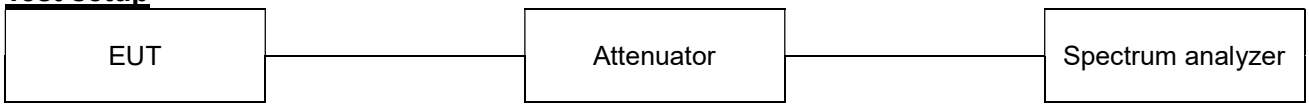
7.3. 6 dB Bandwidth(DTS Channel Bandwidth)

Test setup



Limit

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902–928 MHz, 2 400–2 483.5 MHz, and 5 725–5 850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure

ANSI C63.10 - Section 11.8.2

Test settings

DTS bandwidth

One of the following procedures may be used to determine the modulated DTS bandwidth.

Option 1

1) Set RBW = 100 kHz.
2) Set the video bandwidth (VBW) ≥ 3 x RBW.
3) Detector = Peak.
4) Trace mode = max hold.
5) Sweep = auto couple.
6) Allow the trace to stabilize.
7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Option 2

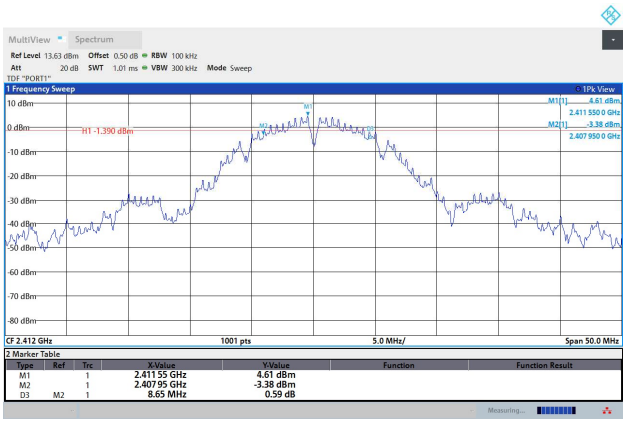
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6 dB.

Test results

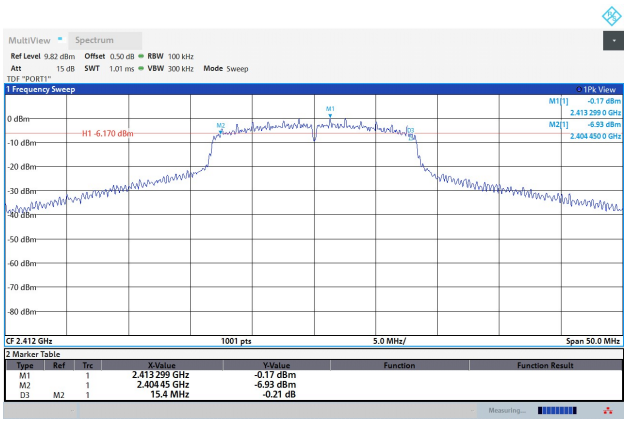
Test mode	Frequency(㎒)	6 ㏈ bandwidth(㎒)
802.11b	2 412	8.65
	2 437	8.15
	2 462	8.15
802.11g	2 412	15.40
	2 437	15.80
	2 462	15.20
802.11n HT20	2 412	15.20
	2 437	15.20
	2 462	15.20

