

6.6.3 Test data

Pass: Please refer to appendix A for details

BlueAsia

6.7 Conducted spurious emissions

Test Standard	47 CFR Part 15, Subpart C 15.247(d)
Test Method	ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 Clause 11.11
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX

6.7.1 Limit

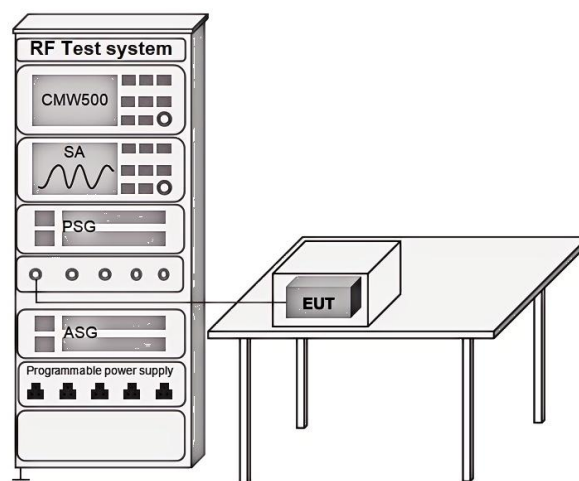
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB.

Attenuation below the general limits specified in §15.209(a) is not required.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.7.2 Test setup



6.7.3 Test data

Pass: Please refer to appendix A for details

BlueAsia

6.8 Radiated spurious emissions

Test Standard	47 CFR Part 15, Subpart C 15.247(d)
Test Method	ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 Clause 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX

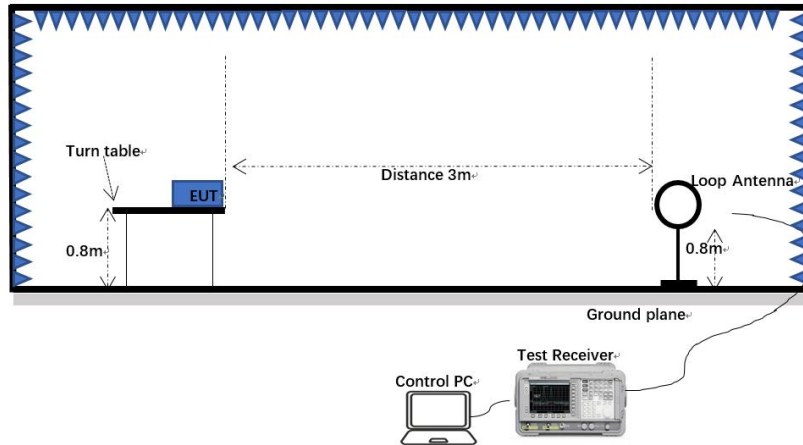
6.8.1 Limit

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

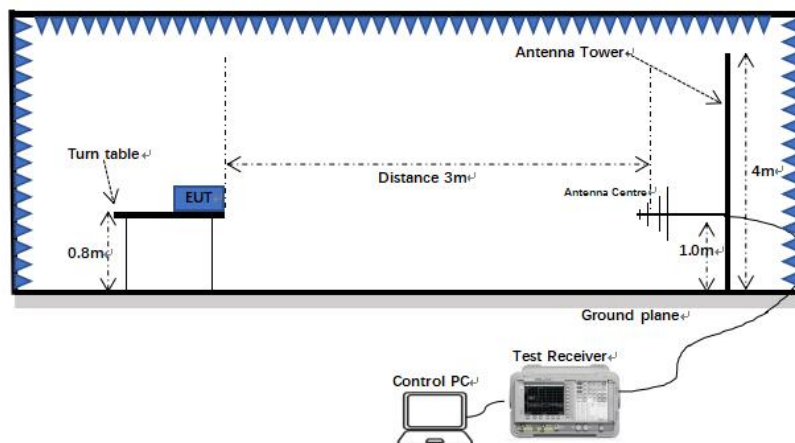
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

6.8.2 Test setup

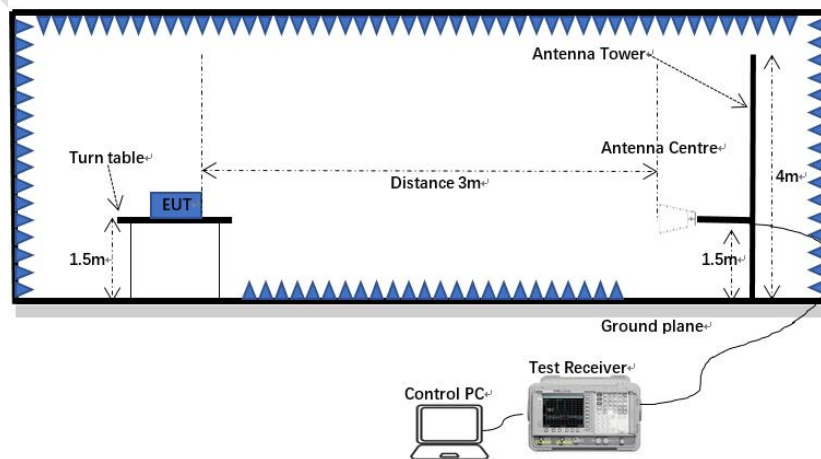
Below 1GHz:



30MHz-1GHz:



Above 1GHz:



6.8.3 Procedure

- a) For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c) The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h) Test the EUT in the lowest channel, the middle channel, the highest channel.
- i) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j) Repeat above procedures until all frequencies measured was complete.

Note 1: Scan from 9 kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.

