

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 (Y axis) and the loop antenna is coplanar, the others are vertical and horizontal. and the worst case was recorded.

1. Unwanted Emission

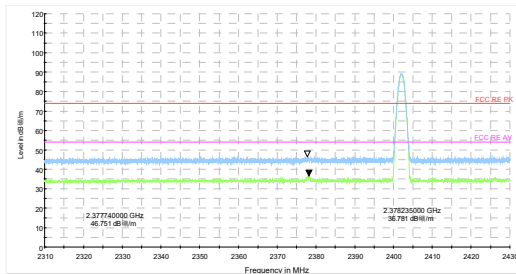
1.1. Bluetooth LE

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.

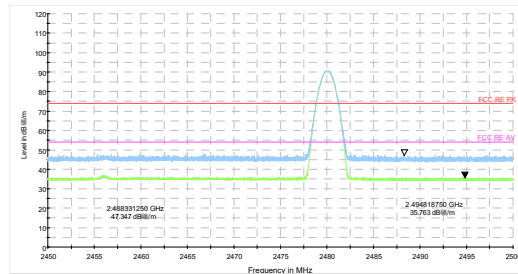
A symbol ($\text{dB}_{\text{dBm}}/\text{m}$) in the test plot below means ($\text{dB}\mu\text{V}/\text{m}$)

The signal beyond the limit is carrier.

After the pretest, Bluetooth LE (2M) 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 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 μ V/m) in the test plot below means (dB μ 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**

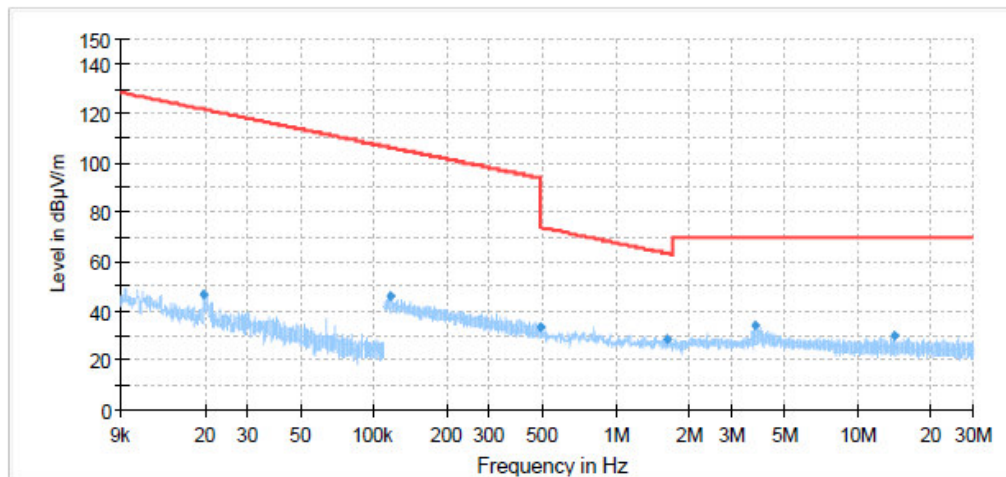
 QP Level @Spectrum Overview H
  QP Level @Spectrum Overview V
  QP Level @Final Results
  QP Limit

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

Continuous TX mode:

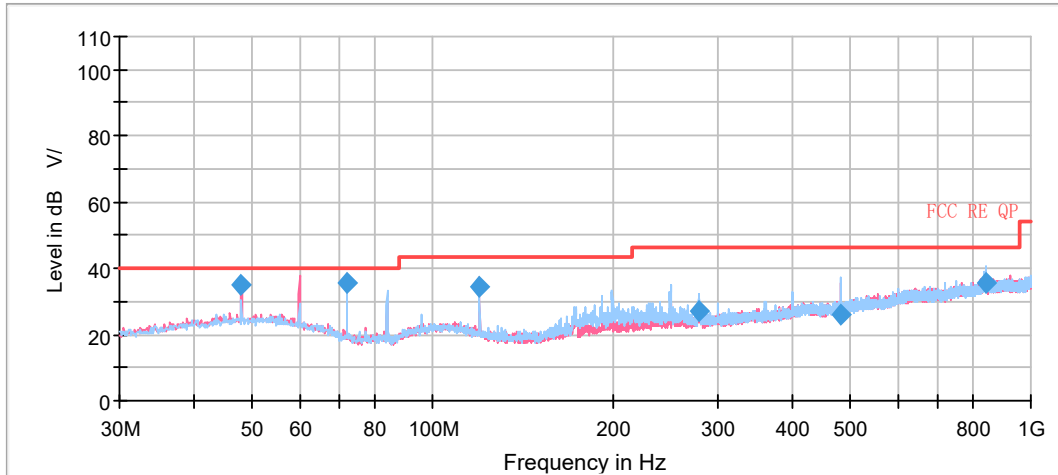
During the test, the Radiates Emission from 9kHz to 1GHz was performed in all modes with all channels. The test data of the worst-case condition (Bluetooth LE-Channel 39) was recorded in this report.



Final Result

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Azimuth (deg)	Corr. (dB/m)
0.02	47.07	121.68	74.61	500.00	105.00	17
0.12	46.21	106.23	60.02	150.00	148.00	17
0.49	33.24	73.80	40.56	150.00	122.00	17
1.64	28.75	63.31	34.56	150.00	0.00	17
3.75	34.14	69.50	35.36	150.00	256.00	17
14.18	29.71	69.50	39.79	150.00	1.00	17

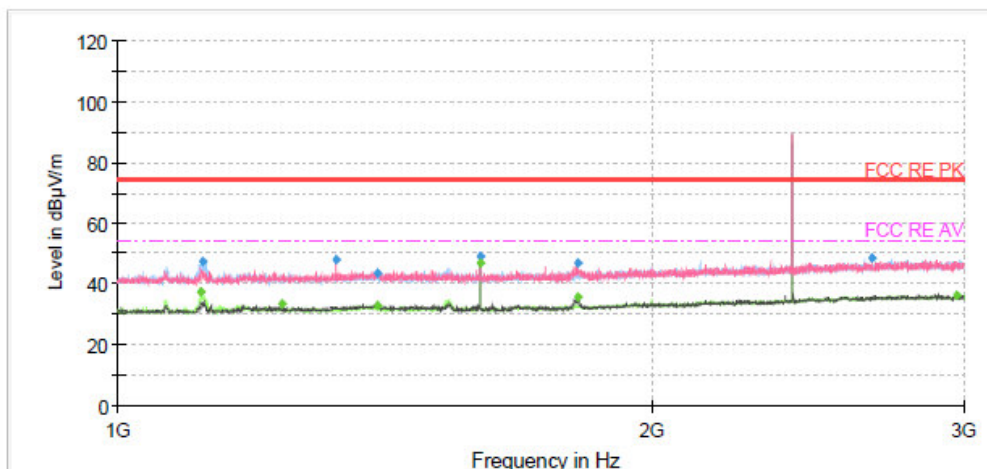
Radiates Emission from 9kHz to 30MHz



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)
47.945000	35.04	40.00	4.96	100.0	V	48.0	21.2
71.952500	35.79	40.00	4.21	100.0	V	309.0	16.1
119.967500	34.33	43.50	9.17	100.0	V	108.0	17.2
278.198750	26.89	46.00	19.11	100.0	H	72.0	20.6
480.080000	26.06	46.00	19.94	200.0	H	117.0	24.8
841.647500	35.50	46.00	10.50	100.0	H	132.0	30.6

