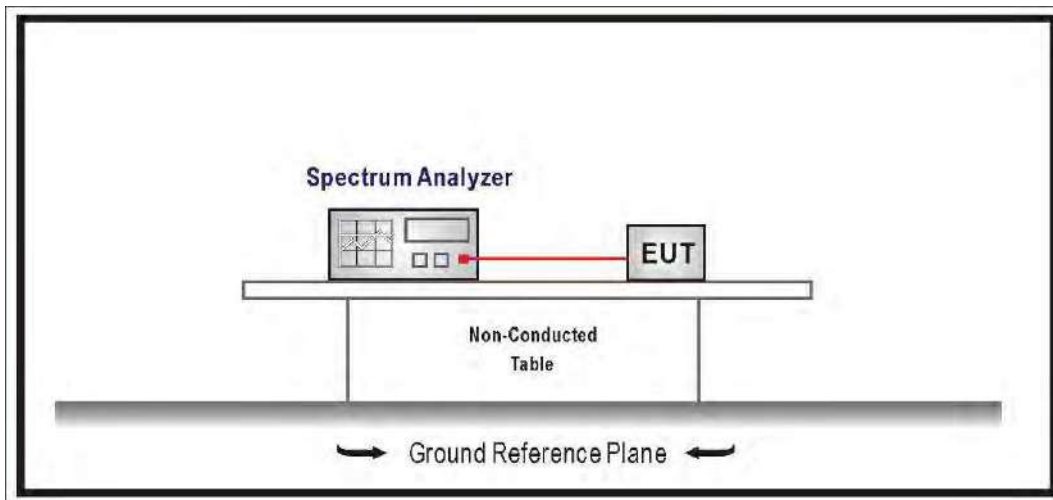


6. Maximum Power Spectral Density

6.1. Test Setup



6.2. Test Limit

1. For the band 5.15 ~ 5.25 GHz, the peak power spectral density shall not exceed 17 dBm in any 1 MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
2. For client devices in the 5.15 ~ 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi
3. For the 5.25 ~ 5.35 GHz ,5470 ~ 5600 MHz and 5650 ~ 5725 MHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
4. For the band 5.725 ~ 5.850 GHz, the peak power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

6.3. Test Procedure

The EUT was setup to ANSI C63.10: 2013; tested to U-NII test procedure of KDB 789033.

6.4. Test Result of Maximum Power Spectral Density

<For Indoor AP and Client Band 4>

Modulation	Frequency (MHz)	Power Spectral Density (dBm)			Limit (dBm)	Result
		Ant. 0	Ant. 1	Total		
802.11a	5180	5.010	5.360	8.388	≤ 15.89	Pass
	5220	10.690	10.770	13.930	≤ 15.89	Pass
	5240	8.890	9.000	12.145	≤ 15.89	Pass
	5745	-6.790	-5.570	-2.938	≤ 28.45	Pass
	5785	-7.410	-5.790	-3.325	≤ 28.45	Pass
	5825	-7.880	-6.620	-4.005	≤ 28.45	Pass
802.11ac (20 MHz)	5180	4.400	5.660	8.173	≤ 15.89	Pass
	5220	10.760	10.830	13.892	≤ 15.89	Pass
	5240	8.560	8.990	11.877	≤ 15.89	Pass
	5745	-6.810	-5.400	-2.951	≤ 28.45	Pass
	5785	-7.350	-6.230	-3.657	≤ 28.45	Pass
	5825	-7.250	-6.620	-3.827	≤ 28.45	Pass
802.11ac (40 MHz)	5190	-0.680	0.390	3.075	≤ 15.89	Pass
	5230	5.440	6.020	8.927	≤ 15.89	Pass
	5755	-9.130	-8.250	-5.480	≤ 28.45	Pass
	5795	-9.560	-8.800	-5.976	≤ 28.45	Pass
802.11ac (80 MHz)	5210	-2.960	-2.130	0.782	≤ 15.89	Pass
	5775	-13.920	-13.640	-10.470	≤ 28.45	Pass

Note:

- Total power spectral density = power spectral density + duty factor, and the duty factor refer to section 2.3.
- Directional Gain = $10 \log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{Ant}]$ for U-NII-1: 7.11dBi & U-NII-3: 7.55dBi >6dBi;
 - U-NII-1 limit of Indoor AP = $17 - (7.11 - 6) = 15.89\text{dBm}$.
 - U-NII-3 limit = $30 - (7.55 - 6) = 28.45\text{dBm}$.

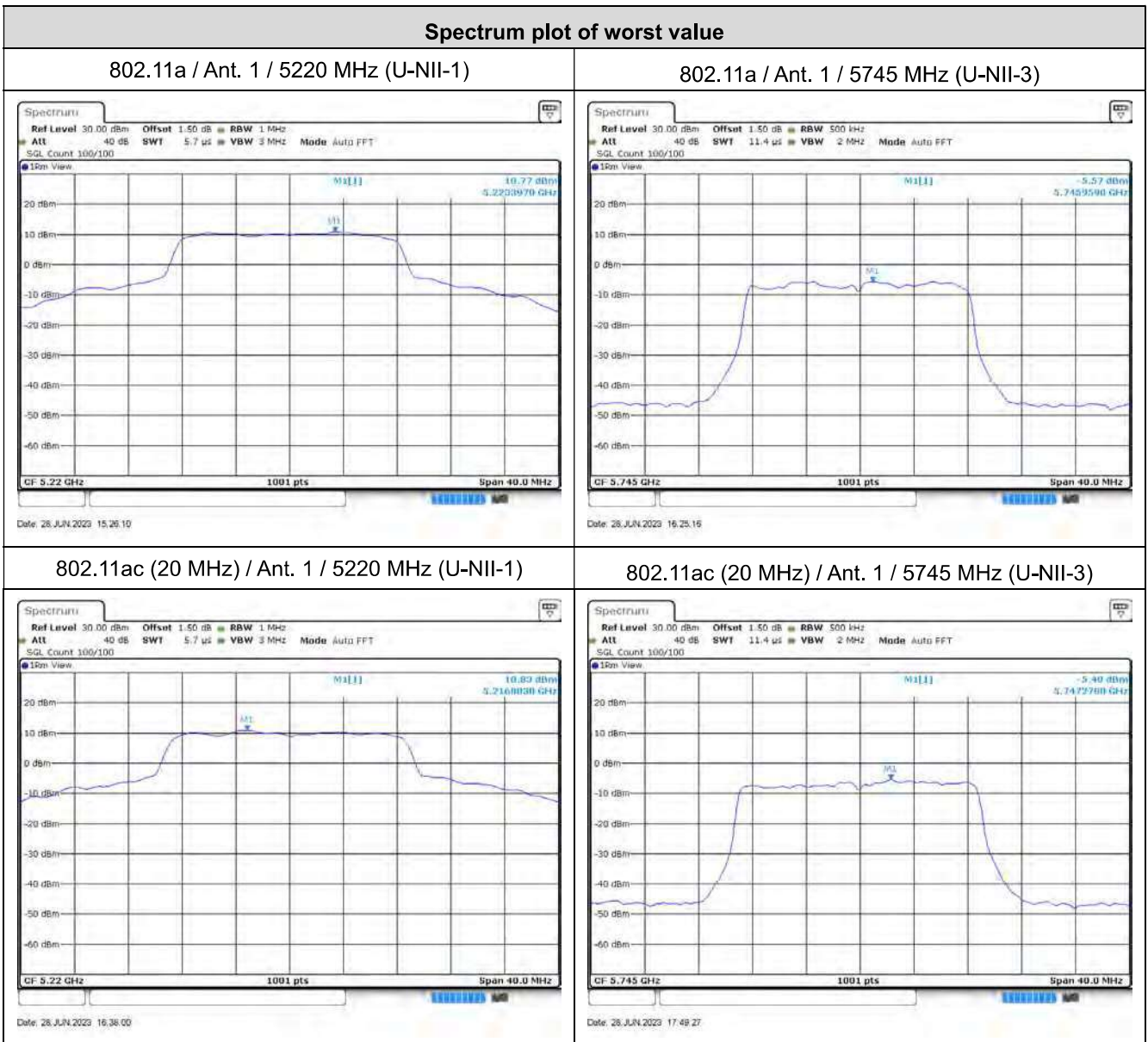
<For Client Band 1>

Modulation	Frequency (MHz)	Power Spectral Density (dBm)			Limit (dBm)	Result
		Ant. 0	Ant. 1	Total		
802.11a	5180	5.010	5.360	8.388	≤ 9.89	Pass
	5220	6.160	6.740	9.659	≤ 9.89	Pass
	5240	6.220	6.710	9.672	≤ 9.89	Pass
802.11ac (20 MHz)	5180	4.400	5.660	8.173	≤ 9.89	Pass
	5220	6.130	6.820	9.586	≤ 9.89	Pass
	5240	6.190	6.880	9.646	≤ 9.89	Pass
802.11ac (40 MHz)	5190	-0.680	0.390	3.075	≤ 9.89	Pass
	5230	5.440	6.020	8.927	≤ 9.89	Pass
802.11ac (80 MHz)	5210	-2.960	-2.130	0.782	≤ 9.89	Pass

Note:

- Total power spectral density = power spectral density + duty factor, and the duty factor refer to section 2.3.
- Directional Gain = $10\log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{Ant}]$ for U-NII-1: 7.11dBi >6dBi, so U-NII-1 limit of Client = $11 - (7.11 - 6) = 9.89\text{dBm}$.

<For Indoor AP and Client Band 4>

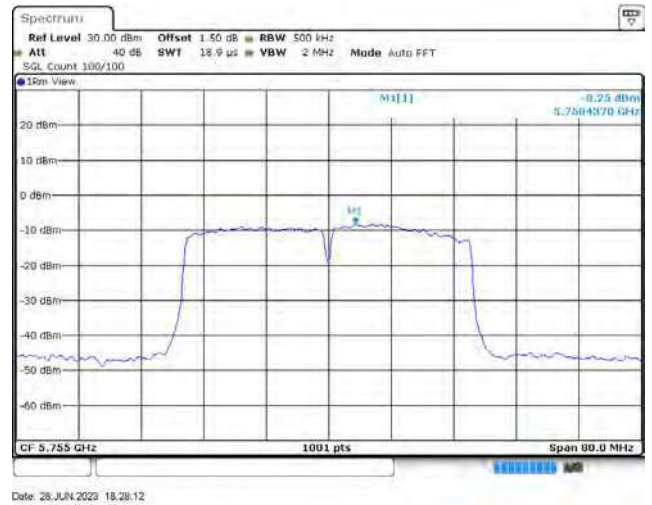


Spectrum plot of worst value

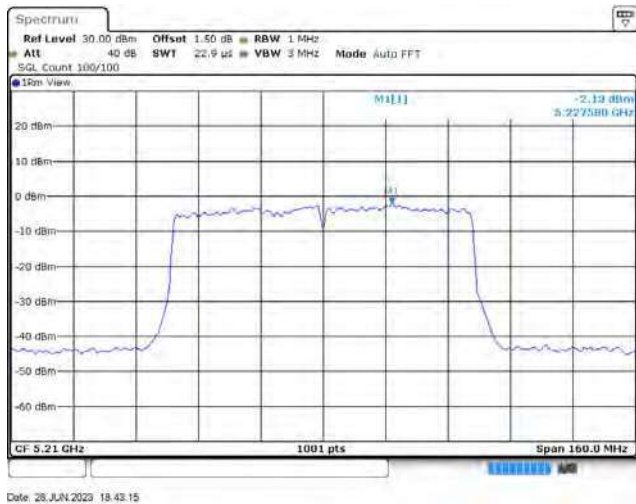
802.11ac (40 MHz) / Ant. 1 / 5230 MHz (U-NII-1)



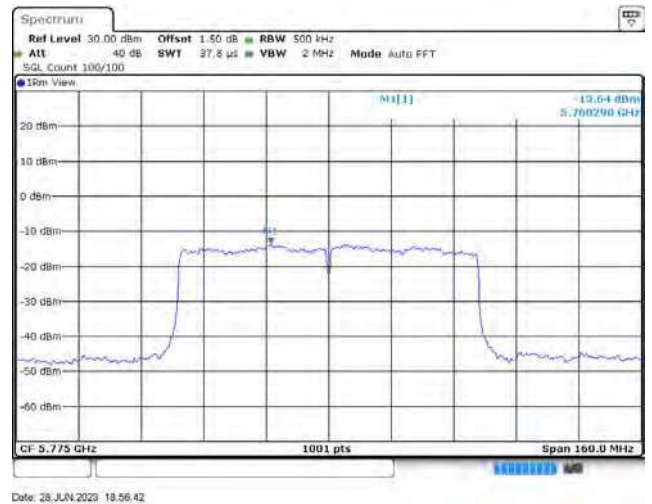
802.11ac (40 MHz) / Ant. 1 / 5755 MHz (U-NII-3)



802.11ac (80 MHz) / Ant. 1 / 5210 MHz (U-NII-1)



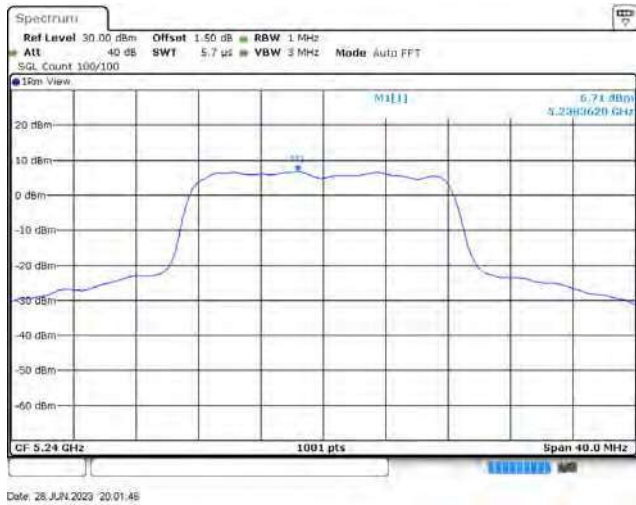
802.11ac (80 MHz) / Ant. 1 / 5775 MHz (U-NII-3)



<For Client Band 1>

Spectrum plot of worst value

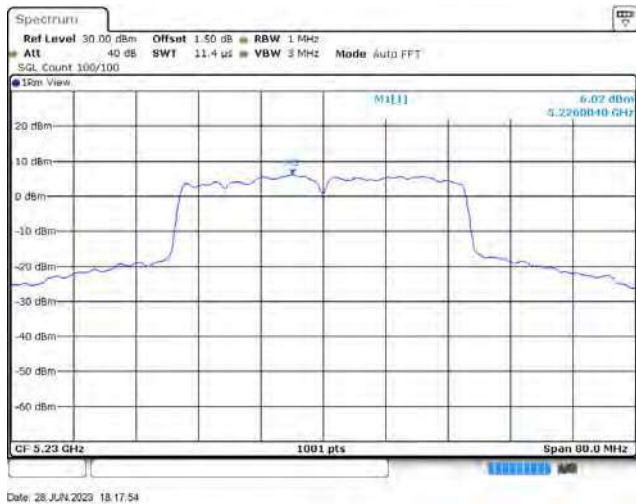
802.11a / Ant. 1 / 5240 MHz (U-NII-1)



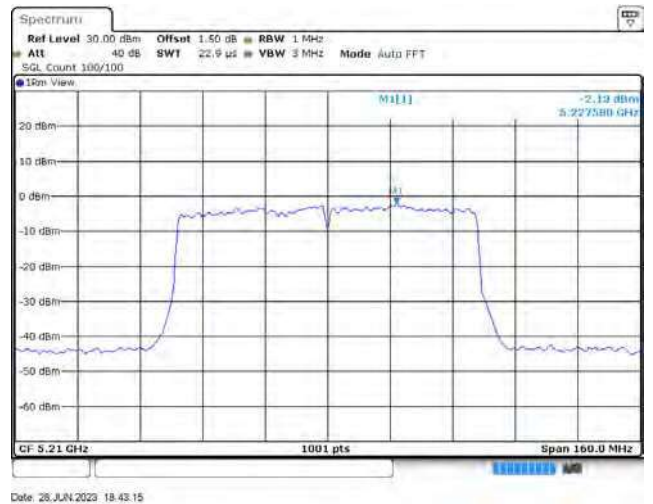
802.11ac (20 MHz) / Ant. 1 / 5240 MHz (U-NII-1)



802.11ac (40 MHz) / Ant. 1 / 5230 MHz (U-NII-1)



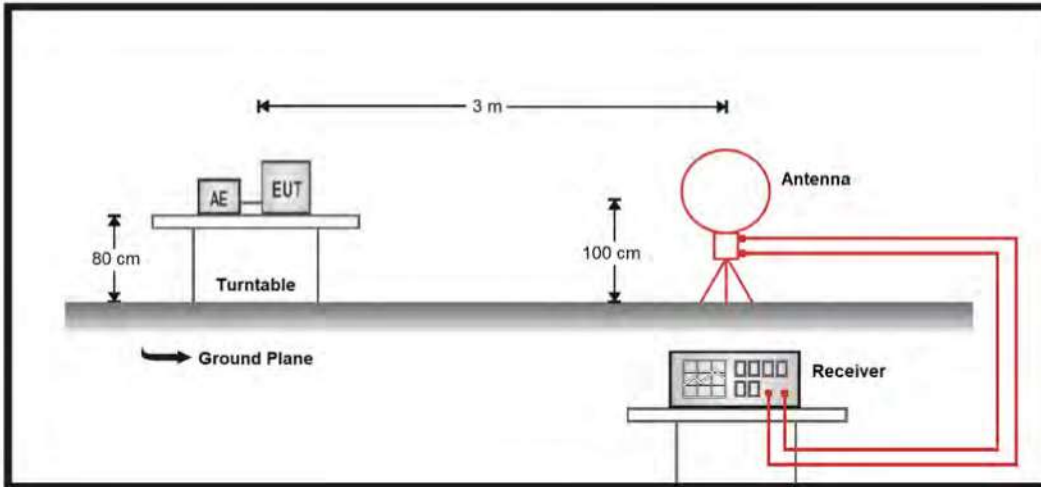
802.11ac (80 MHz) / Ant. 1 / 5210 MHz (U-NII-1)



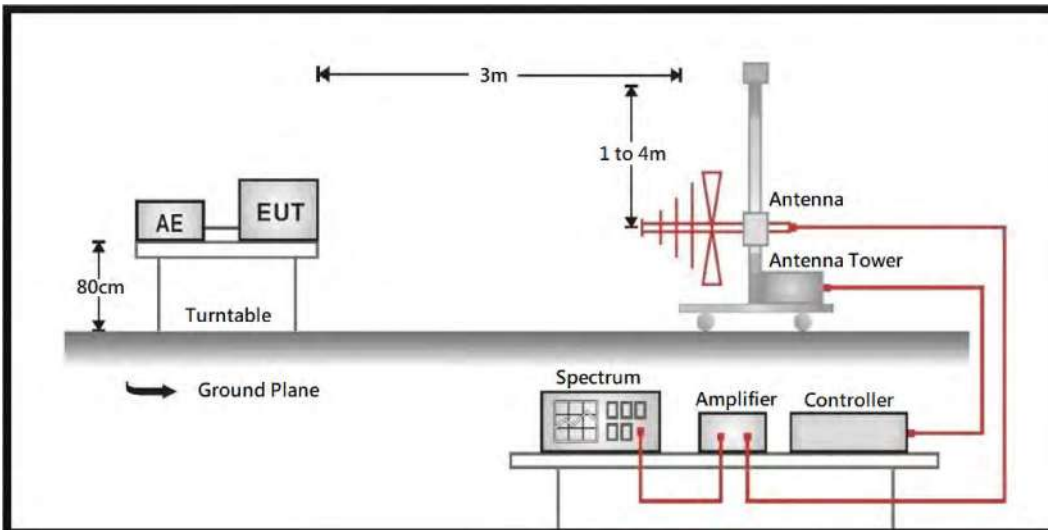
7. Transmitter Radiated Spurious Emission

7.1. Test Setup

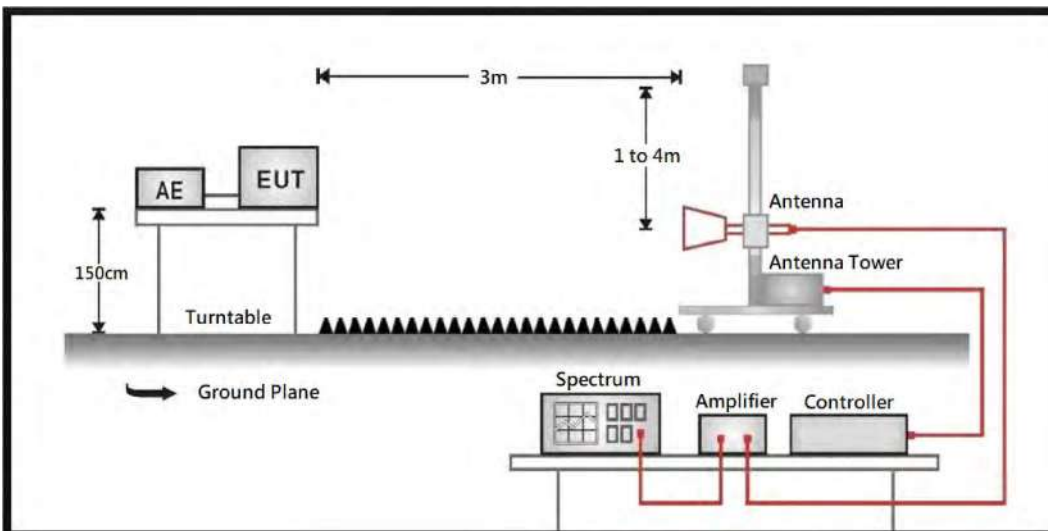
9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



Above 1 GHz



7.2. Test Limit

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	20 log (2400/F(kHz))	300
0.490 – 1.705	24000/F(kHz)	20 log (24000/F(kHz))	30
1.705 - 30	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Unwanted Emission out of the restricted bands Test Limit

Frequency (MHz)	EIRP Limit (dBm/MHz)	Equivalent Field Strength (dBuV/m@3m)
5150 – 5250	-27	68.2
5250 – 5350	-27	68.2
5470 – 5725	-27	68.2
5725 – 5850	-27 * ¹	68.2 * ¹
	10 * ²	105.2 * ²
	15.6 * ³	110.8 * ³
	27 * ⁴	122.2 * ⁴

*¹ beyond 75 MHz or more above of the band edge.

*² below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.

*³ below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.

*⁴ from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Remark:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \text{ uV/m, where P is the eirp (Watts).}$$

7.3. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 or 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The additional latch filter below 1 GHz was used to measure the level of harmonics radiated emission during field strength of harmonics measurement.

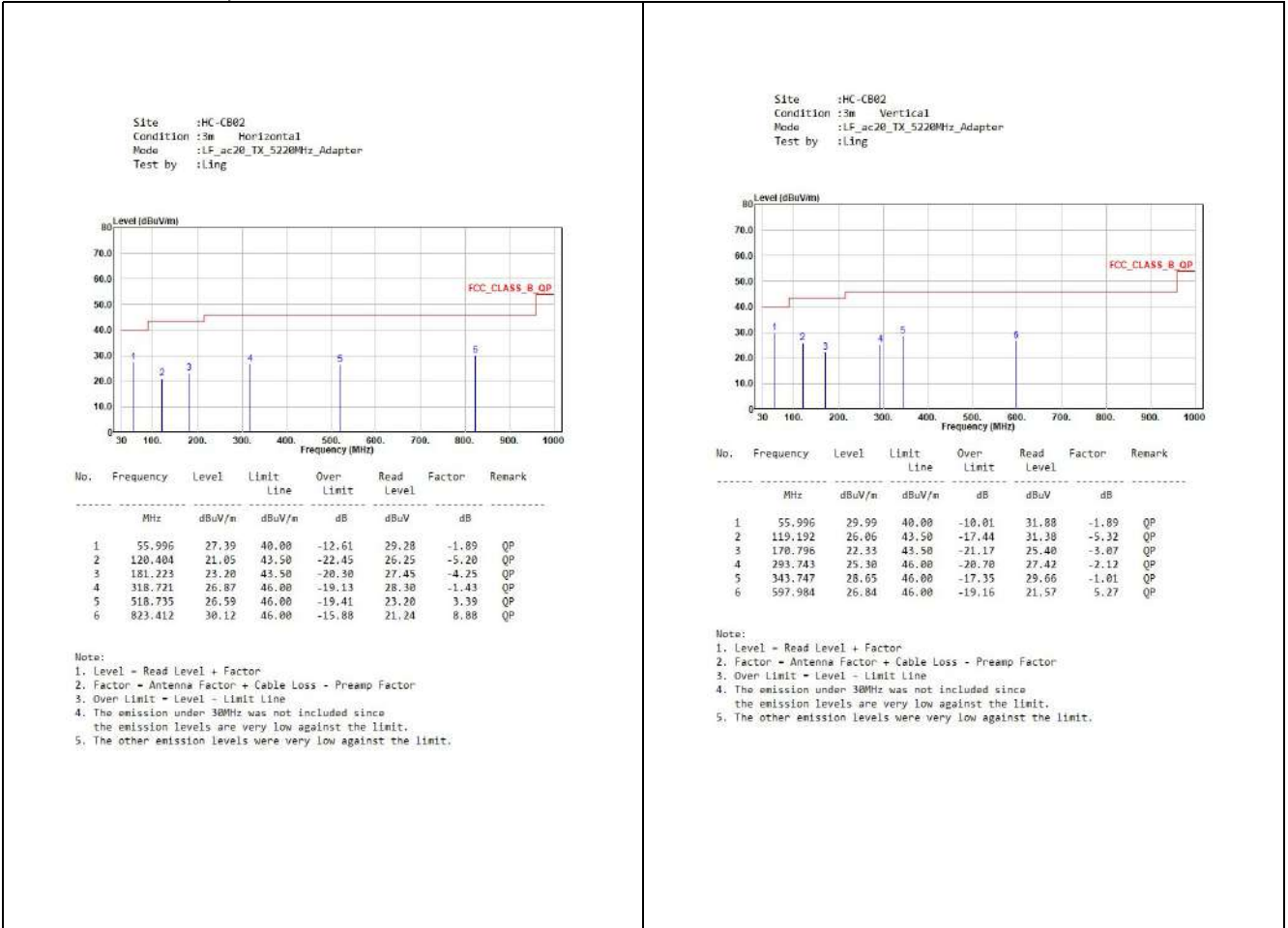
The bandwidth below 1 GHz setting on the field strength meter is 120 kHz, above 1 GHz are 1 MHz.

