



Mode: UNII-3

Operating frequency: 5 745 MHz

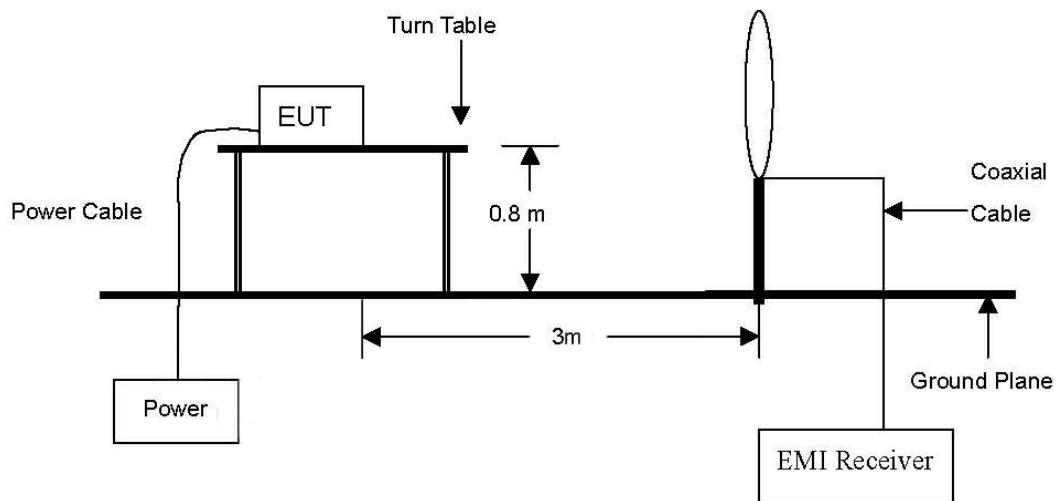
Test voltage (%)	Test voltage (V)	Temperature (°C)	Maintaining time	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	DC 3.850	-20.0	Startup	5 745.002 500	2 500	0.000 04
			2 minutes	5 745.010 000	10 000	0.000 17
			5 minutes	5 745.010 000	10 000	0.000 17
			10 minutes	5 744.985 000	-15 000	-0.000 26
		-10.0	Startup	5 745.017 500	17 500	0.000 30
			2 minutes	5 745.015 000	15 000	0.000 26
			5 minutes	5 744.997 500	-2 500	-0.000 04
			10 minutes	5 745.017 500	17 500	0.000 30
		0.0	Startup	5 744.987 500	-12 500	-0.000 22
			2 minutes	5 745.015 000	15 000	0.000 26
			5 minutes	5 744.992 500	-7 500	-0.000 13
			10 minutes	5 744.987 500	-12 500	-0.000 22
100 %	DC 3.850	10.0	Startup	5 744.972 500	-27 500	-0.000 48
			2 minutes	5 744.982 500	-17 500	-0.000 30
			5 minutes	5 744.977 500	-22 500	-0.000 39
			10 minutes	5 744.975 000	-25 000	-0.000 44
		20.0	Startup	5 744.967 500	-32 500	-0.000 57
			2 minutes	5 744.960 000	-40 000	-0.000 70
			5 minutes	5 744.980 000	-20 000	-0.000 35
			10 minutes	5 744.967 500	-32 500	-0.000 57
		25.4	Startup	5 744.952 500	-47 500	-0.000 83
			2 minutes	5 744.960 000	-40 000	-0.000 70
			5 minutes	5 744.957 500	-42 500	-0.000 74
			10 minutes	5 744.952 500	-47 500	-0.000 83
100 %	DC 3.850	30.0	Startup	5 744.962 500	-37 500	-0.000 65
			2 minutes	5 744.955 000	-45 000	-0.000 78
			5 minutes	5 744.965 000	-35 000	-0.000 61
			10 minutes	5 744.977 500	-22 500	-0.000 39
		40.0	Startup	5 744.967 500	-32 500	-0.000 57
			2 minutes	5 744.960 000	-40 000	-0.000 70
			5 minutes	5 744.957 500	-42 500	-0.000 74
			10 minutes	5 744.965 000	-35 000	-0.000 61
		50.0	Startup	5 744.982 500	-17 500	-0.000 30
			2 minutes	5 744.962 500	-37 500	-0.000 65
			5 minutes	5 744.967 500	-32 500	-0.000 57
			10 minutes	5 744.972 500	-27 500	-0.000 48
100 %	DC 4.428	55.0	Startup	5 744.975 000	-25 000	-0.000 44
			2 minutes	5 744.967 500	-32 500	-0.000 57
			5 minutes	5 744.980 000	-20 000	-0.000 35
			10 minutes	5 744.970 000	-30 000	-0.000 52
		25.4	Startup	5 744.967 500	-32 500	-0.000 57
			2 minutes	5 744.967 500	-32 500	-0.000 57
			5 minutes	5 744.970 000	-30 000	-0.000 52
			10 minutes	5 744.972 500	-27 500	-0.000 48
		25.4	Startup	5 744.970 000	-30 000	-0.000 52
			2 minutes	5 744.967 500	-32 500	-0.000 57
			5 minutes	5 744.957 500	-42 500	-0.000 74
			10 minutes	5 744.965 000	-35 000	-0.000 61



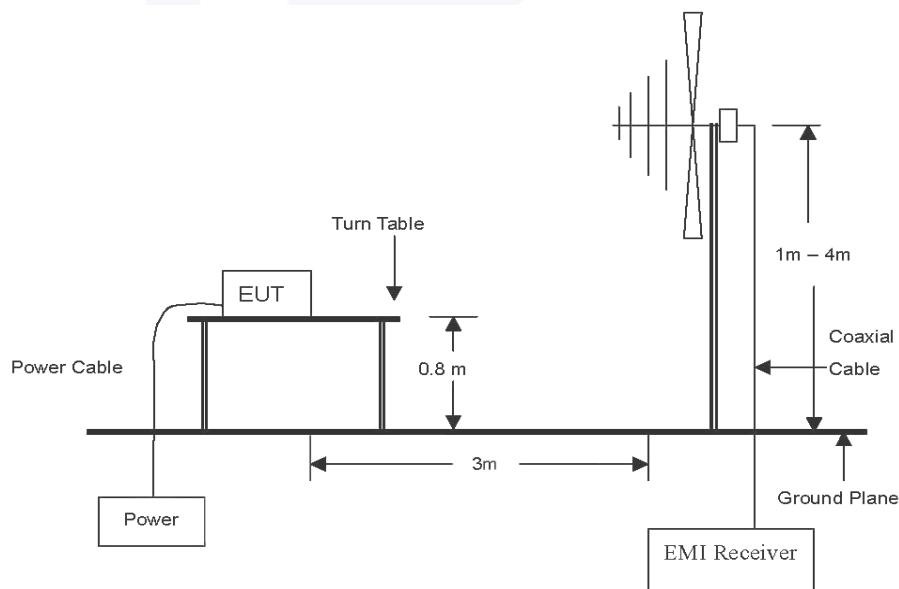
3.6. Radiated restricted band and emissions

Test setup

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

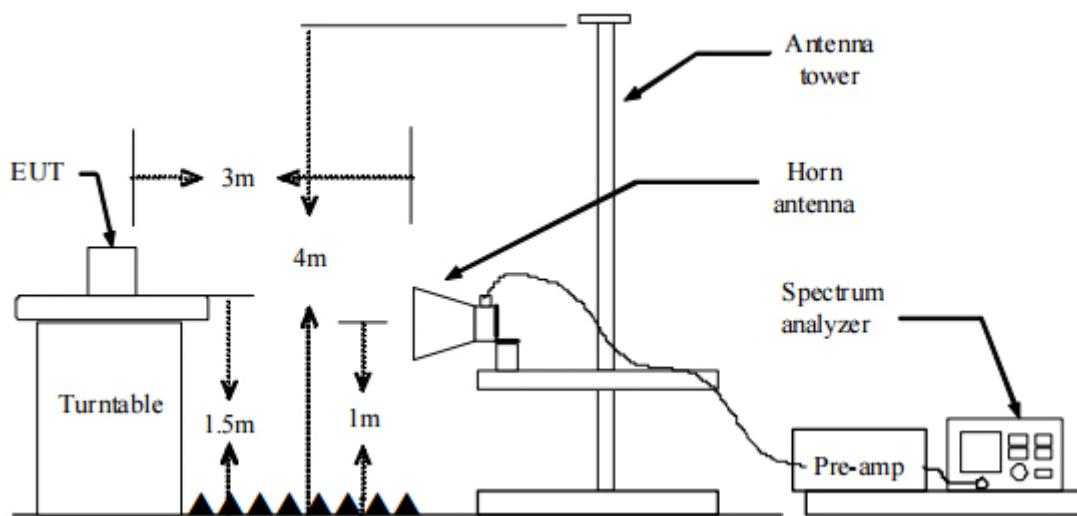


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.





