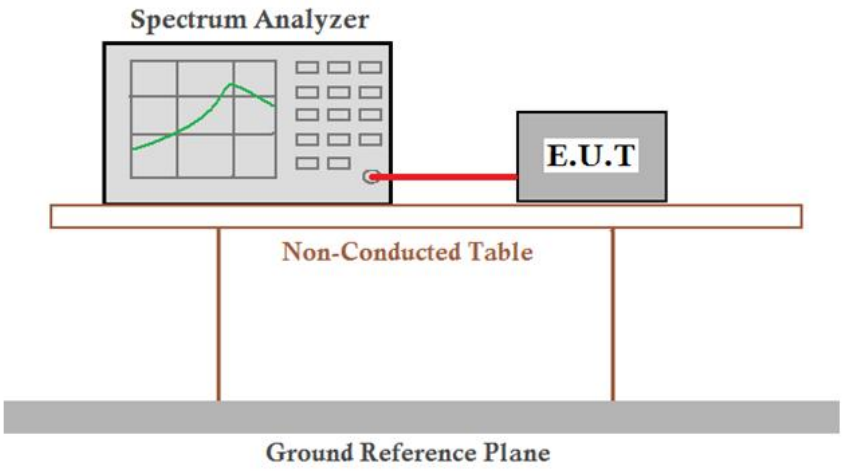
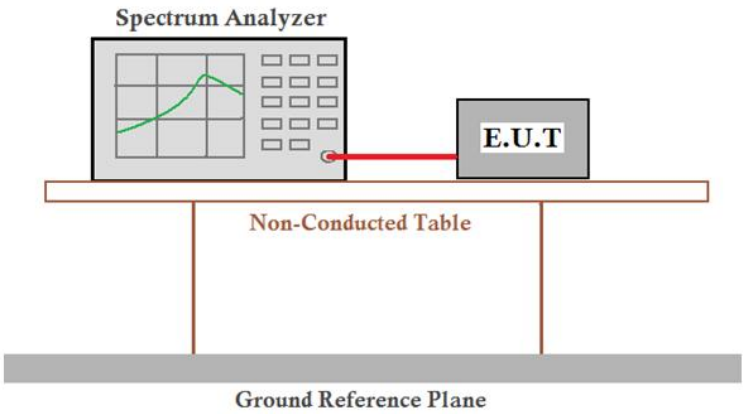
3.4 Carrier Frequencies Separationy

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10: 2013 Section 7.8.2
Test Setup:	
Test Instruments:	Refer to section 2.9 for details
Exploratory Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the worst case of all modulation type.
Limit:	2/3 of the 20dB bandwidth
	Remark: the transmission power is less than 0.125W.
Test Results:	Pass

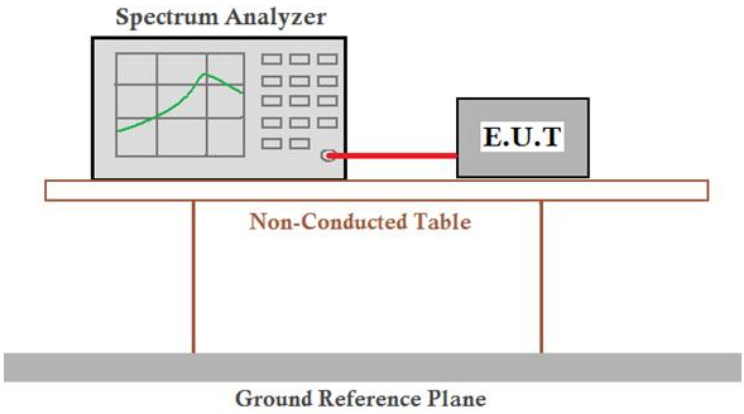
The detailed test data see: **Appendix C**

3.5 Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10: 2013 Section 7.8.4
Test Setup:	
Instruments Used:	Refer to section 2.9 for details
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass

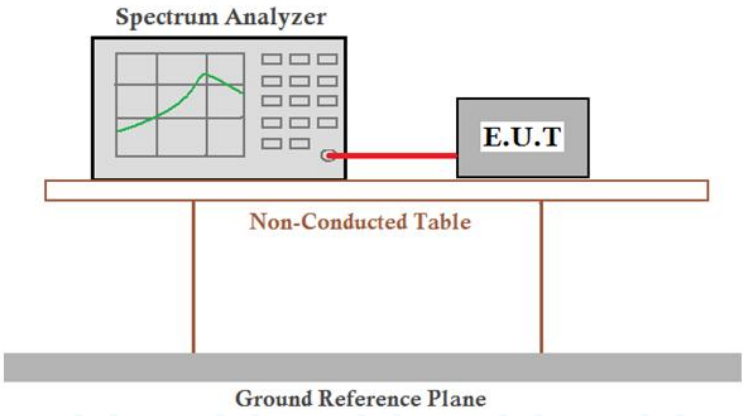
The detailed test data see: **Appendix D**

3.6 Hopping Channel Number

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10: 2013 Section 7.8.3
Test Setup:	
Instruments Used:	Refer to section 2.9 for details
Test Mode:	Hopping transmitting with all kind of modulation
Limit:	At least 15 channels
Test Results:	Pass

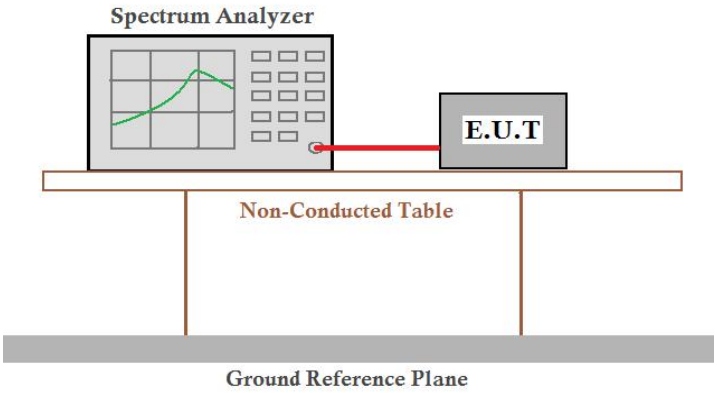
The detailed test data see: **Appendix E**

3.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 7.8.6
Test Setup:	
Instruments Used:	Refer to section 2.9 for details
Exploratory Test Mode:	Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the worst case of all modulation type.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test Results:	Pass

The detailed test data see: **Appendix F**

3.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
Instruments Used:	Refer to section 2.9 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the worst case of all modulation type.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test Results:	Pass

The detailed test data see: **Appendix G**

3.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013 Section 11.12				
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz (DC⩾0.98) ⩾1/T (DC<0.98)	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
	Remark: 15.35(b),Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.				

Test Setup:

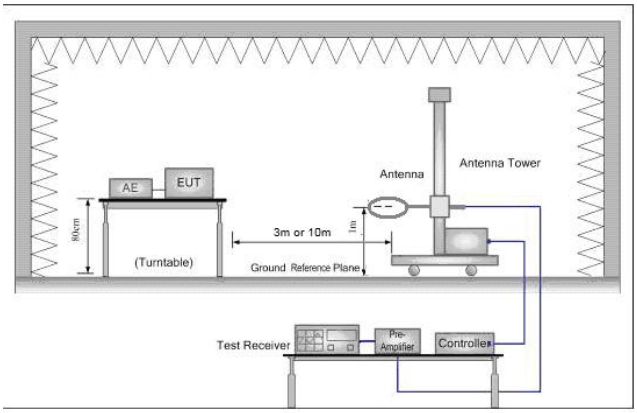


Figure 1. Below 30MHz

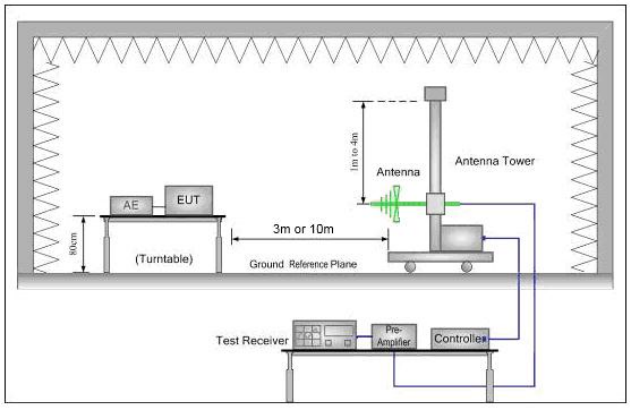


Figure 2. 30MHz to 1GHz

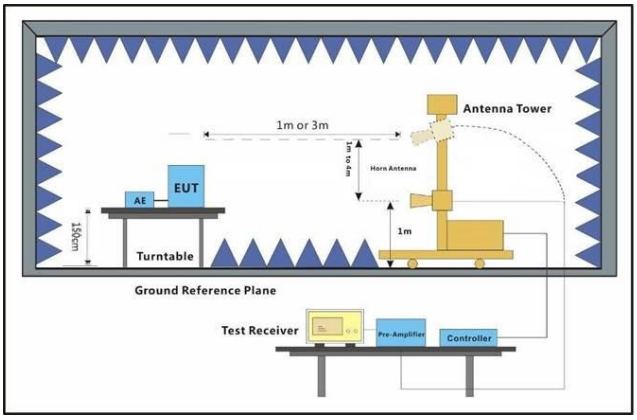


Figure 3. Above 1 GHz

Test 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 camber. 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 semi-anechoic camber. 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.

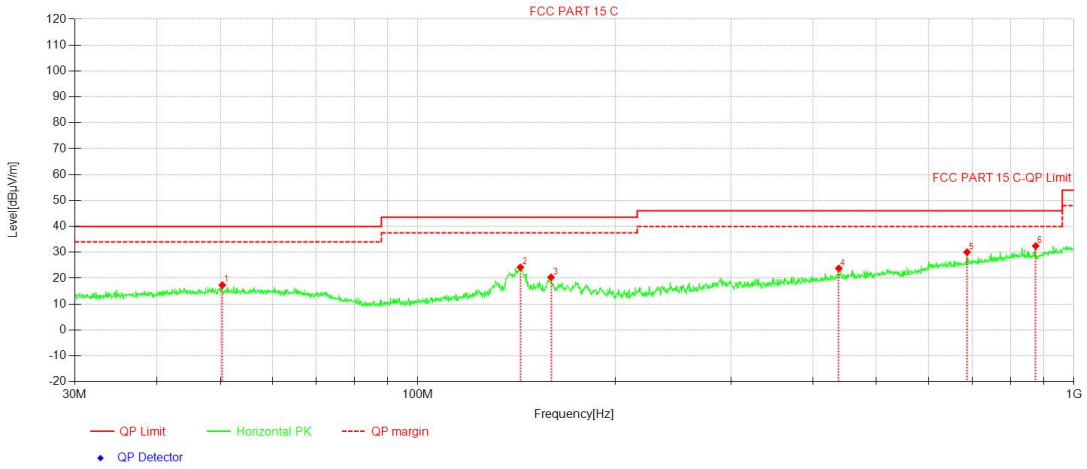
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.

j. Repeat above procedures until all frequencies measured was complete.