Note 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

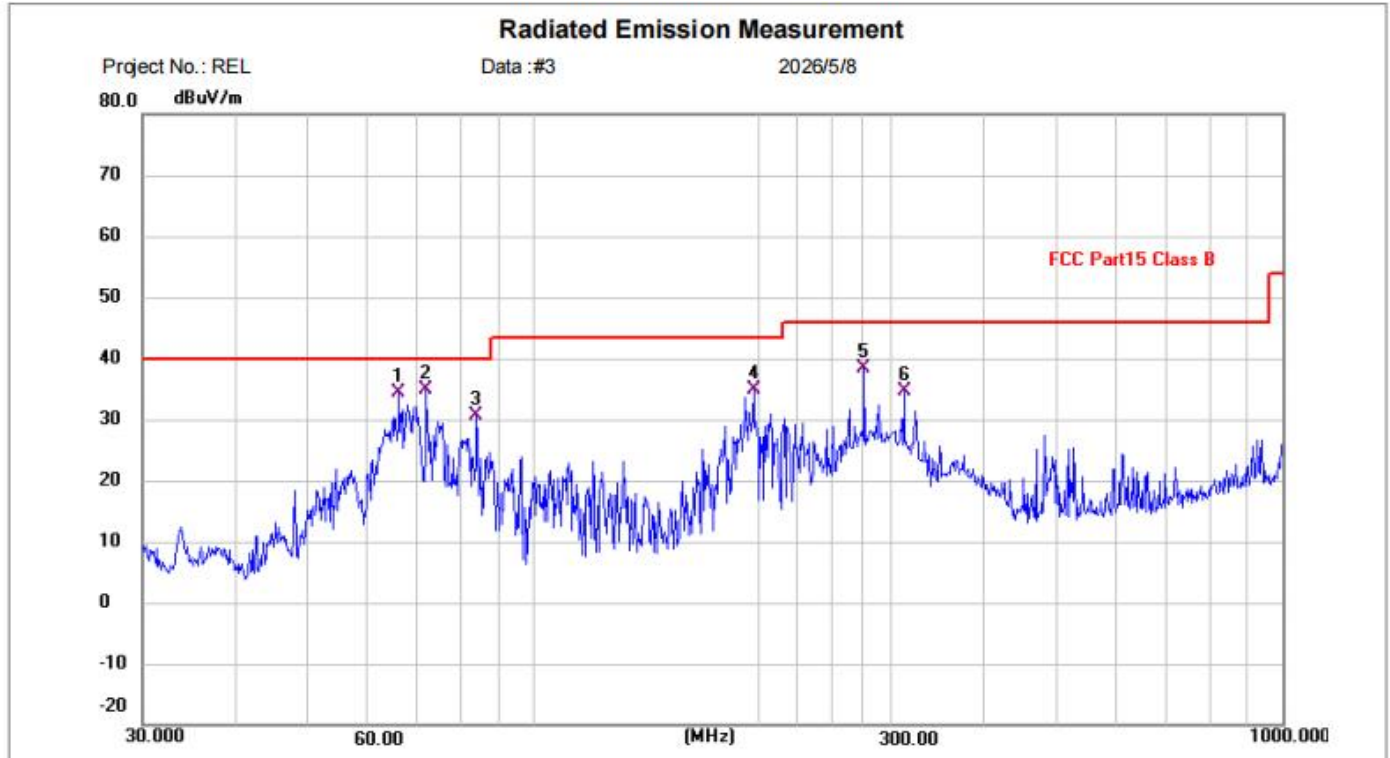
Note 3: The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Level (dBuV)} = \text{Reading (dBuV)} + \text{Factor (dB/m)}$$

6.8.4 Test data

Below 1GHz

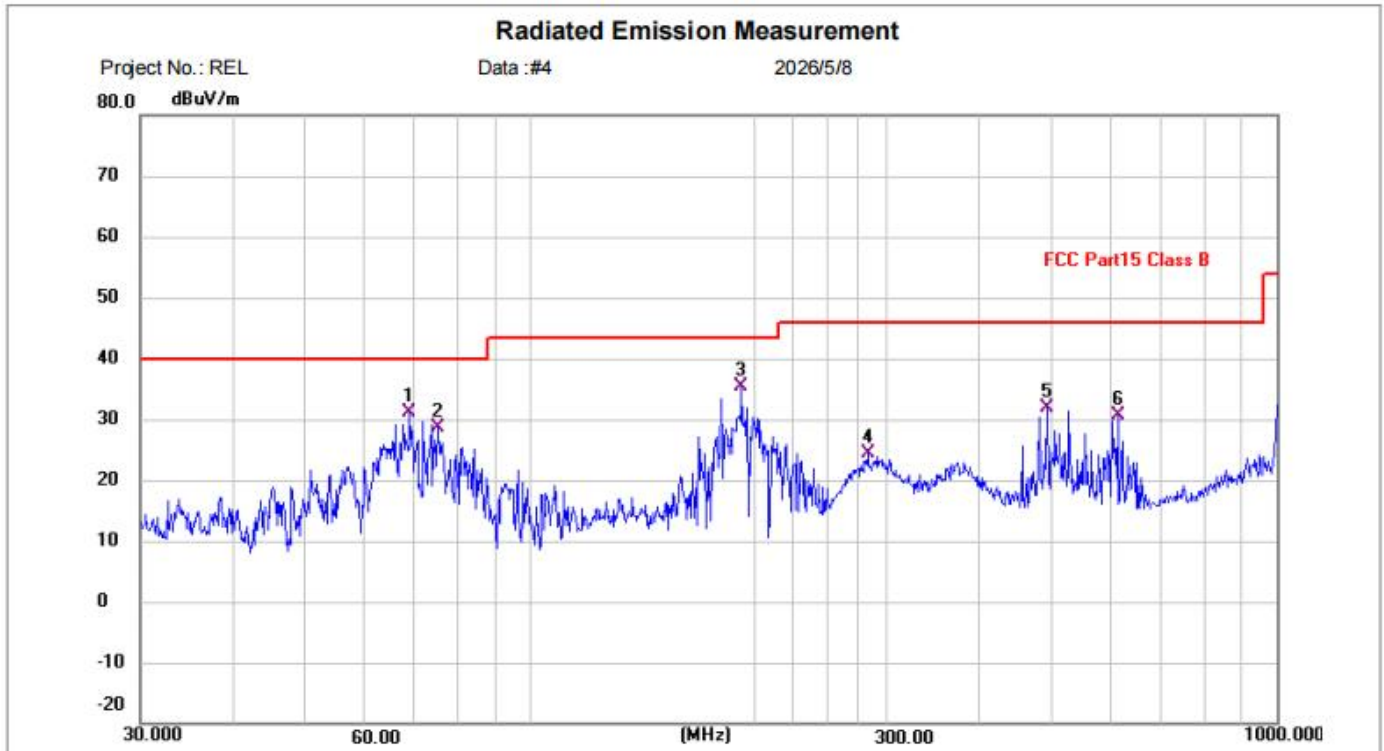
[Test mode: TX low channel]; [Polarity: Horizontal] ;[Power: DC3.3V]



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	66.0342	55.09	-20.68	34.41	40.00	-5.59	QP	P	
2 *	71.8320	56.79	-21.80	34.99	40.00	-5.01	QP	P	
3	83.8155	53.44	-22.92	30.52	40.00	-9.48	QP	P	
4	196.5098	57.27	-22.51	34.76	43.50	-8.74	QP	P	
5	276.1235	58.33	-19.84	38.49	46.00	-7.51	QP	P	
6	312.1794	53.33	-18.58	34.75	46.00	-11.25	QP	P	

Test Result: Pass

[Test mode: TX low channel]; [Polarity: Vertical] ;[Power: DC3.3V]