Bluetooth LE-Channel 0

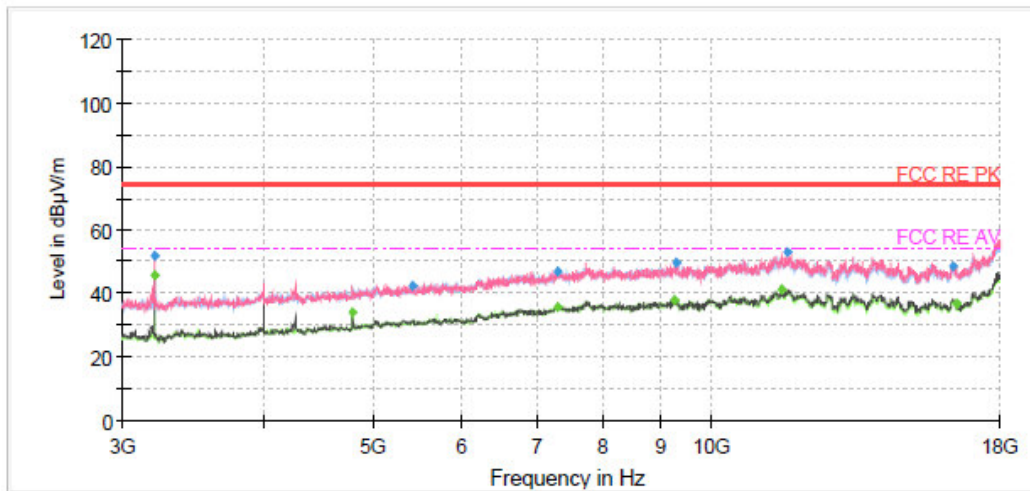


Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1113.25	---	37.20	54.00	16.80	500.00	200.0	H	188.00	-12
1115.75	47.68	---	74.00	26.32	500.00	200.0	H	133.00	-12
1237.50	---	33.74	54.00	20.26	500.00	200.0	H	217.00	-12
1328.75	47.98	---	74.00	26.02	500.00	200.0	V	155.00	-11
1400.25	43.79	---	74.00	30.21	500.00	100.0	V	40.00	-11
1400.25	---	33.00	54.00	21.00	500.00	200.0	V	155.00	-11
1601.25	49.36	---	74.00	24.64	500.00	200.0	V	353.00	-11
1601.25	---	46.61	54.00	7.39	500.00	200.0	V	353.00	-11
1815.50	---	35.51	54.00	18.49	500.00	200.0	V	155.00	-10
1816.75	46.86	---	74.00	27.14	500.00	200.0	V	168.00	-9
2661.50	48.38	---	74.00	25.62	500.00	100.0	V	0.00	-5
2971.00	---	36.47	54.00	17.53	500.00	200.0	V	357.00	-4

Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

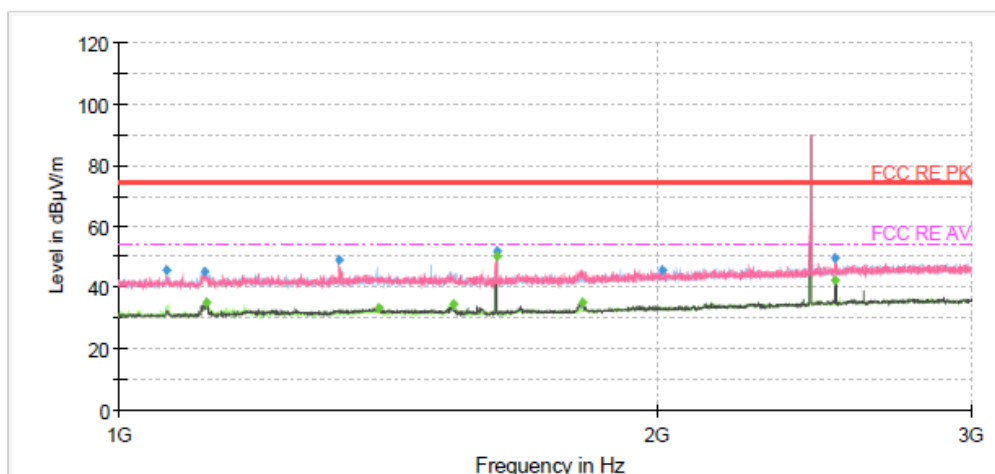


Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3202.50	---	45.92	54.00	8.08	500.00	100.0	V	115.00	-14
3202.50	52.17	---	74.00	21.83	500.00	100.0	V	115.00	-14
4803.75	---	33.79	54.00	20.21	500.00	100.0	H	14.00	-10
5415.00	42.57	---	74.00	31.43	500.00	100.0	H	76.00	-8
7278.75	---	35.89	54.00	18.11	500.00	100.0	H	284.00	-1
7295.63	47.08	---	74.00	26.92	500.00	200.0	V	6.00	0
9268.13	---	38.03	54.00	15.97	500.00	100.0	H	269.00	2
9275.63	49.89	---	74.00	24.11	500.00	100.0	V	181.00	1
11506.88	---	41.33	54.00	12.67	500.00	200.0	H	317.00	6
11649.38	52.91	---	74.00	21.09	500.00	200.0	V	4.00	6
16376.25	48.72	---	74.00	25.28	500.00	100.0	V	24.00	8
16483.13	---	36.63	54.00	17.37	500.00	100.0	V	150.00	8