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



Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

Test procedure below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel, ground parallel and perpendicular of the antenna are set to make the measurement. It was determined that parallel was worst-case orientation; therefore, all final radiated testing was performed with the EUT in parallel.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 MHz

1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna ,and its height are 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.
3. 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 and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
5. Spectrum analyzer settings for $f < 1$ GHz:
 - ① Span = wide enough to fully capture the emission being measured
 - ② RBW = 100 kHz
 - ③ VBW \geq RBW
 - ④ Detector = quasi peak
 - ⑤ Sweep time = auto
 - ⑥ Trace = max hold

6. Spectrum analyzer settings for $f \geq 1 \text{ GHz}$: Peak

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW $\geq 3 \text{ MHz}$
- ④ Detector = peak
- ⑤ Sweep time = auto
- ⑥ Trace = max hold
- ⑦ Trace was allowed to stabilize

7. Spectrum analyzer settings for $f \geq 1 \text{ GHz}$: Average

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW $\geq 3 \times \text{RBW}$
- ④ Detector = RMS, if span/(# of points in sweep) $\leq (\text{RBW}/2)$. 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.
- ⑤ 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 in order to use linear voltage averaging. Log or dB averaging shall not be used.
- ⑥ Sweep = auto
- ⑦ Trace = max hold
- ⑧ Perform a trace average of at least 100 traces.
- ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is $10 \log(1/x)$, where x is the duty cycle.
 - 2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is $20 \log(1/x)$, where x is the duty cycle.
 - 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

**Note.**

1. $f < 30 \text{ MHz}$, extrapolation factor of 40 dB/decade of distance. $F_d = 40 \log(D_m/D_s)$
2. $f \geq 30 \text{ MHz}$, 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. Field strength(dB μ N/m) = Level(dB μ N) + CF (dB) + or DCF(dB)
3. Margin(dB) = Limit(dB μ N/m) - Field strength(dB μ N/m)
4. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
5. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.
6. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
7. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (MHz)	Distance (Meters)	Radiated (μ N/m)
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**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 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.



According to 15.407(b), (b) Undesirable emission limits: Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p of $-27 \text{ dBm}/\text{MHz}$.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of $-27 \text{ dBm}/\text{MHz}$.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of $-27 \text{ dBm}/\text{MHz}$.
- (4) For transmitters operating in the 5.725-5.85 GHz band:
 - i) All emissions shall be limited to a level of $-27 \text{ dBm}/\text{MHz}$ at 75 MHz or more above or below the band edge increasing linearly to $10 \text{ dBm}/\text{MHz}$ at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of $15.6 \text{ dBm}/\text{MHz}$ at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of $27 \text{ dBm}/\text{MHz}$ at the band edge.
 - ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

**Duty cycle**

Regarding to KDB 789033 D02 v02r01, B)2)b), the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

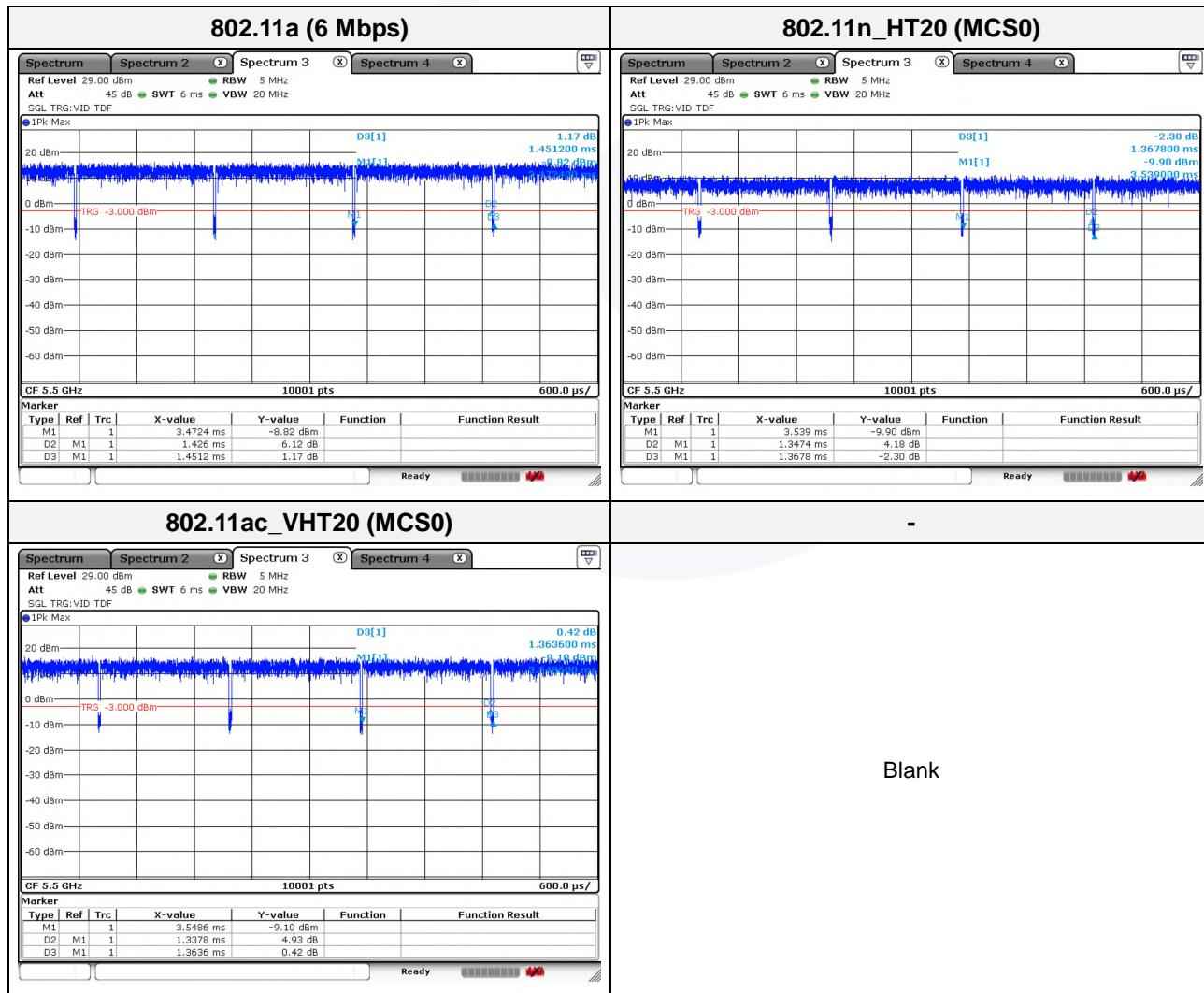
Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$, where T is defined in II.B.1.a), and the number of sweep points across duration T exceeds 100.

Test mode	T _{on} time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
802.11a	1.426	1.451	0.98	98.28	-
802.11n_HT20	1.338	1.364	0.98	98.09	-
802.11ac_VHT20	1.347	1.368	0.98	98.46	-

Note:

Duty cycle (Linear) = T_{on} time/Period

DCF(Duty cycle correction factor (dB)) = 10log(1/duty cycle)

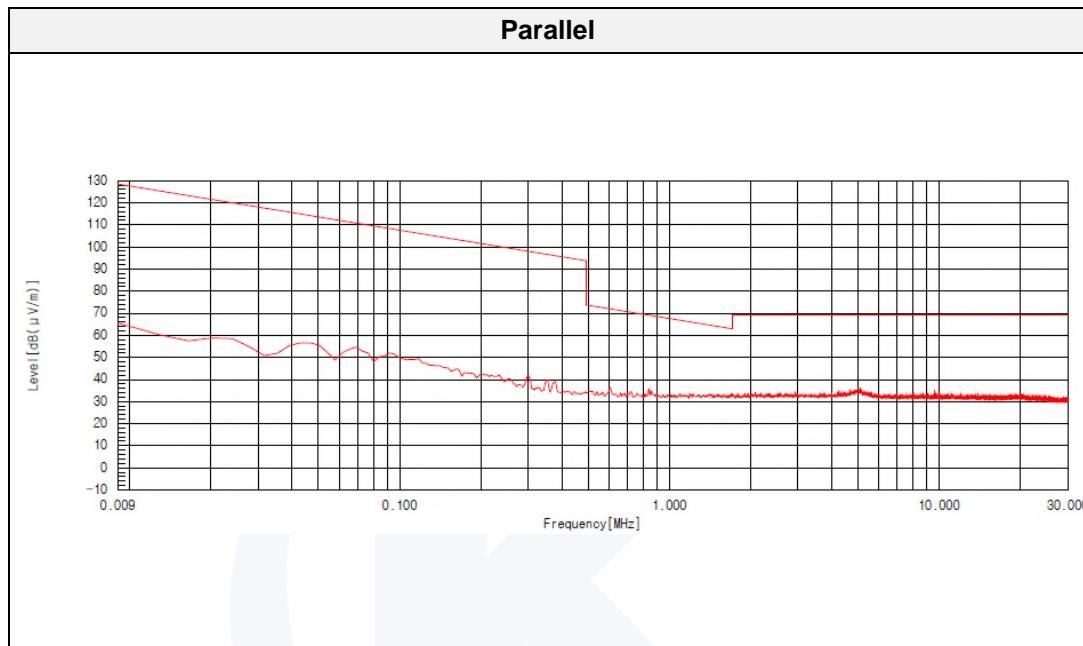


**Test results (Below 30 MHz)**

Band 802.11ac_VHT20 (MCS0) (Worst Case)