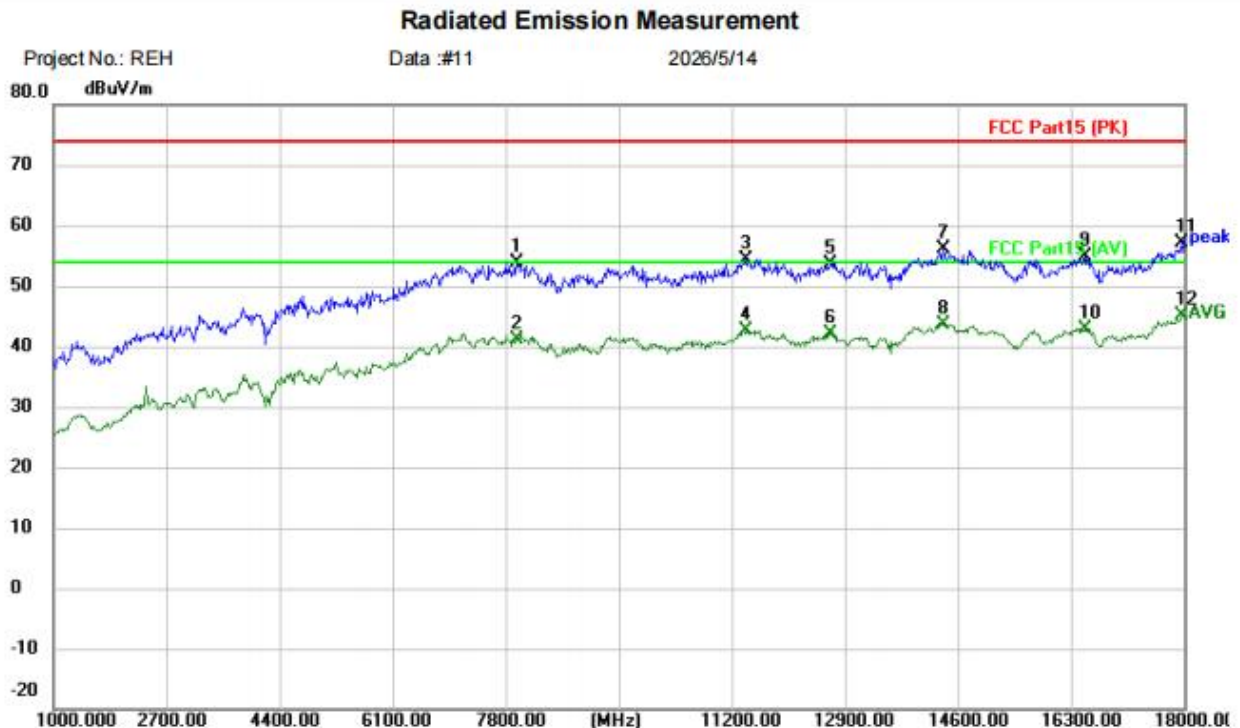
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	68.8721	52.43	-21.39	31.04	40.00	-8.96	QP	P	
2	75.1822	51.35	-22.61	28.74	40.00	-11.26	QP	P	
3 *	191.7450	57.46	-22.06	35.40	43.50	-8.10	QP	P	
4	282.9852	43.94	-19.49	24.45	46.00	-21.55	QP	P	
5	492.4685	45.49	-13.70	31.79	46.00	-14.21	QP	P	
6	612.0642	42.32	-11.74	30.58	46.00	-15.42	QP	P	

Test Result: Pass

For radiation transmission, tests have been conducted on BLE 1Mbps and 2Mbps modes, covering low, medium and high channels. Only the worst 1Mbps/low channels mode was reported.

Above 1GHz:

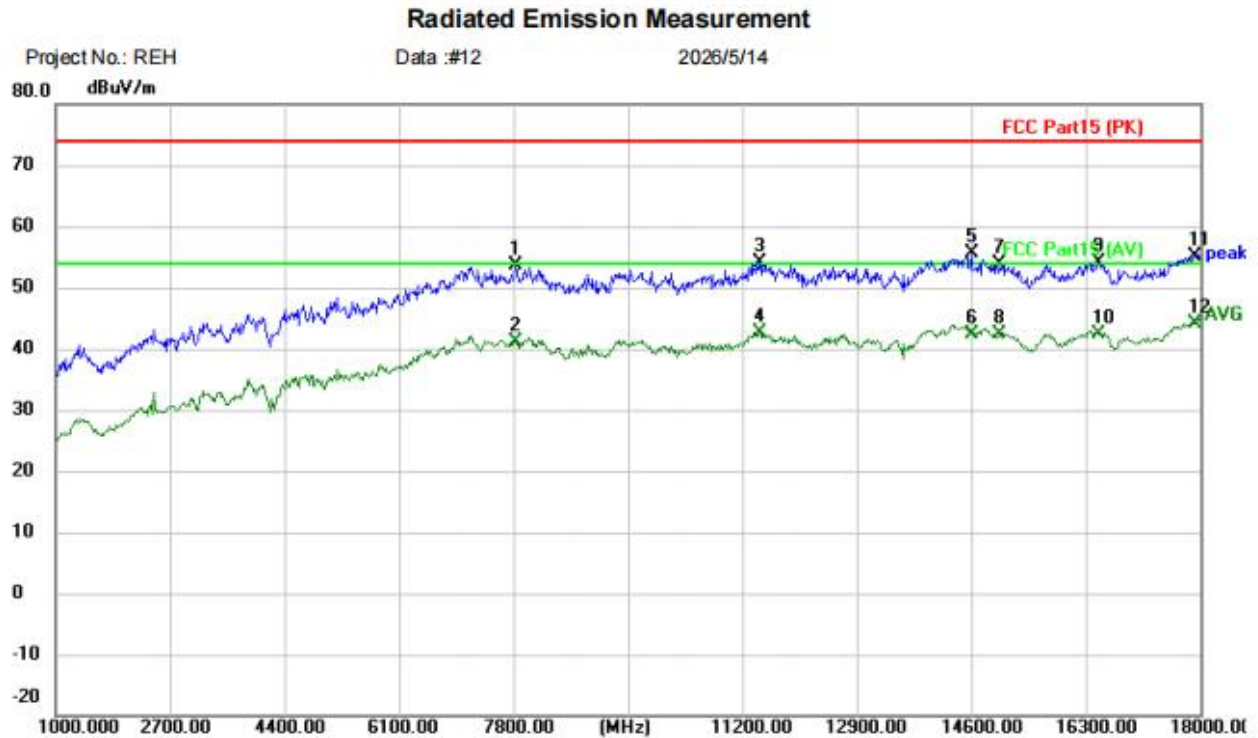
[Test mode: TX low channel]; [Polarity: Horizontal] ;[Power: DC3.3V]



