BLE_2M_Ant1_2402_30~1000

01:24:54 16.08.2023

BLE_2M_Ant1_2402_1000~26500

01:25:17 16.08.2023

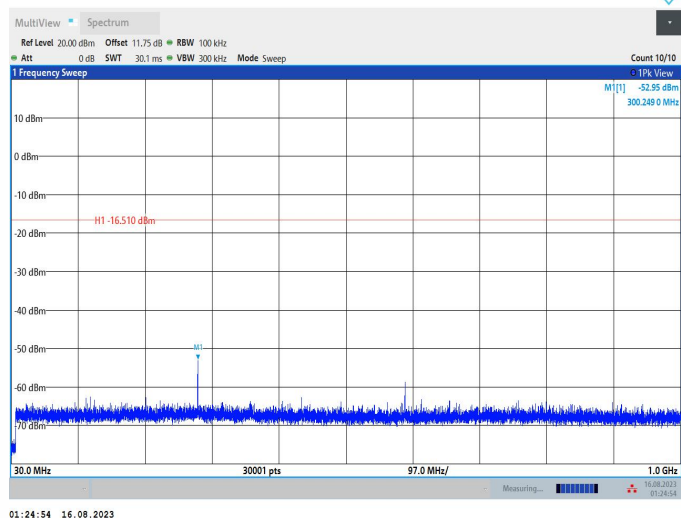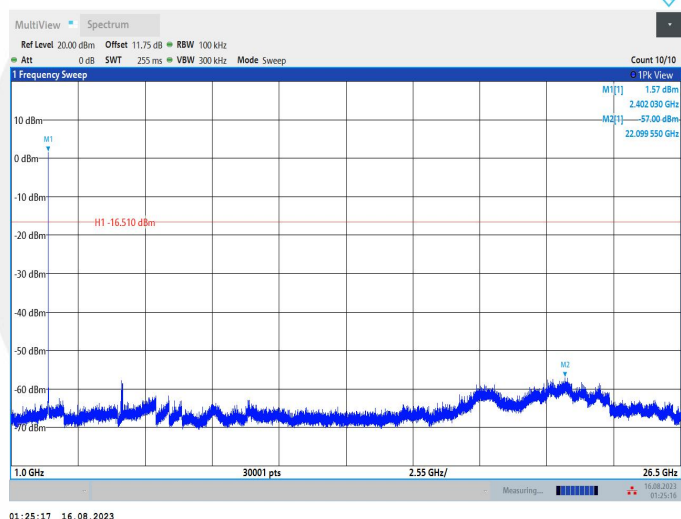| BLE_2M_Ant1_2440_30~1000 |
|---|

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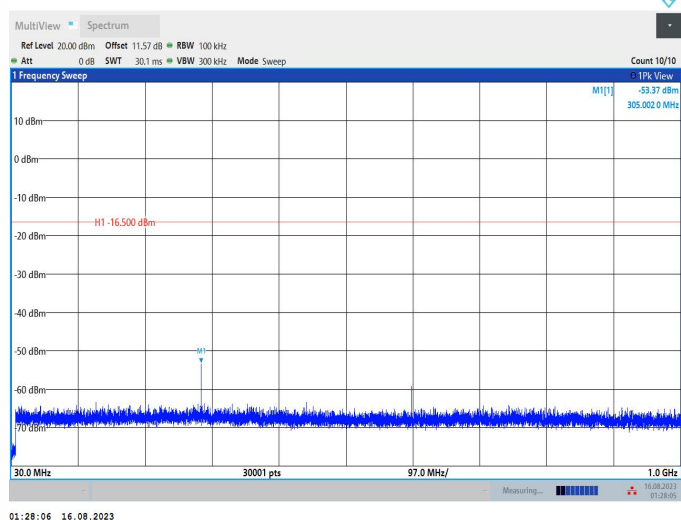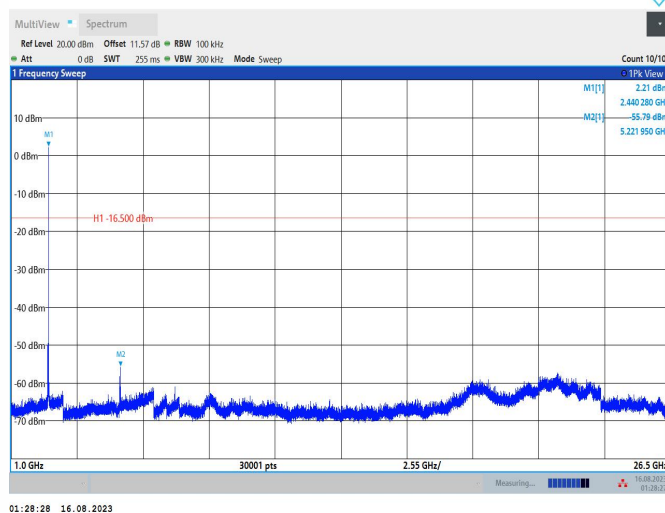
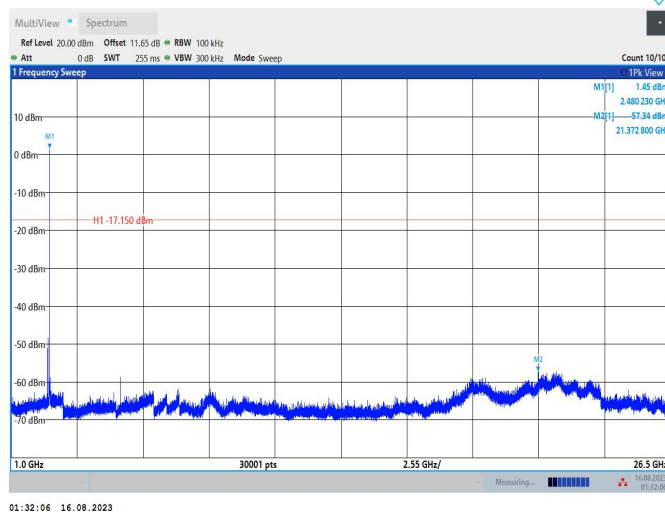## BLE_2M_Ant1_2440_1000~26500