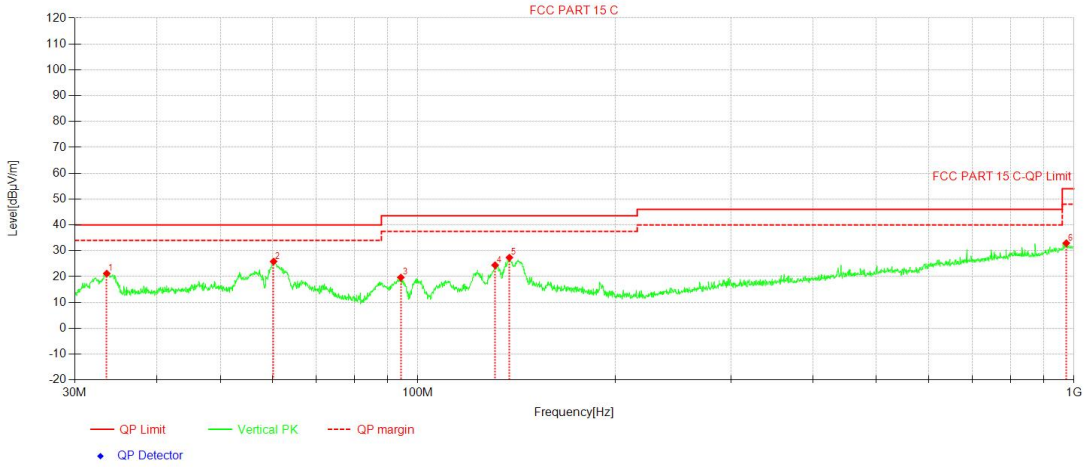
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ⩾ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10 Hz, when duty cycle is no less than 98 percent. • VBW ⩾ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge+Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode. Through Pre-scan, find the DH5 of data type is the worst case of All modulation type.
Instruments Used:	Refer to section 2.9 for details
Test Results:	Pass

Test data

For 30-1000MHz



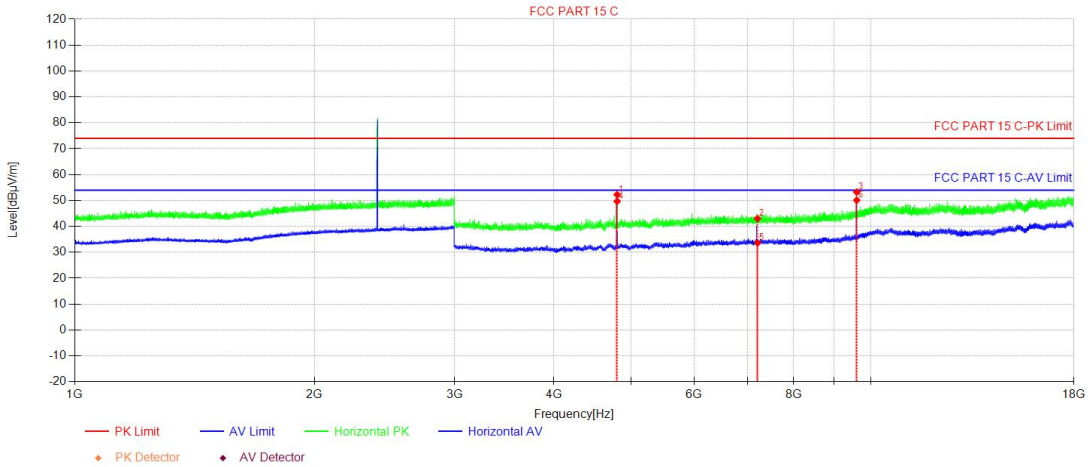
NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	50.35	25.40	-8.07	17.33	40.00	22.67	100	123	PK	H
2	143.33	32.45	-8.27	24.18	43.50	19.32	100	0	PK	H
3	159.60	28.13	-7.80	20.33	43.50	23.17	100	343	PK	H
4	438.14	26.88	-3.09	23.79	46.00	22.21	100	190	PK	H
5	687.15	27.90	2.16	30.06	46.00	15.94	100	43	PK	H
6	874.22	27.92	4.52	32.44	46.00	13.56	100	255	PK	H