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		7970.000	47.28	6.54	53.82	74.00	-20.18	peak	
2		7970.000	34.66	6.54	41.20	54.00	-12.80	AVG	
3		11404.00	44.88	9.62	54.50	74.00	-19.50	peak	
4		11404.00	33.06	9.62	42.68	54.00	-11.32	AVG	
5		12679.00	43.99	9.57	53.56	74.00	-20.44	peak	
6		12679.00	32.57	9.57	42.14	54.00	-11.86	AVG	
7		14379.00	46.32	9.81	56.13	74.00	-17.87	peak	
8		14379.00	33.83	9.81	43.64	54.00	-10.36	AVG	
9		16504.00	45.25	9.58	54.83	74.00	-19.17	peak	
10		16504.00	33.27	9.58	42.85	54.00	-11.15	AVG	
11		17966.00	44.64	12.51	57.15	74.00	-16.85	peak	
12	*	17966.00	32.52	12.51	45.03	54.00	-8.97	AVG	

Test Result: Pass

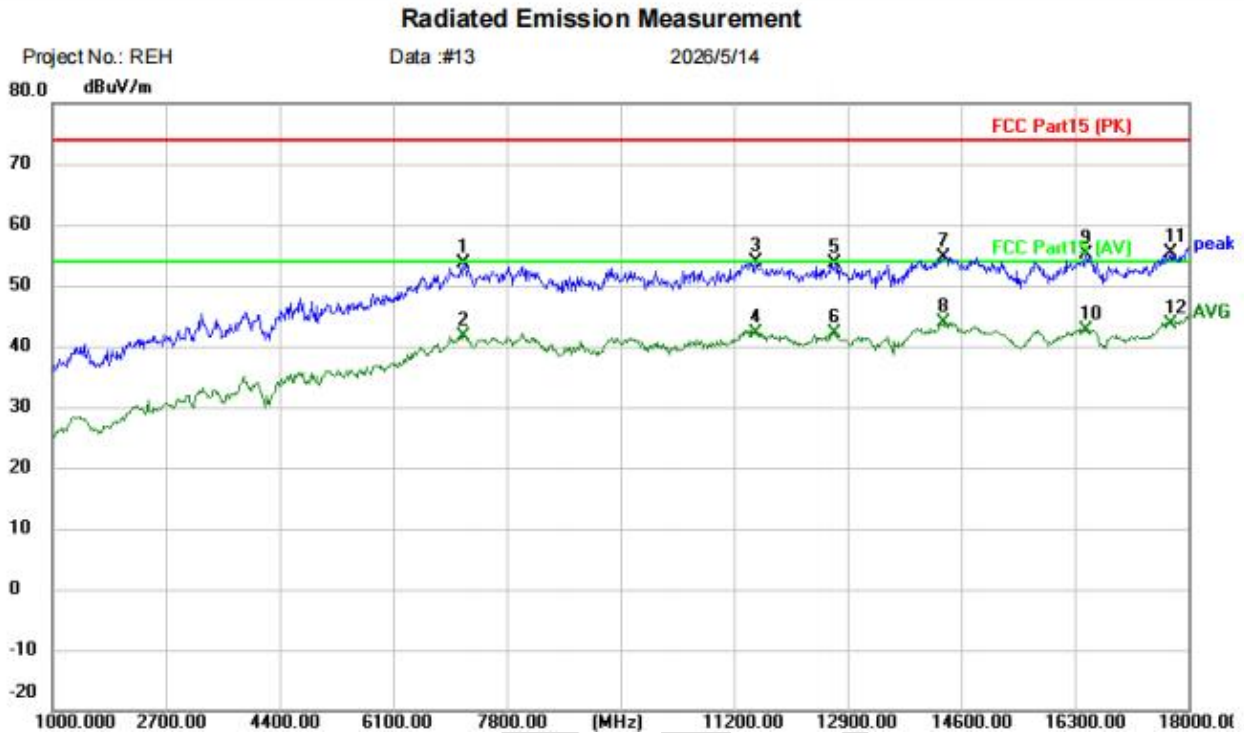
[Test mode: TX low channel]; [Polarity: Vertical] ;[Power: DC3.3V]



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		7834.000	47.56	5.98	53.54	74.00	-20.46	peak	
2		7834.000	35.12	5.98	41.10	54.00	-12.90	AVG	
3		11455.00	44.33	9.89	54.22	74.00	-19.78	peak	
4		11455.00	32.86	9.89	42.75	54.00	-11.25	AVG	
5		14600.00	46.44	9.13	55.57	74.00	-18.43	peak	
6		14600.00	33.19	9.13	42.32	54.00	-11.68	AVG	
7		15025.00	45.31	8.47	53.78	74.00	-20.22	peak	
8		15025.00	33.83	8.47	42.30	54.00	-11.70	AVG	
9		16487.00	44.68	9.50	54.18	74.00	-19.82	peak	
10		16487.00	32.92	9.50	42.42	54.00	-11.58	AVG	
11		17915.00	43.43	11.78	55.21	74.00	-18.79	peak	
12	*	17915.00	32.25	11.78	44.03	54.00	-9.97	AVG	

