

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

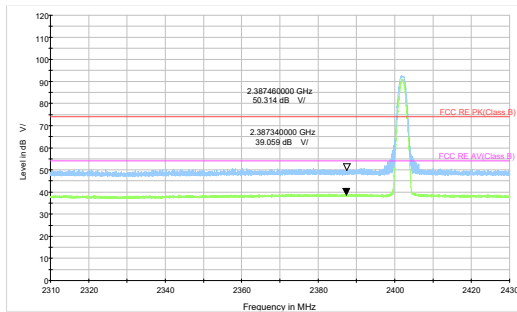
1.1. Bluetooth LE

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.

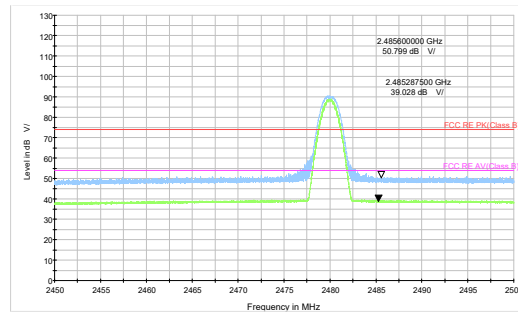
A symbol ($\text{dB } \mu\text{V/m}$) in the test plot below means ($\text{dB}\mu\text{V/m}$)

The signal beyond the limit is carrier.

After the pretest, Bluetooth LE (1M) was selected as the worst Mode for Bluetooth LE.



Bluetooth LE Channel 0 Peak+ Average



Bluetooth LE Channel 39 Peak+Average

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 (dB V) in the test plot below means (dBμV/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

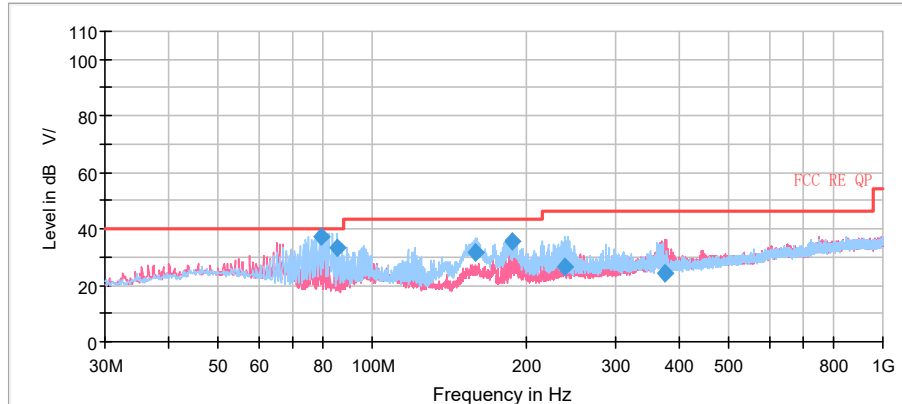
For above 1GHz

 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

After the pretest, Bluetooth LE (1M) was selected as the worst Mode for Bluetooth LE.

Continuous TX mode:

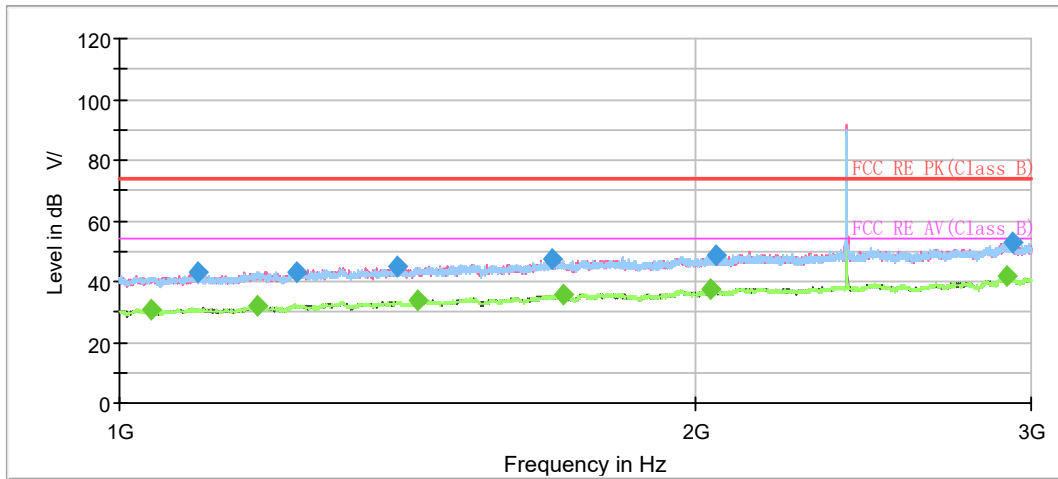
During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels. The test data of the worst-case condition (**Bluetooth LE-Channel 0**) was recorded in this report.



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)
79.833750	37.11	40.00	2.89	225.0	H	193.0	15.5
85.371250	33.46	40.00	6.54	200.0	H	9.0	15.0
159.852500	31.83	43.50	11.67	100.0	H	63.0	16.2
187.827500	35.73	43.50	7.77	100.0	H	303.0	18.2
238.833750	26.35	46.00	19.65	125.0	H	93.0	20.0
374.956250	24.37	46.00	21.63	125.0	V	0.0	22.8