BLE_2M_Ant1_2480_30~1000
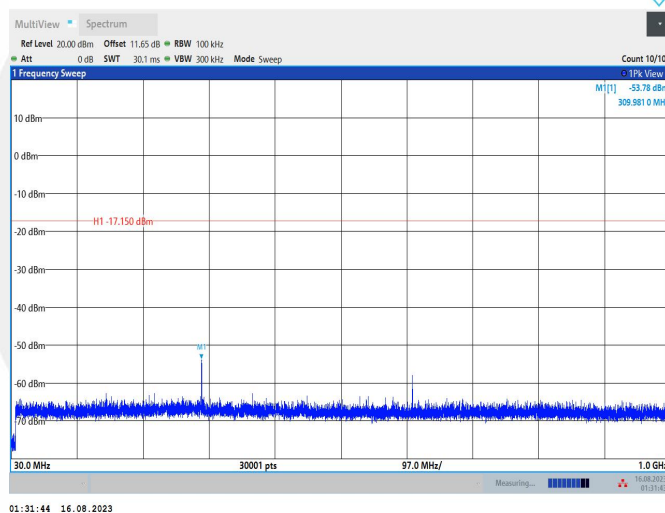
BLE_2M_Ant1_2480_1000~26500

8.6 RADIATED SPURIOUS EMISSION

8.6.1 Applicable Standard

According to FCC Part 15.247(d),15.205, 15.209 and KDB 558074 D01 15.247 Meas Guidancev05r02
According to IC RSS-Gen and RSS-247

8.6.2 Conformance Limit

According to FCC Part 15.247(d): 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)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.205,the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

8.6.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

8.6.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz(1GHz to 25GHz), 100 kHz for f < 1 GHz(30MHz to 1GHz)

VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

8.6.5 Test Results

Temperature:	22° C
Relative Humidity:	43%
ATM Pressure:	1011 mbar

■ Spurious Emission below 30MHz(9KHz to 30MHz)

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor

■ Spurious Emission Above 1GHz(1GHz to 25GHz)

All the antenna(Antenna 1) and modes(BLE_1M, BLE_2M) mode have been tested, and the worst(Antenna 1,BLE_2M) resultrecorded was report as below:

Test mode:	BLE_2M			Frequency:		Channel 0: 2402MHz	
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11463.7	V	60.13	42.41	74.00	54.00	13.87	11.59
14655	V	63.80	45.14	74.00	54.00	10.20	8.86
17960.6	V	67.11	46.37	74.00	54.00	6.89	7.63
11476.8	H	59.95	42.99	74.00	54.00	14.05	11.01
14688.7	H	64.33	44.44	74.00	54.00	9.67	9.56
17735.6	H	65.50	46.99	74.00	54.00	8.50	7.01

Test mode:	BLE_2M			Frequency:		Channel 19: 2440MHz	
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11478.7	V	59.86	42.80	74.00	54.00	14.14	11.20
14578.1	V	63.18	45.83	74.00	54.00	10.82	8.17
17975.6	V	68.10	46.73	74.00	54.00	5.90	7.27
10070.6	H	57.36	39.30	74.00	54.00	16.64	14.70
14625	H	63.80	45.99	74.00	54.00	10.20	8.01
17971.8	H	66.25	46.52	74.00	54.00	7.75	7.48

Test mode:	BLE_2M			Frequency:		Channel 39: 2480MHz	
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11478.7	V	60.72	42.52	74.00	54.00	13.28	11.48
14626.8	V	64.11	45.95	74.00	54.00	9.89	8.05
17970	V	67.63	46.84	74.00	54.00	6.37	7.16
11450.6	H	59.95	42.46	74.00	54.00	14.05	11.54
14568.7	H	63.75	45.81	74.00	54.00	10.25	8.19
17975.6	H	67.49	47.22	74.00	54.00	6.51	6.78

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L– Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

All the antenna(Antenna 1) and modes(BLE_1M, BLE_2M) mode have been tested, and the worst(Antenna 1,BLE_2M) resultrecorded was report as below:

Test mode:	BLE_2M		Frequency:	Channel 0: 2402MHz	
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2388.34	H	45.08	74.00	37.53	54.00
2389.46	V	44.64	74.00	39.62	54.00

Test mode:	BLE_2M		Frequency:	Channel 39: 2480MHz	
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2483.78	H	45.60	74.00	38.52	54.00
2483.70	V	46.48	74.00	40.22	54.00

Note:
(1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
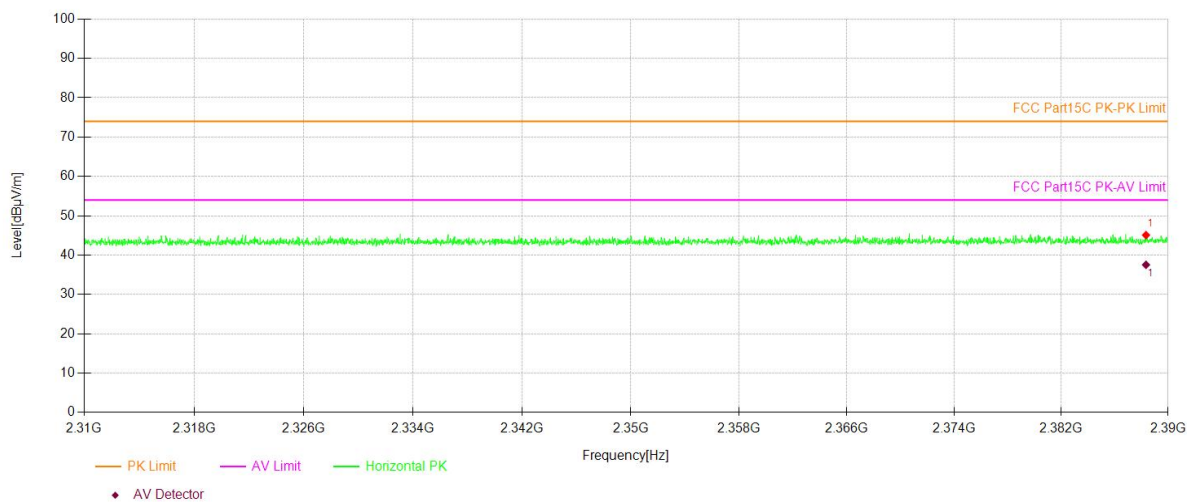
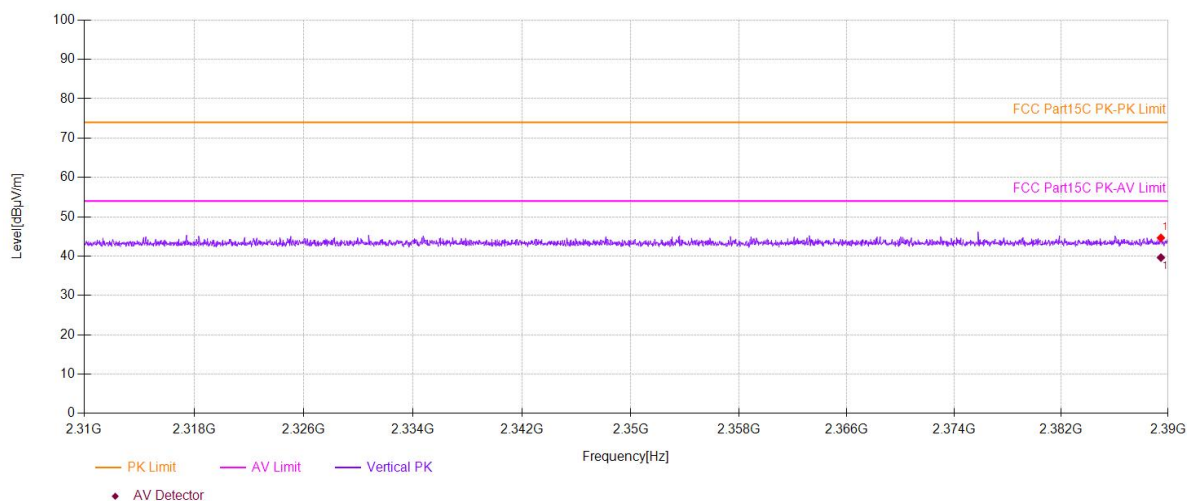| Test Model	Spurious Emission in Restricted Band2483.5-2500MHz		
	Channel 39: 2480MHz	BLE_2M	H

Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz		
	Channel 39: 2480MHz	BLE_2M	V
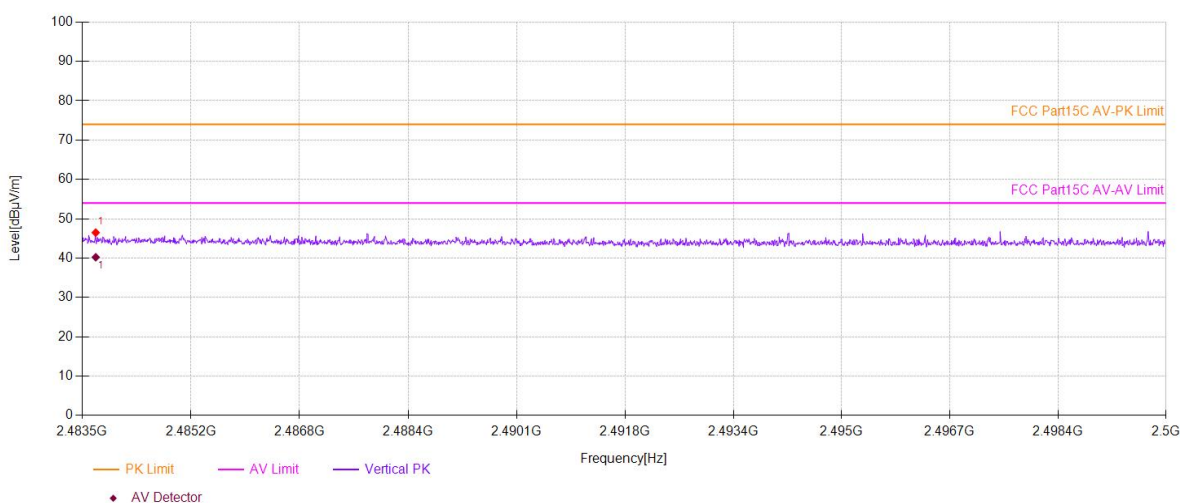
All the antenna(Antenna 1) and modes(BLE_1M, BLE_2M) mode have been tested, and the worst(Antenna 1,BLE_2M) resultrecorded was report as below:

Mode:	BLE2402
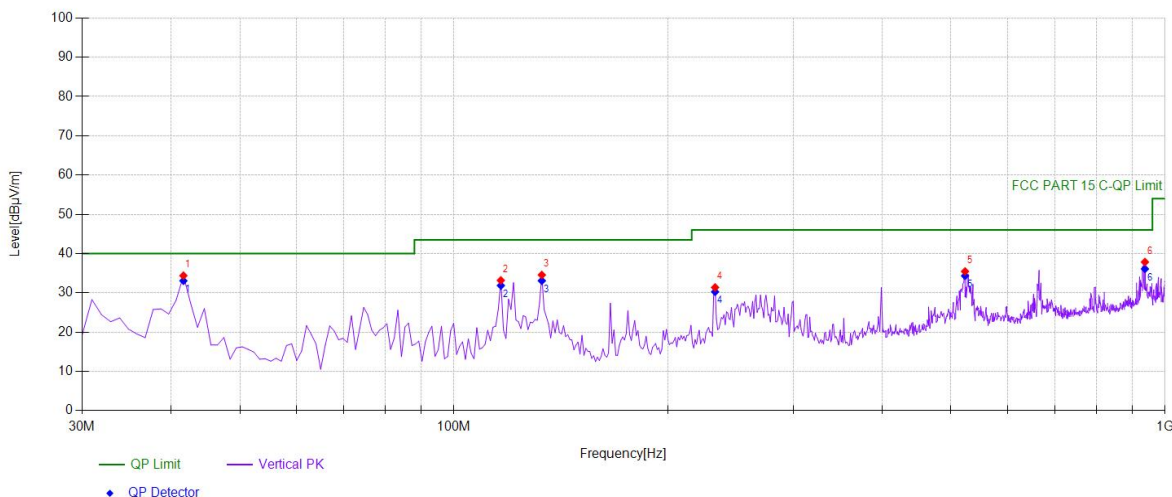
Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Detector	Limit [dBµV/m]	Margin [dB]	Polarity
1	41.6517	52.19	-17.80	34.39	PK	40.00	5.61	Vertical
2	116.416	50.89	-17.71	33.18	PK	43.50	10.32	Vertical
3	132.922	53.87	-19.30	34.57	PK	43.50	8.93	Vertical
4	232.932	47.25	-15.87	31.38	PK	46.00	14.62	Vertical
5	523.253	45.14	-9.68	35.46	PK	46.00	10.54	Vertical
6	936.886	40.35	-2.50	37.85	PK	46.00	8.15	Vertical

Mode:	BLE2402
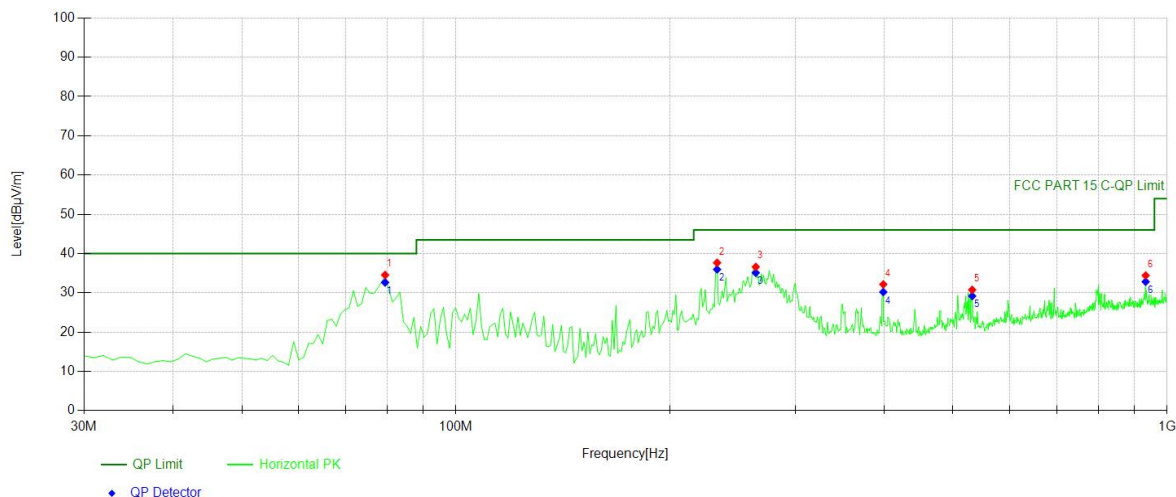
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	79.5195	55.97	-21.42	34.55	PK	40.00	5.45	Horizontal
2	232.932	53.54	-15.87	37.67	PK	46.00	8.33	Horizontal
3	264.004	51.62	-15.00	36.62	PK	46.00	9.38	Horizontal
4	398.969	43.95	-11.79	32.16	PK	46.00	13.84	Horizontal
5	531.992	40.23	-9.45	30.78	PK	46.00	15.22	Horizontal
6	933.003	36.98	-2.56	34.42	PK	46.00	11.58	Horizontal

Mode:	BLE2440
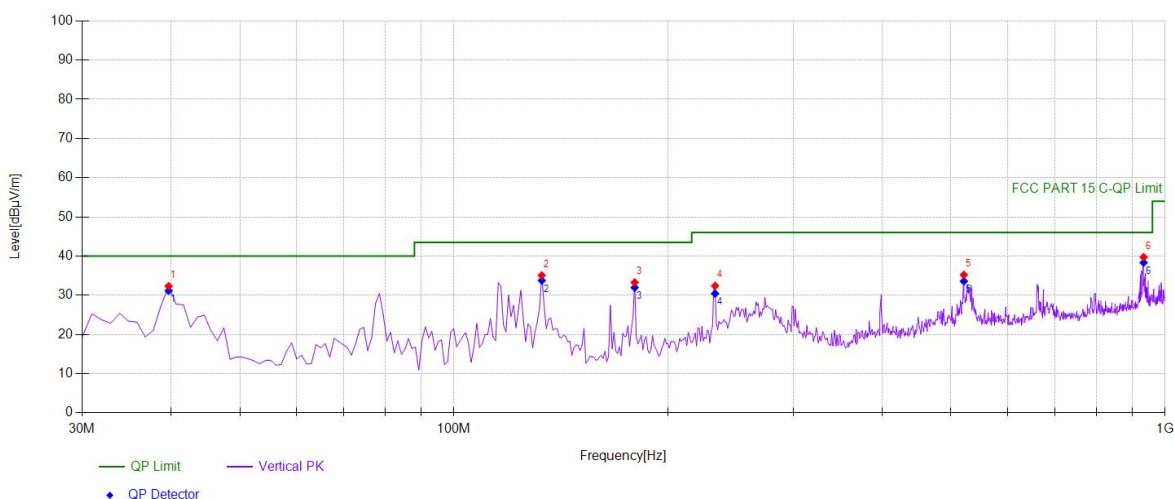
| | QP Limit | Vertical PK |
| QP Detector | | |

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	39.7097	50.25	-17.93	32.32	PK	40.00	7.68	Vertical
2	132.922	54.38	-19.30	35.08	PK	43.50	8.42	Vertical
3	179.529	51.70	-18.42	33.28	PK	43.50	10.22	Vertical
4	232.932	48.27	-15.87	32.40	PK	46.00	13.60	Vertical
5	521.311	44.93	-9.73	35.20	PK	46.00	10.80	Vertical
6	933.003	42.30	-2.56	39.74	PK	46.00	6.26	Vertical

Mode:	BLE2440
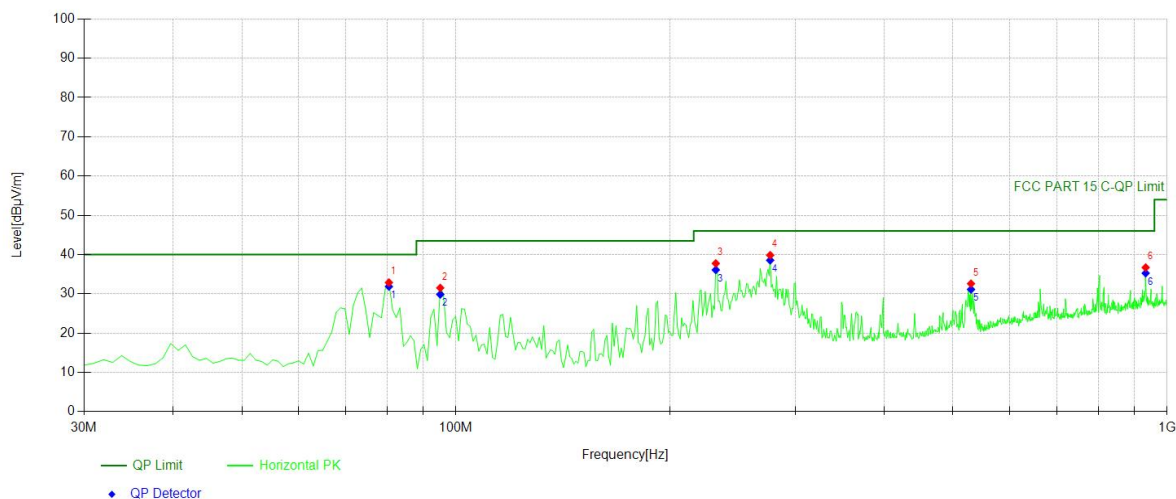
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	80.4905	54.25	-21.37	32.88	PK	40.00	7.12	Horizontal
2	95.0551	49.49	-17.97	31.52	PK	43.50	11.98	Horizontal
3	231.962	53.70	-15.95	37.75	PK	46.00	8.25	Horizontal
4	276.626	54.22	-14.37	39.85	PK	46.00	6.15	Horizontal
5	530.050	42.10	-9.50	32.60	PK	46.00	13.40	Horizontal
6	933.003	39.28	-2.56	36.72	PK	46.00	9.28	Horizontal
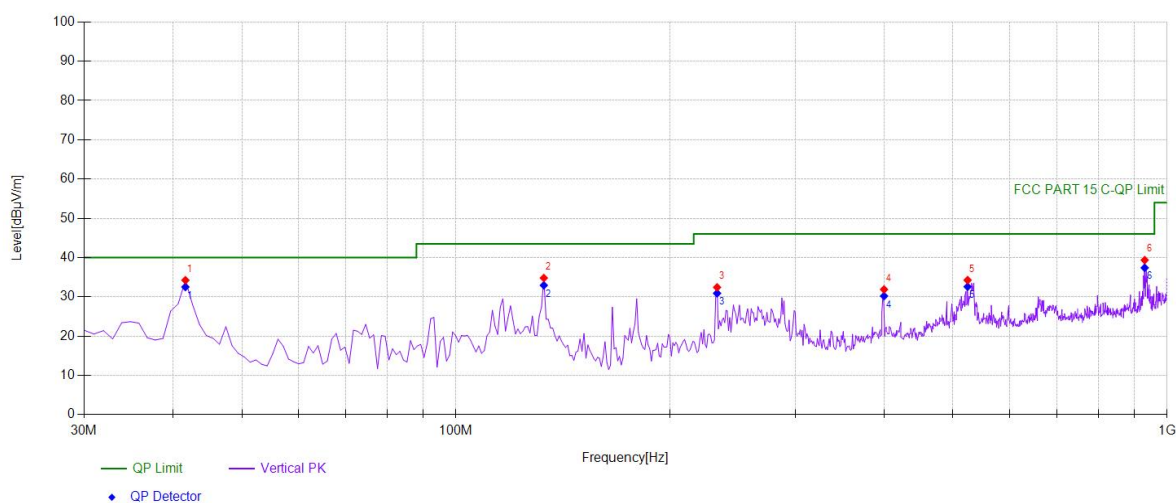
Suspected Data List

Mode:	BLE2480

- QP Limit
- Vertical PK
- ◆ QP Detector

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	41.6517	52.04	-17.80	34.24	PK	40.00	5.76	Vertical
2	132.922	54.12	-19.30	34.82	PK	43.50	8.68	Vertical
3	232.932	48.30	-15.87	32.43	PK	46.00	13.57	Vertical
4	399.939	43.68	-11.79	31.89	PK	46.00	14.11	Vertical
5	524.224	43.91	-9.65	34.26	PK	46.00	11.74	Vertical
6	930.090	41.99	-2.62	39.37	PK	46.00	6.63	Vertical

Mode:	BLE2480
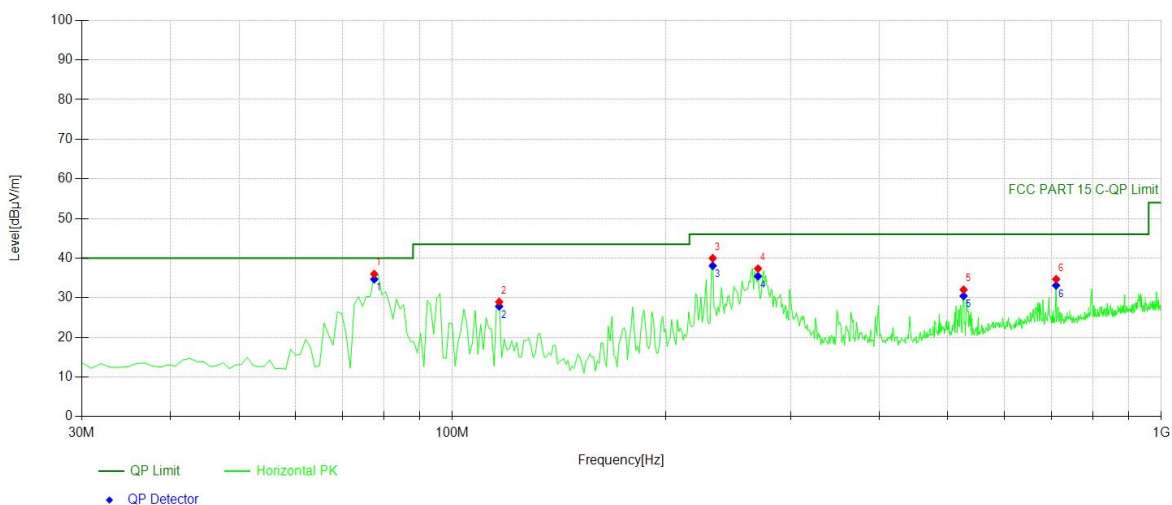
QP Limit	Horizontal PK
QP Detector	

Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Detector	Limit [dBµV/m]	Margin [dB]	Polarity
1	77.5776	57.11	-21.12	35.99	PK	40.00	4.01	Horizontal
2	116.416	46.68	-17.71	28.97	PK	43.50	14.53	Horizontal
3	232.932	55.86	-15.87	39.99	PK	46.00	6.01	Horizontal
4	269.829	52.12	-14.76	37.36	PK	46.00	8.64	Horizontal
5	526.166	41.63	-9.60	32.03	PK	46.00	13.97	Horizontal
6	710.650	40.52	-5.84	34.68	PK	46.00	11.32	Horizontal

8.7 CONDUCTED EMISSIONS TEST

8.7.1 Applicable Standard

According to FCC Part 15.207(a)
According to IC RSS-Gen 8.8

8.7.2 Conformance Limit

<div align="center">

Conducted Emission Limit

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

</div>

Note: 1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

8.7.3 Test Configuration

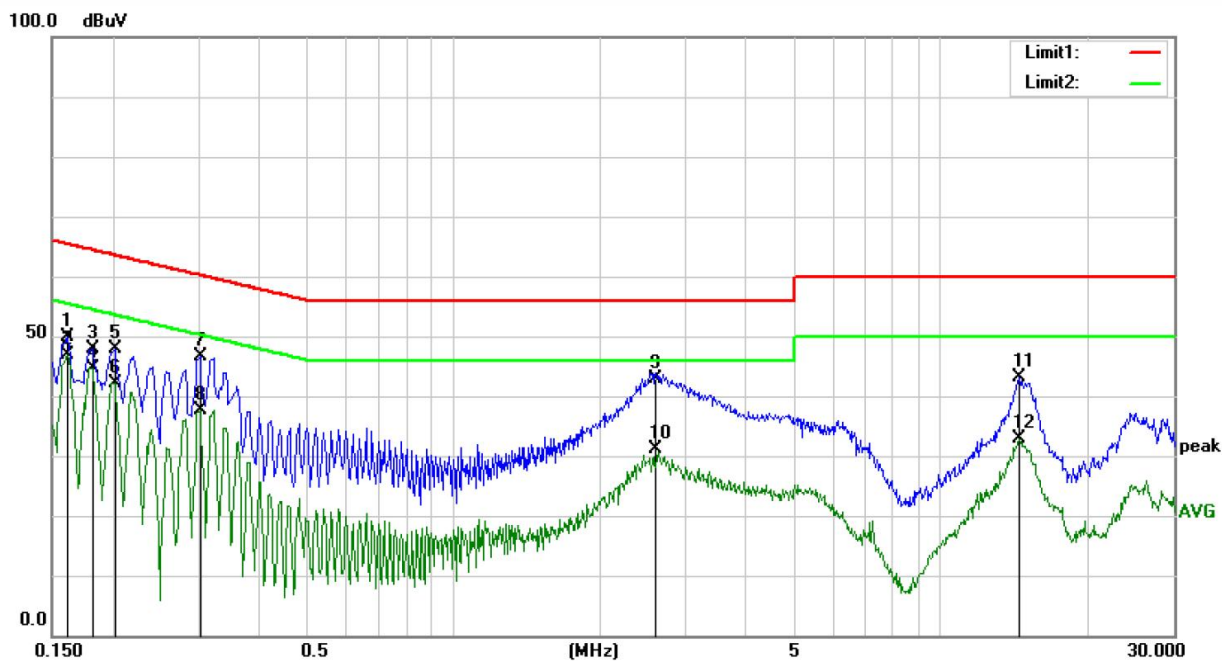Test according to clause 7.3 conducted emission test setup

8.7.4 Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Repeat above procedures until all frequency measured were complete.

8.7.5 Test Results

PASS

	Site	Conduction #2		Phase:	**L1**	Temperature:	23.6
Limit:	(CE)FCC PART 15 class B_QP			Power:	AC 120V/60Hz	Humidity:	48 %
Mode:	AC charging						
Note:							

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1620	39.82	10.15	49.97	65.36	-15.39	QP	
2	*	0.1620	36.75	10.15	46.90	55.36	-8.46	AVG	
3		0.1820	37.83	10.16	47.99	64.39	-16.40	QP	
4		0.1820	34.55	10.16	44.71	54.39	-9.68	AVG	
5		0.2020	37.60	10.16	47.76	63.53	-15.77	QP	
6		0.2020	31.86	10.16	42.02	53.53	-11.51	AVG	
7		0.3020	36.54	10.15	46.69	60.19	-13.50	QP	
8		0.3020	27.58	10.15	37.73	50.19	-12.46	AVG	
9		2.6060	32.60	10.21	42.81	56.00	-13.19	QP	
10		2.6060	20.91	10.21	31.12	46.00	-14.88	AVG	
11		14.4420	32.65	10.46	43.11	60.00	-16.89	QP	
12		14.4420	22.46	10.46	32.92	50.00	-17.08	AVG	