Test Result: Pass

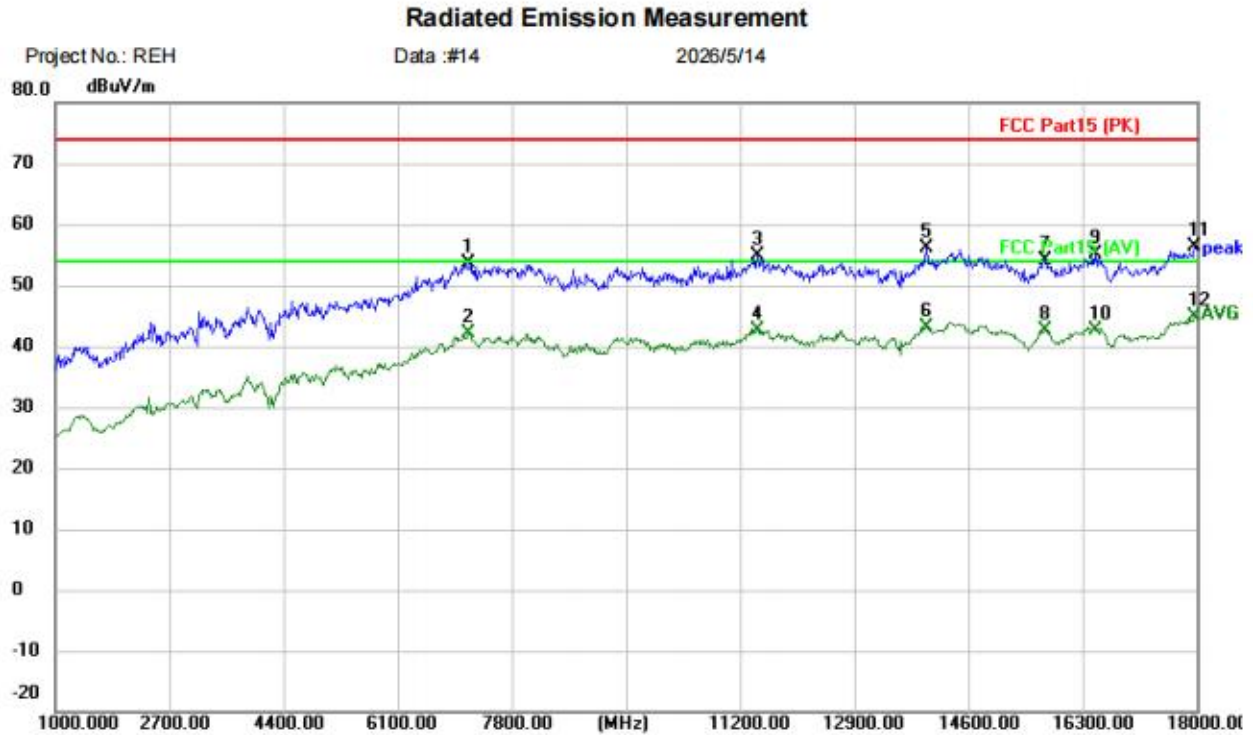
[Test mode: TX middle channel]; [Polarity: Horizontal] ;[Power: DC3.3V]



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		7154.000	46.46	7.17	53.63	74.00	-20.37	peak	
2		7154.000	34.56	7.17	41.73	54.00	-12.27	AVG	
3		11523.00	43.82	10.09	53.91	74.00	-20.09	peak	
4		11523.00	32.05	10.09	42.14	54.00	-11.86	AVG	
5		12713.00	43.74	9.78	53.52	74.00	-20.48	peak	
6		12713.00	32.35	9.78	42.13	54.00	-11.87	AVG	
7		14328.00	44.66	10.02	54.68	74.00	-19.32	peak	
8	*	14328.00	33.78	10.02	43.80	54.00	-10.20	AVG	
9		16470.00	45.72	9.39	55.11	74.00	-18.89	peak	
10		16470.00	33.24	9.39	42.63	54.00	-11.37	AVG	
11		17745.00	44.44	10.82	55.26	74.00	-18.74	peak	
12		17745.00	32.90	10.82	43.72	54.00	-10.28	AVG	

Test Result: Pass

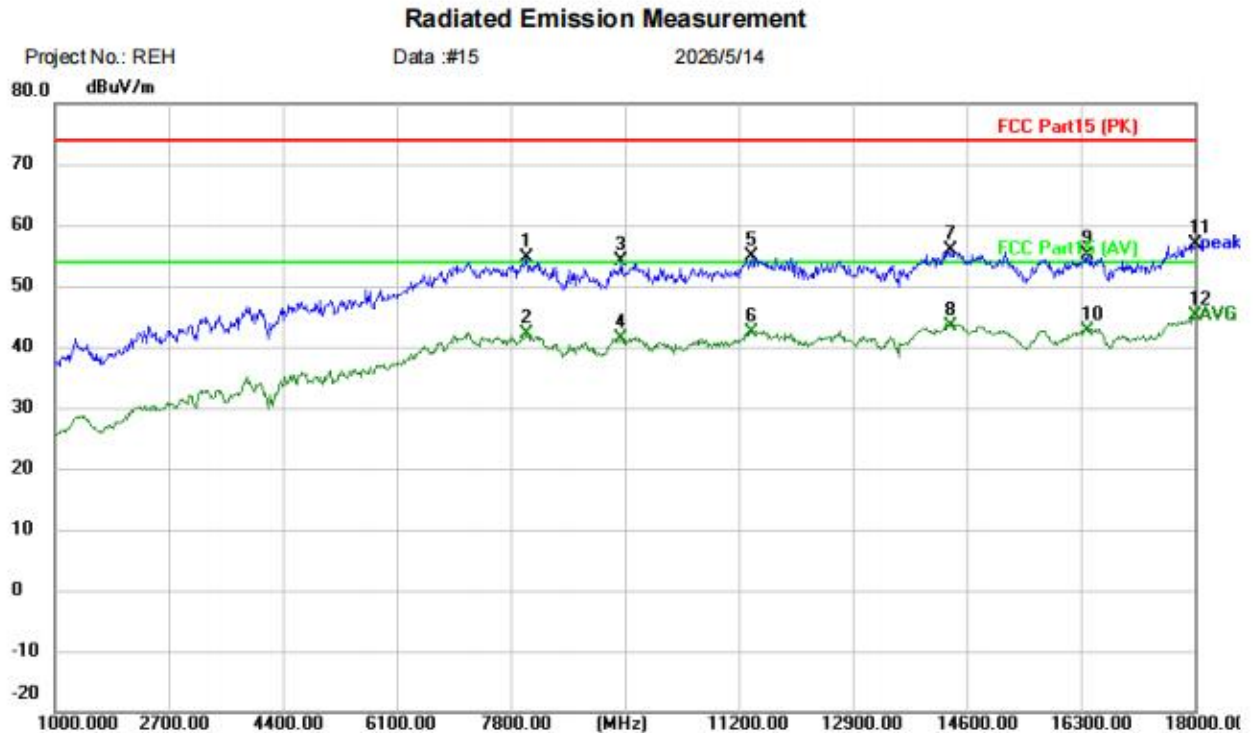
[Test mode: TX middle channel]; [Polarity: Vertical] ;[Power: DC3.3V]



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7154.000	46.55	7.17	53.72	74.00	-20.28	peak	
2		7154.000	34.88	7.17	42.05	54.00	-11.95	AVG	
3		11455.00	44.92	9.89	54.81	74.00	-19.19	peak	
4		11455.00	32.73	9.89	42.62	54.00	-11.38	AVG	
5		13971.00	46.02	10.07	56.09	74.00	-17.91	peak	
6		13971.00	33.09	10.07	43.16	54.00	-10.84	AVG	
7		15739.00	45.92	8.12	54.04	74.00	-19.96	peak	
8		15739.00	34.46	8.12	42.58	54.00	-11.42	AVG	
9		16487.00	45.60	9.50	55.10	74.00	-18.90	peak	
10		16487.00	33.19	9.50	42.69	54.00	-11.31	AVG	
11		17966.00	43.89	12.51	56.40	74.00	-17.60	peak	
12	*	17966.00	32.28	12.51	44.79	54.00	-9.21	AVG	

