

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

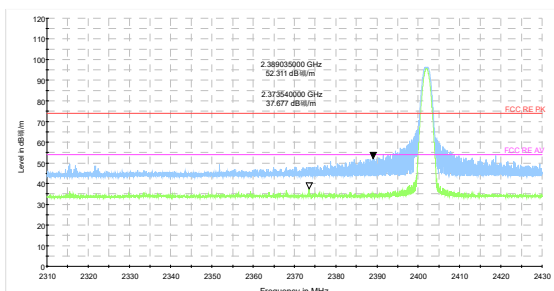
1.1. Bluetooth LE

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.

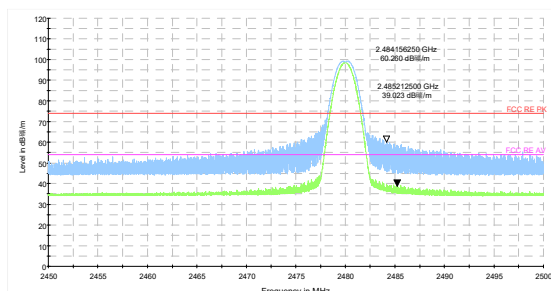
A symbol ($\text{dB}\mu\text{V/m}$) in the test plot below means ($\text{dB}\mu\text{V/m}$)

The signal beyond the limit is carrier.

After the pretest, Bluetooth LE (125kbps) 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 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

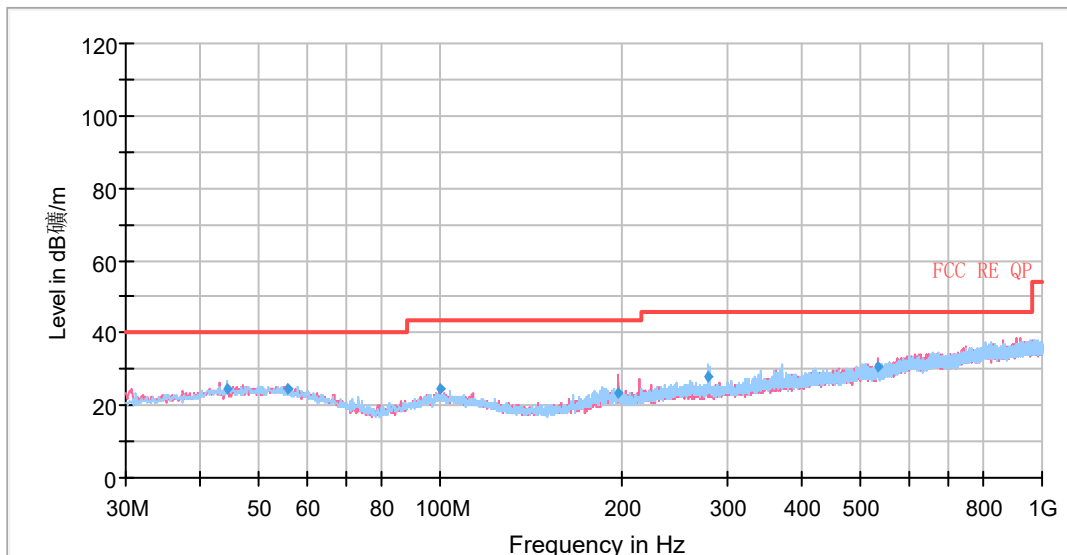
 PK Level @Spectrum Overview H
  PK Level @Spectrum Overview V
  PK Level @Final Results
  PK Limit

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

Continuous TX mode:

After the pretest, Bluetooth LE (125kbps) was selected as the worst Mode for Bluetooth LE.