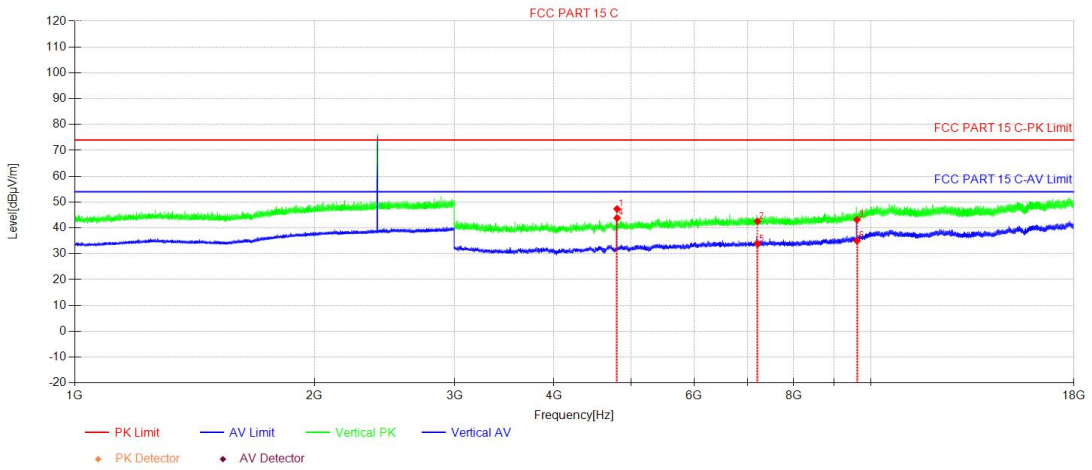
NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	33.56	30.65	-9.48	21.17	40.00	18.83	100	284	PK	V
2	60.28	34.64	-8.79	25.85	40.00	14.15	100	235	PK	V
3	94.21	33.11	-13.47	19.64	43.50	23.86	100	315	PK	V
4	131.14	33.75	-9.33	24.42	43.50	19.08	100	39	PK	V
5	137.90	36.04	-8.68	27.36	43.50	16.14	100	21	PK	V
6	973.47	25.23	7.72	32.95	54.00	21.05	100	349	PK	V

For above 1GHz

DH5 2402MHz

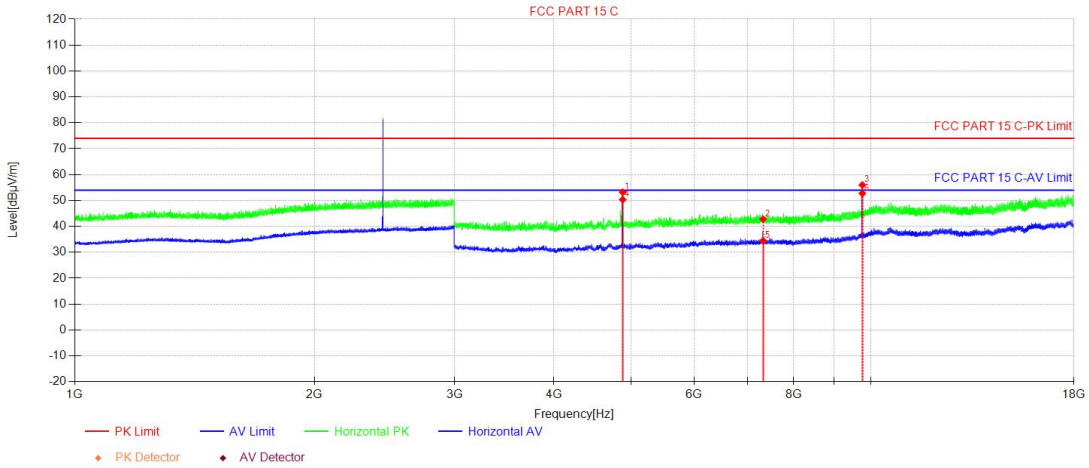


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	4800.84	56.85	-4.60	52.25	74.00	21.75	150	55	PK	H
2	7206.21	44.77	-1.76	43.01	74.00	30.99	150	162	PK	H
3	9601.83	52.44	0.84	53.28	74.00	20.72	150	4	PK	H
4	4801.59	54.29	-4.60	49.69	54.00	4.31	150	37	AV	H
5	7206.21	35.37	-1.76	33.61	54.00	20.39	150	91	AV	H
6	9602.58	49.28	0.84	50.12	54.00	3.88	150	4	AV	H