			100.0 dBuV				

Site Conduction #2

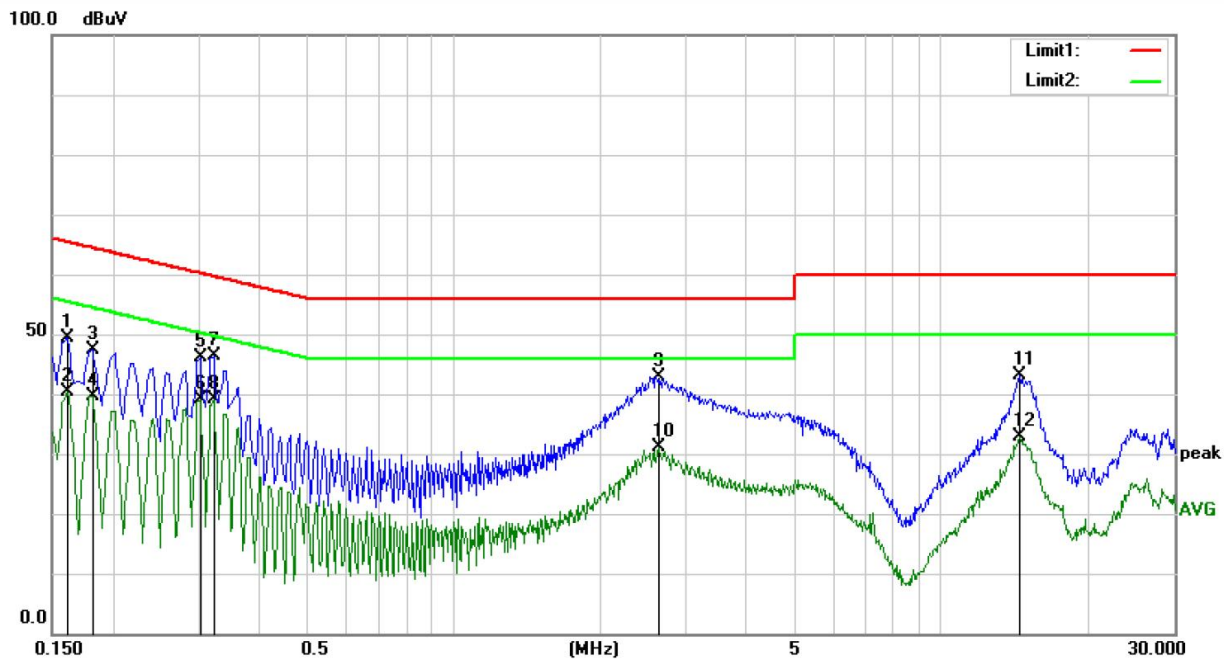Phase: **N**

Temperature: 23.6

Limit: (CE)FCC PART 15 class B_QP

Power: AC 120V/60Hz

Humidity: 48 %

Mode: AC charging

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	39.32	10.15	49.47	65.36	-15.89	QP	
2		0.1620	30.25	10.15	40.40	55.36	-14.96	AVG	
3		0.1820	37.33	10.16	47.49	64.39	-16.90	QP	
4		0.1820	29.55	10.16	39.71	54.39	-14.68	AVG	
5		0.3020	36.04	10.15	46.19	60.19	-14.00	QP	
6		0.3020	28.87	10.15	39.02	50.19	-11.17	AVG	
7		0.3220	36.27	10.14	46.41	59.66	-13.25	QP	
8	*	0.3220	29.09	10.14	39.23	49.66	-10.43	AVG	
9		2.6340	32.60	10.21	42.81	56.00	-13.19	QP	
10		2.6340	20.91	10.21	31.12	46.00	-14.88	AVG	
11		14.4420	32.65	10.46	43.11	60.00	-16.89	QP	
12		14.4420	22.46	10.46	32.92	50.00	-17.08	AVG	

8.8 ANTENNA APPLICATION

8.8.1   Antenna Requirement

Standard	Requirement
FCC CRF Part15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
FCC 47 CFR Part 15.247 (b)	If transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
RSS-Gen Section 6.8	The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.
RSS-247 Section 5.4	If the transmitter employs an antenna system that emits multiple directional beams, but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device (i.e. the sum of the power supplied to all antennas, antenna elements, staves, etc., and summed across all carriers or frequency channels) shall not exceed the applicable output power limit. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

8.8.2   Result

PASS.

Note: ☑   Antenna use a permanently attached antenna which is not replaceable.
       ☐   Not using a standard antenna jack or electrical connector for antenna replacement
       ☐   The antenna has to be professionally installed (please provide method of installation)

Please refer to the attached documentInternal Photos to show the antenna connector.

--------- END OF REPORT --------