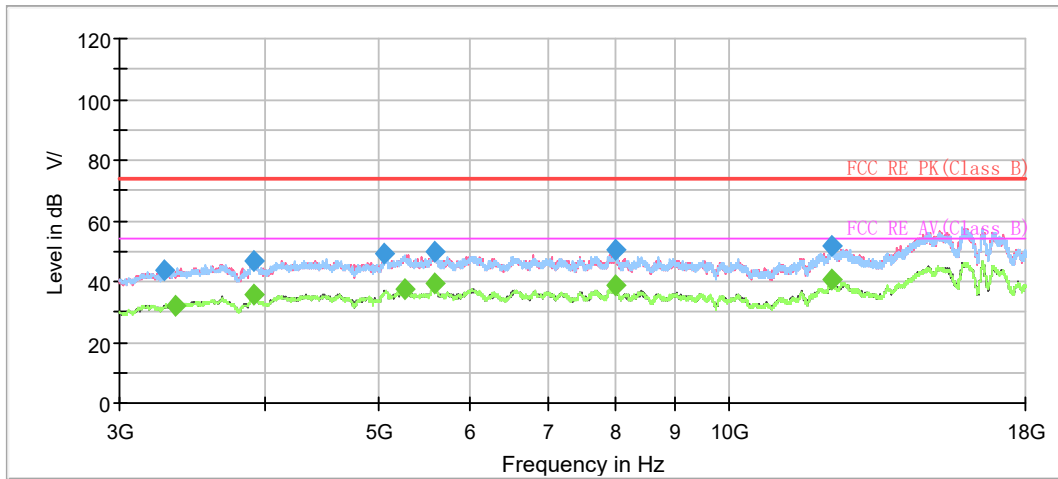
Bluetooth LE-Channel 0



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

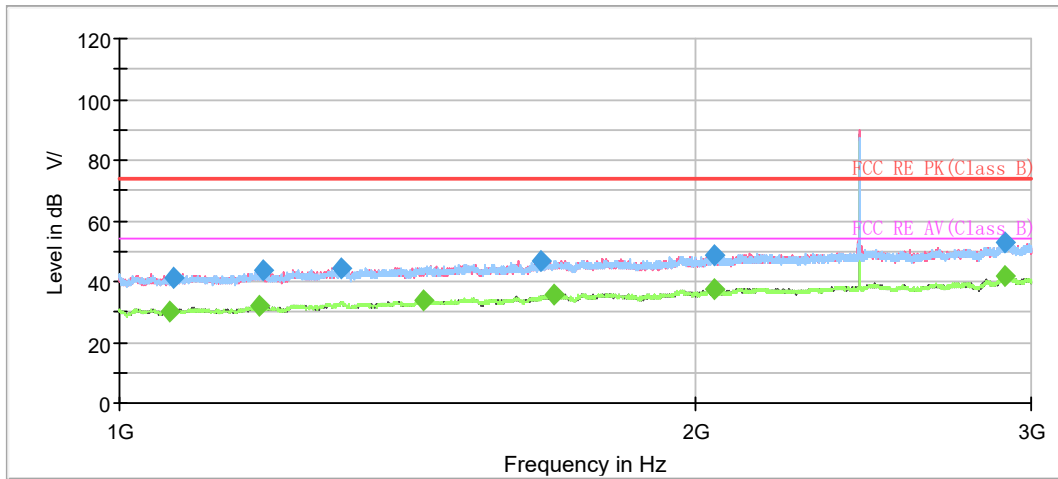
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1039.250000	---	30.66	54.00	23.34	500.0	200.0	V	25.0	-5.6
1098.000000	43.14	---	74.00	30.86	500.0	100.0	H	10.0	-5.0
1180.250000	---	32.09	54.00	21.91	500.0	100.0	V	278.0	-4.0
1237.250000	43.22	---	74.00	30.78	500.0	100.0	H	187.0	-3.4
1396.250000	44.90	---	74.00	29.10	500.0	200.0	H	274.0	-2.3
1433.000000	---	33.63	54.00	20.37	500.0	100.0	V	328.0	-1.9
1683.250000	47.15	---	74.00	26.85	500.0	200.0	V	212.0	0.4
1706.500000	---	35.74	54.00	18.26	500.0	100.0	H	116.0	0.5
2038.500000	---	37.36	54.00	16.64	500.0	200.0	V	249.0	2.4
2053.000000	48.57	---	74.00	25.43	500.0	100.0	H	23.0	2.4
2915.250000	---	41.63	54.00	12.37	500.0	200.0	H	274.0	8.3
2935.000000	53.14	---	74.00	20.86	500.0	100.0	H	0.0	7.8



Radiates Emission from 3GHz to 18GHz

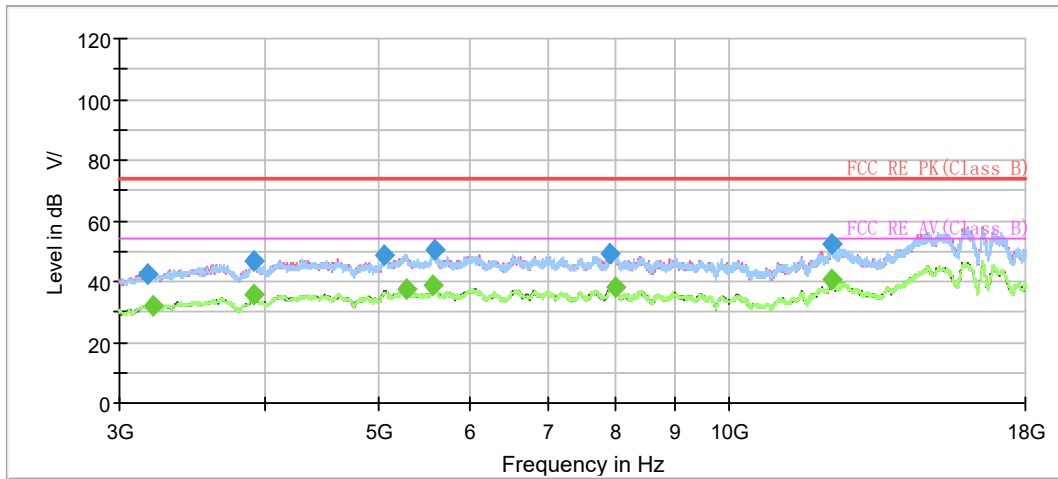
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3281.250000	43.44	---	74.00	30.56	500.0	200.0	V	75.0	-1.0
3346.875000	---	32.12	54.00	21.88	500.0	200.0	V	134.0	-0.6
3911.250000	---	35.91	54.00	18.09	500.0	200.0	V	11.0	3.5
3918.750000	46.66	---	74.00	27.34	500.0	100.0	H	93.0	3.1
5068.125000	49.34	---	74.00	24.66	500.0	100.0	H	49.0	5.3
5268.750000	---	37.68	54.00	16.32	500.0	200.0	V	19.0	6.6
5591.250000	---	39.22	54.00	14.78	500.0	200.0	V	86.0	8.1
5593.125000	49.62	---	74.00	24.38	500.0	200.0	H	300.0	8.1
7996.875000	---	38.67	54.00	15.33	500.0	200.0	H	287.0	9.9
8008.125000	50.24	---	74.00	23.76	500.0	100.0	V	233.0	9.6
12264.375000	51.63	---	74.00	22.37	500.0	100.0	V	254.0	14.4
12273.750000	---	40.57	54.00	13.43	500.0	200.0	H	336.0	14.6

Bluetooth LE-Channel 19



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

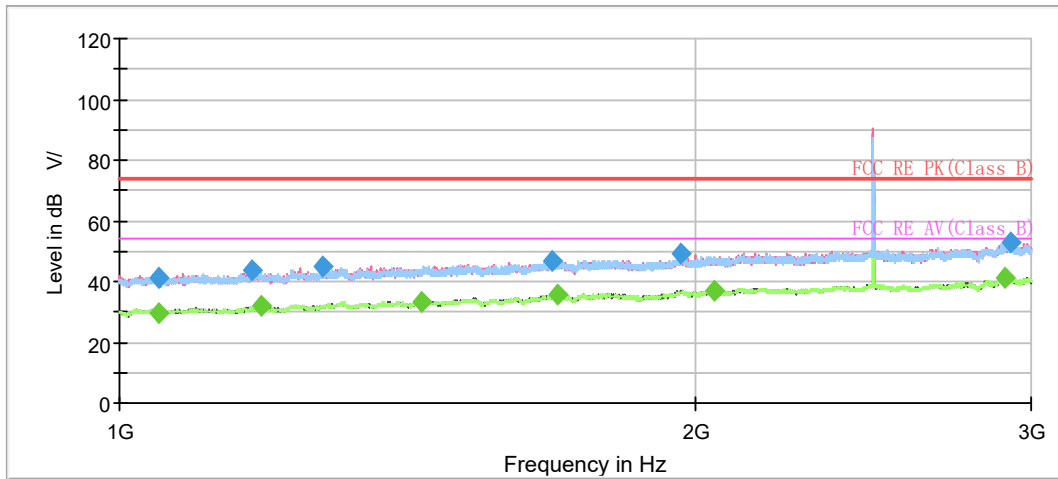
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1062.000000	---	30.28	54.00	23.72	500.0	100.0	V	244.0	-5.9
1066.250000	41.52	---	74.00	32.48	500.0	200.0	H	292.0	-5.7
1183.750000	---	32.00	54.00	22.00	500.0	100.0	H	270.0	-3.9
1188.000000	43.55	---	74.00	30.45	500.0	200.0	H	326.0	-4.1
1306.250000	44.53	---	74.00	29.47	500.0	100.0	V	10.0	-2.2
1440.750000	---	33.68	54.00	20.32	500.0	200.0	H	218.0	-1.7
1661.250000	46.85	---	74.00	27.15	500.0	100.0	H	52.0	-0.1
1689.750000	---	35.60	54.00	18.40	500.0	100.0	H	138.0	0.4
2048.250000	48.62	---	74.00	25.38	500.0	100.0	V	0.0	2.5
2048.500000	---	37.24	54.00	16.76	500.0	200.0	H	182.0	2.5
2905.000000	---	41.58	54.00	12.42	500.0	200.0	H	253.0	8.5
2906.250000	53.05	---	74.00	20.95	500.0	100.0	V	317.0	8.5



Radiates Emission from 3GHz to 18GHz

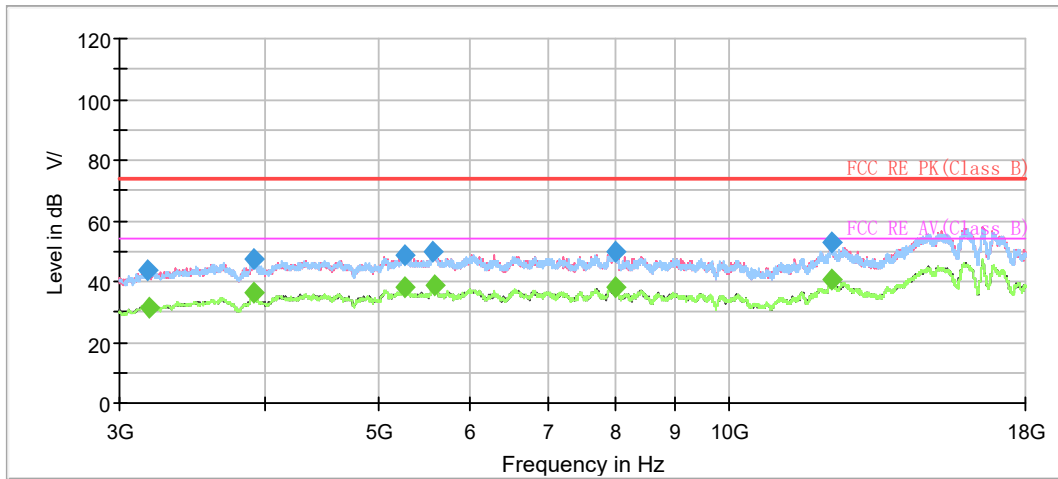
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3174.375000	42.54	---	74.00	31.46	500.0	200.0	V	99.0	-0.9
3206.250000	---	32.25	54.00	21.75	500.0	100.0	V	0.0	-0.8
3907.500000	---	35.95	54.00	18.05	500.0	100.0	V	137.0	3.6
3909.375000	46.52	---	74.00	27.48	500.0	100.0	V	353.0	3.7
5066.250000	48.73	---	74.00	25.27	500.0	100.0	H	92.0	5.4
5291.250000	---	37.74	54.00	16.26	500.0	100.0	V	129.0	6.2
5581.875000	---	39.00	54.00	15.00	500.0	200.0	V	29.0	7.6
5591.250000	50.42	---	74.00	23.58	500.0	100.0	H	127.0	8.1
7918.125000	49.11	---	74.00	24.89	500.0	100.0	H	301.0	9.7
7995.000000	---	38.15	54.00	15.85	500.0	100.0	H	197.0	9.9
12271.875000	---	40.33	54.00	13.67	500.0	100.0	H	58.0	14.6
12279.375000	52.16	---	74.00	21.84	500.0	200.0	V	113.0	14.5

Bluetooth LE-Channel 39



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

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1047.500000	41.26	---	74.00	32.74	500.0	100.0	H	0.0	-6.0
1048.750000	---	29.53	54.00	24.47	500.0	100.0	V	303.0	-6.1
1172.500000	43.41	---	74.00	30.59	500.0	100.0	H	296.0	-4.3
1185.750000	---	31.85	54.00	22.15	500.0	100.0	V	86.0	-4.0
1277.750000	44.96	---	74.00	29.04	500.0	100.0	V	118.0	-3.3
1438.000000	---	33.50	54.00	20.50	500.0	200.0	V	36.0	-1.7
1684.500000	46.60	---	74.00	27.40	500.0	100.0	V	351.0	0.4
1696.500000	---	35.60	54.00	18.40	500.0	100.0	H	98.0	0.3
1965.750000	49.45	---	74.00	24.55	500.0	200.0	H	206.0	2.2
2048.250000	---	37.06	54.00	16.94	500.0	100.0	V	254.0	2.5
2905.000000	---	41.52	54.00	12.48	500.0	200.0	V	217.0	8.5
2924.500000	53.08	---	74.00	20.92	500.0	100.0	V	73.0	8.1