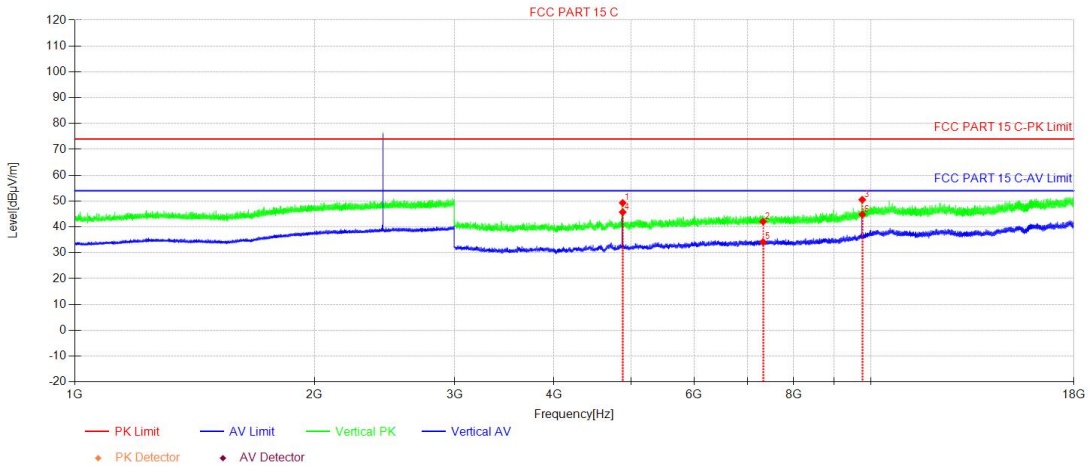


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	4800.84	51.95	-4.60	47.35	74.00	26.65	150	340	PK	V
2	7206.21	44.31	-1.76	42.55	74.00	31.45	150	107	PK	V
3	9608.58	42.29	0.88	43.17	74.00	30.83	150	126	PK	V
4	4801.59	48.41	-4.60	43.81	54.00	10.19	150	340	AV	V
5	7206.21	35.55	-1.76	33.79	54.00	20.21	150	4	AV	V
6	9608.58	34.12	0.88	35.00	54.00	19.00	150	323	AV	V

DH5 2441MHz

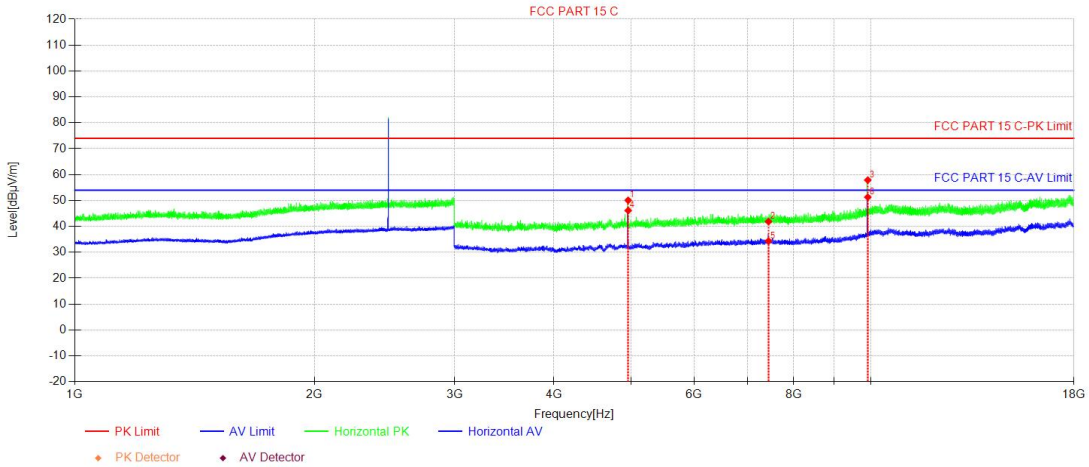


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	4878.84	57.92	-4.70	53.22	74.00	20.78	150	36	PK	H
2	7323.22	44.27	-1.49	42.78	74.00	31.22	150	288	PK	H
3	9758.59	54.38	1.62	56.00	74.00	18.00	150	3	PK	H
4	4879.59	55.02	-4.70	50.32	54.00	3.68	150	36	AV	H
5	7323.22	35.93	-1.49	34.44	54.00	19.56	150	288	AV	H
6	9758.59	51.10	1.62	52.72	54.00	1.28	150	3	AV	H