Distance of measurement: 3 meter

Channel 100 (Worst Case)

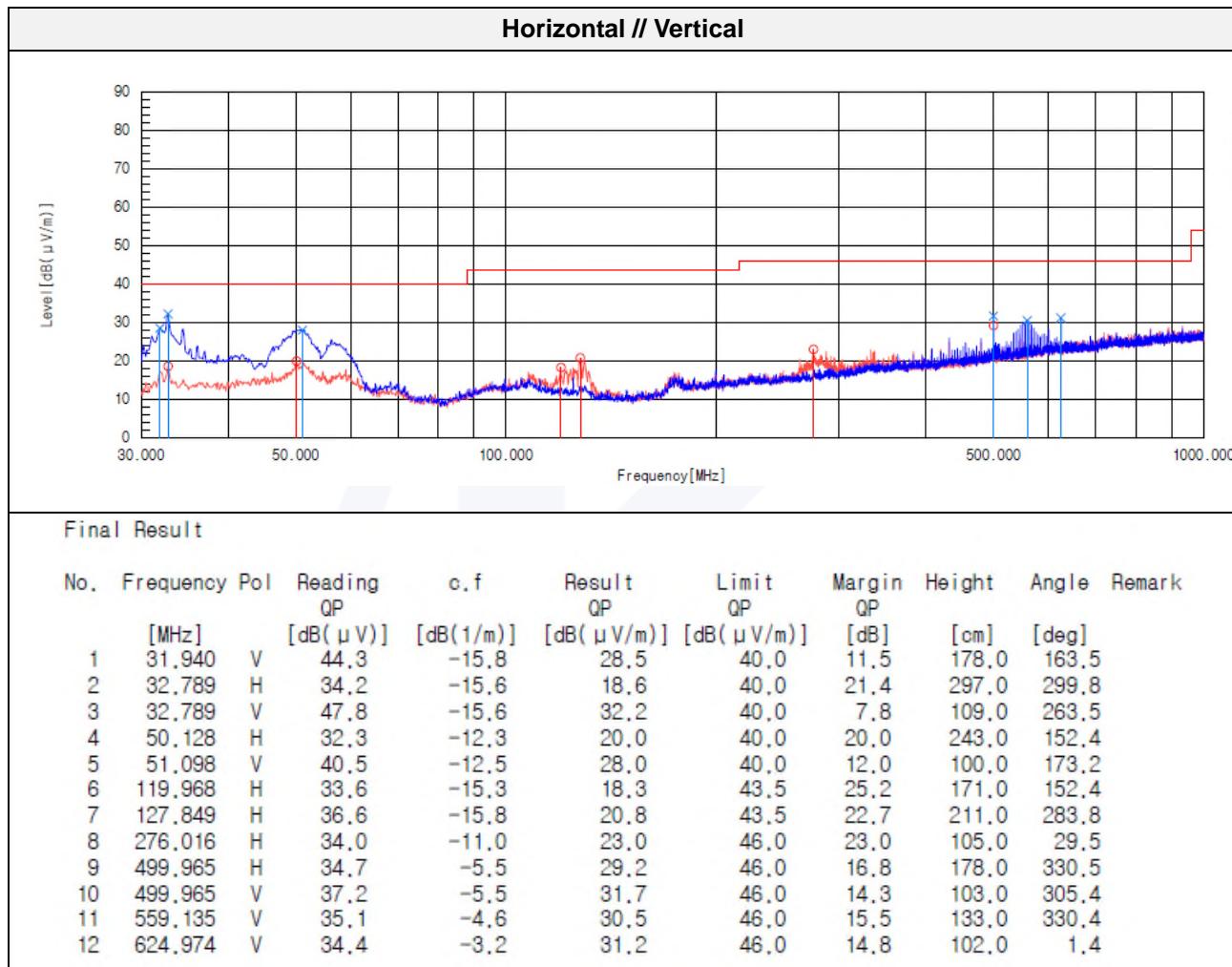


**Test results (Below 1 000 MHz)**

Band 802.11ac_VHT20 (MCS0) (Worst Case)

Distance of measurement: 3 meter

Channel 100 (Worst Case)



**Test results (Above 1 000 MHz)**

Mode: 802.11a (6 Mbps)