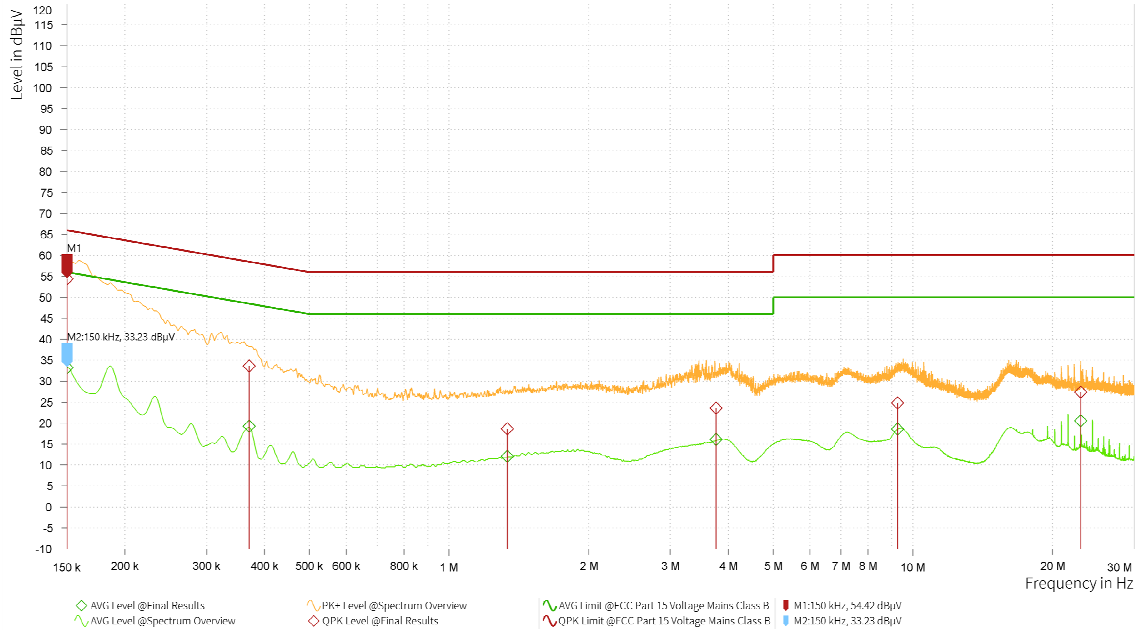
Radiates Emission from 3GHz to 18GHz

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)
3172.500000	43.99	---	74.00	30.01	500.0	100.0	V	111.0	-1.0
3178.125000	---	31.47	54.00	22.53	500.0	200.0	H	74.0	-0.9
3911.250000	---	36.21	54.00	17.79	500.0	200.0	H	358.0	3.5
3918.750000	47.25	---	74.00	26.75	500.0	200.0	V	268.0	3.1
5265.000000	48.77	---	74.00	25.23	500.0	200.0	H	214.0	6.5
5280.000000	---	37.89	54.00	16.11	500.0	100.0	V	359.0	6.4
5578.125000	49.95	---	74.00	24.05	500.0	200.0	H	281.0	7.4
5593.125000	---	38.92	54.00	15.08	500.0	200.0	H	358.0	8.1
7993.125000	49.89	---	74.00	24.11	500.0	100.0	V	140.0	9.9
7995.000000	---	38.44	54.00	15.56	500.0	100.0	H	52.0	9.9
12275.625000	---	40.34	54.00	13.66	500.0	200.0	V	247.0	14.6
12277.500000	52.72	---	74.00	21.28	500.0	100.0	H	140.0	14.6

2. Conducted Emission

2.1. Bluetooth LE

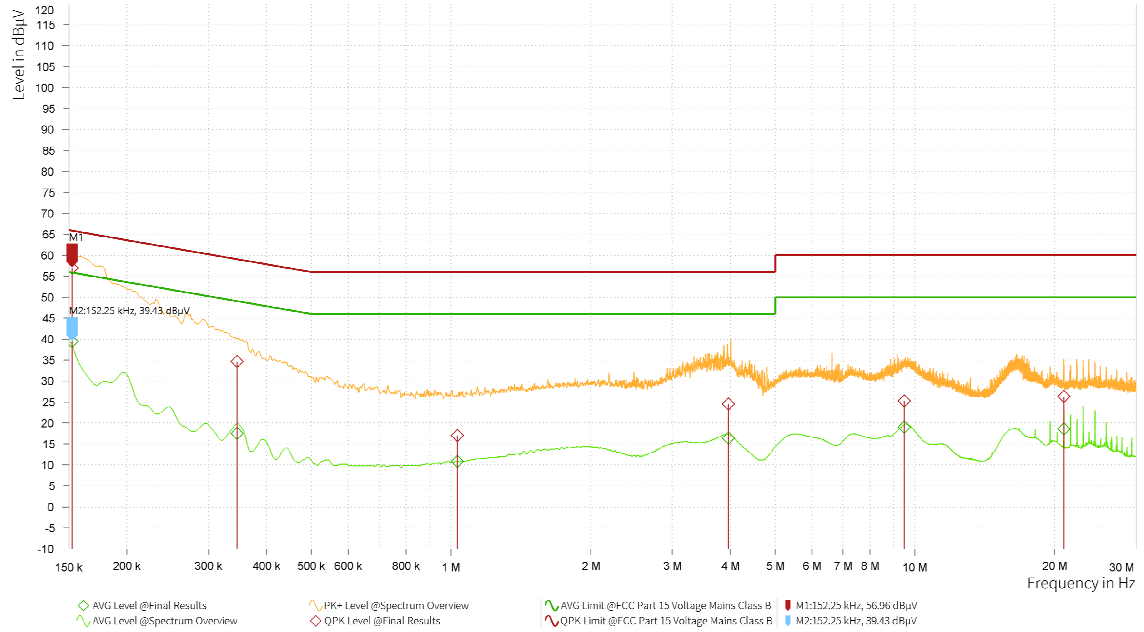
During the test, the Conducted Emission was performed in all modes with all channels. The test data of the worst-case condition (**Bluetooth LE-Channel 0**) was recorded in this report.



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]
0.150	54.42	66.00	11.58	33.23	56.00	22.77	20.90	L1	9.000	1.000
0.371	33.62	58.49	24.87	19.29	48.49	29.20	20.90	L1	9.000	1.000
1.336	18.62	56.00	37.38	12.07	46.00	33.93	19.93	L1	9.000	1.000
3.764	23.58	56.00	32.42	16.12	46.00	29.88	19.44	L1	9.000	1.000
9.272	24.82	60.00	35.18	18.57	50.00	31.43	19.41	L1	9.000	1.000
23.010	27.39	60.00	32.61	20.54	50.00	29.46	19.73	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]
0.152	56.96	65.88	8.91	39.43	55.88	16.45	20.91	N	9.000	1.000
0.346	34.65	59.06	24.41	17.52	49.06	31.54	20.94	N	9.000	1.000
1.032	17.05	56.00	38.95	10.84	46.00	35.16	20.15	N	9.000	1.000
3.962	24.51	56.00	31.49	16.38	46.00	29.62	19.44	N	9.000	1.000
9.490	25.27	60.00	34.73	19.06	50.00	30.94	19.43	N	9.000	1.000
20.958	26.35	60.00	33.65	18.60	50.00	31.40	19.75	N	9.000	1.000

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 kHz to 30 MHz