6 dB bandwidth

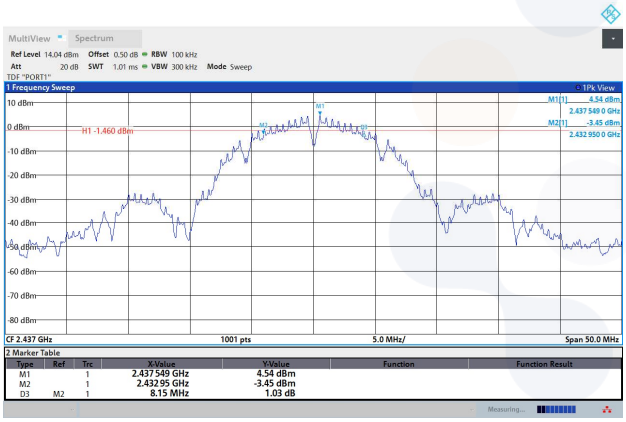
802.11b / 2 412 MHz



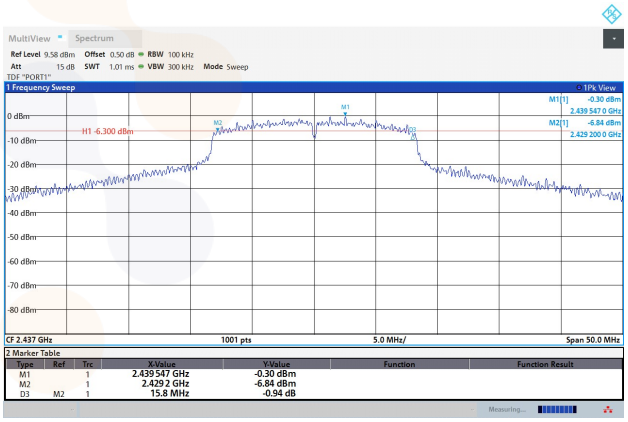
802.11g / 2 412 MHz



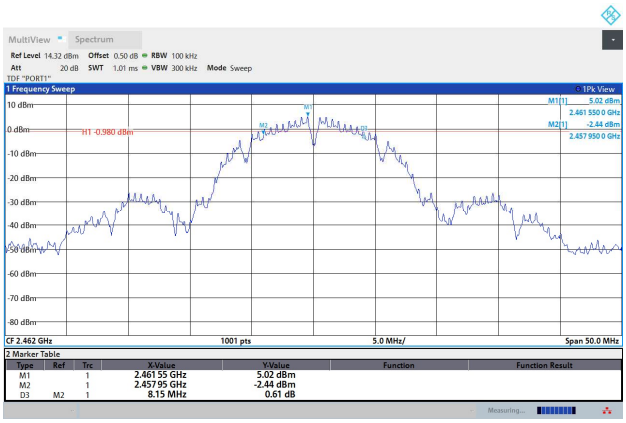
802.11b / 2 437 MHz



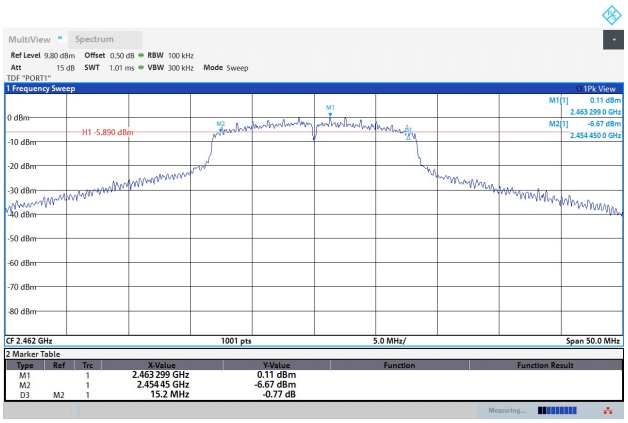
802.11g / 2 437 MHz



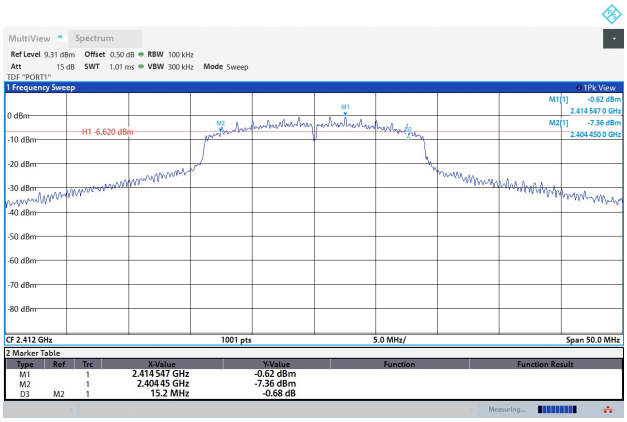
802.11b / 2 462 MHz



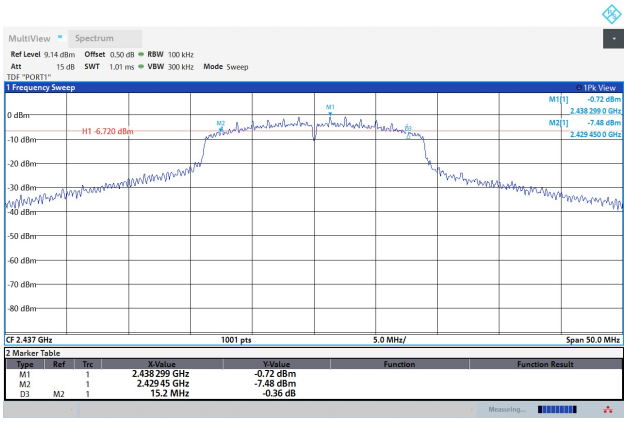
802.11g / 2 462 MHz



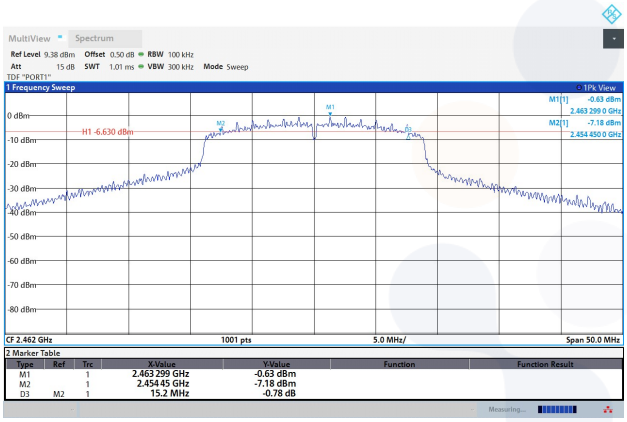
802.11n HT20 / 2 412 ㎒



802.11n HT20 / 2 437 ㎒



802.11n HT20 / 2 462 ㎒



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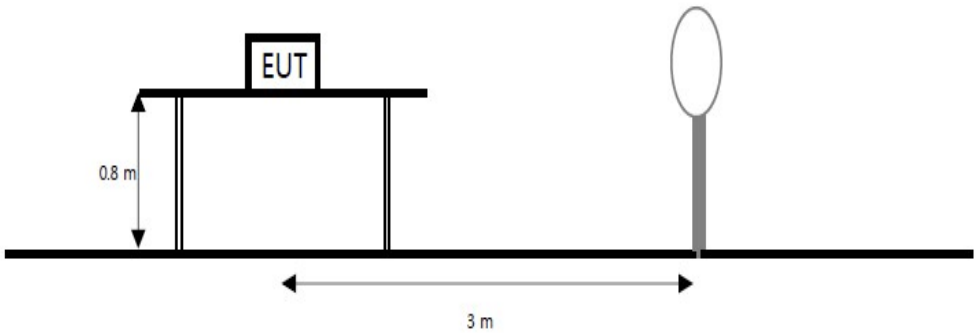
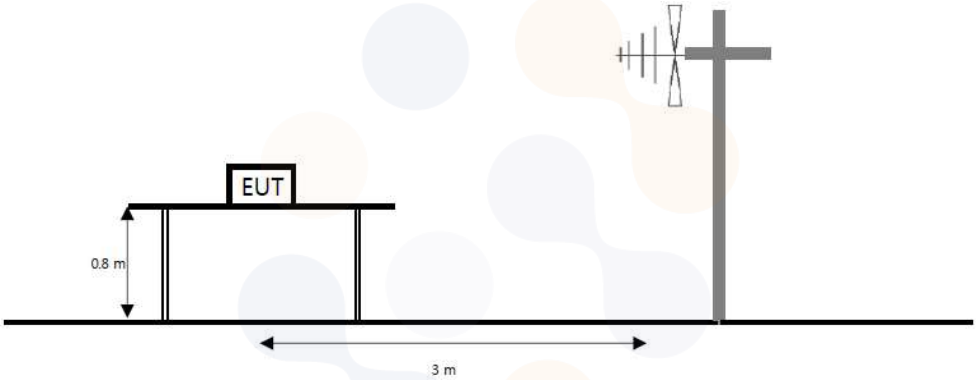
7.4. Spurious Emission, Band Edge and Restricted bands

Test setup

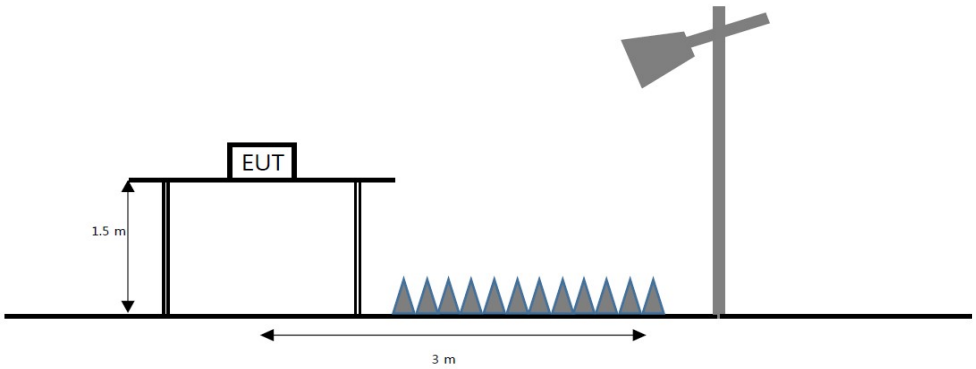
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



Limit

According to section 15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field strength (㎛/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

According to section 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

㎒	㎒	㎒	㎓
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 ㎒, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 ㎒, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

Test procedure
ANSI C63.10-2013

Test settings
Peak field strength measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW ≥ (3×RBW)
4. Detector = peak
5. Sweep time = auto
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

Table. RBW as a function of frequency

Frequency	RBW
9 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

Average field strength measurements

Trace averaging with continuous EUT transmission at full power

If the EUT can be configured or modified to transmit continuously (D ≥ 98%), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1. RBW = 1 ㎒ (unless otherwise specified).
2. VBW ≥ (3×RBW).
3. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
4. Averaging type = power (i.e., rms):
   1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
   2) Some instruments require linear display mode to use linear voltage averaging. Log or ㏈ averaging shall not be used.
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.

Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (D ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%), then the following procedure shall be used:

1. The EUT shall be configured to operate at the maximum achievable duty cycle.
2. Measure the duty cycle D of the transmitter output signal as described in 11.6.
3. RBW = 1 ㎒ (unless otherwise specified).
4. VBW ≥ [3 × RBW].
5. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
6. Averaging type = power (i.e., rms):

1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.

7. Sweep time = auto.
8. Perform a trace average of at least 100 traces.
9. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
   1) If power averaging (rms) mode was used in step f), then the applicable correction factor is [10 log (1 / D)], where D is the duty cycle.
   2) If linear voltage averaging mode was used in step f), then the applicable correction factor is [20 log (1 / D)], where D is the duty cycle.
   3) If a specific emission is demonstrated to be continuous (D ≥ 98%) rather than turning ON and OFF with with the transmit cycle, then no duty cycle correction is required for that emission.

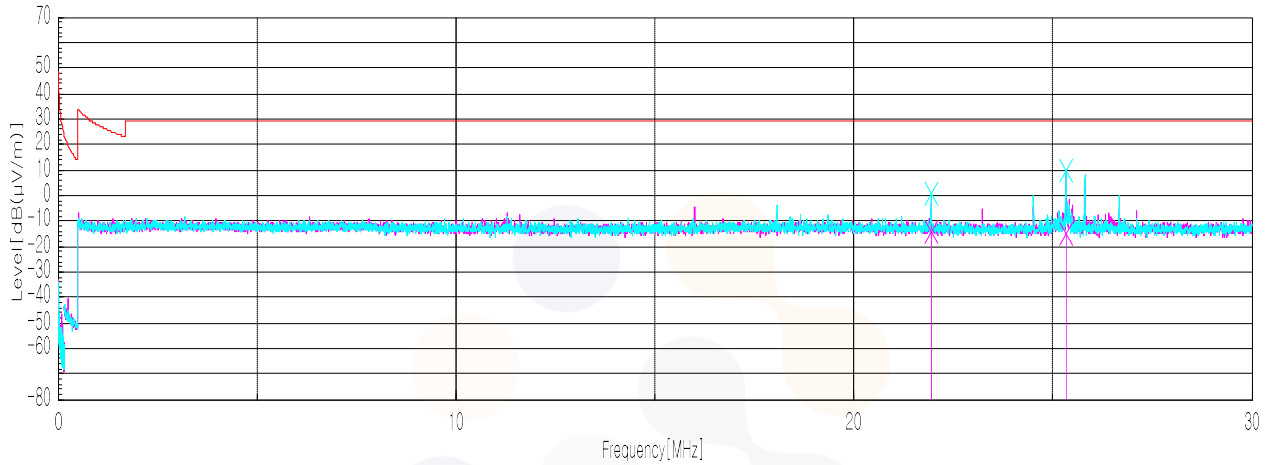
Notes:

1. f <30 MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/D_s)$
   f ≥30 MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/D_s)$
   Where:
   F_d= Distance factor in dB
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d(dB)
3. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
4. Average test would be performed if the peak result were greater than the average limit.
5. [1)] means restricted band.

