Prüfbericht-Nr.: *Test Report No.:*	60266327-002	**Auftrags-Nr.:** *Order No.:*	23870157
Kunden Referenz-Nr.: Client Reference No.:	-	**Auftragsdatum** *Order date:*	2019-02-26
Auftraggeber: *Client:*	3M Company 410 E. Fillmore Ave, St. Paul, MN, 55144-1000 USA	Pär Rundqvist par.rundqvist@mmm.com +46 370694200	
Prüfgegenstand: *Test item:*	WS Protac Xpi		
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	Model: MT15H7AWS6-111	FCC ID: Y9ZMT15H7WS6	
Auftrags-Inhalt: *Order content:*	Partial FCC Certification testing –Bluetooth classic and Bluetooth Low Energy radio		
Prüfgrundlage: *Test specification:*	FCC Part 15 Subpart C 15.205 & 15.209 FCC Part 15 Subpart B 15.109 ANSI C63.4-2014 & ANSI C63.10-2013		
Wareneingangsdatum: *Date of receipt:*	2019-02-26		
Prüfmuster-Nr.: *Test sample No.:*	A000224206-001		
Prüfzeitraum: *Testing period:*	2019-03-25 => 2019-04-08		
Ort der Prüfung: *Place of testing:*	Lund, Sweden		
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland Sweden		
Prüfergebnis: *Test results:*	Pass		

Geprüft von *Tested by:*	Stefan Olsson Test Engineer		**Kontrolliert von** *Reviewed by:*	Per Isacsson Lab Manager	
2019-12-02			2019-12-02		
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sontiges /*Other:*

Only Radiated Emissions, FCC Rule parts 15.109, 15.205, 15.209 are covered in this report

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts.

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Revisions ***Revisions***			
Revision Revision	**Datum** Date	**Anmerkung** Remark	**Verfasser** Author
001	2019-09-19	First release	Stefan Olsson
002	2019-12-02	-Page 14: Extrapolation factor changed to 20log(3/1). -Pages 20/26/32/38/44/50/56: corrected limit lines in the graphs.	Stefan Olsson
Note: Latest revision report will replace all previous reports			

Summary of Test Results

FCC Rule Part	Test item	Result	Remarks
15.107 15.207	AC POWER CONDUCTED EMISSION	N/A	Battery powered only
15.205 15.109 15.209	RADIATED EMISSIONS	PASS	Meets the requirement of limit
15.247(a)(2)	6dB BANDWIDTH	n.p	
15.247(b)(3)	OUTPUT POWER	n.p	
15.247(d)	OUT OF BAND EMISSIONS	n.p	
15.247(d)	100 kHz Bandwidth of Frequency Band Edges	n.p	
15.247(e)	POWER SPECTRAL DENSITY	n.p	
15.203	ANTENNA REQUIREMENT	n.p	

Possible test case verdicts:

- test case does not apply to the test object ....: N/A
- test object does meet the requirement .....: PASS
- test object does not meet the requirement ....: FAIL
- test case not performed on the test object ....: n.p.

Table of contents

1 Test Sites 5
2 Product Information 6
2.1 General description 6
2.2 Radio specific details 6
2.2.1 Bluetooth Low Energy radio 6
2.2.2 Bluetooth Classic radio 7
2.3 Equipment Under Test (EUT) identification 7
2.4 Ancillary equipment identification 8
3 Test Methods and Operation modes 8
3.1 Test Methods 8
3.2 Operation modes 8
3.2.1 Tested channels/Frequencies 9
4 Test Methodology 10
4.1 Radiated Emission Test 10
5 Test Results 13
5.1 Radiated emissions 13
5.2 Test setups 14
5.3 Test results 15
5.3.1 Bluetooth classic 15
5.3.2 Bluetooth Low Energy (BLE) 33
5.3.3 Idle 51
6 Test Equipment List 57
7 Measurement Uncertainty 58
8 Appendix 1 – Test Setup photos 58

1 TEST SITES

Testing facility

TÜV Rheinland Sweden AB
Mobilvägen 10
223 62 Lund
Sweden

FCC Test Firm Registration Number: 517458

2 PRODUCT INFORMATION

2.1 General description

Model name:	WS Protac Xpi
Manufacturer:	3M Peltor
Model number:	MT15H7AWS6-111
FCC ID:	Y9ZMT15H7WS6
Description:	Bluetooth hearing protector
Supported Radio Technologies:	Bluetooth Low Energy – 2402 MHz – 2480 MHz Bluetooth Classic – 2402 MHz – 2480 MHz
Highest internal frequency	2480 MHz
Supply Voltage to Product:	User replaceable battery (2 AA batteries)
Ancillary Equipment:	See section 2.4

2.2 Radio specific details

2.2.1 Bluetooth Low Energy radio

Operating Frequency Range	2402 MHz – 2480 MHz
Radio Protocol	Bluetooth Low Energy
Channel Spacing	2 MHz
Number of channels	40
Modulation	GFSK
Number of antennas	1
Antenna type	Internal PCB antenna
Antenna gain	+6,55dBi

2.2.2 Bluetooth Classic radio

Operating Frequency Range	2402 MHz – 2480 MHz
Radio Protocol	Bluetooth Classic
Channel Spacing	1 MHz
Number of channels	79
Modulation	GFSK π/4-DQPSK 8-DPSK
Number of antennas	1
Antenna type	Internal PCB antenna
Antenna gain	+6,55dBi

2.3 Equipment Under Test (EUT) identification

TÜV Rheinland ID	S/N	HW	SW
A000224206-001	-	K404Ava04	k404-csr-application ver 0.1.2

2.4 Ancillary equipment identification

TÜV Rheinland ID	Type	Model	Manufacturer	S/N
A000224206-009	Cable		3M Peltor	

3 TEST METHODS AND OPERATION MODES

3.1 Test Methods

The following standards/references has been considered for the testing

Standard	Description
FCC Part 15 (Subpart C)	§15.205 Restricted bands of operation
FCC Part 15 (Subpart B)	§15.109 Radiated emission limits; general requirements, unintentional radiators
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements, intentional radiators
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system and hybrid system devices operating under §15.247 of the FCC rules

3.2 Operation modes

Testing was performed at the lowest operating frequency, at the operating frequency in the middle of the specified frequency band and at the highest operating frequency of each supported technology as per below.
A special test software was used to enable the continuous transmission at max output power of each channel. Bluetooth Classis was tested with DH5 packages. This is considered as worst cases.

3.2.1 Tested channels/Frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
Bluetooth classic (2.4 GHz)	0	2402
	39	2440
	78	2480
Bluetooth Low Energy (2.4 GHz)	37	2402
	17	2440
	39	2480

4 TEST METHODOLOGY

4.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the turntable on an 80cm high table for below 1 GHz & 1.5 m height for above 1 GHz measurement, for frequencies up to 18GHz the EUT is 3 meters far from the measuring antenna, above 18GHz the distance is 1 meter. The turntable was rotated 360˚ for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurements above 1000 MHz was performed by 3 different horn antennas, the measurement below 30 MHz was performed by loop antenna and measurement from 30 MHz to 1 GHz was performed by Log-Periodic Antenna.

Test Setup Configuration

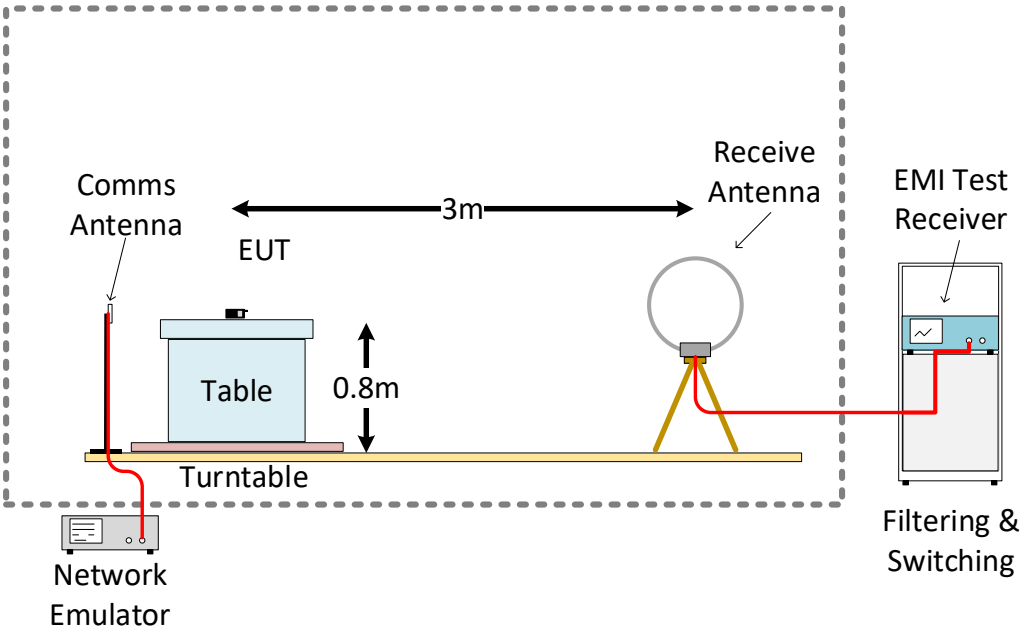


Figure 1: Frequency range 9 KHz – 30 MHz

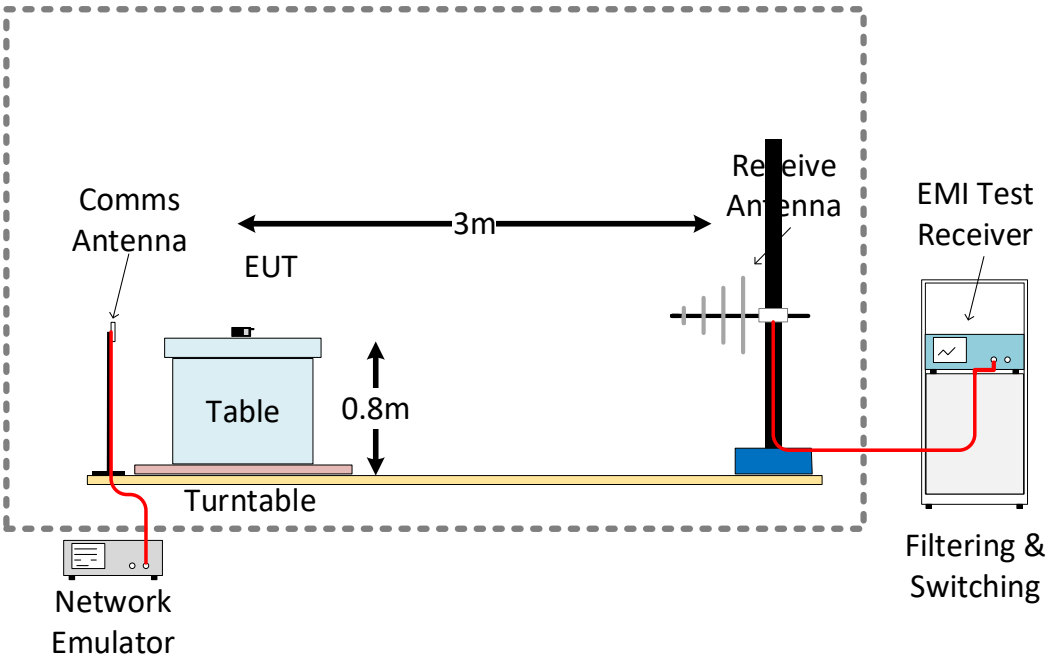


Figure 2: Frequency range 30 MHz – 1 GHz

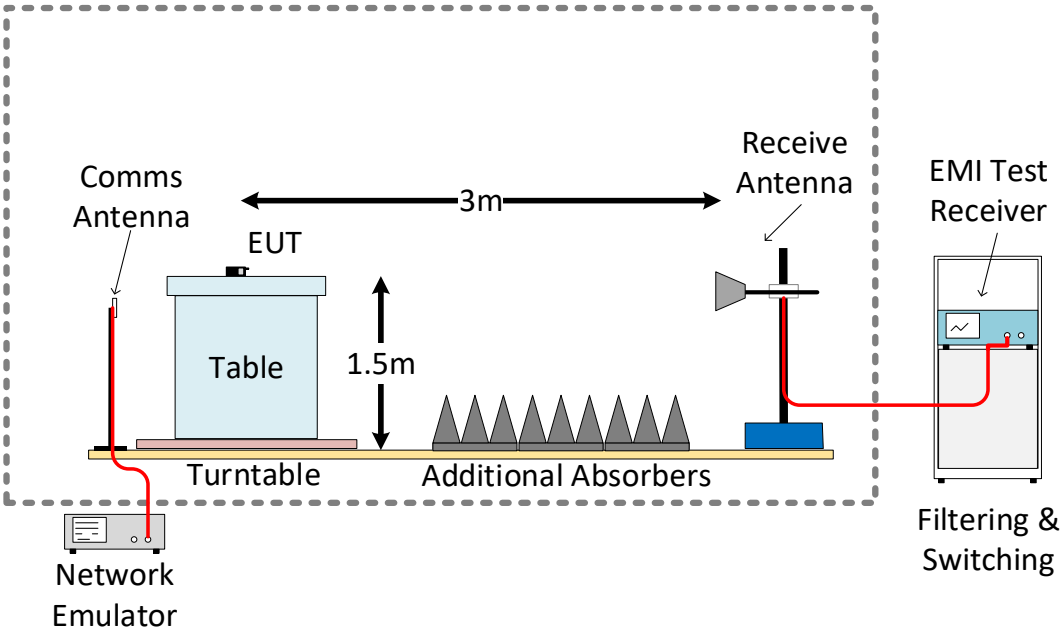


Figure 3: Frequency range 1 GHz – 18 GHz

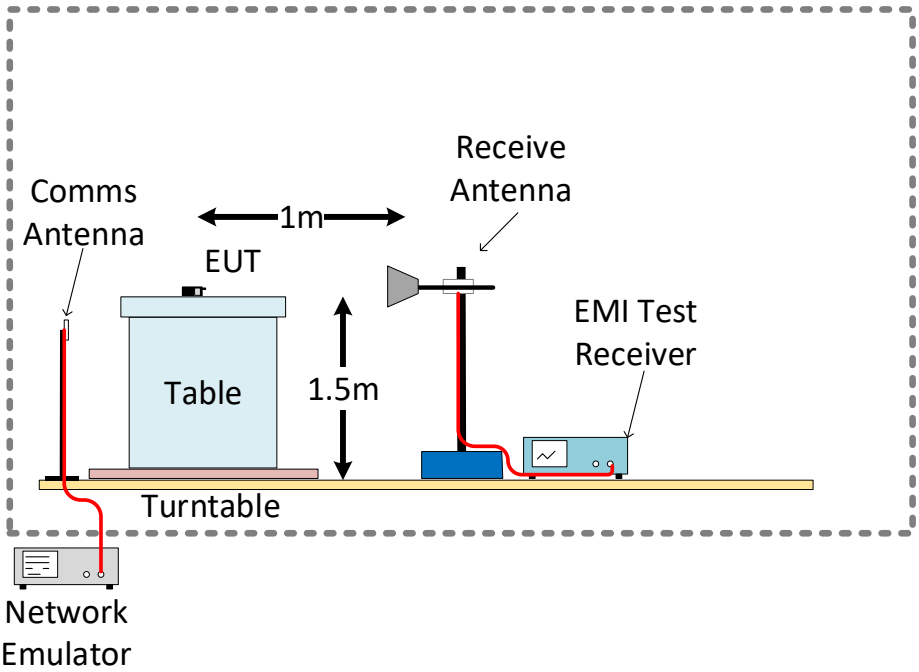


Figure 4: Frequency range 18 GHz – 40 GHz

5 TEST RESULTS

5.1 Radiated emissions

Result	Pass
Test period	2019-03-25 to 2019-04-08
Test Engineer	Martin Stump
Test Specification	FCC part 15 Subpart C Section 15.209 & 15.205 FCC Part 15 Subpart B Section 15.109
Test Method	ANSI C63.10 – 2013 ANSI C63.4 - 2014
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3 m for 9 KHz to 18 GHz 1 m for 18 GHz to 40 GHz
Detector	Quasi-peak, except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz where an Average detector is used.
Requirement	As per the limits mentioned in the below table
Ancillary equipment	See section 2.4
Environmental conditions	Temperature: + 18 - 20 °C Relative Humidity: 20 - 40 %

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 3 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBµV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

For measurements above 18GHz the measurement was performed at 1m distance, the limit line has been adjusted for this using the following formula: Extrapolation (dB) = 20log (3meter / 1meter) = +9,54db

