

ANNEX A: Test Result

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the loop antenna is coplanar, the others are vertical and horizontal. and the worst case was recorded.

1. Unwanted Emission

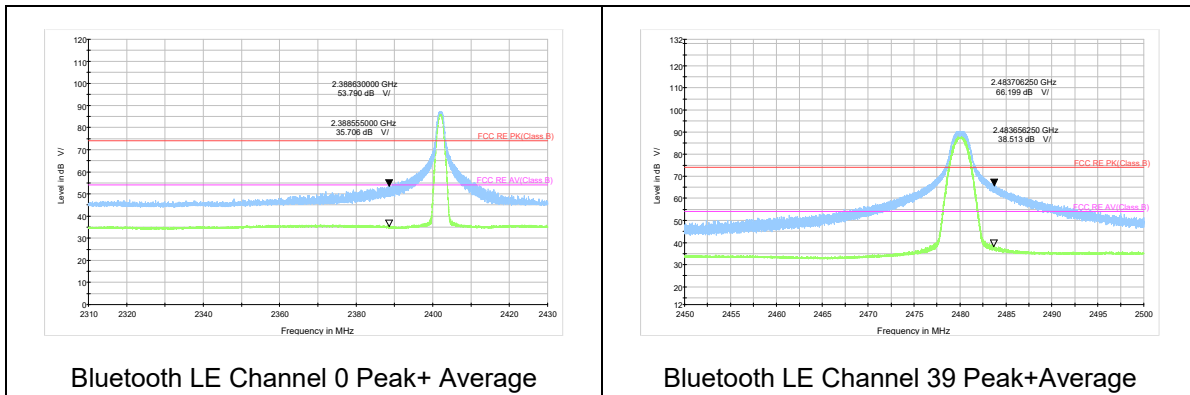
1.1. Bluetooth LE

The following graphs display the maximum values of horizontal and vertical by software. Blue trace uses the peak detection, Green trace uses the average detection.

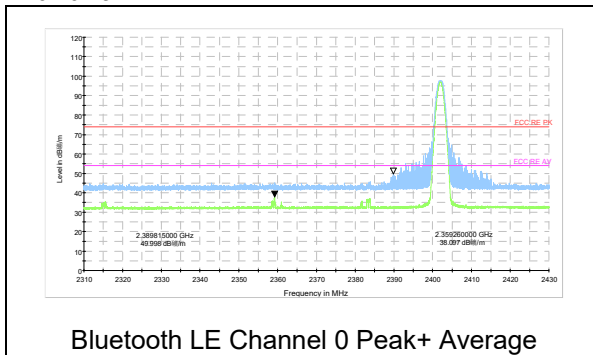
The signal beyond the limit is carrier.

A symbol ($\text{dB } \mu\text{V/m}$) in the test plot below means (dB $\mu\text{V/m}$)

Original



Variant



Result of RE

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier. The Radiates Emission from 9kHz to 30MHz and 18GHz to 26.5GHz are more than 20dB below the limit are not reported.

Remark:

1. **Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)**
2. **Margin = Limit – Quasi-Peak/ MAX Peak/ Average**
3. **A symbol ($\text{dB } \mu\text{V/m}$) in the test plot below means ($\text{dB}\mu\text{V/m}$)**
4. **The following graphs display the maximum values of coaxial and coplanar for 9k-30MHz; horizontal and vertical for above 30MHz by software.**
5. **For below 1GHz**

 QP Level @Spectrum Overview H
  QP Level @Spectrum Overview V
  QP Level @Final Results
  QP Limit