Test results (Below 30 ㎒) –Worst case: 802.11g mode / 2 437 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
21.94	V	35.20	20.82	-30.68	-	-14.66	29.50	44.16
25.34	V	34.50	20.95	-30.30	-	-14.85	29.50	44.35

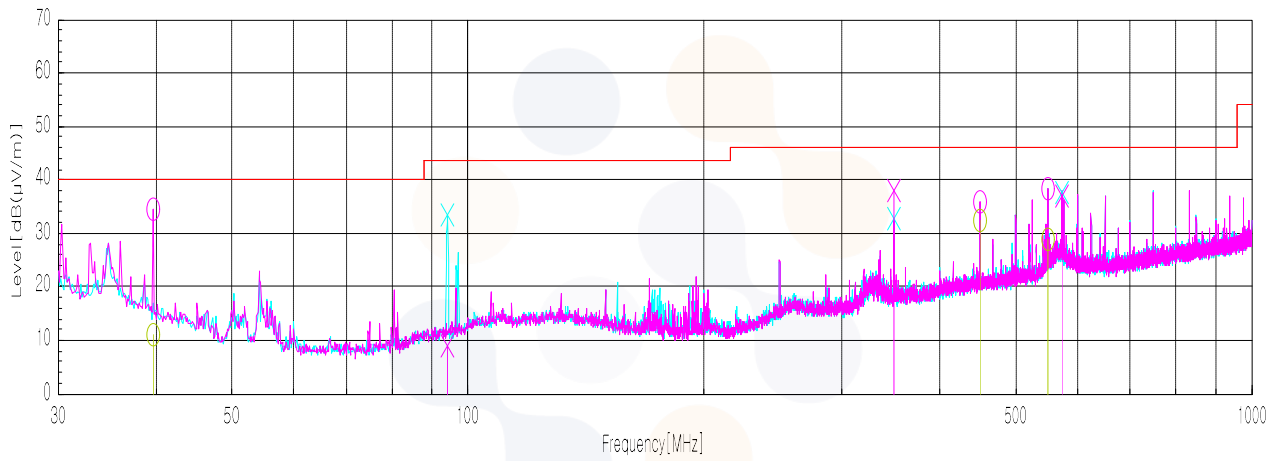
Horizontal/Vertical



Test results (Below 1 000 ㎒) – Worst case: 802.11g mode / 2 437 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
39.70	H	21.20	19.41	-29.52	-	11.09	40.00	28.91
94.26	V	21.80	15.30	-28.06	-	9.04	43.50	34.46
349.98	V	42.30	20.10	-24.39	-	38.01	46.00	7.99
450.01	H	33.00	22.70	-23.37	-	32.33	46.00	13.67
550.04	H	26.50	24.80	-22.31	-	28.99	46.00	17.01
571.99	V	34.70	24.46	-22.12	-	37.04	46.00	8.96

Horizontal/Vertical



Test results (Above 1 000 ㎒)

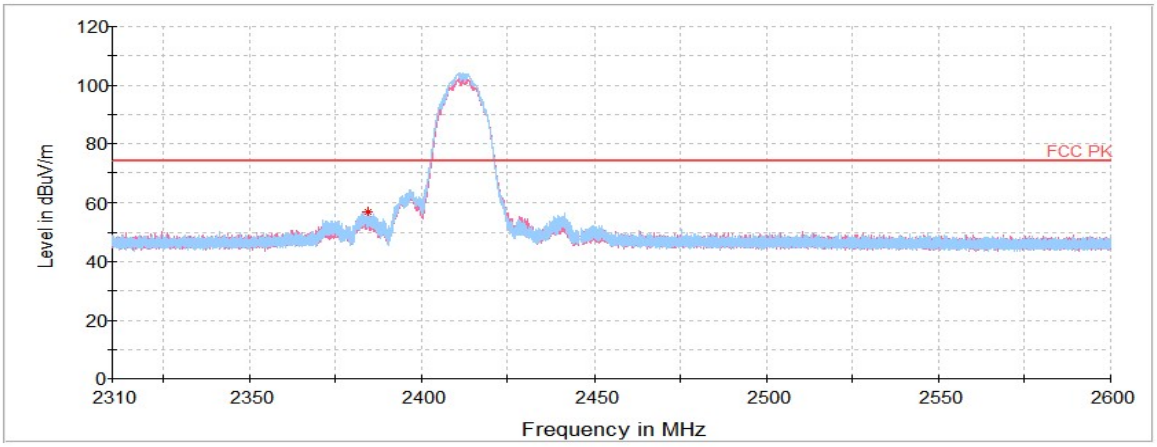
802.11b_2 412 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 383.58[1)]	H	51.06	31.94	-26.44	-	56.56	74.00	17.44
4 870.70[1)]	V	63.72	33.63	-53.49	-	43.86	74.00	30.14
5 330.17	V	64.44	34.26	-52.43	-	46.27	74.00	27.73
7 169.41	H	63.23	35.43	-51.36	-	47.30	74.00	26.70
Average Data								
2 383.58[1)]	H	44.72	31.94	-26.44	-	50.22	54.00	3.78

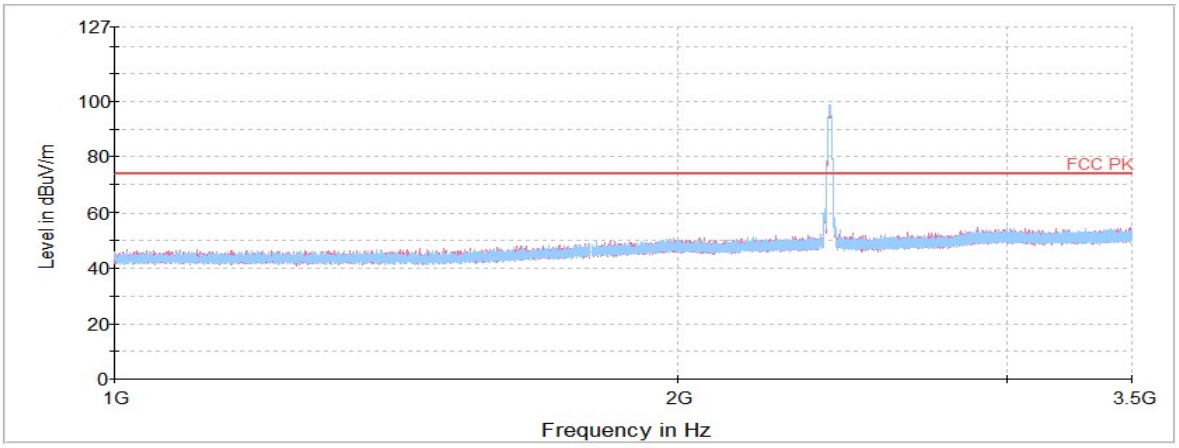
Average Data

Blank

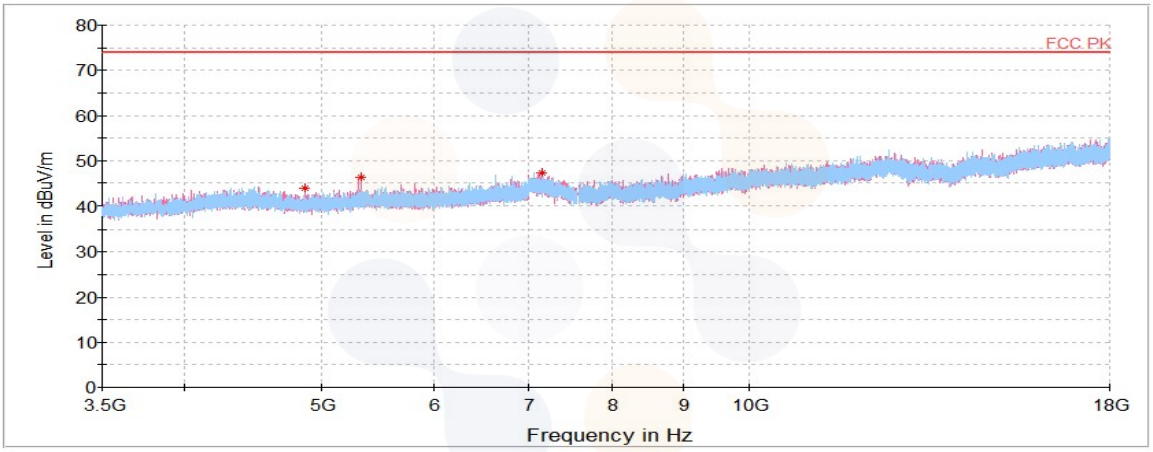
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



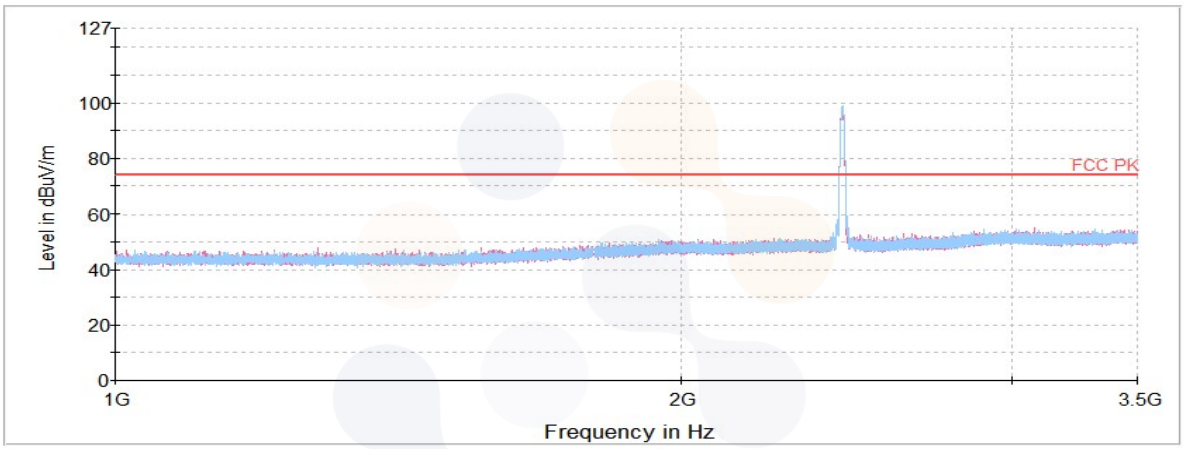
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



