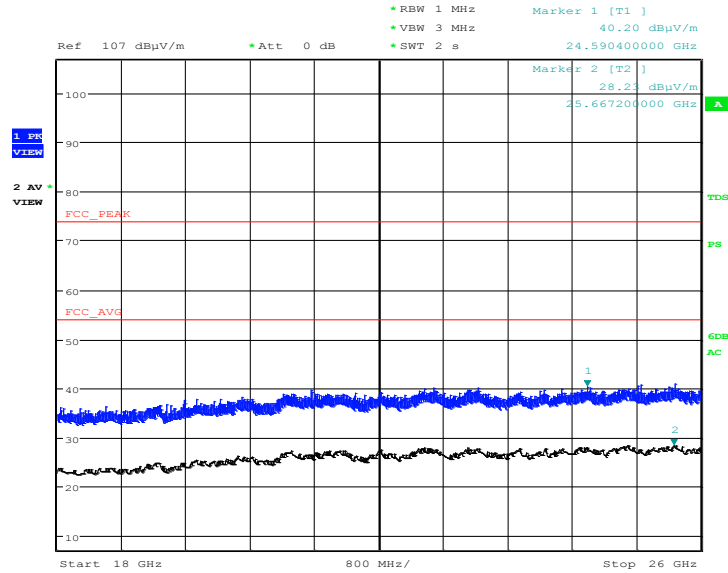
Duty cycle correction factor for 60% duty cycle = $20 \cdot \log(1/0.6) = 4.4$ dB

Worst case average reading $42.5 + 4.4 = 46.9$ dBuV/m < 54 dBuV/, (7.1 dB Margin).



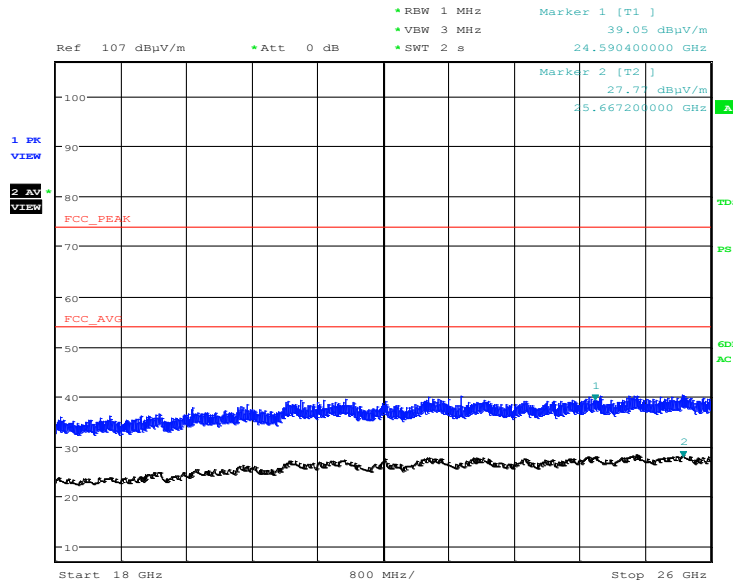
18 to 26 GHz

BLT TX on 2442 MHz (Vertical antenna polarization)



Date: 29.MAR.2017 13:25:08

BLT TX on 2442 MHz (Horizontal antenna polarization)



Date: 29.MAR.2017 13:28:40

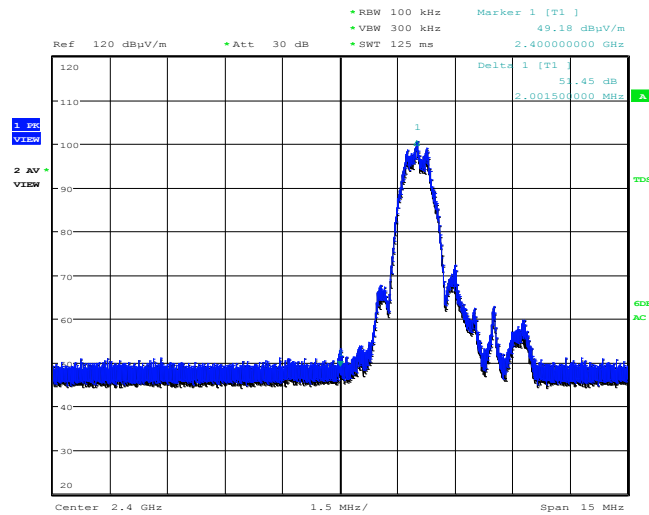
No emissions above the noise floor observed.