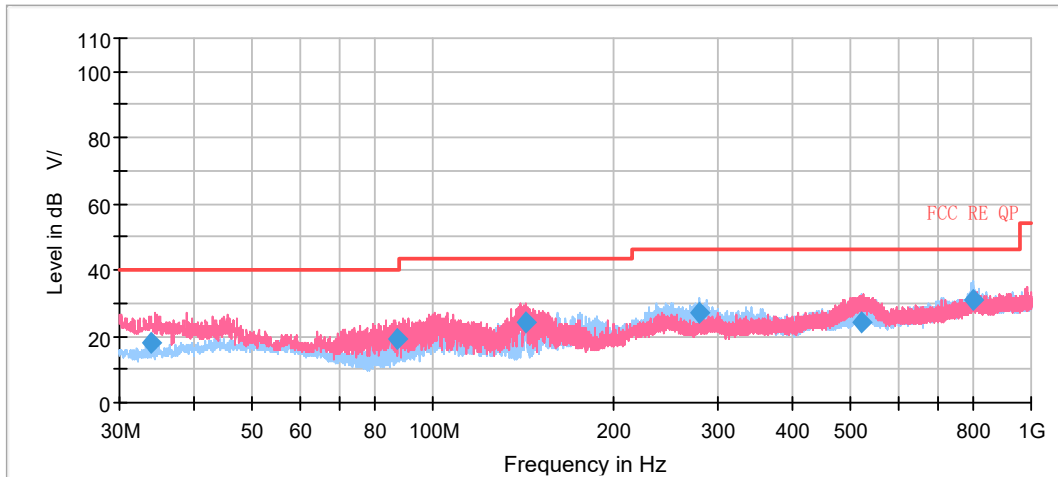
For above 1GHz

 PK Level @Spectrum Overview H
  PK Level @Spectrum Overview V
  PK Level @Final Results
  PK Limit
 AVG Level @Spectrum Overview H
  AVG Level @Spectrum Overview V
  AVG Level @Final Results
  AVG Limit

Original

Continuous TX mode:

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels. The test data of the worst-case condition (Bluetooth LE-Channel 0) was recorded in this report.



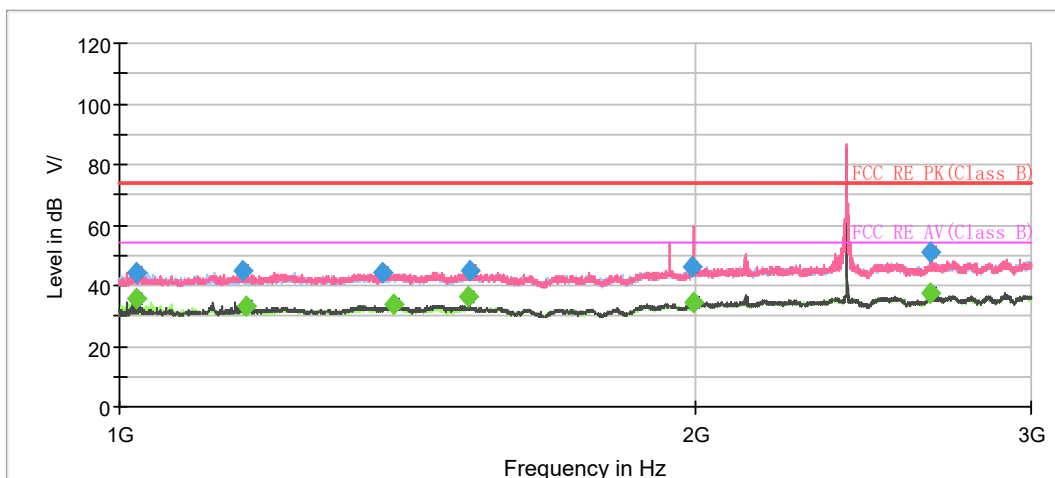
Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
33.942000	17.87	40.00	22.13	100.0	V	75.0	17.3
87.021667	19.36	40.00	20.64	109.0	V	229.0	15.3
142.865333	24.24	43.50	19.26	100.0	V	150.0	14.9
279.086667	26.81	46.00	19.19	100.0	H	99.0	19.9
520.468667	24.46	46.00	21.54	184.0	H	231.0	25.1
799.824333	30.82	46.00	15.18	100.0	H	48.0	29.0

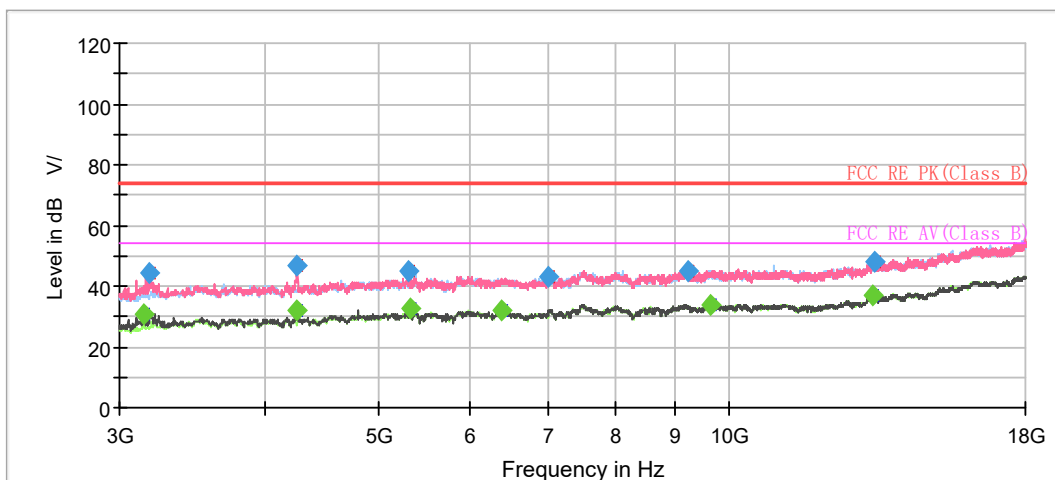
Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak

Bluetooth LE-Channel 0



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz



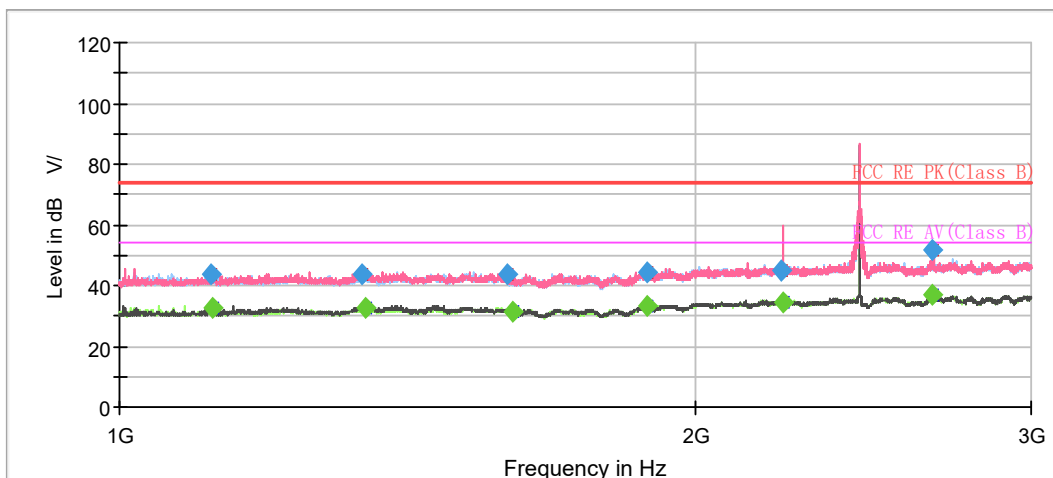
Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1021.250000	---	35.84	54.00	18.16	500.0	200.0	H	73.0	-8.6
1021.500000	44.24	---	74.00	29.76	500.0	200.0	H	73.0	-8.6
1160.500000	44.78	---	74.00	29.22	500.0	100.0	V	329.0	-7.7
1164.000000	---	33.16	54.00	20.84	500.0	200.0	V	57.0	-7.7
1372.250000	44.51	---	74.00	29.49	500.0	100.0	V	84.0	-6.4
1392.750000	---	33.90	54.00	20.10	500.0	100.0	V	66.0	-6.2
1523.250000	---	36.61	54.00	17.39	500.0	200.0	H	77.0	-5.4
1525.000000	44.93	---	74.00	29.07	500.0	200.0	H	120.0	-5.4
1994.750000	46.08	---	74.00	27.92	500.0	200.0	H	207.0	-3.0
1996.500000	---	34.36	54.00	19.64	500.0	100.0	V	235.0	-3.0
2655.000000	---	37.28	54.00	16.72	500.0	100.0	V	0.0	-0.1
2655.250000	50.89	---	74.00	23.11	500.0	100.0	V	0.0	-0.1

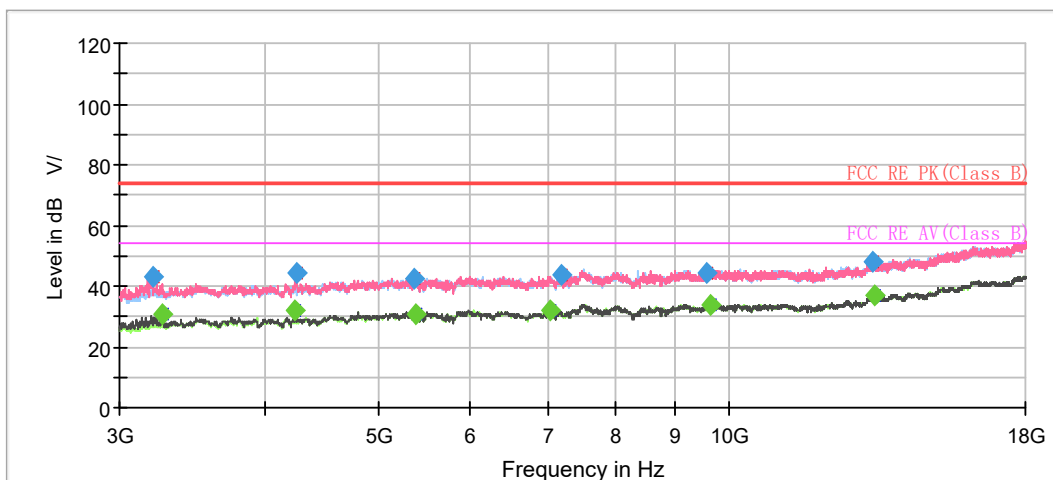
Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