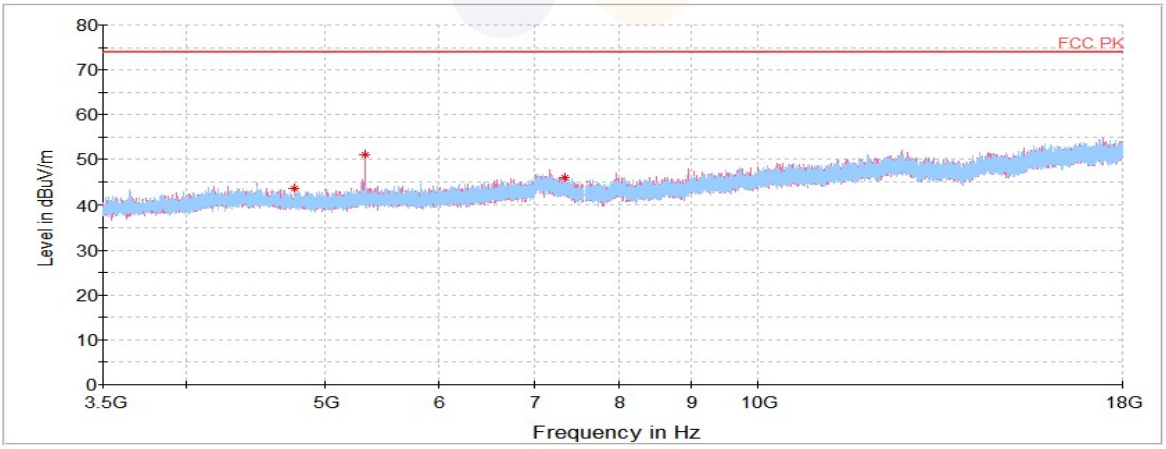
802.11b_2 437 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
4 757.42[1)]	H	63.31	33.65	-53.44	-	43.52	74.00	30.48
5 333.80	V	69.18	34.27	-52.44	-	51.01	74.00	22.99
7 365.61[1)]	V	62.65	35.35	-52.15	-	45.85	74.00	28.15
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



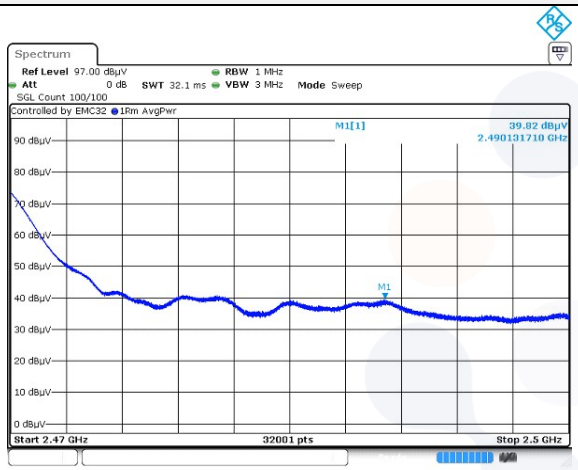
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



802.11b_2 462 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 490.13[1)]	H	45.58	32.18	-26.53	-	51.23	74.00	22.77
5 010.72[1)]	H	63.17	33.62	-53.22	-	43.57	74.00	30.43
5 307.97	H	63.72	34.22	-52.40	-	45.54	74.00	28.46
7 448.53[1)]	H	62.64	35.32	-52.49	-	45.47	74.00	28.53
Average Data								
2 490.13[1)]	H	39.82	32.18	-26.53	-	45.47	54.00	8.53

Average Data



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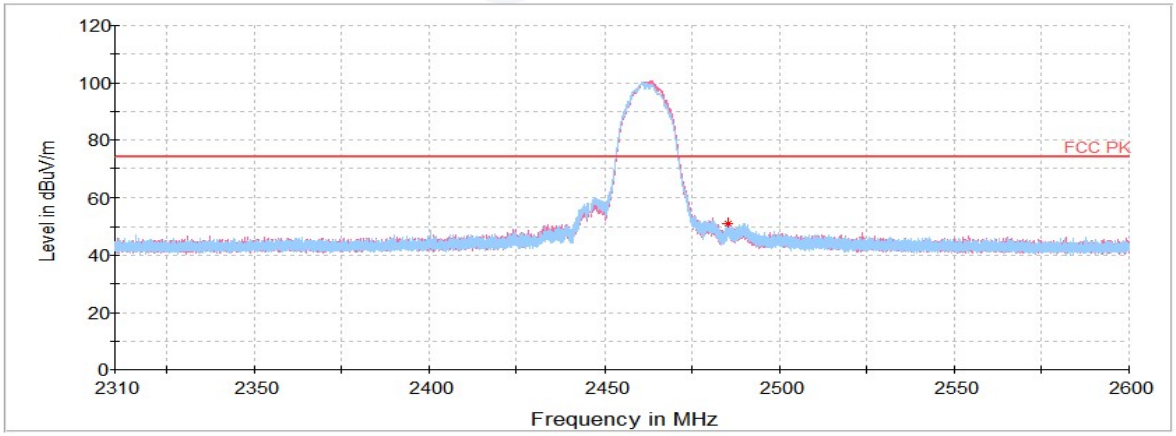
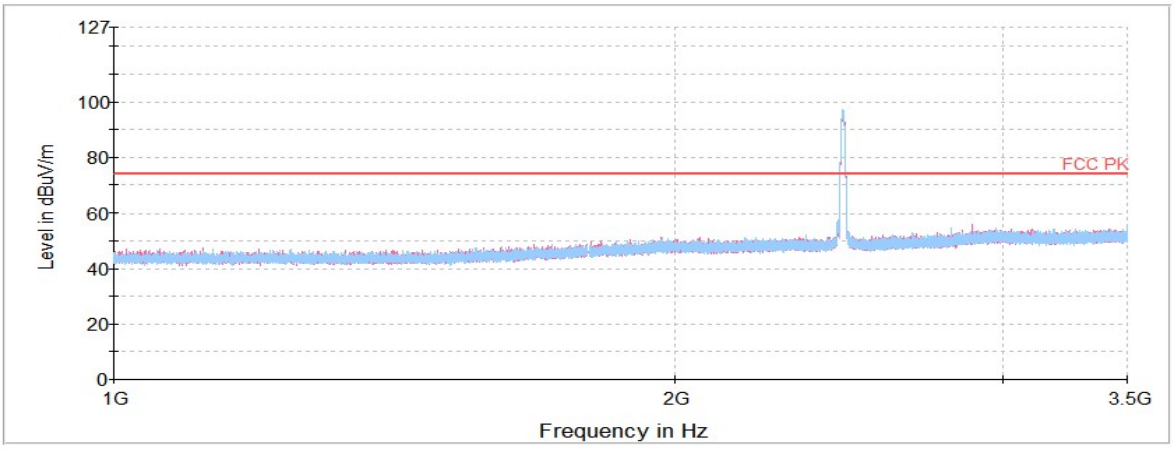
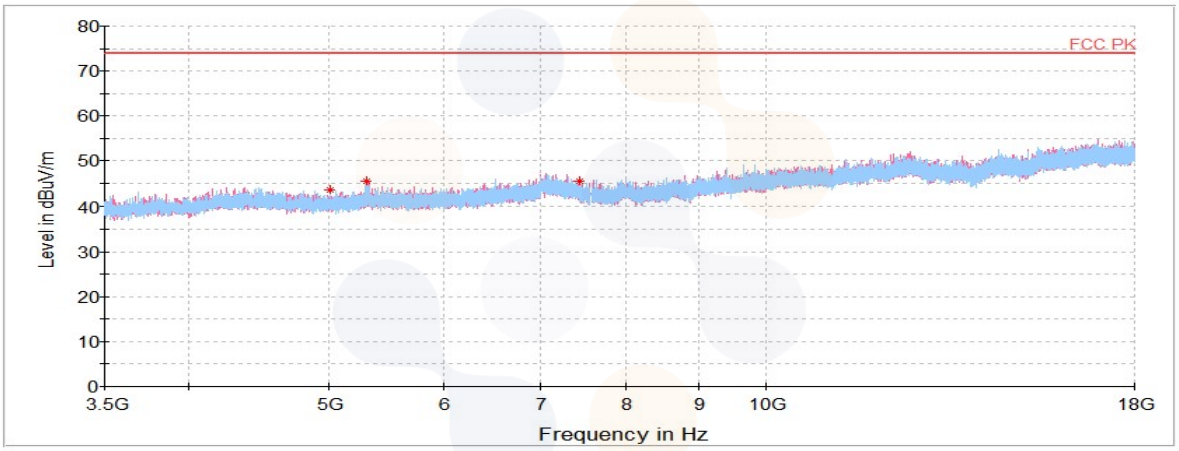
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