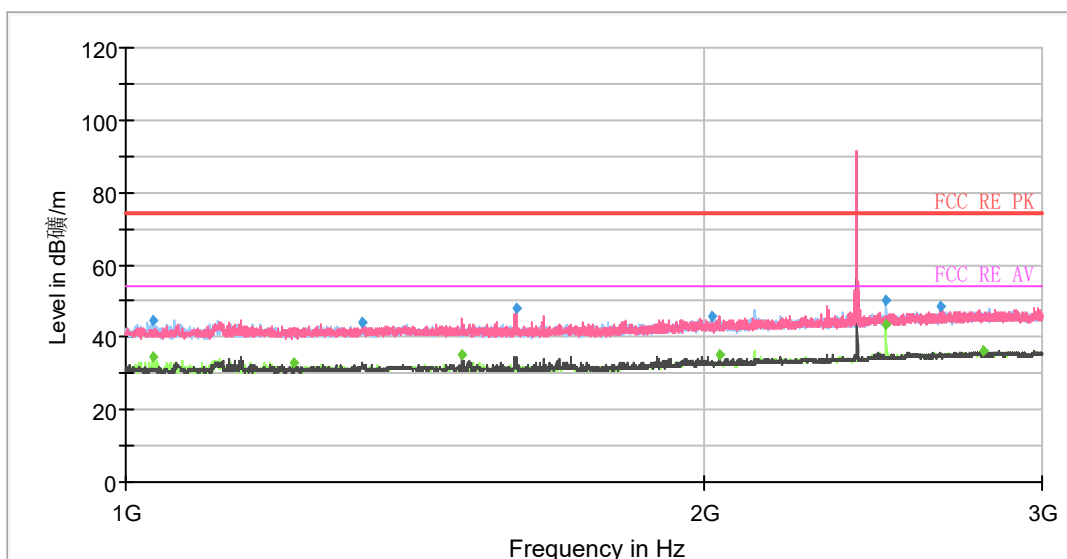
During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels. The test data of the worst-case condition (Bluetooth LE-Channel 39) was recorded in this report.



Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
44.19	24.32	40.00	15.68	1000.00	200.0	H	303.00	20
55.71	24.53	40.00	15.47	1000.00	100.0	V	196.00	20
99.96	24.72	43.50	18.78	1000.00	100.0	V	282.00	19
197.93	23.51	43.50	19.99	1000.00	200.0	V	0.00	18
279.29	27.77	46.00	18.23	1000.00	100.0	H	78.00	20
535.01	30.71	46.00	15.29	1000.00	100.0	V	0.00	26

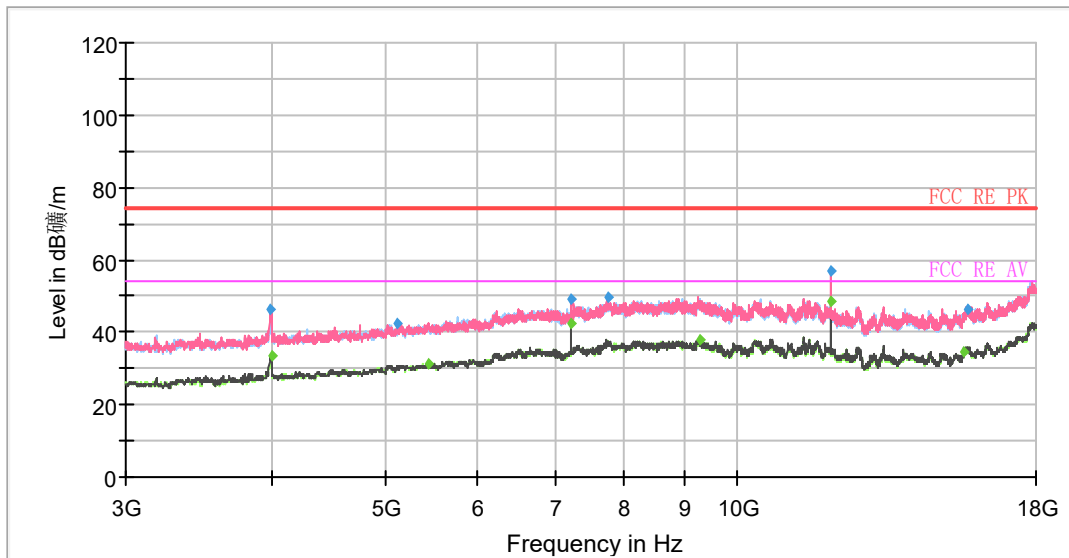
Bluetooth LE-Channel 0



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

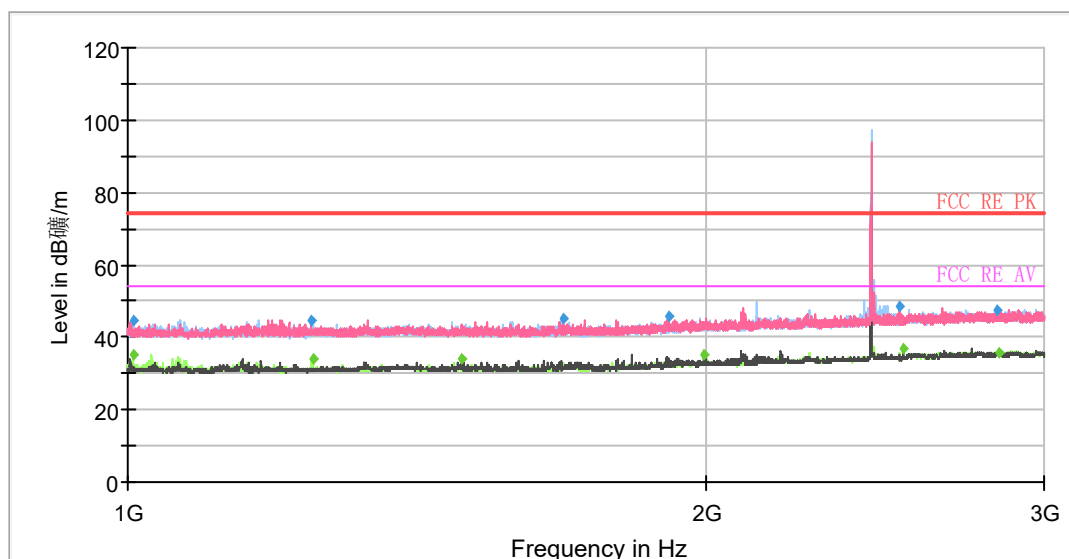
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1032.25	44.82	---	74.00	29.18	500.00	100.0	H	98.00	-12
1033.75	---	34.76	54.00	19.24	500.00	200.0	H	106.00	-12
1223.50	---	32.87	54.00	21.13	500.00	200.0	H	257.00	-12
1329.00	44.19	---	74.00	29.81	500.00	100.0	V	166.00	-11
1496.50	---	35.40	54.00	18.60	500.00	200.0	V	118.00	-11
1596.50	47.76	---	74.00	26.24	500.00	200.0	V	256.00	-11
2017.25	45.65	---	74.00	28.35	500.00	100.0	H	2.00	-8
2037.75	---	34.98	54.00	19.02	500.00	100.0	V	235.00	-8
2489.75	---	43.47	54.00	10.53	500.00	100.0	H	2.00	-6
2490.00	50.46	---	74.00	23.54	500.00	100.0	H	2.00	-6
2655.75	48.50	---	74.00	25.50	500.00	200.0	H	133.00	-5
2798.75	---	36.18	54.00	17.82	500.00	200.0	V	256.00	-5



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)
3993.75	46.37	---	74.00	27.63	500.00	200.0	V	141.00	-11
3995.63	---	33.64	54.00	20.36	500.00	200.0	V	141.00	-11
5128.13	42.42	---	74.00	31.58	500.00	200.0	V	315.00	-9
5439.38	---	31.36	54.00	22.64	500.00	200.0	H	18.00	-8
7205.63	---	42.33	54.00	11.67	500.00	100.0	V	183.00	-2
7205.63	49.36	---	74.00	24.64	500.00	100.0	V	183.00	-2
7740.00	49.60	---	74.00	24.40	500.00	100.0	V	29.00	1
9303.75	---	38.03	54.00	15.97	500.00	200.0	H	311.00	1
12009.38	56.93	---	74.00	17.07	500.00	100.0	V	247.00	6
12011.25	---	48.33	54.00	5.67	500.00	100.0	V	247.00	6
15630.00	---	34.62	54.00	19.38	500.00	100.0	H	80.00	6
15755.63	46.35	---	74.00	27.65	500.00	100.0	V	230.00	7

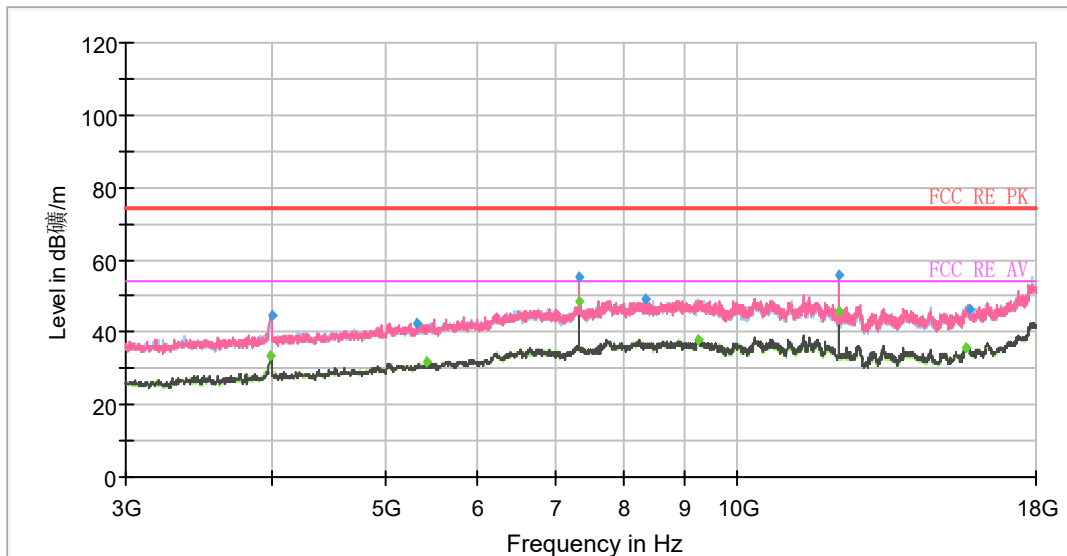
Bluetooth LE-Channel 19



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

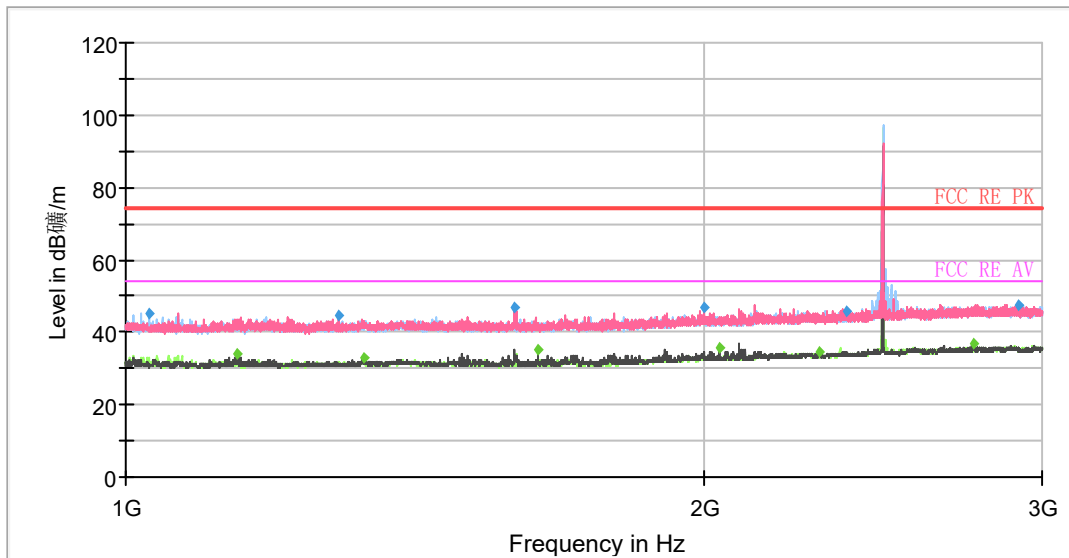
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1006.00	---	35.07	54.00	18.93	500.00	100.0	H	145.00	-12
1007.00	44.87	---	74.00	29.13	500.00	100.0	H	62.00	-12
1245.75	44.89	---	74.00	29.11	500.00	200.0	H	237.00	-12
1248.00	---	34.27	54.00	19.73	500.00	200.0	H	237.00	-12
1492.00	---	33.82	54.00	20.18	500.00	200.0	V	218.00	-11
1687.25	45.29	---	74.00	28.71	500.00	100.0	H	228.00	-10
1912.00	45.69	---	74.00	28.31	500.00	200.0	V	218.00	-9
1994.75	---	35.17	54.00	18.83	500.00	200.0	V	58.00	-8
2523.25	48.49	---	74.00	25.51	500.00	100.0	V	248.00	-6
2533.75	---	36.81	54.00	17.19	500.00	100.0	H	314.00	-6
2838.50	47.49	---	74.00	26.51	500.00	100.0	H	357.00	-5
2840.25	---	35.77	54.00	18.23	500.00	200.0	H	73.00	-5



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)
3990.00	---	33.55	54.00	20.45	500.00	200.0	V	146.00	-11
3995.63	44.84	---	74.00	29.16	500.00	100.0	V	154.00	-11
5323.13	42.53	---	74.00	31.47	500.00	100.0	H	343.00	-8
5413.13	---	31.59	54.00	22.41	500.00	200.0	H	64.00	-8
7318.13	55.03	---	74.00	18.97	500.00	200.0	V	1.00	-1
7320.00	---	48.30	54.00	5.70	500.00	200.0	V	346.00	-1
8326.88	49.09	---	74.00	24.91	500.00	100.0	V	264.00	1
9243.75	---	37.98	54.00	16.02	500.00	200.0	H	1.00	2
12198.75	55.74	---	74.00	18.26	500.00	100.0	V	185.00	6
12200.63	---	45.70	54.00	8.30	500.00	100.0	V	185.00	6
15682.50	---	35.82	54.00	18.18	500.00	100.0	H	196.00	7
15813.75	46.08	---	74.00	27.92	500.00	200.0	V	190.00	7

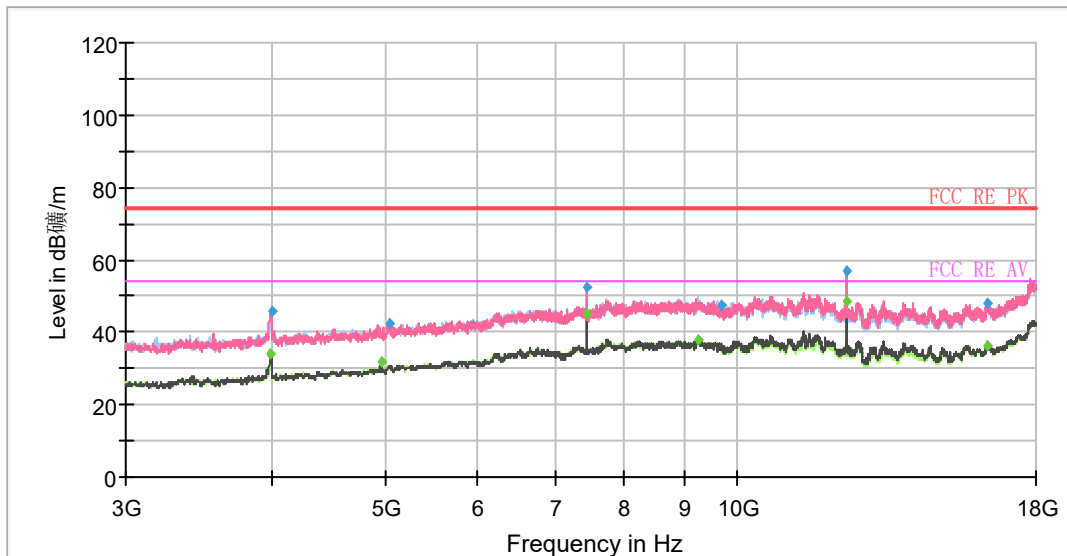
Bluetooth LE-Channel 39



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)
1028.75	45.32	---	74.00	28.68	500.00	100.0	H	104.00	-12
1142.50	---	33.98	54.00	20.02	500.00	200.0	V	43.00	-12
1291.75	44.90	---	74.00	29.10	500.00	200.0	V	198.00	-11
1331.50	---	32.86	54.00	21.14	500.00	100.0	V	158.00	-11
1595.25	46.72	---	74.00	27.28	500.00	100.0	V	283.00	-11
1639.75	---	34.99	54.00	19.01	500.00	200.0	V	254.00	-10
1998.75	46.68	---	74.00	27.32	500.00	100.0	V	75.00	-8
2037.75	---	35.97	54.00	18.03	500.00	100.0	V	256.00	-8
2294.75	---	34.51	54.00	19.49	500.00	200.0	H	199.00	-7
2375.50	45.91	---	74.00	28.09	500.00	100.0	V	283.00	-7
2766.75	---	36.58	54.00	17.42	500.00	100.0	H	356.00	-5
2917.75	47.24	---	74.00	26.76	500.00	100.0	H	356.00	-5



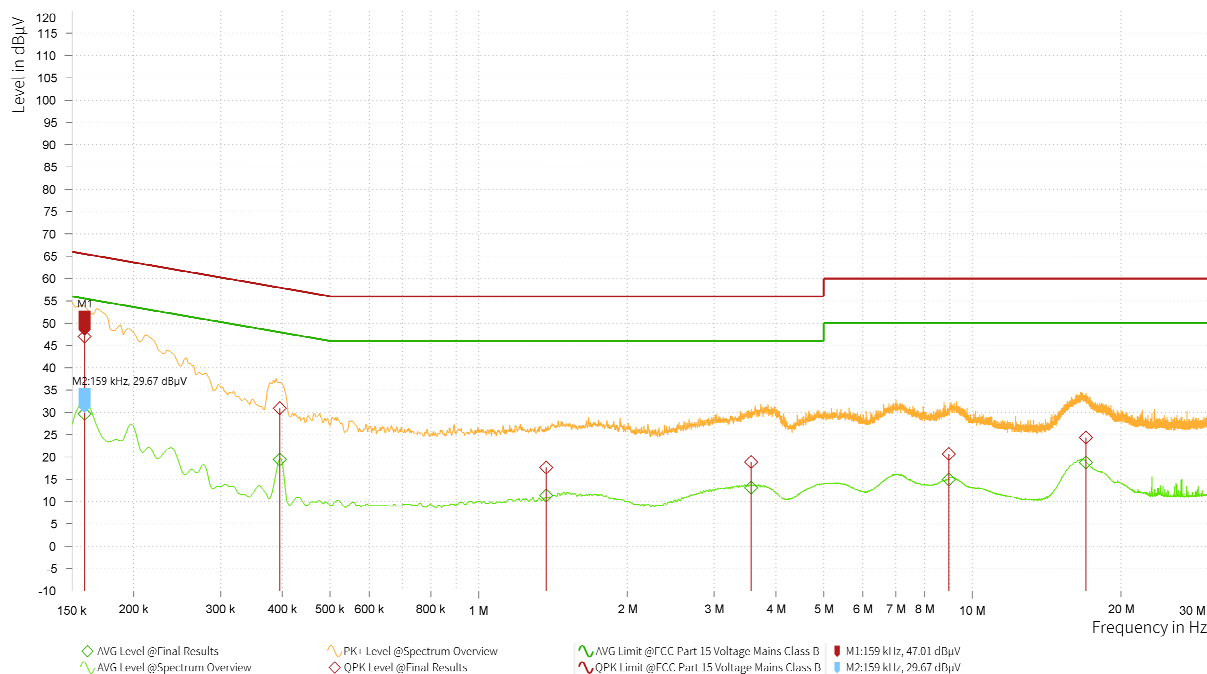
Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3988.13	---	33.95	54.00	20.05	500.00	100.0	V	151.00	-11
3997.50	45.75	---	74.00	28.25	500.00	200.0	V	137.00	-11
4959.38	---	31.60	54.00	22.40	500.00	100.0	V	2.00	-10
5045.63	42.41	---	74.00	31.59	500.00	100.0	V	17.00	-8
7440.00	---	45.20	54.00	8.80	500.00	100.0	V	166.00	0
7440.00	52.30	---	74.00	21.70	500.00	100.0	V	166.00	0
9255.00	---	37.72	54.00	16.28	500.00	200.0	V	1.00	2
9675.00	47.69	---	74.00	26.31	500.00	100.0	H	206.00	1
12401.25	56.78	---	74.00	17.22	500.00	100.0	V	181.00	5
12401.25	---	48.43	54.00	5.57	500.00	100.0	V	181.00	5
16323.75	---	36.49	54.00	17.51	500.00	200.0	H	6.00	8
16342.50	47.96	---	74.00	26.04	500.00	100.0	V	135.00	8