Bluetooth LE-Channel 19



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz



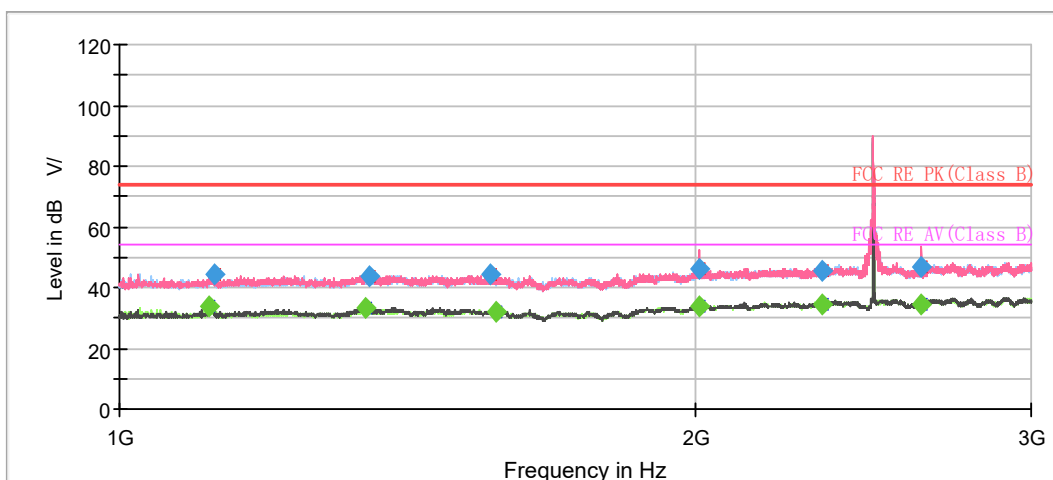
Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1115.750000	43.67	---	74.00	30.33	500.0	200.0	H	66.0	-8.0
1119.500000	---	32.51	54.00	21.49	500.0	200.0	H	56.0	-8.0
1340.250000	43.97	---	74.00	30.03	500.0	100.0	V	115.0	-6.6
1344.250000	---	32.65	54.00	21.35	500.0	100.0	V	188.0	-6.6
1596.000000	43.57	---	74.00	30.43	500.0	100.0	V	309.0	-5.1
1606.000000	---	31.46	54.00	22.54	500.0	200.0	V	2.0	-5.0
1888.500000	44.07	---	74.00	29.93	500.0	200.0	H	145.0	-3.5
1890.250000	---	33.34	54.00	20.66	500.0	100.0	V	202.0	-3.5
2222.500000	44.81	---	74.00	29.19	500.0	100.0	V	349.0	-2.0
2223.000000	---	34.54	54.00	19.46	500.0	200.0	V	15.0	-2.0
2661.250000	---	36.86	54.00	17.14	500.0	200.0	V	353.0	-0.1
2661.250000	51.72	---	74.00	22.28	500.0	200.0	V	353.0	-0.1

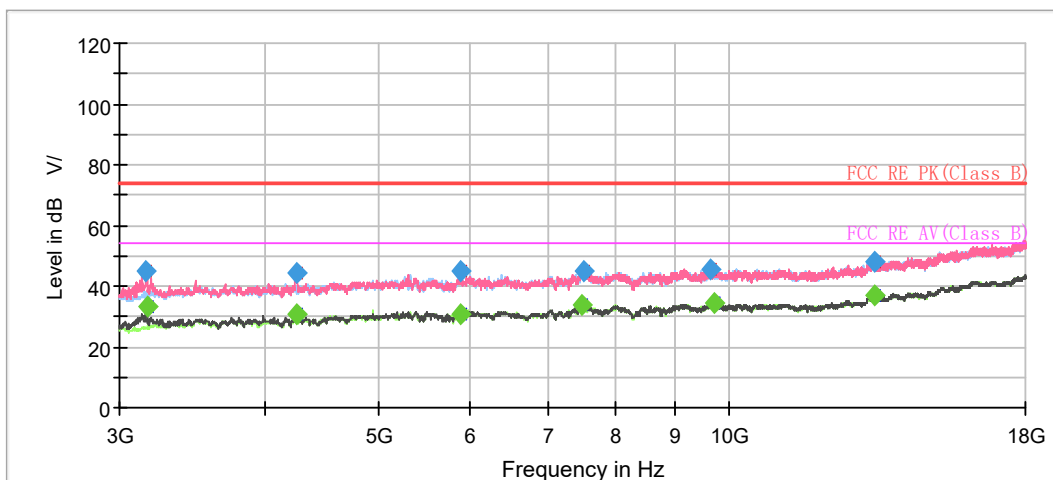
Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