Band: UNII-1

Distance of measurement: 3 meter

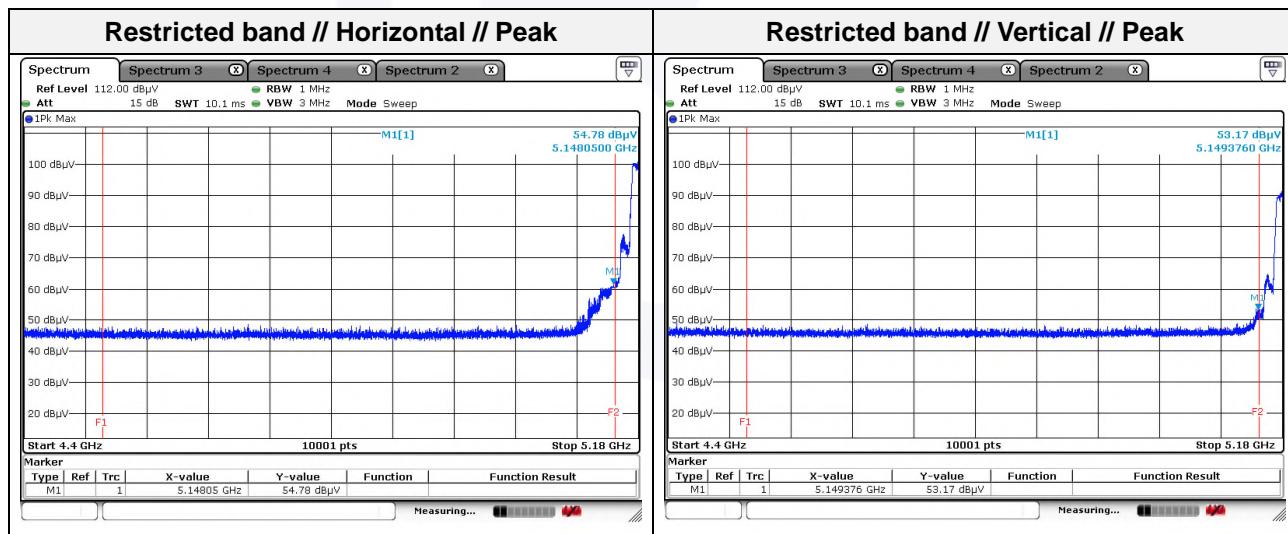
Channel: 36

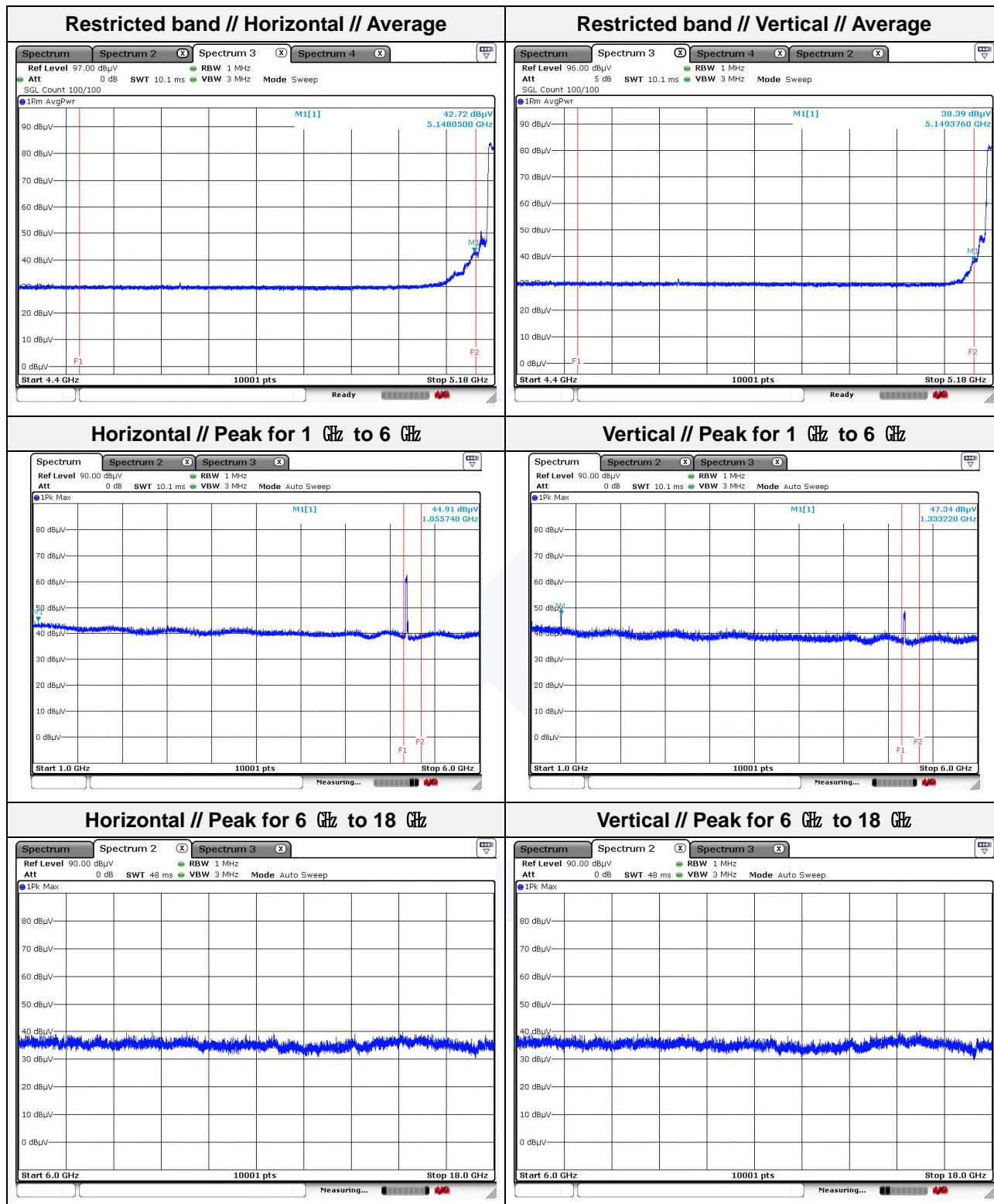
- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1 055.74	44.91	Peak	H	-6.60	-	38.31	74.00	35.69
1 333.22	47.34	Peak	V	-5.13	-	42.21	74.00	31.79

- Band edge

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
5 148.05	54.78	Peak	H	5.60	-	60.38	74.00	13.62
5 148.05	42.72	Average	H	5.60	-	48.32	54.00	5.68
5 149.38	53.17	Peak	V	5.61	-	58.78	74.00	15.22
5 149.38	38.39	Average	V	5.61	-	44.00	54.00	10.00





Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11a (6 Mbps)

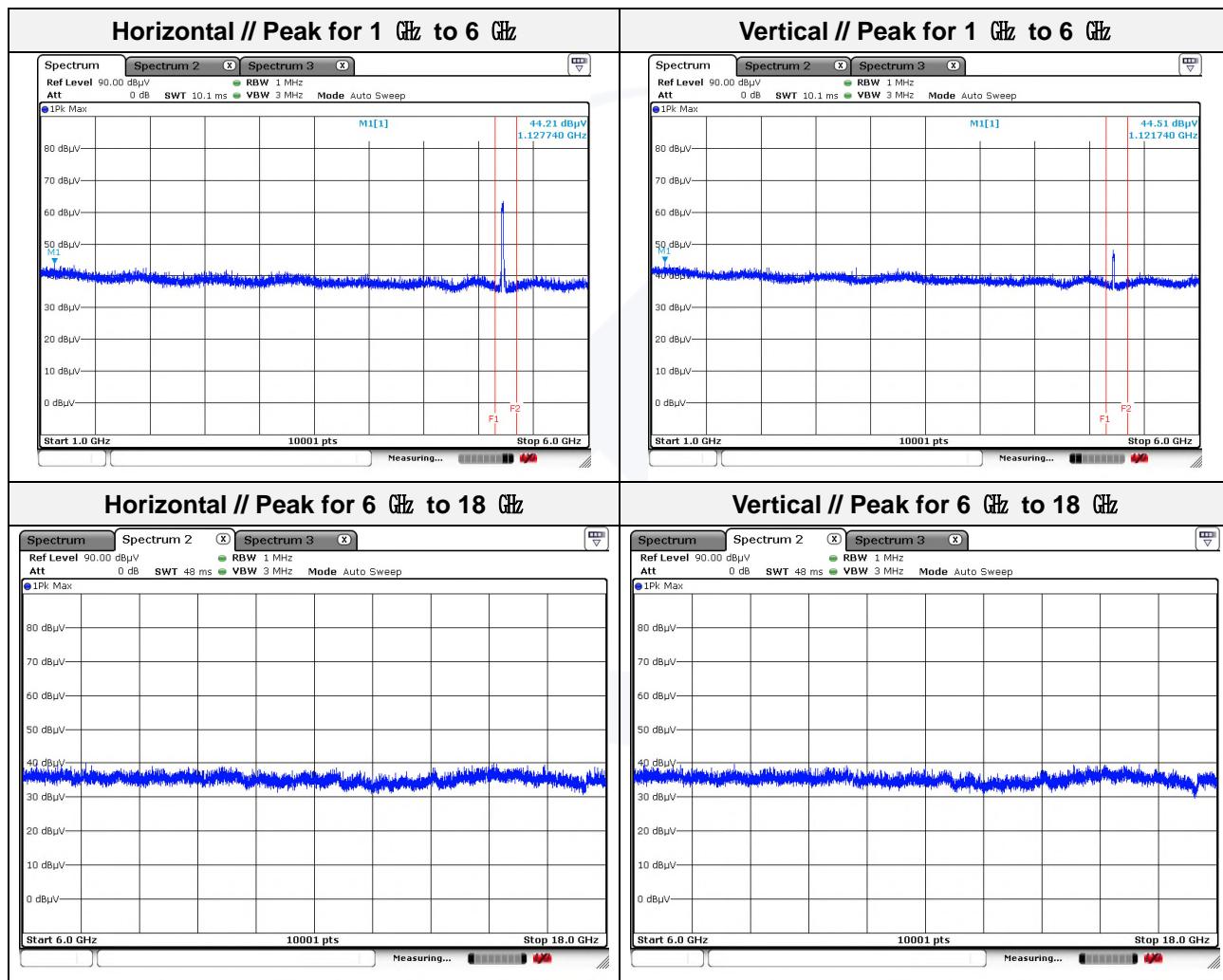
Band: UNII-1

Distance of measurement: 3 meter

Channel: 44

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1121.74	44.51	Peak	V	-6.26	-	38.25	74.00	35.75
1127.74	44.21	Peak	H	-6.23	-	37.98	74.00	36.02



Note.

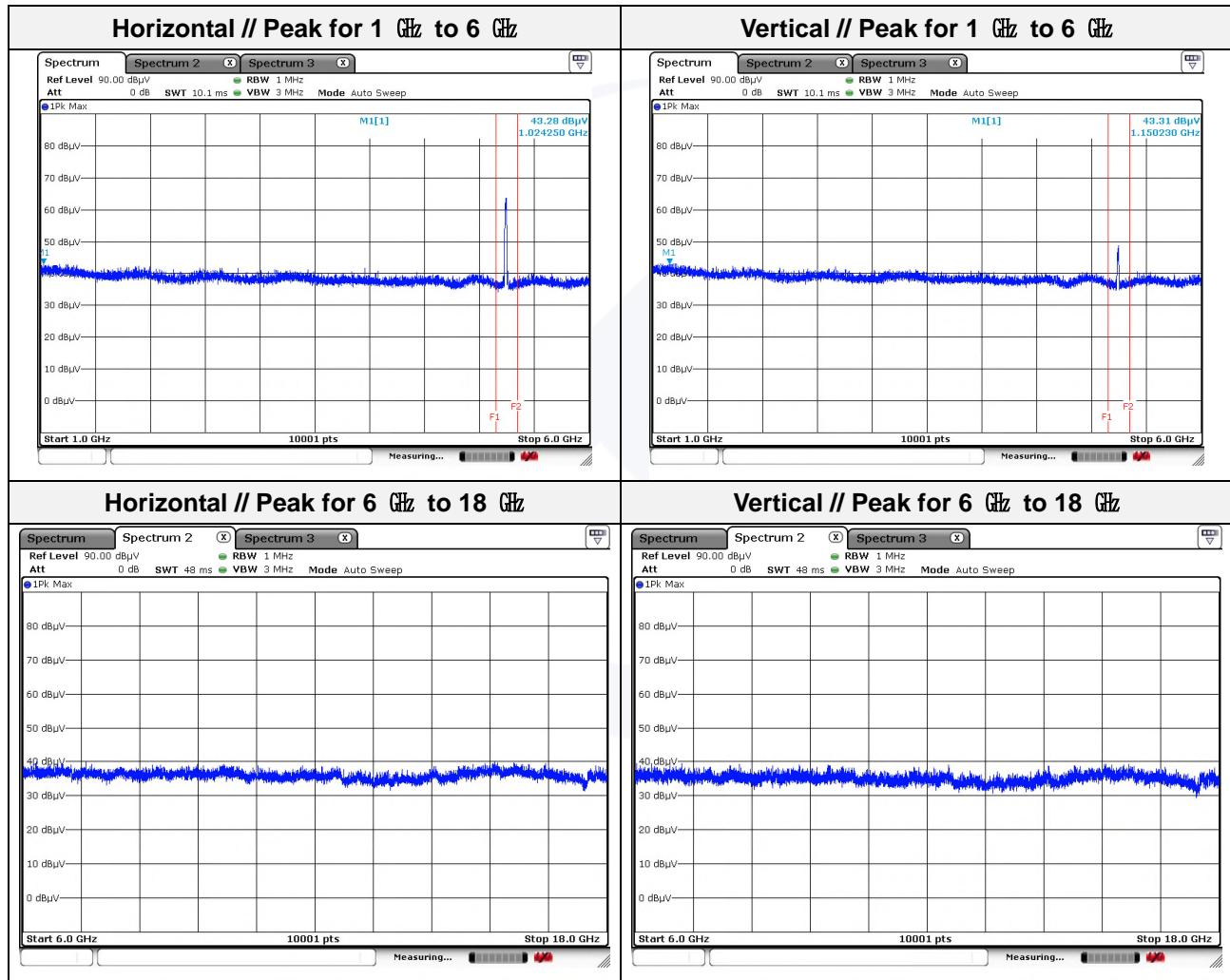
1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11a (6 Mbps)
 Band: UNII-1
 Distance of measurement: 3 meter
 Channel: 48