Test Result: Pass

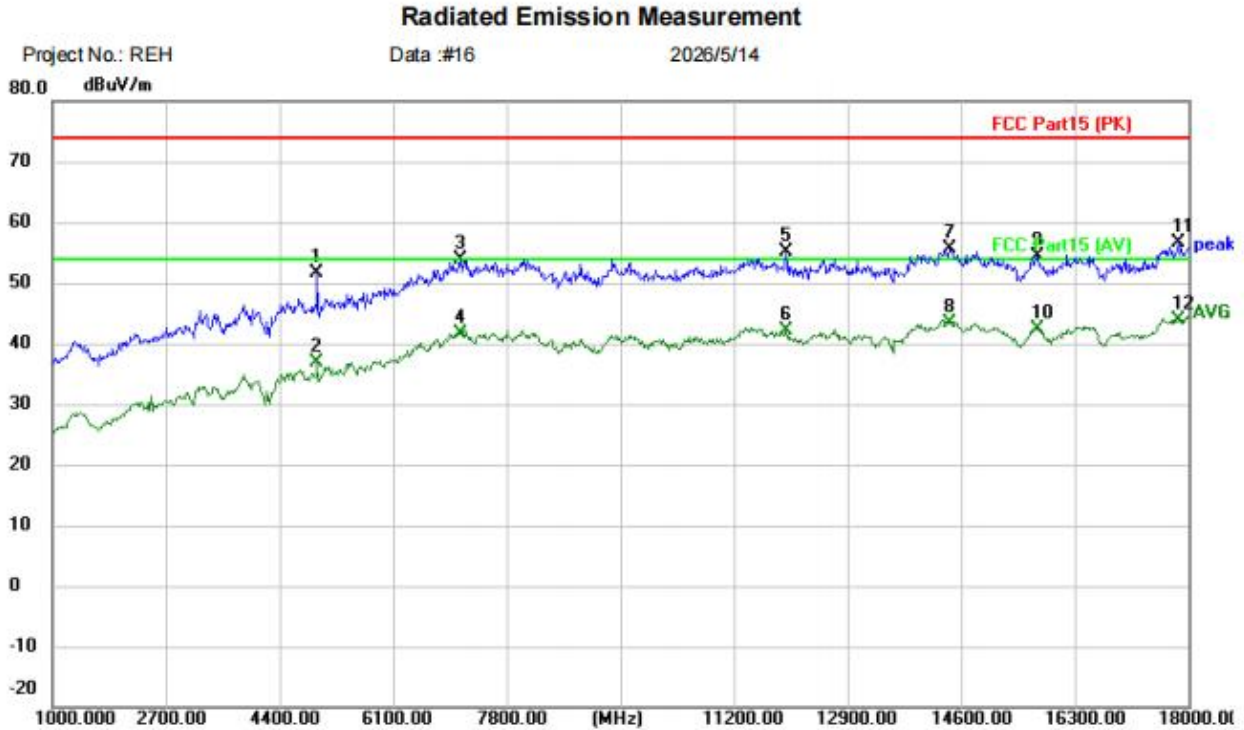
[Test mode: TX High channel]; [Polarity: Horizontal] ;[Power: DC3.3V]



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB	dBuV/m	dBuV/m	dB		
1		8038.000	47.87	6.68	54.55	74.00	-19.45	peak	
2		8038.000	35.40	6.68	42.08	54.00	-11.92	AVG	
3		9449.000	46.53	7.51	54.04	74.00	-19.96	peak	
4		9449.000	33.90	7.51	41.41	54.00	-12.59	AVG	
5		11387.00	45.38	9.47	54.85	74.00	-19.15	peak	
6		11387.00	32.85	9.47	42.32	54.00	-11.68	AVG	
7		14362.00	46.00	9.88	55.88	74.00	-18.12	peak	
8		14362.00	33.45	9.88	43.33	54.00	-10.67	AVG	
9		16402.00	46.06	9.00	55.06	74.00	-18.94	peak	
10		16402.00	33.72	9.00	42.72	54.00	-11.28	AVG	
11		18000.00	43.99	13.01	57.00	74.00	-17.00	peak	
12	*	18000.00	32.08	13.01	45.09	54.00	-8.91	AVG	

Test Result: Pass

[Test mode: TX High channel]; [Polarity: Vertical] ;[Power: DC3.3V]



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4961.000	51.99	-0.37	51.62	74.00	-22.38	peak	
2		4961.000	37.21	-0.37	36.84	54.00	-17.16	AVG	
3		7103.000	46.90	6.99	53.89	74.00	-20.11	peak	
4		7103.000	34.55	6.99	41.54	54.00	-12.46	AVG	
5		11982.00	45.96	9.11	55.07	74.00	-18.93	peak	
6		11982.00	33.10	9.11	42.21	54.00	-11.79	AVG	
7		14430.00	46.04	9.67	55.71	74.00	-18.29	peak	
8		14430.00	33.76	9.67	43.43	54.00	-10.57	AVG	
9		15739.00	46.23	8.12	54.35	74.00	-19.65	peak	
10		15739.00	34.29	8.12	42.41	54.00	-11.59	AVG	
11		17847.00	45.22	11.34	56.56	74.00	-17.44	peak	
12	*	17847.00	32.46	11.34	43.80	54.00	-10.20	AVG	

Test Result: Pass

Note:When scanning in the range of 1GHz~ 25GHz and the interference above 18GHz is very small, it is a low noise signal. The point shown in the figure above is the highest emission that can be found during the test, so only the above point is shown. The fundamental frequency is blocked by the filter. Only stray emission.

For Radiated emission,1Mbps and 2Mbps mode all have been tested,only worse case 1Mbps mode is reported.