Radiates Emission from 3GHz to 18GHz

Bluetooth LE-Channel 19

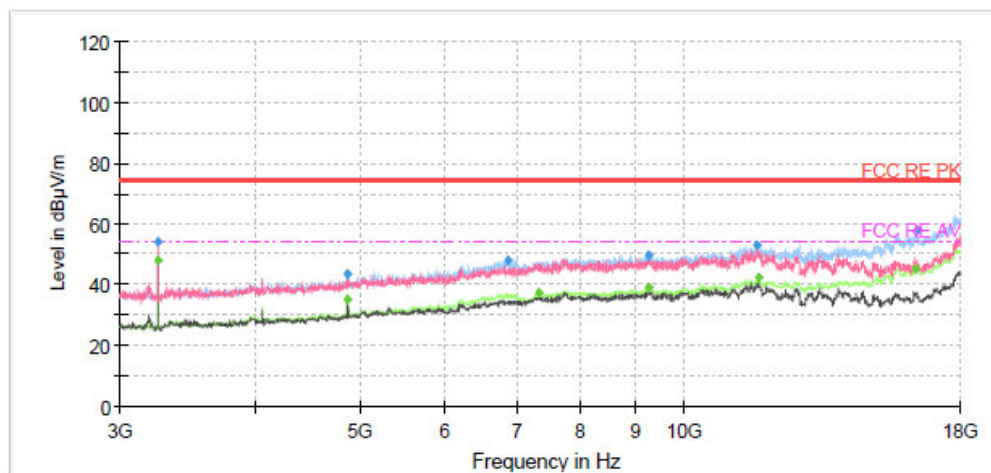


Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1063.50	45.60	---	74.00	28.40	500.00	200.0	H	115.00	-12
1117.25	45.38	---	74.00	28.62	500.00	200.0	V	322.00	-12
1118.75	---	35.30	54.00	18.70	500.00	200.0	H	179.00	-12
1328.75	49.04	---	74.00	24.96	500.00	200.0	V	197.00	-11
1398.50	---	33.52	54.00	20.48	500.00	100.0	V	127.00	-11
1538.50	---	34.58	54.00	19.42	500.00	200.0	H	52.00	-11
1626.75	52.02	---	74.00	21.98	500.00	200.0	V	330.00	-10
1626.75	---	50.11	54.00	3.89	500.00	200.0	V	330.00	-10
1817.75	---	35.05	54.00	18.95	500.00	200.0	V	168.00	-9
2015.50	46.04	---	74.00	27.96	500.00	200.0	V	168.00	-8
2519.50	---	42.55	54.00	11.45	500.00	100.0	V	56.00	-6
2519.50	49.58	---	74.00	24.42	500.00	100.0	V	56.00	-6

Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

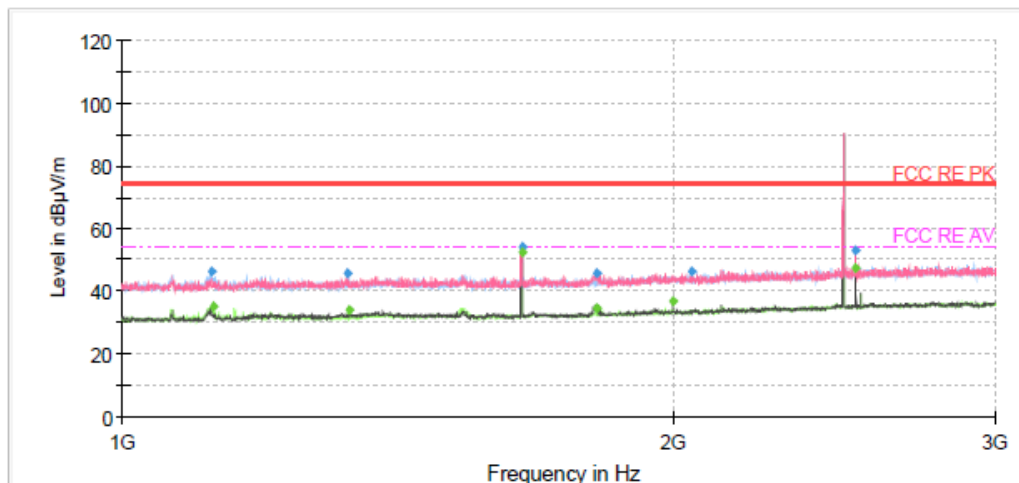


Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3253.13	---	48.23	54.00	5.77	500.00	100.0	V	49.00	-14
3253.13	54.00	---	74.00	20.00	500.00	100.0	V	49.00	-14
4878.75	---	35.24	54.00	18.76	500.00	100.0	H	278.00	-10
4878.75	43.81	---	74.00	30.19	500.00	100.0	H	278.00	-10
6847.50	47.96	---	74.00	26.04	500.00	200.0	H	337.00	-2
7308.75	---	37.39	54.00	16.61	500.00	200.0	H	343.00	-1
9240.00	49.76	---	74.00	24.24	500.00	200.0	H	149.00	2
9245.63	---	39.02	54.00	14.98	500.00	200.0	H	85.00	2
11658.75	52.95	---	74.00	21.05	500.00	200.0	H	272.00	6
11690.63	---	42.22	54.00	11.78	500.00	200.0	H	286.00	6
16331.25	---	45.02	54.00	8.98	500.00	200.0	H	337.00	8
16383.75	57.92	---	74.00	16.08	500.00	200.0	H	272.00	8