The frequency range from 9 kHz to 10th harmonics and included The frequency range from the lowest oscillator frequency generated within the device up to the 10th harmonic was checked is checked.

7.4. Test Result of Transmitter Radiated Spurious Emission

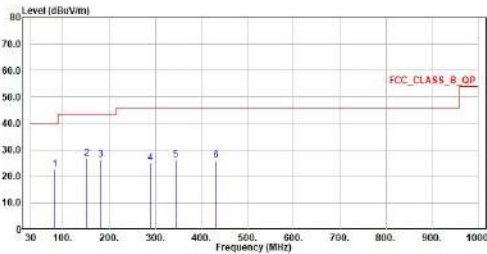
30 MHz ~ 1 GHz

Mode 1: EUT + Adapter



Mode 2: EUT + 802.3at PoE

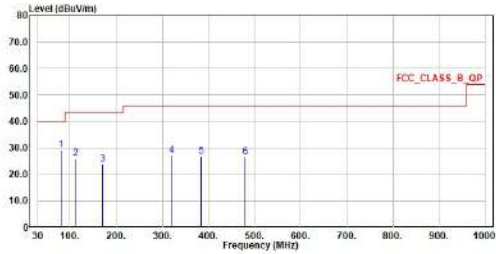
Site :HC-CB02
 Condition :3m Horizontal
 Mode :LF_ac20_TX_5220MHz_POE
 Test by :iling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	Mhz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	81.216	22.67	40.00	-17.33	30.01	-7.34	QP
2	151.299	26.72	43.50	-16.78	29.38	-2.66	QP
3	180.835	26.19	43.50	-17.31	30.37	-4.18	QP
4	288.602	24.99	46.00	-21.01	27.22	-2.23	QP
5	343.747	26.28	46.00	-19.72	27.29	-1.01	QP
6	430.659	25.96	46.00	-20.04	24.42	1.54	QP

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The emission under 30MHz was not included since the emission levels are very low against the limit.
 5. The other emission levels were very low against the limit.

Site :HC-CB02
 Condition :3m Vertical
 Mode :LF_ac20_TX_5220MHz_POE
 Test by :iling

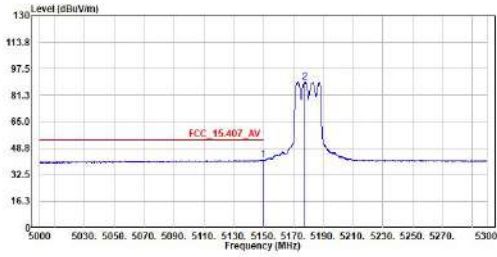


No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	Mhz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	80.506	29.17	40.00	-10.83	36.31	-7.14	QP
2	111.141	26.00	43.50	-17.50	31.90	-5.90	QP
3	170.214	23.90	43.50	-19.60	27.03	-3.13	QP
4	320.370	27.03	46.00	-18.97	28.42	-1.39	QP
5	383.177	26.89	46.00	-19.11	26.59	0.30	QP
6	480.032	26.04	46.00	-19.36	24.06	2.58	QP

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The emission under 30MHz was not included since the emission levels are very low against the limit.
 5. The other emission levels were very low against the limit.

Above 1 GHz

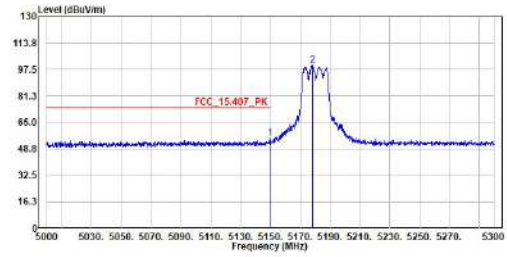
Site :HC-CB02
 Condition :3m Horizontal
 Mode :a_TX_5180MHz
 Test by :Ling Chen



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	5149.850	41.69	54.00	-12.31	18.22	23.47	Average
2	5177.900	89.41	-----	-----	65.92	23.49	Average

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

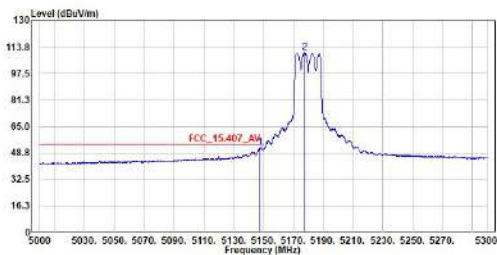
Site :HC-CB02
 Condition :3m Horizontal
 Mode :a_TX_5180MHz
 Test by :Ling Chen



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	5150.000	55.49	74.00	-18.51	32.02	23.47	Peak
2	5178.200	100.11	-----	-----	76.62	23.49	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

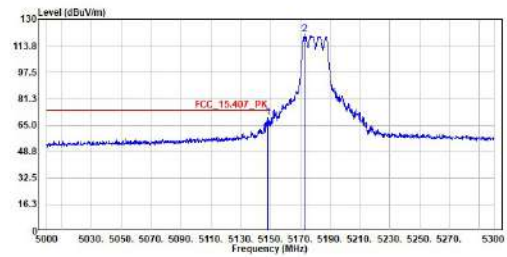
Site :HC-CB02
 Condition :3m Vertical
 Mode :a_TX_5180MHz
 Test by :Ling Chen



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	5147.600	52.06	54.00	-1.94	28.59	23.47	Average
2	5177.600	110.16	-----	-----	86.67	23.49	Average

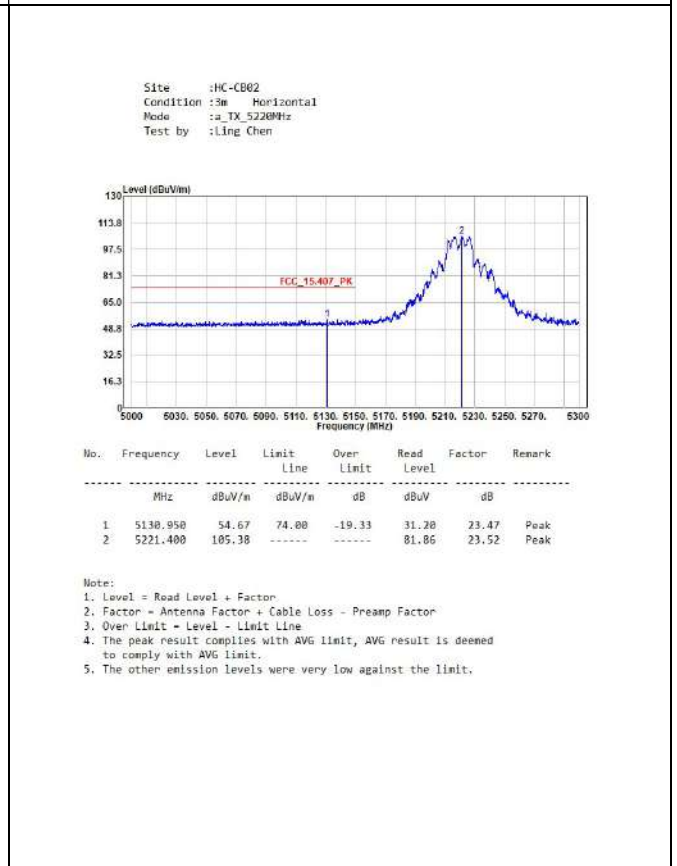
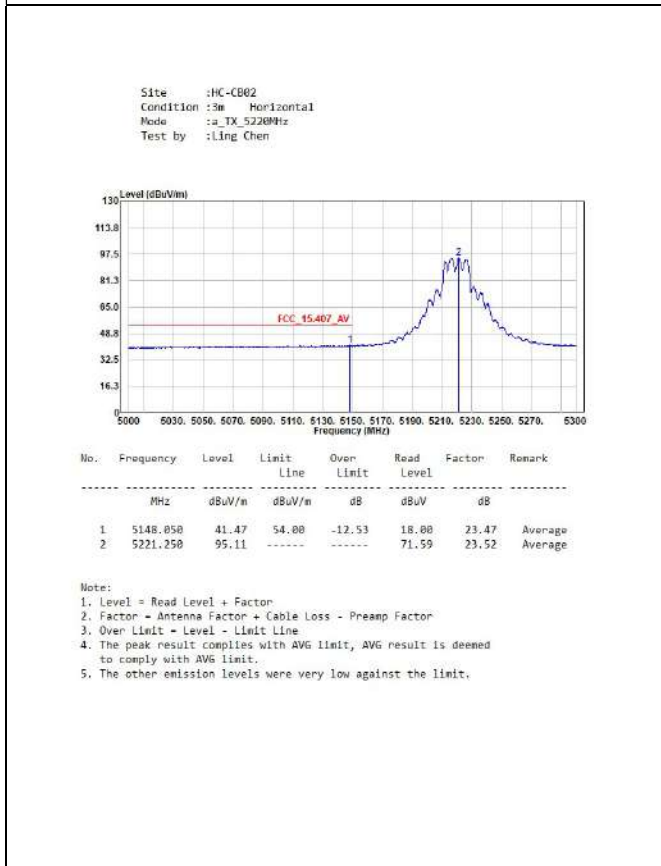
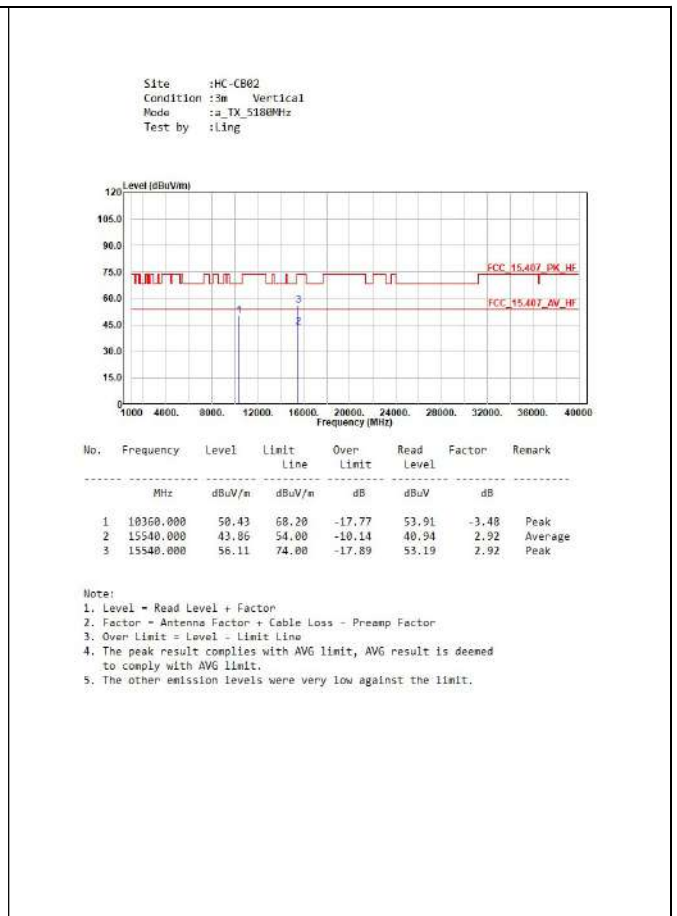
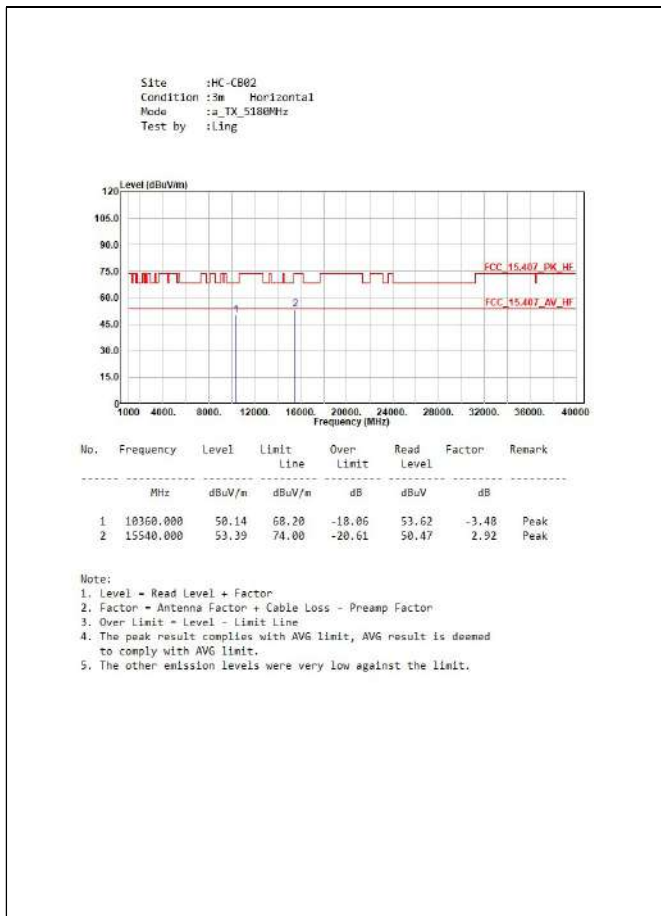
Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

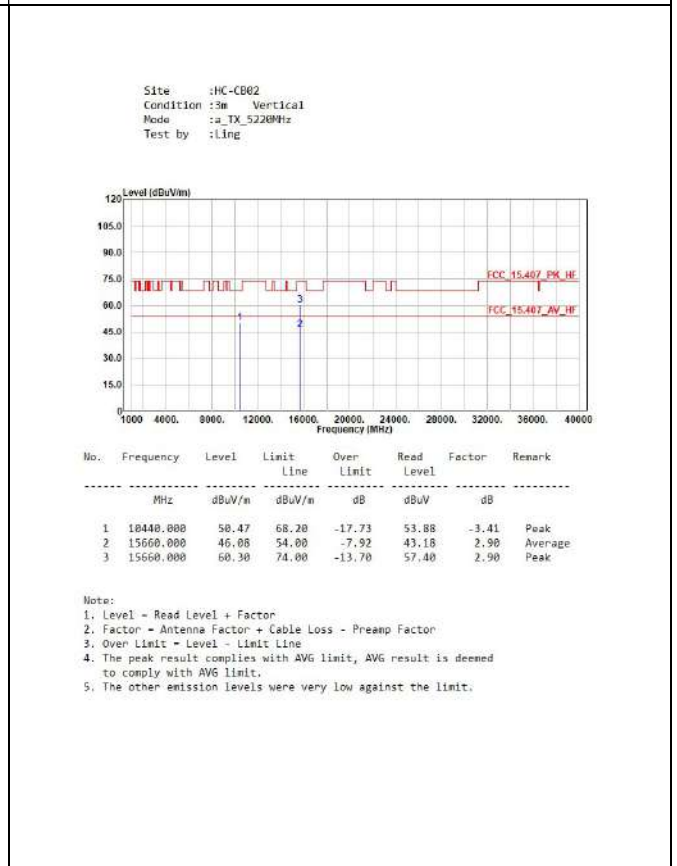
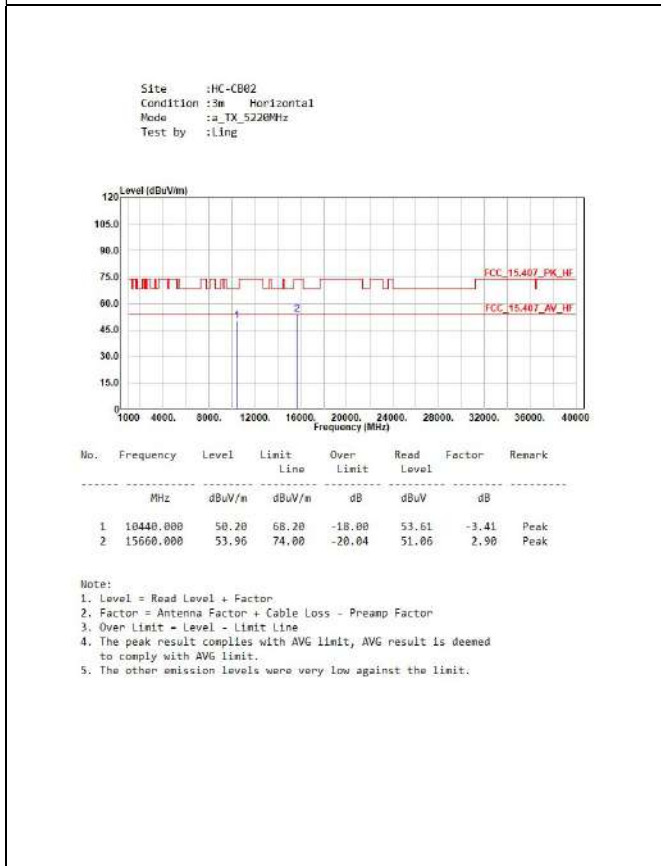
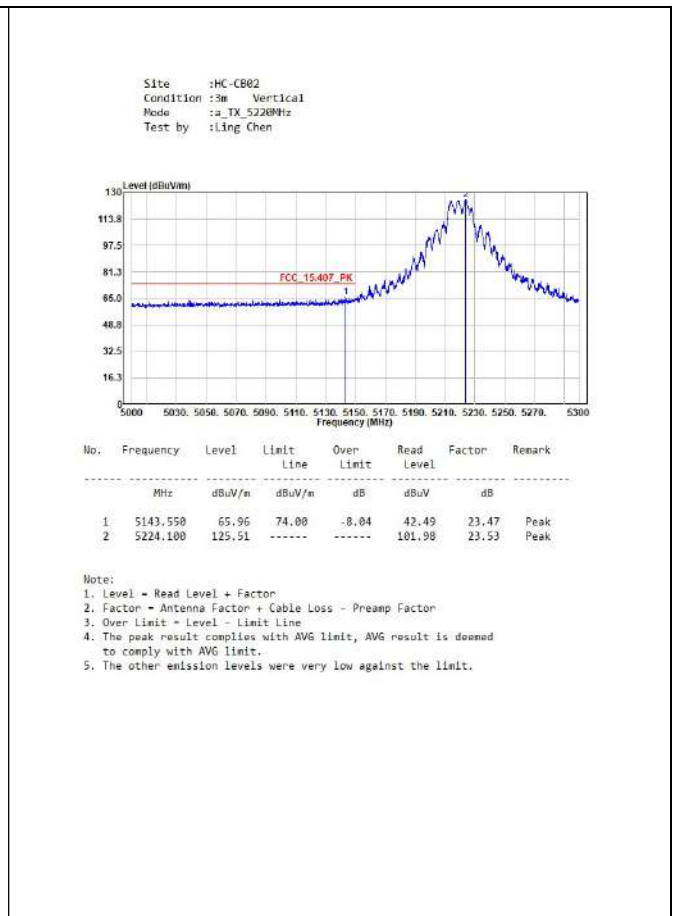
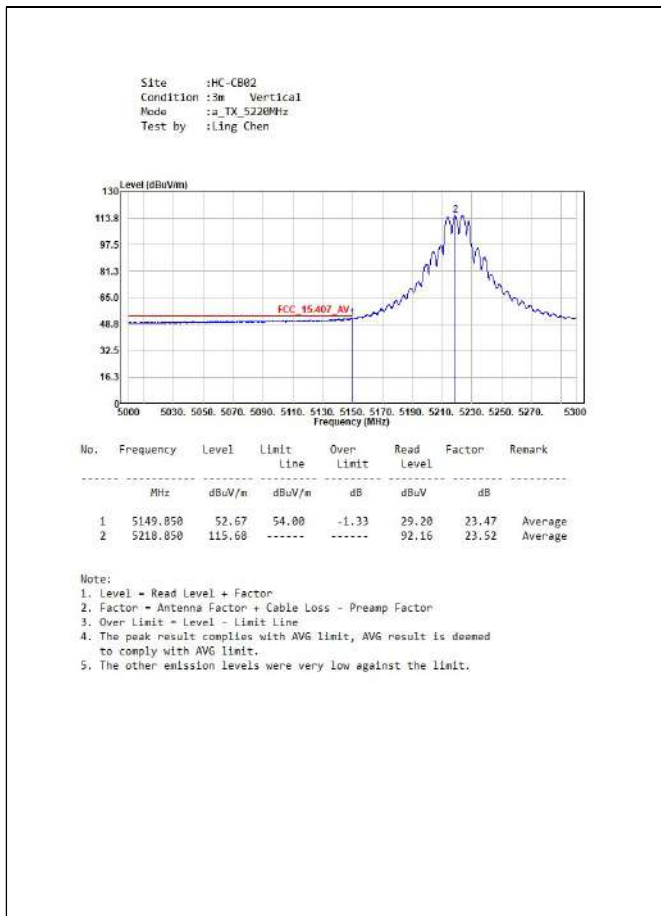
Site :HC-CB02
 Condition :3m Vertical
 Mode :a_TX_5180MHz
 Test by :Ling Chen

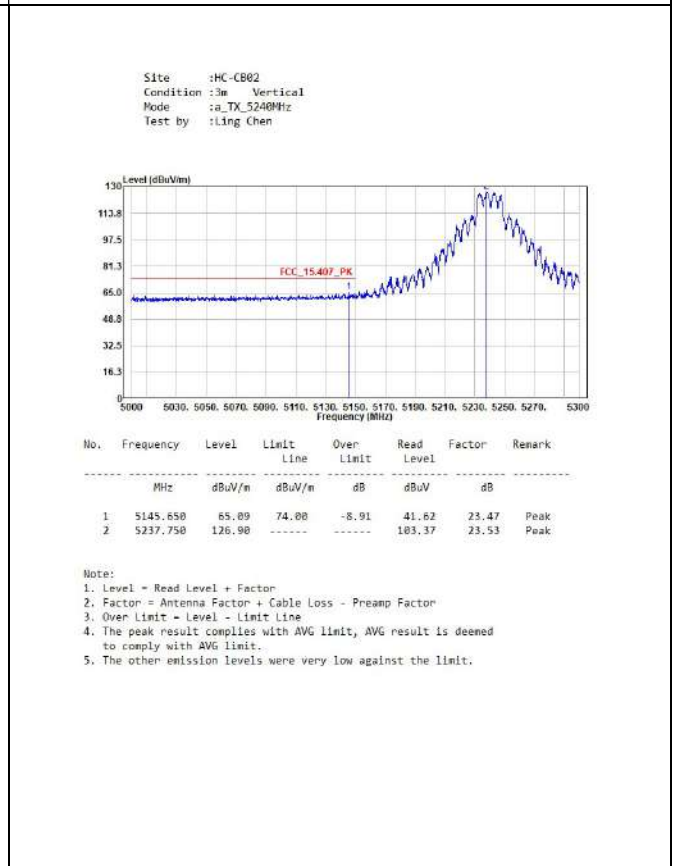
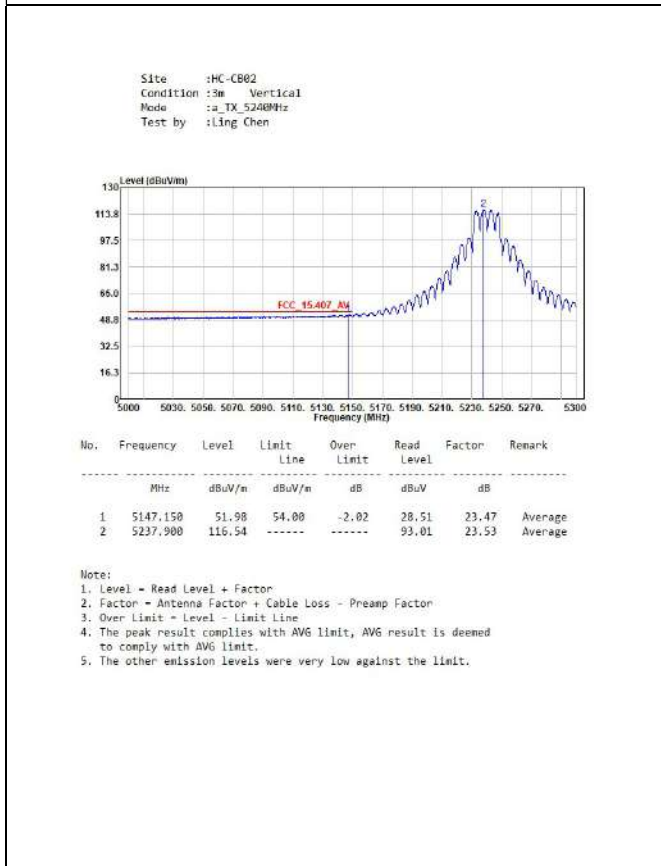
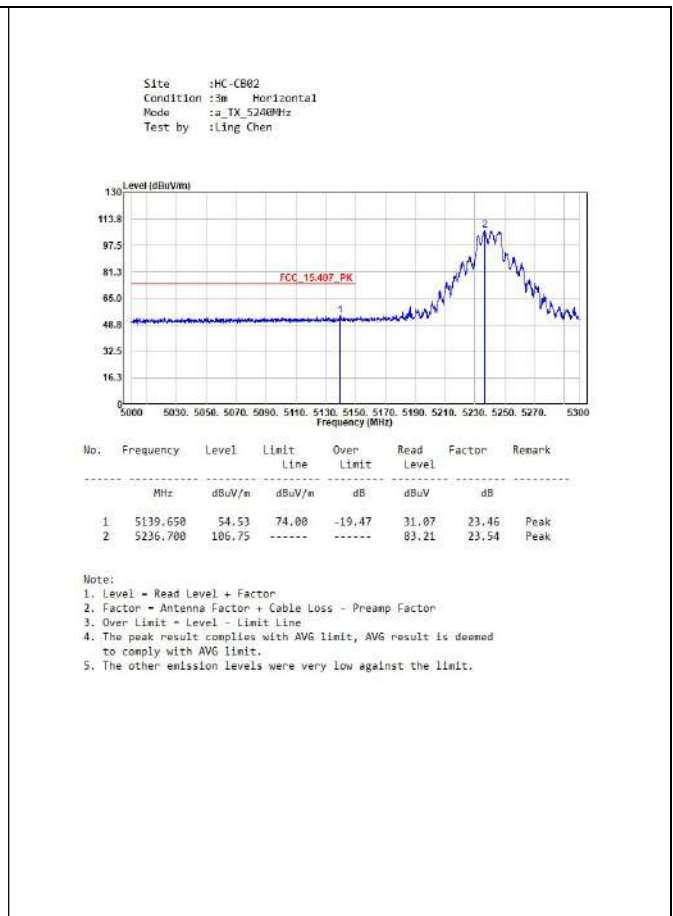
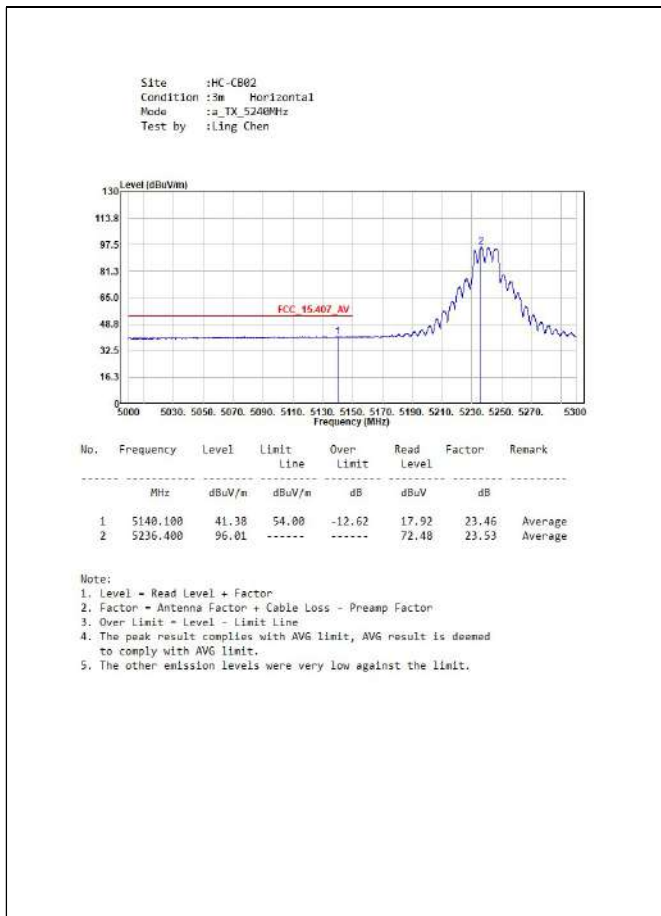