2. Conducted Emission

2.1. Bluetooth LE

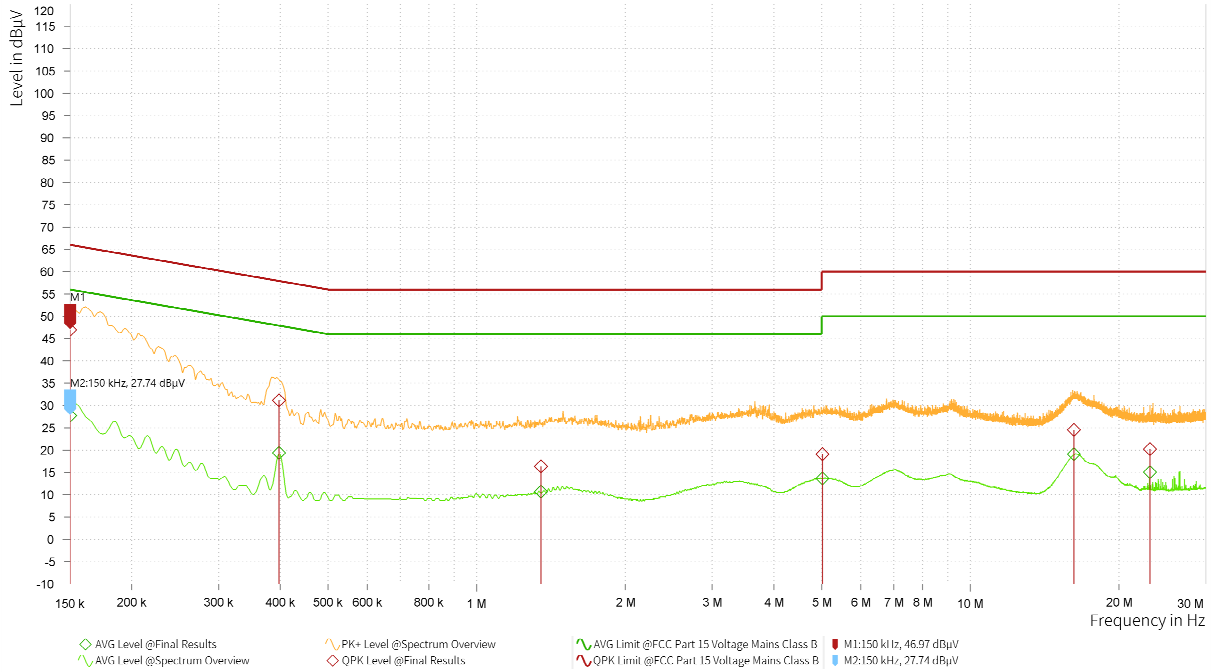
During the test, the Conducted Emission was performed in all modes with all channels. The test data of the worst-case condition (Bluetooth LE-Channel 39) was recorded in this report.



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]
0.159	47.01	65.52	18.51	29.67	55.52	25.84	20.90	L1	9.000	1.000
0.395	30.92	57.95	27.04	19.44	47.95	28.51	20.88	L1	9.000	1.000
1.370	17.65	56.00	38.35	11.34	46.00	34.66	19.91	L1	9.000	1.000
3.566	18.84	56.00	37.16	13.08	46.00	32.92	19.45	L1	9.000	1.000
8.959	20.65	60.00	39.35	14.93	50.00	35.07	19.41	L1	9.000	1.000
16.989	24.39	60.00	35.61	18.74	50.00	31.26	19.56	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]
0.150	46.97	66.00	19.03	27.74	56.00	28.26	20.91	N	9.000	1.000
0.398	31.14	57.91	26.76	19.35	47.91	28.55	20.89	N	9.000	1.000
1.349	16.37	56.00	39.63	10.66	46.00	35.34	19.93	N	9.000	1.000
5.015	19.10	60.00	40.90	13.67	50.00	36.33	19.41	N	9.000	1.000
16.222	24.52	60.00	35.48	19.08	50.00	30.92	19.58	N	9.000	1.000
23.127	20.21	60.00	39.79	15.05	50.00	34.95	19.79	N	9.000	1.000

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 kHz to 30 MHz