

TEST REPORT

Part 15 Subpart C 15.247

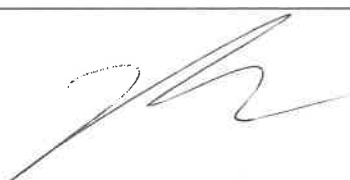
Equipment under test Pogme
Model name Bro-wifi01
FCC ID 2A2WX-BRO-WIFI01
Applicant 10pple
Manufacturer 10pple
Date of test(s) 2021.08.18 ~ 2021.08.23
Date of issue 2021.08.25

Issued to
10pple

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Seoul, Republic of Korea
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Issued by
KES Co., Ltd.

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Test and report completed by :	Report approval by :
	
Gu-Bong, Kang Test engineer	Young-Jin, Lee Technical manager



Revision history

Revision	Date of issue	Test report No.	Description
-	2021.08.25	KES-RF1-21T0154	Initial

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1. General information

Applicant: 10pple
Applicant address: 26ho, Yeonji Square L, INDUK University, 12, Choansan-ro, Nowon-gu, Seoul,
Republic of Korea
Test site: KES Co., Ltd.
Test site address: ☐ 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea
☒ 473-29, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea
Test Facility FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s): 15.247
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test Pogme
Frequency range 2 412 Mhz ~ 2 462 Mhz (802.11b/g/n_HT20)
2 422 Mhz ~ 2 452 Mhz (802.11n_HT40)
2 402 Mhz ~ 2 480 Mhz (LE 1Mbps)
Model: Bro-wifi01
Modulation technique WIFI : DSSS, OFDM
LE : GFSK
Number of channels 2 412 Mhz ~ 2 462 Mhz (802.11b/g/n_HT20) : 11ch
2 422 Mhz ~ 2 452 Mhz (802.11n_HT40) : 7ch
2 402 Mhz ~ 2 480 Mhz (LE 1Mbps) : 40ch
Antenna specification 2.4G WiFi&BLE Antenna type : PCB antenna Peak gain : 3.40 dBi
Power source AC 120 V (DC Adapter Output 12 V)
H/W version v1.1
S/W version v1.0

1.2. Test configuration

The **10pple // Pogme // Bro-wifi01** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247
KDB 558074 D01 v05 r02
ANSI C63.10-2013

1.3. Device modifications

N/A

1.4. Information about Variant Model name

N/A

1.5. Frequency/channel operations

Ch.	Frequency (MHz)	Rate(Mbps)
01	2 412	802.11b/g/n_HT20
.	.	.
06	2 437	802.11b/g/n_HT20
.	.	.
11	2 462	802.11b/g/n_HT20

Ch.	Frequency (MHz)	Rate(Mbps)
03	2 422	802.11n_HT40
.	.	.
06	2 437	802.11n_HT40
.	.	.
09	2 452	802.11n_HT40

Ch.	Frequency (MHz)	Rate(Mbps)
00	2 402	LE 1 Mbps
.	.	.
20	2 442	LE 1 Mbps
.	.	.
39	2 480	LE 1 Mbps

1.6. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.7. Measurement results explanation example

For all conducted test items

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 0.51 + 10 = 10.51 \end{aligned}$$

1.8. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.46 dB
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1GHz	4.40 dB
	Above 1GHz	5.94 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

2. Summary of tests

Reference	Parameter	Test results
15.247(a)(2)	6 dB bandwidth	N/A ⁽¹⁾
15.247(b)(3)	Output power	Pass
15.247(e)	Power spectral density	N/A ⁽¹⁾
15.205 15.209	Radiated restricted band and emission	Pass
15.247(d)	Conducted spurious emission and band edge	N/A ⁽¹⁾
15.207(a)	AC conducted emissions	Pass

Note :

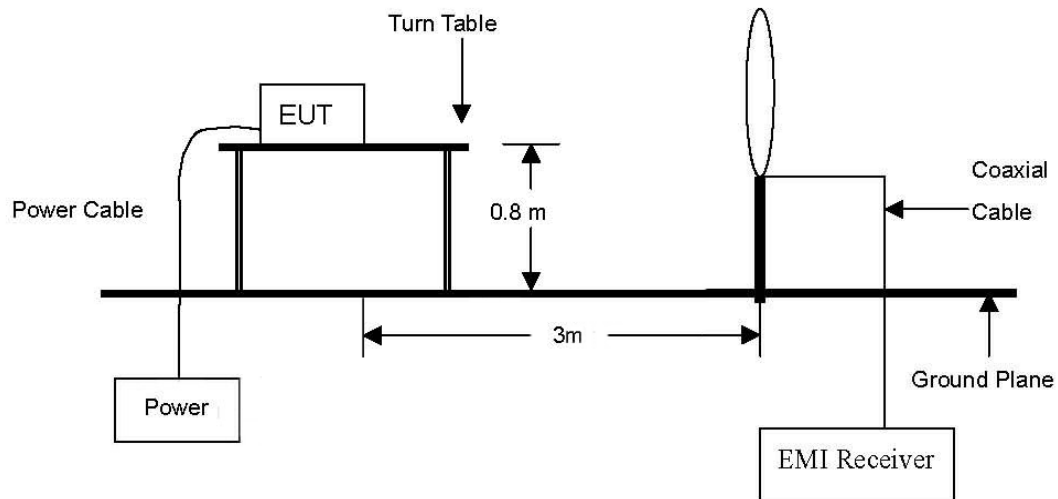
- 1) Please Refer to the approved Module Report (Report No.: RSHD200218007-00A) for result of existing test items.

3. Test results

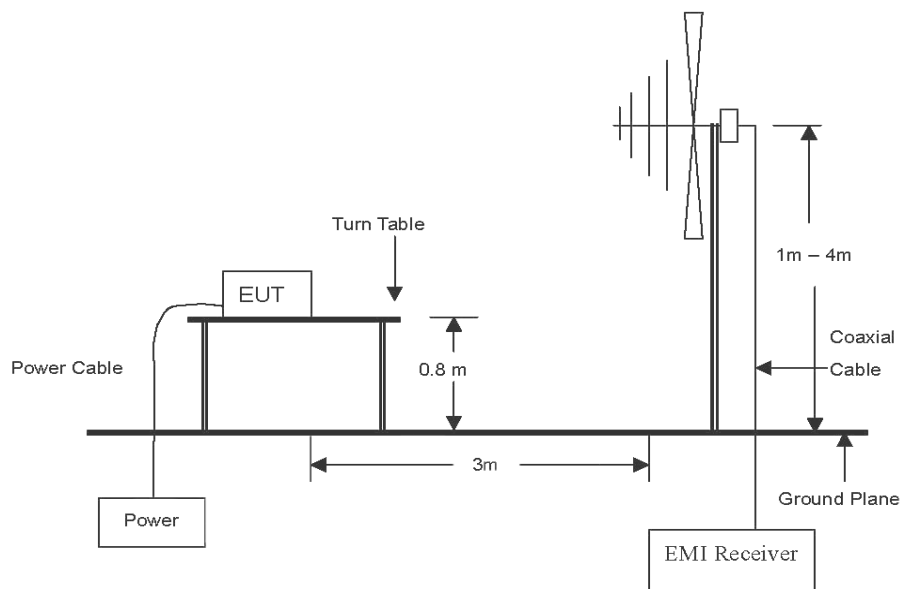
3.1. Radiated restricted band and emissions

Test setup

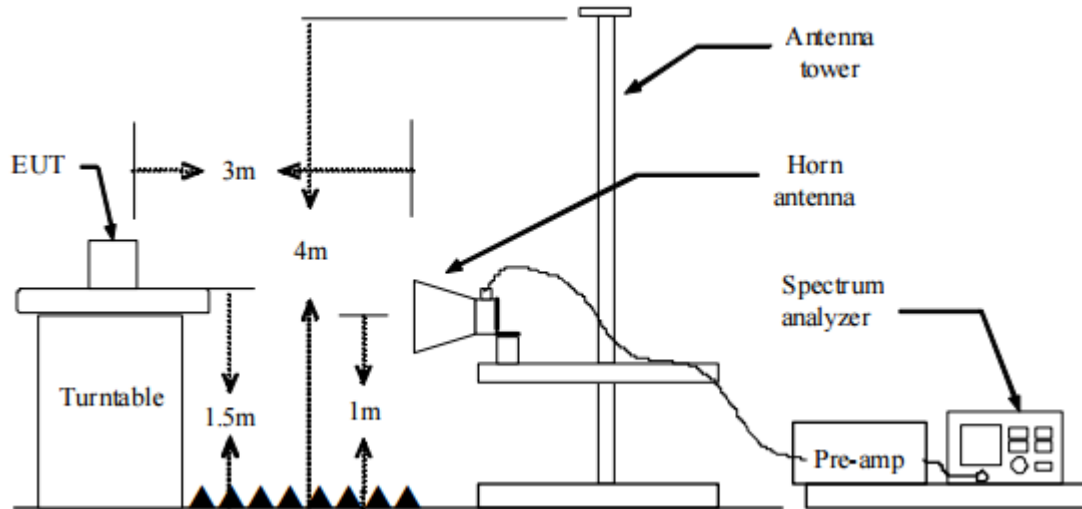
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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 $f < 1 \text{ GHz}$:
 - 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 MHz
 - ④ Detector = peak
 - ⑤ Sweep time = auto
 - ⑥ Trace = max hold
 - ⑦ Trace was allowed to stabilize