Band edge radiated emission measurements:

EUT tested per ANSI C63.10 2013 section 6.10, table data not suitable for reporting band edge emissions.

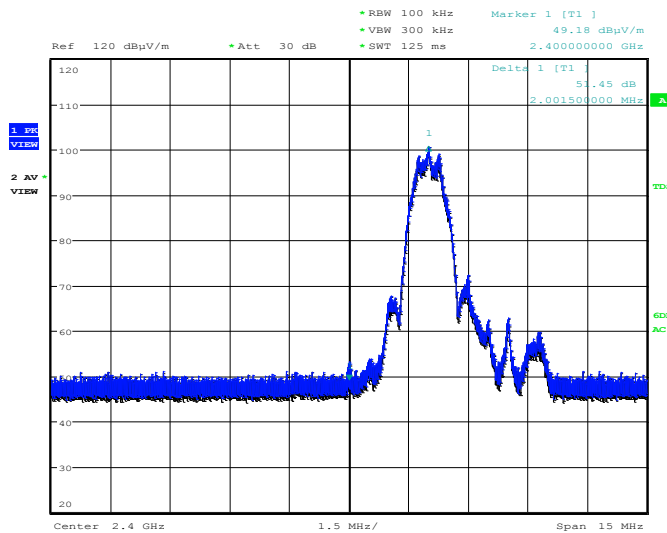
Lower band edge (BLE TX on 2402 MHz):

Vertical antenna polarization



VAP BLE 2402 LBE
Date: 18.APR.2017 09:47:24

Horizontal antenna polarization

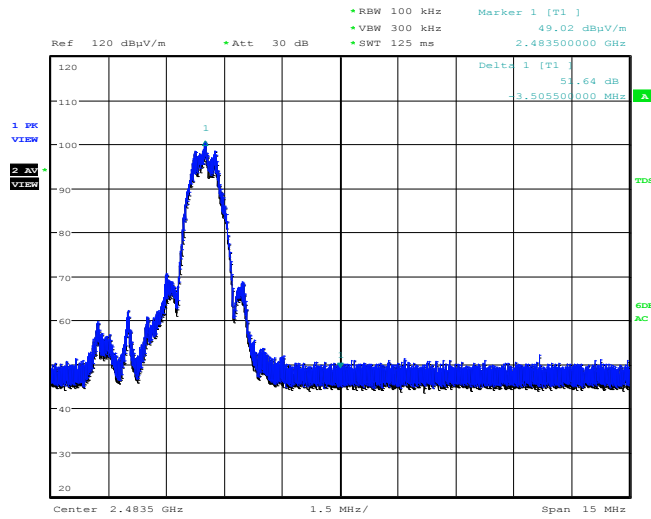


VAP BLE 2402 LBE
Date: 18.APR.2017 09:47:24

More than 20 dBc measured.
Sweep points set to 30,001.