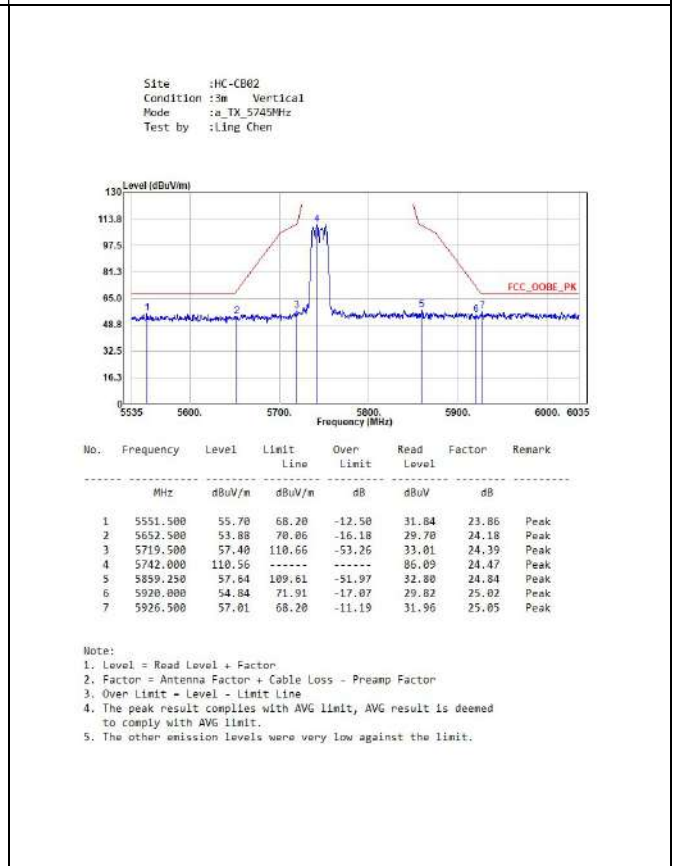
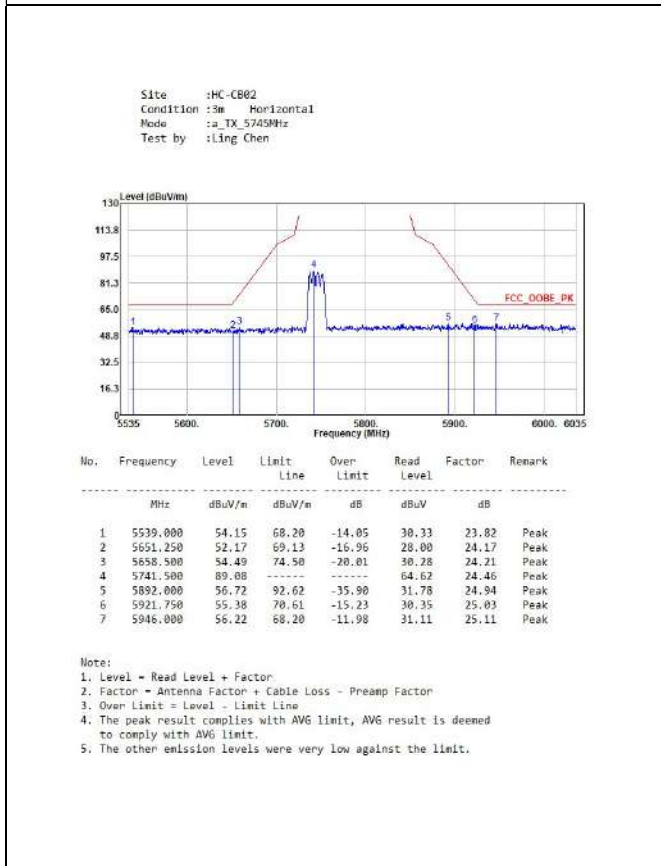
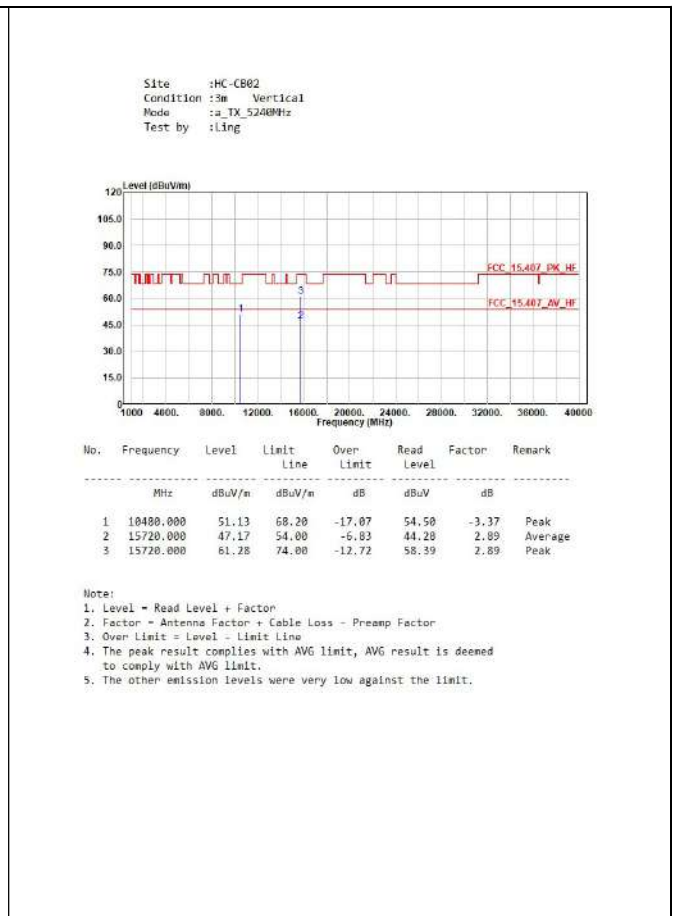
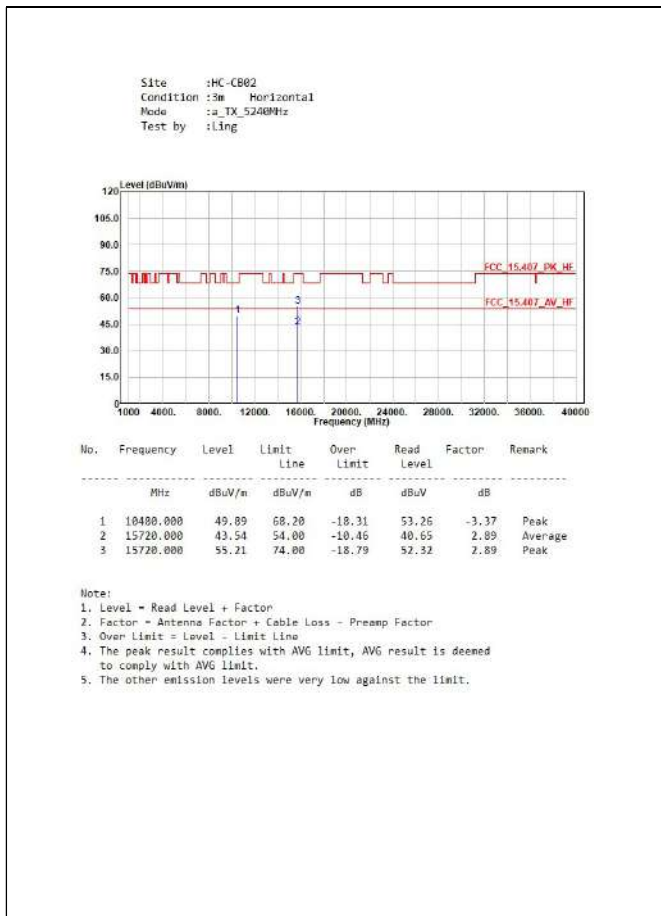
No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	5147.900	89.52	74.00	-4.48	46.05	23.47	Peak
2	5172.800	128.71	-----	-----	97.22	23.49	Peak

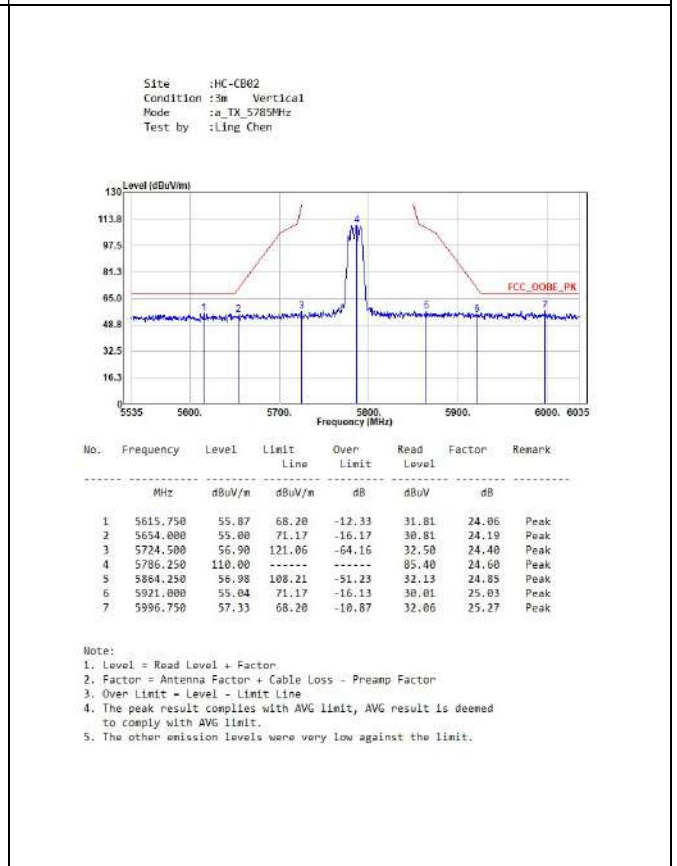
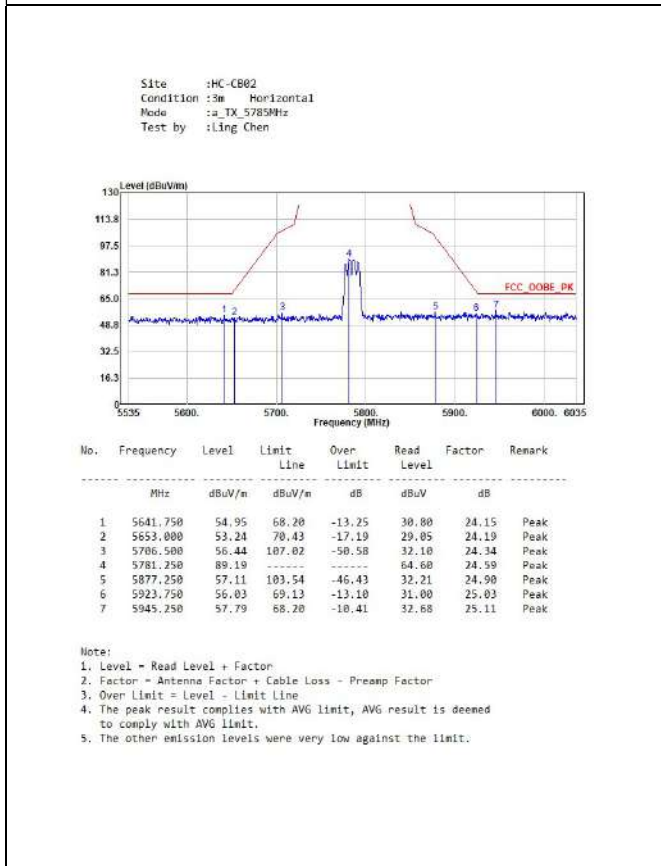
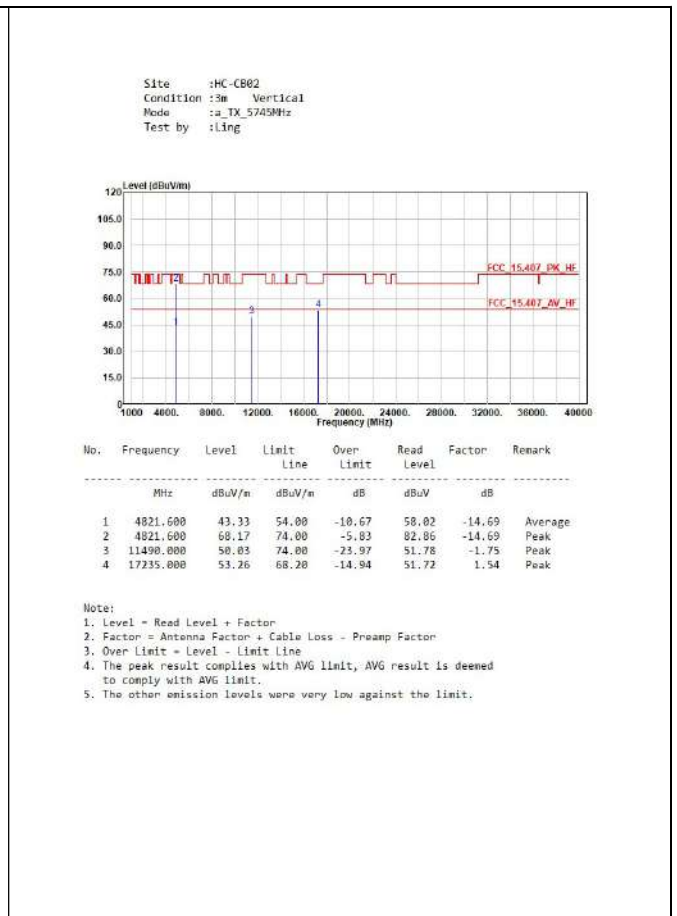
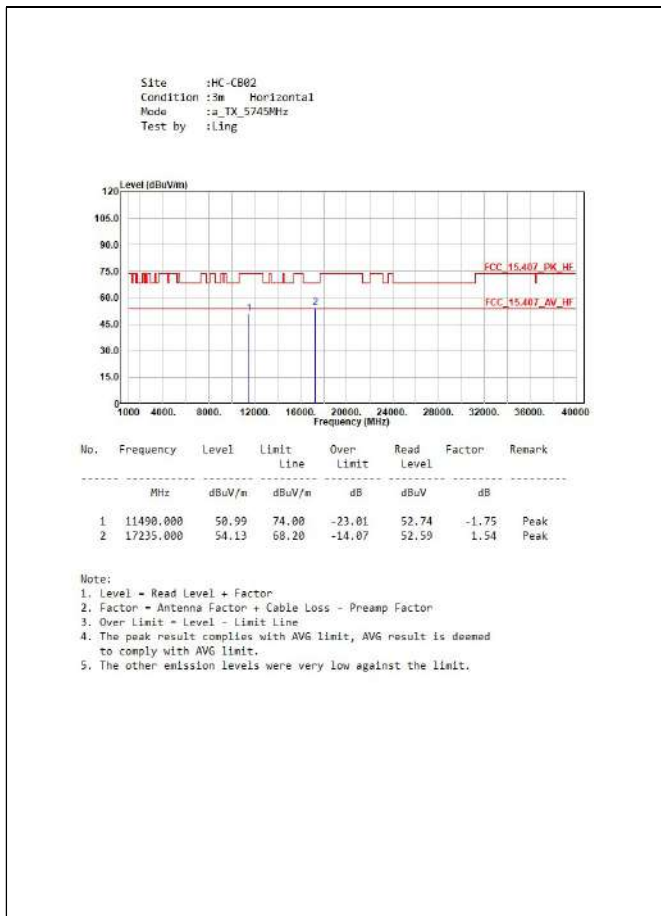
Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

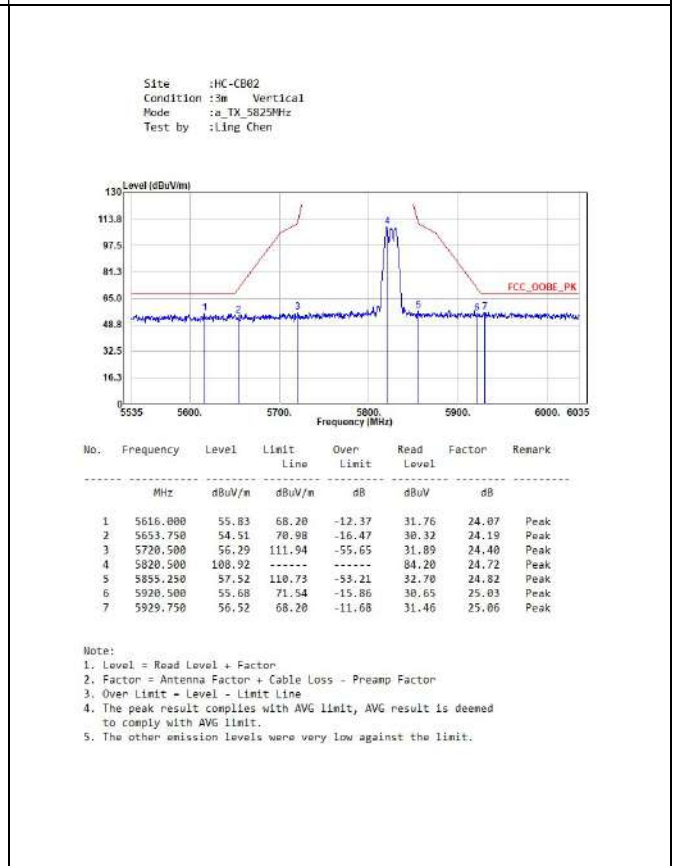
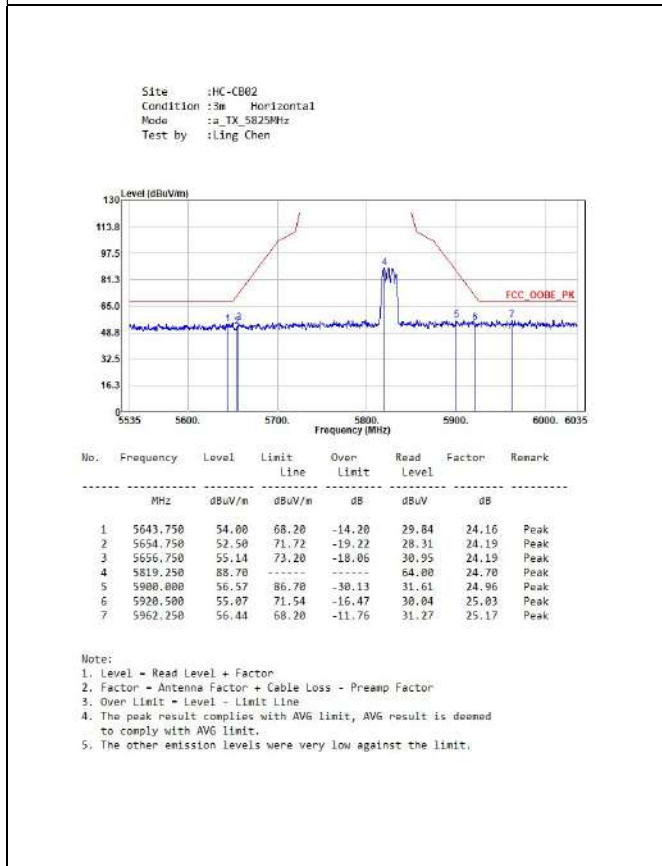
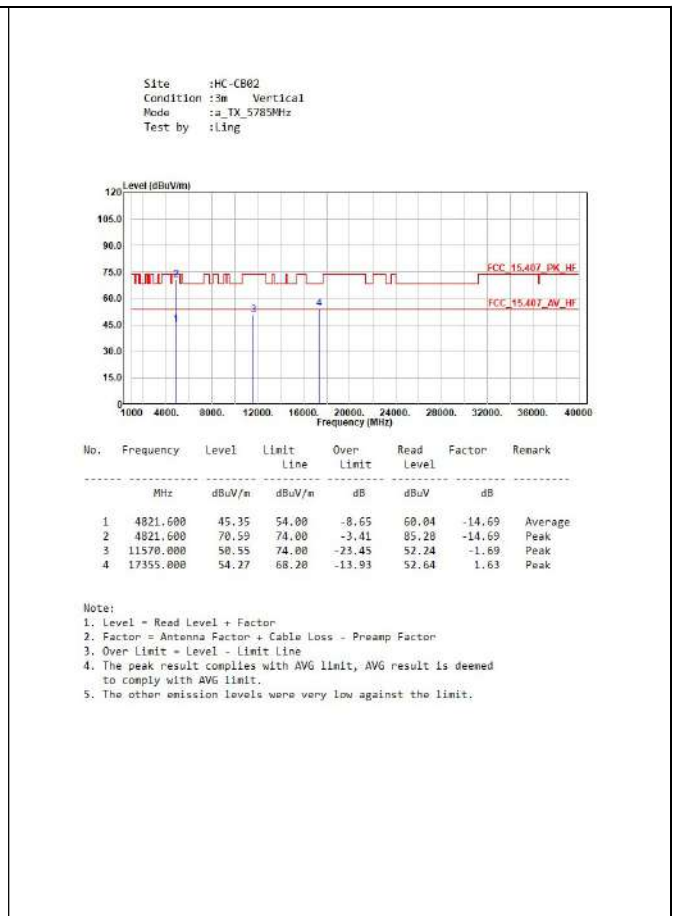
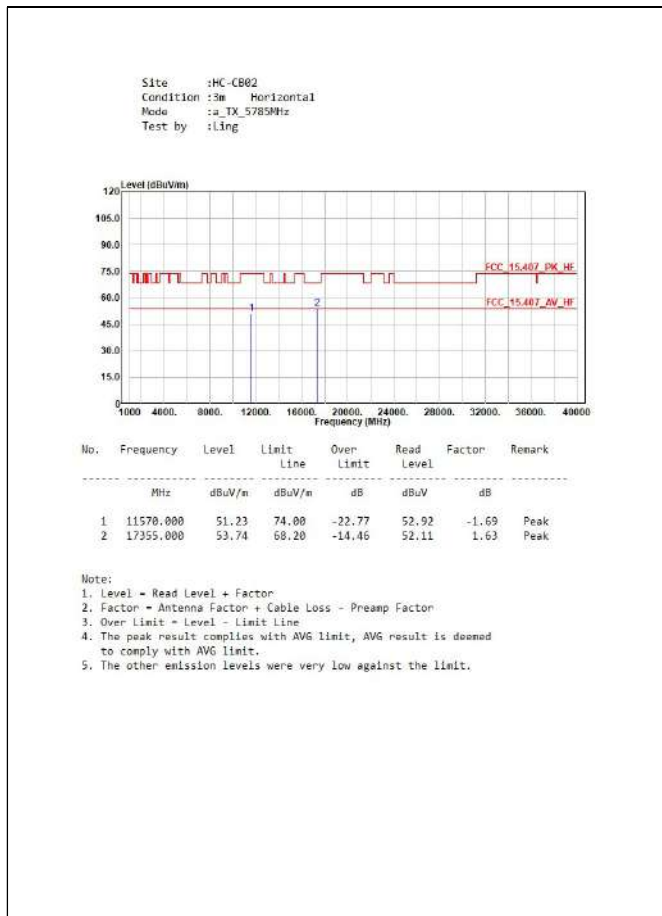