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

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW $\geq 3 \times$ RBW
- ④ Detector = RMS, if span/(# of points in sweep) $\leq$ (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. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/D_s)$
 $f \geq 30$ 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. Field strength(dB μ V/m) = Level(dB μ V) + CF (dB) + or DCF(dB)
3. Margin(dB) = Limit(dB μ V/m) - Field strength(dB μ V/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.
7. 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.
8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
9. 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 ($\mu V/m$)
0.009 ~ 0.490	300	2 400 / F(kHz)
0.490 ~ 1.705	30	24 000 / 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.

Duty cycle

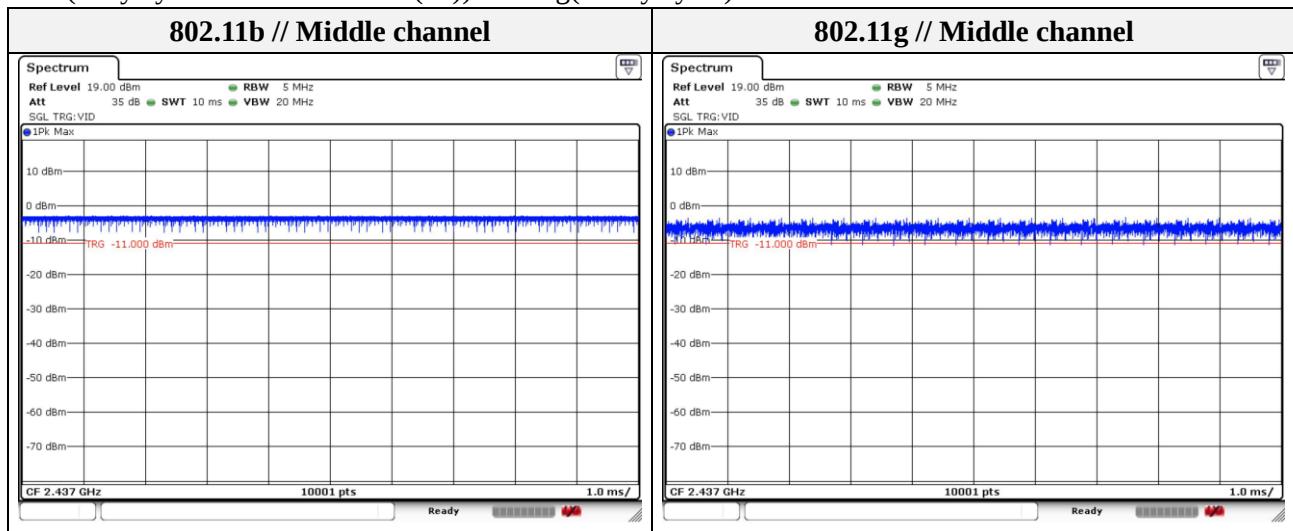
Regarding to KDB 558074 D01_v04, 6.0, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

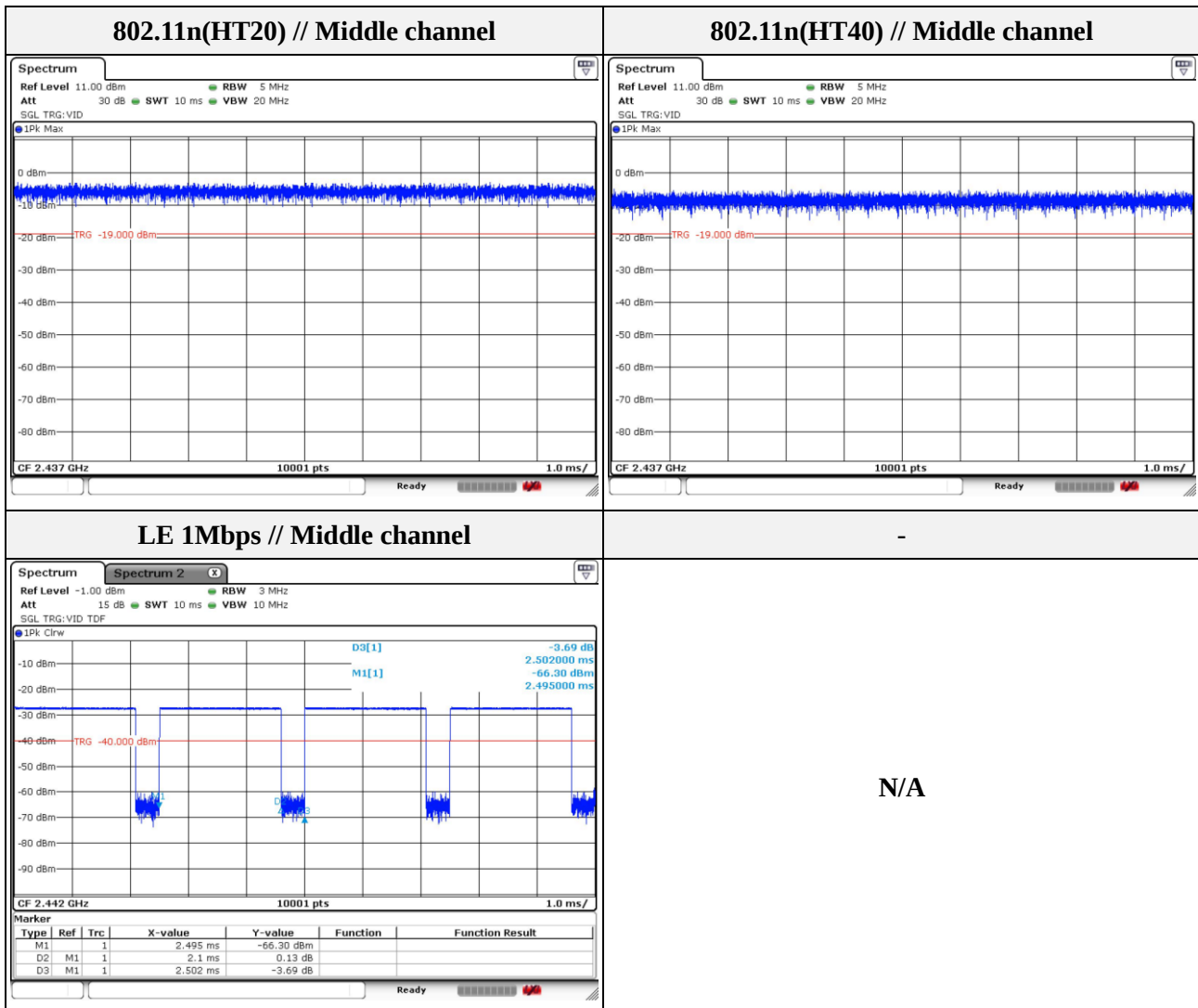
Set RBW $\geq$ OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100.