6.9 Radiated emissions which fall in the restricted bands

Test Standard	47 CFR Part 15, Subpart C 15.247(d)
Test Method	ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 Clause 11.12
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX

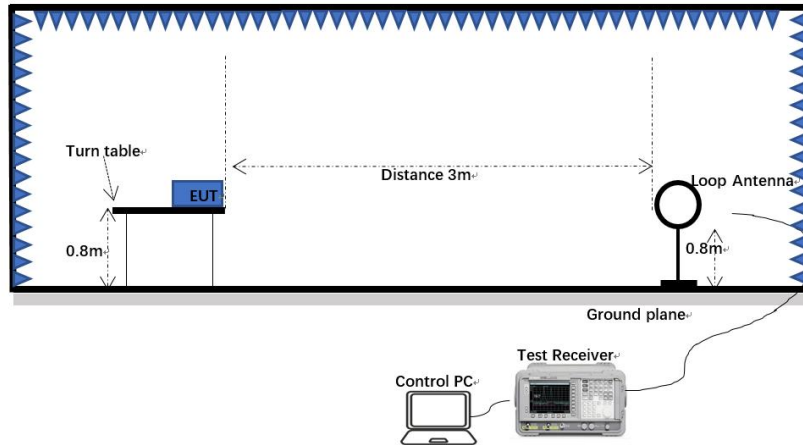
6.9.1 Limit

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

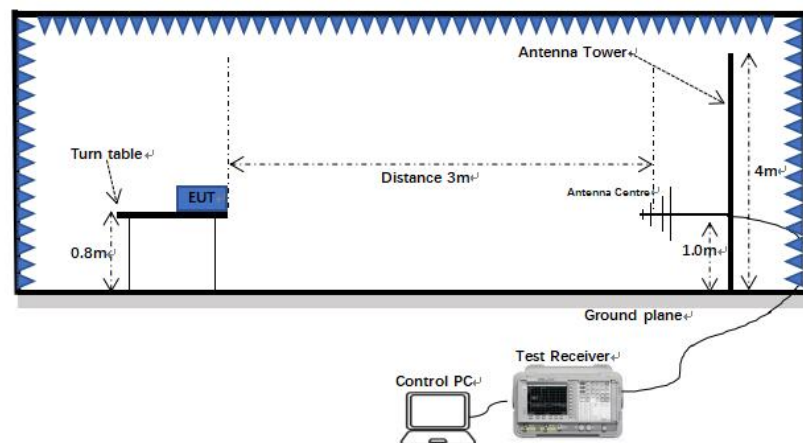
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

6.9.2 Test setup

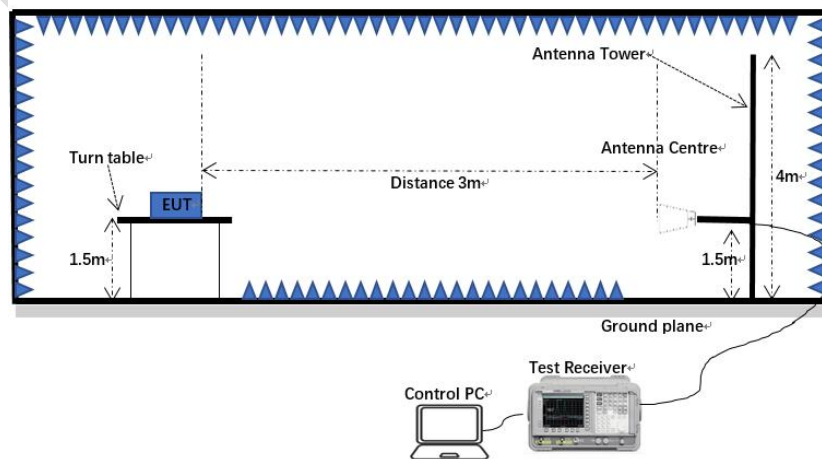
Below 1GHz:



30MHz-1GHz:



Above 1GHz:



6.9.3 Procedure

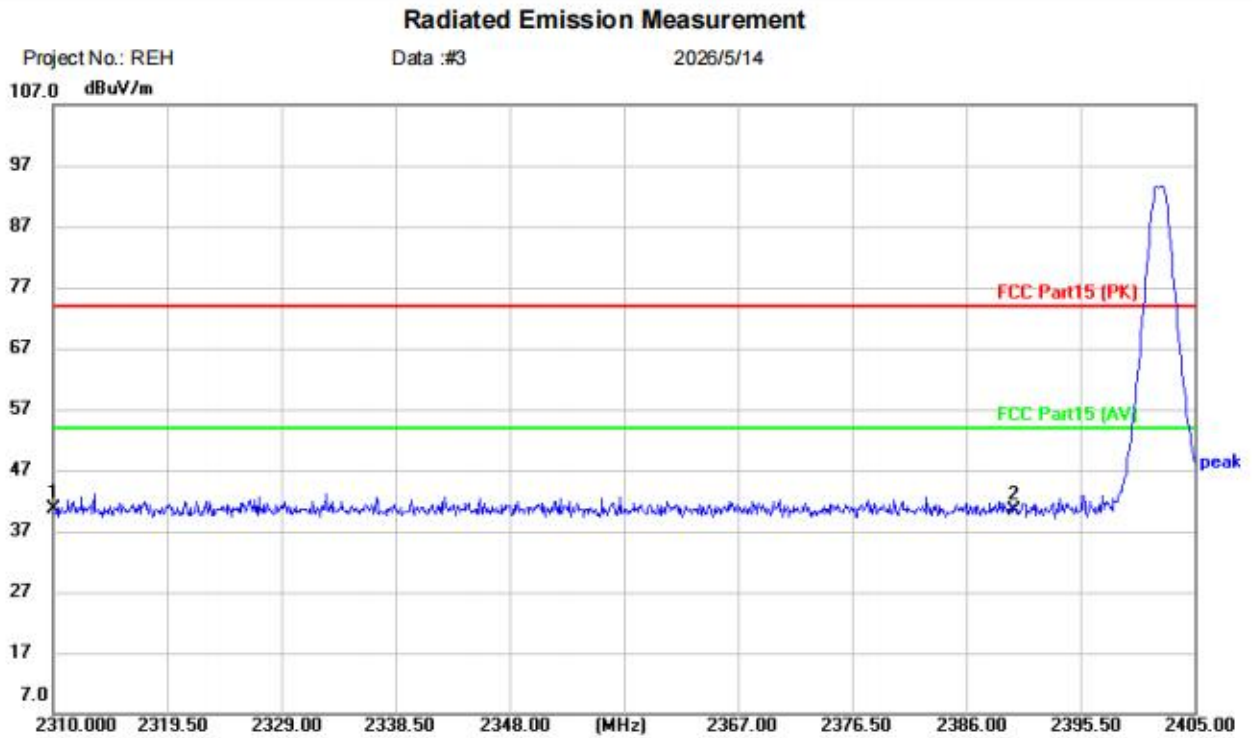
- a) For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c) The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h) Test the EUT in the lowest channel, the middle channel, the highest channel.
- i) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j) Repeat above procedures until all frequencies measured was complete.