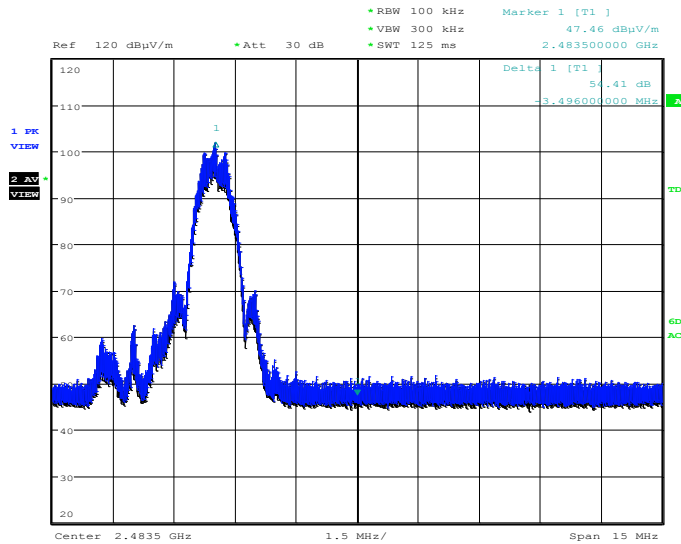
Lower band edge (BLE TX on 2480 MHz):

Vertical antenna polarization



VAP BLE 2480 UBE
Date: 18.APR.2017 10:02:15

Horizontal antenna polarization



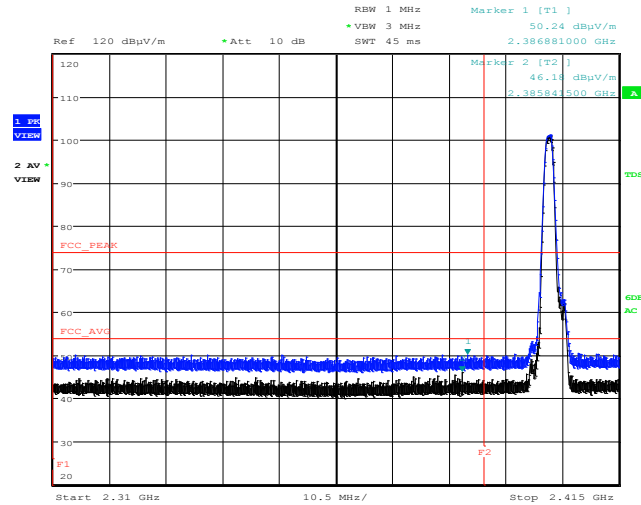
HAP BLE 2480 UBE
Date: 18.APR.2017 09:59:32

More than 20 dBc measured.

Restricted band radiated emissions

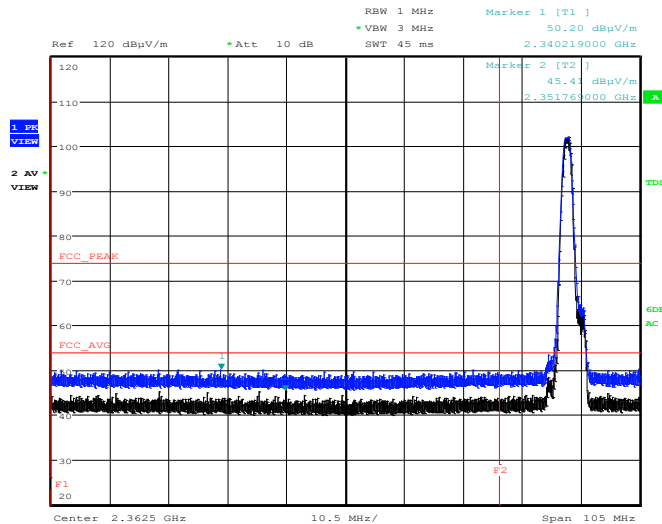
Lower restricted band (BLE TX on 2402 MHz)