Bluetooth LE-Channel 39



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz



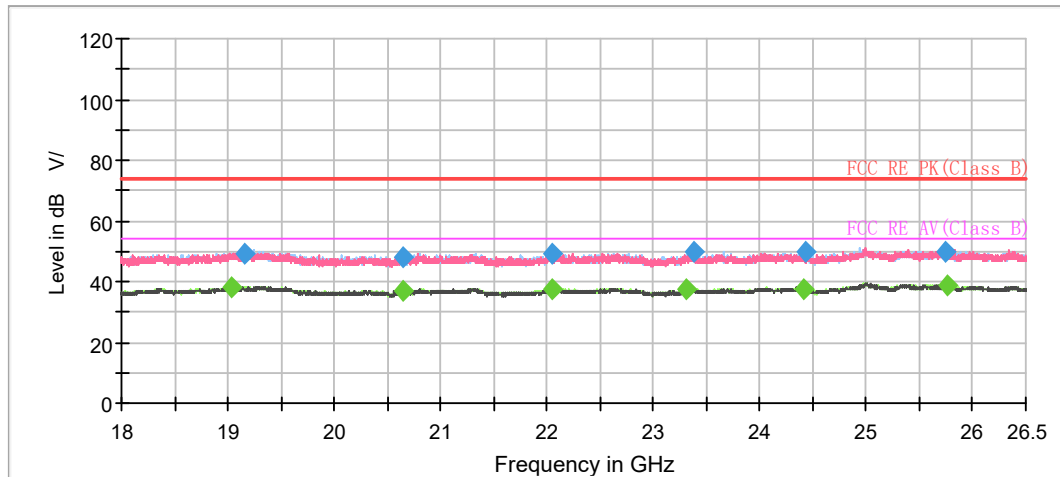
Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1115.000000	---	33.72	54.00	20.28	500.0	200.0	V	330.0	-8.0
1120.750000	44.17	---	74.00	29.83	500.0	200.0	H	59.0	-8.0
1346.500000	---	33.46	54.00	20.54	500.0	100.0	V	80.0	-6.6
1350.000000	43.92	---	74.00	30.08	500.0	100.0	V	85.0	-6.5
1564.750000	44.24	---	74.00	29.76	500.0	100.0	H	348.0	-5.2
1574.750000	---	31.93	54.00	22.07	500.0	200.0	H	345.0	-5.2
2009.750000	46.07	---	74.00	27.93	500.0	100.0	V	219.0	-2.9
2010.250000	---	33.83	54.00	20.17	500.0	200.0	H	253.0	-2.9
2330.250000	---	34.46	54.00	19.54	500.0	100.0	V	66.0	-1.5
2334.500000	45.67	---	74.00	28.33	500.0	100.0	H	237.0	-1.5
2630.000000	46.66	---	74.00	27.34	500.0	200.0	V	187.0	-0.2
2630.500000	---	34.19	54.00	19.81	500.0	200.0	V	9.0	-0.2

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

During the test, the Radiates Emission from 18GHz to 26.5GHz was performed in all modes with all channels, Bluetooth LE-Channel 0 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



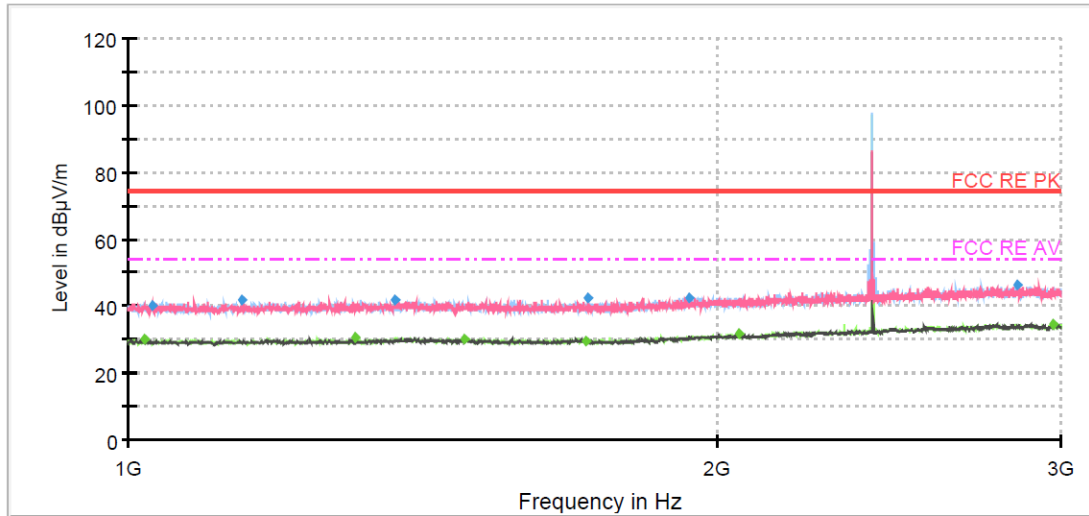
Radiates Emission from 18GHz to 26.5GHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19042.312500	---	38.17	54.00	15.83	500.0	200.0	H	42.0	-6.9
19153.875000	49.53	---	74.00	24.47	500.0	200.0	V	51.0	-6.7
20644.562500	47.98	---	74.00	26.02	500.0	100.0	H	154.0	-6.7
20650.937500	---	36.81	54.00	17.19	500.0	200.0	H	135.0	-6.7
22040.687500	49.05	---	74.00	24.95	500.0	100.0	H	292.0	-6.0
22047.062500	---	37.44	54.00	16.56	500.0	200.0	H	140.0	-6.0
23311.437500	---	37.47	54.00	16.53	500.0	200.0	H	97.0	-5.4
23376.250000	49.58	---	74.00	24.42	500.0	200.0	V	145.0	-5.3
24418.562500	---	37.48	54.00	16.52	500.0	200.0	H	343.0	-4.5
24439.812500	49.67	---	74.00	24.33	500.0	200.0	V	300.0	-4.6
25749.875000	49.91	---	74.00	24.09	500.0	200.0	H	107.0	-3.4
25761.562500	---	38.90	54.00	15.10	500.0	100.0	H	254.0	-3.4