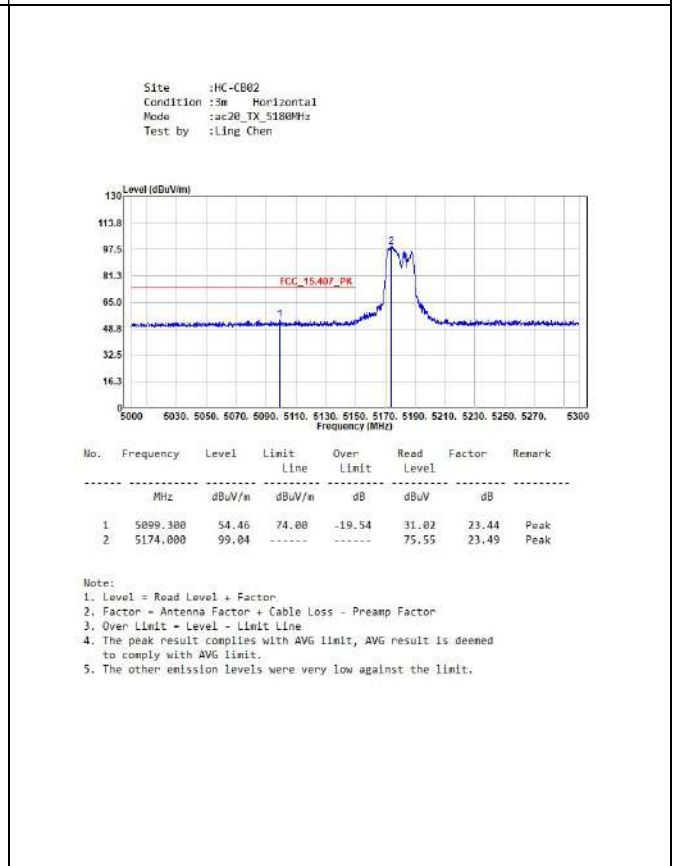
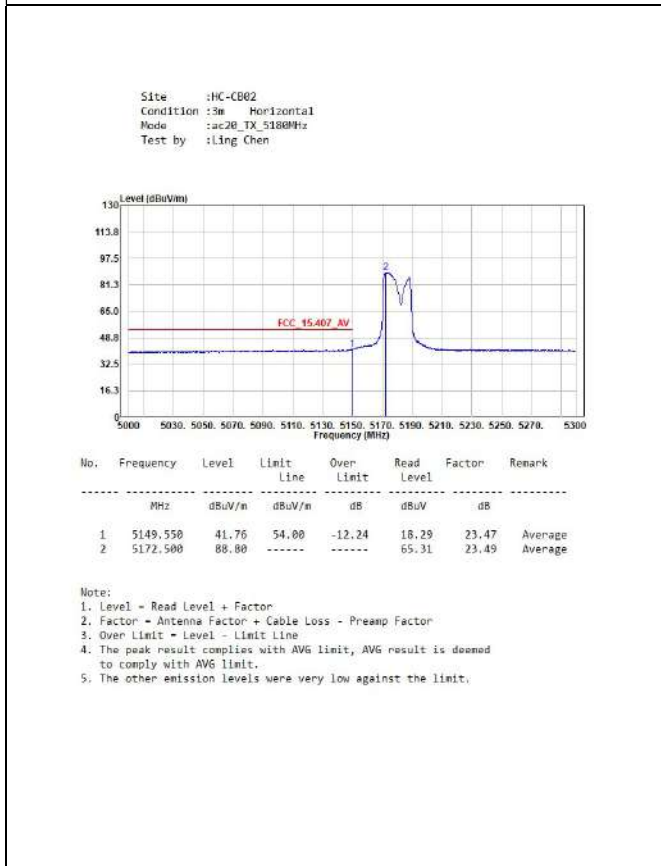
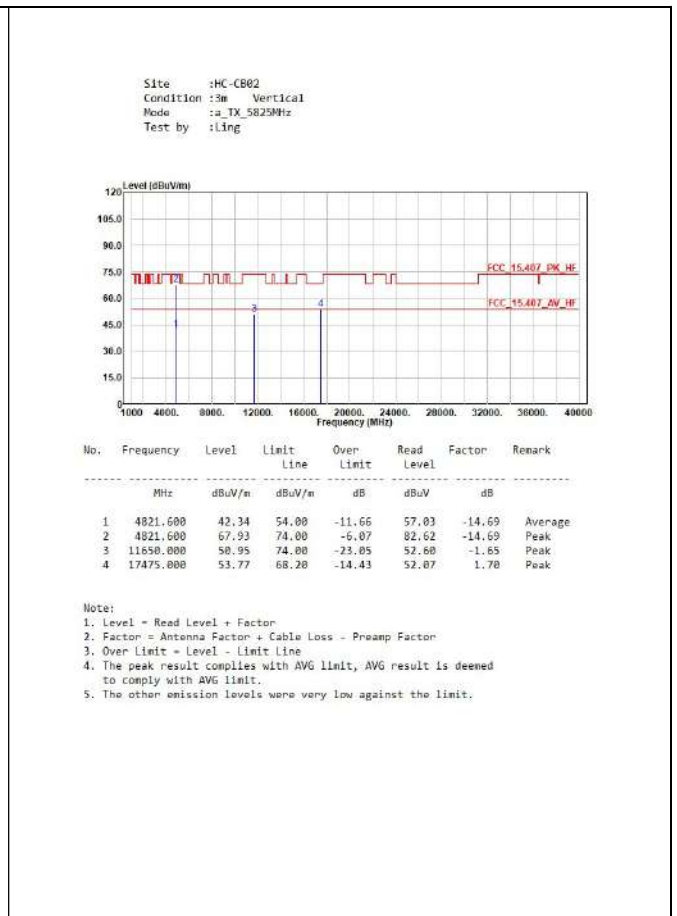
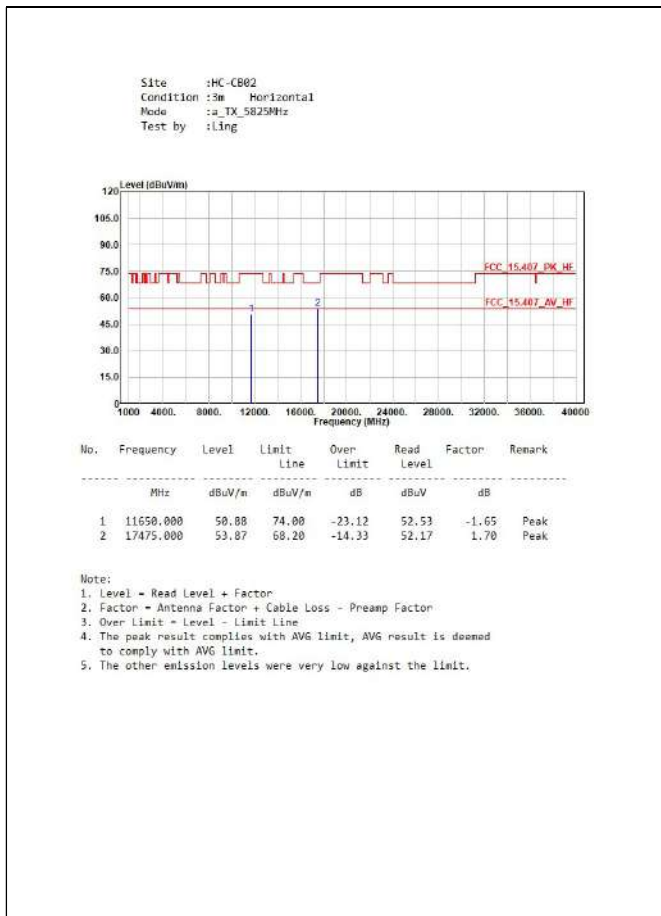


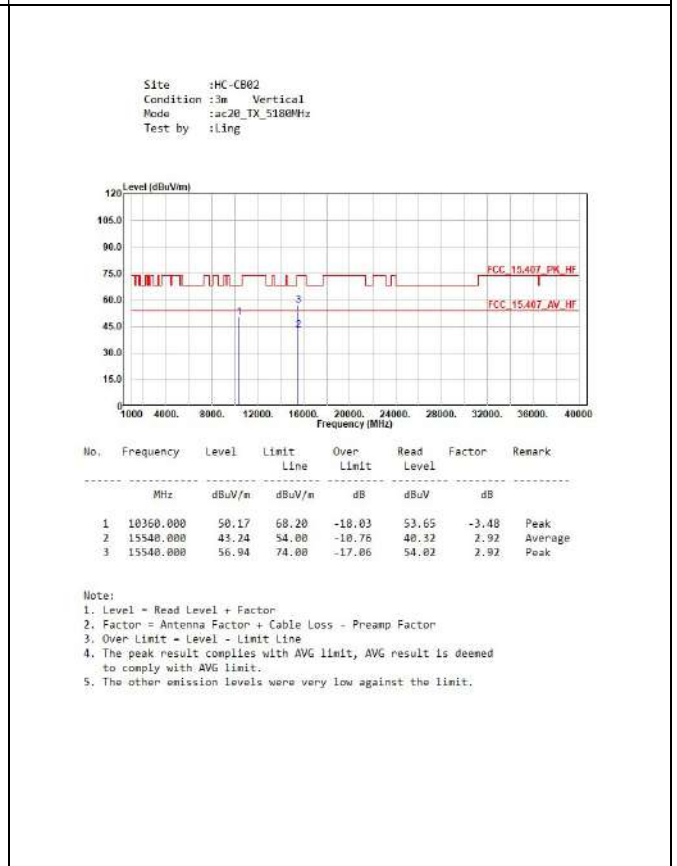
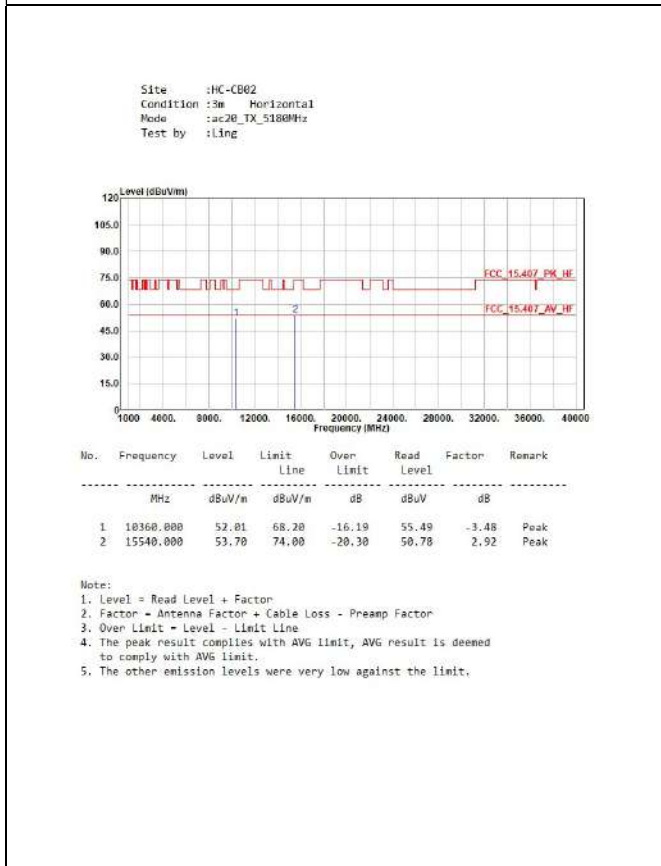
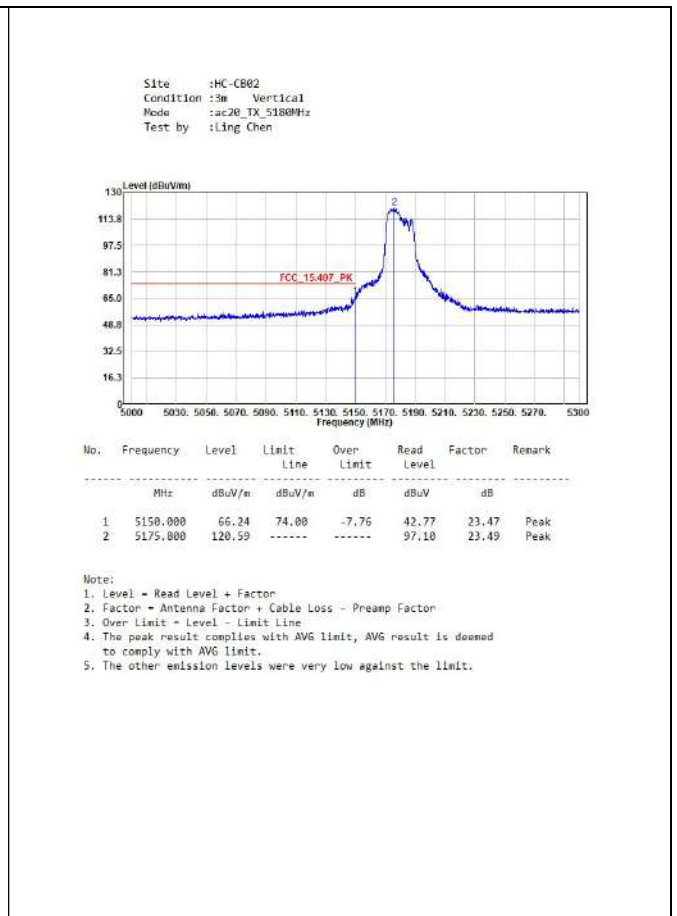
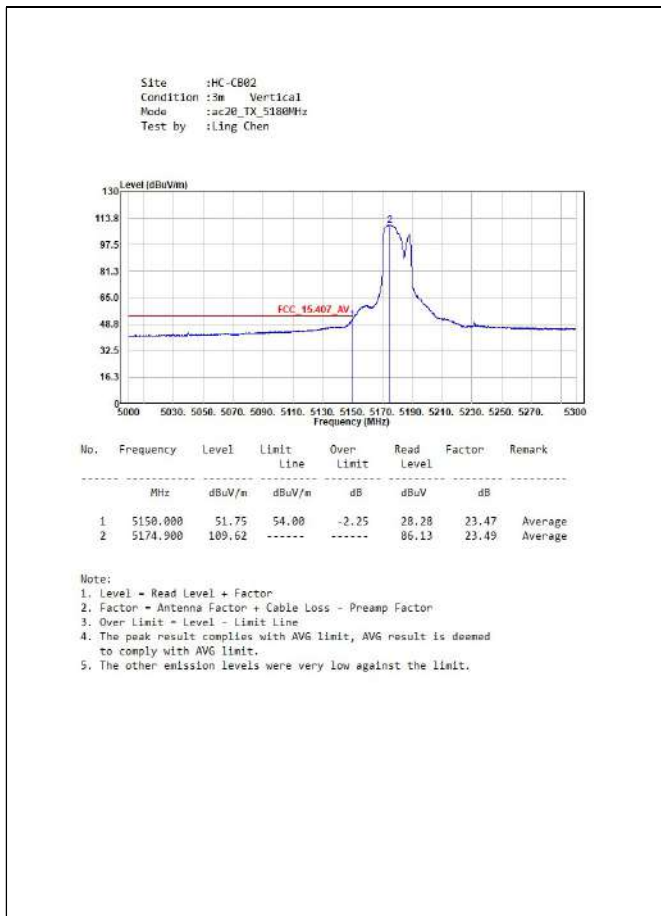


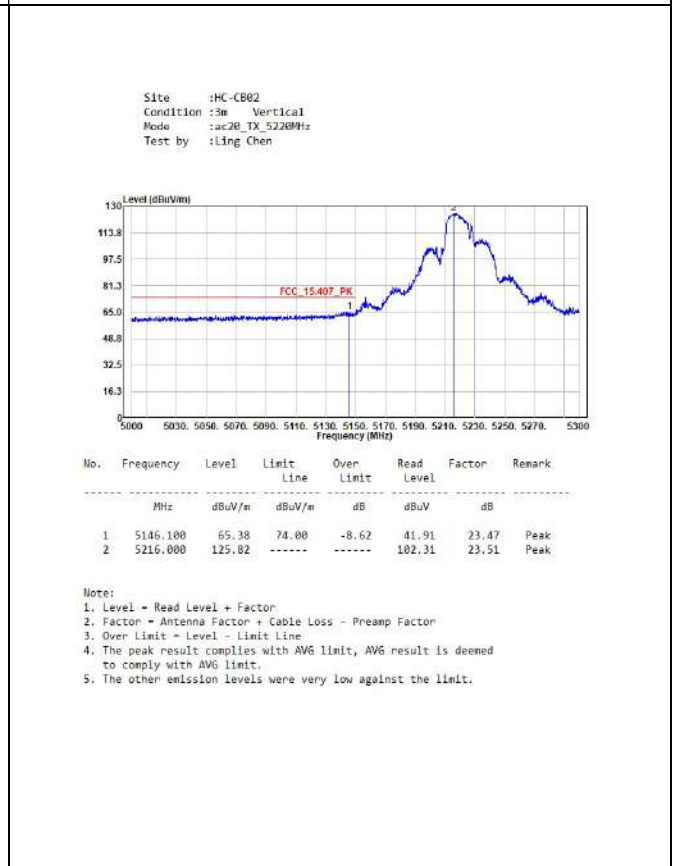
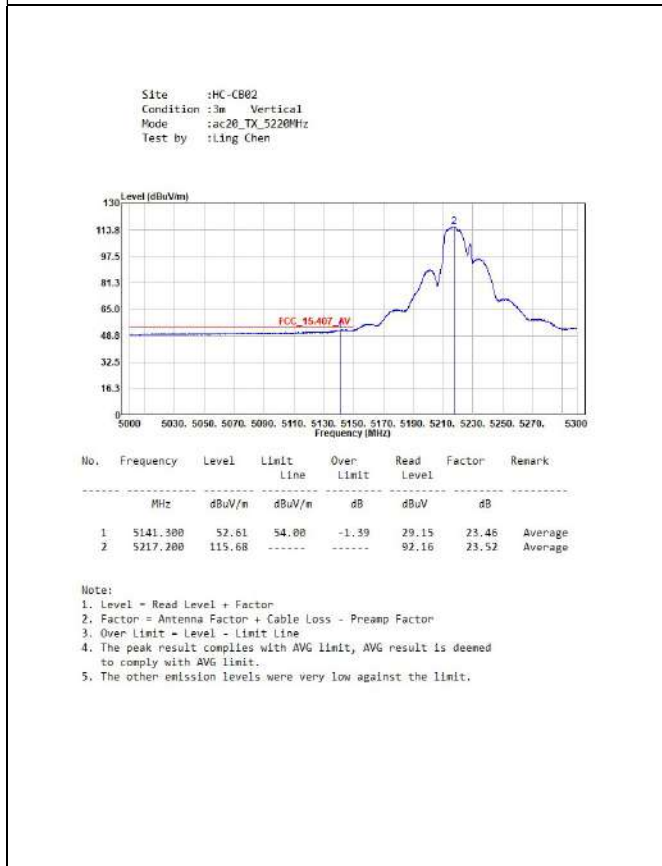
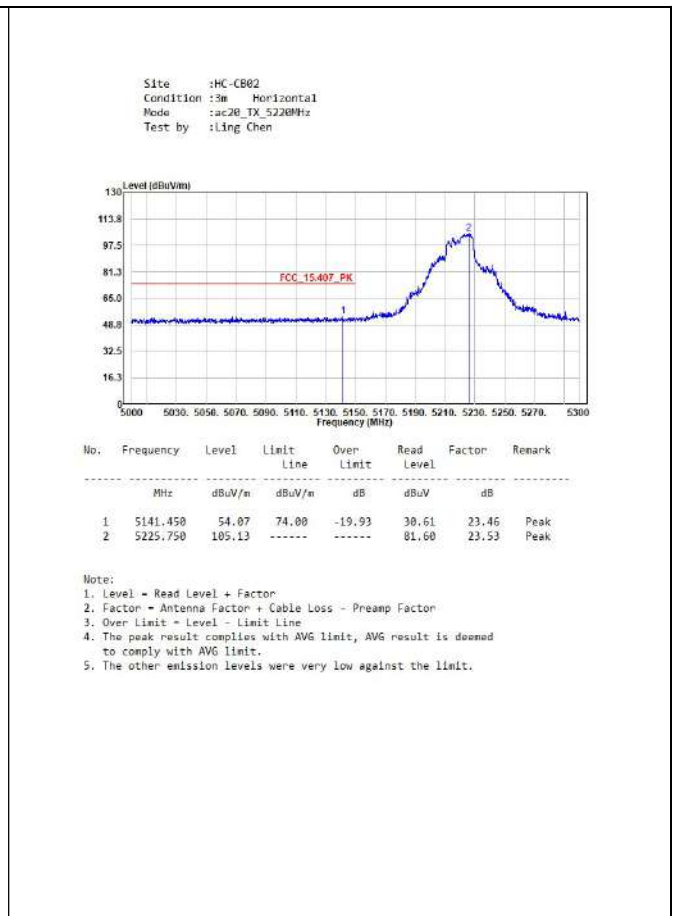
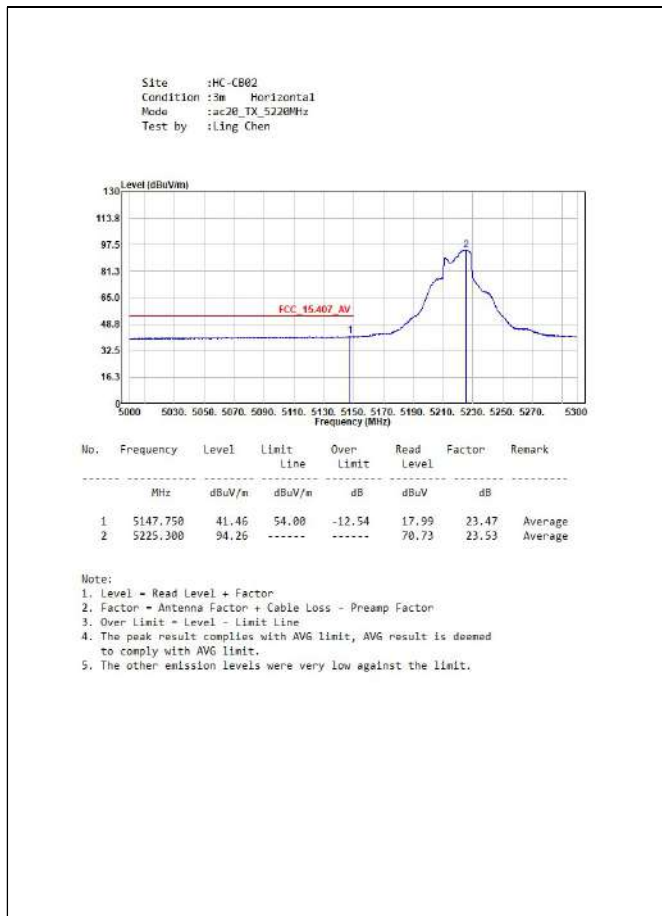