Radiates Emission from 3GHz to 18GHz

Bluetooth LE-Channel 39

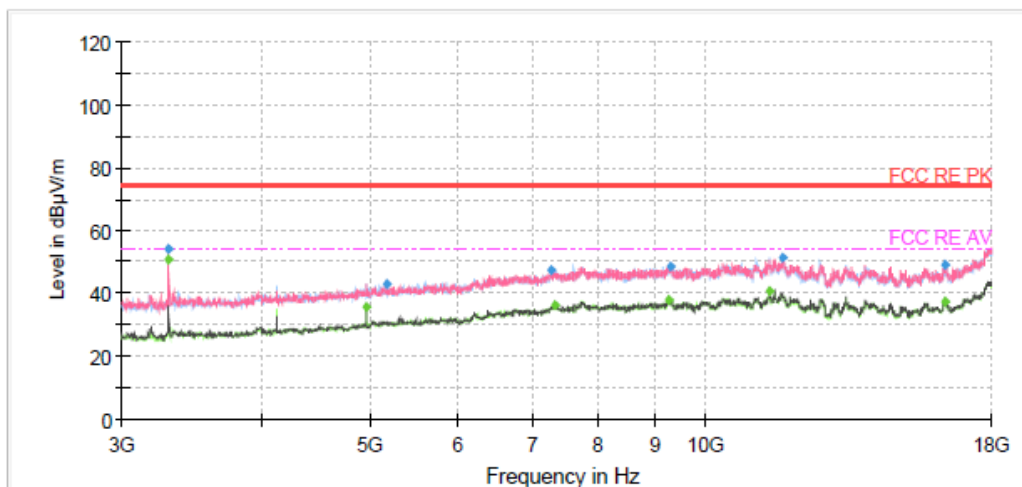


Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1118.25	46.44	---	74.00	27.56	500.00	200.0	H	134.00	-12
1121.00	---	35.15	54.00	18.85	500.00	200.0	H	134.00	-12
1328.50	45.62	---	74.00	28.38	500.00	200.0	V	166.00	-11
1329.25	---	34.26	54.00	19.74	500.00	200.0	H	232.00	-11
1653.25	54.38	---	74.00	19.62	500.00	200.0	V	334.00	-10
1653.25	---	52.66	54.00	1.34	500.00	200.0	V	334.00	-10
1816.25	---	34.68	54.00	19.32	500.00	200.0	V	352.00	-10
1817.75	45.74	---	74.00	28.26	500.00	200.0	V	357.00	-9
2000.00	---	36.87	54.00	17.13	500.00	200.0	V	179.00	-8
2049.75	46.39	---	74.00	27.61	500.00	100.0	V	2.00	-8
2518.50	---	47.70	54.00	6.30	500.00	100.0	V	4.00	-6
2518.50	52.93	---	74.00	21.07	500.00	100.0	V	4.00	-6

Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz



Final Result

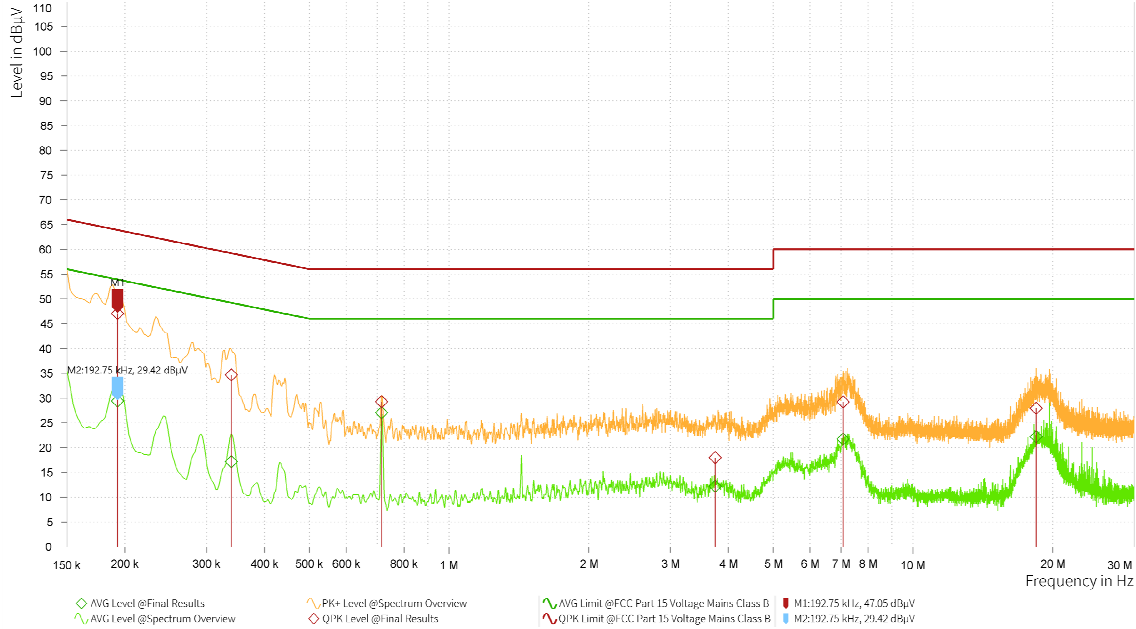
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3305.63	---	50.83	54.00	3.17	500.00	100.0	V	50.00	-14
3305.63	54.25	---	74.00	19.75	500.00	100.0	V	50.00	-14
4959.38	---	35.97	54.00	18.03	500.00	100.0	H	264.00	-10
5180.63	43.23	---	74.00	30.77	500.00	100.0	V	0.00	-8
7276.88	47.20	---	74.00	26.80	500.00	200.0	H	0.00	-1
7314.38	---	36.09	54.00	17.91	500.00	100.0	V	35.00	-1
9241.88	---	37.84	54.00	16.16	500.00	100.0	V	340.00	2
9303.75	48.80	---	74.00	25.20	500.00	200.0	H	23.00	1
11381.25	---	40.57	54.00	13.43	500.00	100.0	V	50.00	5
11703.75	51.36	---	74.00	22.64	500.00	200.0	V	7.00	6
16335.00	49.24	---	74.00	24.76	500.00	200.0	H	346.00	8
16344.38	---	37.57	54.00	16.43	500.00	200.0	V	124.00	8

Radiates Emission from 3GHz to 18GHz

2. Conducted Emission

2.1. Bluetooth LE

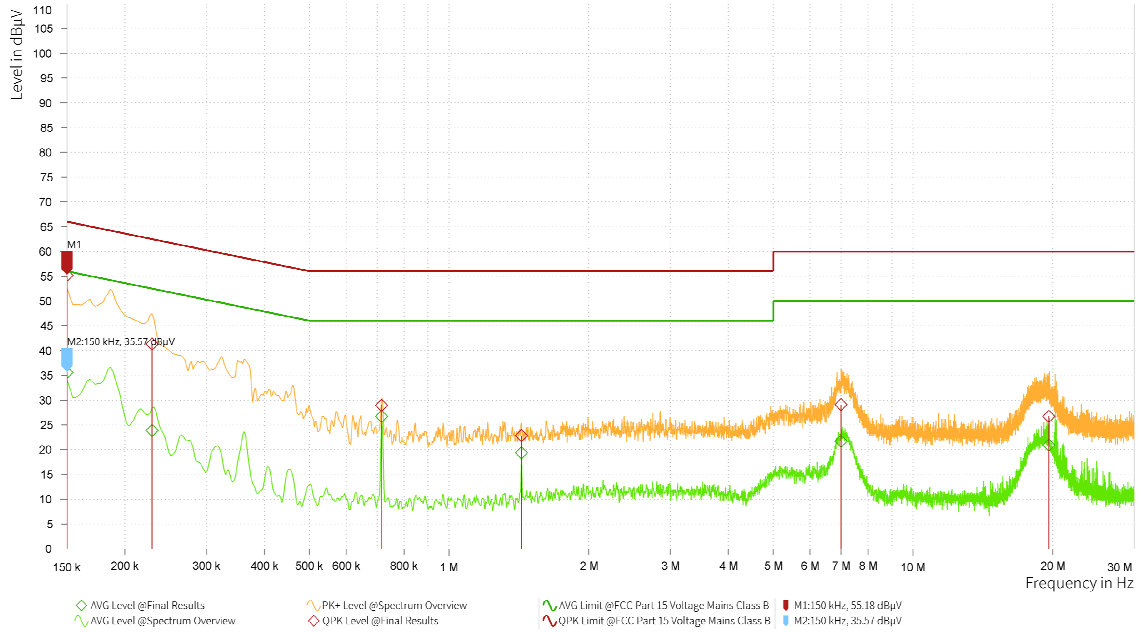
During the test, the Conducted Emission was performed in all modes with all channels. The test data of the worst-case condition (Bluetooth LE-Channel 39) was recorded in this report.



Frequency [MHz]	Process State	PK+ Level [dBμV]	PK+: QPK Limit [dBμV]	PK+ Margin [dB]	AVG Level [dBμV]	AVG Limit [dBμV]	AVG Margin [dB]	Correction [dB]	Line
0.193	Final	50.74	63.92	13.18	33.05	53.92	20.87	21.02	L1
0.339	Final	39.78	59.23	19.45	22.87	49.23	26.36	20.93	L1
0.715	Final	30.42	56.00	25.58	26.22	46.00	19.78	20.55	L1
3.748	Final	25.79	56.00	30.21	12.82	46.00	33.18	19.44	L1
7.071	Final	33.68	60.00	26.32	22.59	50.00	27.41	19.41	L1
18.438	Final	36.04	60.00	23.96	21.63	50.00	28.37	19.61	L1

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]
0.150	55.18	66.00	10.82	35.57	56.00	20.43	20.91	N	9.000	1.000
0.229	41.31	62.49	21.18	23.85	52.49	28.65	21.01	N	9.000	1.000
0.715	28.95	56.00	27.05	26.69	46.00	19.31	20.56	N	9.000	1.000
1.433	22.80	56.00	33.20	19.35	46.00	26.65	19.89	N	9.000	1.000
6.999	29.07	60.00	30.93	21.67	50.00	28.33	19.41	N	9.000	1.000
19.644	26.72	60.00	33.28	20.92	50.00	29.08	19.70	N	9.000	1.000

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 kHz to 30 MHz