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1 024.25	43.28	Peak	H	-6.76	-	36.52	74.00	37.48
1 150.23	43.31	Peak	V	-6.12	-	37.19	74.00	36.81



Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11n_HT20 (MCS0)

Band: UNII-1

Distance of measurement: 3 meter

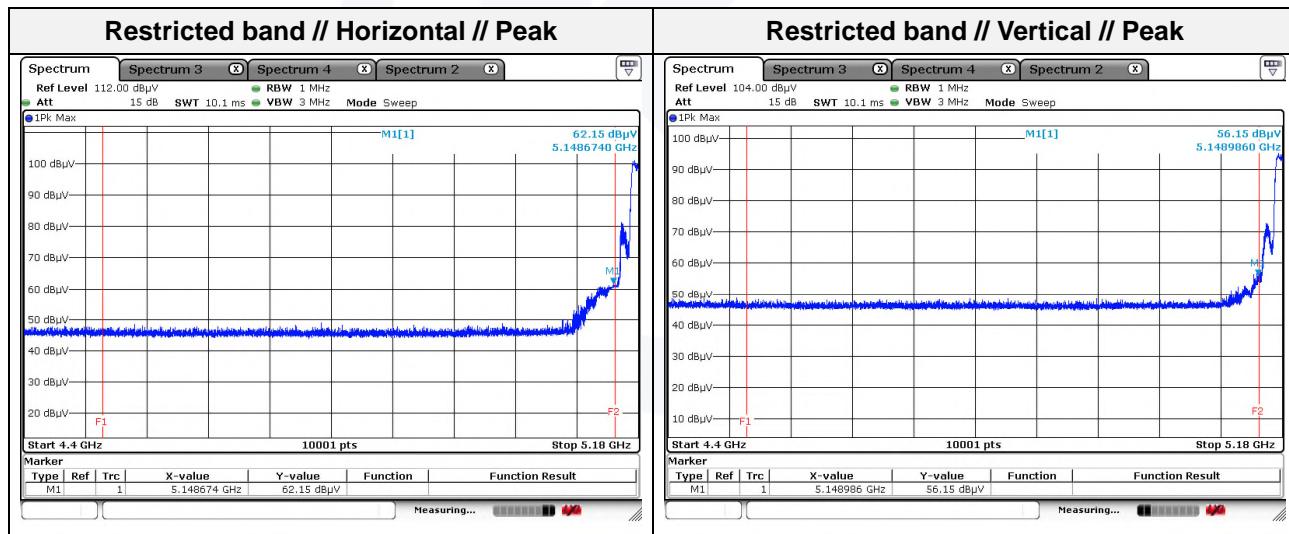
Channel: 36

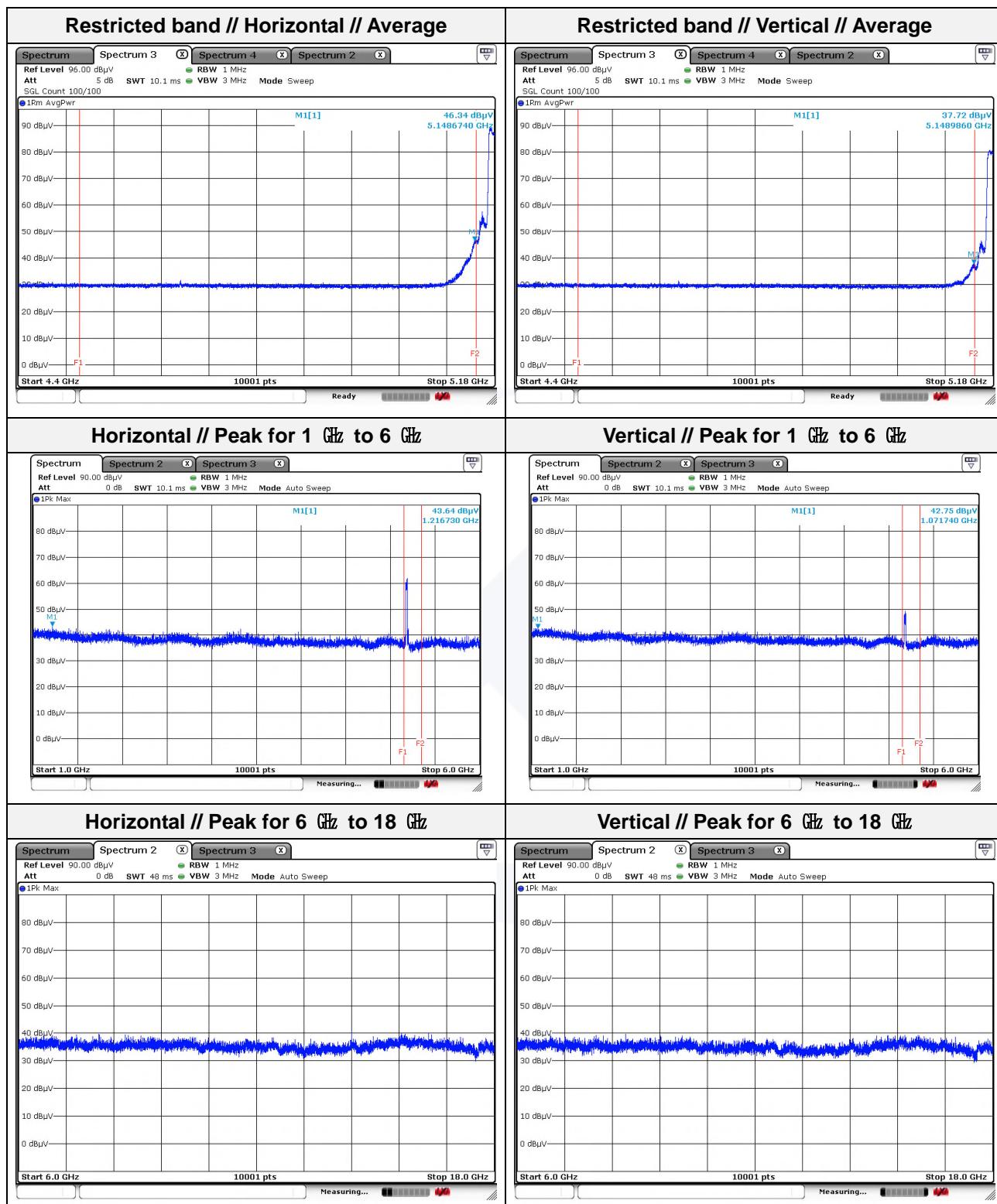
- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 071.74	42.75	Peak	V	-6.51	-	36.24	74.00	37.76
1 216.73	43.64	Peak	H	-5.77	-	37.87	74.00	36.13

- Band edge

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 148.67	62.15	Peak	H	5.61	-	67.76	74.00	6.24
5 148.67	46.34	Average	H	5.61	-	51.95	54.00	2.05
5 148.99	56.15	Peak	V	5.61	-	61.76	74.00	12.24
5 148.99	37.72	Average	V	5.61	-	43.33	54.00	10.67





Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11n_HT20 (MCS0)

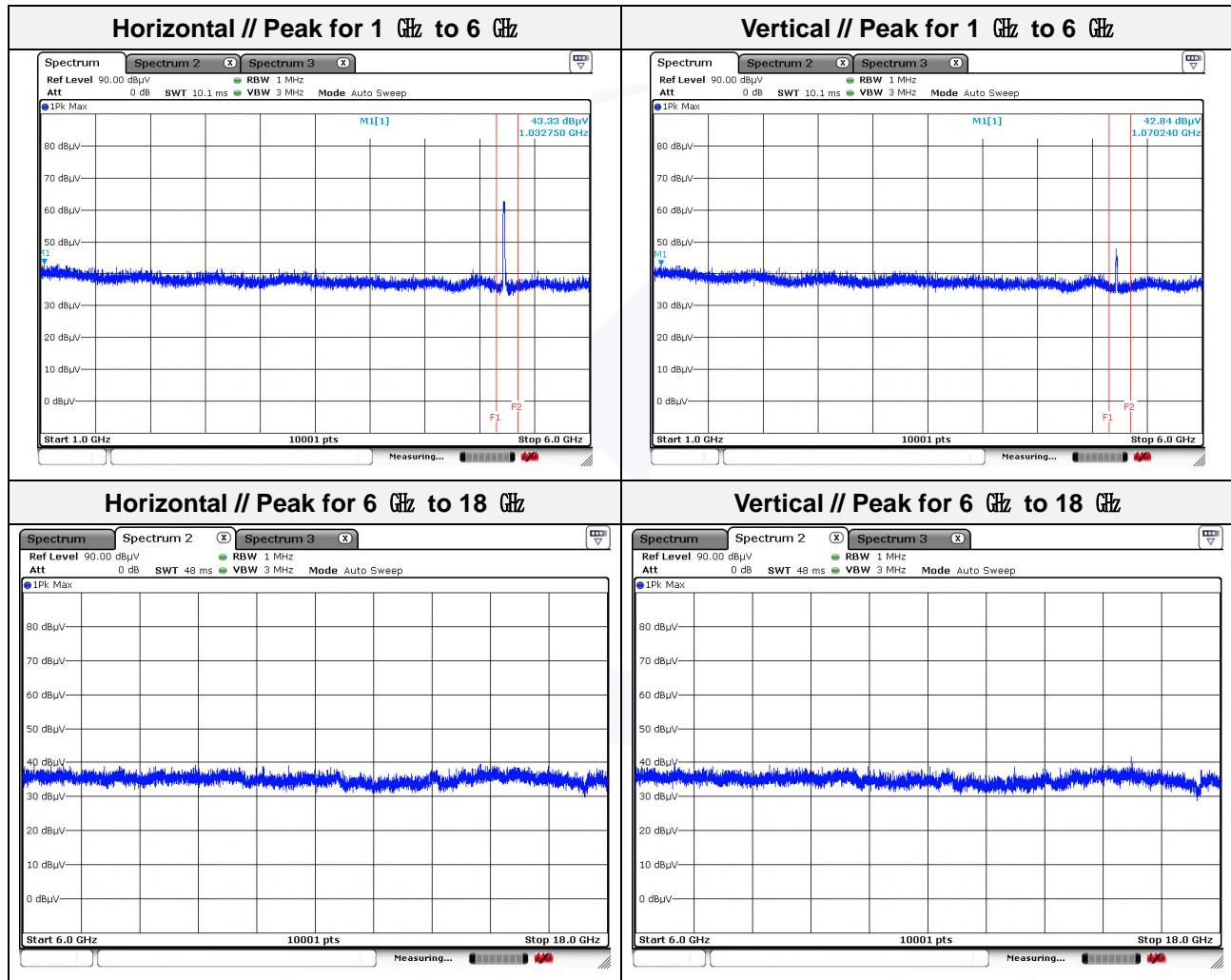
Band: UNII-1

Distance of measurement: 3 meter

Channel: 44

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1 032.75	43.33	Peak	H	-6.71	-	36.62	74.00	37.38
1 070.24	42.84	Peak	V	-6.52	-	36.32	74.00	37.68



Note.

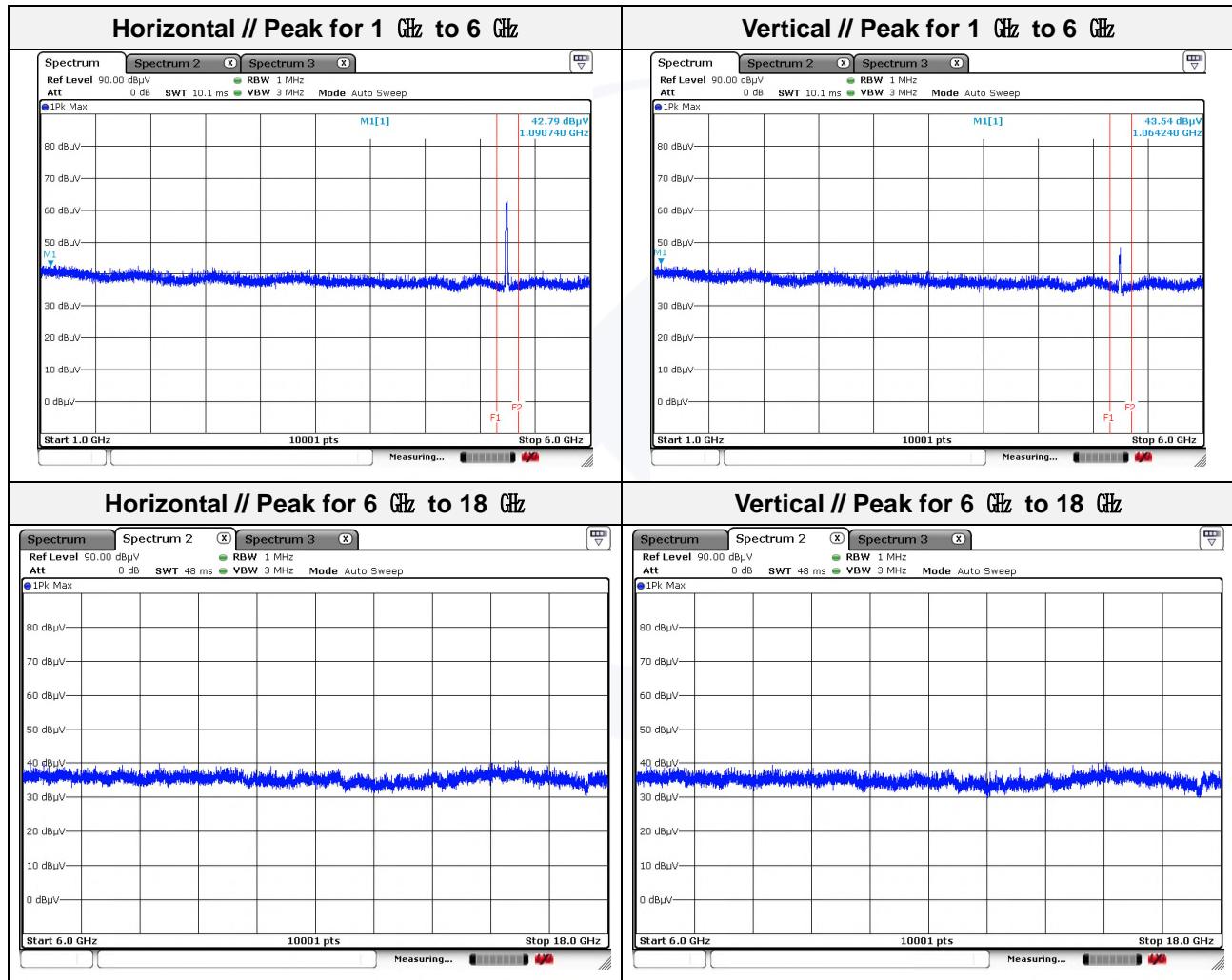
1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11n_HT20 (MCS0)
 Band: UNII-1
 Distance of measurement: 3 meter
 Channel: 48

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1 064.24	43.54	Peak	V	-6.55	-	36.99	74.00	37.01
1 090.74	42.79	Peak	H	-6.42	-	36.37	74.00	37.63



Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



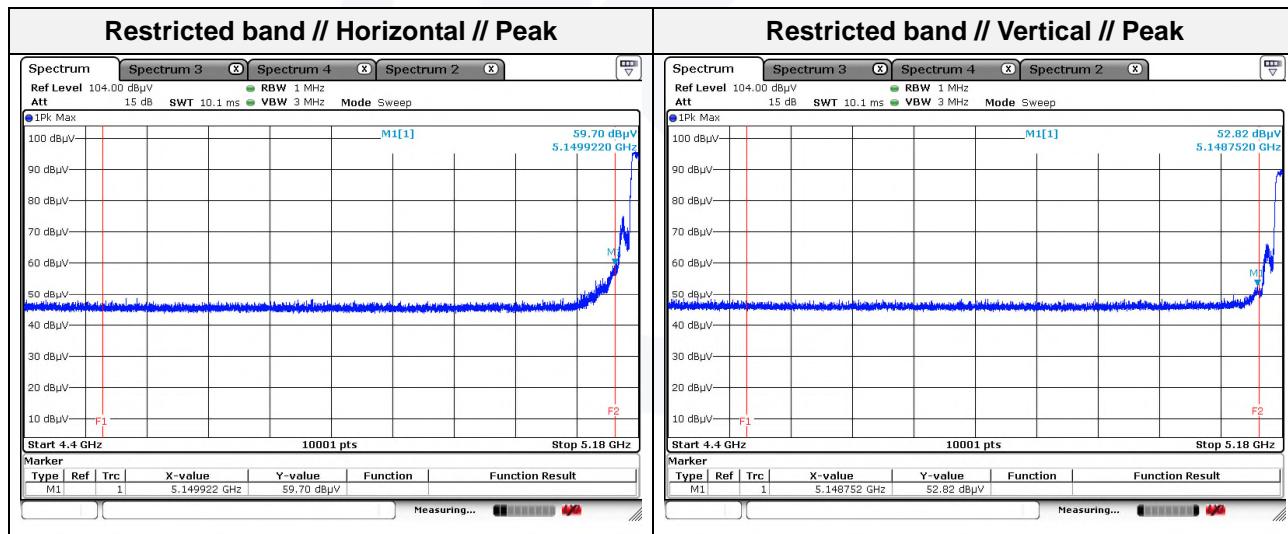
Mode: 802.11ac_VHT20 (MCS0)
 Band: UNII-1
 Distance of measurement: 3 meter
 Channel: 36

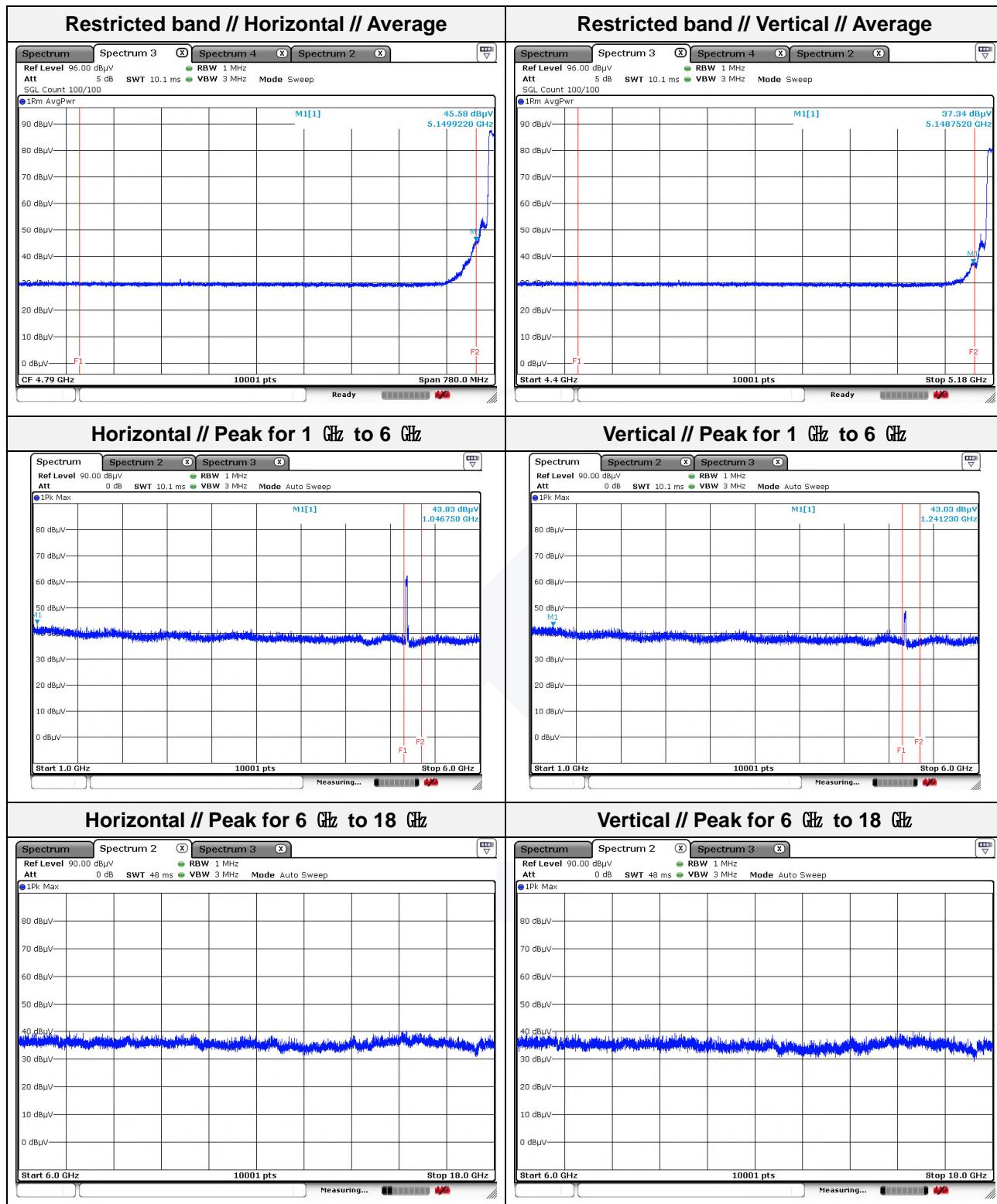
- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 046.75	43.83	Peak	H	-6.64	-	37.19	74.00	36.81
1 241.23	43.03	Peak	V	-5.64	-	37.39	68.20	30.81

- Band edge

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 148.75	52.82	Peak	V	5.61	-	58.43	74.00	15.57
5 148.75	37.34	Average	V	5.61	-	42.95	54.00	11.05
5 149.92	59.70	Peak	H	5.61	-	65.31	74.00	8.69
5 149.92	45.58	Average	H	5.61	-	51.19	54.00	2.81





Note.

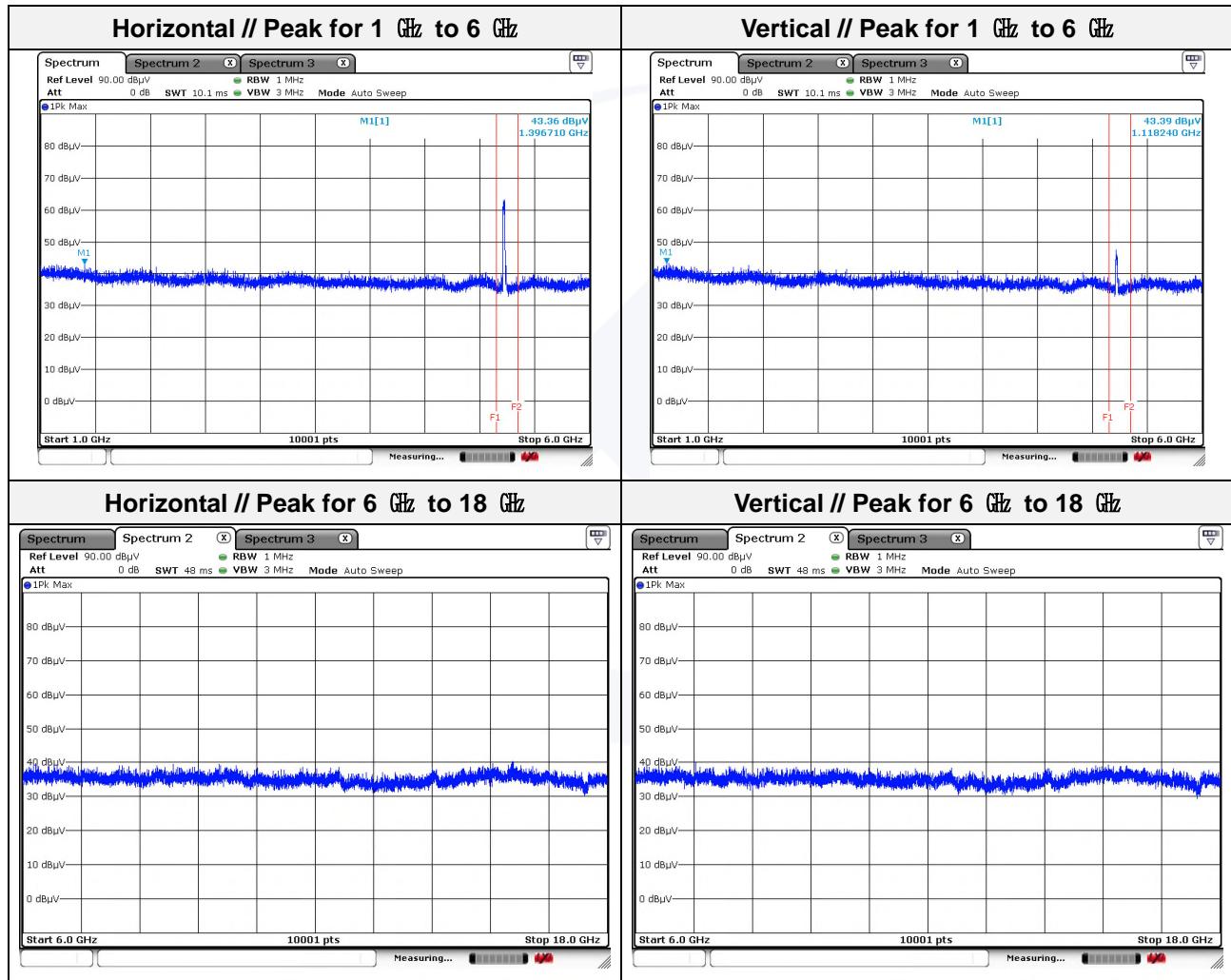
1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11ac_VHT20 (MCS0)
 Band: UNII-1
 Distance of measurement: 3 meter
 Channel: 44

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1 118.24	43.39	Peak	V	-6.28	-	37.11	74.00	36.89
1 396.71	43.36	Peak	H	-4.78	-	38.58	74.00	35.42



Note.

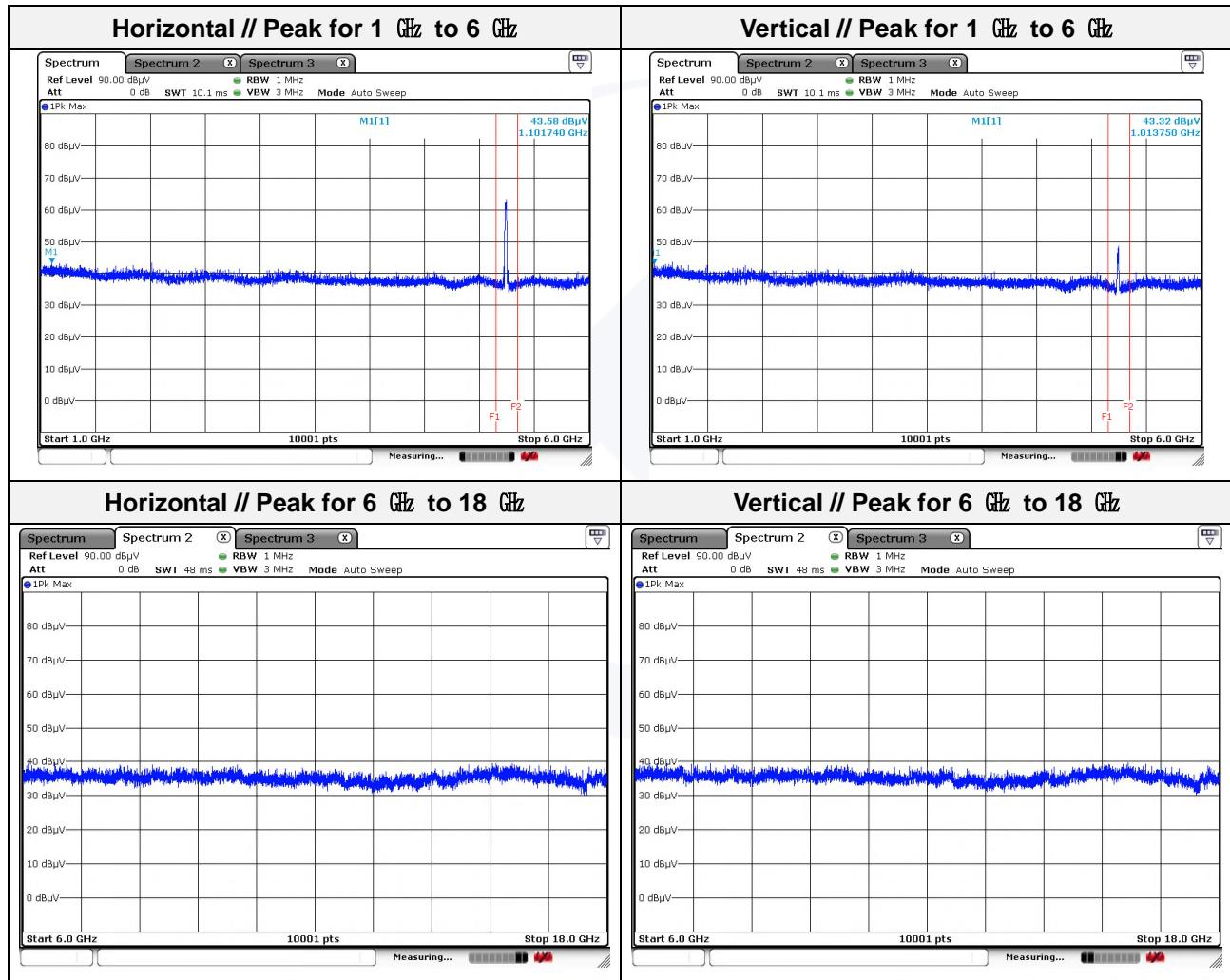
1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11ac_VHT20 (MCS0)
 Band: UNII-1
 Distance of measurement: 3 meter
 Channel: 48

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
1 013.75	43.32	Peak	V	-6.81	-	36.51	74.00	37.49
1 101.74	43.58	Peak	H	-6.36	-	37.22	74.00	36.78



Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: 802.11a (6 Mbps)

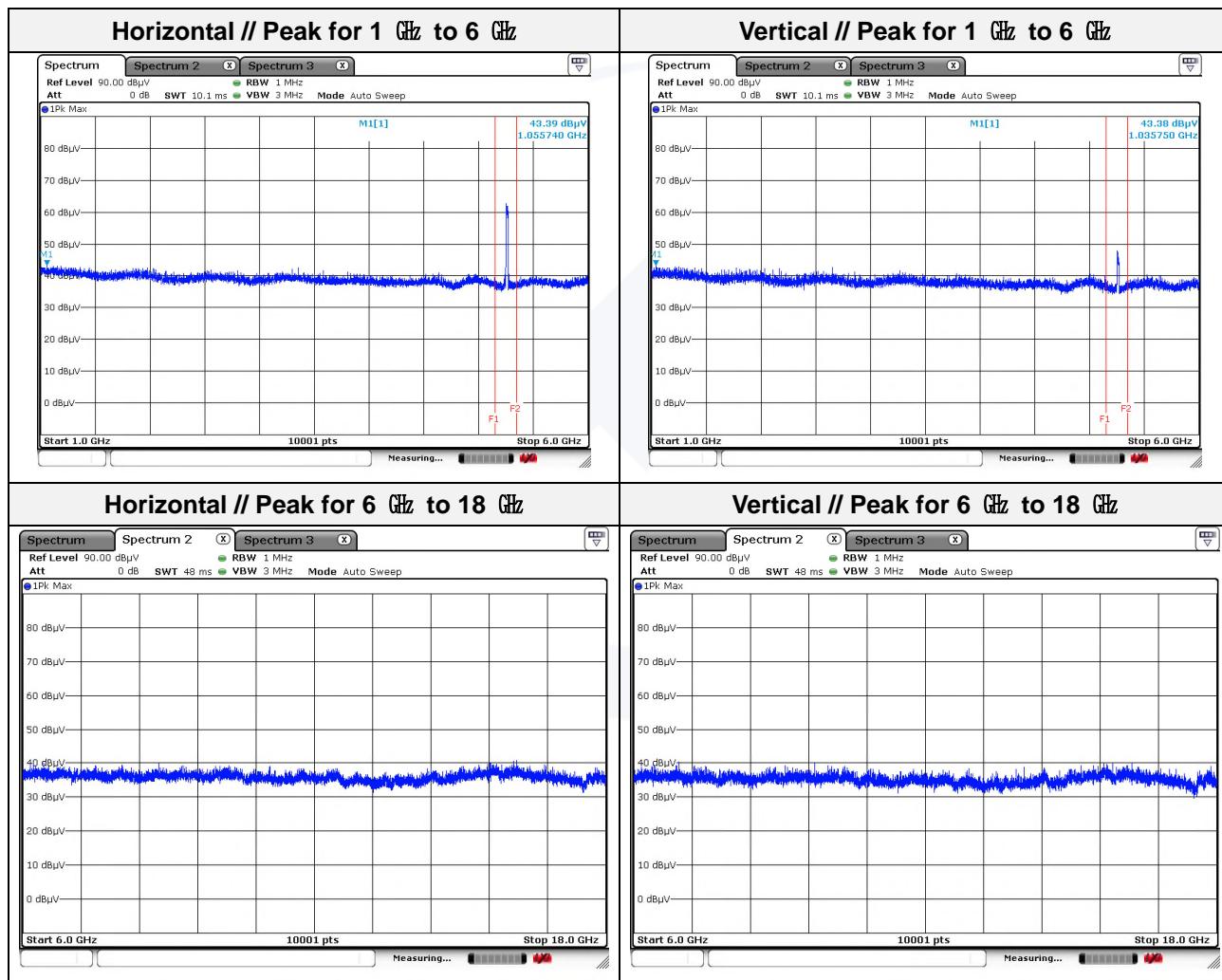
Band: UNII-2A

Distance of measurement: 3 meter

Channel: 52

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 035.75	43.38	Peak	V	-6.70	-	36.68	74.00	37.32
1 055.74	43.39	Peak	H	-6.60	-	36.79	74.00	37.21



Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.