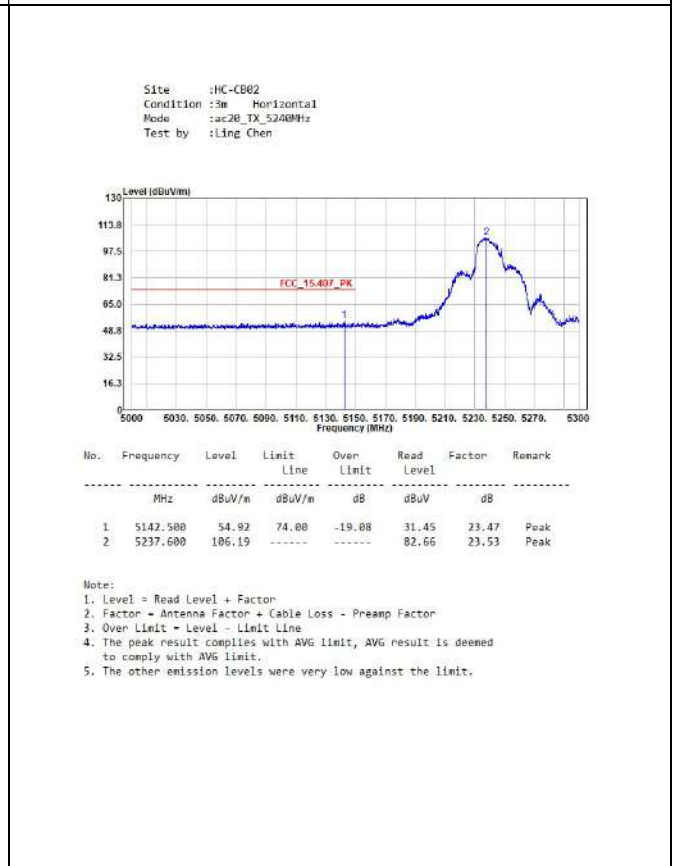
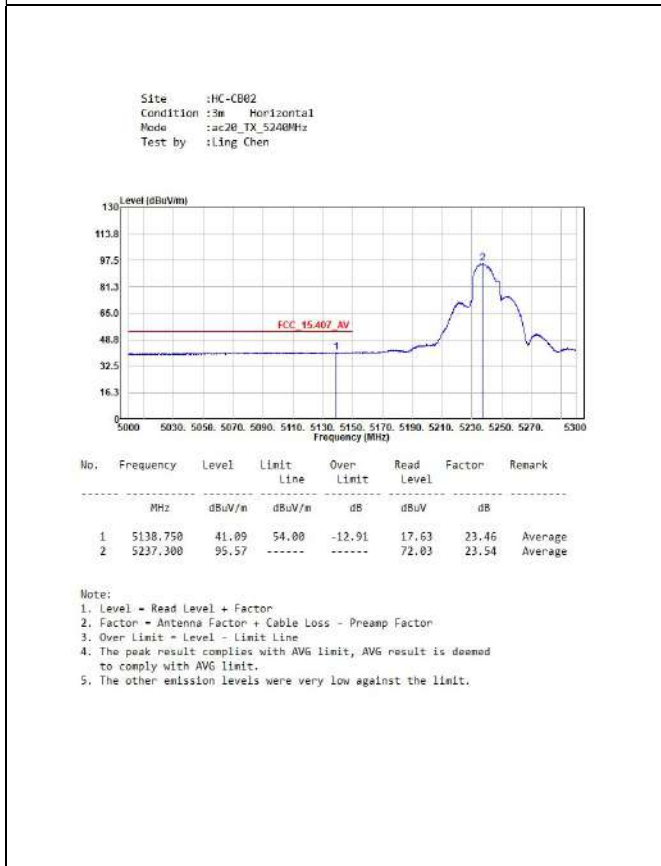
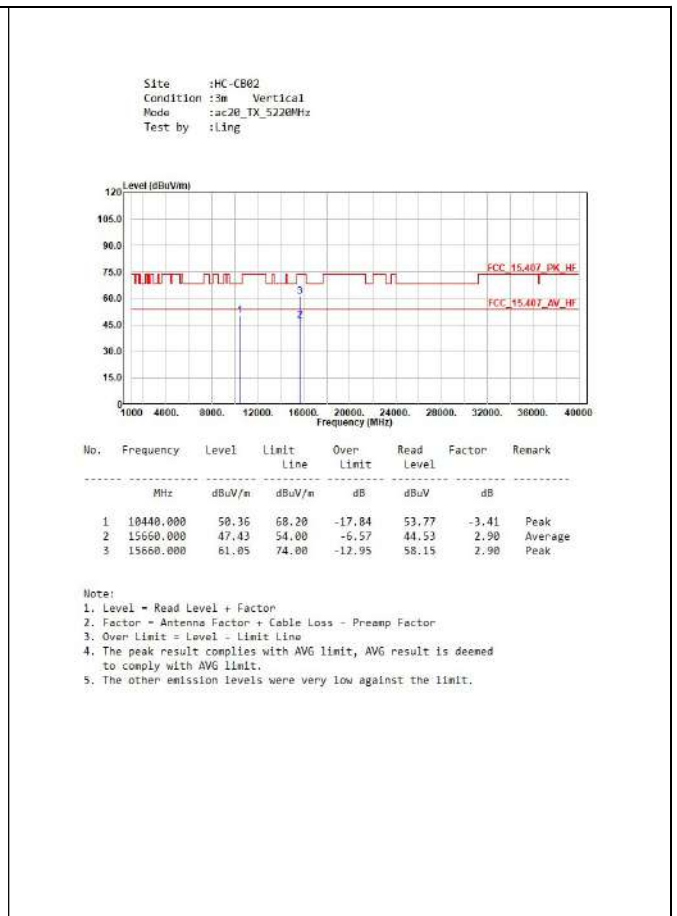
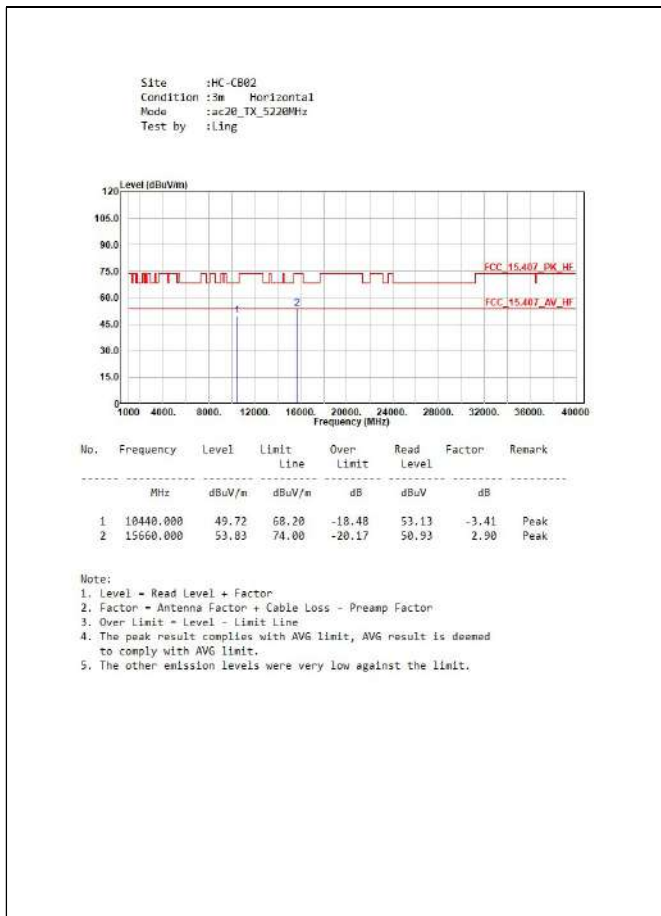


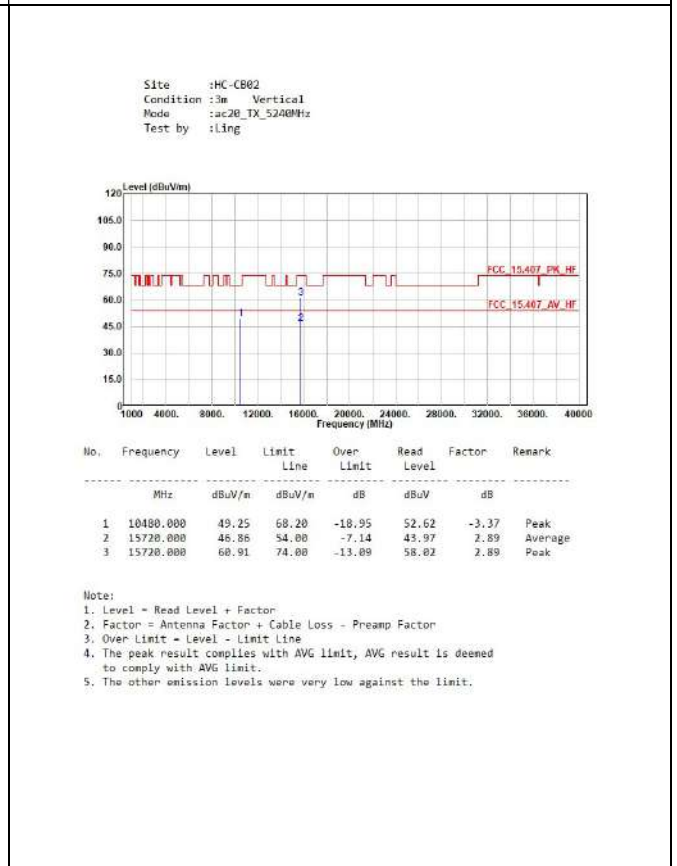
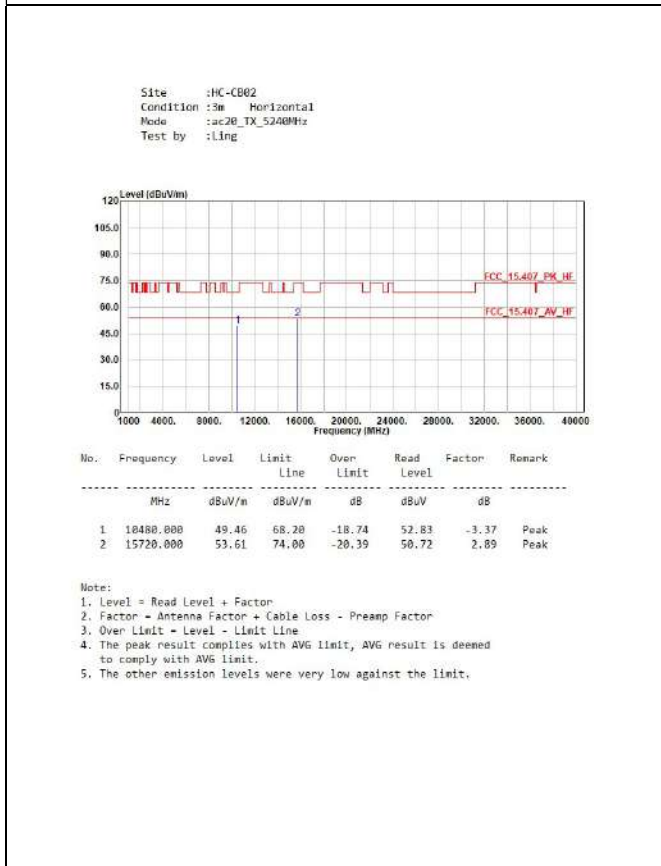
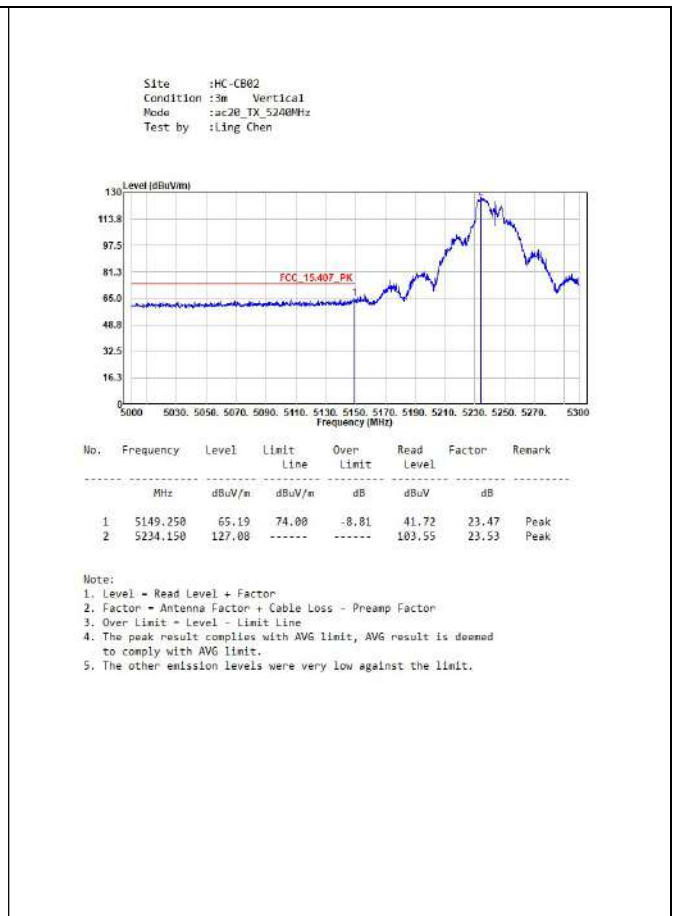
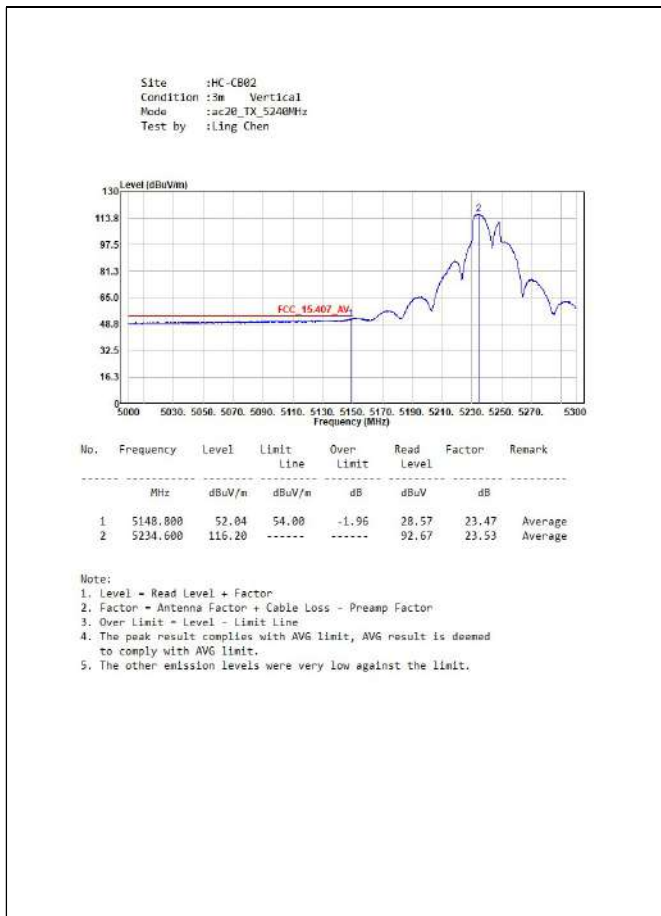


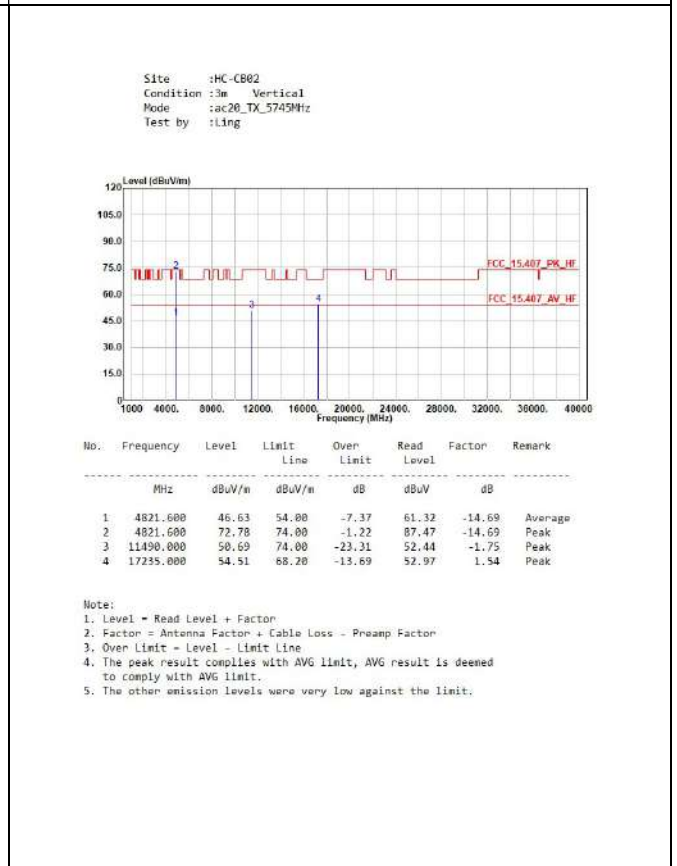
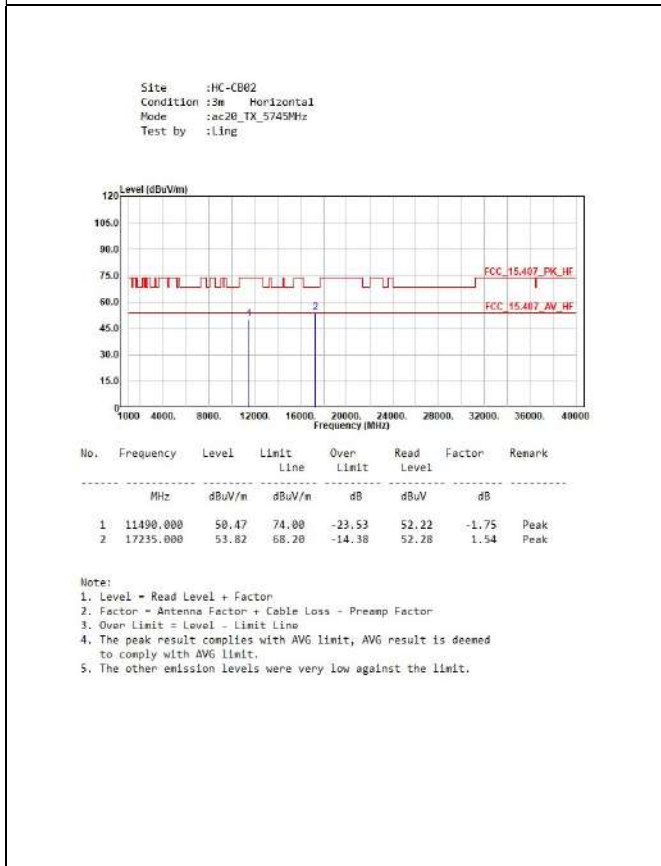
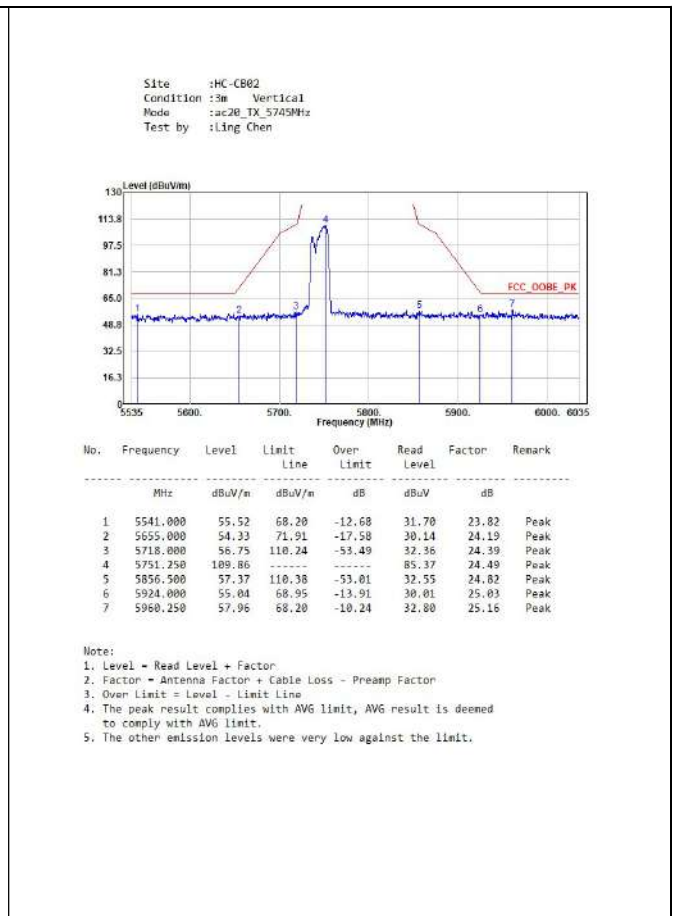
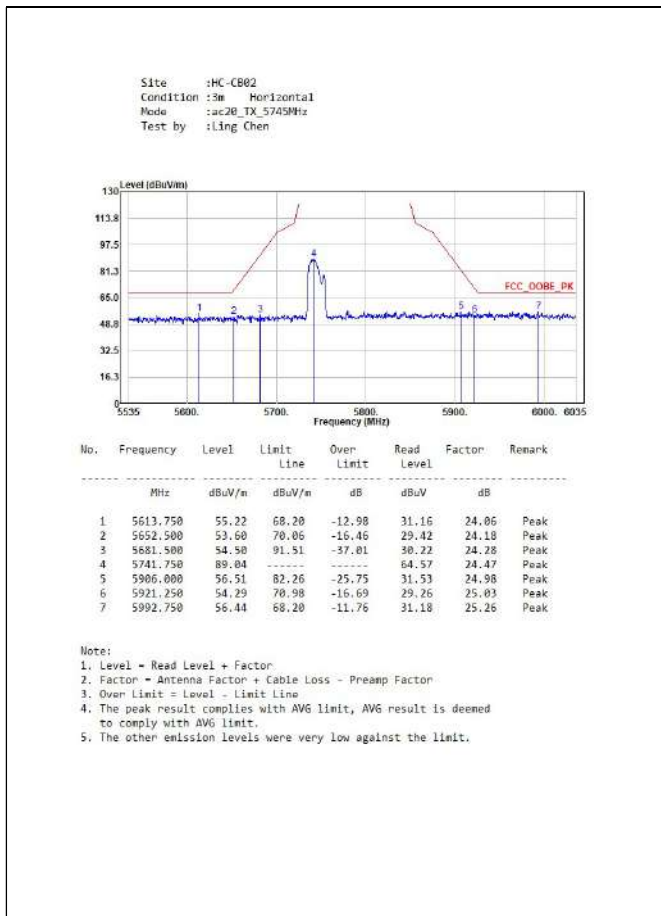


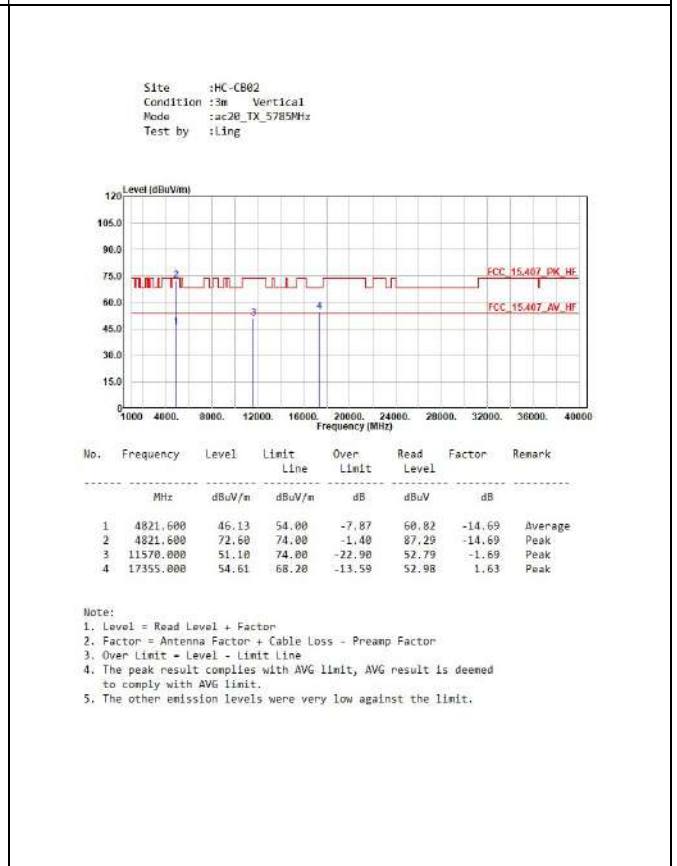
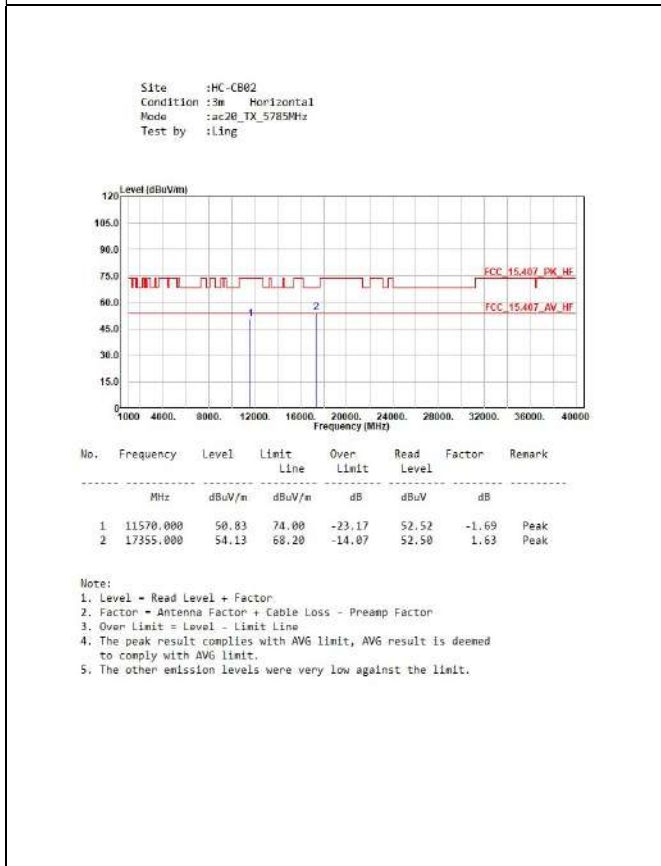
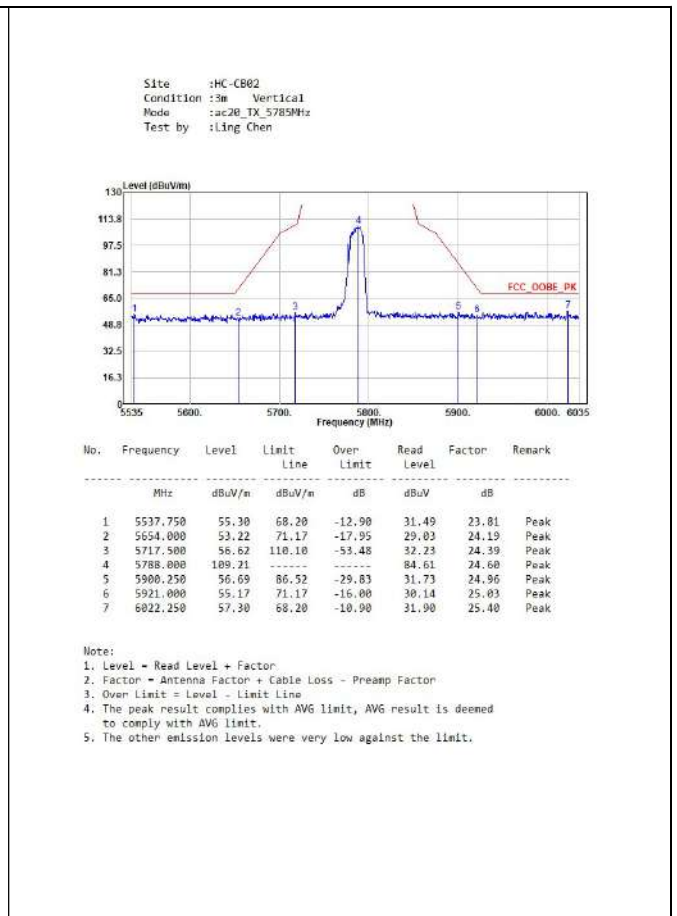
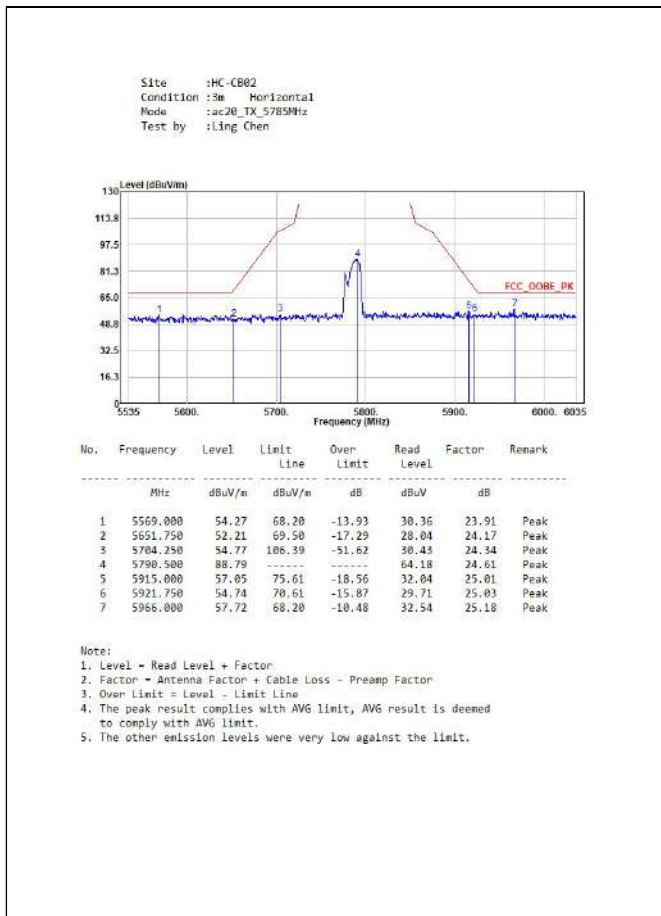