Test mode	T _{on} time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
LE 1Mbps	2.10	2.50	0.84	84	0.76
802.11b	10	10	1.00	100	0
802.11g	10	10	1.00	100	0
802.11n(HT20)	10	10	1.00	100	0
802.11n(HT40)	10	10	1.00	100	0

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

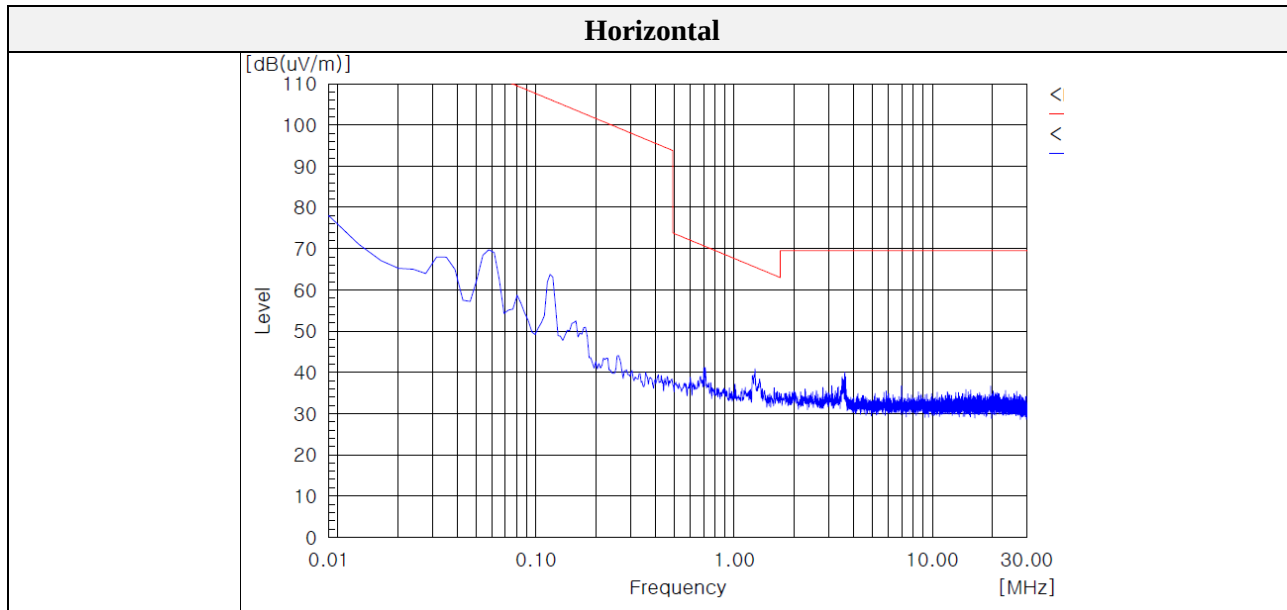
DCF(Duty cycle correction factor (dB)) = 10log(1/duty cycle)





Test results (Below 30 MHz)

Mode: LE
 Transfer rate: 1 Mbps
 Distance of measurement: 3 meter
 Channel: 39(Worst case)

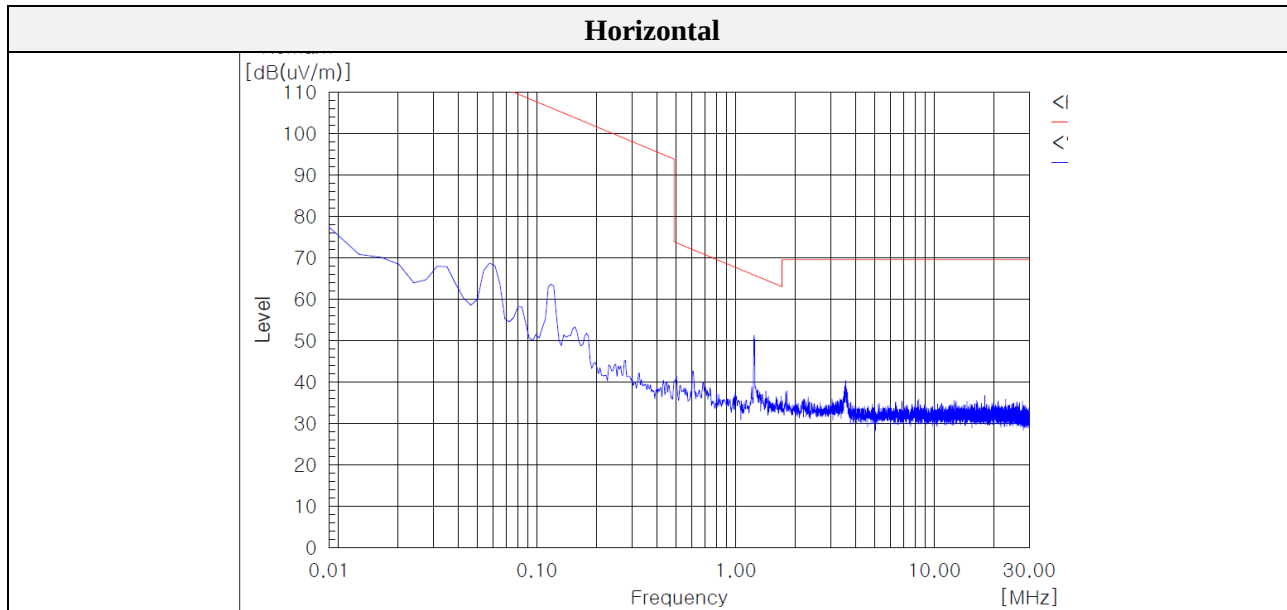


Note.

1. No spurious emission were detected under 30 MHz

Test results (Below 30 MHz)

Mode: 802.11b
 Transfer rate: 1 Mbps
 Distance of measurement: 3 meter
 Channel: 06(Worst case)



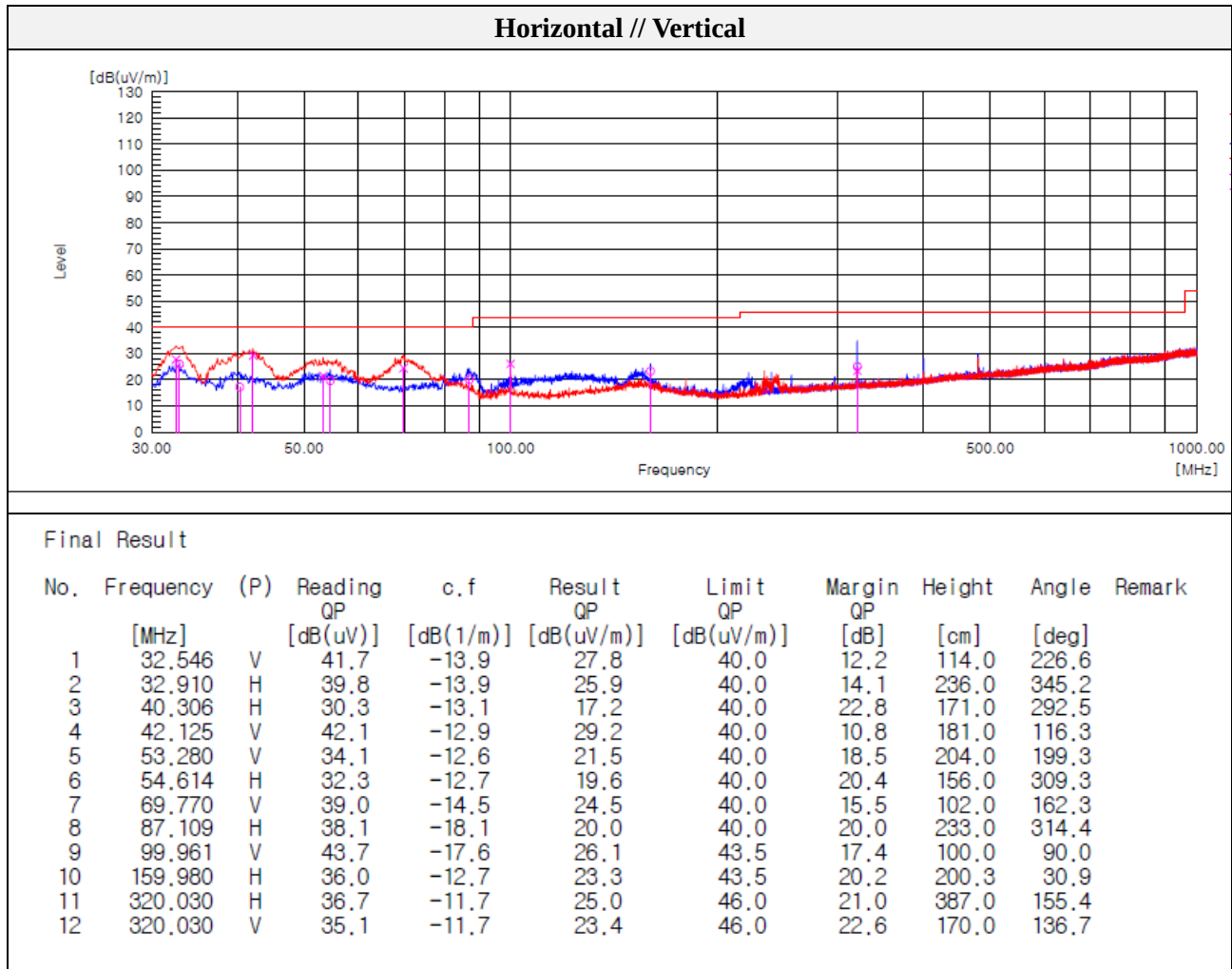
Note.

1. No spurious emission were detected under 30 MHz



Test results (Below 1 000 MHz)

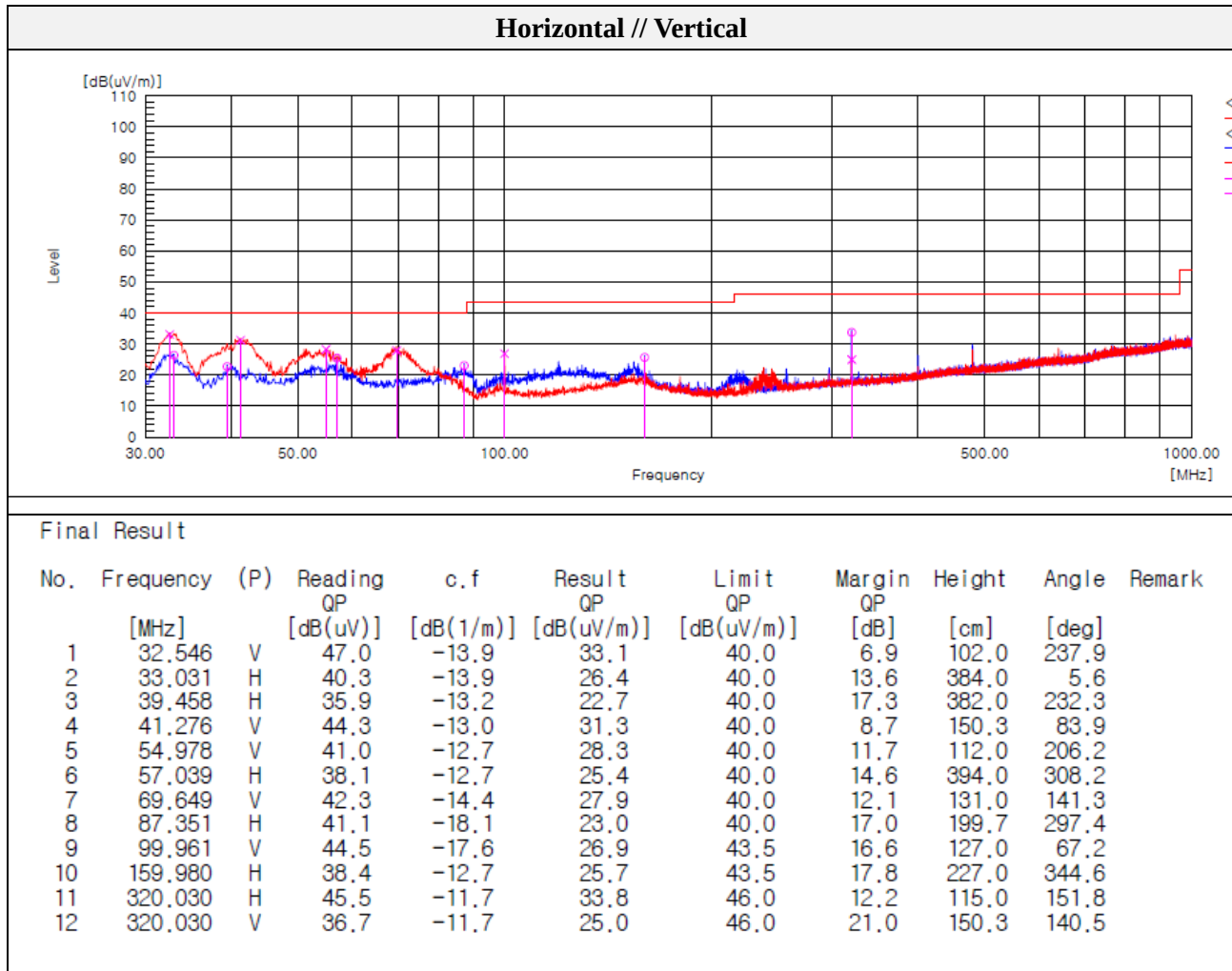
Mode: LE
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 39(Worst case)





Test results (Below 1 000 MHz)

Mode: 802.11b
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 06(Worst case)



Test results (Above 1 000 MHz)

Mode: LE

Transfer rate: 1 Mbps

Distance of measurement: 3 meter

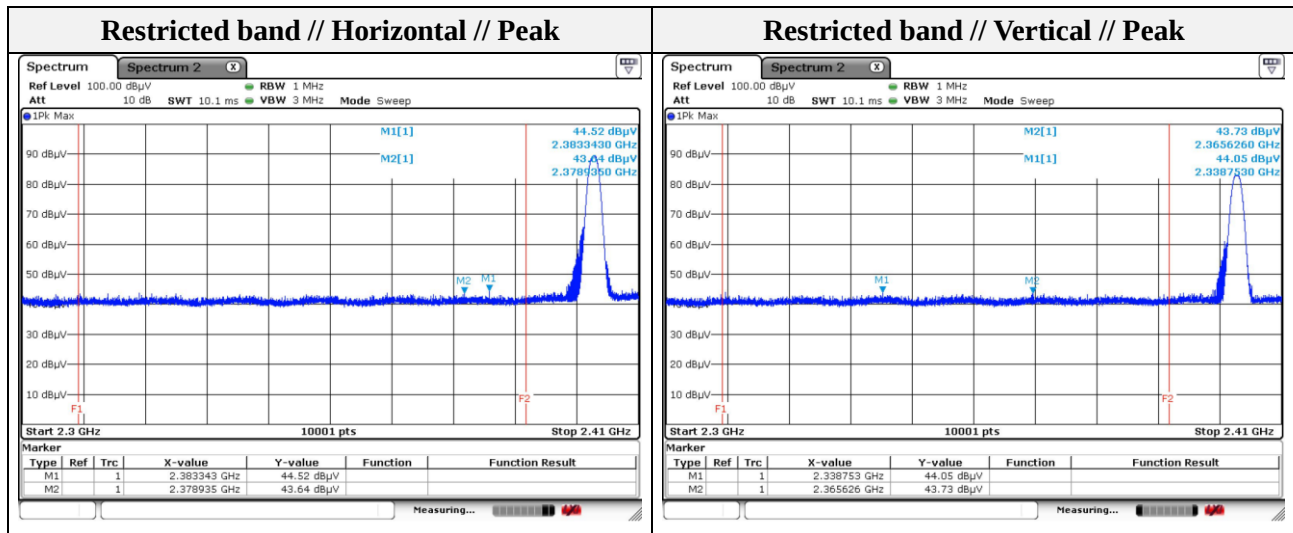
Channel: 00

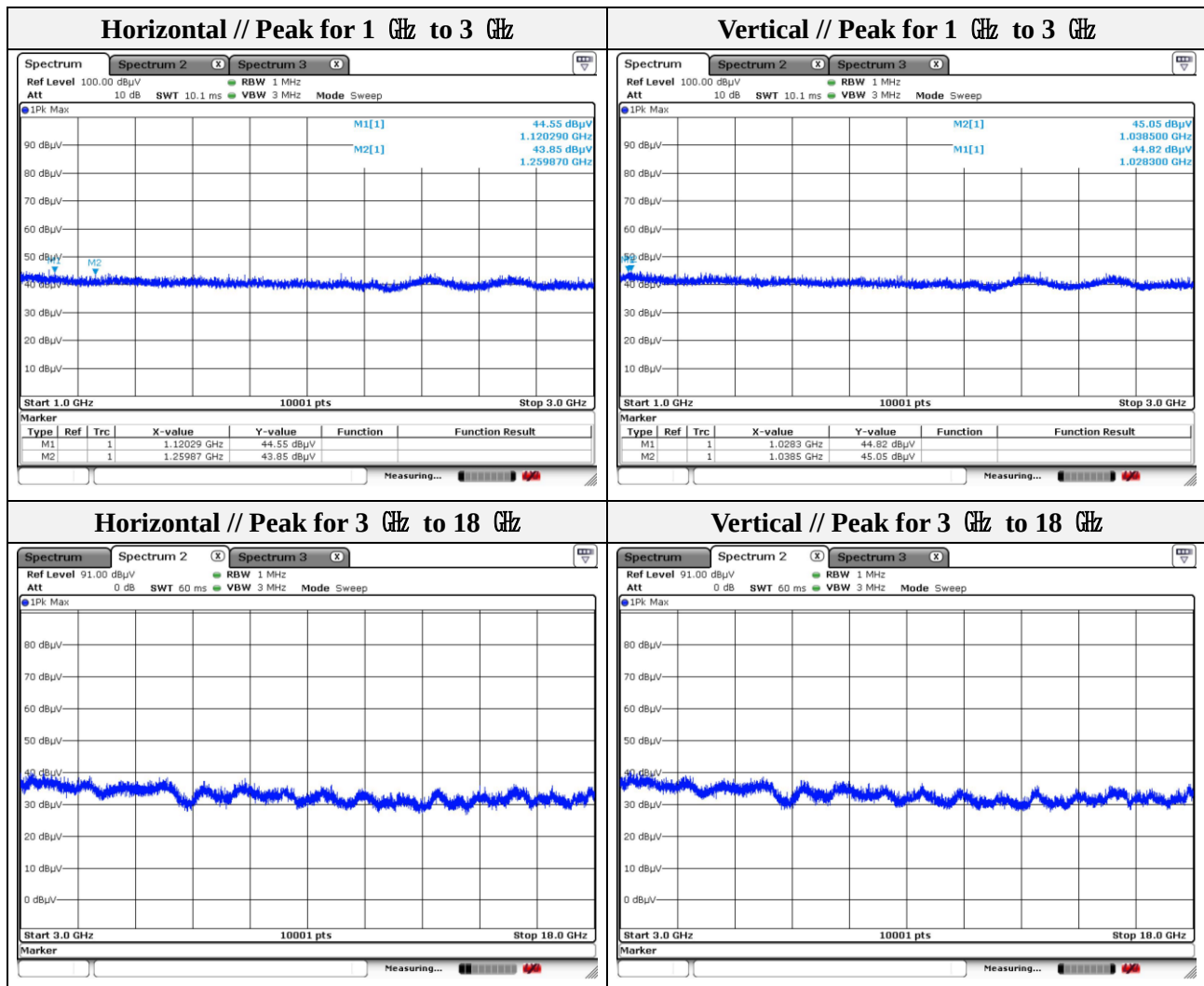
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 028.30	44.82	Peak	V	-11.01	-	33.81	74.00	40.19
1 038.50	45.05	Peak	V	-10.96	-	34.09	74.00	39.91
1 120.29	44.55	Peak	H	-10.52	-	34.03	74.00	39.97
1 259.87	43.85	Peak	H	-9.78	-	34.07	74.00	39.93

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 338.75	44.05	Peak	V	2338.75	-	41.06	74.00	32.94
2 365.63	43.73	Peak	V	2365.63	-	40.86	74.00	33.14
2 378.94	43.64	Peak	H	2378.94	-	40.83	74.00	33.17
2 383.34	44.52	Peak	H	2383.34	-	41.73	74.00	32.27





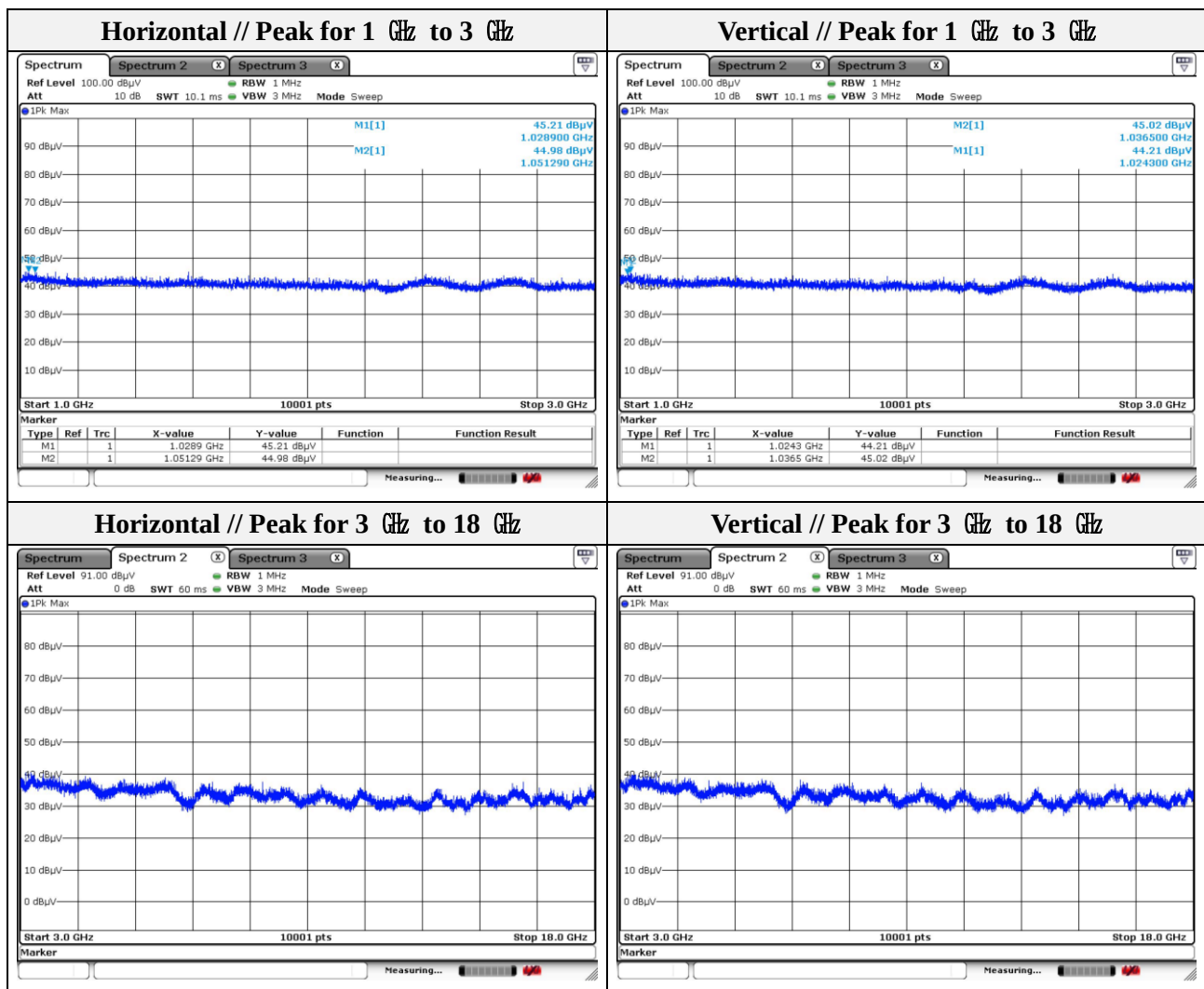
Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

Mode: LE
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 20

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 024.30	44.21	Peak	V	-11.03	-	33.18	74.00	40.82
1 028.90	45.21	Peak	H	-11.01	-	34.20	74.00	39.80
1 036.50	45.02	Peak	V	-10.97	-	34.05	74.00	39.95
1 051.29	44.98	Peak	H	-10.89	-	34.09	74.00	39.91



Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

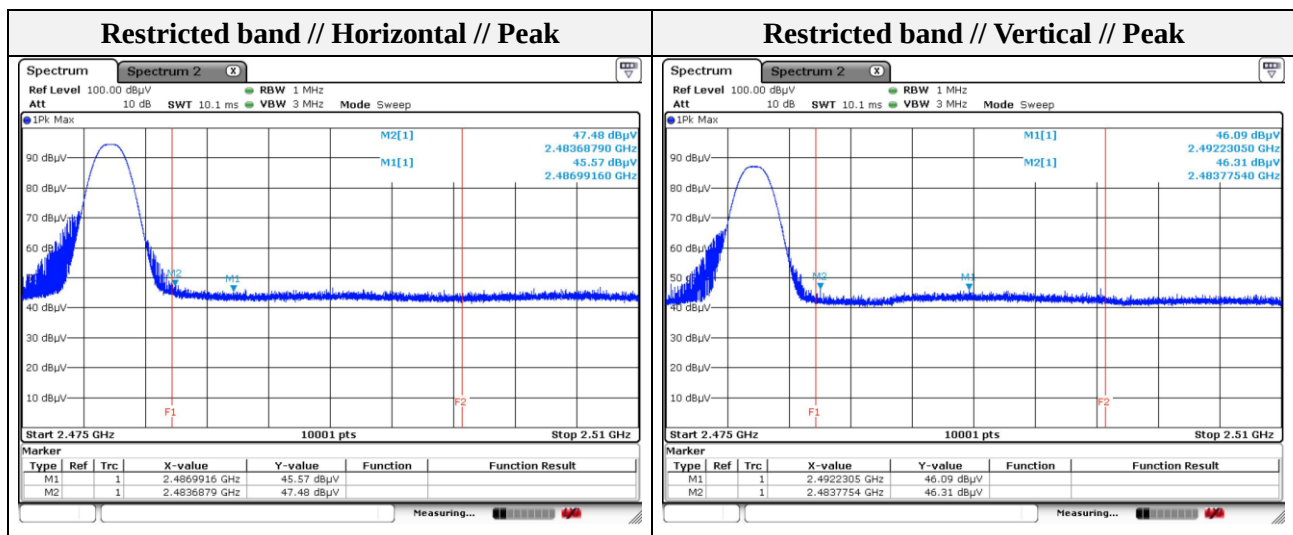
Mode: LE
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 39

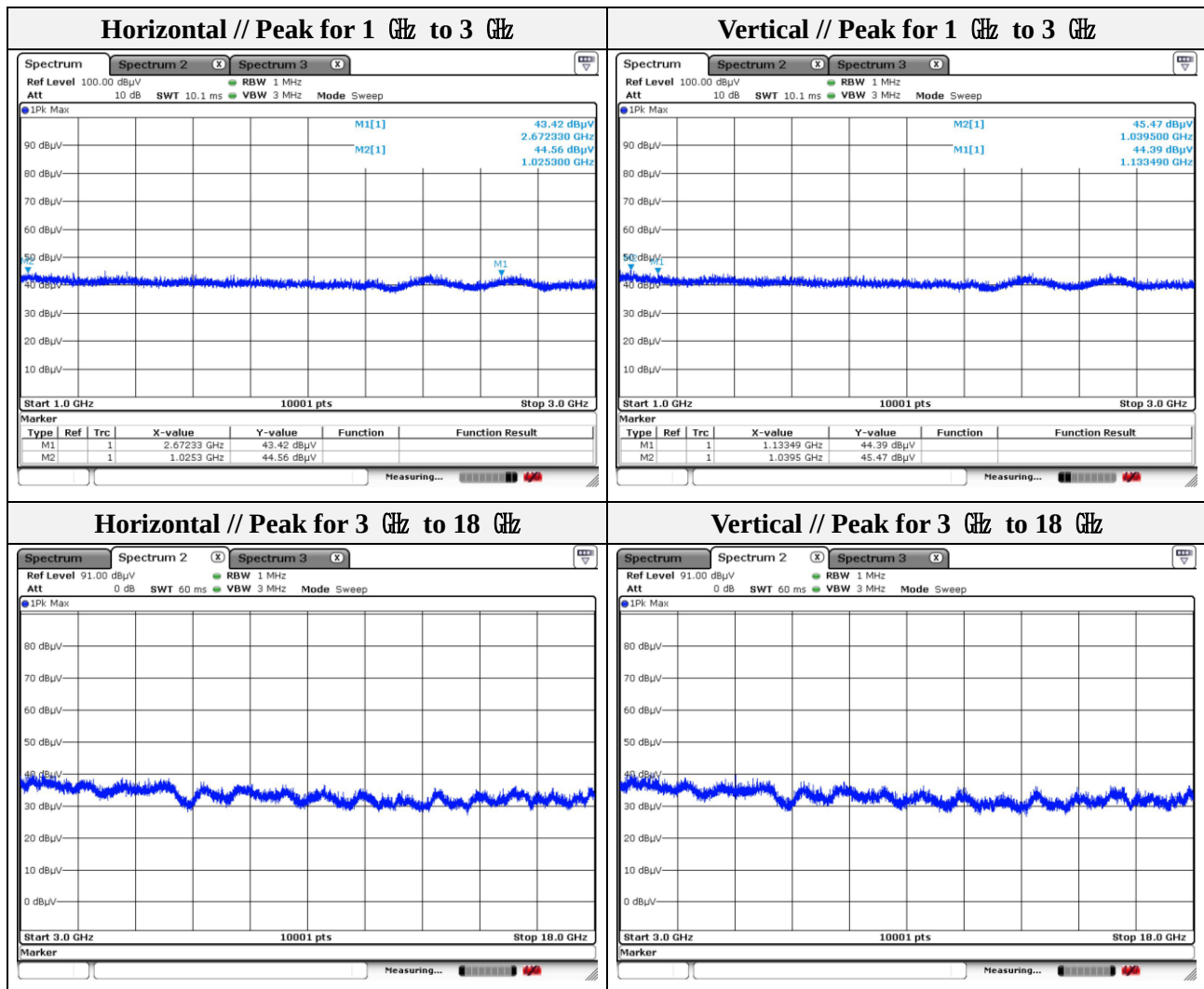
- **Spurious**

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 025.30	44.56	Peak	H	-11.03	-	33.53	74.00	40.47
1 039.50	45.47	Peak	V	-10.95	-	34.52	74.00	39.48
1 133.49	44.39	Peak	V	-10.45	-	33.94	74.00	40.06
2 672.33	43.42	Peak	H	-1.83	-	41.59	74.00	32.41

- **Band edge**

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 483.69	47.48	Peak	H	-2.40	-	45.08	74.00	28.92
2 483.78	46.31	Peak	V	-2.40	-	43.91	74.00	30.09
2 486.99	45.57	Peak	H	-2.39	-	43.18	74.00	30.82
2 492.23	46.09	Peak	V	-2.37	-	43.72	74.00	30.28



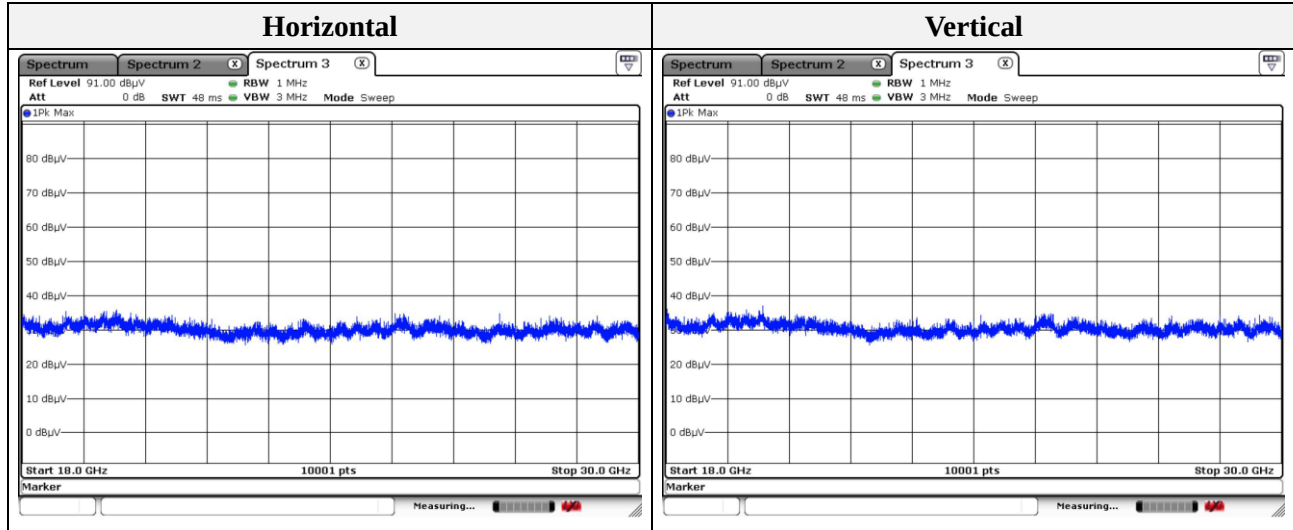


Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

Test results (18 GHz to 30 GHz)

Mode: LE
 Transfer rate: 1 Mbps
 Distance of measurement: 3 meter
 Channel: 39(Worst case)



Note.

1. No spurious emission were detected above 18 GHz.

Test results (Above 1 000 MHz)

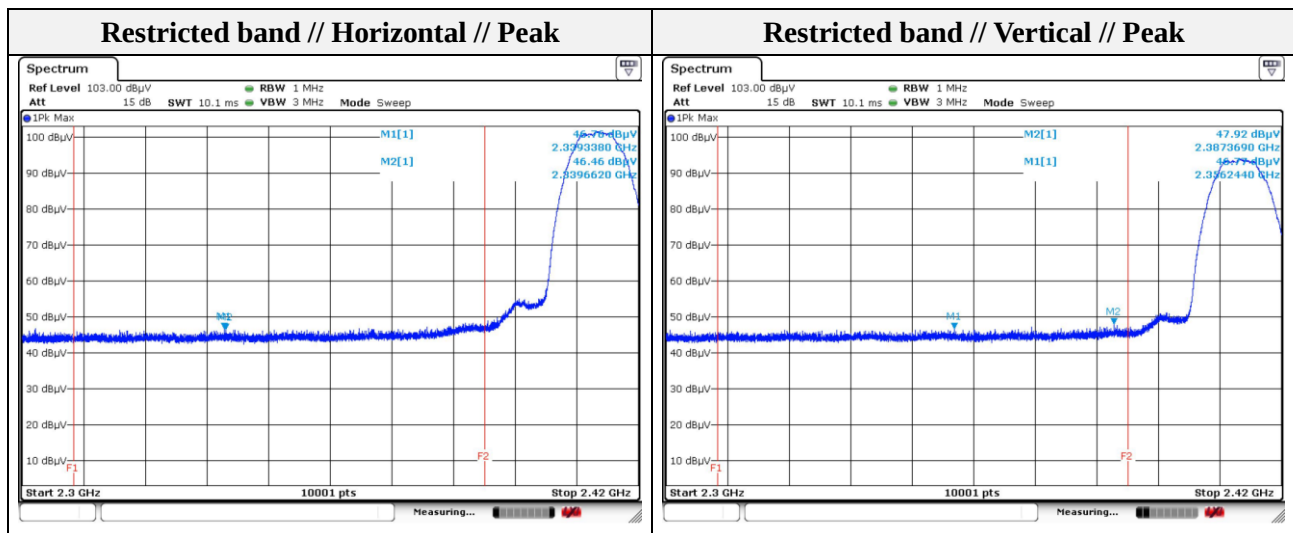
Mode: 802.11b
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 01

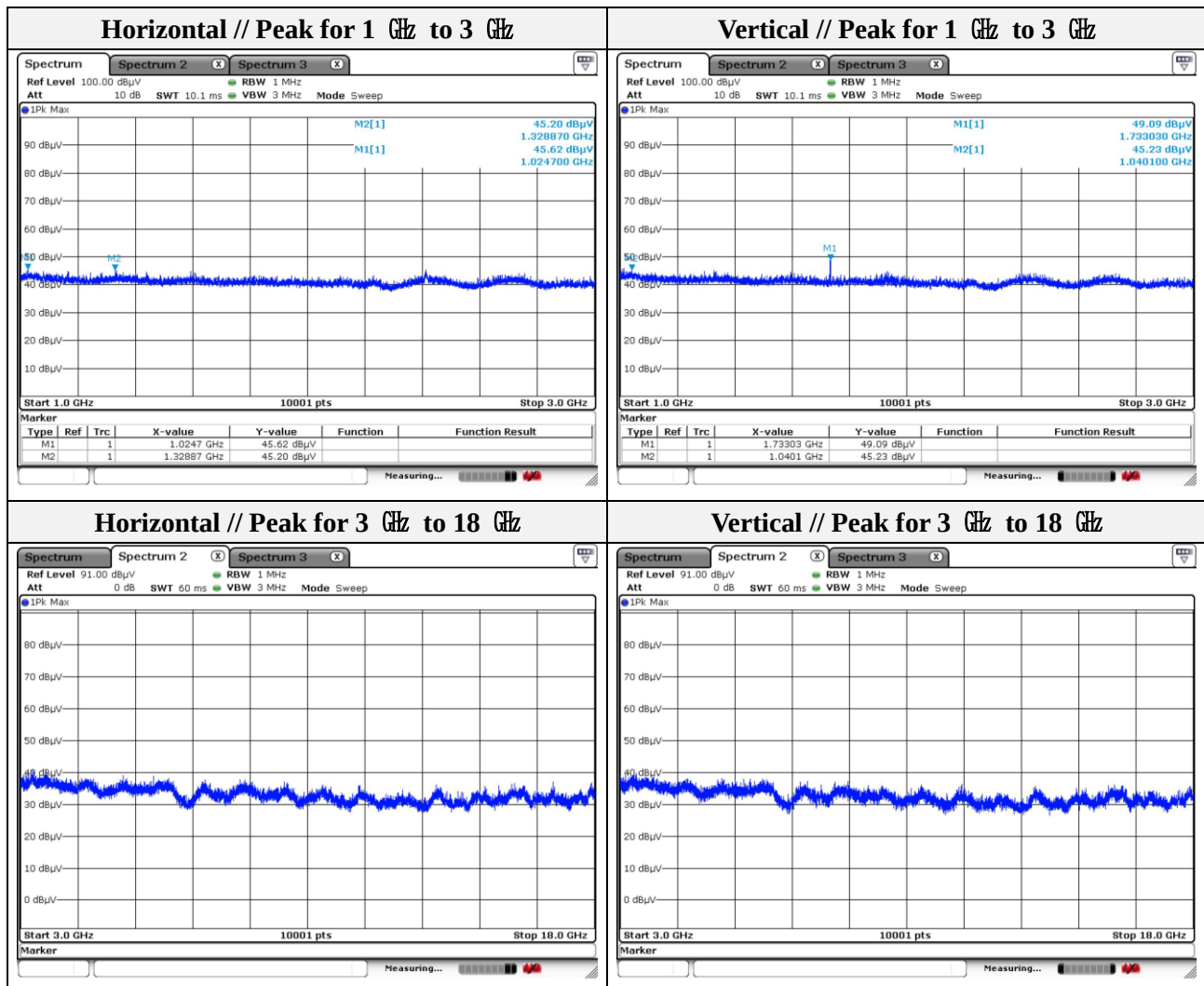
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 024.70	45.62	Peak	H	-11.03	-	34.59	74.00	39.41
1 040.10	45.23	Peak	V	-10.95	-	34.28	74.00	39.72
1 328.87	45.20	Peak	H	-9.41	-	35.79	74.00	38.21
1 733.03	49.09	Peak	V	-6.61	-	42.48	74.00	31.52

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 339.34	46.76	Peak	H	-2.98	-	43.78	74.00	30.22
2 339.66	46.46	Peak	H	-2.98	-	43.48	74.00	30.52
2 356.24	46.77	Peak	V	-2.91	-	43.86	74.00	30.14
2 387.37	47.92	Peak	V	-2.78	-	45.14	74.00	28.86





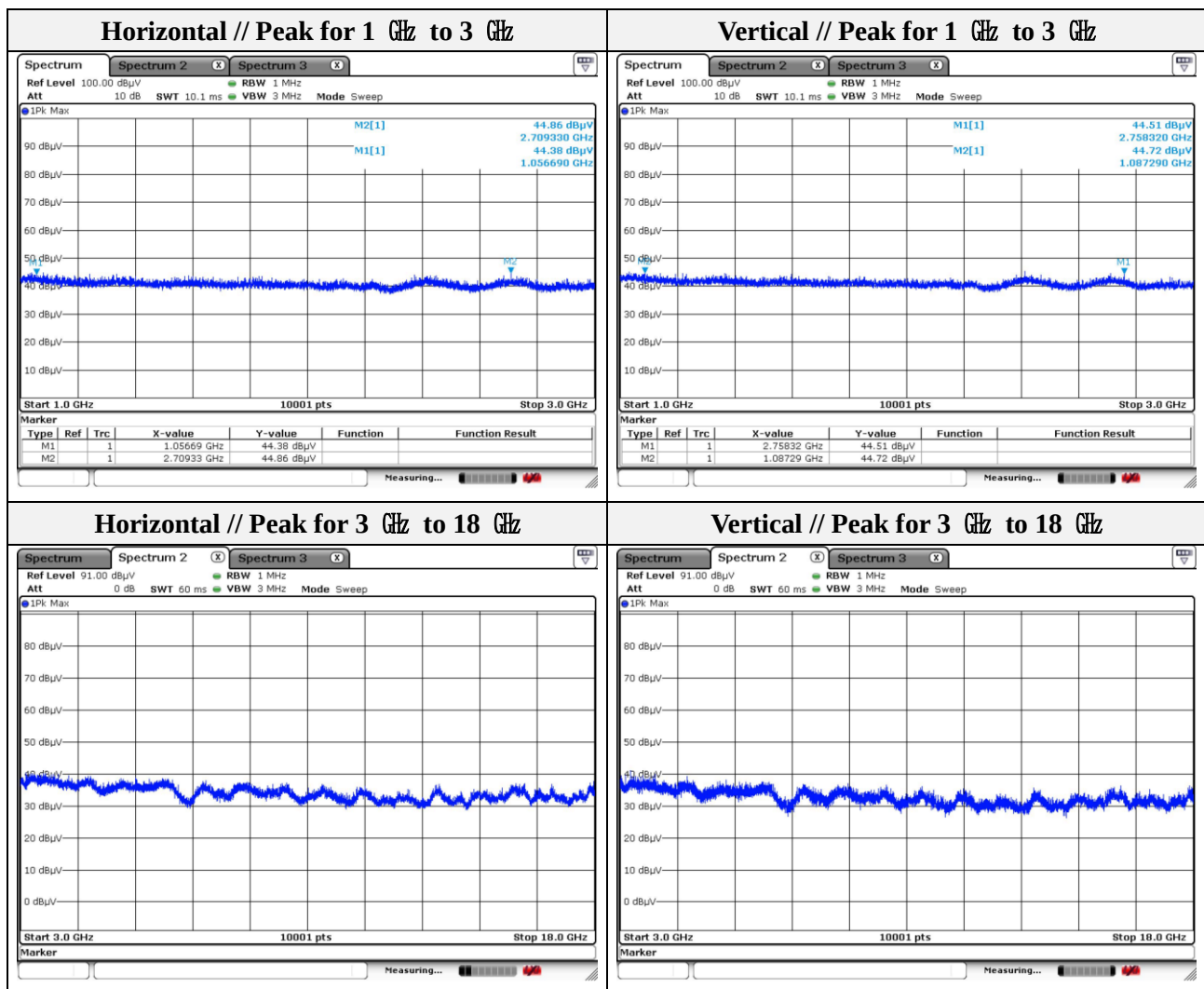
Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11b
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 06

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 056.69	44.38	Peak	H	-10.86	-	33.52	74.00	40.48
1 087.29	44.72	Peak	V	-10.70	-	34.02	74.00	39.98
2 709.33	44.86	Peak	H	-1.71	-	43.15	74.00	30.85
2 758.32	44.51	Peak	V	-1.55	-	42.96	74.00	31.04



Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

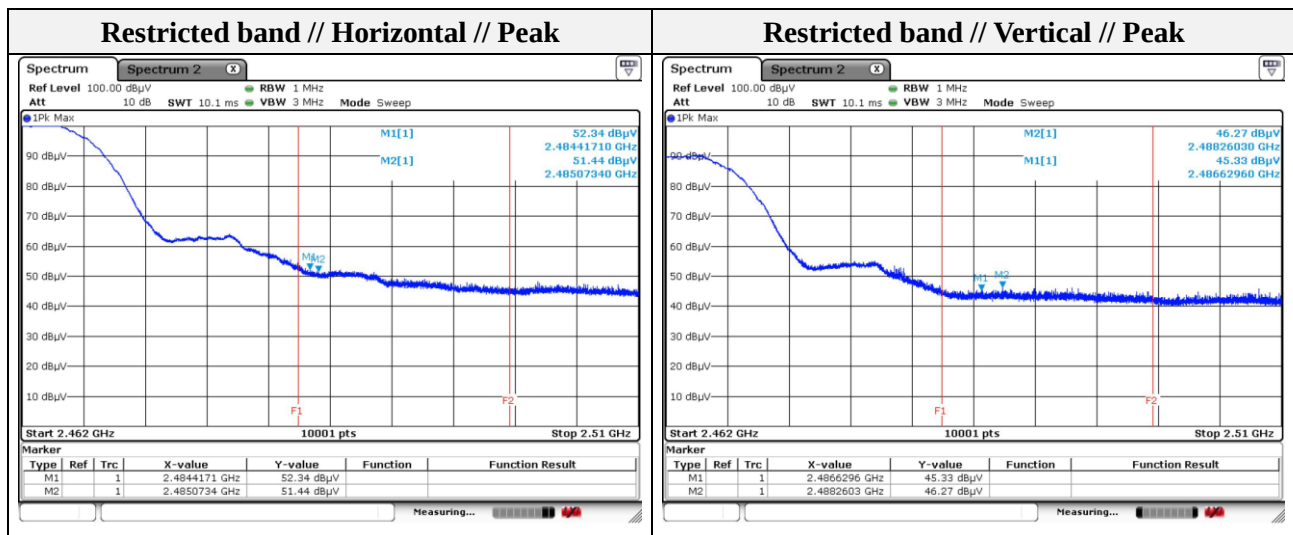
Mode: 802.11b
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 11

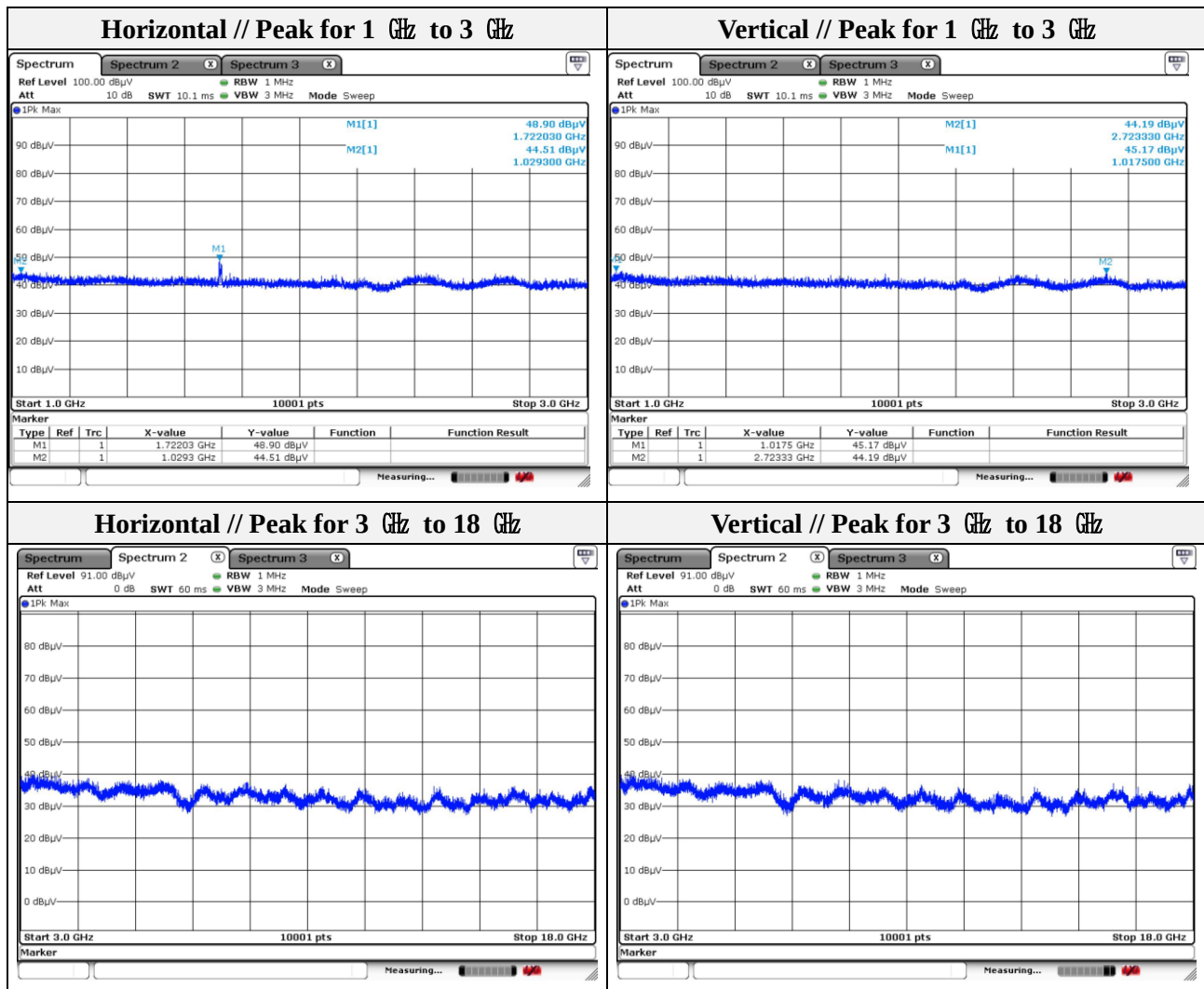
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 017.50	45.17	Peak	V	1017.50	-	34.10	74.00	39.90
1 029.30	44.51	Peak	H	1029.30	-	33.51	74.00	40.49
1 722.03	48.90	Peak	H	1722.03	-	42.20	74.00	31.80
2 723.33	44.19	Peak	V	2723.33	-	42.52	74.00	31.48

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 484.42	52.34	Peak	H	-2.40	-	49.94	74.00	24.06
2 485.07	51.44	Peak	H	-2.39	-	49.05	74.00	24.95
2 486.63	45.33	Peak	V	-2.39	-	42.94	74.00	31.06
2 488.26	46.27	Peak	V	-2.38	-	43.89	74.00	30.11





Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.