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

Variant
Bluetooth LE-Channel 0

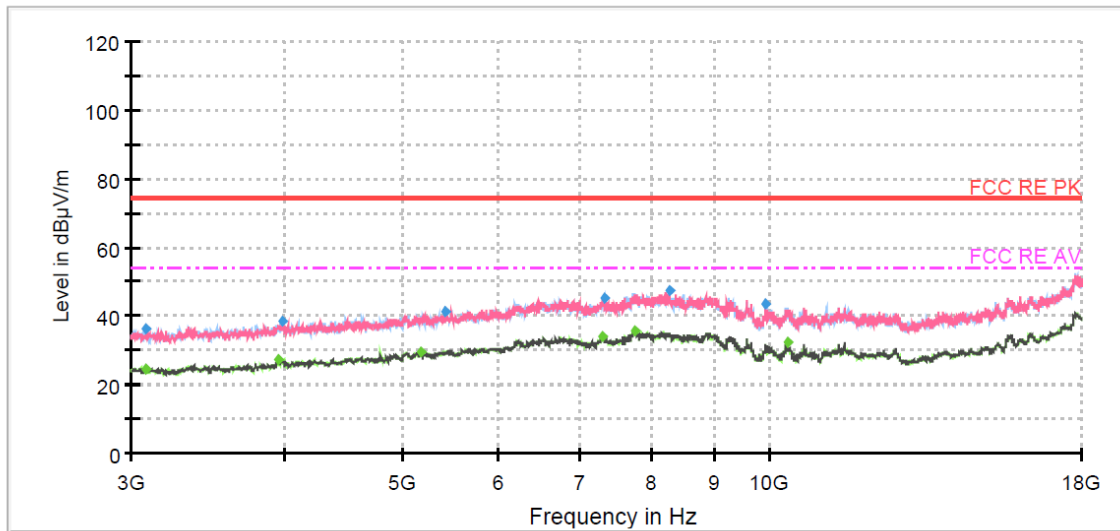


Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1018.25	---	30.03	54.00	23.97	500.00	200.0	H	46.00	-12
1029.00	40.22	---	74.00	33.78	500.00	200.0	H	57.00	-12
1143.25	41.85	---	74.00	32.15	500.00	100.0	V	233.00	-12
1305.75	---	30.57	54.00	23.43	500.00	200.0	H	3.00	-11
1368.50	41.83	---	74.00	32.17	500.00	100.0	V	28.00	-11
1484.75	---	30.21	54.00	23.79	500.00	100.0	H	301.00	-11
1713.00	---	29.45	54.00	24.55	500.00	100.0	H	1.00	-10
1716.75	42.33	---	74.00	31.67	500.00	200.0	V	0.00	-10
1934.75	42.65	---	74.00	31.35	500.00	200.0	H	301.00	-9
2050.75	---	31.77	54.00	22.23	500.00	100.0	H	23.00	-8
2847.00	46.32	---	74.00	27.68	500.00	100.0	H	190.00	-5
2971.50	---	34.72	54.00	19.28	500.00	100.0	V	353.00	-4

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Margin = Limit –MAX Peak/ Average



Radiates Emission from 3GHz to 18GHz

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3082.50	36.08	---	74.00	37.92	500.00	200.0	H	353.00	-14
3086.25	---	24.61	54.00	29.39	500.00	100.0	H	1.00	-14
3960.00	---	27.22	54.00	26.78	500.00	100.0	V	0.00	-11
3988.13	38.74	---	74.00	35.26	500.00	100.0	H	345.00	-11
5186.25	---	29.85	54.00	24.15	500.00	200.0	V	341.00	-8
5433.75	41.30	---	74.00	32.70	500.00	200.0	H	2.00	-8
7301.25	---	34.25	54.00	19.75	500.00	100.0	H	183.00	0
7306.88	45.46	---	74.00	28.54	500.00	100.0	H	62.00	-1
7745.63	---	35.66	54.00	18.34	500.00	200.0	H	214.00	1
8266.88	47.19	---	74.00	26.81	500.00	200.0	V	341.00	1
9924.38	43.28	---	74.00	30.72	500.00	100.0	V	0.00	1
10333.13	---	32.19	54.00	21.81	500.00	100.0	V	0.00	2

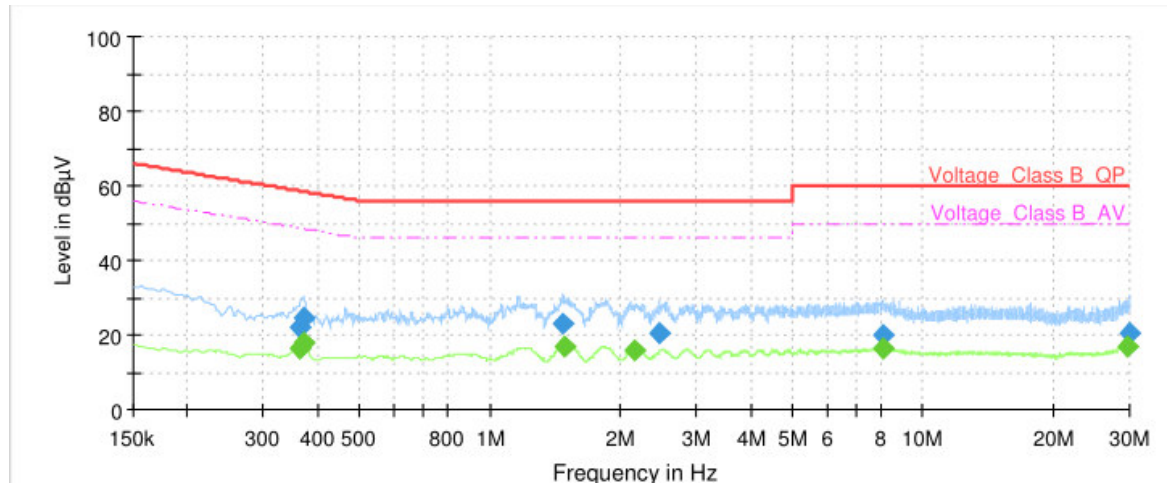
Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
 2. Margin = Limit –MAX Peak/ Average

2. Conducted Emission

2.1. Bluetooth LE

During the test, the Conducted Emission was performed in all modes with all channel. The test data of the worst-case condition (Bluetooth LE-Channel 0) was recorded in this report.

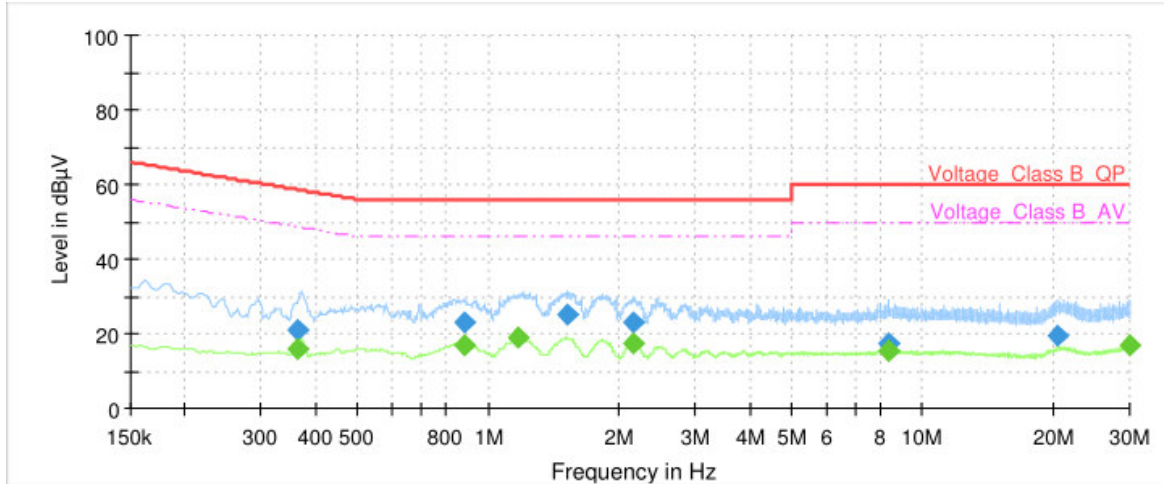
Original



L line Conducted Emission from 150 KHz to 30 MHz

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.36	---	16.20	48.69	32.49	1000.0	9.000	L1	ON	21.0
0.36	21.95	---	58.69	36.74	1000.0	9.000	L1	ON	21.0
0.37	24.36	---	58.49	34.13	1000.0	9.000	L1	ON	21.0
0.37	---	17.72	48.44	30.72	1000.0	9.000	L1	ON	21.0
1.48	22.90	---	56.00	33.10	1000.0	9.000	L1	ON	19.9
1.48	---	16.81	46.00	29.19	1000.0	9.000	L1	ON	19.9
2.15	---	16.14	46.00	29.86	1000.0	9.000	L1	ON	19.7
2.45	20.30	---	56.00	35.70	1000.0	9.000	L1	ON	19.6
8.05	20.13	---	60.00	39.87	1000.0	9.000	L1	ON	19.5
8.09	---	16.23	50.00	33.77	1000.0	9.000	L1	ON	19.5
29.68	---	17.15	50.00	32.85	1000.0	9.000	L1	ON	19.7
29.85	20.29	---	60.00	39.71	1000.0	9.000	L1	ON	19.7

Remark: Correct factor=cable loss + LISN factor



N line Conducted Emission from 150 KHz to 30 MHz

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.36	---	16.00	48.69	32.69	1000.0	9.000	N	ON	21.0
0.36	21.01	---	58.69	37.68	1000.0	9.000	N	ON	21.0
0.88	---	17.16	46.00	28.84	1000.0	9.000	N	ON	20.3
0.88	22.97	---	56.00	33.03	1000.0	9.000	N	ON	20.3
1.17	---	18.80	46.00	27.20	1000.0	9.000	N	ON	20.1
1.53	25.38	---	56.00	30.62	1000.0	9.000	N	ON	19.9
2.15	---	17.32	46.00	28.68	1000.0	9.000	N	ON	19.7
2.16	23.22	---	56.00	32.78	1000.0	9.000	N	ON	19.7
8.33	---	15.16	50.00	34.84	1000.0	9.000	N	ON	19.5
8.36	17.45	---	60.00	42.55	1000.0	9.000	N	ON	19.5
20.38	19.45	---	60.00	40.55	1000.0	9.000	N	ON	19.8
29.91	---	16.76	50.00	33.24	1000.0	9.000	N	ON	19.7

Remark: Correct factor=cable loss + LISN factor

Variant



Frequency [MHz]	QPK Level [dBµV]	QPK Limit [dBµV]	QPK Margin [dB]	AVG Level [dBµV]	AVG Limit [dBµV]	AVG Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]	Meas. Time [s]
0.384	25.65	58.19	32.55	20.64	48.19	27.55	20.89	L1	9.000	1.000
1.230	29.55	56.00	26.45	20.60	46.00	25.40	20.00	L1	9.000	1.000
2.600	28.08	56.00	27.92	20.94	46.00	25.06	19.53	L1	9.000	1.000
4.691	24.77	56.00	31.23	18.73	46.00	27.27	19.41	L1	9.000	1.000
12.235	19.66	60.00	40.34	14.18	50.00	35.82	19.43	L1	9.000	1.000
20.346	18.89	60.00	41.11	13.62	50.00	36.38	19.67	L1	9.000	1.000

Remark: Correct factor=cable loss + LISN factor

L line Conducted Emission from 150 kHz to 30 MHz



Frequency [MHz]	QPK Level [dBμV]	QPK Limit [dBμV]	QPK Margin [dB]	AVG Level [dBμV]	AVG Limit [dBμV]	AVG Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]	Meas. Time [s]
0.382	26.12	58.24	32.12	21.39	48.24	26.85	20.90	N	9.000	1.000
1.212	29.42	56.00	26.58	20.48	46.00	25.52	20.02	N	9.000	1.000
2.231	28.37	56.00	27.63	20.91	46.00	25.09	19.60	N	9.000	1.000
4.007	25.00	56.00	31.00	19.64	46.00	26.36	19.44	N	9.000	1.000
7.753	22.69	60.00	37.31	16.70	50.00	33.30	19.41	N	9.000	1.000
20.252	18.48	60.00	41.52	13.51	50.00	36.49	19.72	N	9.000	1.000

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 kHz to 30 MHz