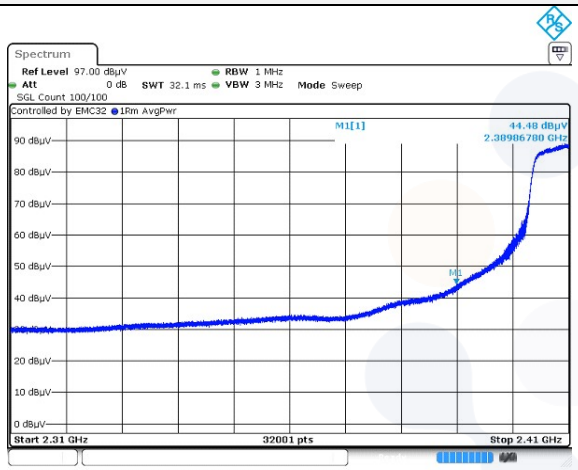
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



802.11g_2 412 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 389.87[1)]	V	54.82	31.96	-26.42	-	60.36	74.00	13.64
4 867.53[1)]	V	63.10	33.63	-53.49	-	43.24	74.00	30.76
5 339.23	V	65.84	34.28	-52.45	-	47.67	74.00	26.33
7 182.09	V	62.53	35.43	-51.41	-	46.55	74.00	27.45
Average Data								
2 389.87[1)]	V	44.48	31.96	-26.42	0.30	50.32	54.00	3.68

Average Data



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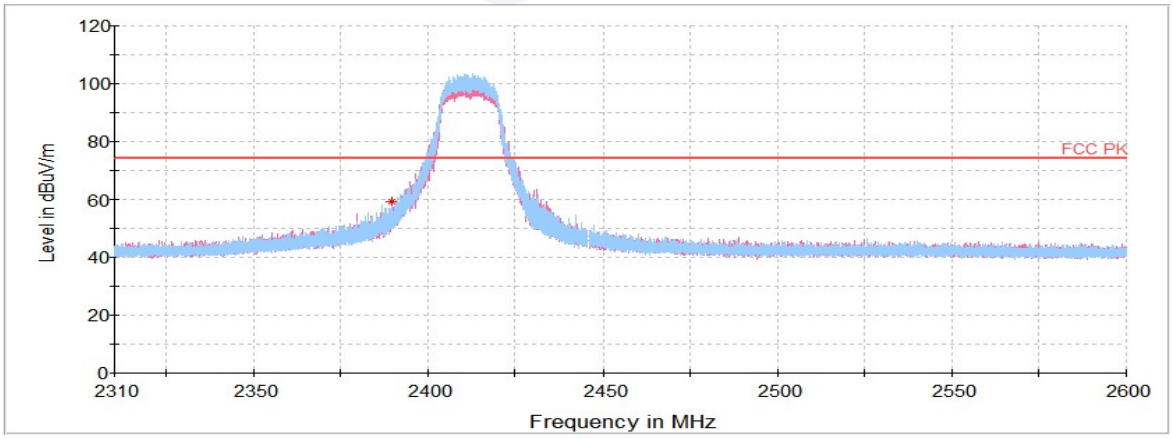
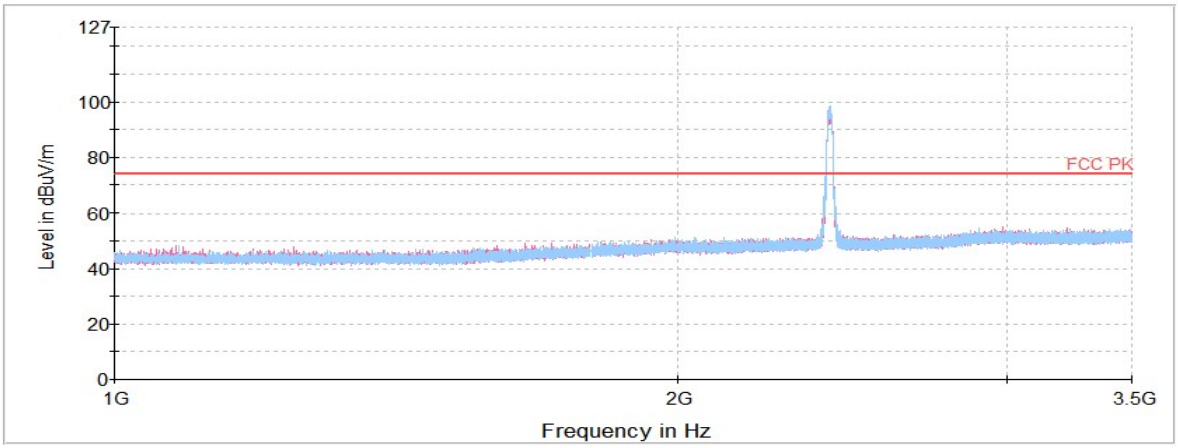
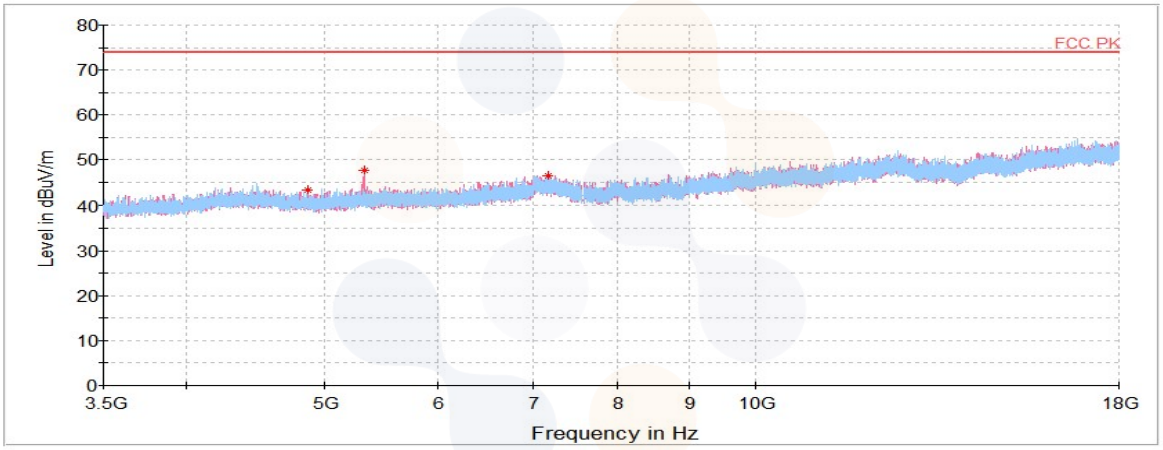
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



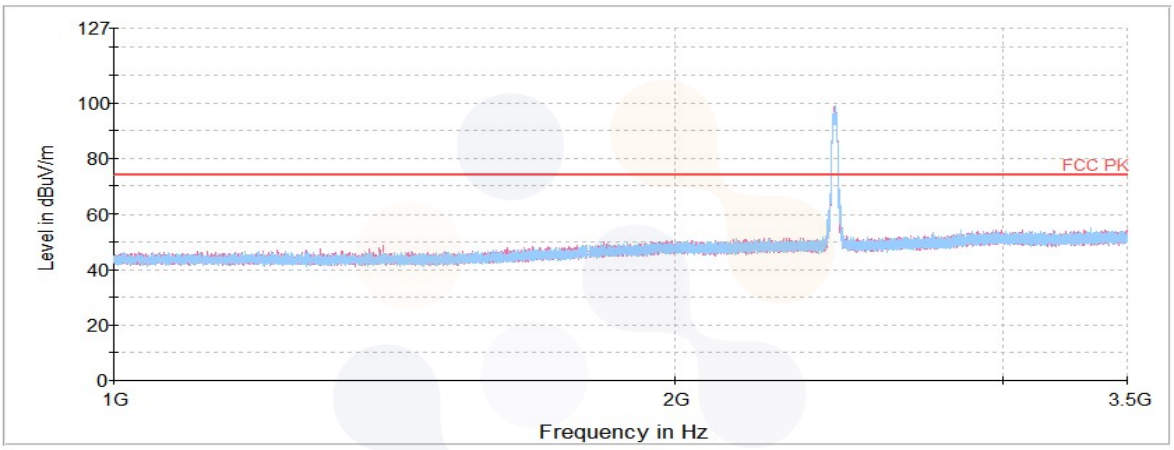
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



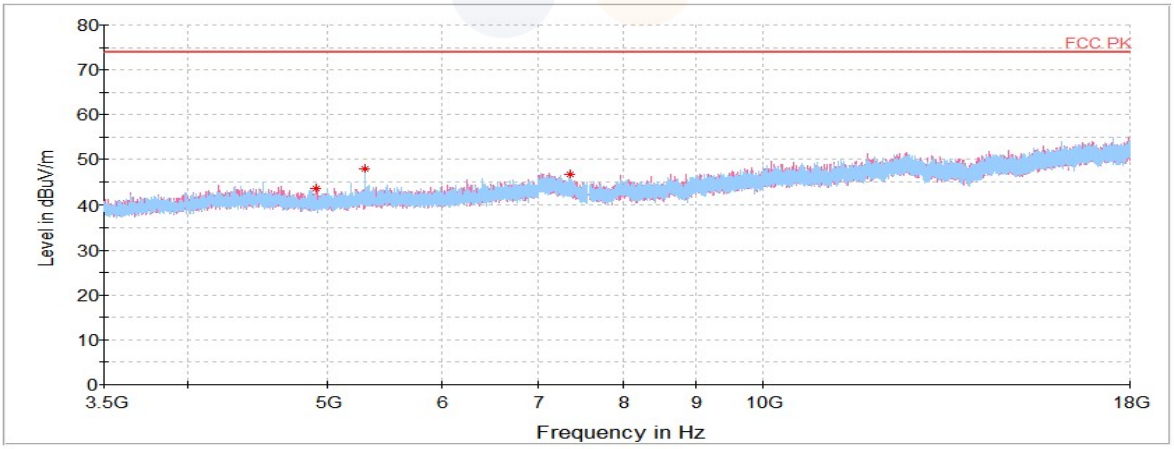
802.11g_2 437 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
4 914.66[1)]	V	63.36	33.62	-53.46	-	43.52	74.00	30.48
5 312.95	H	66.18	34.23	-52.40	-	48.01	74.00	25.99
7 376.03[1)]	V	63.64	35.35	-52.20	-	46.79	74.00	27.21
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



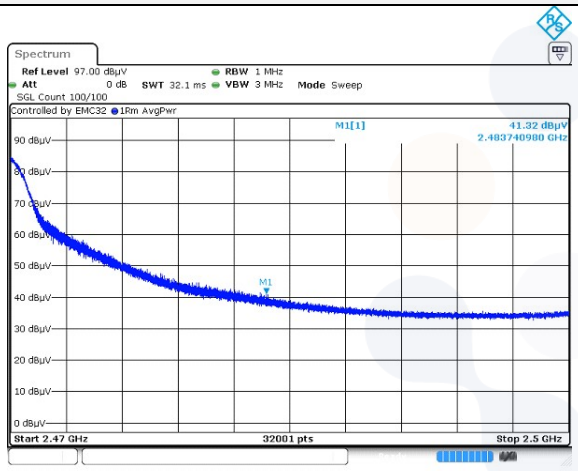
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



802.11g_2 462 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 483.74[1)]	H	52.30	32.16	-26.52	-	57.94	74.00	16.06
3 693.03[1)]	H	66.33	33.22	-54.65	-	44.90	74.00	29.10
4 934.59[1)]	H	63.06	33.61	-53.41	-	43.26	74.00	30.74
5 312.50	V	69.48	34.23	-52.40	-	51.31	74.00	22.69
7 393.70[1)]	V	62.86	35.34	-52.27	-	45.93	74.00	28.07
Average Data								
2 483.74[1)]	H	41.32	32.16	-26.52	0.30	47.26	54.00	6.74

Average Data



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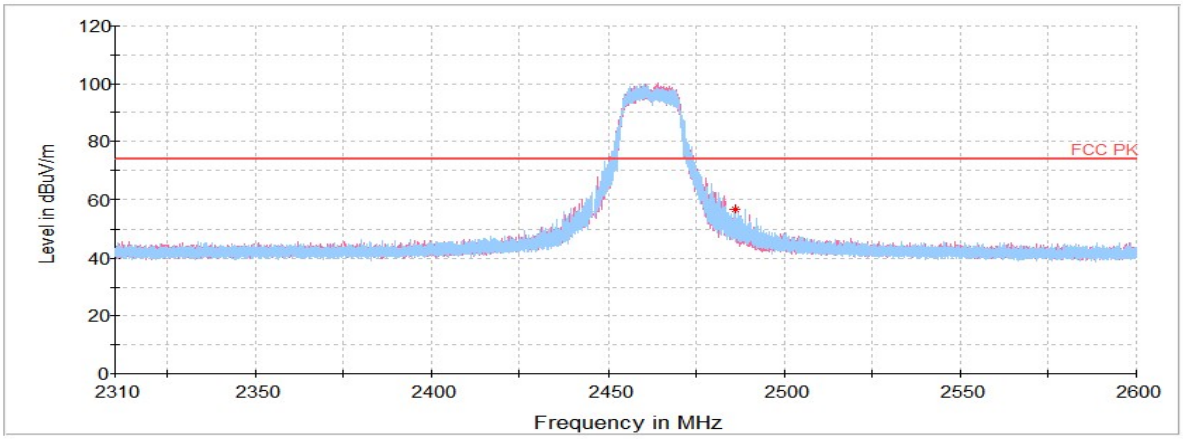
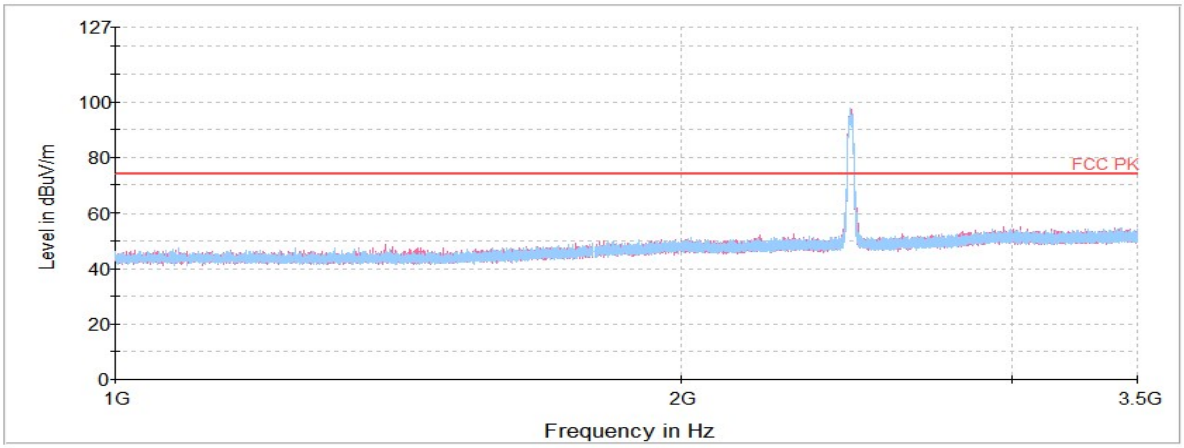
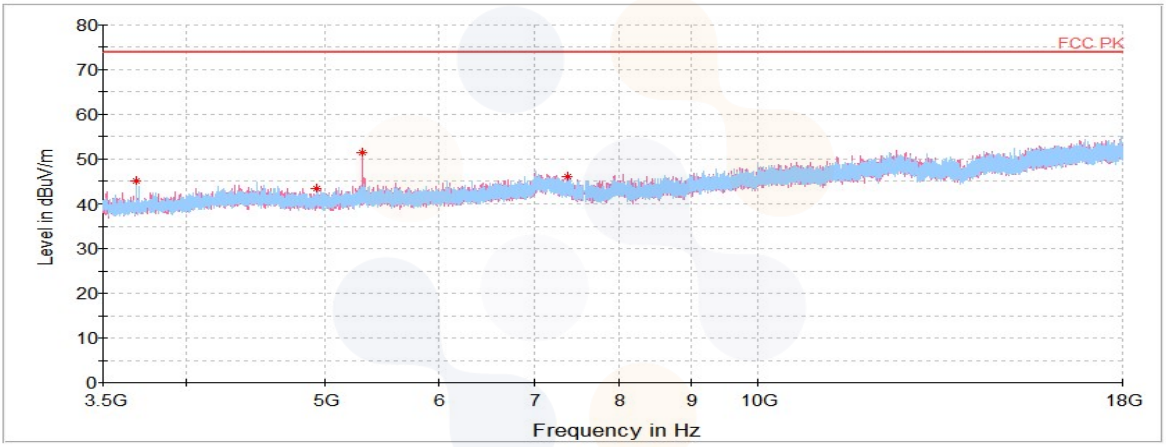
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



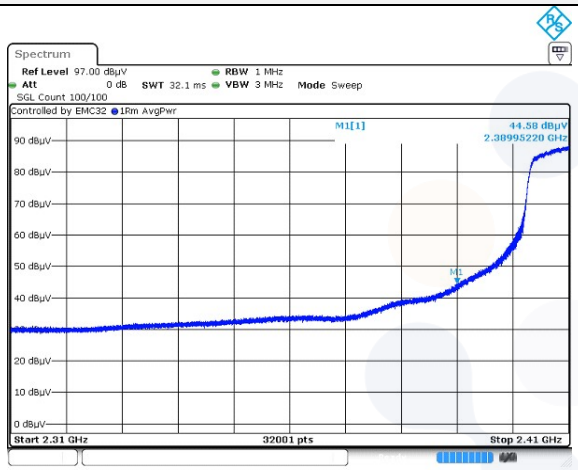
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