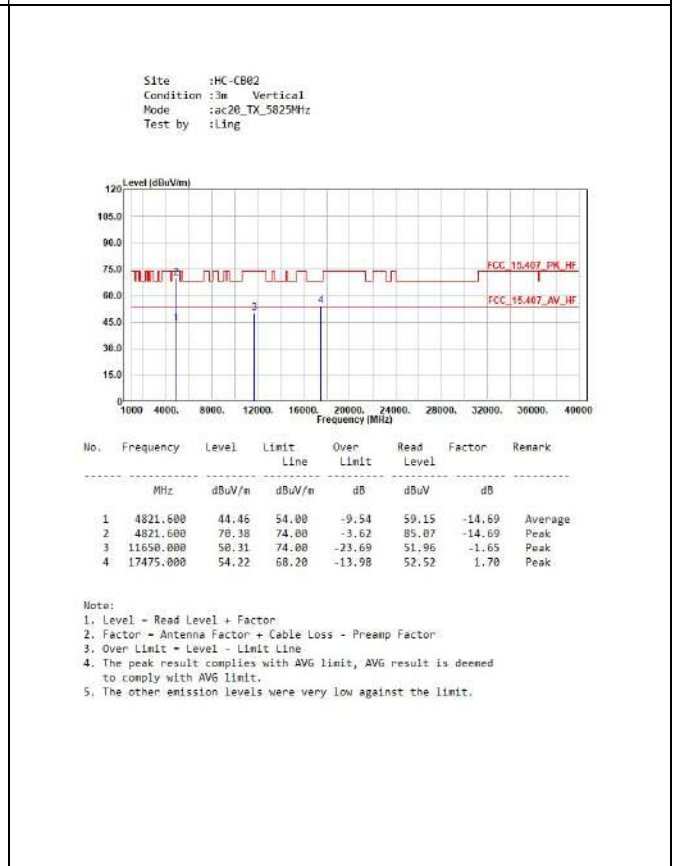
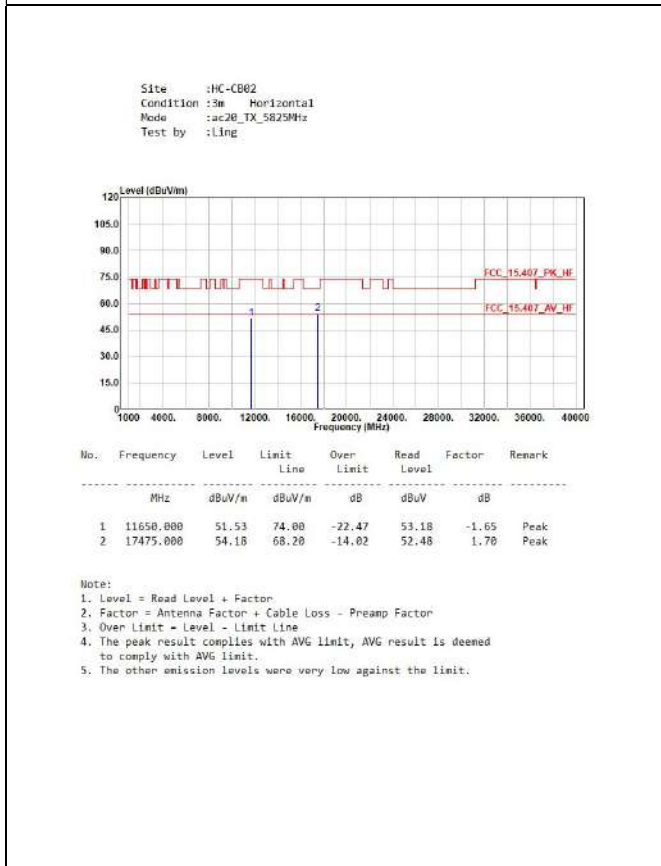
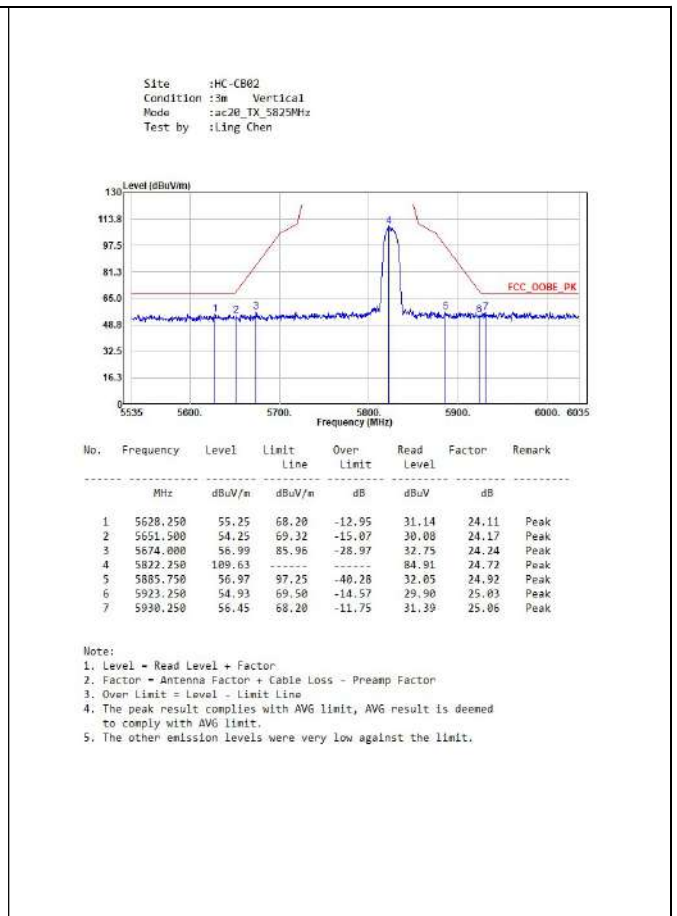
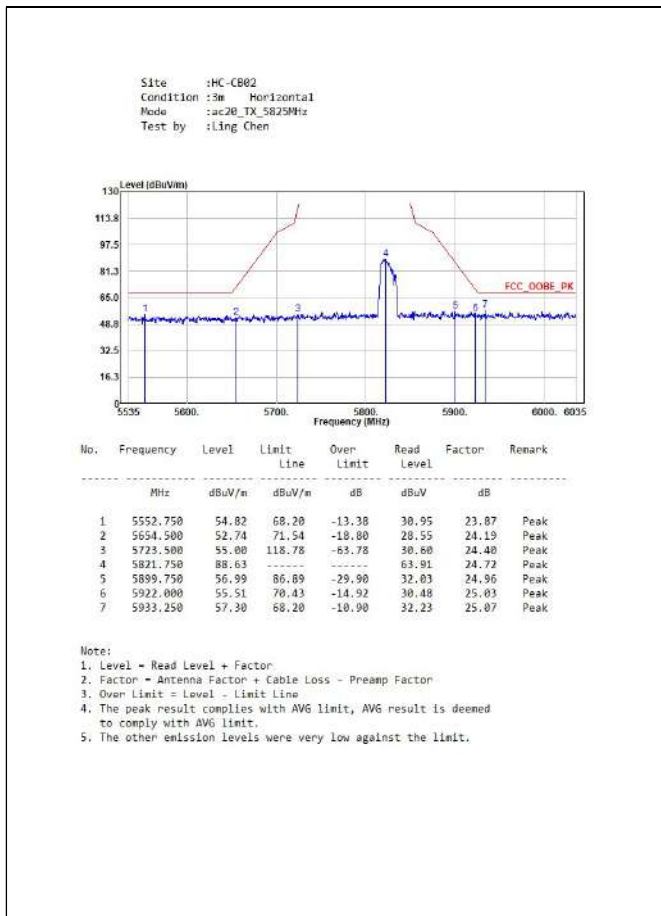


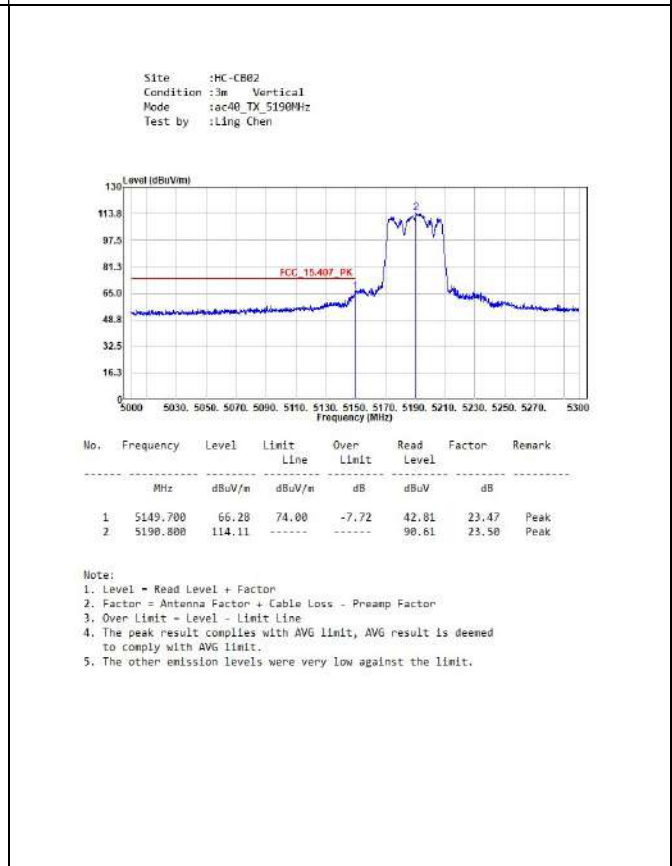
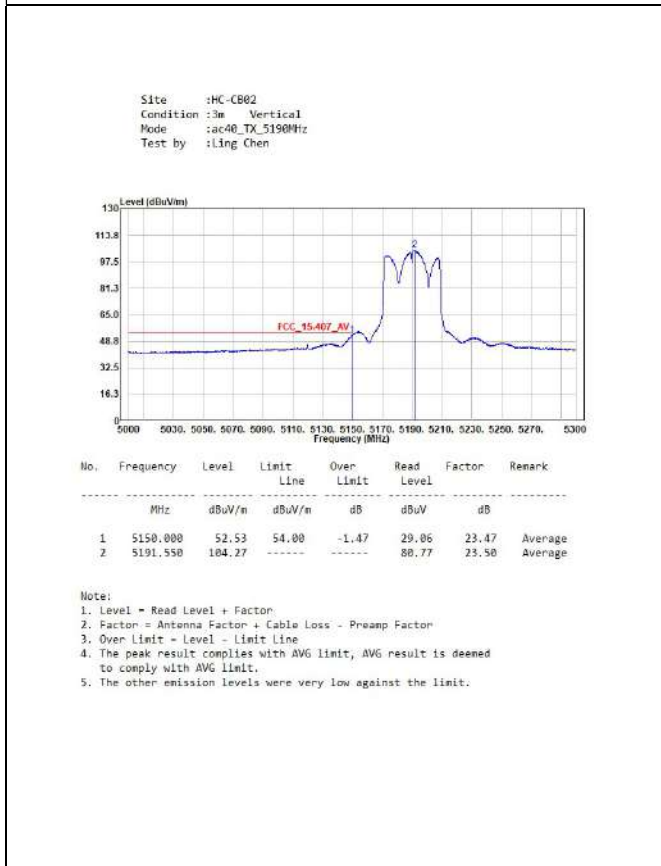
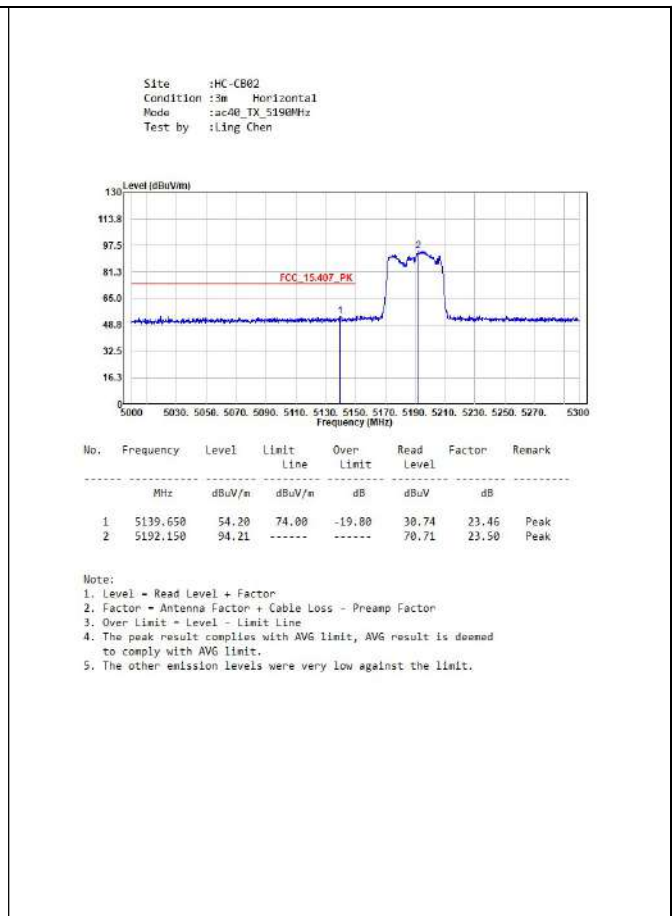
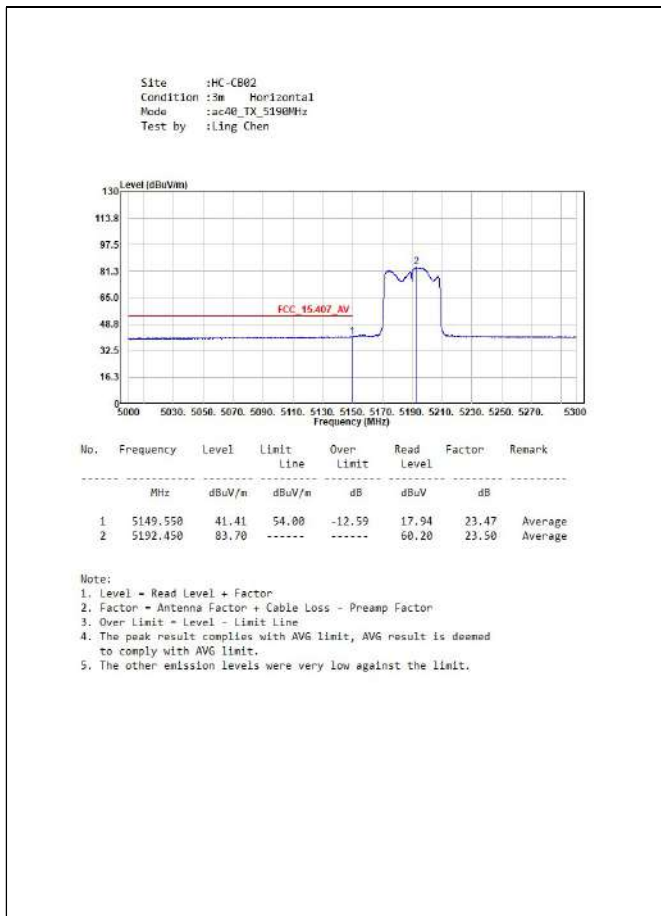


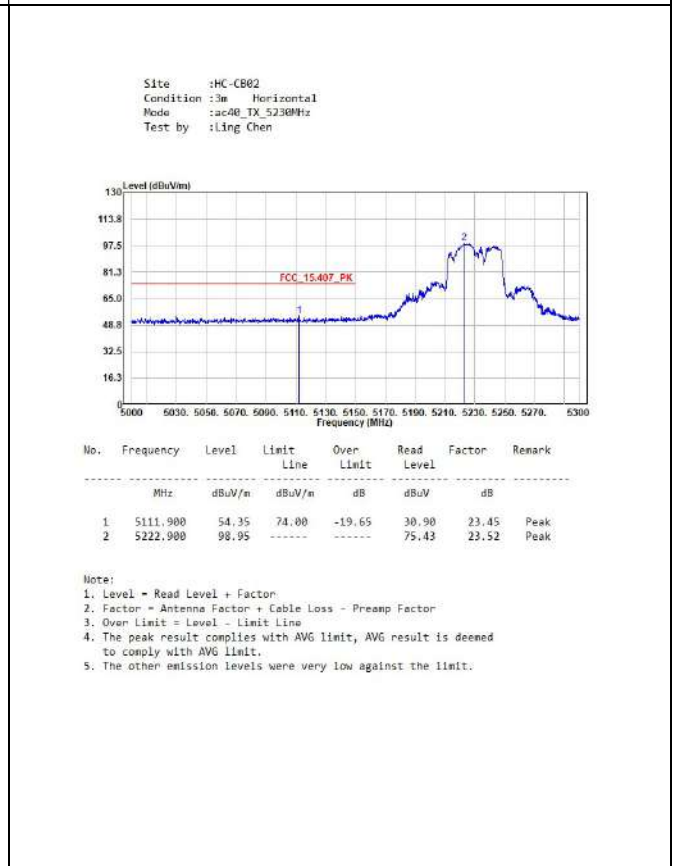
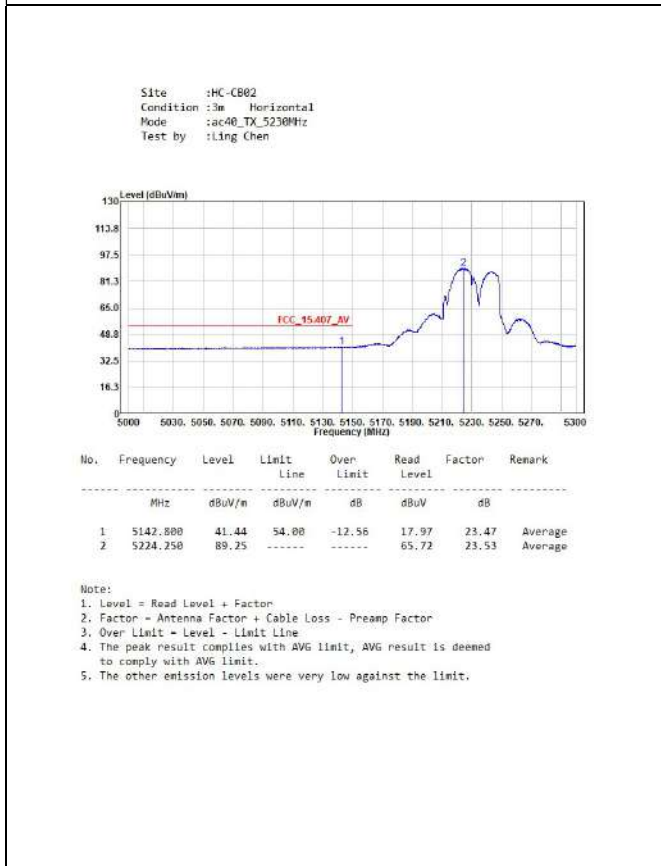
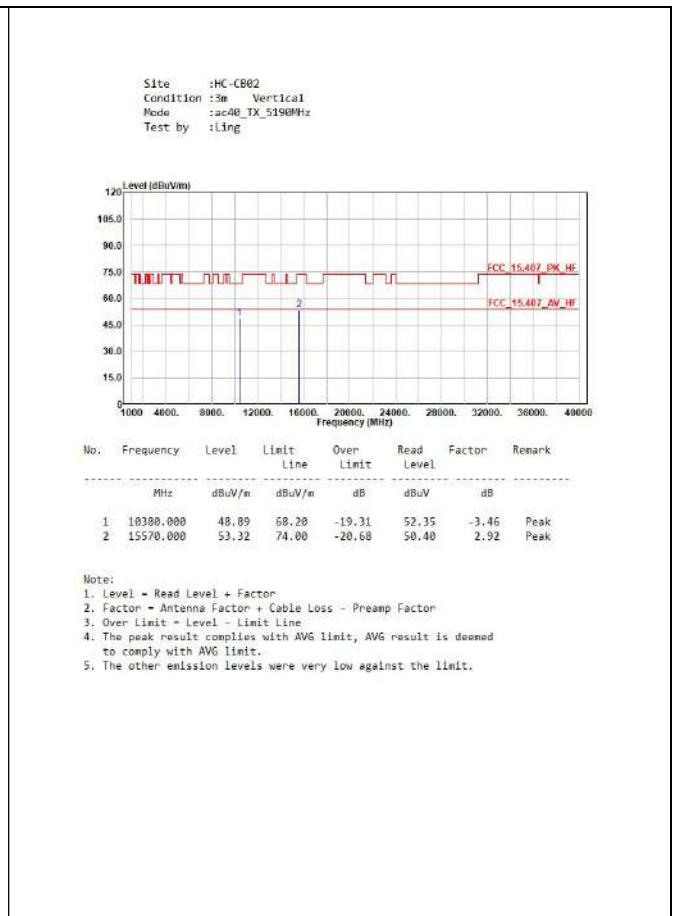
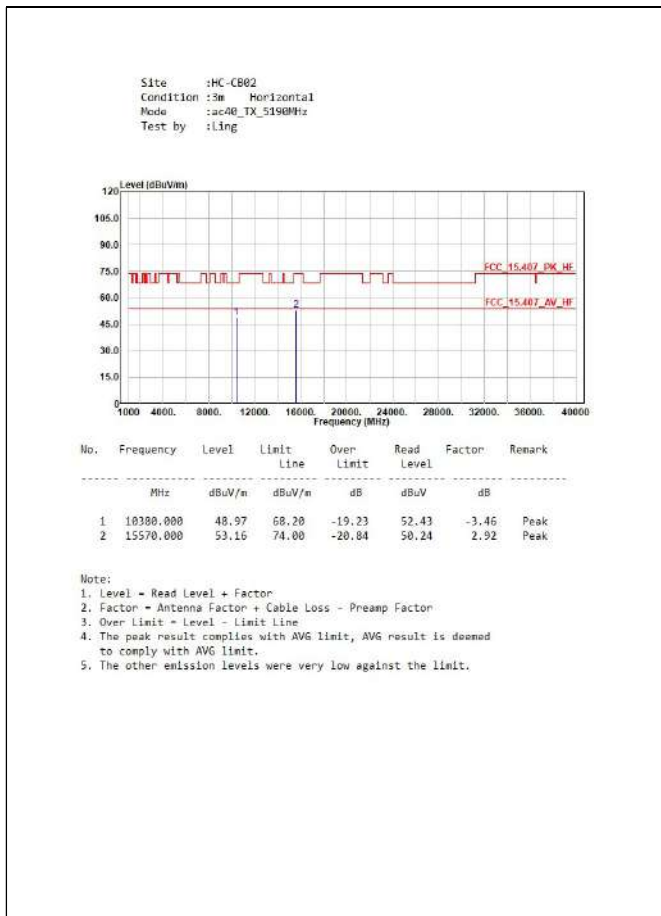












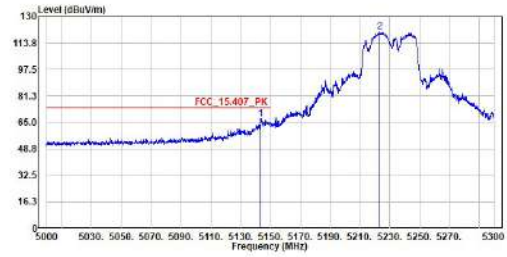
Site :HC-CB02
 Condition :3m Vertical
 Mode :ac40_TX_5230MHz
 Test by :Ling Chen



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	5149.250	51.73	54.00	-2.27	28.26	23.47	Average
2	5223.650	110.59	-----	-----	87.06	23.53	Average

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

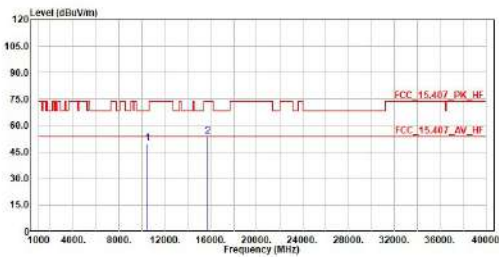
Site :HC-CB02
 Condition :3m Vertical
 Mode :ac40_TX_5230MHz
 Test by :Ling Chen



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	5143.550	67.08	74.00	-6.92	43.61	23.47	Peak
2	5223.200	120.55	-----	-----	97.02	23.53	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

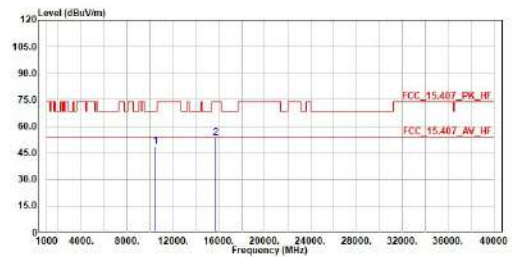
Site :HC-CB02
 Condition :3m Horizontal
 Mode :ac40_TX_5230MHz
 Test by :Ling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	10460.000	49.00	68.20	-18.40	53.20	-3.40	Peak
2	15690.000	53.88	74.00	-20.12	50.98	2.90	Peak