Note 1: Level (dBuV) = Reading (dBuV) + Factor (dB/m)

Note 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

6.9.4 Test data

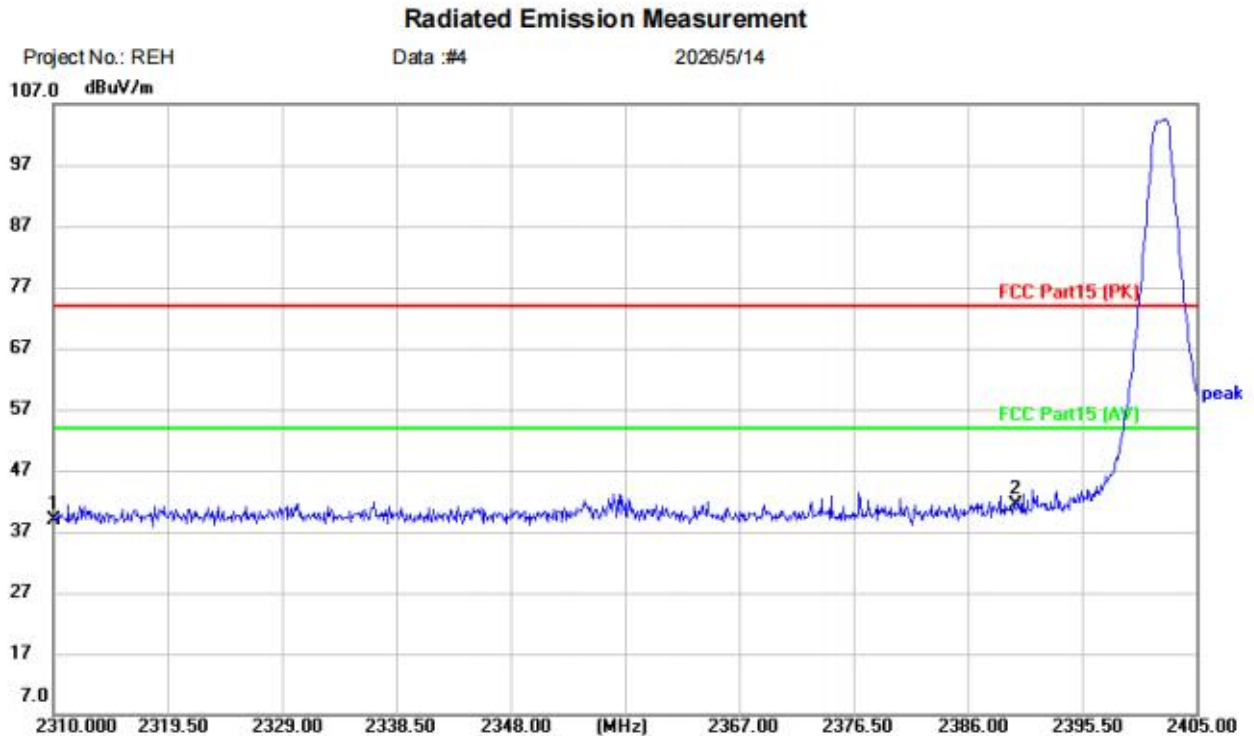
[Test mode: TX low channel]; [Polarity: Horizontal] ;[Power: DC3.3V]



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2310.000	50.12	-9.51	40.61	74.00	-33.39	peak	
2		2390.000	49.51	-9.19	40.32	74.00	-33.68	peak	

Test Result: Pass

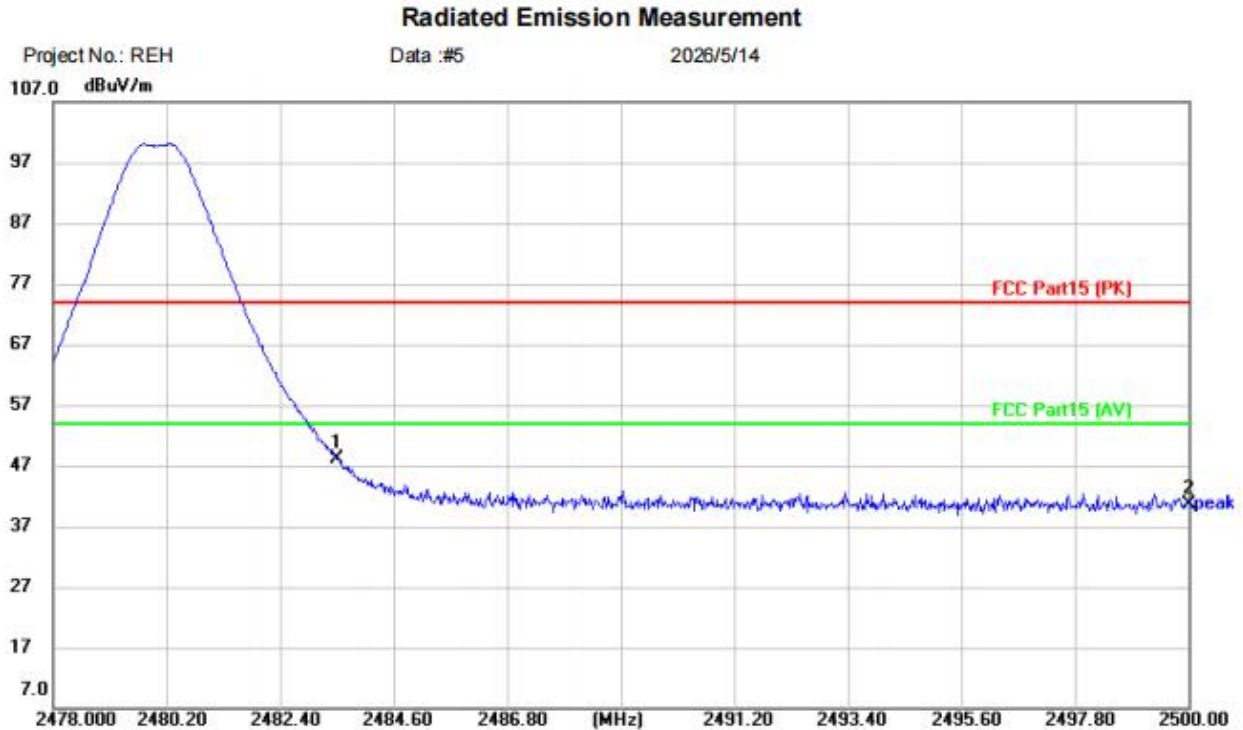
[Test mode:TX low channel]; [Polarity: Vertical] ;[Power: DC3.3V]



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2310.000	48.45	-9.51	38.94	74.00	-35.06	peak	
2	*	2390.000	50.45	-9.19	41.26	74.00	-32.74	peak	

Test Result: Pass

[Test mode: TX High channel]; [Polarity: Horizontal] ;[Power: DC3.3V]



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2483.500	57.23	-9.14	48.09	74.00	-25.91	peak	
2		2500.000	49.64	-9.11	40.53	74.00	-33.47	peak	

Test Result: Pass