802.11n HT20_2 412 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 389.95[1)]	V	55.83	31.96	-26.42	-	61.37	74.00	12.63
4 877.95[1)]	H	62.83	33.62	-53.49	-	42.96	74.00	31.04
5 311.59	V	63.14	34.22	-52.40	-	44.96	74.00	29.04
7 190.70	H	62.96	35.42	-51.45	-	46.93	74.00	27.07
Average Data								
2 389.95[1)]	V	44.58	31.96	-26.42	0.32	50.44	54.00	3.56

Average Data



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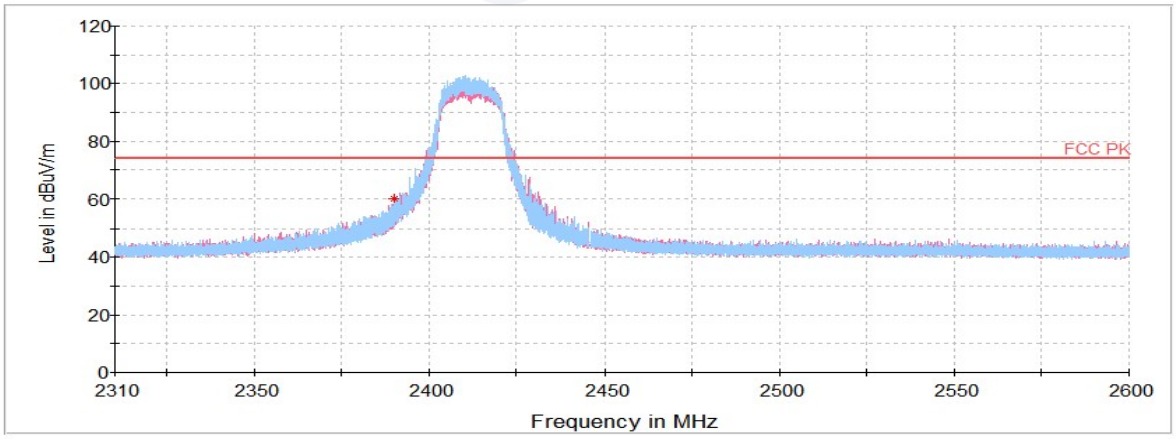
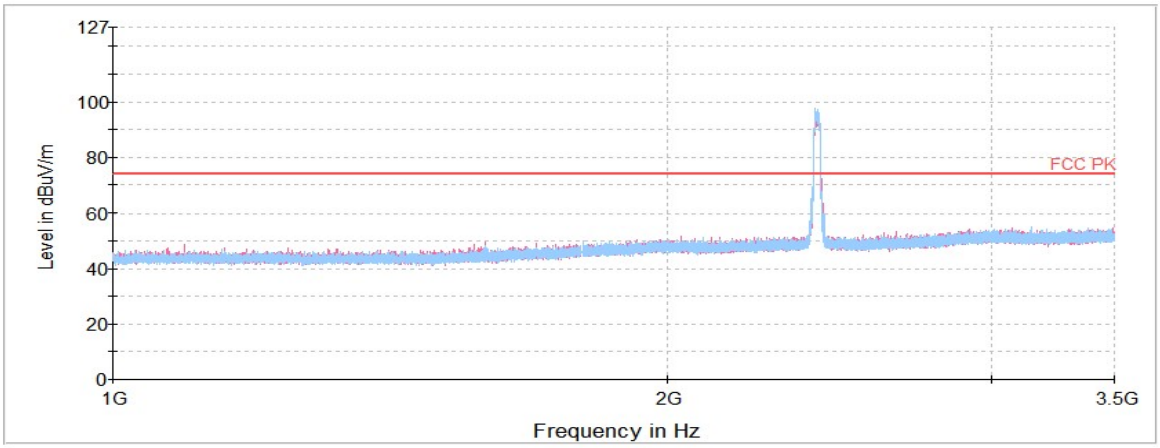
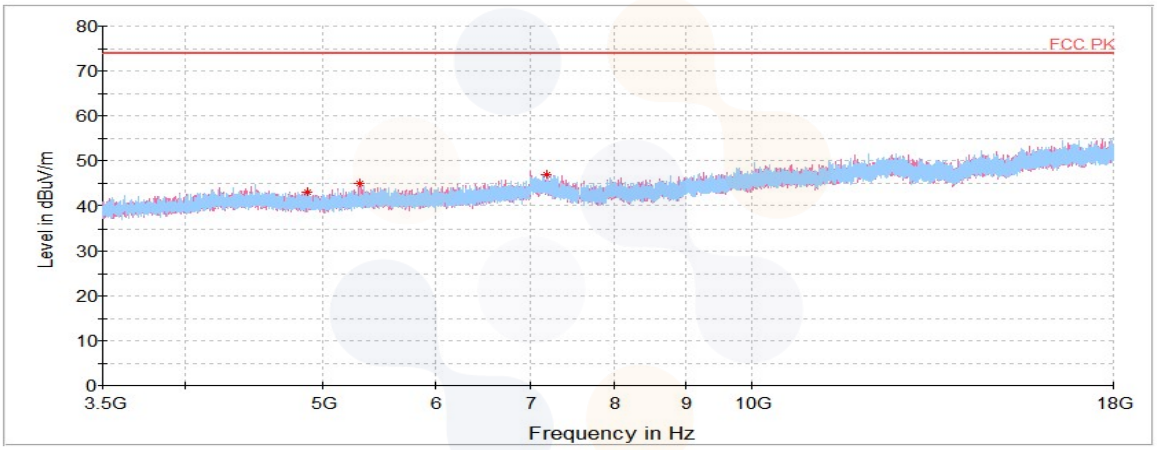
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



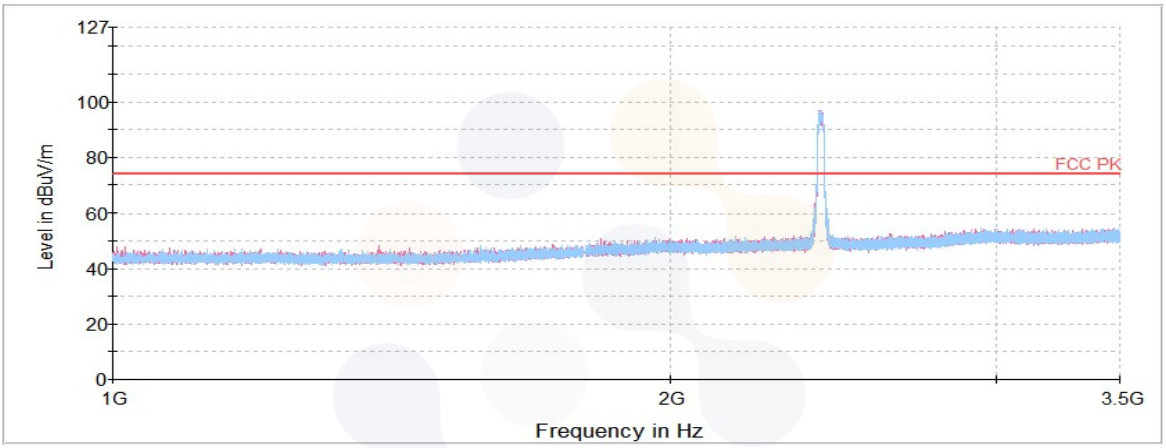
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



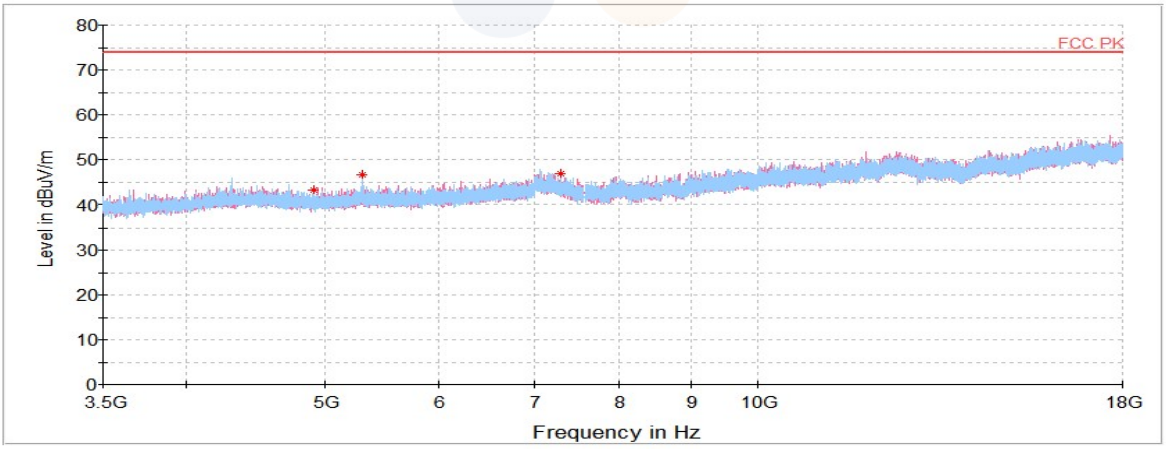
802.11n HT20_2 437 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
4 916.47[1)]	H	62.90	33.62	-53.46	-	43.06	74.00	30.94
5 311.59	H	64.87	34.22	-52.40	-	46.69	74.00	27.31
7 302.17[1)]	V	63.35	35.38	-51.90	-	46.83	74.00	27.17
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