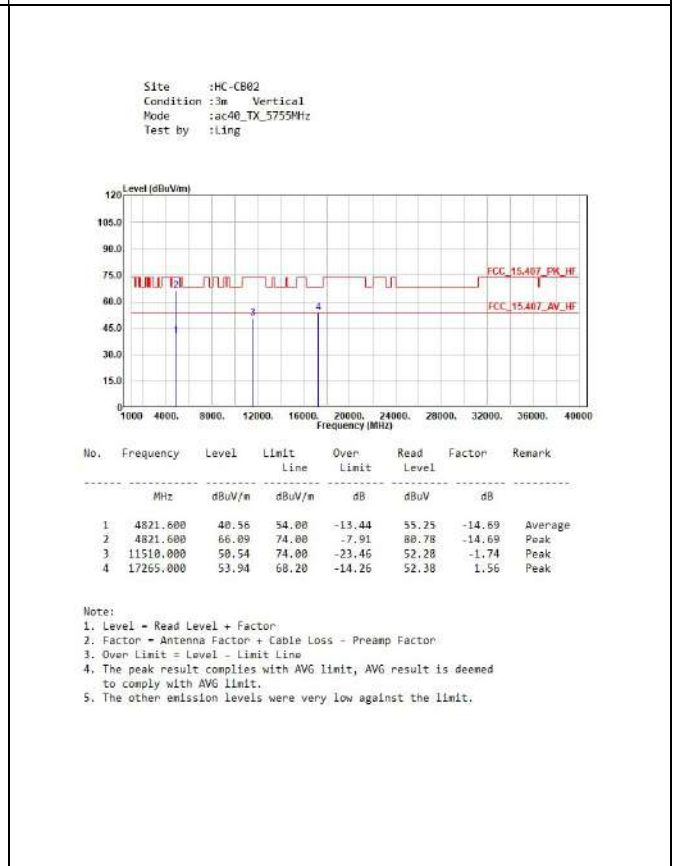
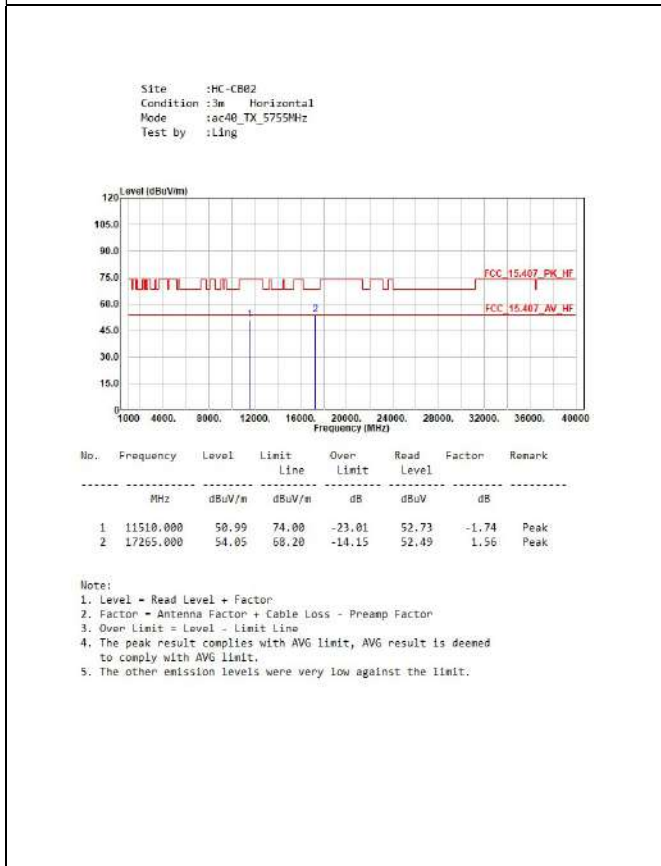
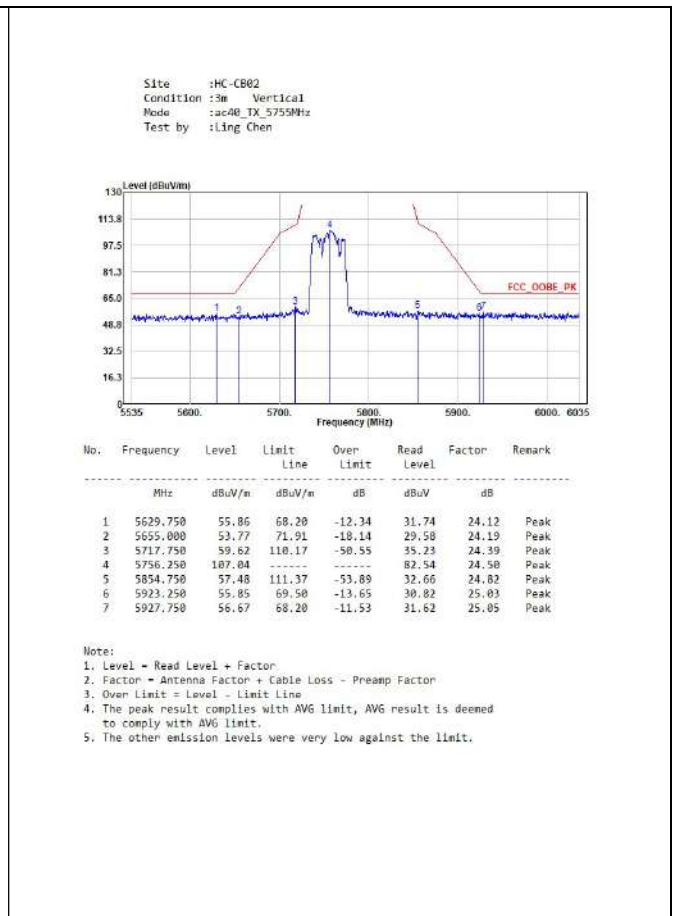
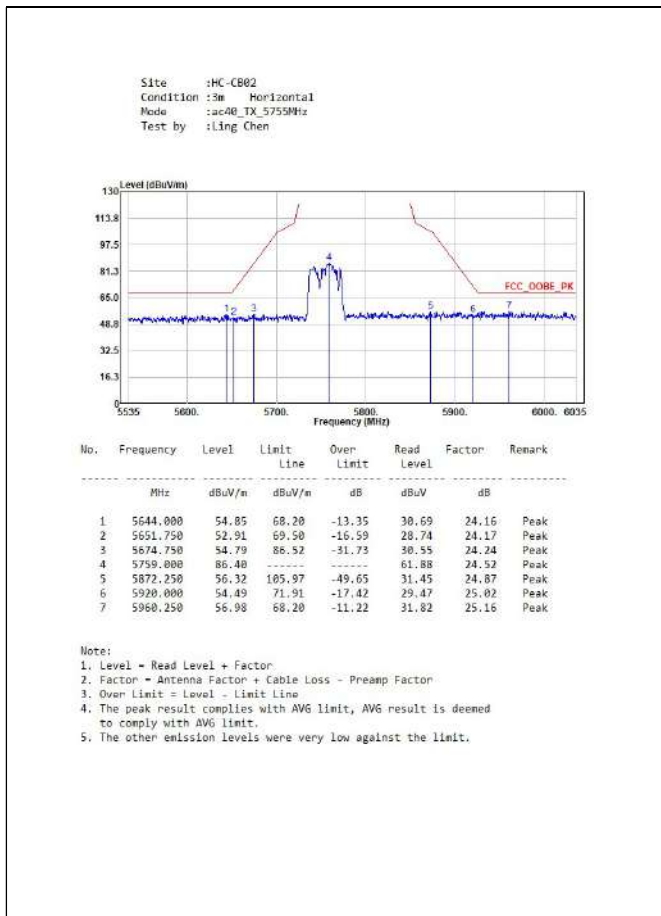
Note:
 1. Level = Read Level + Factor
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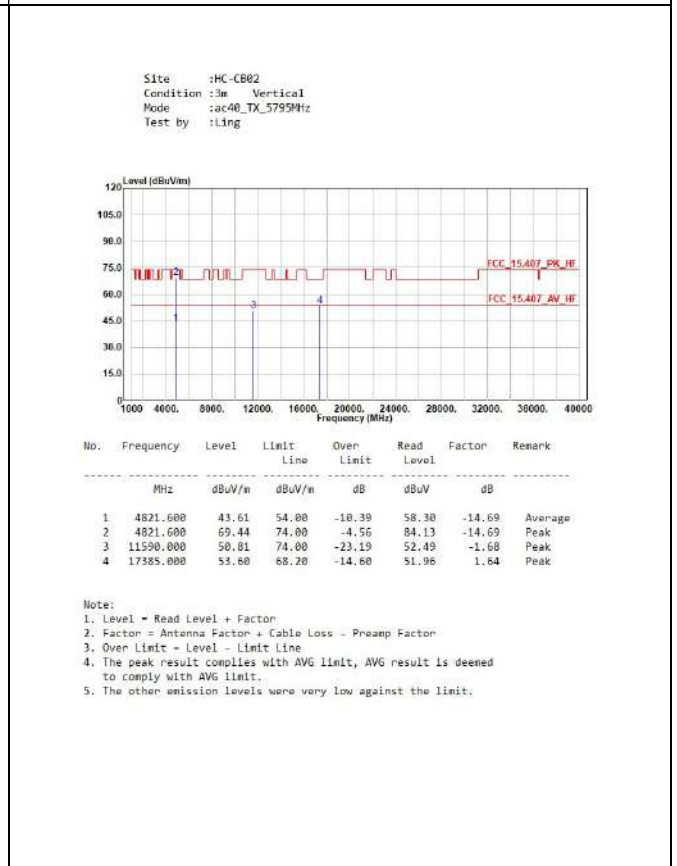
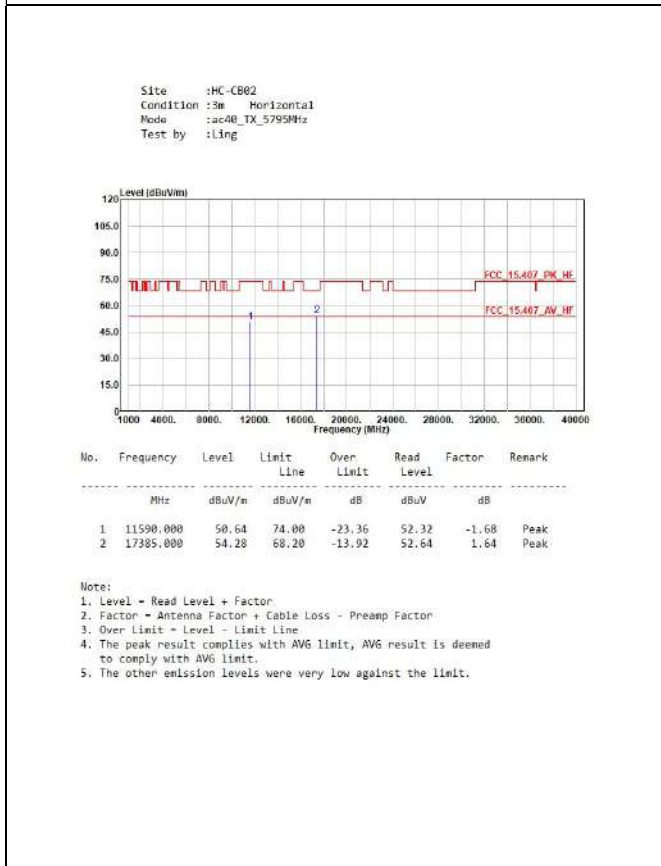
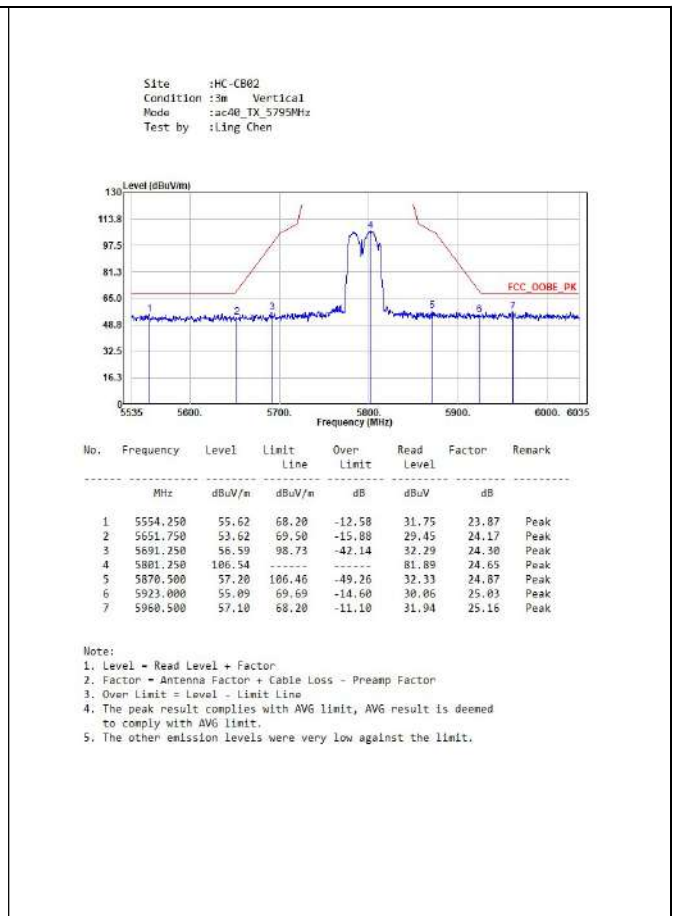
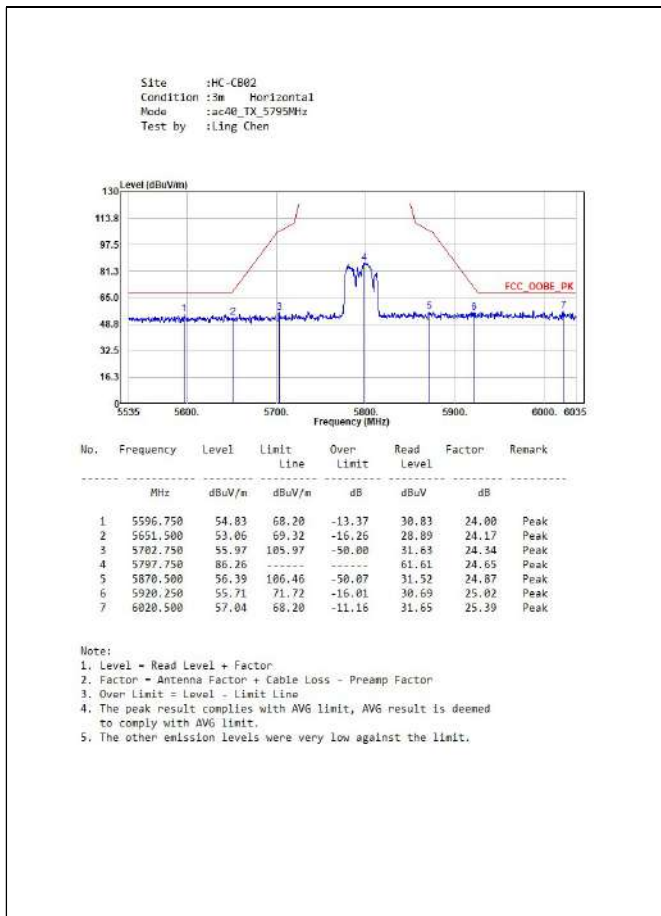
Site :HC-CB02
 Condition :3m Vertical
 Mode :ac40_TX_5230MHz
 Test by :Ling

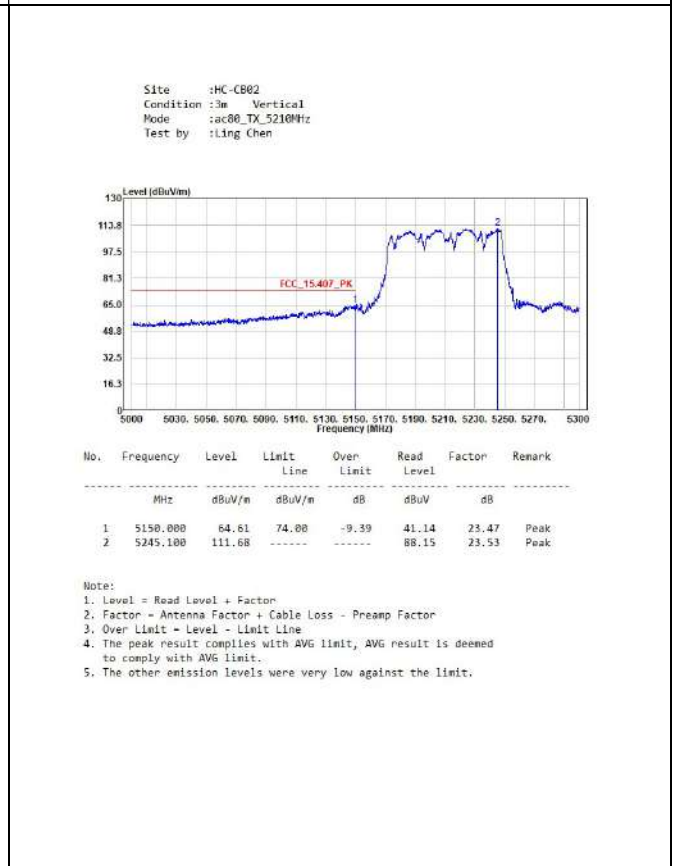
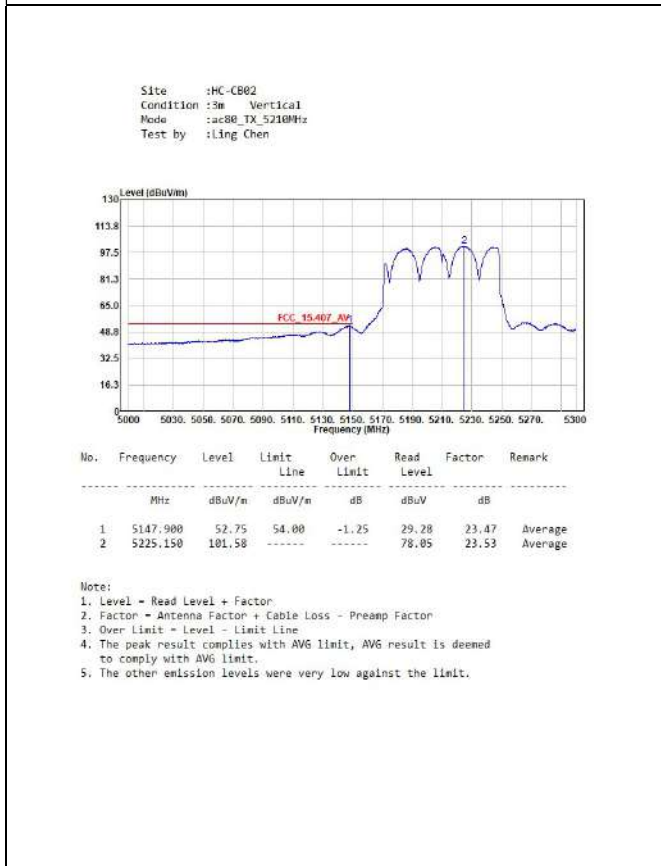
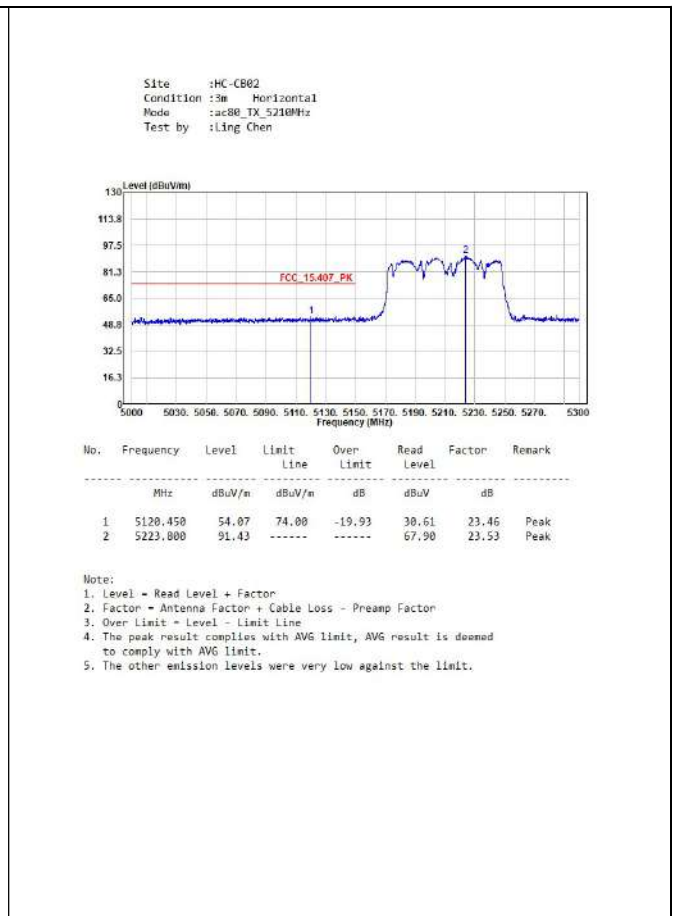
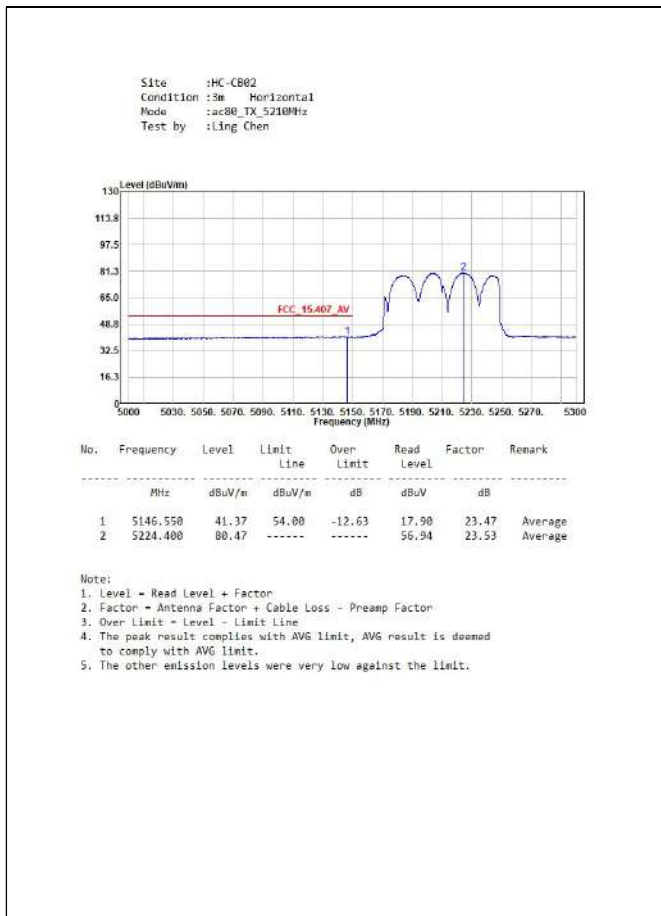