Vertical antenna polarization



VAP BLE 2402 LRB
 Date: 18.APR.2017 10:13:07

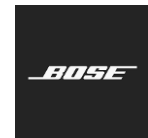
Horizontal antenna polarization



HAP BLE 2402 LRB
 Date: 18.APR.2017 10:16:53

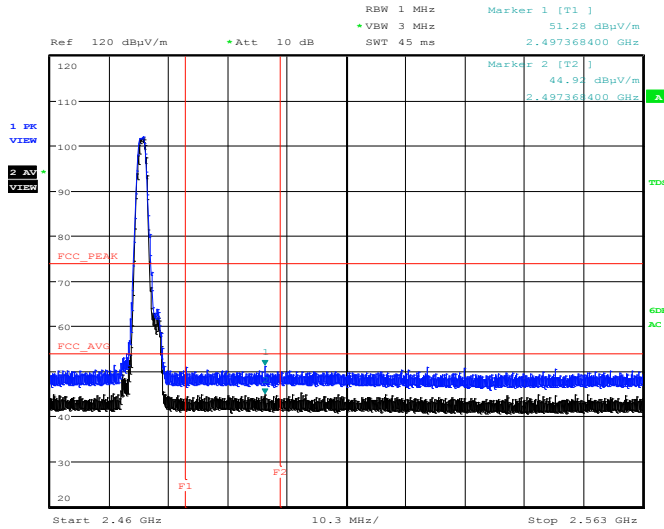
Frequency search limit lines at 2310 & 2390 MHz.

Peak emissions below the average limit.
 Sweep points 30,001



Upper restricted band (BLE TX on 2480 MHz)

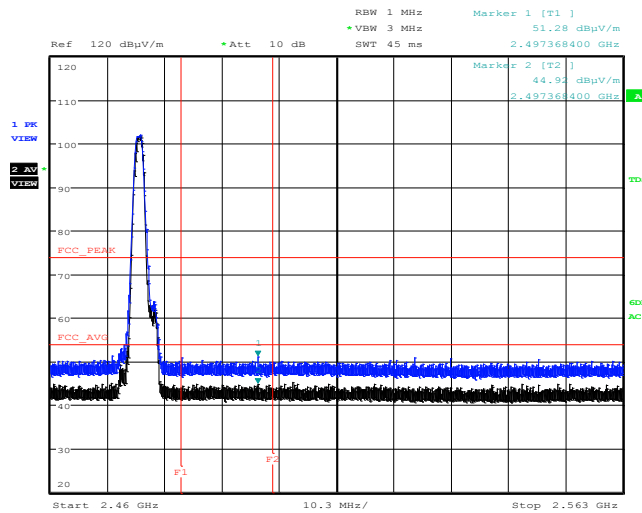
Vertical antenna polarization



HAP BLE 2480 URB

 Date: 18.APR.2017 10:29:46

Horizontal antenna polarization



HAP BLE 2480 URB

 Date: 18.APR.2017 10:29:46

Frequency search limit lines at 2483.5 & 2500 MHz.

 Peak emissions below the average limit.



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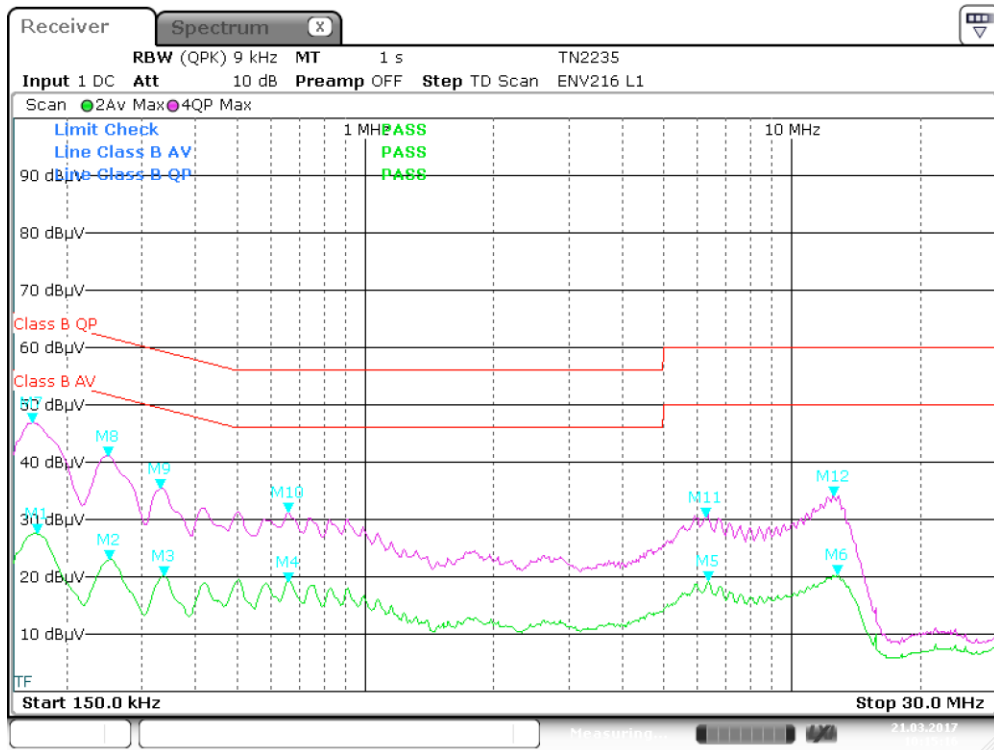
FCC ID: A94422914 IC: 3232A-422914



7. AC Mains Conducted Emissions

EUT is in charging mode with 5V USB power supply.
EUT does not operate while charging.

Max Hold plot: 150 kHz to 30 MHz, Line (120 V, 60 Hz)

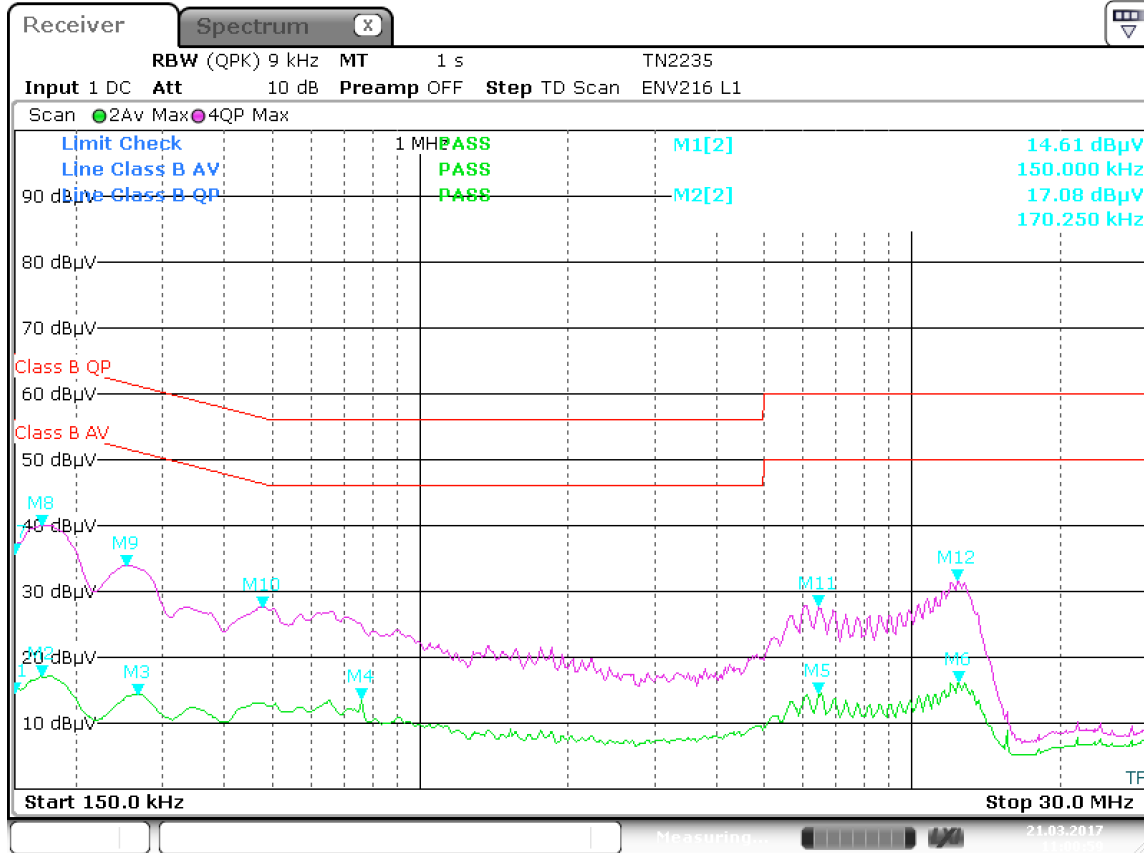


Date: 21.MAR.2017 10:15:17

FCC 15B Class B, CISPR 13, CISPR 22 Class B Product							
Frequency MHz	MEASURED		LIMIT		MARGIN		Notes
	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG	
0.1703	40.50	17.40	64.9	54.9	24.4	37.5	Line
0.1703	40.50	17.40	64.9	54.9	24.4	37.5	Line
0.2558	34.20	14.40	61.6	51.6	27.4	37.2	Line
0.2648	33.90	14.50	61.3	51.3	27.4	36.8	Line
12.3338	31.90	16.20	60.0	50.0	28.1	33.8	Line
11.9985	31.40	16.20	60.0	50.0	28.6	33.8	Line
0.4763	27.70	13.00	56.4	46.4	28.7	33.4	Line
0.1500	35.90	15.00	66.0	56.0	30.1	41.0	Line
0.7620	25.00	13.60	56.0	46.0	31.0	32.4	Line
6.4568	27.90	14.70	60.0	50.0	32.1	35.3	Line
6.4613	27.90	14.70	60.0	50.0	32.1	35.3	Line
15.6863	12.50	9.10	60.0	50.0	47.5	40.9	Line

Passes FCC limits by 24.4 dB at 0.1703 MHz (QP measurement) on the Line side

Max Hold plot: 150 kHz to 30 MHz, Neutral (120 V, 60 Hz)



Date: 21.MAR.2017 11:00:59

FCC 15B Class B, CISPR 13, CISPR 22 Class B Product							
Frequency MHz	MEASURED		LIMIT		MARGIN		Notes
	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG	
0.1703	40.10	17.10	64.9	54.9	24.8	37.8	Neutral
0.1703	40.10	17.10	64.9	54.9	24.8	37.8	Neutral
0.2535	34.00	14.10	61.6	51.6	27.6	37.5	Neutral
0.2670	33.50	14.40	61.2	51.2	27.7	36.8	Neutral
12.3630	31.80	16.20	60.0	50.0	28.2	33.8	Neutral
12.4418	31.80	16.20	60.0	50.0	28.2	33.8	Neutral
0.4785	27.70	13.00	56.4	46.4	28.7	33.4	Neutral
0.1500	35.70	14.60	66.0	56.0	30.3	41.4	Neutral
0.1500	35.70	14.60	66.0	56.0	30.3	41.4	Neutral
0.7620	25.00	13.70	56.0	46.0	31.0	32.3	Neutral
6.4703	27.90	14.50	60.0	50.0	32.1	35.5	Neutral
6.4613	27.90	14.50	60.0	50.0	32.1	35.5	Neutral

Passes FCC limits by 24.8 dB at 0.1703 MHz (QP measurement) on the Neutral side.



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8. Equipment list

Used For	Tracking Number	Description	Model	Make	Most recent calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
RE Below 1 GHz	TN1375	Positioner	SC99V	Sunol Sciences	NA	NA		
RE Below 1 GHz	TN2319	EMI Analyzer	ESR26	Rohde & Schwarz	4/14/2016	4/14/2017		
RE Below 1 GHz	TN644	3m Chamber	AP191	Rantec	5/23/2016	5/3/2017		4/23/2017
RE Below 1 GHz	TN1541-3	Antenna	JB6	Sunol Sciences	10/24/2016	10/24/2017		
RE Below 1 GHz	TN2077	Pre-Amp	Bose	MN ZX60-3018G+			4/23/2016	4/23/2017
RE Below 1 GHz	TN2281	iPod	4G	Apple	NA	NA	NA	NA
RE Above 1 GHz	TN2602	Pre-Amp	AFS42-01001800-28-10P-42	Miteq			1/8/2016	1/7/2018
RE Above 1 GHz (3/29/2017)	TN1663	EMI Analyzer	ESU40	Rohde & Schwarz	4/6/2016	4/6/2017		
RE Above 1 GHz (After 4/7/2017)	TN1663	EMI Analyzer	ESU40	Rohde & Schwarz	4/5/2017	4/6/2018		
RE Above 1 GHz	TN2414	2.4 GHz Notch Filter	BRM50702-07	Micro-Tronics			3/29/2016	3/29/2018
RE Above 1 GHz	TN2385	Chamber	3 Meter	AP Americas			11/24/2015	11/24/2018
RE Above 1 GHz	TN1757	Pre-Amp	JS4018004000-30-8P-A1	Miteq			1/8/2016	1/7/2018
RE Above 1 GHz	TN1596	Horn	AT4640	Amplifier Research	NA	NA	NA	NA
RE Above 1 GHz	TN2349	Horn	3117	ETS Lindgren	11/23/2016	11/23/2017		
RE Above 1 GHz	TN2368	Cable	TRU-210	TRU			1/8/2016	1/7/2018
RE Above 1 GHz	TN2342	2.4 GHz Notch Filter	BRM50702-07	Micro-Tronics			3/29/2016	3/29/2018
RF Conducted	TN2342	2.4 GHz Notch Filter	BRM50702-07	Micro-Tronics			3/29/2016	3/29/2018
RF Conducted (3/15/2017)	TN2408	EMI Analyzer	FSV40	Rohde & Schwarz	4/5/2016	4/5/2017		
RF Conducted (After 4/6/2017)	TN2408	EMI Analyzer	FSV40	Rohde & Schwarz	4/5/2017	4/5/2018		
AC Mains CE	TN2235	LISN	ENV216	Rohde & Schwarz	12/3/2015	12/2/2017		
AC Mains CE	TN2247	EMI Analyzer	ESR7	Rohde & Schwarz	4/4/2017	4/4/2018		



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DESIGN ASSURANCE ENGINEERING Wireless Transceiver Bluetooth Test Report

FCC ID: A94422914 IC: 3232A-422914



9. Measurement uncertainty

AC Mains conducted emissions 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 emission uncertainty (30 MHz – 1 GHz)

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 emissions above 1 GHz

Uncertainty Budget				
Title:	Radiated Emissions above 1 GHz			
Source of Uncertainty	Value units:±/- dB	Distribution	Divisor	Uncertainty (± dB)
RF spec anal-level-Ref.	0.6	Rect.	1.73	0.35
RF spec anal-level-Freq resp.	1.0	Rect.	1.73	0.58
RF spec anal-level-Display	0.3	Rect.	1.73	0.17
RF spec anal-level-QP det.	1.0	Rect.	1.73	0.58
Antenna factor	0.9	Norm.	2.00	0.45
Preamp corr. Factor	0.5	Rect.	1.73	0.29
Cable corr. Factor	0.5	Rect.	1.73	0.29
Combined uncertainty (RSS):				1.09
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				2.18

Conducted RF measurements

Uncertainty Budget				
Title:	Conducted RF measurements			
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Analyzer - absolute level	0.3	Rect.	1.73	0.17
Analyzer - frequency response	0.5	Rect.	1.73	0.29
Analyzer - attenuator switching	0.2	Rect.	1.73	0.12
Analyzer - bandwidth switching	0.2	Rect.	1.73	0.12
Analyzer - display	0.5	Rect.	1.73	0.29
Cable correction factor	0.5	Norm.	2.00	0.25
Combined uncertainty (RSS):				0.54
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				1.07

End of Report