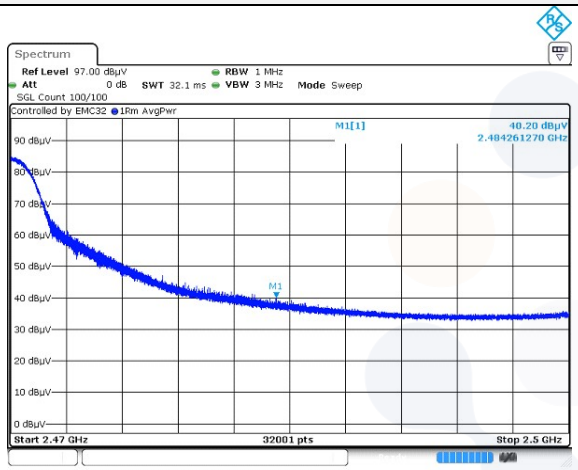
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



802.11n HT20_2 462 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 484.26[1)]	H	51.47	32.17	-26.52	-	57.12	74.00	16.88
4 974.92[1)]	H	63.48	33.61	-53.31	-	43.78	74.00	30.22
5 329.72	V	63.16	34.26	-52.43	-	44.99	74.00	29.01
7 414.55[1)]	H	63.89	35.33	-52.35	-	46.87	74.00	27.13
Average Data								
2 484.26[1)]	H	40.20	32.17	-26.52	0.32	46.17	54.00	7.83

Average Data



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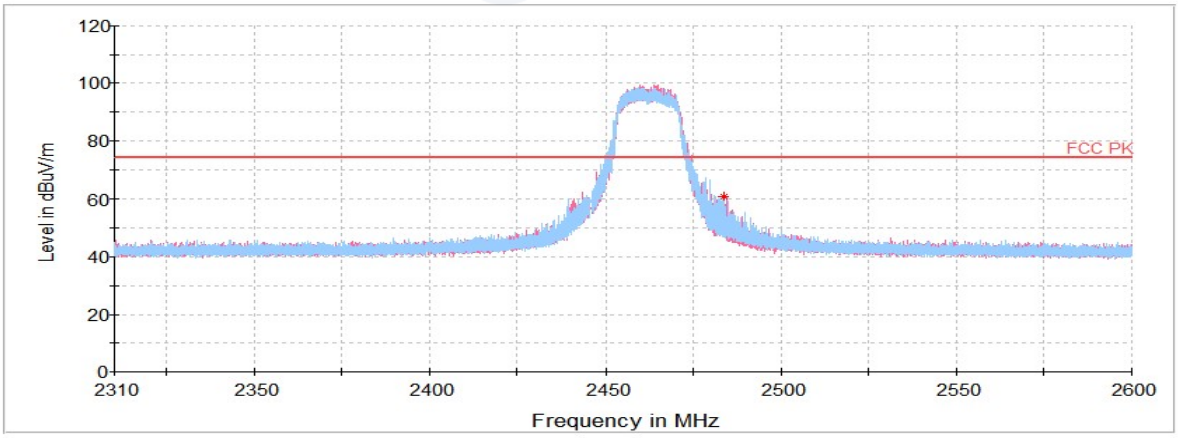
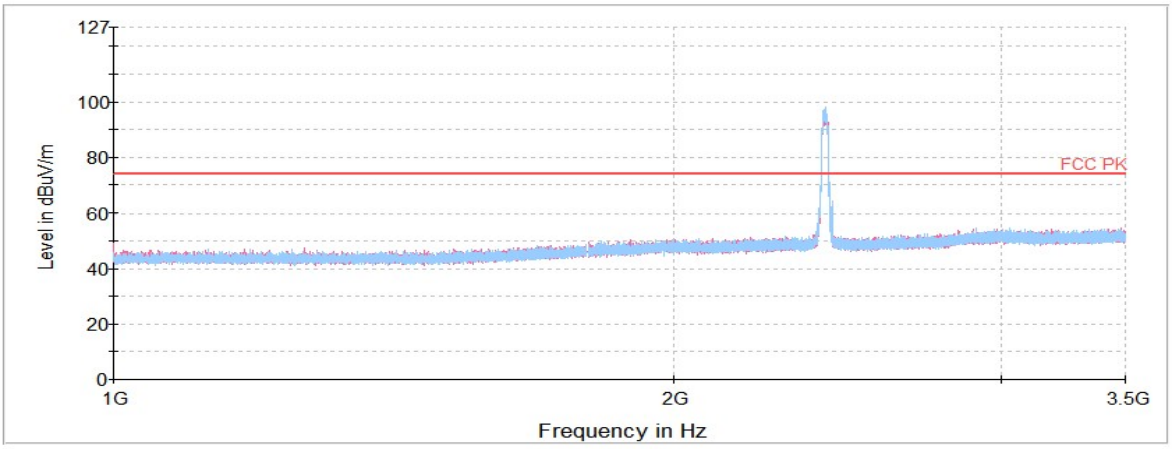
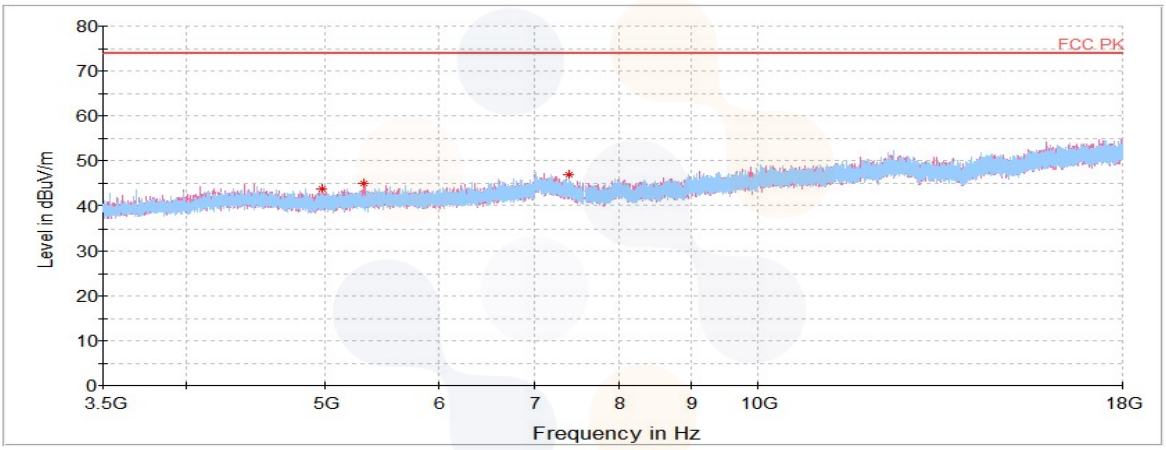
Horizontal/Vertical for Band-edge



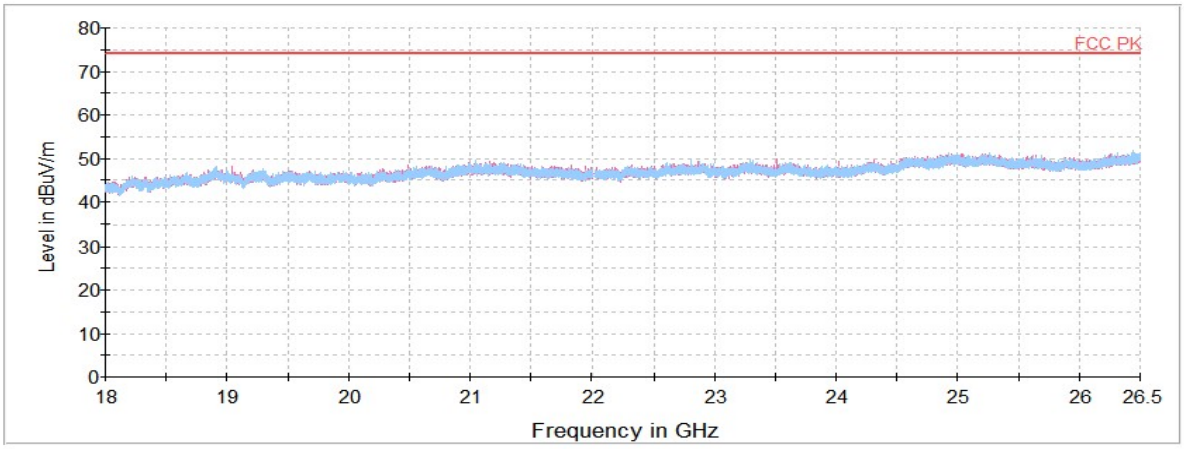
Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



Test results (Above 18 ㎓) – Worst case: 802.11n HT20_2 412 ㎒

Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓


Note: The worst case was based on the lowest margin condition considering harmonic and spurious emission.