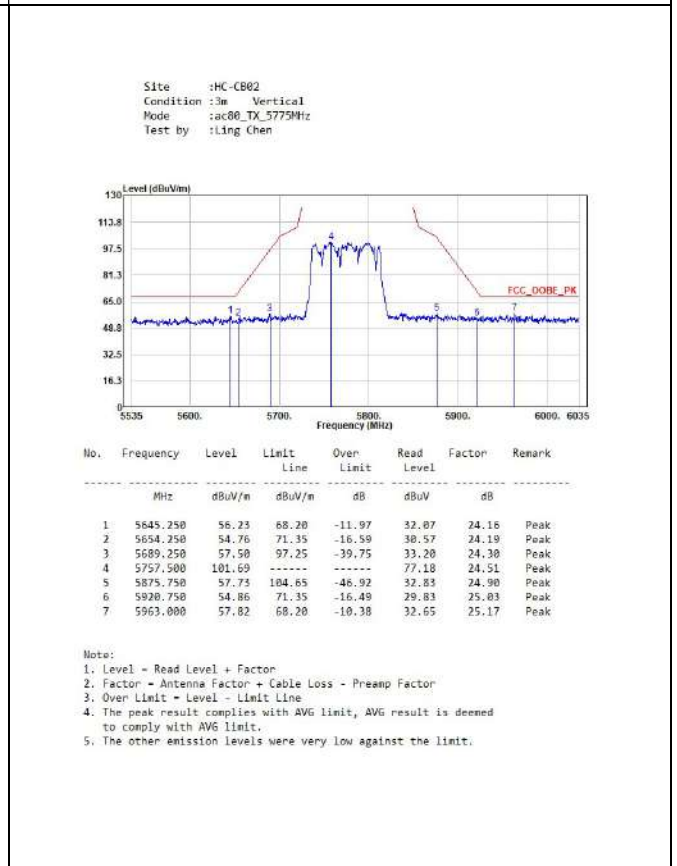
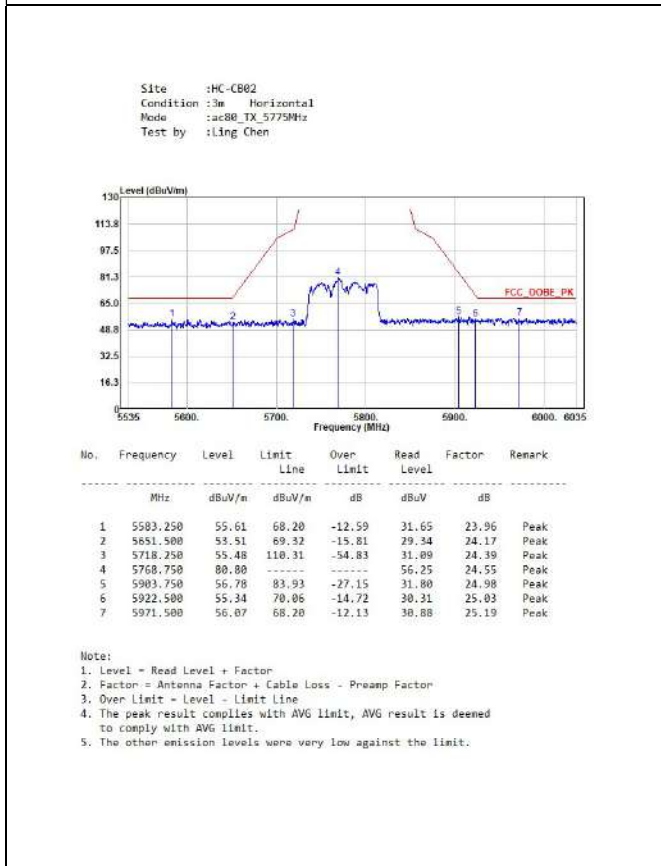
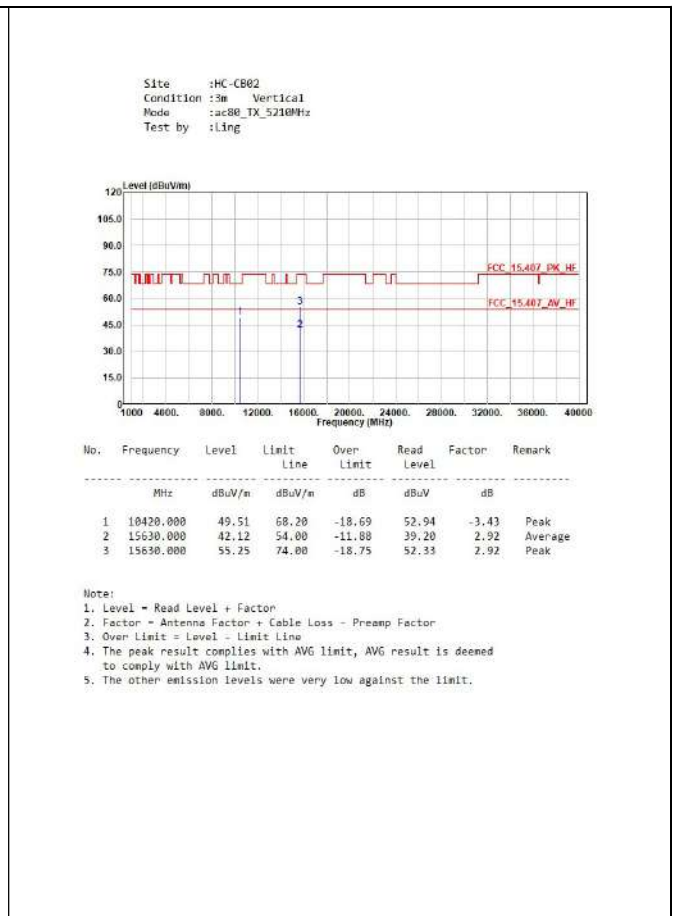
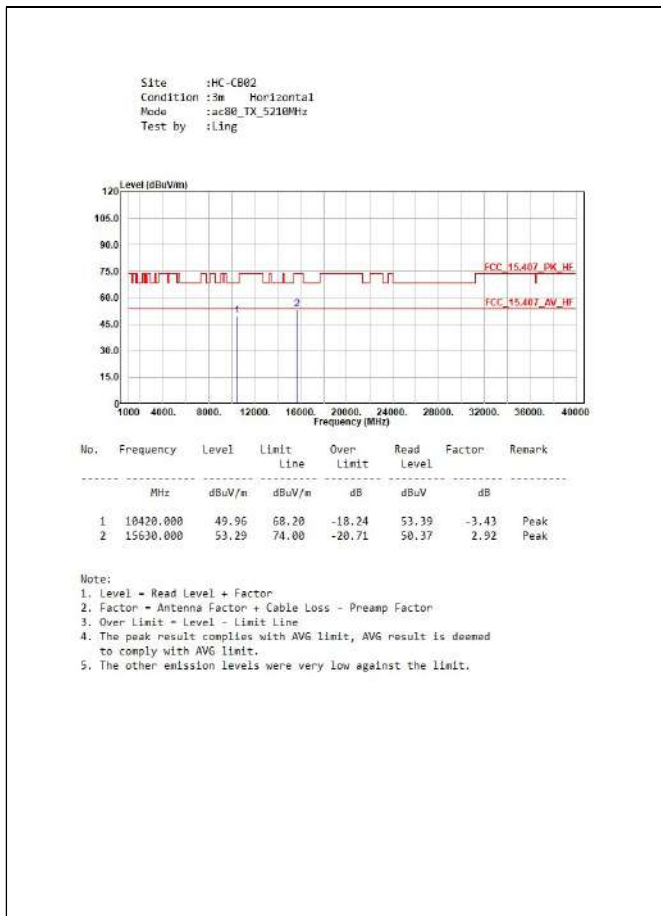
No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	10460.000	48.60	68.20	-19.60	52.00	-3.40	Peak
2	15690.000	53.51	74.00	-20.49	50.61	2.90	Peak

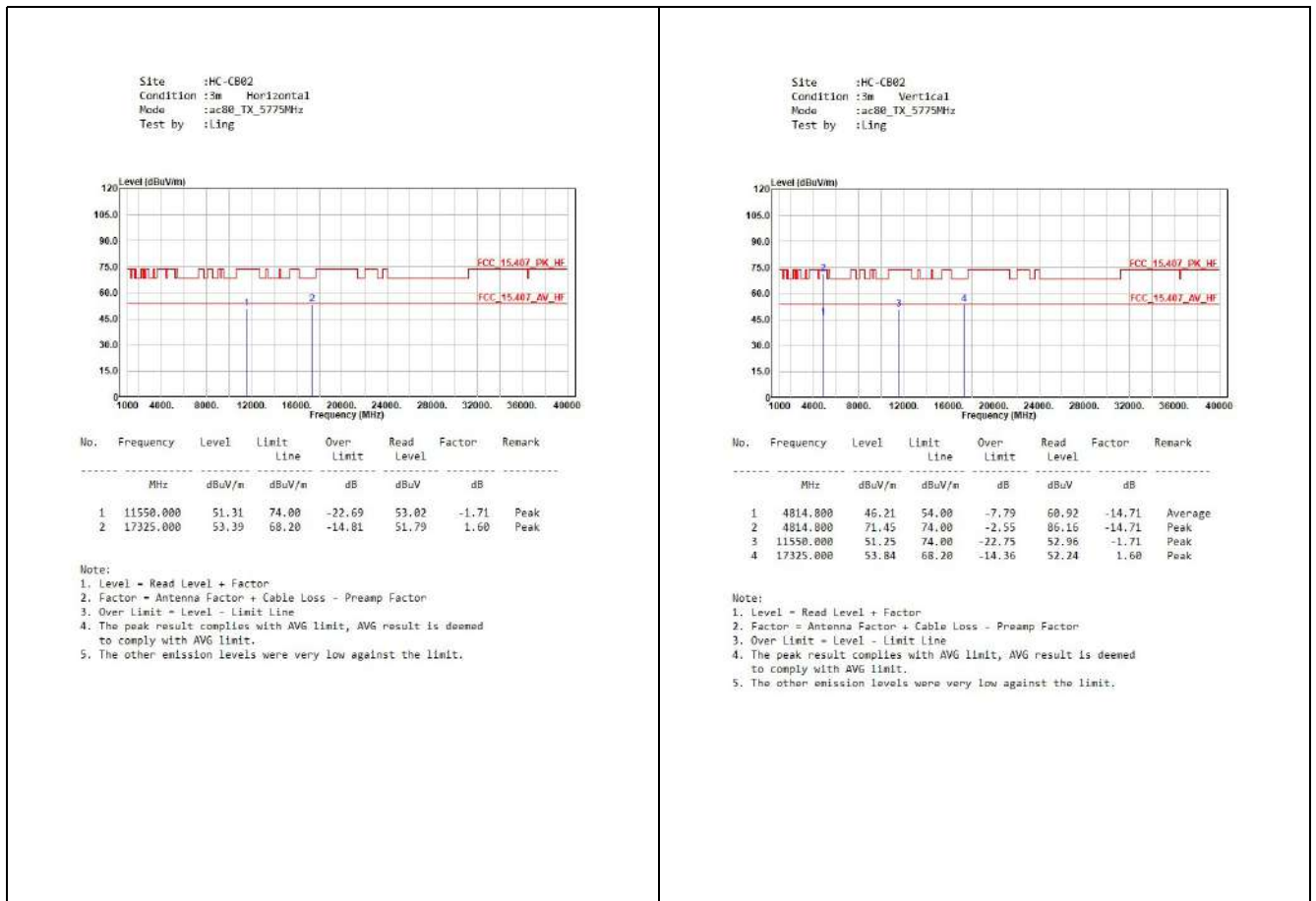
Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
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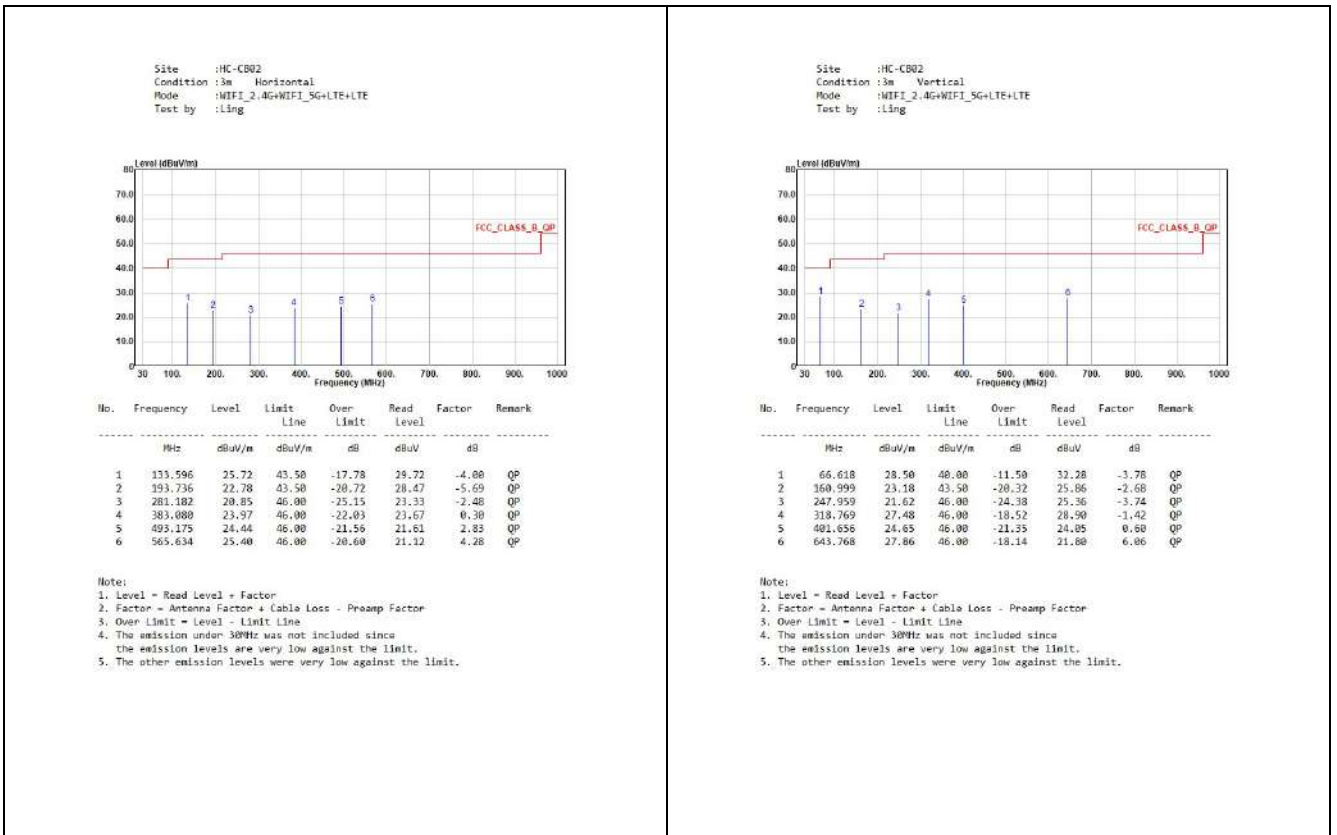


Appendix A

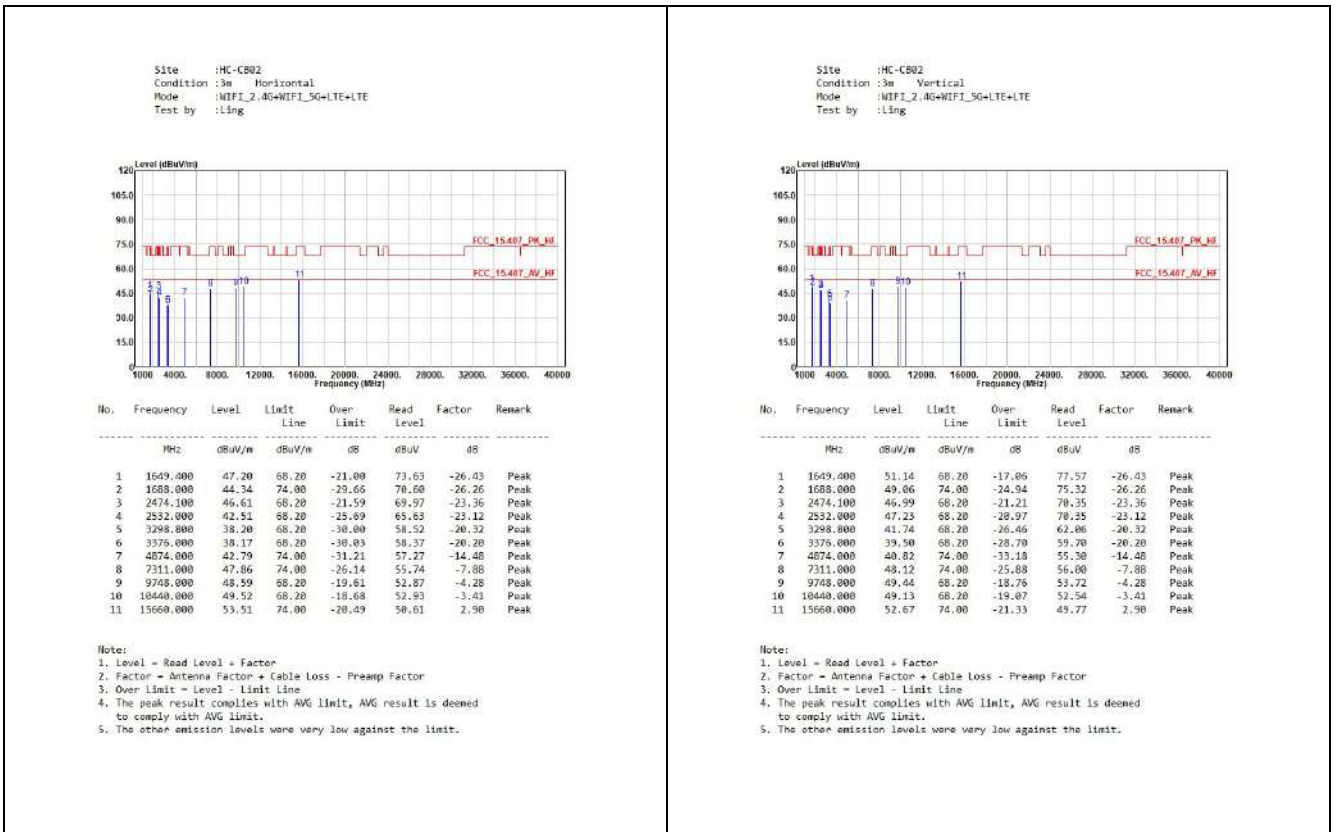
➤ Test Result of Radiated Emissions Co-location

1. WiFi 2.4 GHz + WiFi 5 GHz + WWAN module 1: LTE + WWAN module 2: LTE function

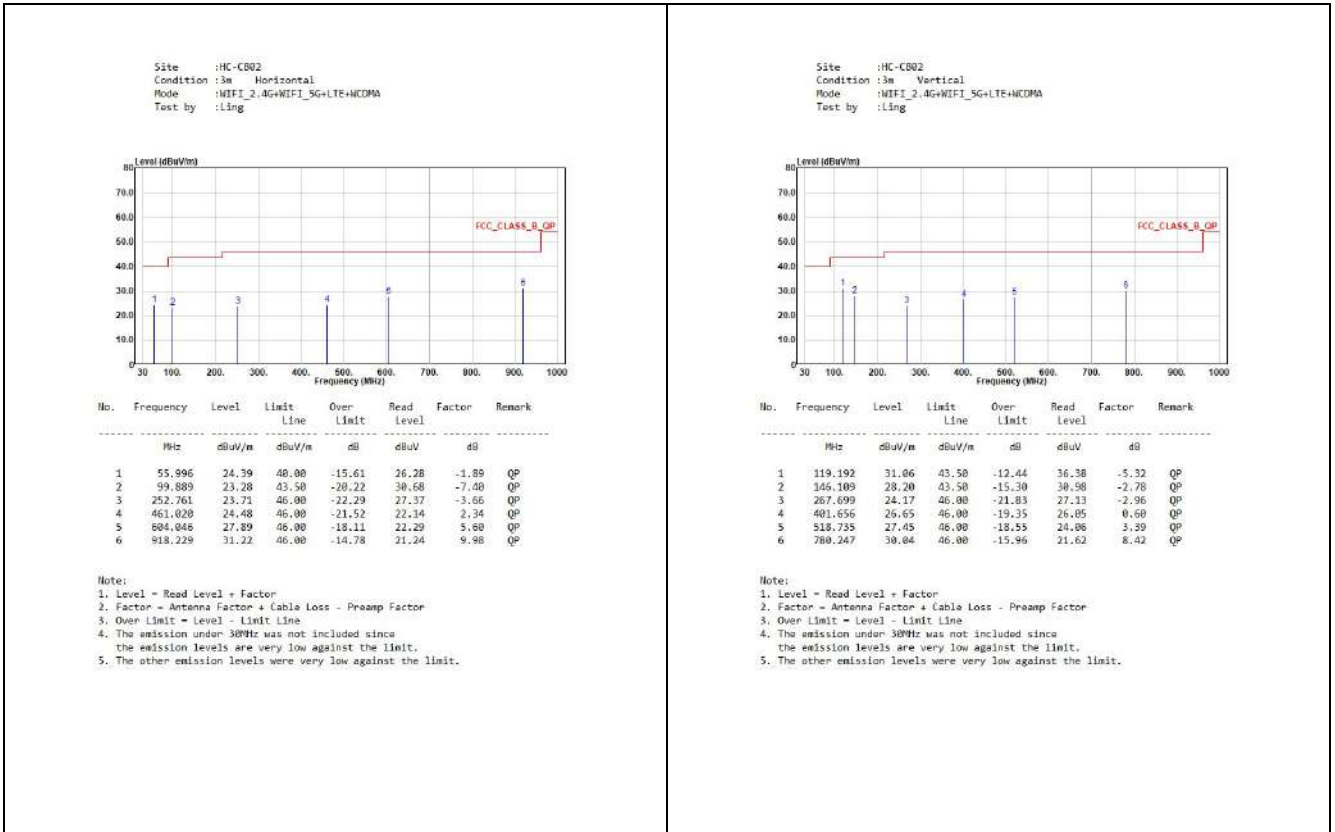
30 MHz ~ 1 GHz:



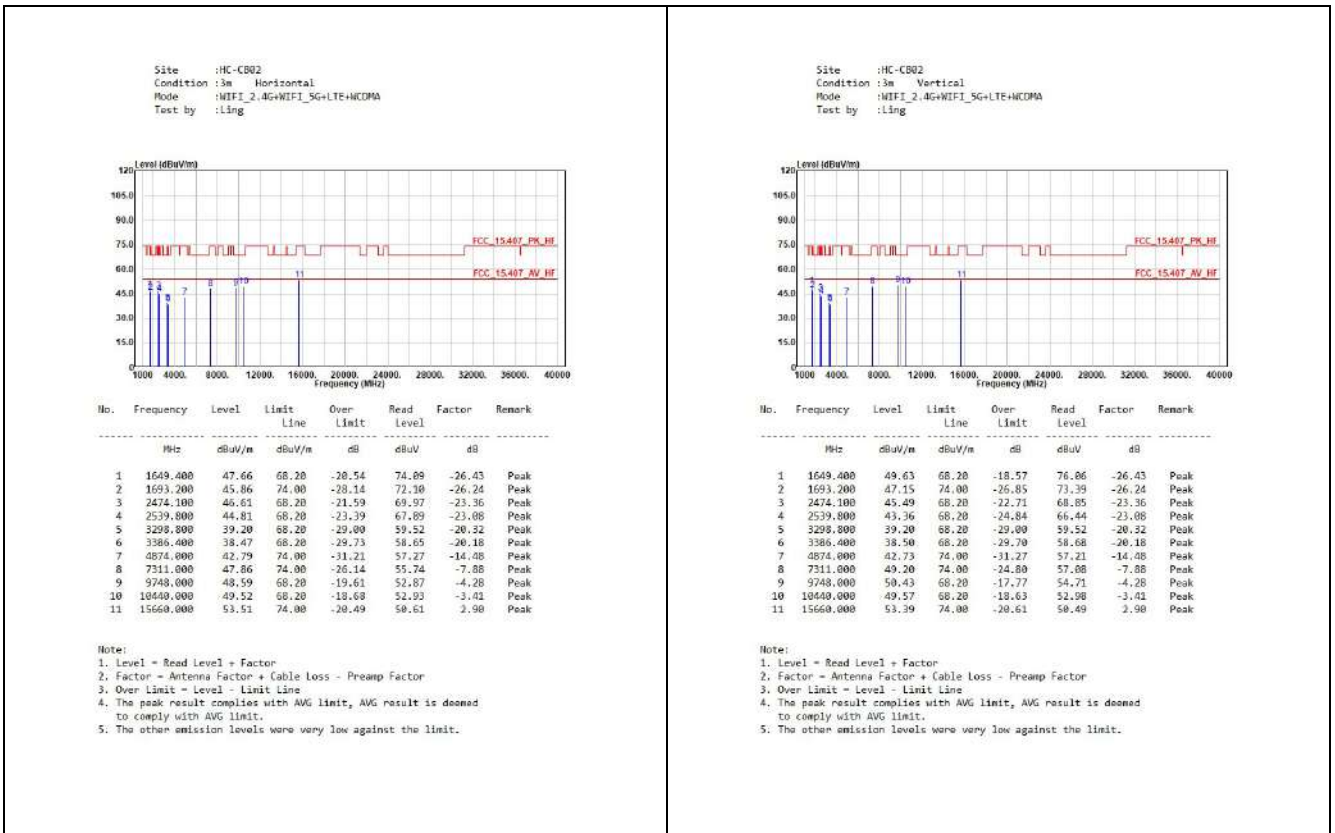
Above 1 GHz:



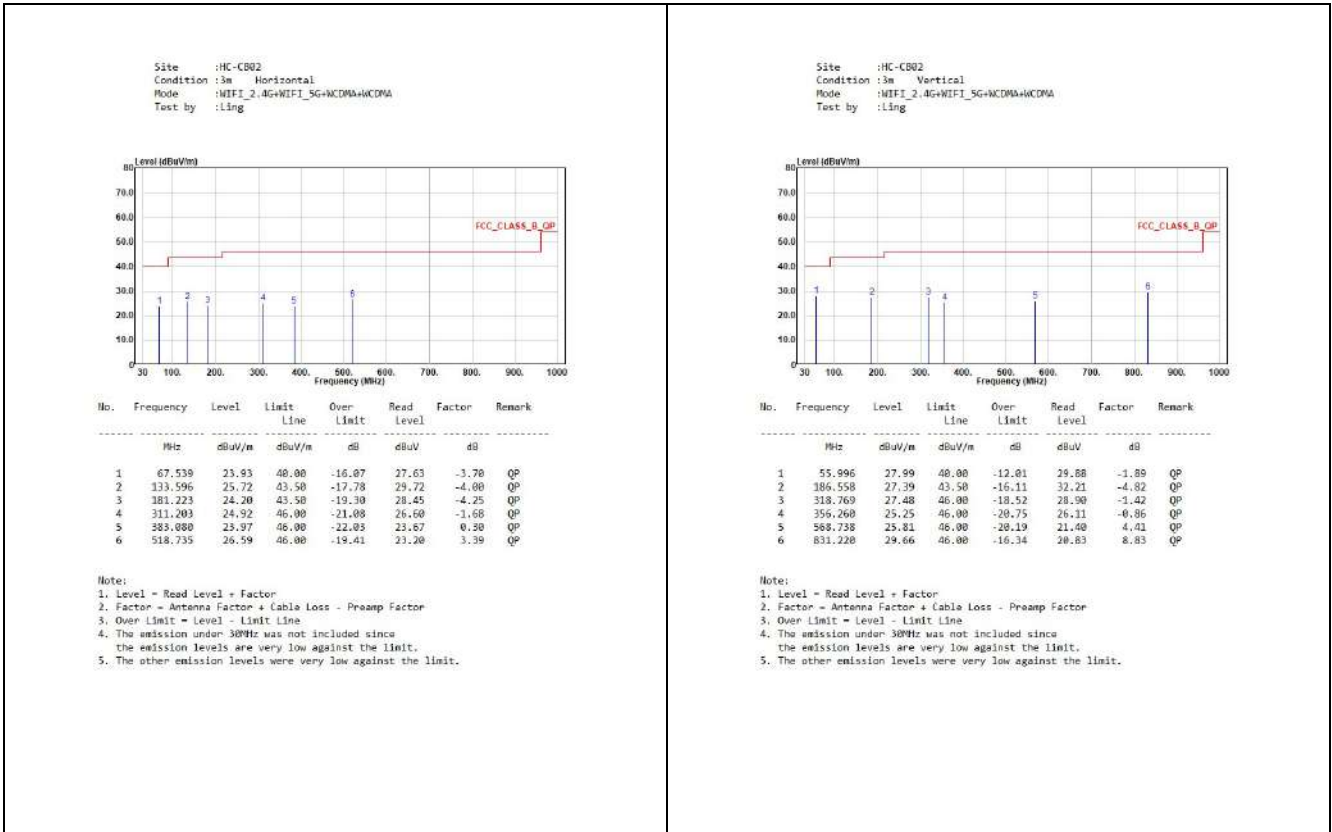
**2. WiFi 2.4 GHz + WiFi 5 GHz + WWAN module 1: LTE + WWAN module 2: WCDMA function
30 MHz ~ 1 GHz:**



Above 1 GHz:



3. WiFi 2.4 GHz + WiFi 5 GHz + WWAN module 1: WCDMA + WWAN module 2: WCDMA function 30 MHz ~ 1 GHz:



Above 1 GHz:

