

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.

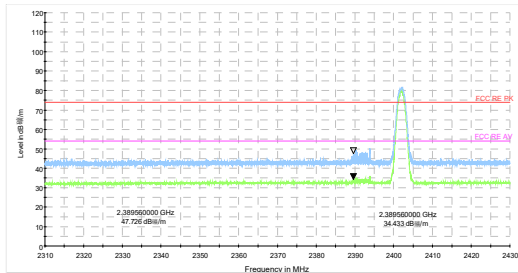
1. Unwanted Emission

1.1. Bluetooth LE

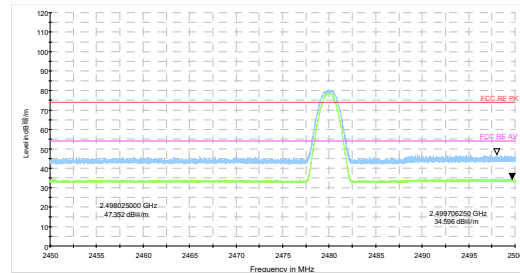
The following graphs display the maximum values of horizontal and vertical by software. Blue trace uses the peak detection, Green trace uses the average detection.

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

The signal beyond the limit is carrier.



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 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. **The following graphs display the maximum values of coaxial and coplanar for 9k-30MHz; horizontal and vertical for above 30MHz by software.**
4. **For below 1GHz**

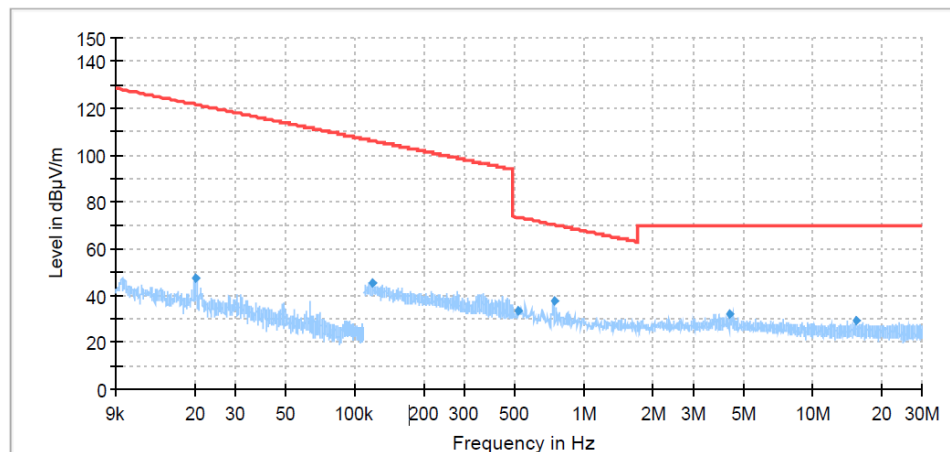
 QP Level @Spectrum Overview H
  QP Level @Spectrum Overview V
  QP Level @Final Results
  QP Limit

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

Continuous TX mode:

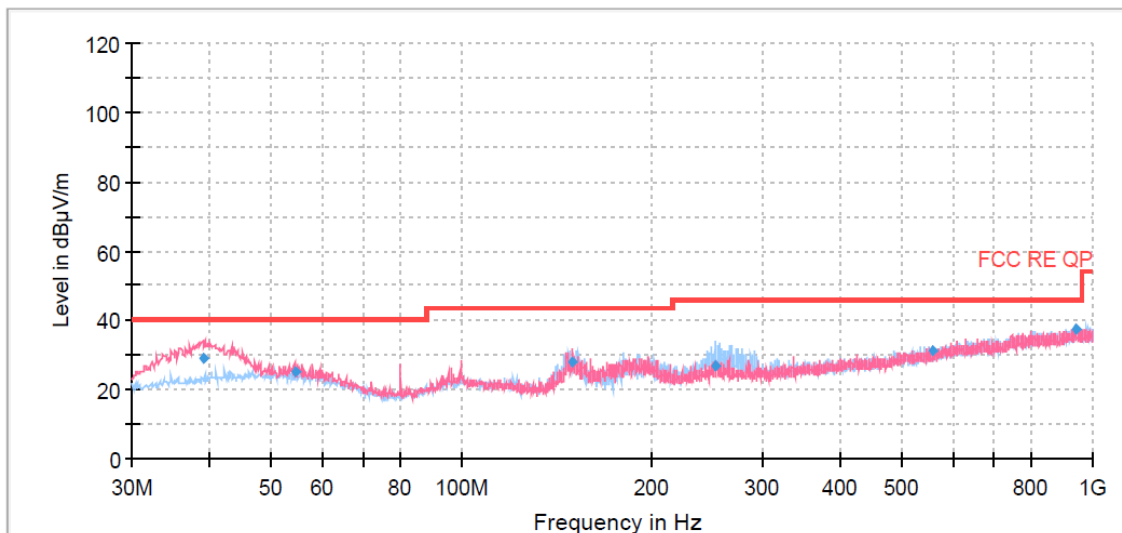
During the test, the Radiates Emission from 9kHz to 1GHz was performed in all modes with all channels. The test data of the worst-case condition (**Bluetooth LE-Channel 39**) was recorded in this report.



Radiates Emission from 9kHz to 30MHz

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Azimuth (deg)	Corr. (dB/m)
0.02	47.50	121.48	73.98	500.00	57.00	17
0.12	45.54	106.16	60.63	150.00	2.00	17
0.51	33.29	73.42	40.13	150.00	1.00	17
0.74	37.33	70.25	32.92	150.00	106.00	17
4.35	32.37	69.50	37.13	150.00	357.00	17
15.53	29.27	69.50	40.23	150.00	29.00	17

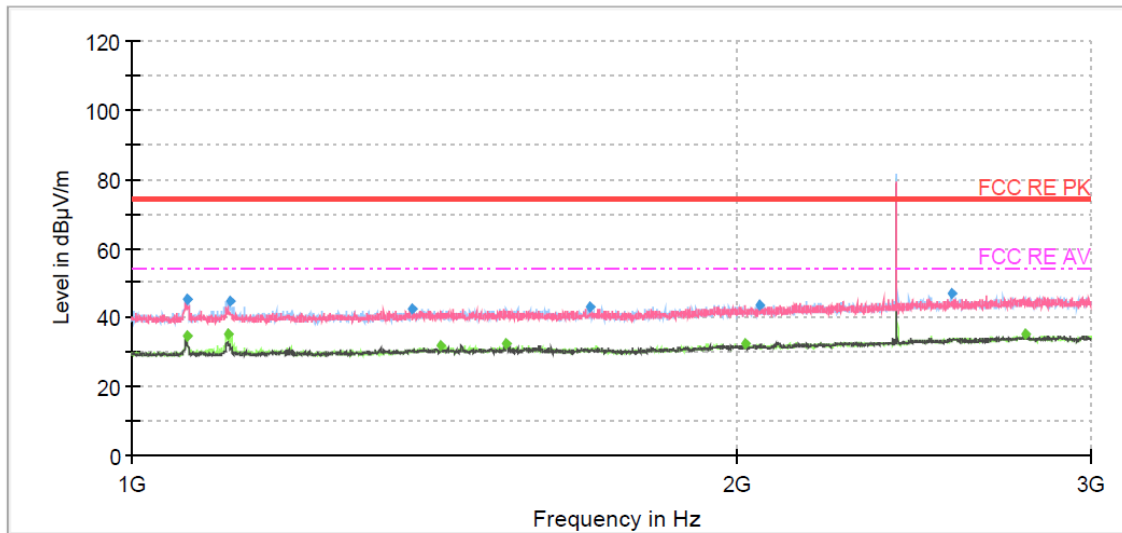


Radiates Emission from 30MHz to 1GHz

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.85	28.93	40.00	11.07	1000.00	100.0	V	132.00	19
54.37	24.92	40.00	15.08	1000.00	100.0	V	345.00	20
150.04	27.86	43.50	15.64	1000.00	100.0	V	195.00	15
252.62	26.61	46.00	19.39	1000.00	101.0	H	127.00	20
556.47	31.02	46.00	14.98	1000.00	200.0	H	109.00	26
940.22	37.40	46.00	8.60	1000.00	200.0	H	330.00	32