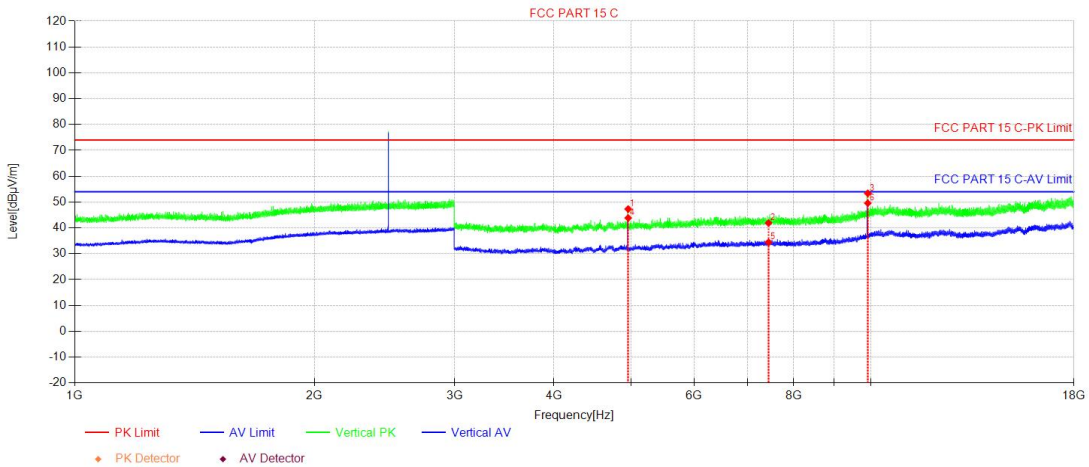


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	4878.84	53.99	-4.70	49.29	74.00	24.71	150	339	PK	V
2	7323.22	43.53	-1.49	42.04	74.00	31.96	150	322	PK	V
3	9757.84	48.91	1.61	50.52	74.00	23.48	150	2	PK	V
4	4879.59	50.41	-4.70	45.71	54.00	8.29	150	322	AV	V
5	7323.22	35.62	-1.49	34.13	54.00	19.87	150	88	AV	V
6	9758.59	43.20	1.62	44.82	54.00	9.18	150	2	AV	V

DH5 2480MHz



NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	4956.85	54.91	-4.85	50.06	74.00	23.94	150	0	PK	H
2	7440.22	43.21	-1.34	41.87	74.00	32.13	150	357	PK	H
3	9913.85	55.64	2.24	57.88	74.00	16.12	150	4	PK	H
4	4957.60	50.99	-4.86	46.13	54.00	7.87	150	40	AV	H
5	7440.22	35.69	-1.34	34.35	54.00	19.65	150	303	AV	H
6	9914.60	49.05	2.24	51.29	54.00	2.71	150	4	AV	H



NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	4956.85	52.15	-4.85	47.30	74.00	26.70	150	323	PK	V
2	7440.22	43.24	-1.34	41.90	74.00	32.10	150	341	PK	V
3	9913.85	51.17	2.24	53.41	74.00	20.59	150	15	PK	V
4	4957.60	48.69	-4.86	43.83	54.00	10.17	150	341	AV	V
5	7440.22	35.77	-1.34	34.43	54.00	19.57	150	51	AV	V
6	9914.60	47.34	2.24	49.58	54.00	4.42	150	15	AV	V

Note:

1. The Measurement (Result Level) is calculated by Reading Level adding the Correct Factor(maybe including Ant.Factor and the Cable Factor etc.), The basic equation is as follows:
   Result Level= Reading Level + Correct Factor(including Ant.Factor, Cable Factor etc.)
2. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
3. The amplitude of 18GHz to 25GHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be report.
4. All channels had been pre-test, DH5 is the worst case, only the worst case was reported.