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

5.2 Test setups

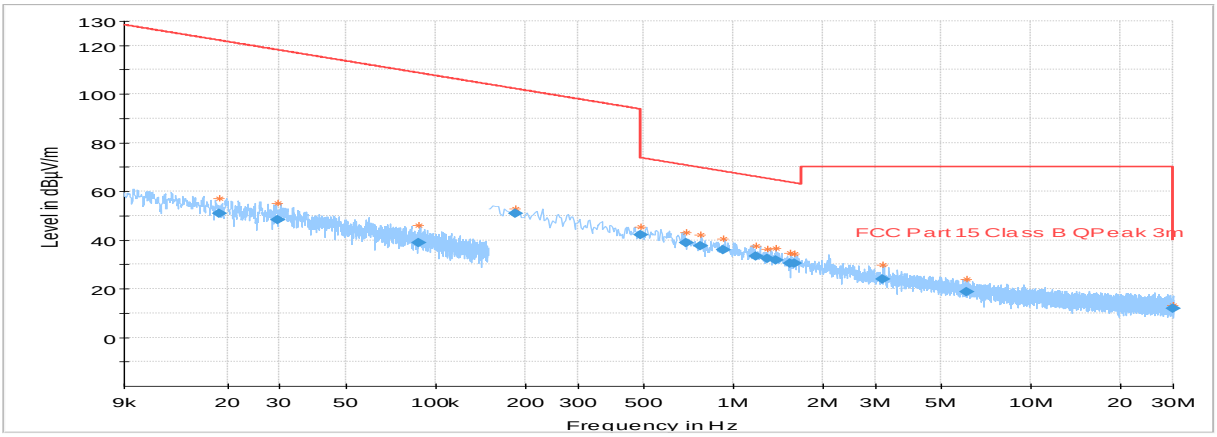
Test	Constellation (see also notes below)	EUT Radio	Result
1	EUT + cable A000224206-009	Bluetooth classic	PASS
2	EUT + cable A000224206-009	BLE	PASS

5.3 Test results

5.3.1 Bluetooth classic

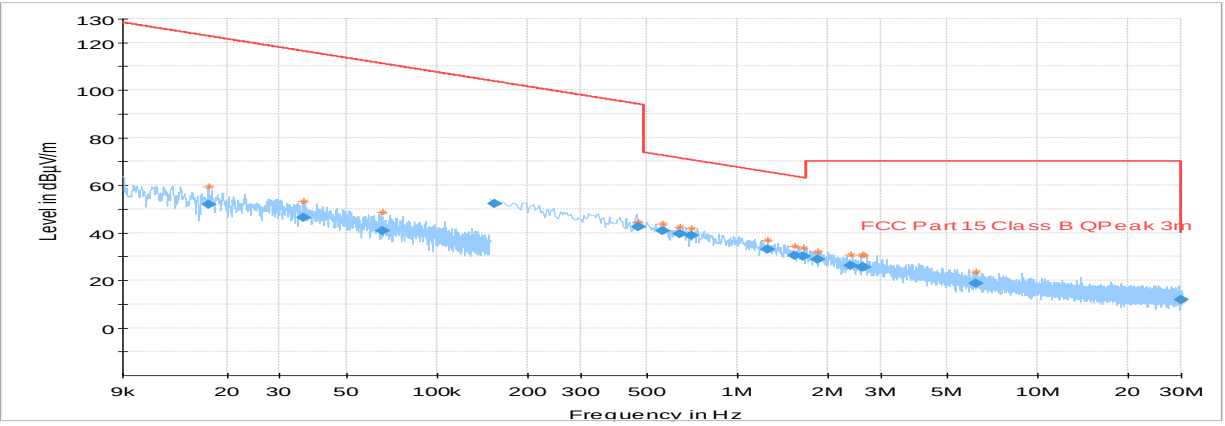
5.3.1.1 Channel frequency 2402 MHz (Low)

Test mode condition	Bluetooth classic	
Antenna orientation	parallel	
Channel frequency	2402 MHz (Low)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-05-04
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 25



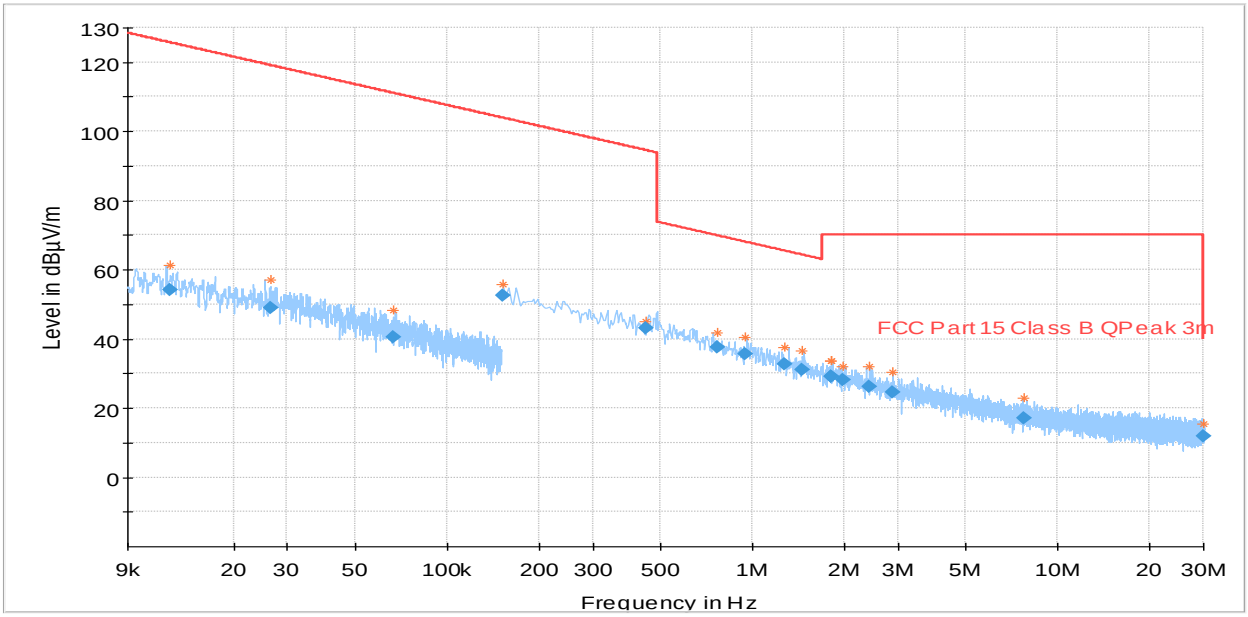
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.696882	38.79	70.75	31.96	9	100	H	157
0.776577	37.74	69.81	32.07	9	100	H	-19
0.921945	36.08	68.33	32.25	9	100	H	25
1.197525	33.49	66.06	32.57	9	100	H	293
1.30578	32.52	65.31	32.79	9	100	H	198
1.389753	31.77	64.77	33	9	100	H	136

Test mode condition	Bluetooth classic	
Antenna orientation	perpendicular	
Channel frequency	2402 MHz (Low)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-05-04
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test24



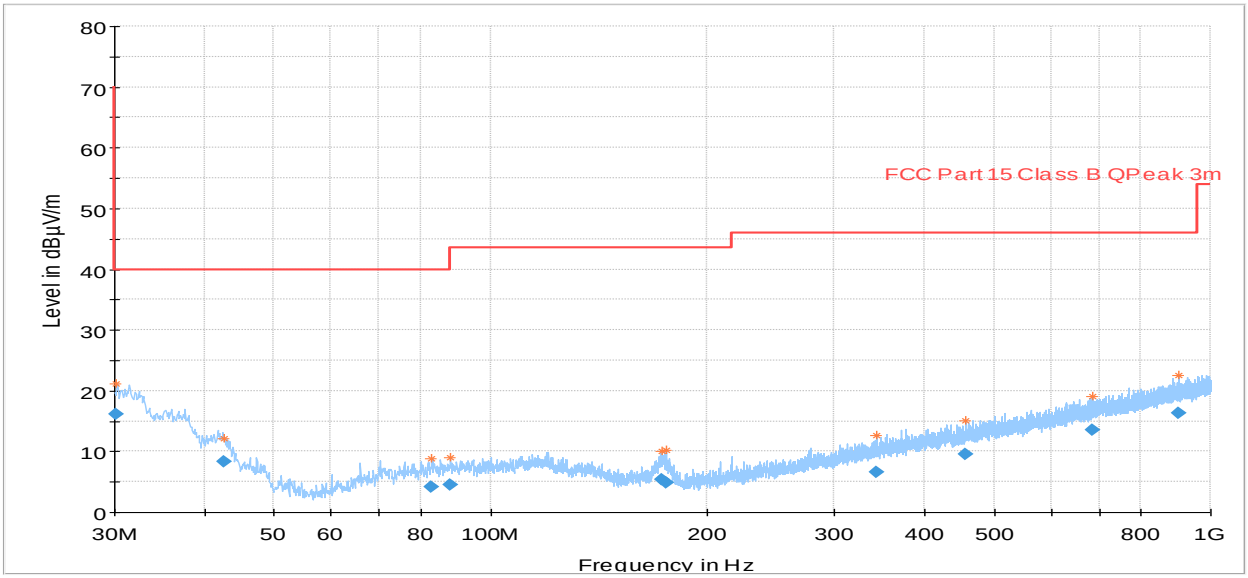
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.563859	40.91	72.58	31.68	9	100	H	68
0.644607	39.64	71.43	31.78	9	100	H	296
0.699501	38.76	70.72	31.95	9	100	H	22
1.260975	32.97	65.61	32.64	9	100	H	202
1.555599	30.57	63.79	33.23	9	100	H	161
1.662906	29.95	63.22	33.27	9	100	H	247

Test mode condition	Bluetooth classic	
Antenna orientation	Ground parallel	
Channel frequency	2402 MHz (Low)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 39



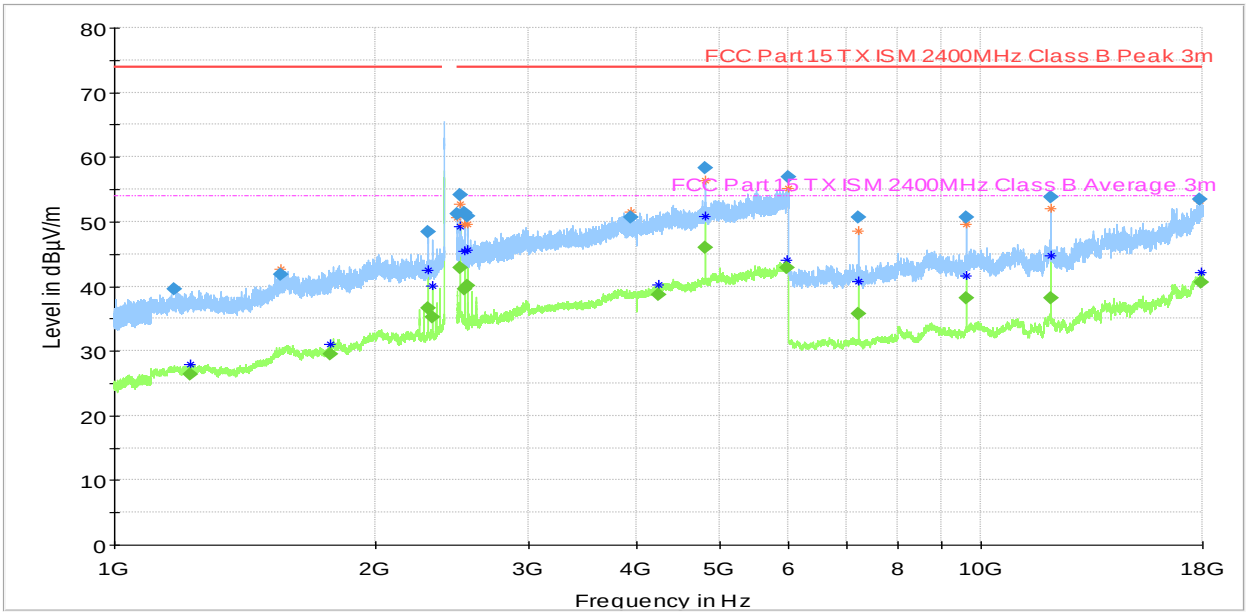
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.765957	37.75	69.93	32.18	9	100	H	107
0.947979	35.76	68.08	32.33	9	100	H	90
1.275261	32.67	65.52	32.84	9	100	H	182
1.453395	31.17	64.38	33.21	9	100	H	202
1.813707	29.1	70.1	41	9	100	H	22
1.819281	29.04	70.1	41.06	9	100	H	292

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2402 MHz (Low)	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,6 %
Chamber details	Chamber: SAC 5	Test 1



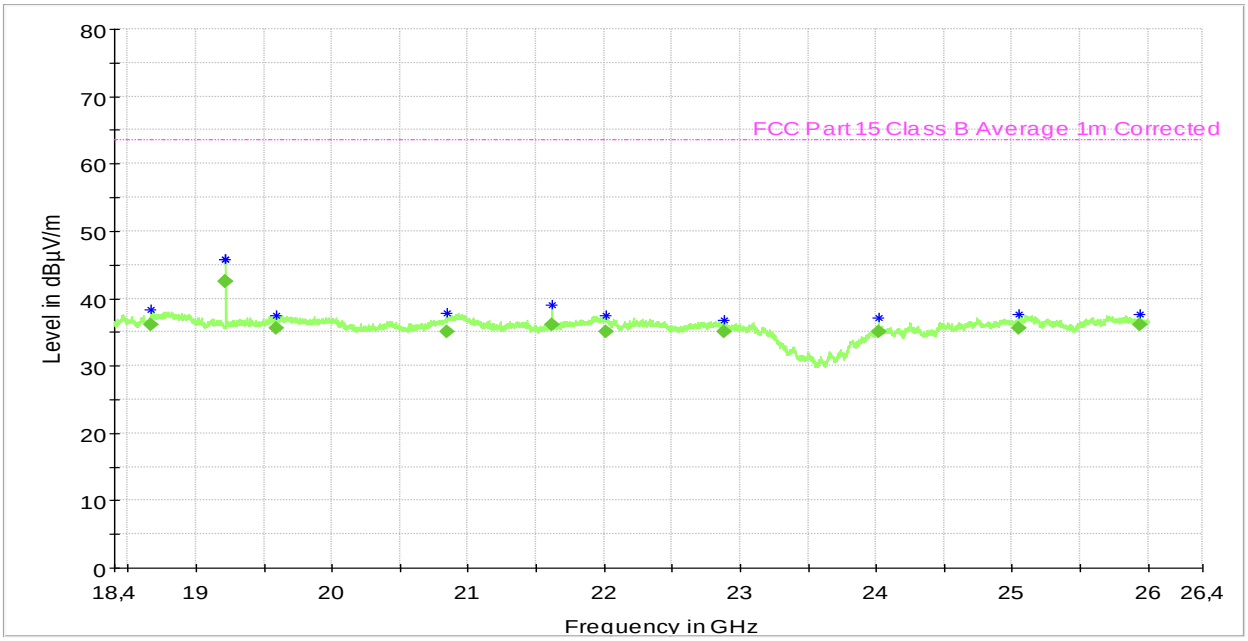
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.152094	16.13	40	23.87	1000	120	100	V
42.54976	8.28	40	31.72	1000	120	275	H
82.80952	4.16	40	35.84	1000	120	278	V
87.93692	4.54	40	35.46	1000	120	100	V
684.77936	13.47	46	32.53	1000	120	229	V
902.13552	16.36	46	29.64	1000	120	128	H

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2402 MHz (Low)	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-04
Environmental conditions	Temperature: 19 ^{0}C	Humidity: 30,5 %
Chamber details	Chamber: SAC 5	Test 22



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2505.9477	42.94	54	11.06	1000	198	H	276
2532.057	39.54	54	14.46	1000	196	H	277
2557.9333	40.12	54	13.88	1000	158	H	307
4240.703	38.75	54	15.25	1000	185	H	98
5975.667	42.8	54	11.2	1000	146	V	278
17905.614	40.6	54	13.4	1000	210	V	-8

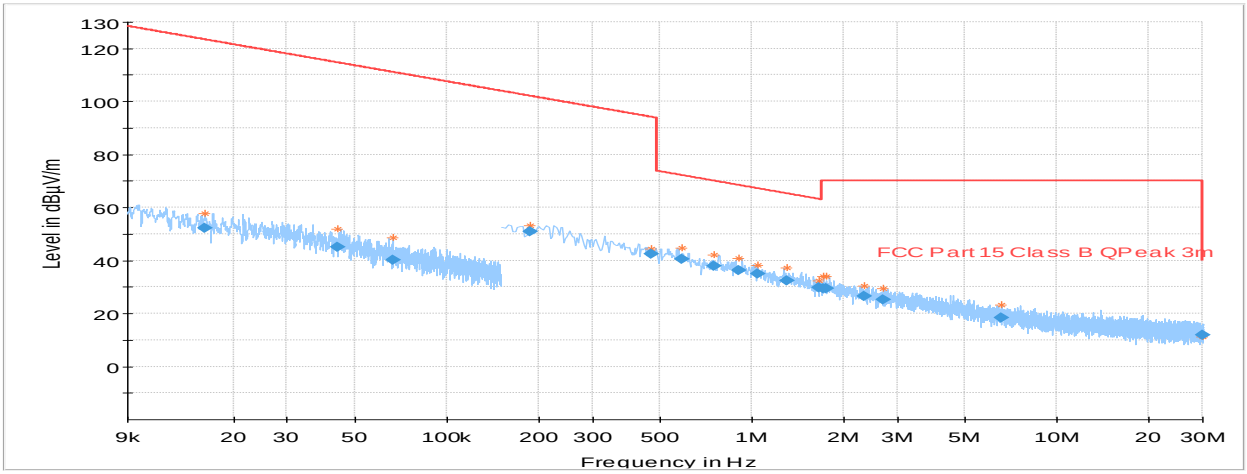
Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2402 MHz (Low)	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 15



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
18672.721	36.05	63.52	27.47	1000	155	H	262
19220.034	42.56	63.52	20.96	1000	155	V	187
19220.089	42.48	63.52	21.04	1000	155	V	187
21616.733	36.03	63.52	27.49	1000	155	V	232
25047.534	35.64	63.52	27.88	1000	155	V	262
25937.736	36.18	63.52	27.34	1000	155	V	172

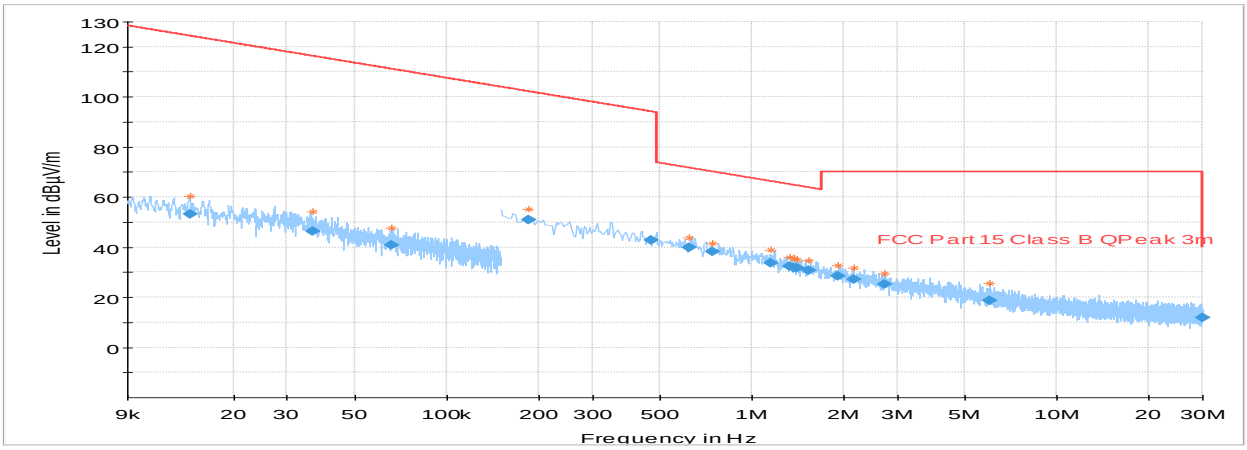
5.3.1.2 Channel frequency 2440 MHz (Mid)

Test mode condition	Bluetooth classic	
Antenna orientation	parallel	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-05-04
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 26



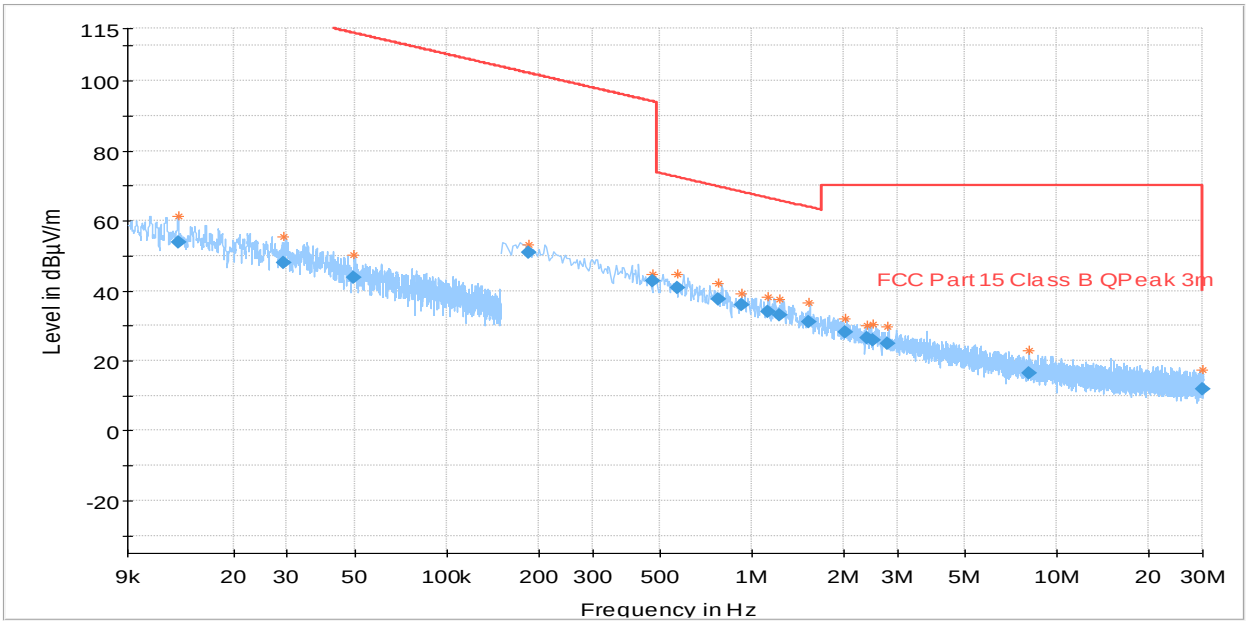
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.592839	40.38	72.15	31.77	9	100	H	243
0.74766	38.08	70.14	32.06	9	100	H	247
0.906045	36.13	68.48	32.35	9	100	H	205
1.048911	34.9	67.21	32.3	9	100	H	292
1.307958	32.53	65.3	32.77	9	100	H	202
1.651359	29.84	63.28	33.44	9	100	H	296

Test mode condition	Bluetooth classic	
Antenna orientation	perpendicular	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 27



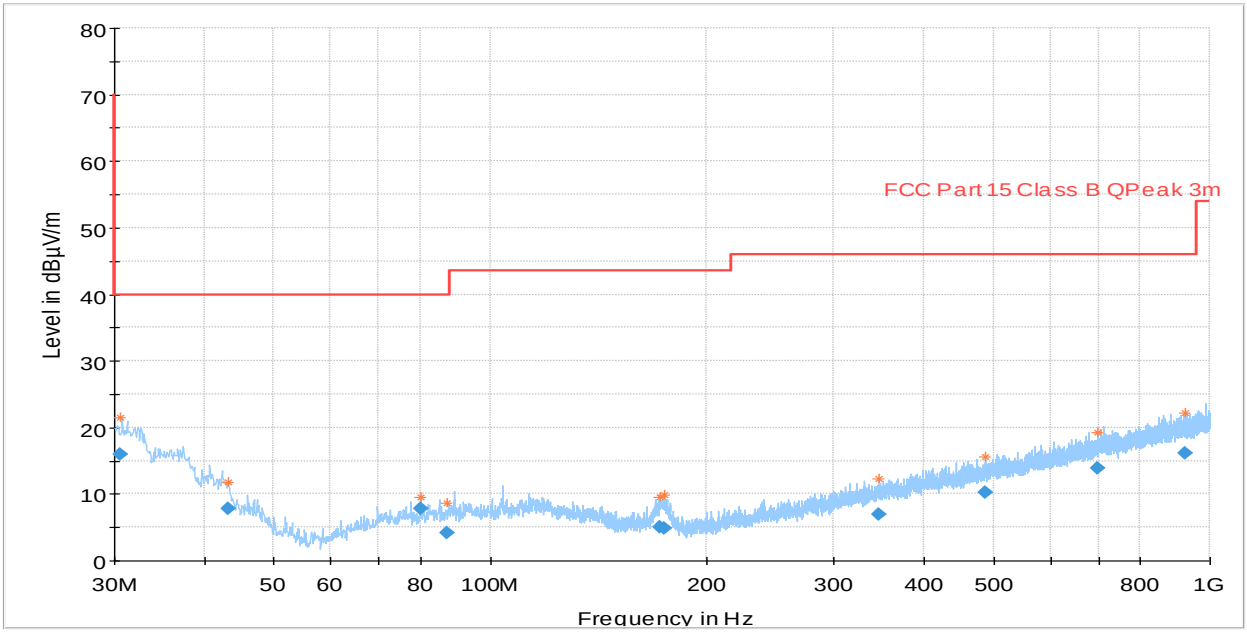
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.624159	39.90	71.70	31.80	9.000	100.0	H	67.0
0.743235	38.12	70.19	32.07	9.000	100.0	H	333.0
1.155093	33.84	66.37	32.53	9.000	100.0	H	295.0
1.327920	32.35	65.17	32.82	9.000	100.0	H	135.0
1.382928	31.81	64.81	33.00	9.000	100.0	H	108.0
1.410990	31.61	64.64	33.03	9.000	100.0	H	90.0

Test mode condition	Bluetooth classic	
Antenna orientation	Ground parallel	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 40



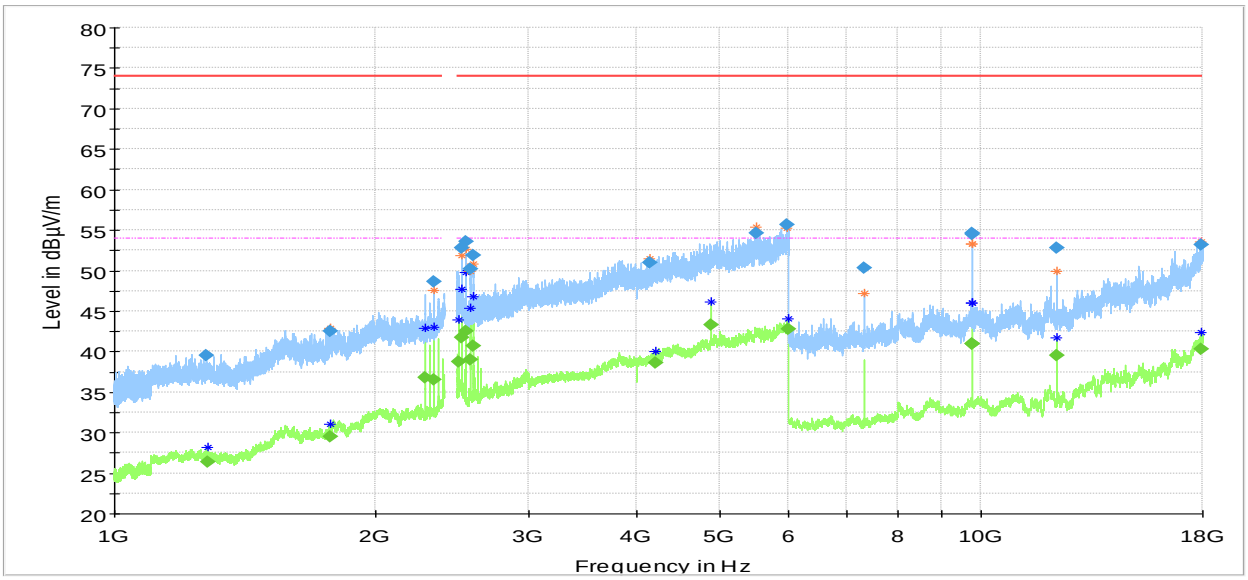
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.570030	40.92	72.49	31.57	9.000	100.0	H	315.0
0.775887	37.59	69.82	32.23	9.000	100.0	H	70.0
0.922947	35.96	68.32	32.35	9.000	100.0	H	160.0
1.134543	33.87	66.53	32.66	9.000	100.0	H	25.0
1.239282	32.90	65.76	32.86	9.000	100.0	H	115.0

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,6 %
Chamber details	Chamber: SAC 5	Test 2



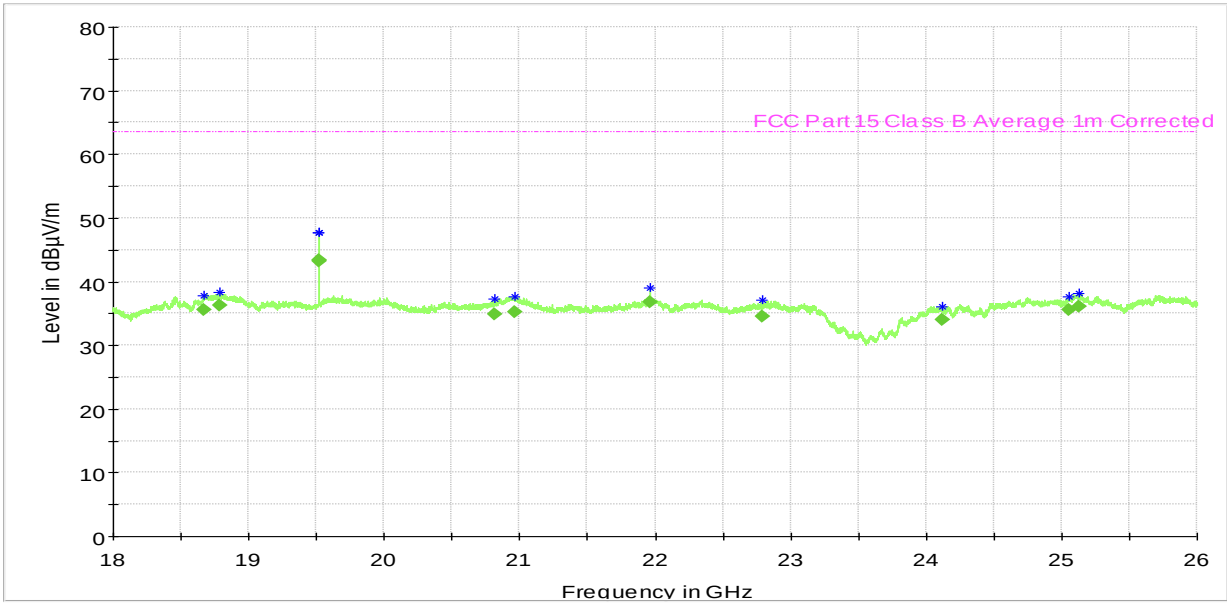
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.5522	16.05	40	23.95	1000	120	100	V	251
43.16096	7.77	40	32.23	1000	120	330	V	157
79.99352	7.85	40	32.15	1000	120	128	V	113
486.5788	10.18	46	35.82	1000	120	275	V	290
699.1256	13.89	46	32.11	1000	120	375	V	137
923.09656	16.13	46	29.87	1000	120	328	V	22

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-04
Environmental conditions	Temperature: 19,0 ^{0}C	Humidity: 30,5 %
Chamber details	Chamber: SAC 5	Test 23



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2517.9666	41.71	54	12.29	1000	158	H	278
2544.0602	42.46	54	11.54	1000	197	H	278
4879.987	43.26	54	10.74	1000	206	H	232
5981.558	42.77	54	11.23	1000	165	V	277
9759.53	40.97	54	13.03	1000	206	H	230
9759.61	40.96	54	13.04	1000	205	H	232

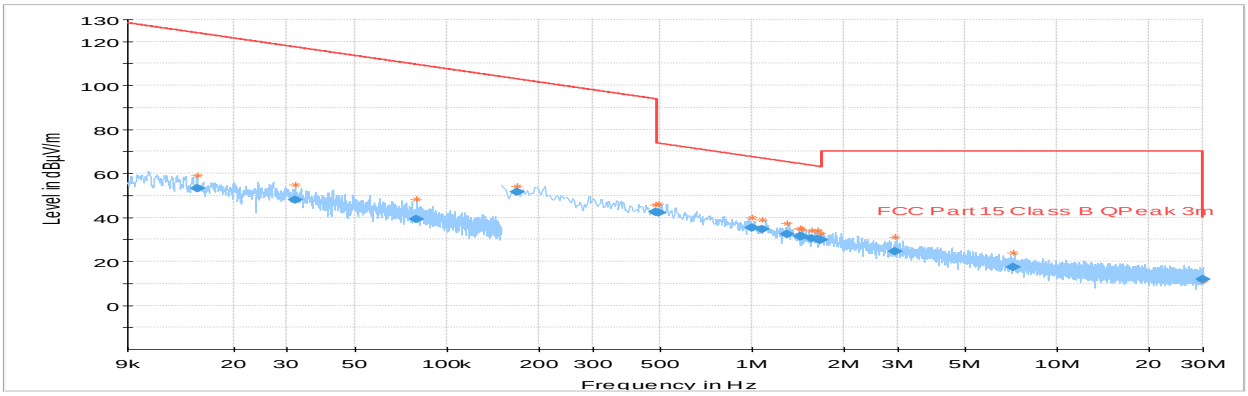
Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 16



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
18672.088	35.56	63.52	27.96	1000	155	V	82
18789.325	36.29	63.52	27.23	1000	155	V	112
19515.99	43.29	63.52	20.23	1000	155	V	262
19516.079	43.3	63.52	20.22	1000	155	V	262
21958.661	36.86	63.52	26.66	1000	155	V	293
25131.058	36.13	63.52	27.39	1000	155	V	277

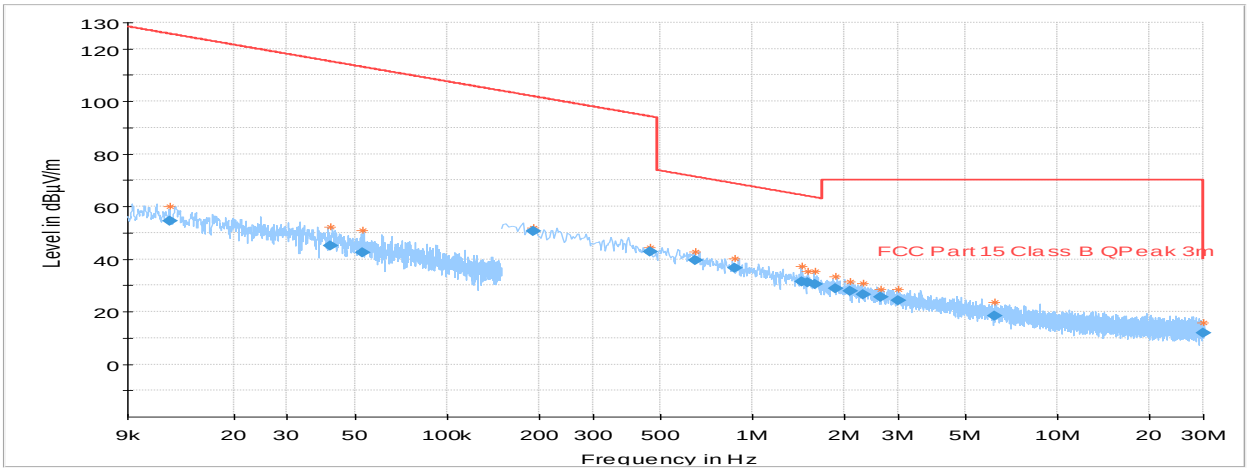
5.3.1.1 Channel frequency 2480 MHz (High)

Test mode condition	Bluetooth classic	
Antenna orientation	perpendicular	
Channel frequency	2480 MHz (High)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 28



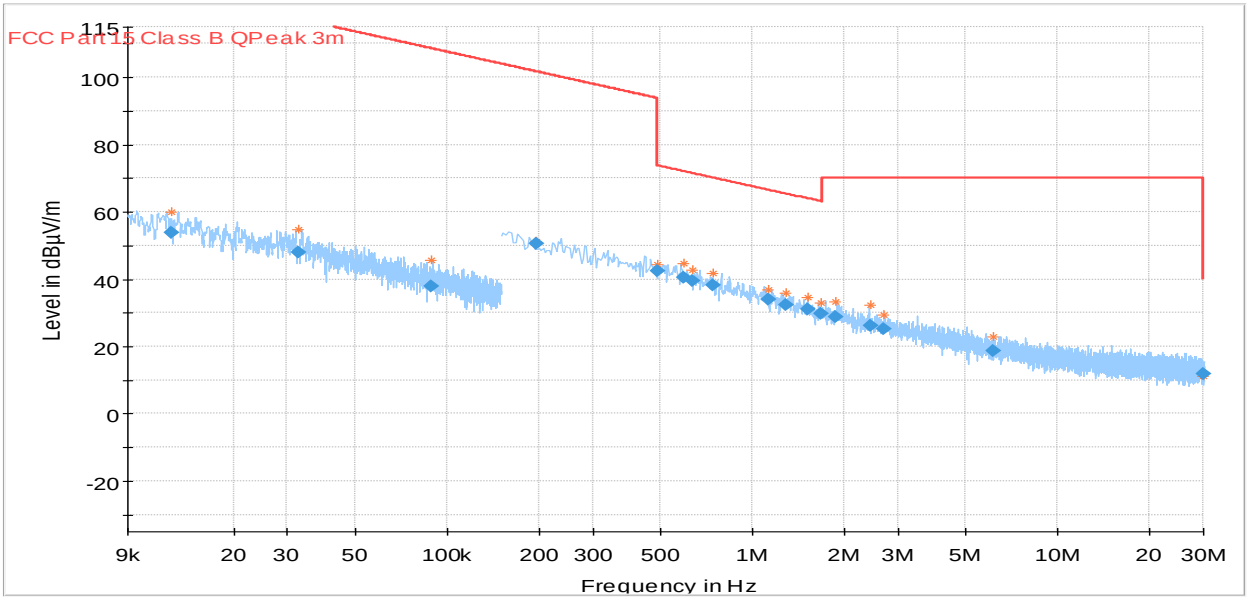
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.494835	42.19	73.72	31.53	9	100	H	293
1.003206	35.26	67.59	32.34	9	100	H	293
1.076136	34.59	66.99	32.4	9	100	H	202
1.303611	32.43	65.33	32.9	9	100	H	270
1.431945	31.41	64.51	33.1	9	100	H	338
1.45356	31.28	64.38	33.1	9	100	H	250

Test mode condition	Bluetooth classic	
Antenna orientation	Parallel to axis	
Channel frequency	2480 MHz (High)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 29



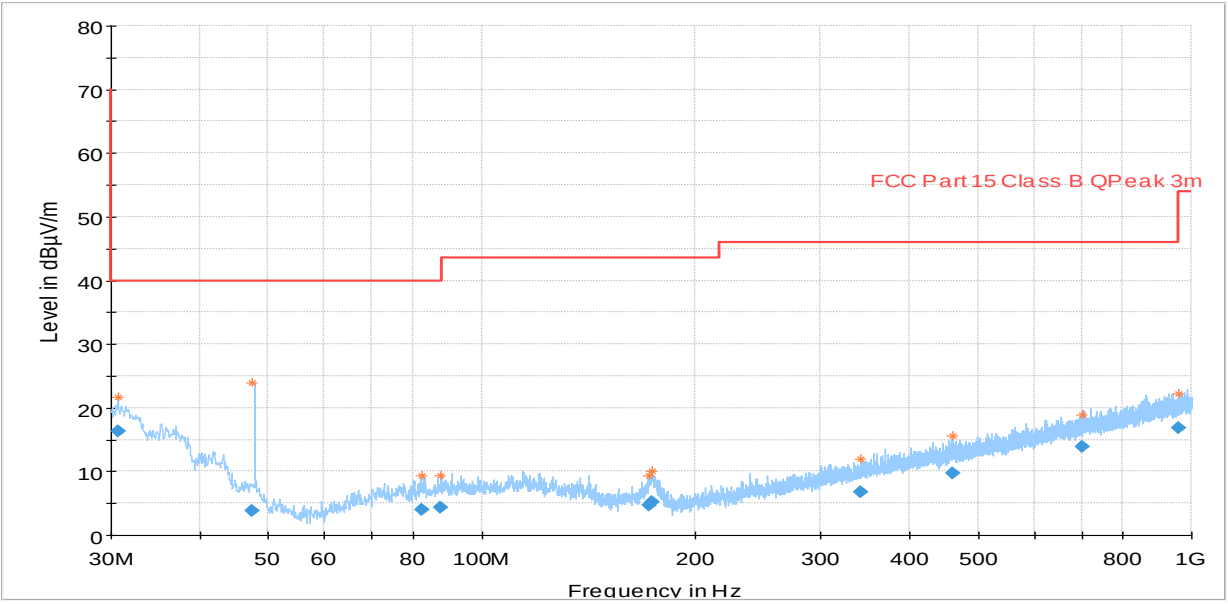
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.650085	39.51	71.35	31.85	9	100	H	135
0.872451	36.52	68.8	32.28	9	100	H	134
1.453377	31.3	64.38	33.08	9	100	H	115
1.513785	30.94	64.03	33.09	9	100	H	270
1.603779	30.29	63.53	33.24	9	100	H	115
1.874826	28.66	70.1	41.44	9	100	H	243

Test mode condition	Bluetooth classic	
Antenna orientation	Parallel to ground	
Channel frequency	2480 MHz (High)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 41



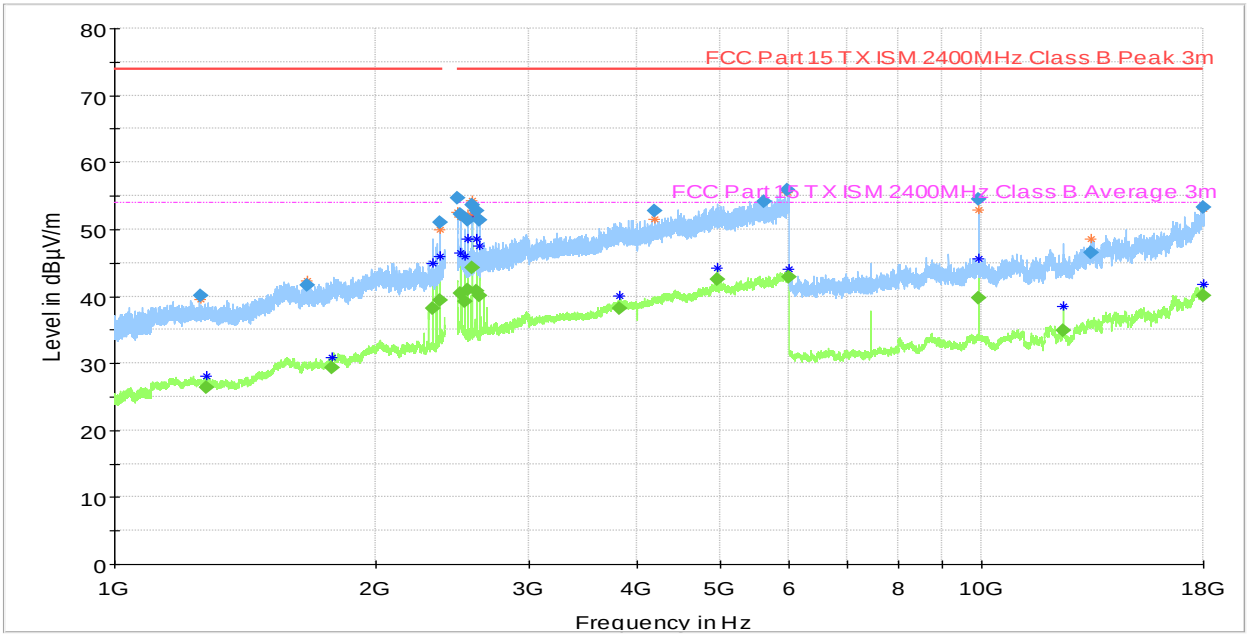
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.490395	42.28	73.79	31.51	9	100	H	45
0.596046	40.48	72.1	31.62	9	100	H	334
0.636693	39.67	71.53	31.86	9	100	H	71
0.747045	38.13	70.15	32.02	9	100	H	115
1.125507	34.11	66.6	32.48	9	100	H	-23
1.286799	32.51	65.44	32.93	9	100	H	295

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2480 MHz (High)	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,2 ^{0}C	Humidity: 33,3 %
Chamber details	Chamber: SAC 5	Test 3



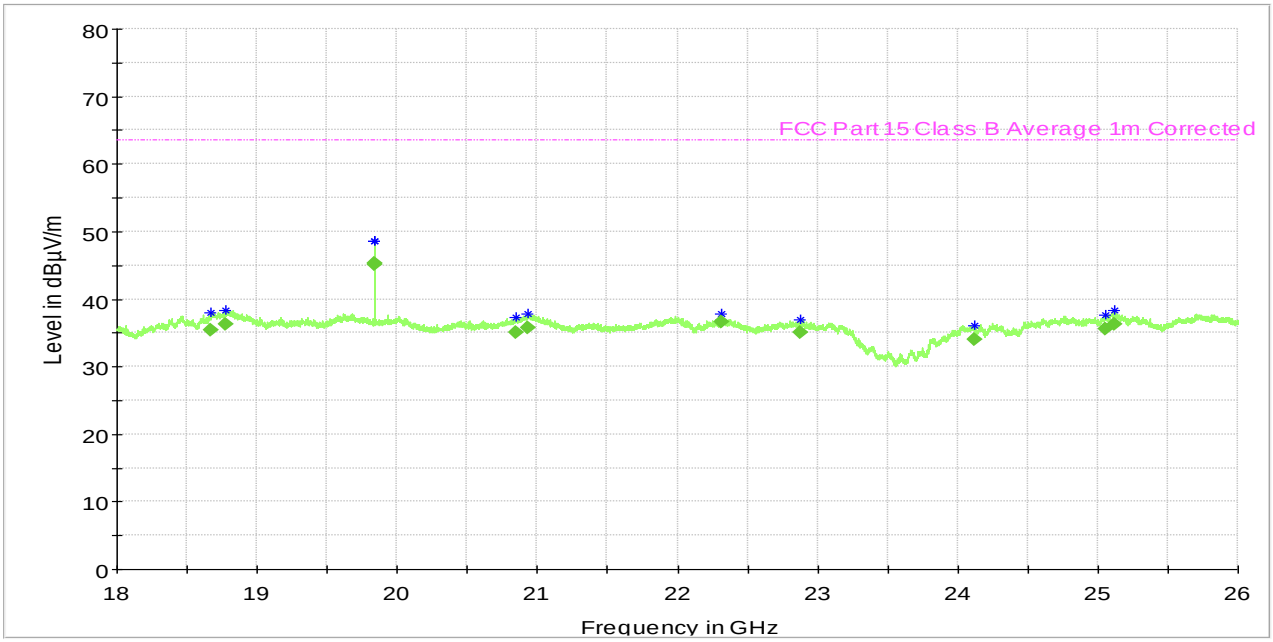
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.67612	16.28	40	23.72	1000	120	325	H	152
47.48764	3.81	40	36.19	1000	120	360	H	25
82.41036	3.97	40	36.03	1000	120	128	V	108
87.51384	4.34	40	35.66	1000	120	328	V	202
699.90328	13.81	46	32.19	1000	120	275	V	68
957.07764	16.77	46	29.23	1000	120	225	V	71

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2480 MHz (High)	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 45



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2505.9721	40.41	54	13.59	1000	187	H	277
2558.0007	41.02	54	12.98	1000	135	V	310
2584.034	44.24	54	9.76	1000	135	V	310
2609.9692	40.82	54	13.18	1000	115	V	310
4960.046	42.48	54	11.52	1000	206	H	307
5980.127	42.8	54	11.2	1000	185	V	175

Test mode condition	Bluetooth classic	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2480 MHz (High)	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 17

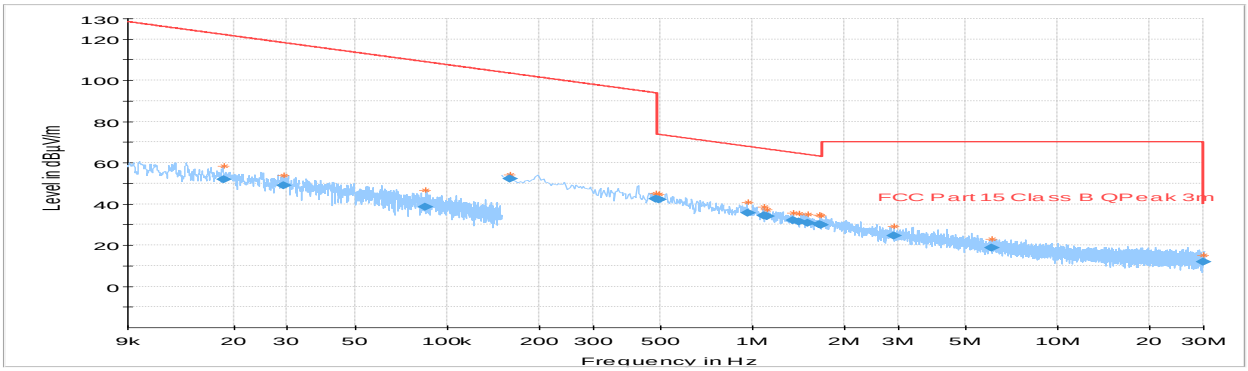


Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
18780.041	36.35	63.52	27.17	1000	155	V	337
19835.972	45.21	63.52	18.31	1000	155	V	263
19835.973	45.18	63.52	18.34	1000	155	V	262
20935.907	35.82	63.52	27.7	1000	155	H	22
22318.672	36.67	63.52	26.85	1000	155	V	304
25120.069	36.31	63.52	27.21	1000	155	V	217

5.3.2 Bluetooth Low Energy (BLE)

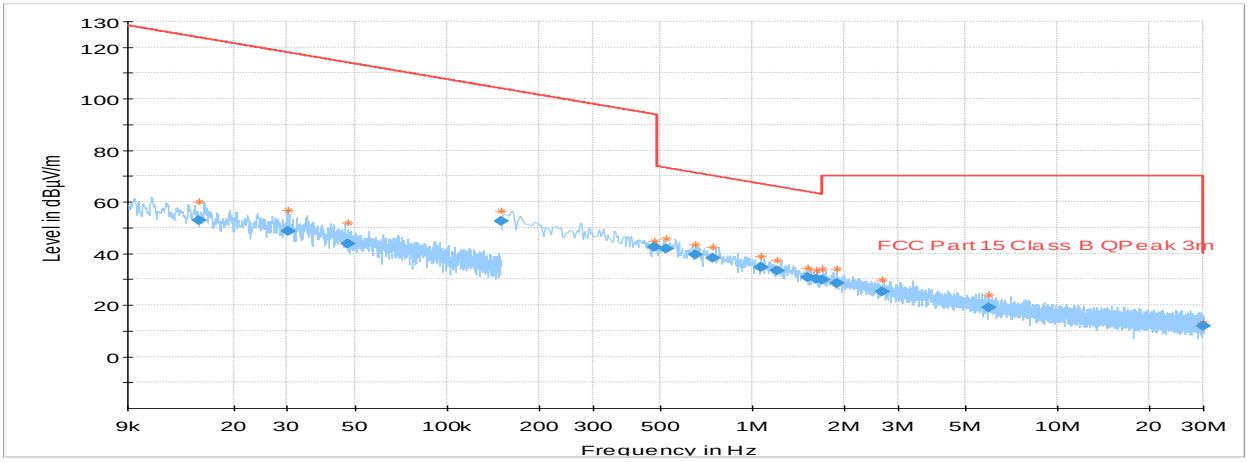
5.3.2.1 Channel frequency 2402 MHz (Low)

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to axis	
Channel frequency	2402 MHz (Low)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-05-04
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 30



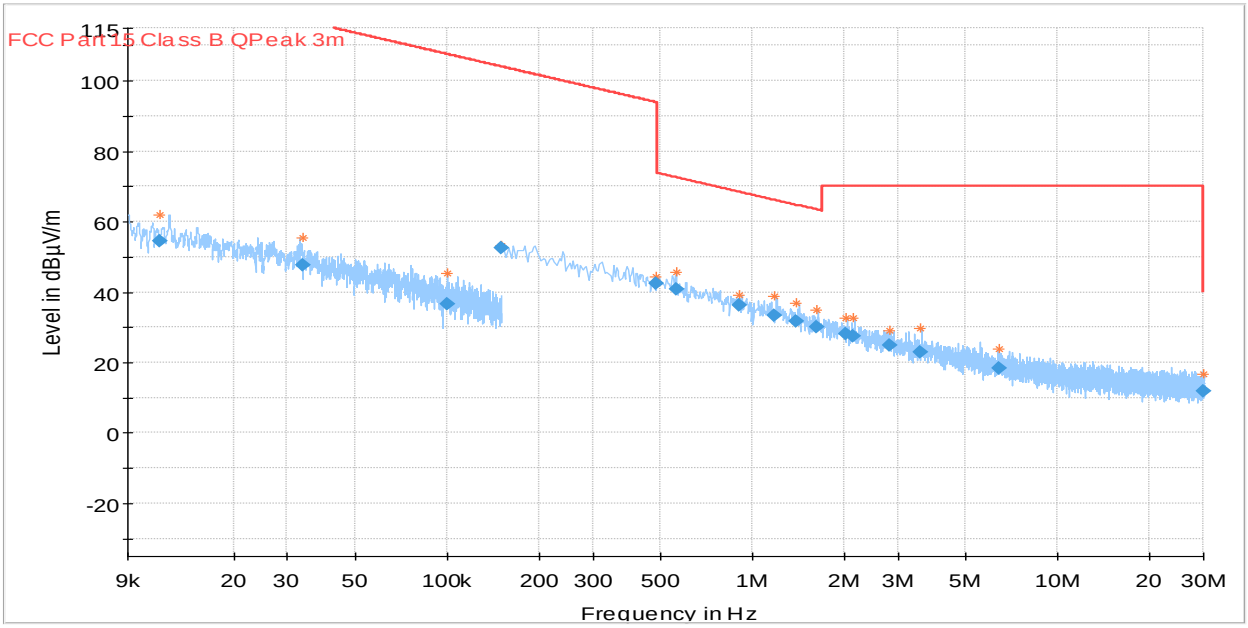
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.495501	42.11	73.7	31.59	9	100	H	112
0.963948	35.56	67.94	32.38	9	100	H	-20
1.086573	34.46	66.9	32.44	9	100	H	45
1.112418	34.13	66.7	32.57	9	100	H	157
1.357746	32	64.97	32.97	9	100	H	109
1.426557	31.45	64.54	33.09	9	100	H	202

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	perpendicular	
Channel frequency	2402 MHz (Low)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 31



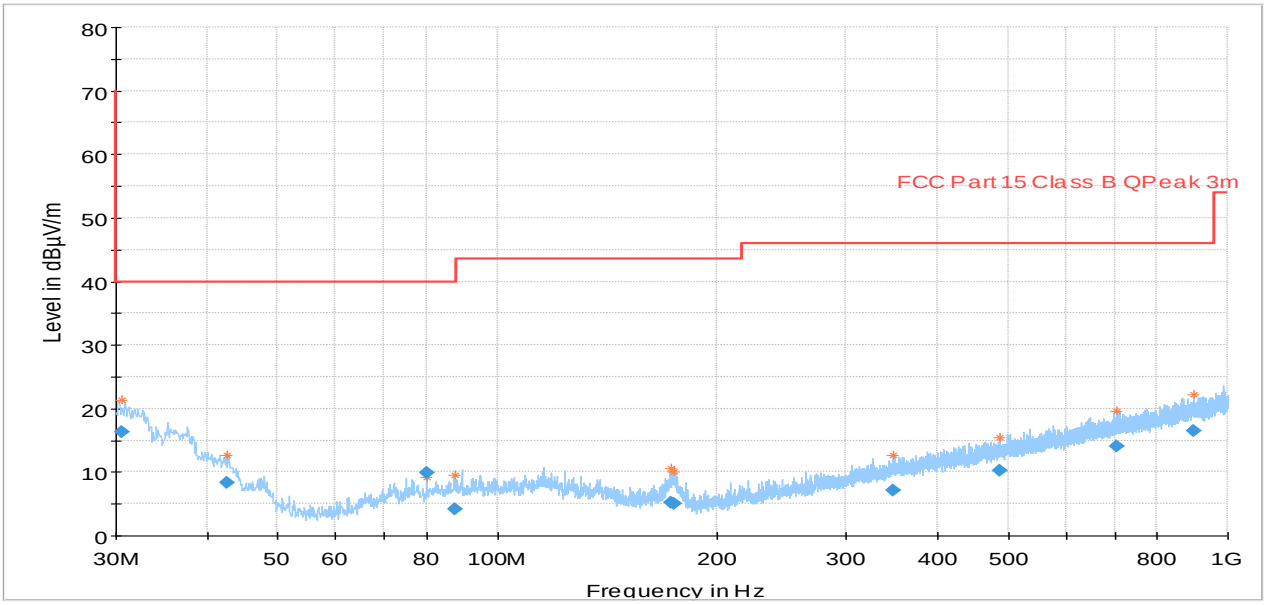
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.520146	41.69	73.28	31.59	9	100	H	44
0.647658	39.52	71.38	31.86	9	100	H	202
0.739551	38.1	70.24	32.14	9	100	H	250
1.06296	34.74	67.09	32.36	9	100	H	225
1.200345	33.28	66.04	32.76	9	100	H	287
1.522872	30.83	63.98	33.15	9	100	H	199

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to ground	
Channel frequency	2402 MHz (Low)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 42



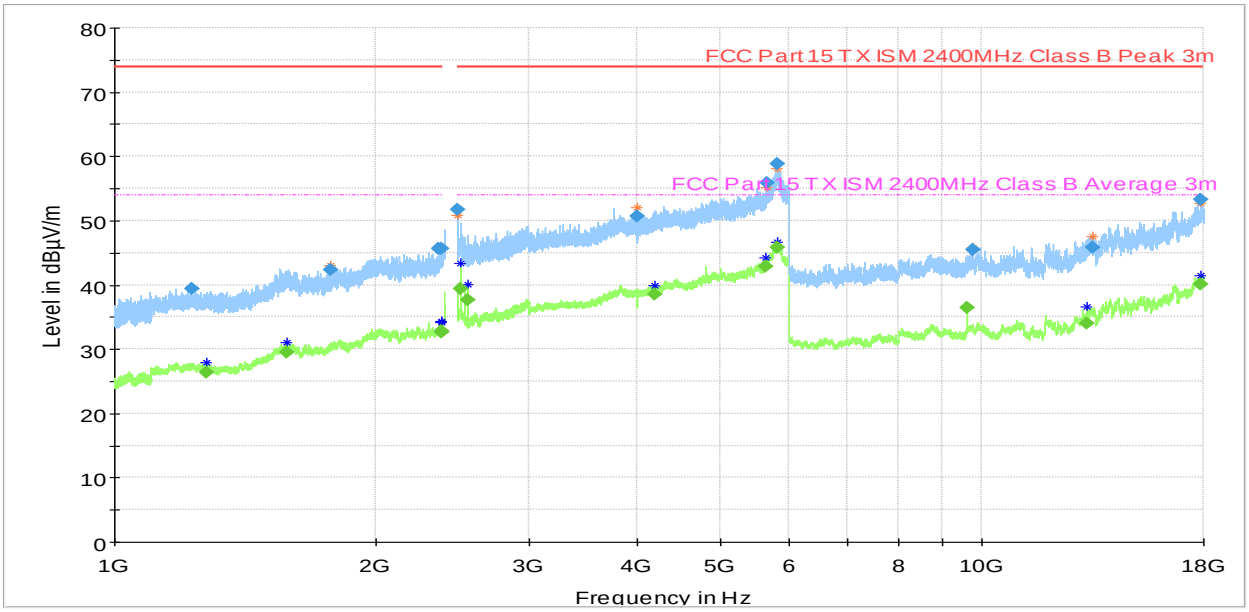
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.566268	40.86	72.55	31.69	9	100	H	25
0.905664	36.14	68.48	32.34	9	100	H	335
1.182543	33.48	66.17	32.69	9	100	H	67
1.385343	31.79	64.8	33.01	9	100	H	314
1.629699	30.2	63.39	33.2	9	100	H	5
2.016075	28	70.1	42.1	9	100	H	288

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2402 MHz (ow)	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,2 ^{0}C	Humidity: 33,3 %
Chamber details	Chamber: SAC 5	Test 4



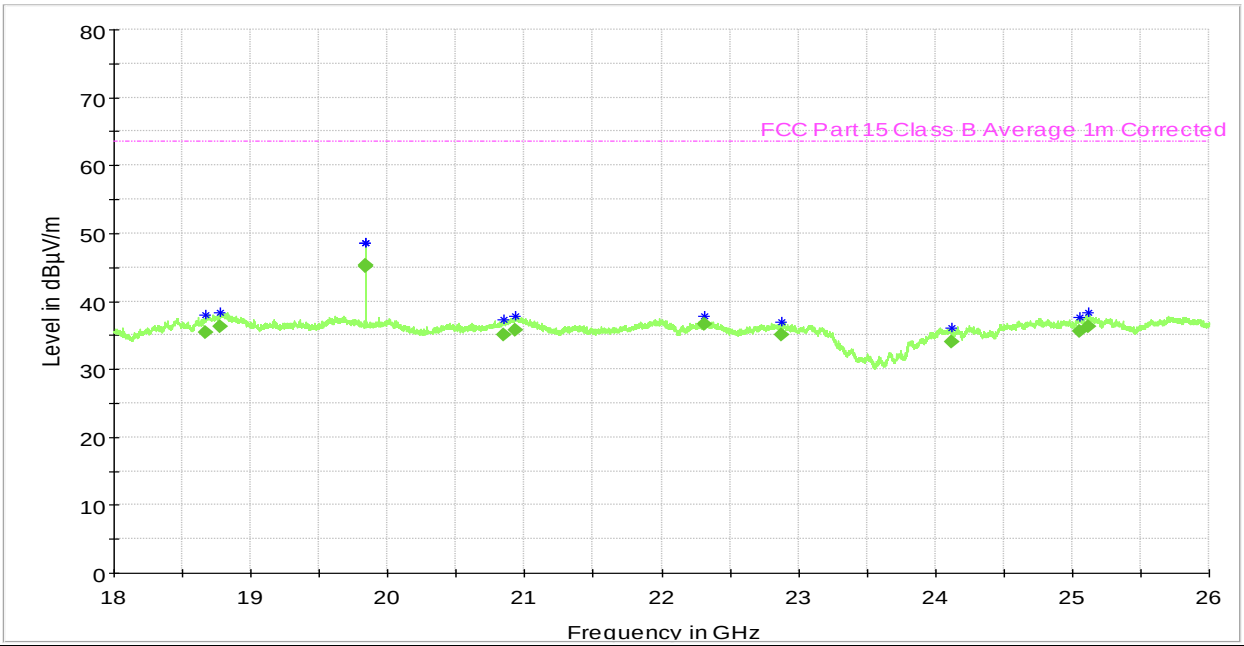
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.61011	16.23	40	23.77	1000	120	275	H	160
42.52824	8.25	40	31.75	1000	120	410	V	134
80.01284	9.89	40	30.12	1000	120	125	V	292
87.50476	4.24	40	35.76	1000	120	207	V	197
703.82548	14.05	46	31.95	1000	120	275	H	62
897.41216	16.42	46	29.58	1000	120	125	H	242

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2402 MHz (ow)	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-03-28
Environmental conditions	Temperature: 18,8 ^{0}C	Humidity: 34,2 %
Chamber details	Chamber: SAC 5	Test 11



Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2506.0341	39.31	---	54	14.69	1000	185	V	321
4188.488	38.6	---	54	15.4	1000	208	H	188
5636.232	42.93	---	54	11.07	1000	115	V	277
5795.512	---	58.79	74	15.21	1000	200	V	45
5805.707	45.73	---	54	8.27	1000	100	H	262
17871.187	40.1	---	54	13.9	1000	185	H	232

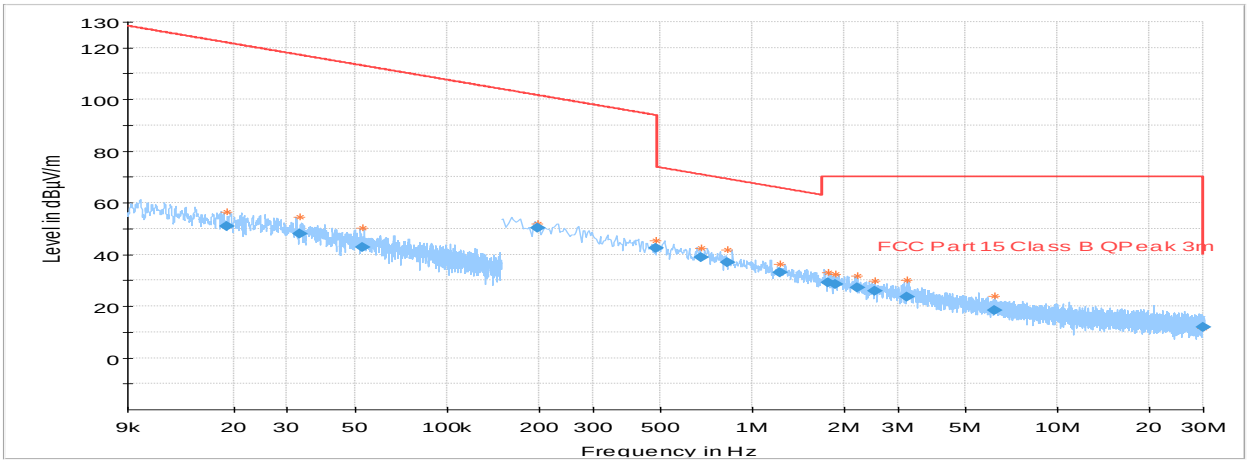
Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2402 MHz (ow)	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 18



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
18780.041	36.35	63.52	27.17	1000	155	V	337
19835.972	45.21	63.52	18.31	1000	155	V	263
19835.973	45.18	63.52	18.34	1000	155	V	262
20935.907	35.82	63.52	27.7	1000	155	H	22
22318.672	36.67	63.52	26.85	1000	155	V	304
25120.069	36.31	63.52	27.21	1000	155	V	217

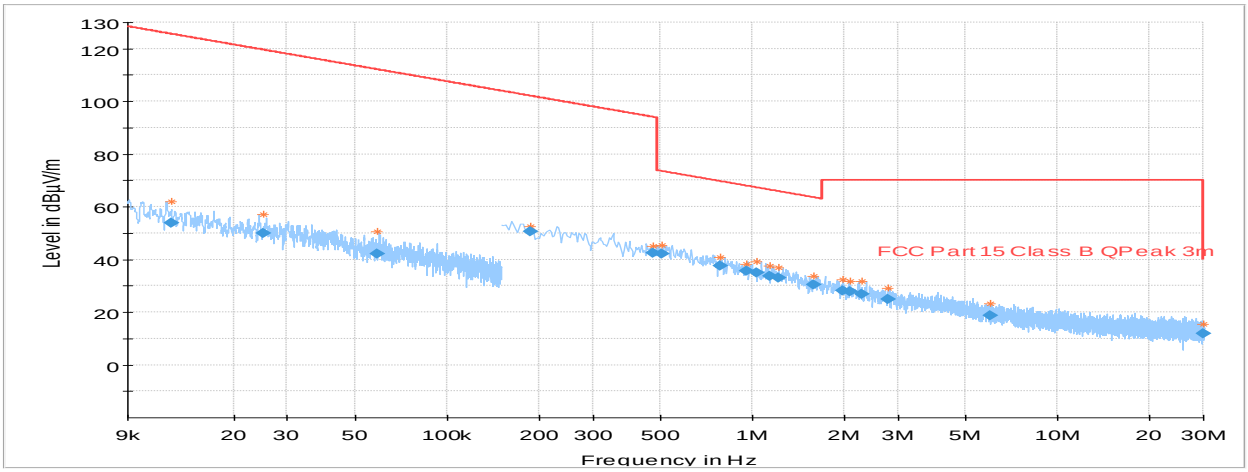
5.3.2.1 Channel frequency 2440 MHz (Mid)

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	perpendicular to axis	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 32



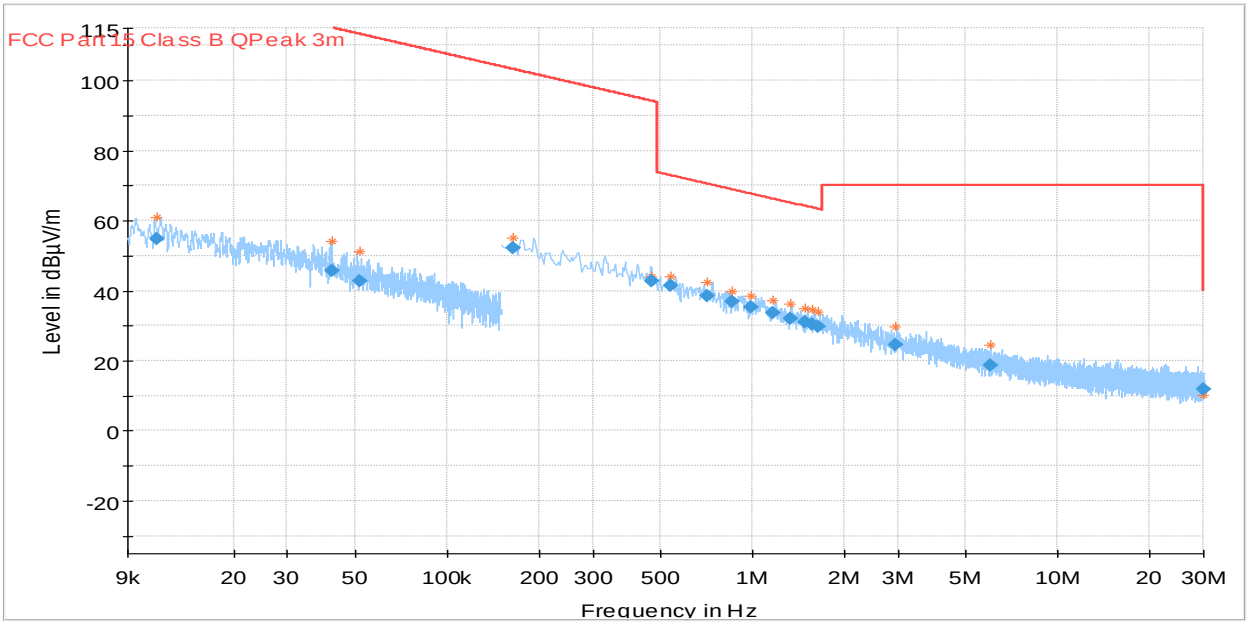
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.679248	39.04	70.97	31.93	9	100	H	202
0.828312	37.04	69.25	32.21	9	100	H	108
1.23783	32.94	65.77	32.83	9	100	H	338
1.78098	29.19	70.1	40.91	9	100	H	202
1.881765	28.58	70.1	41.52	9	100	H	315
2.219763	27.17	70.1	42.93	9	100	H	67

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to axis	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-05
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 34,6 %
Chamber details	Chamber: SAC 5	Test 33



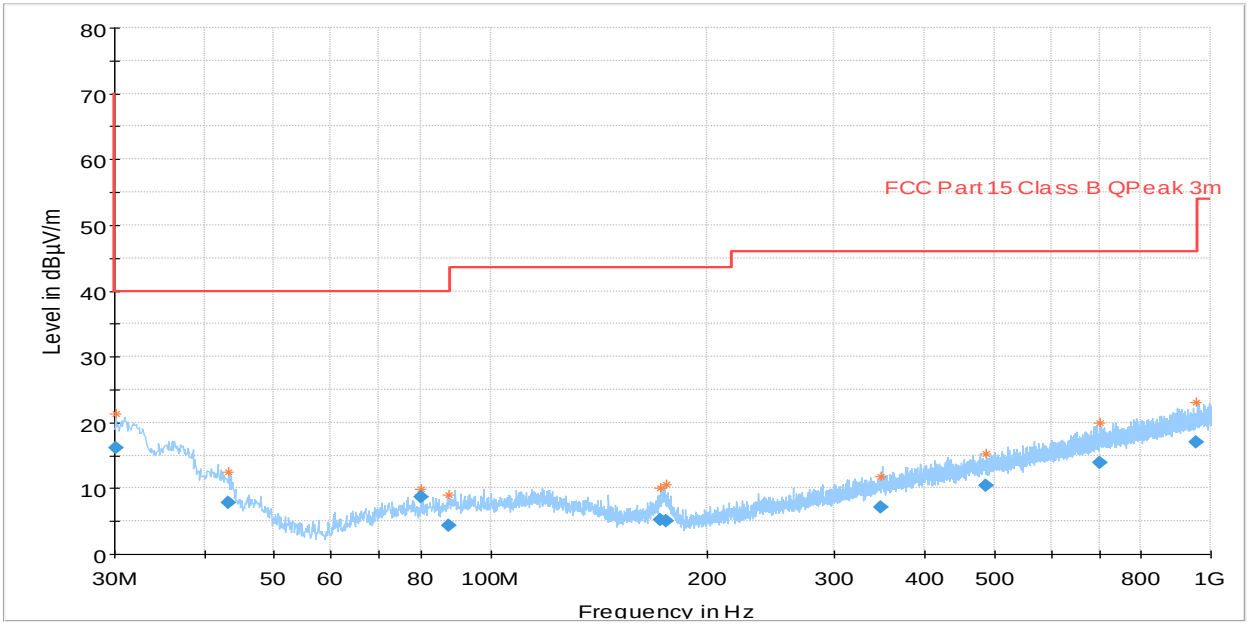
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.505293	42.02	73.53	31.51	9	100	H	338
0.786594	37.51	69.7	32.19	9	100	H	293
0.95943	35.63	67.98	32.35	9	100	H	295
1.030554	34.95	67.36	32.41	9	100	H	289
1.145565	33.76	66.44	32.69	9	100	H	202
1.222887	33.1	65.88	32.78	9	100	H	68

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to ground	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 43



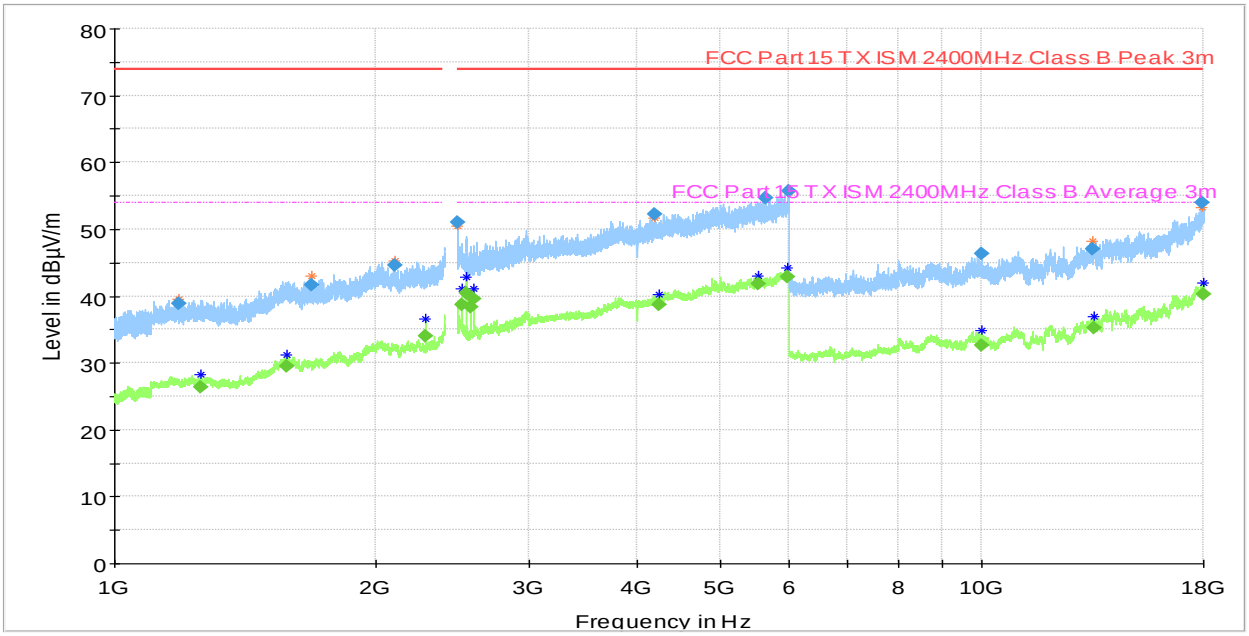
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.538218	41.4	72.99	31.59	9	100	H	22
0.712734	38.61	70.56	31.94	9	100	H	-2
0.853893	36.76	68.99	32.23	9	100	H	292
0.991914	35.35	67.69	32.34	9	100	H	90
1.161657	33.54	66.32	32.79	9	100	H	18
1.328373	32.16	65.16	33	9	100	H	-20

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-03-26
Environmental conditions	Temperature: 19,2 ^{0}C	Humidity: 33,3 %
Chamber details	Chamber: SAC 5	Test 5



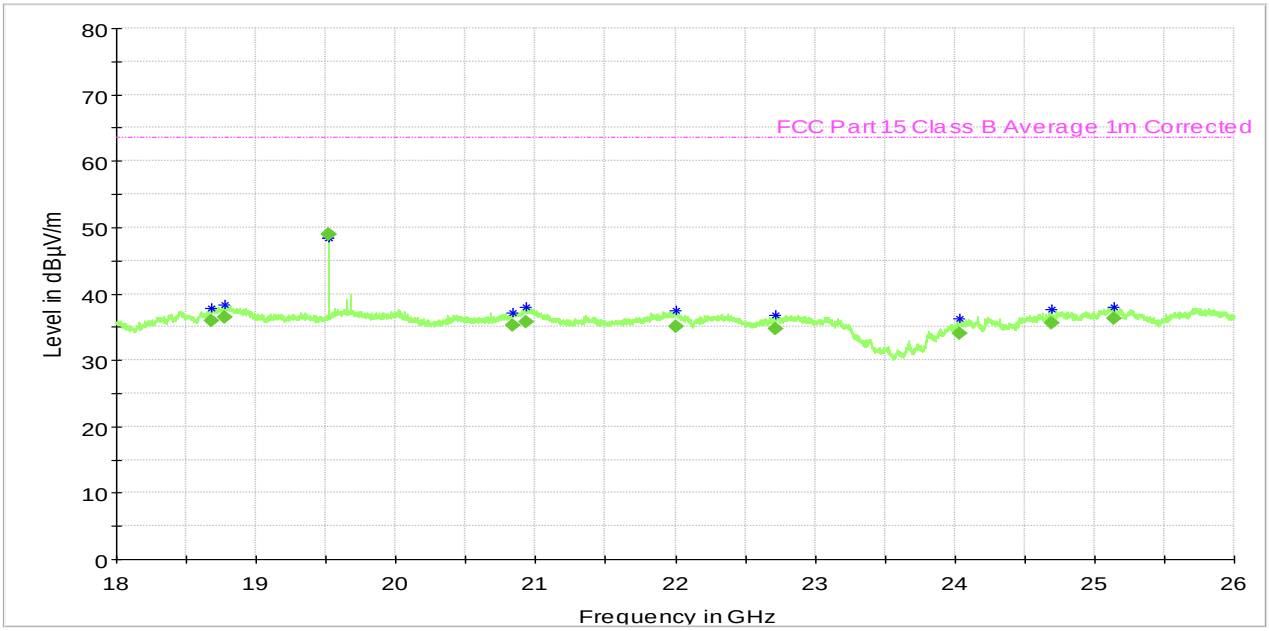
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.118629	16.16	40	23.84	1000	120	410	H	66
43.20772	7.73	40	32.27	1000	120	125	H	27
80.00864	8.75	40	31.25	1000	120	103	V	68
487.92168	10.39	46	35.61	1000	120	179	H	202
699.85304	13.93	46	32.07	1000	120	275	H	-22
956.30116	16.97	46	29.03	1000	120	175	H	251

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 14



Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2543.9965	40.44	---	54	13.56	1000	197	H	277
2596.0117	39.48	---	54	14.52	1000	158	H	307
4236.437	38.66	---	54	15.34	1000	135	H	142
5529.724	41.74	---	54	12.26	1000	165	H	307
5977.878	42.88	---	54	11.12	1000	100	H	187
17984.564	40.21	---	54	13.79	1000	205	V	130

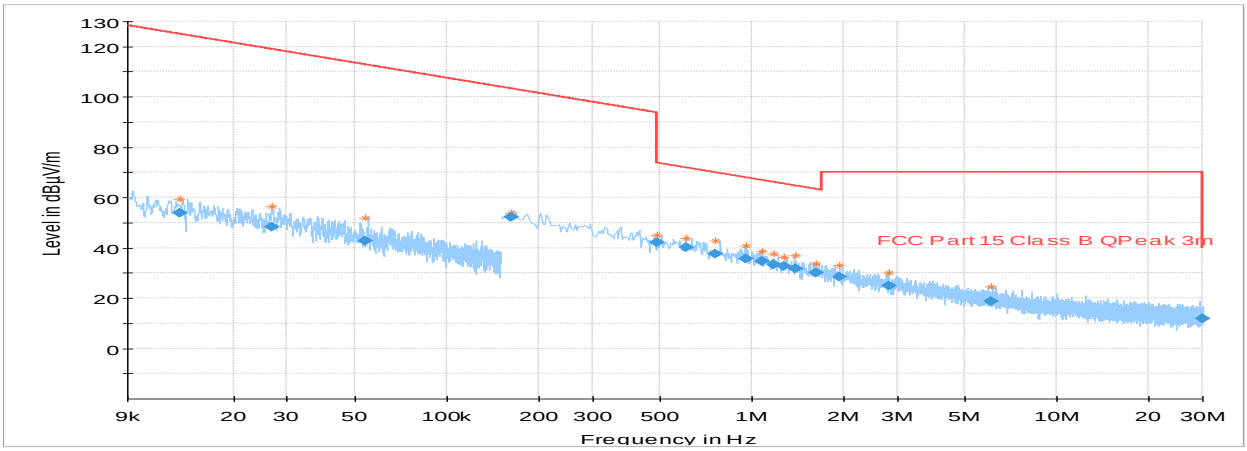
Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2440 MHz (Mid)	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 19



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
18674.825	35.94	63.52	27.58	1000	155	V	232
18772.656	36.5	63.52	27.02	1000	155	V	82
19515.999	48.97	63.52	14.55	1000	155	V	262
19516.049	48.96	63.52	14.56	1000	155	V	262
20932.816	35.73	63.52	27.79	1000	155	V	307
25137.962	36.25	63.52	27.27	1000	155	H	112

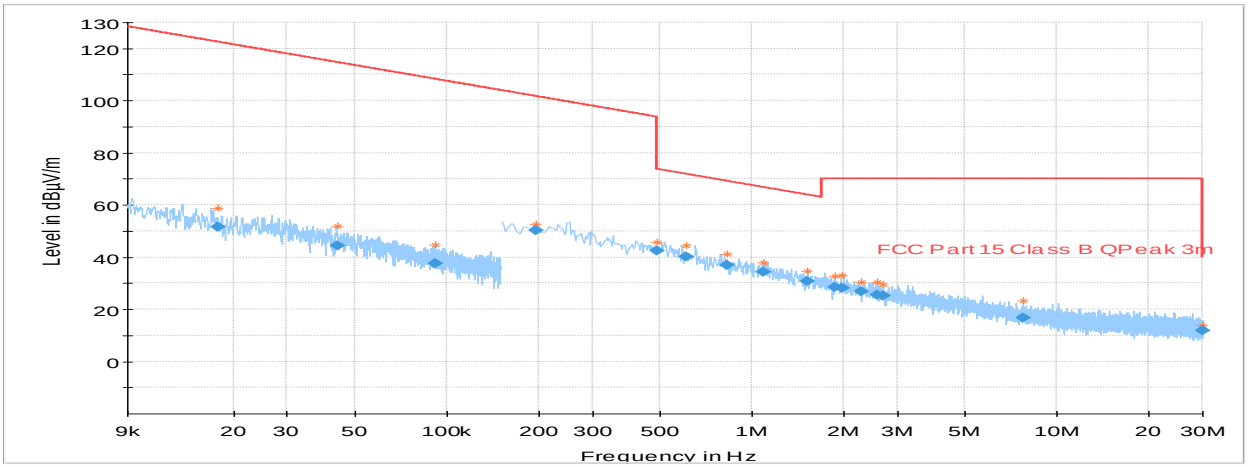
5.3.2.2 Channel frequency 2480 MHz (High)

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to axis	
Channel frequency	2480 MHz (High)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 34



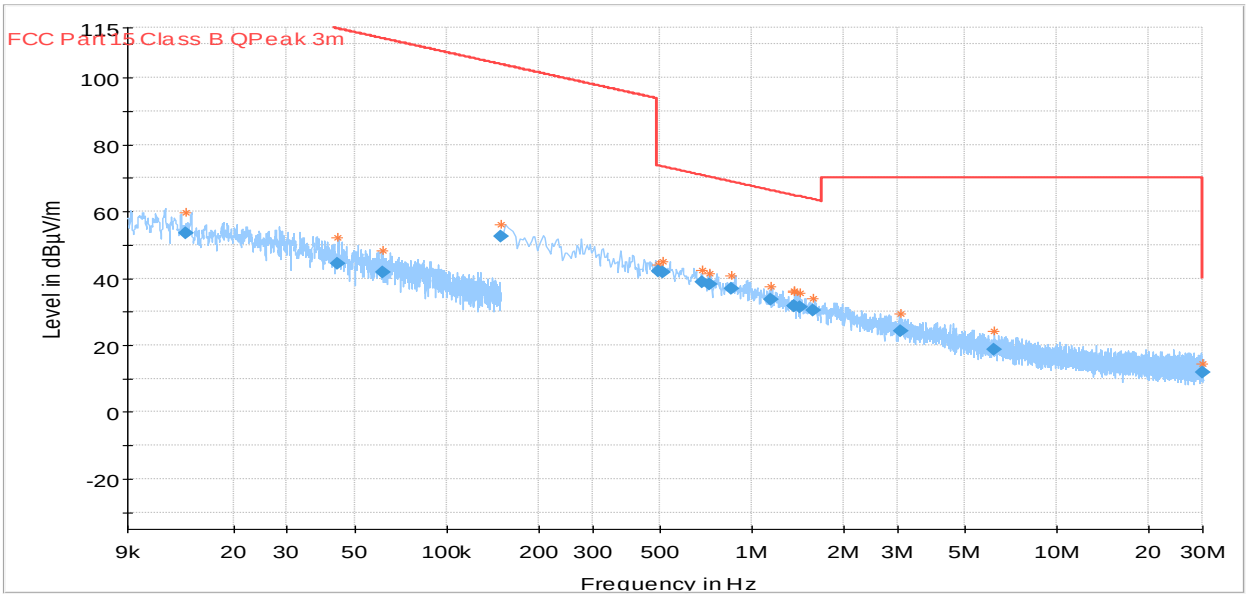
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.490596	42.24	73.79	31.55	9.000	100.0	H	153.0
0.612159	40.17	71.87	31.70	9.000	100.0	H	250.0
0.763149	37.71	69.96	32.25	9.000	100.0	H	183.0
0.952239	35.77	68.05	32.28	9.000	100.0	H	68.0
1.080873	34.52	66.95	32.43	9.000	100.0	H	160.0
1.177236	33.48	66.21	32.73	9.000	100.0	H	108.0

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	perpendicular to axis	
Channel frequency	2480 MHz (High)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 35



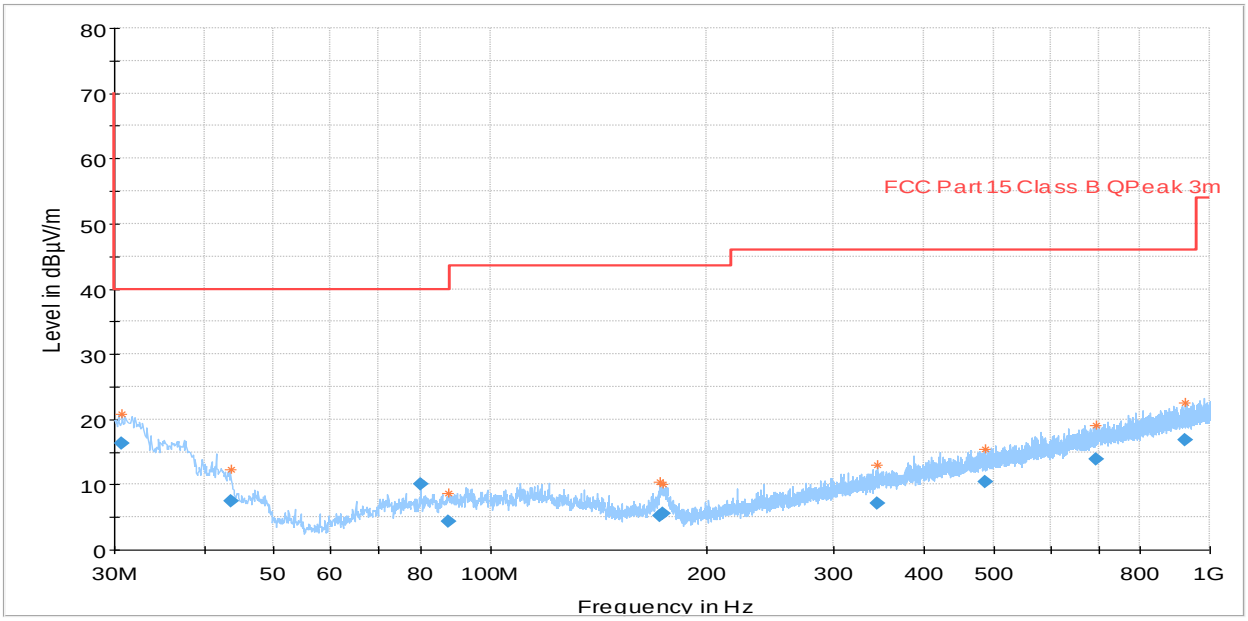
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.608478	40.16	71.92	31.76	9.000	100.0	H	160.0
0.828756	36.99	69.25	32.26	9.000	100.0	H	160.0
1.098174	34.37	66.81	32.44	9.000	100.0	H	-23.0
1.524996	30.74	63.97	33.23	9.000	100.0	H	202.0
1.882128	28.63	70.10	41.47	9.000	100.0	H	247.0
1.971180	28.12	70.10	41.98	9.000	100.0	H	292.0

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to ground	
Channel frequency	2480 MHz (High)	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 44



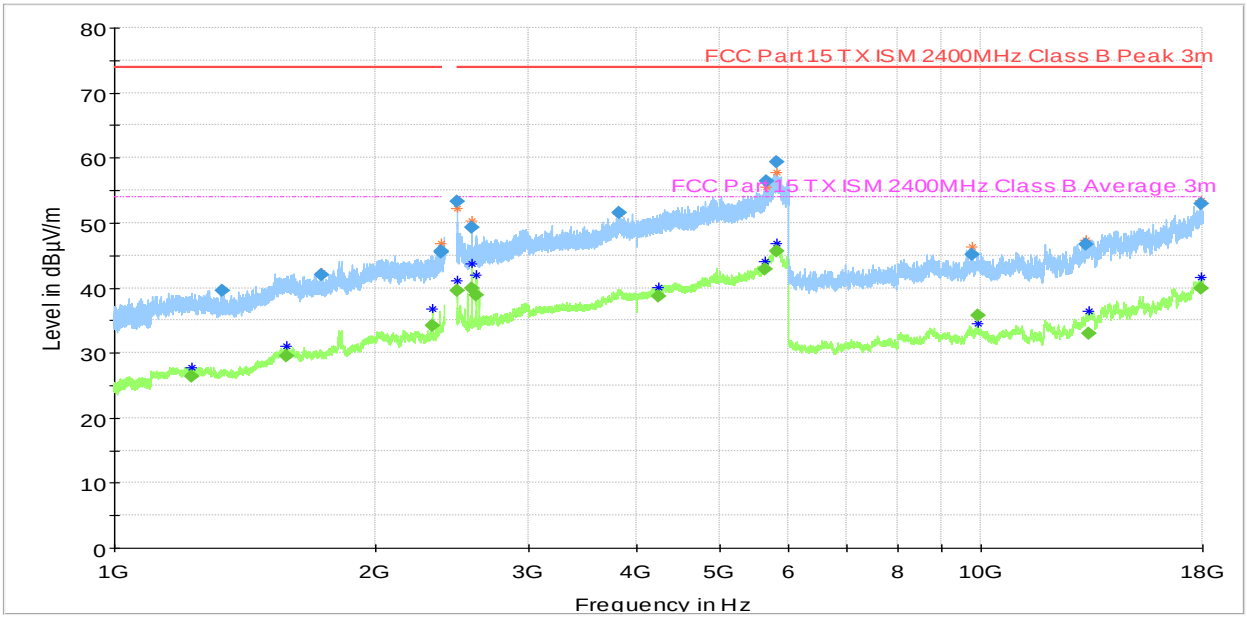
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.496167	42.21	73.69	31.48	9.000	100.0	H	22.0
0.509628	41.87	73.46	31.59	9.000	100.0	H	134.0
0.684246	38.97	70.91	31.93	9.000	100.0	H	108.0
0.722943	38.34	70.43	32.10	9.000	100.0	H	315.0
0.859851	36.80	68.93	32.13	9.000	100.0	H	70.0
1.151325	33.73	66.40	32.67	9.000	100.0	H	293.0

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2480 MHz (High)	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-03-27
Environmental conditions	Temperature: 18,8 ^{0}C	Humidity: 34,2 %
Chamber details	Chamber: SAC 5	Test 6



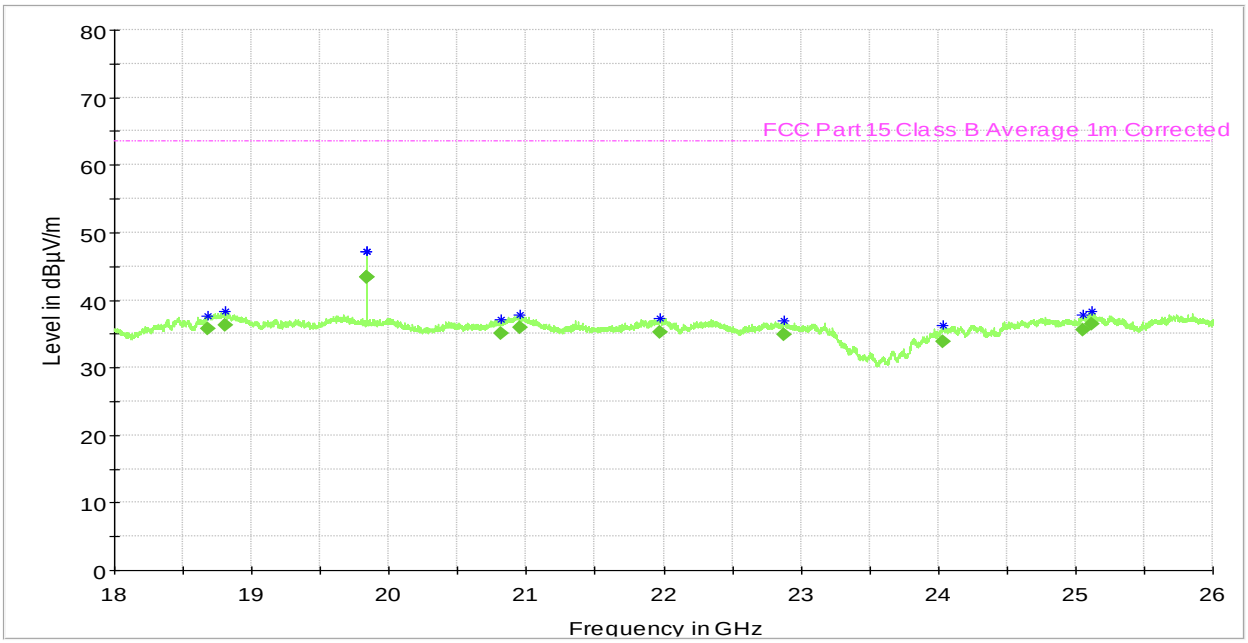
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.72488	16.32	40	23.68	1000	120	310	H	205
43.5094	7.42	40	32.58	1000	120	325	V	64
79.99592	9.99	40	30.01	1000	120	128	V	247
487.81732	10.41	46	35.59	1000	120	275	H	22
695.89364	13.81	46	32.19	1000	120	225	V	200
925.54612	16.81	46	29.19	1000	120	379	H	292

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2480 MHz (High)	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-03-28
Environmental conditions	Temperature: 18,8 ^{0}C	Humidity: 34,2 %
Chamber details	Chamber: SAC 5	Test 12



Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2483.5365	39.6	---	54	14.4	1000	137	V	323
2583.8986	39.91	---	54	14.09	1000	102	V	310
2609.9579	38.83	---	54	15.17	1000	135	V	312
5634.19	42.81	---	54	11.19	1000	210	V	8
5808.405	---	59.37	74	14.63	1000	100	H	135
17930.958	40	---	54	14	1000	185	H	217

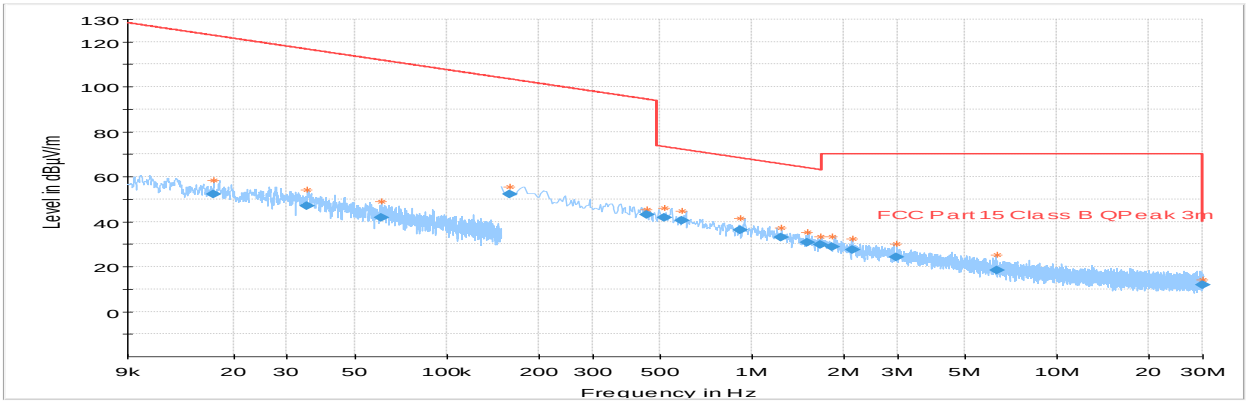
Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	2480 MHz (High)	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.205, 15.209	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 20



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
18678.176	35.77	63.52	27.75	1000	155	V	322
18802.531	36.24	63.52	27.28	1000	155	H	304
19836.006	43.44	63.52	20.08	1000	155	V	175
19836.013	43.47	63.52	20.05	1000	155	V	175
20953.776	35.87	63.52	27.65	1000	155	V	7
25117.392	36.36	63.52	27.16	1000	155	V	142

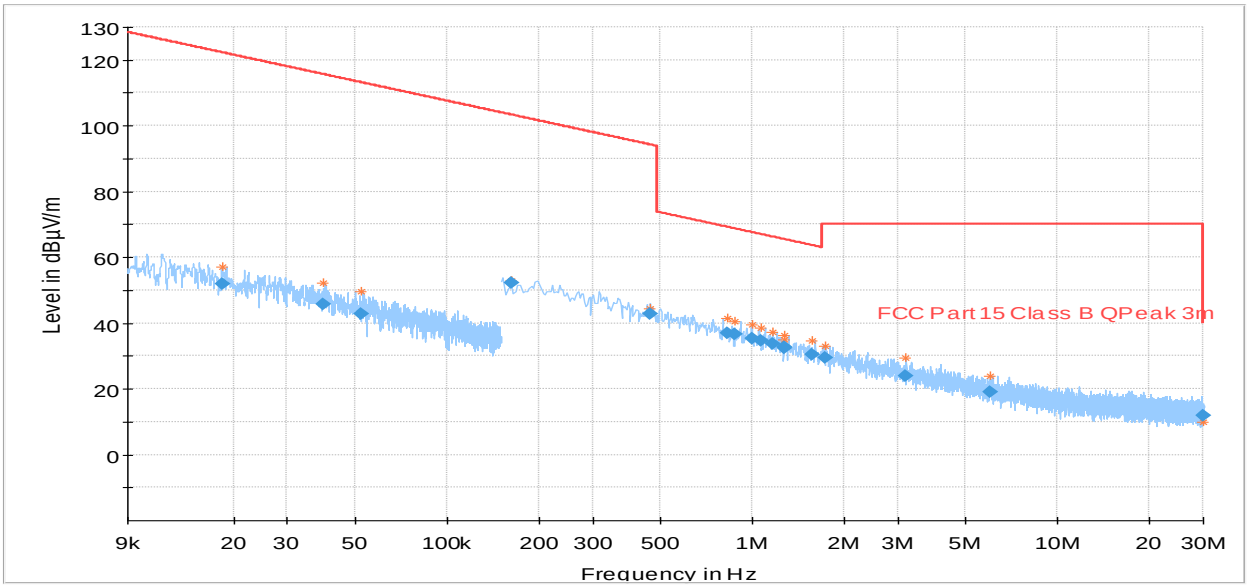
5.3.3 Idle

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to axis	
Channel frequency	Idle	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.109	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 37



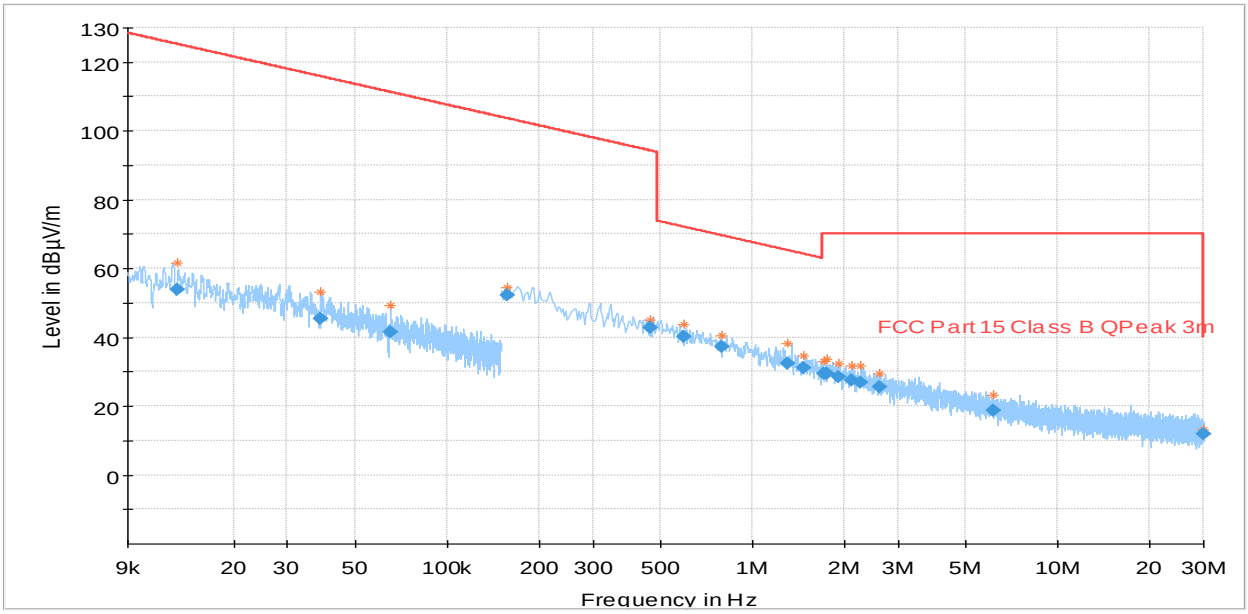
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.519306	41.66	73.3	31.64	9	100	H	293
0.591042	40.42	72.18	31.76	9	100	H	287
0.912237	36.18	68.42	32.24	9	100	H	179
1.250151	32.94	65.69	32.74	9	100	H	-23
1.523859	30.76	63.97	33.21	9	100	H	338
1.673346	29.8	63.16	33.36	9	100	H	135

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	perpendicular	
Channel frequency	Idle	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.109	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-05-04
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 36



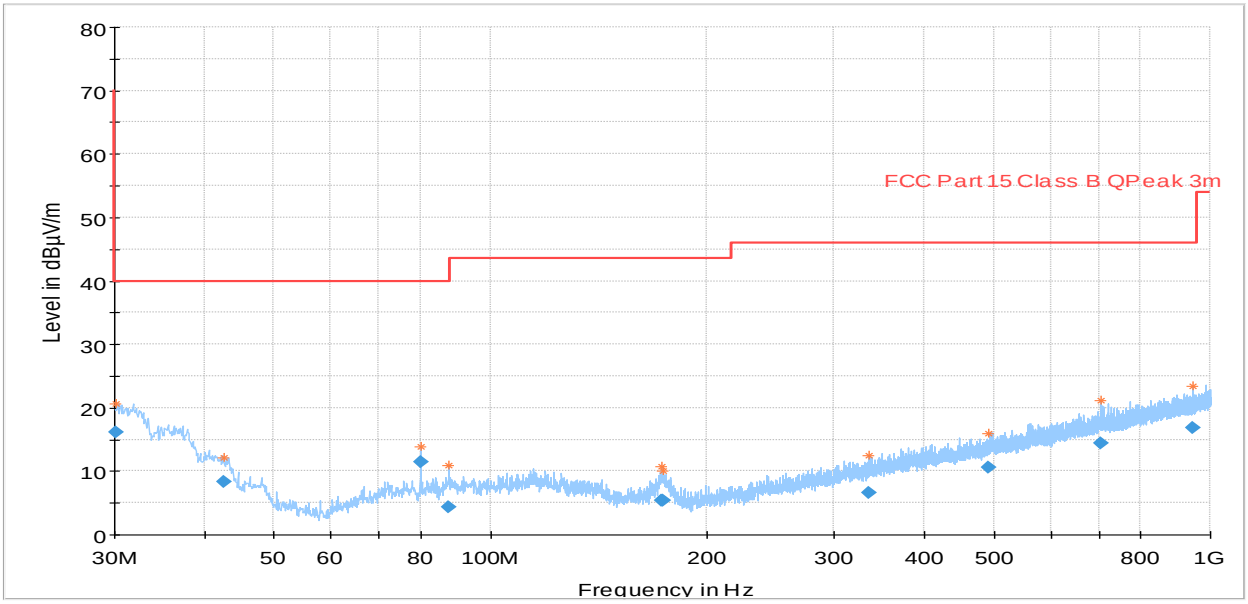
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.828834	36.94	69.25	32.31	9	100	H	157
0.880632	36.47	68.72	32.26	9	100	H	68
0.996168	35.25	67.66	32.41	9	100	H	135
1.062915	34.54	67.09	32.55	9	100	H	198
1.172322	33.53	66.24	32.71	9	100	H	202
1.278468	32.67	65.49	32.83	9	100	H	288

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Parallel to ground	
Channel frequency	Idle	
Sweep frequency	9 KHz - 30 MHz	
FCC Rule part	Part 15.109	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-06
Environmental conditions	Temperature: 18,7 ^{0}C	Humidity: 32,8 %
Chamber details	Chamber: SAC 5	Test 38



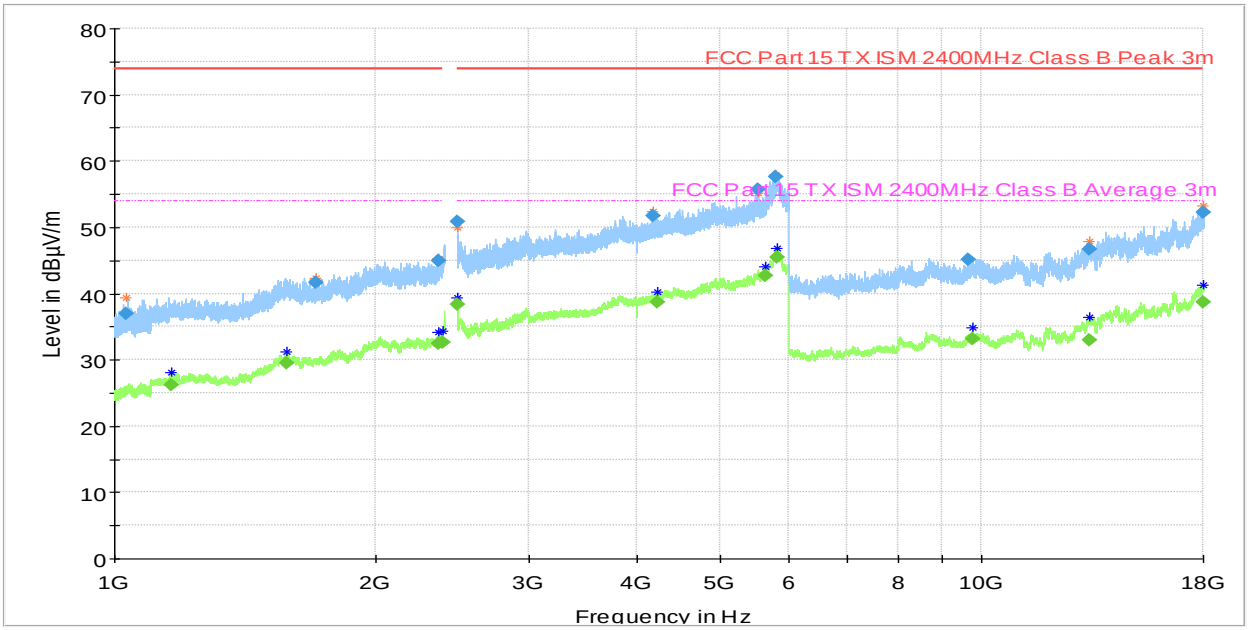
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
0.59724	40.25	72.09	31.83	9	100	H	70
0.791859	37.31	69.64	32.33	9	100	H	63
1.306377	32.33	65.31	32.98	9	100	H	202
1.463187	31.24	64.33	33.08	9	100	H	315
1.71216	29.61	70.1	40.49	9	100	H	62
1.748622	29.31	70.1	40.79	9	100	H	25

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Idle	
Sweep frequency	30 MHz – 1 GHz	
FCC Rule part	Part 15.109	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-03-27
Environmental conditions	Temperature: 18,8 ^{0}C	Humidity: 34,2 %
Chamber details	Chamber: SAC 5	Test 7



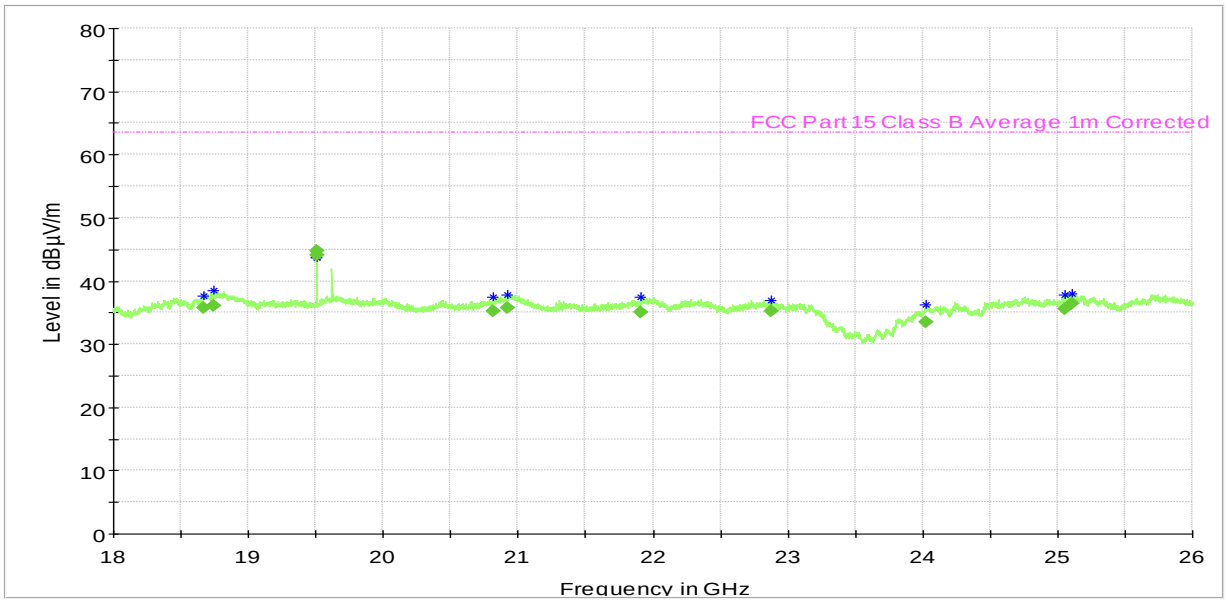
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
30.165137	16.21	40	23.79	1000	120	280	V	22
42.60316	8.4	40	31.6	1000	120	325	H	199
79.99208	11.49	40	28.51	1000	120	127	V	138
492.89556	10.56	46	35.44	1000	120	175	V	202
703.54212	14.34	46	31.66	1000	120	325	H	292
945.1658	16.9	46	29.1	1000	120	410	H	135

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Idle	
Sweep frequency	1 GHz – 18 GHz	
FCC Rule part	Part 15.109	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-03-27
Environmental conditions	Temperature: 18,8 ^{0}C	Humidity: 34,2 %
Chamber details	Chamber: SAC 5	Test 8



Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
2483.5495	38.34	---	54	15.66	1000	115	V	97
4233.08	38.67	---	54	15.33	1000	115	V	-8
5633.993	42.75	---	54	11.25	1000	206	V	51
5779.696	---	57.61	74	16.39	1000	100	V	45
5813.787	45.55	---	54	8.45	1000	135	H	187
17982.586	38.74	---	54	15.26	1000	109	V	262

Test mode condition	Bluetooth Low Energy (BLE)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Idle	
Sweep frequency	18 GHz – 26 GHz	
FCC Rule part	Part 15.109	
EUT	A000224206-001	
Ancillary Equipment	Cable A000224206-009	
Test Engineer	Martin Stump	Date: 2019-04-03
Environmental conditions	Temperature: 19,1 ^{0}C	Humidity: 28,2 %
Chamber details	Chamber: SAC 5	Test 21



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height(cm)	Pol	Azimuth (deg)
19508.069	44.7	63.52	18.82	1000	155	V	308
19508.015	44.08	63.52	19.44	1000	155	V	307
25109.014	36.41	63.52	27.11	1000	155	V	22
18742.636	36.15	63.52	27.37	1000	155	V	217
20923.111	35.83	63.52	27.69	1000	155	V	37
18667.752	35.7	63.52	27.82	1000	155	V	247

6 TEST EQUIPMENT LIST

SAC 5 – Radiated emissions						
Type:	**Manufacturer**	**Model**	**Serial Number**	**GTEM ID**	**Calibration date**	**Calibration Due:**
EMI Test Receiver	Rohde & Schwarz	ESW44	101760	2881044	27.07.2018	27.07.2019
Active Loop Antenna	EMCO	6502	9206-2775	2759035	31.10.2018	31.10.2019
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988	2823181	08.03.2018	08.03.2020
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678	2823164	13.02.2018	13.02.2020
Horn Antenna – 18 GHz – 26 GHz	ETS Lindgren	UG-596A/U	20898	2814839	10.08.2018	10.08.2019
Horn Antenna – 26 GHz - 40 GHz	ETS Lindgren	UG-600A/U	20623	2814834	10.08.2018	10.08.2019
Frequency Multiplier	Rohde & Schwarz	SMZ-90	101350	2886126	13.08.2018	13.08.2019
Control device	Maturo	NCD	NCD/393/2372.01	2884216	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081	2884198	09.09.2018	09.09.2019
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084	2761253	09.09.2018	09.09.2019
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333	2761265	09.09.2018	09.09.2019
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335	2761266	09.09.2018	09.09.2019
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330	2761262	09.09.2018	09.09.2019
Humidity Temperature Probe	Rotronic	HF532-DG1XX21X	0061829280	2926379	14.08.2018	14.08.2020

7 MEASUREMENT UNCERTAINTY

Measurement Uncertainty for Radiated Emission (Coverage Factor k=2)	
Parameter	**Uncertainty**
Field Strength 10 Hz -9 kHz	3,38 dB
Field Strength 9 kHz -30 MHz	3,38 dB
Field Strength 30 MHz -1000 MHz	3,38 dB
Field Strength 1 GHz -18 GHz	4,88 dB
Field Strength 18 GHz - 40 GHz	5,14 dB

8 APPENDIX 1 – TEST SETUP PHOTOS

See report no. 60266327-001 Appendix 1