Bluetooth LE-Channel 0

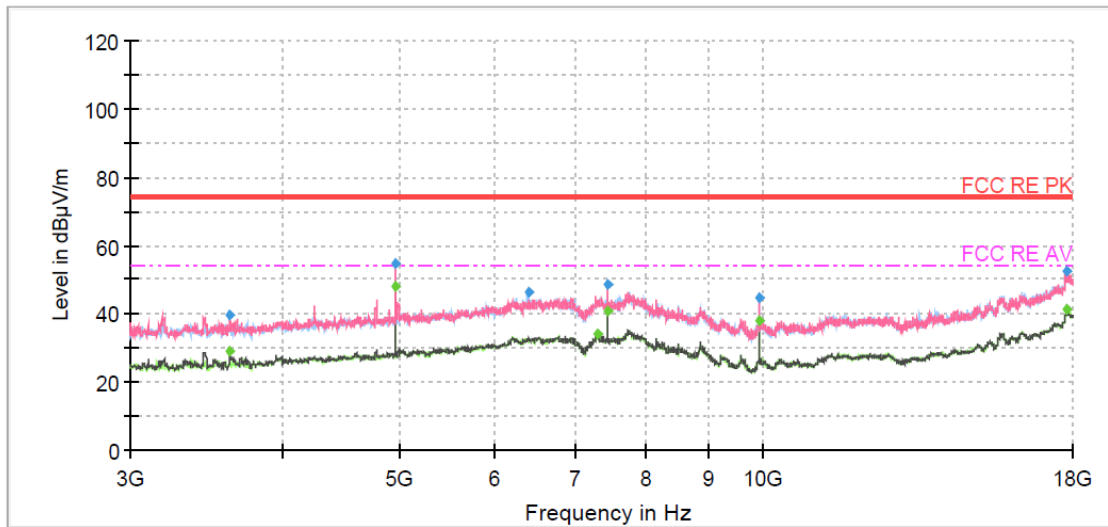


Note: The signal beyond the limit is carrier.

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)
1065.50	---	34.45	54.00	19.55	500.00	100.0	H	113.00	-12
1066.50	45.07	---	74.00	28.93	500.00	100.0	H	113.00	-12
1117.50	---	34.95	54.00	19.05	500.00	200.0	H	142.00	-12
1118.25	44.46	---	74.00	29.54	500.00	200.0	H	114.00	-12
1377.75	42.45	---	74.00	31.55	500.00	200.0	V	217.00	-11
1425.25	---	32.00	54.00	22.00	500.00	200.0	H	114.00	-11
1537.00	---	32.14	54.00	21.86	500.00	100.0	V	25.00	-11
1688.75	42.77	---	74.00	31.23	500.00	200.0	H	20.00	-10
2017.75	---	32.18	54.00	21.82	500.00	100.0	H	0.00	-8
2053.75	43.70	---	74.00	30.30	500.00	100.0	H	239.00	-8
2555.50	47.03	---	74.00	26.97	500.00	200.0	H	88.00	-5
2785.75	---	34.94	54.00	19.06	500.00	100.0	H	267.00	-5

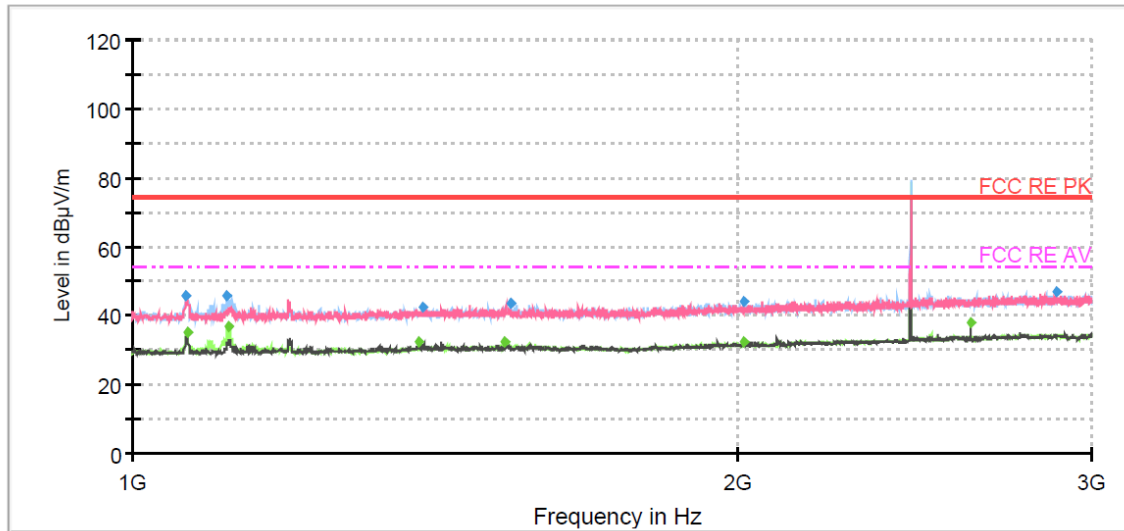


Radiates Emission from 3GHz to 18GHz

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)
3624.38	39.51	---	74.00	34.49	500.00	100.0	V	104.00	-13
3626.25	---	28.86	54.00	25.14	500.00	100.0	V	104.00	-13
4959.38	---	48.06	54.00	5.94	500.00	100.0	V	104.00	-10
4959.38	54.53	---	74.00	19.47	500.00	100.0	H	170.00	-10
6399.38	46.34	---	74.00	27.66	500.00	100.0	H	309.00	-3
7282.50	---	33.79	54.00	20.21	500.00	100.0	H	1.00	-1
7440.00	48.53	---	74.00	25.47	500.00	100.0	V	230.00	0
7440.00	---	40.56	54.00	13.44	500.00	100.0	V	230.00	0
9920.63	---	37.83	54.00	16.17	500.00	100.0	H	216.00	1
9920.63	44.74	---	74.00	29.26	500.00	100.0	H	216.00	1
17801.25	52.45	---	74.00	21.55	500.00	100.0	H	2.00	15
17803.13	---	41.09	54.00	12.91	500.00	100.0	H	12.00	15

Bluetooth LE-Channel 19

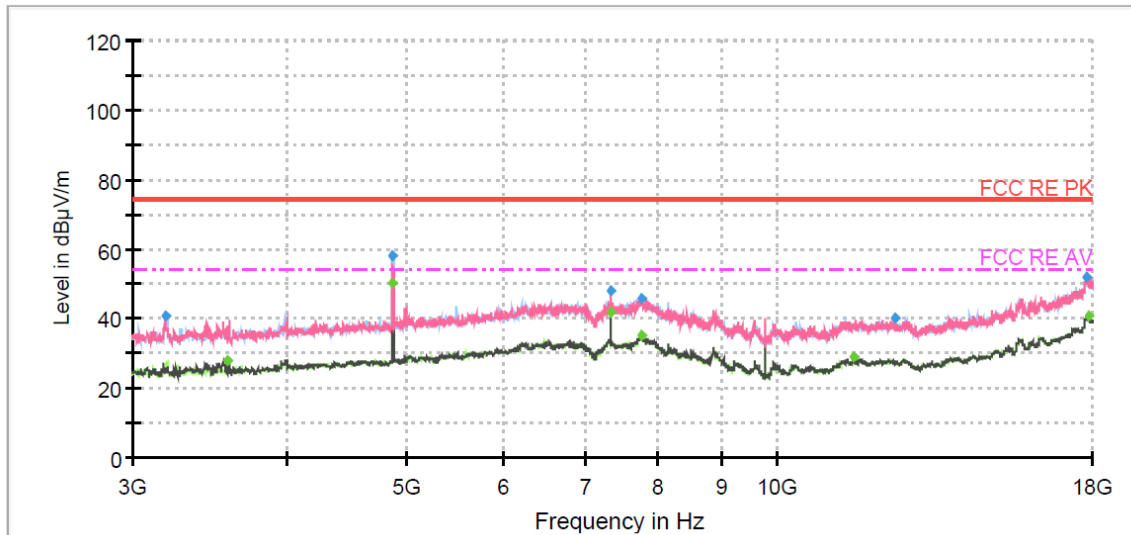


Note: The signal beyond the limit is carrier.

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)
1063.75	45.66	---	74.00	28.34	500.00	100.0	H	181.00	-12
1064.75	---	34.91	54.00	19.09	500.00	100.0	H	181.00	-12
1114.50	45.66	---	74.00	28.34	500.00	100.0	H	126.00	-12
1116.25	---	36.68	54.00	17.32	500.00	100.0	H	126.00	-12
1388.00	---	32.19	54.00	21.81	500.00	100.0	V	14.00	-11
1395.25	42.33	---	74.00	31.67	500.00	200.0	H	109.00	-11
1533.00	---	32.13	54.00	21.87	500.00	100.0	V	18.00	-11
1542.50	43.28	---	74.00	30.72	500.00	200.0	H	69.00	-11
2015.75	---	32.51	54.00	21.49	500.00	100.0	H	126.00	-8
2016.25	44.15	---	74.00	29.85	500.00	100.0	H	347.00	-8
2611.50	---	38.00	54.00	16.00	500.00	200.0	V	1.00	-6
2882.00	46.67	---	74.00	27.33	500.00	200.0	V	302.00	-5

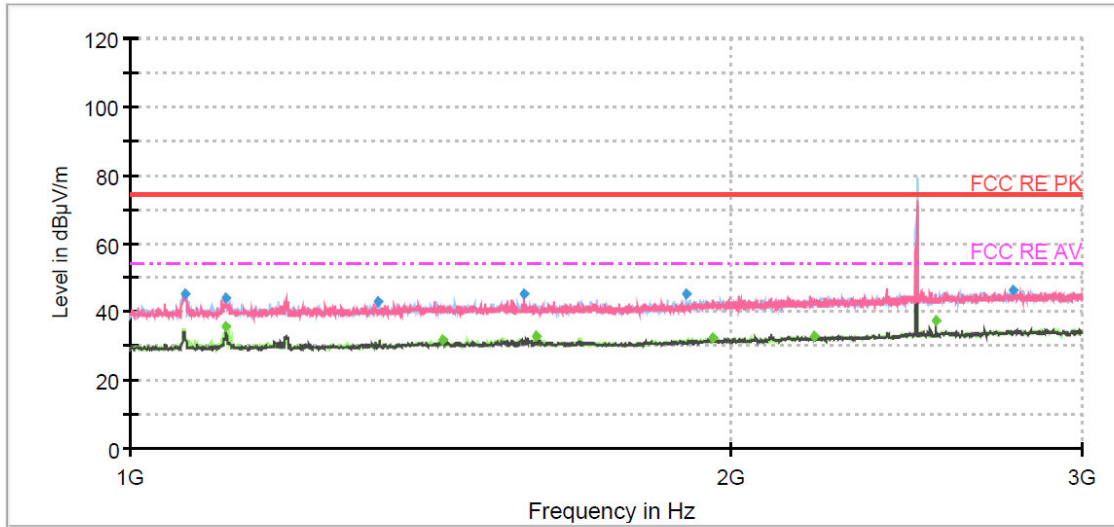


Radiates Emission from 3GHz to 18GHz

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)
3185.63	40.61	---	74.00	33.39	500.00	100.0	H	123.00	-14
3585.00	---	27.86	54.00	26.14	500.00	100.0	V	98.00	-14
4878.75	---	50.40	54.00	3.60	500.00	100.0	H	187.00	-10
4878.75	58.17	---	74.00	15.83	500.00	100.0	H	187.00	-10
7320.00	---	41.88	54.00	12.12	500.00	100.0	V	238.00	-1
7320.00	48.06	---	74.00	25.94	500.00	100.0	V	238.00	-1
7741.88	45.60	---	74.00	28.40	500.00	200.0	H	298.00	1
7741.88	---	35.29	54.00	18.71	500.00	200.0	V	204.00	1
11525.63	---	28.88	54.00	25.12	500.00	100.0	V	349.00	6
12423.75	40.35	---	74.00	33.65	500.00	200.0	V	172.00	5
17776.88	51.88	---	74.00	22.12	500.00	100.0	V	51.00	14
17836.88	---	40.84	54.00	13.16	500.00	200.0	H	265.00	15

Bluetooth LE-Channel 39

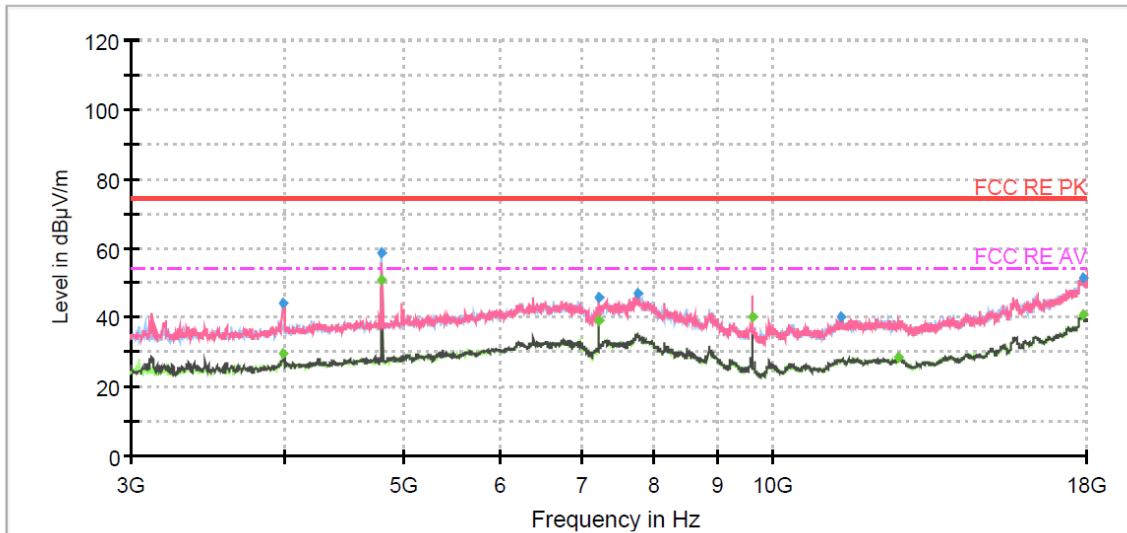


Note: The signal beyond the limit is carrier.

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)
1064.25	44.98	---	74.00	29.02	500.00	100.0	H	127.00	-12
1117.00	44.32	---	74.00	29.68	500.00	200.0	H	120.00	-12
1117.25	---	35.76	54.00	18.24	500.00	200.0	H	135.00	-12
1329.25	43.24	---	74.00	30.76	500.00	200.0	H	232.00	-11
1434.50	---	31.88	54.00	22.12	500.00	100.0	V	2.00	-11
1574.75	45.13	---	74.00	28.87	500.00	200.0	V	99.00	-11
1595.75	---	32.76	54.00	21.24	500.00	200.0	H	0.00	-11
1900.25	45.16	---	74.00	28.84	500.00	100.0	H	2.00	-9
1957.50	---	32.50	54.00	21.50	500.00	100.0	V	0.00	-8
2200.00	---	32.87	54.00	21.13	500.00	200.0	H	0.00	-7
2533.75	---	37.29	54.00	16.71	500.00	100.0	V	0.00	-6
2768.50	46.29	---	74.00	27.71	500.00	100.0	H	213.00	-5



Radiates Emission from 3GHz to 18GHz

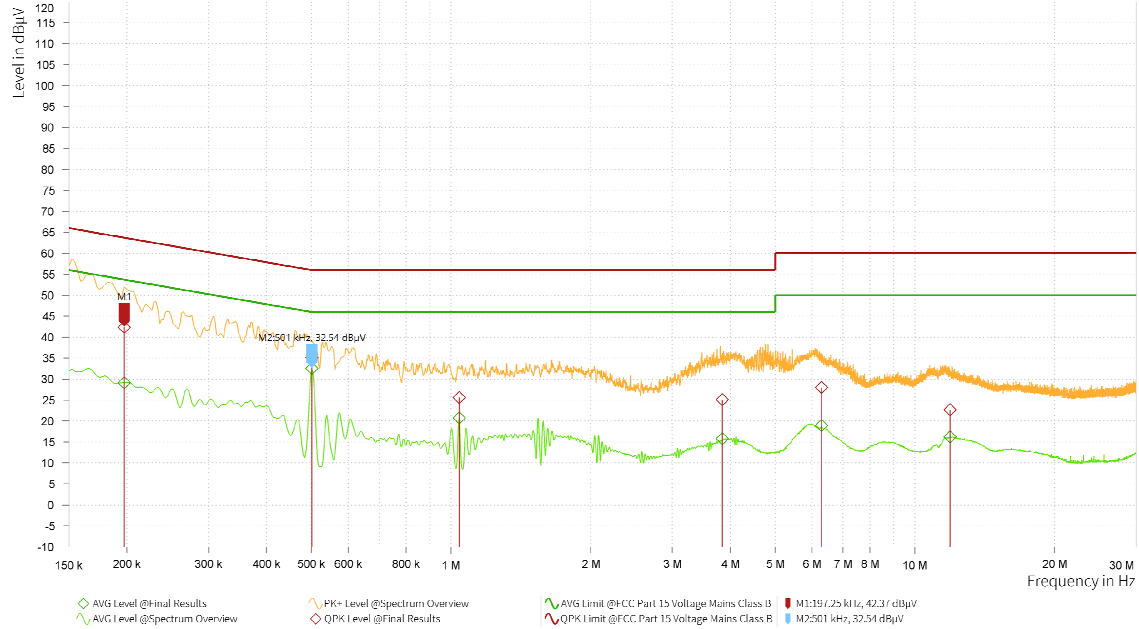
Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3991.88	---	29.31	54.00	24.69	500.00	100.0	V	223.00	-11
3993.75	43.96	---	74.00	30.04	500.00	100.0	V	223.00	-11
4803.75	---	50.78	54.00	3.22	500.00	100.0	H	154.00	-10
4803.75	58.52	---	74.00	15.48	500.00	100.0	H	154.00	-10
7205.63	---	39.06	54.00	14.94	500.00	100.0	V	223.00	-2
7205.63	45.55	---	74.00	28.45	500.00	200.0	H	350.00	-2
7740.00	46.63	---	74.00	27.37	500.00	200.0	V	0.00	1
9607.50	---	39.99	54.00	14.01	500.00	200.0	V	232.00	1
11349.38	40.34	---	74.00	33.66	500.00	100.0	V	254.00	5
12652.50	---	28.32	54.00	25.68	500.00	100.0	H	51.00	5
17840.63	---	40.84	54.00	13.16	500.00	100.0	V	342.00	15
17865.00	51.57	---	74.00	22.43	500.00	100.0	V	342.00	15

2. Conducted Emission

2.1. Bluetooth LE

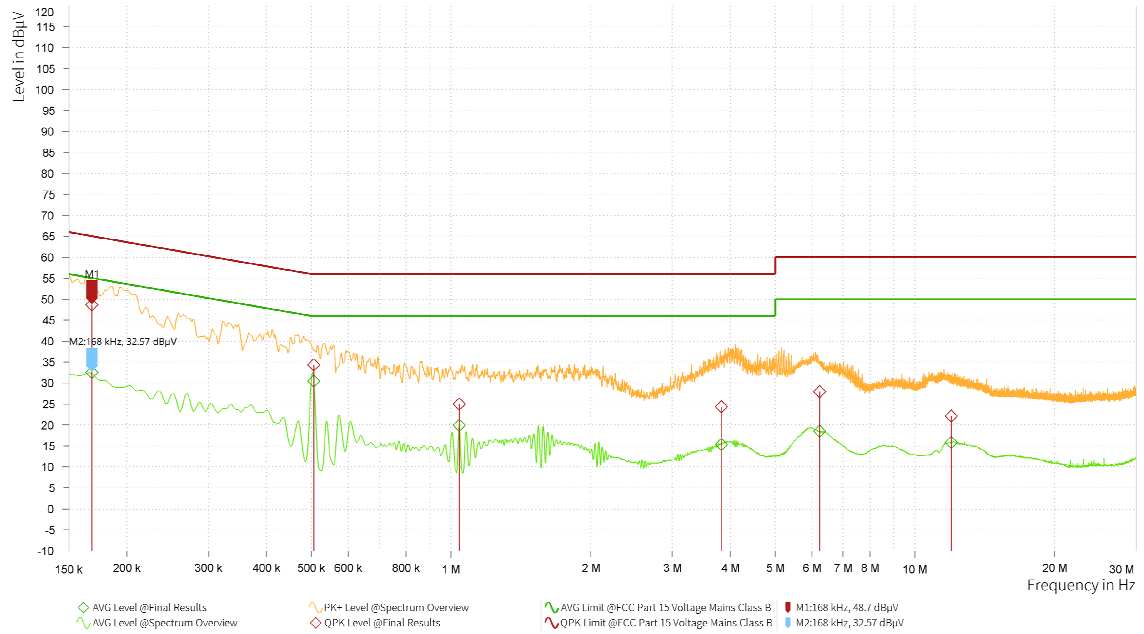
During the test, the Conducted Emission was performed in all modes with all channels. The test data of the worst-case condition (**Bluetooth LE-Channel 39**) was recorded in this report.



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]
0.197	42.37	63.73	21.35	29.12	53.73	24.60	21.02	L1	9.000	1.000
0.501	35.13	56.00	20.87	32.54	46.00	13.46	20.78	L1	9.000	1.000
1.041	25.61	56.00	30.39	20.69	46.00	25.31	20.13	L1	9.000	1.000
3.845	25.12	56.00	30.88	15.78	46.00	30.22	19.43	L1	9.000	1.000
6.293	28.00	60.00	32.00	18.91	50.00	31.09	19.40	L1	9.000	1.000
11.913	22.66	60.00	37.34	16.22	50.00	33.78	19.42	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]
0.168	48.70	65.06	16.36	32.57	55.06	22.49	20.90	N	9.000	1.000
0.506	34.32	56.00	21.68	30.48	46.00	15.52	20.78	N	9.000	1.000
1.041	25.00	56.00	31.00	19.93	46.00	26.07	20.14	N	9.000	1.000
3.829	24.38	56.00	31.62	15.35	46.00	30.65	19.44	N	9.000	1.000
6.234	27.97	60.00	32.03	18.55	50.00	31.45	19.41	N	9.000	1.000
11.990	22.11	60.00	37.89	15.87	50.00	34.13	19.45	N	9.000	1.000

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 kHz to 30 MHz