TEST REPORT

Part 15 Subpart C 15.247 & RSS-247 (Issue 2)

Equipment under test CAR DASH CAM

Model name DVR-C320R

FCC ID 2ADTG-DVRC320R

IC 12594A-DVRC320R

Applicant THINKWARE CORPORATION

Manufacturer THINKWARE CORPORATION

Date of test(s) 2020.06.29 ~ 2020.07.03

Date of issue 2020.07.07

Issued to
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Revision history

Revision	Date of issue	Test report No.	Description
-	2020.07.07	KES-RF-20T0113	Initial

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1. General information

Applicant:	THINKWARE CORPORATION
Applicant address:	A, 9FL, Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
Test site:	KES Co., Ltd.
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Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148 ISED Registration No.: 23298
FCC/IC rule part(s):	15.247 / RSS-247
FCC ID:	2ADTG-DVRC320R
IC Certification	12594A-DVRC320R
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	CAR DASH CAM
Frequency range	2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) 2 422 ㎒ ~ 2 452 ㎒ (11n_HT40)
Model:	DVR-C320R
Modulation technique	DSSS, OFDM
Number of channels	2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) : 11ch 2 422 ㎒ ~ 2 452 ㎒ (11n_HT40) : 9 ch
Antenna specification	Antenna type(2.4㎓ WIFI) : Chip antenna, Peak gain : 2.19 ㏈i
Power source	DC 12 V
H/W version	V3.0(PP)
S/W version	v0.17.00

1.2. Test configuration

The **THINKWARE CORPORATION // DVR-C320R // FCC ID: 2ADTG-DVRC320R // IC : 12594A-DVRC320R** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247
ISED RSS-247 Issue 2 and RSS-Gen Issue 5
KDB 558074 D01 v05 r02
ANSI C63.10-2013

1.3. Device modifications

N/A

1.4. Accessory information

N/A

1.5. 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.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 1.40 + 10.00 = 11.40 (dB)

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.46 dB
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 GHz	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.		

1.7. Frequency/channel operations

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

1.8. Worst case data rate

1. Radiated emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates were:
   802.11b: **1 Mbps**
   802.11g: **6 Mbps**
   802.11n_HT20: **MCS0**
   802.11n_HT40: **MCS0**

2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Parameter	Test results
-	RSS-Gen 6.6	26 dB bandwidth & 99 % bandwidth	N/A[1)]
15.247(a)(2)	RSS-247 5.2 (a) RSS-247 6.2.4	6 dB bandwidth	N/A[1)]
15.247(b)(3)	RSS-247 5.4 (d) RSS-247 6.2.4.1	Output power	Pass
15.247(e)	RSS-247 5.2 (b) RSS-247 6.2.4.1	Power spectral density	N/A[1)]
15.205 15.209	RSS-247 5.5 RSS-Gen 8.9, 8.10	Radiated restricted band and emission	Pass
15.247(d)	RSS-247 5.5	Conducted spurious emission and band edge	N/A[1)]
15.207(a)	RSS-Gen 8.8	AC conducted emissions	N/A[1)]

Note 1) Please Refer to the approved Module Report (Report No.: EC1905007RI03, EC1905007RI04) for these parameters.

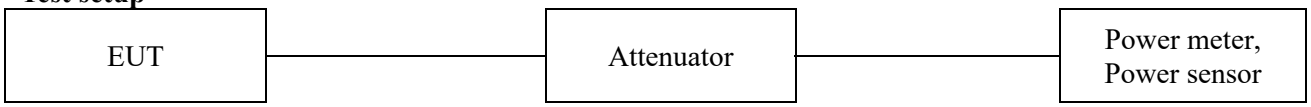
3. Test results

3.1. Output power

Test procedure

ANSI C63.10 – section 11.9.1.1 or section 11.9.1.3 and 11.9.2.3.2

Test setup



ANSI C63.10 - Section 11.9.1.1

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 3 × RBW
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level

ANSI C63.10 - section 11.9.1.3

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS ba ndwidth and shall utilize a fast-responding diode detector.

ANSI C63.10 - section 11.9.2.3.2

Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Limit

According to §15.247(b)(3), For systems using digital modulation in the 902~928 ㎒, 2 400~2 483.5 ㎒, and 5 725~5 850 ㎒ bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted out-put power. Maximum Conducted Out-put Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph (c) of this section, if transmit-ting antennas of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 ㏈i.

According to RSS-247 5.4 (d), For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in Section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

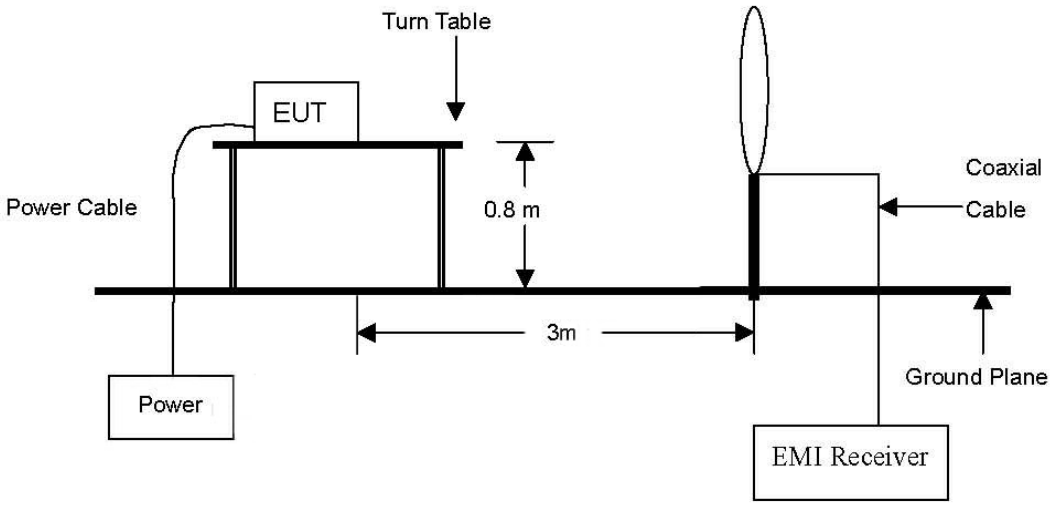
Test results

Measured output power (dBm)						
Mode	**2412 ㎒**		**2437 ㎒**		**2462 ㎒**	
	Peak	**Average**	**Peak**	**Average**	**Peak**	**Average**
11b	19.75	17.22	19.84	17.32	19.64	17.17
11g	21.27	15.79	21.28	15.96	21.26	15.87
11n_HT 20	20.78	15.09	20.88	15.27	20.72	15.07
Mode	**2422 ㎒**		**2437 ㎒**		**2452 ㎒**	
	Peak	**Average**	**Peak**	**Average**	**Peak**	**Average**
11n_HT 40	21.27	15.06	21.06	15.27	20.69	15.21

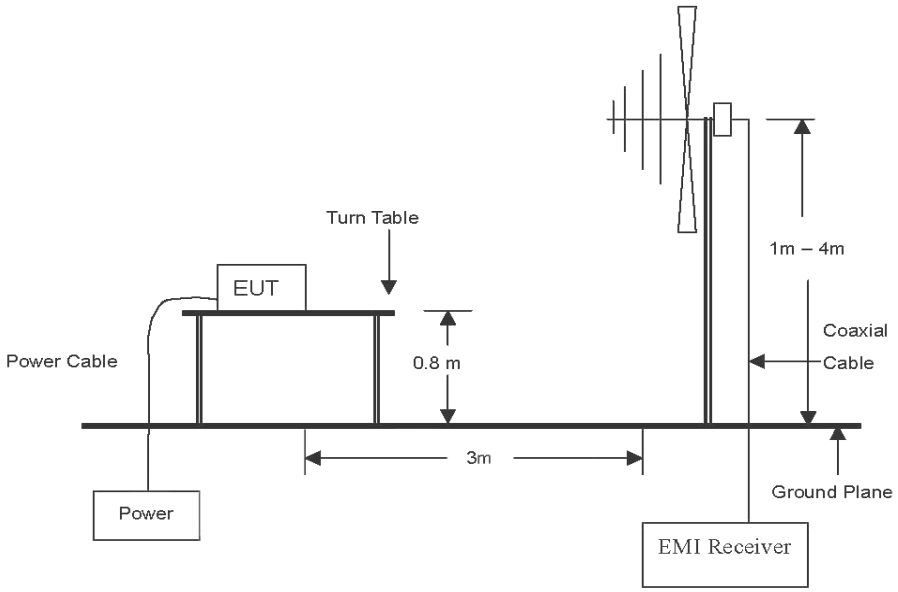
3.2. Radiated restricted band and emissions

Test setup

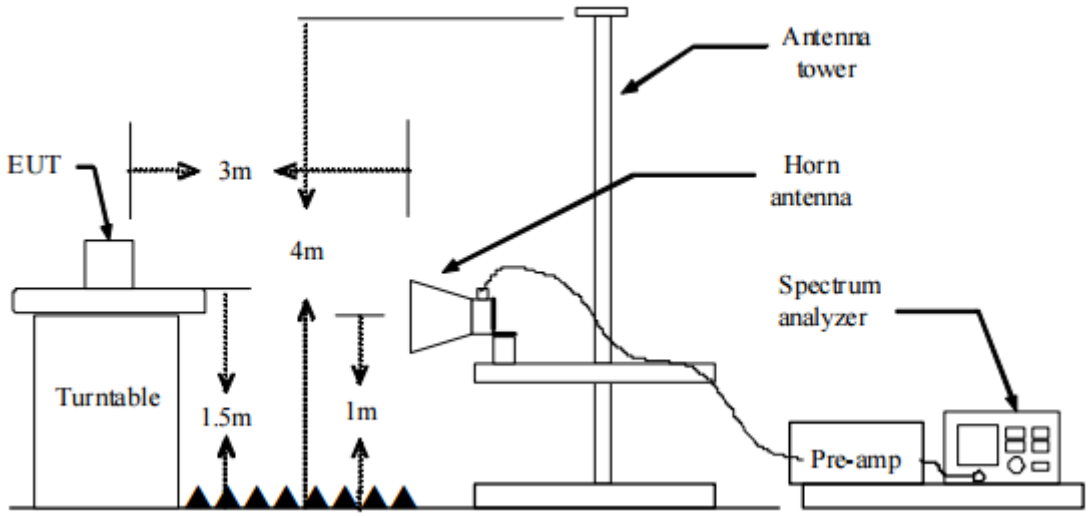
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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.



Test procedure below 30 ㎒

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 and perpendicular of the antenna are set to make the measurement.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
4. 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.
5. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 ㎒

1. Spectrum analyzer settings for $f < 1$ ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 100 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
2. Spectrum analyzer settings for $f \geq 1$ ㎓: Peak
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 ㎒
   ④ Detector = peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
   ⑦ Trace was allowed to stabilize

3. Spectrum analyzer settings for $f \geq 1$ ㎓: Average
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 × RBW
   ④ Detector = RMS, 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.
   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 ㏈ 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. The loop antenna was investigated with three polarizations, and horizontal and vertical polarizations were reported as the worst case.
2. f <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/Ds)$
   $f \geq 30$ ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/Ds)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
3. CF(Correction factors(㏈)) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
4. Field strength(㏈㎶/m) = Level(㏈㎶) + CF (㏈) + or DCF(㏈)
5. Margin(㏈) = Limit(㏈㎶/m) - Field strength(㏈㎶/m)
6. Emissions below 18 ㎓ were measured at a 3 meter test distance while emissions above 18 ㎓ 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 ㏈ of respective limits were not reported.
7. According to exploratory test no any obvious emission were detected from 9㎑ to 30㎒. Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test 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 (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400/F(㎑)
0.490 ~ 1.705	30	24000/F(㎑)
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 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to RSS-Gen, Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2 400 / F(㎑)
0.490 ~ 1.705	30	24 000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960*	3	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

Duty cycle

Regarding to KDB 558074 D01_v05 r02, 6. Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

a) A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on- and off-times of the transmitted signal.

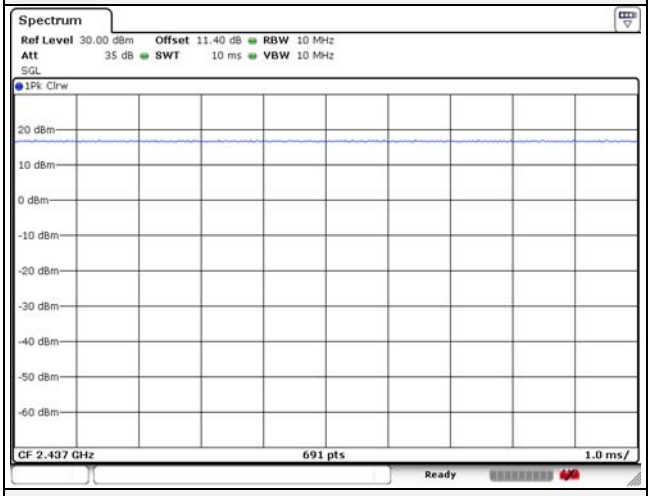
b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on- and off-times of the transmitted signal.

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
802.11b	10.00	10.00	1.00	100	0
802.11g	10.00	10.00	1.00	100	0
802.11n(HT20)	10.00	10.00	1.00	100	0
802.11n(HT40)	10.00	10.00	1.00	100	0

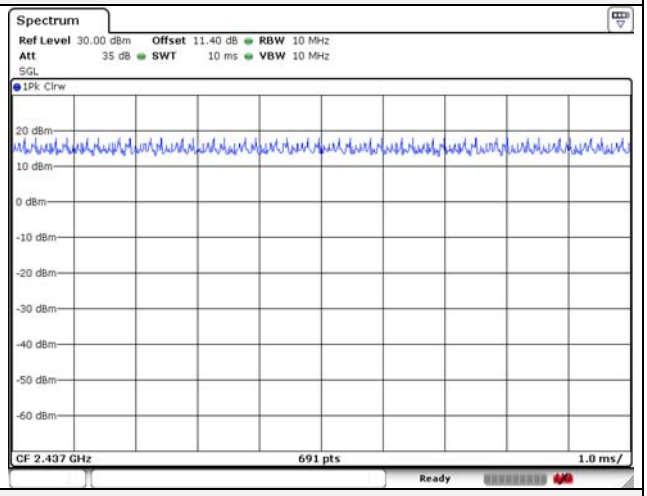
Duty cycle (Linear) = T_{on} time/Period

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

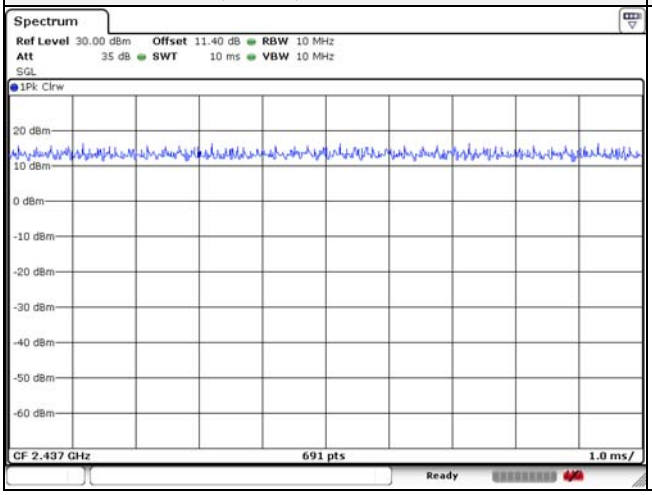
802.11b // Middle channel



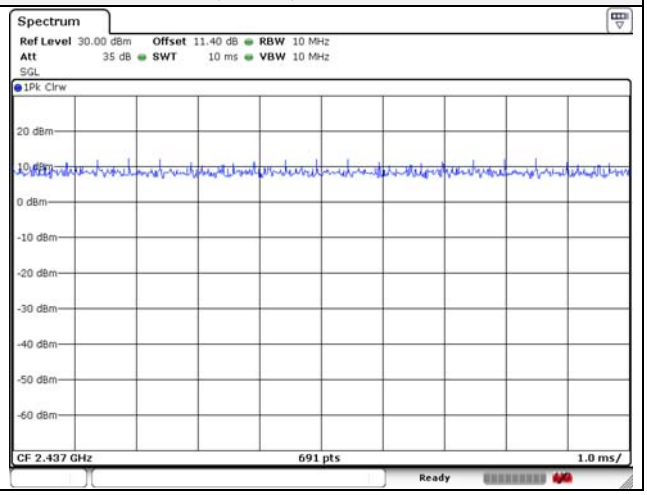
802.11g // Middle channel



802.11n(HT20) // Middle channel



802.11n(HT40) // Middle channel



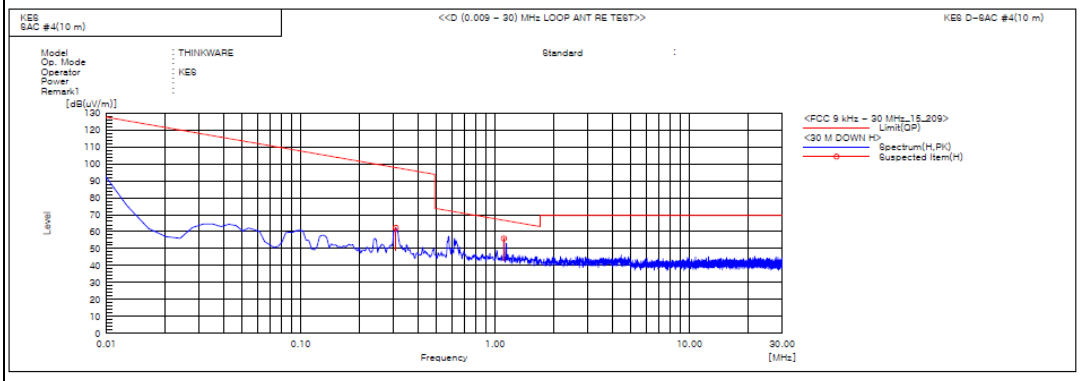
Test results (Below 30 ㎒)

Mode: 802.11b

Distance of measurement: 3 meter

Channel: 06 (Worst case)

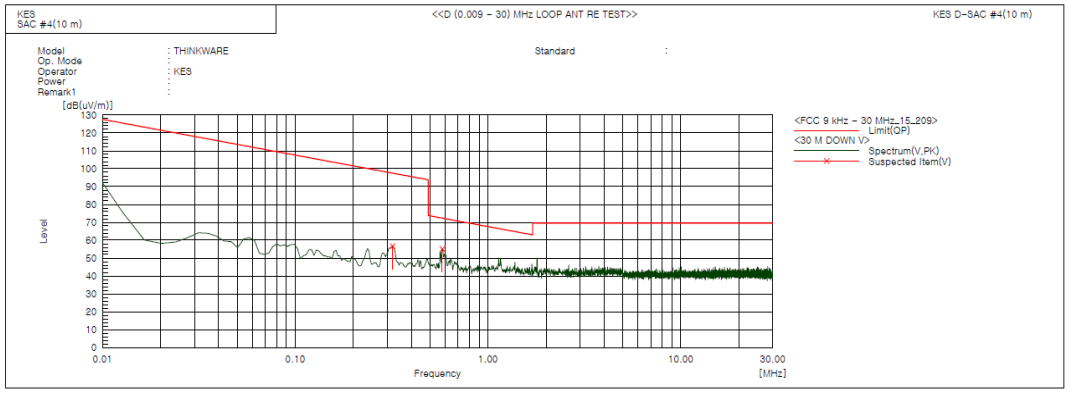
Horizontal



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.009	H	80.0	19.3	99.3	128.5	29.2	100.0	26.0	
2	0.309	H	42.0	20.2	62.2	97.8	35.6	100.0	179.0	
3	1.111	H	34.8	21.2	56.0	66.7	10.7	100.0	95.0	

Vertical



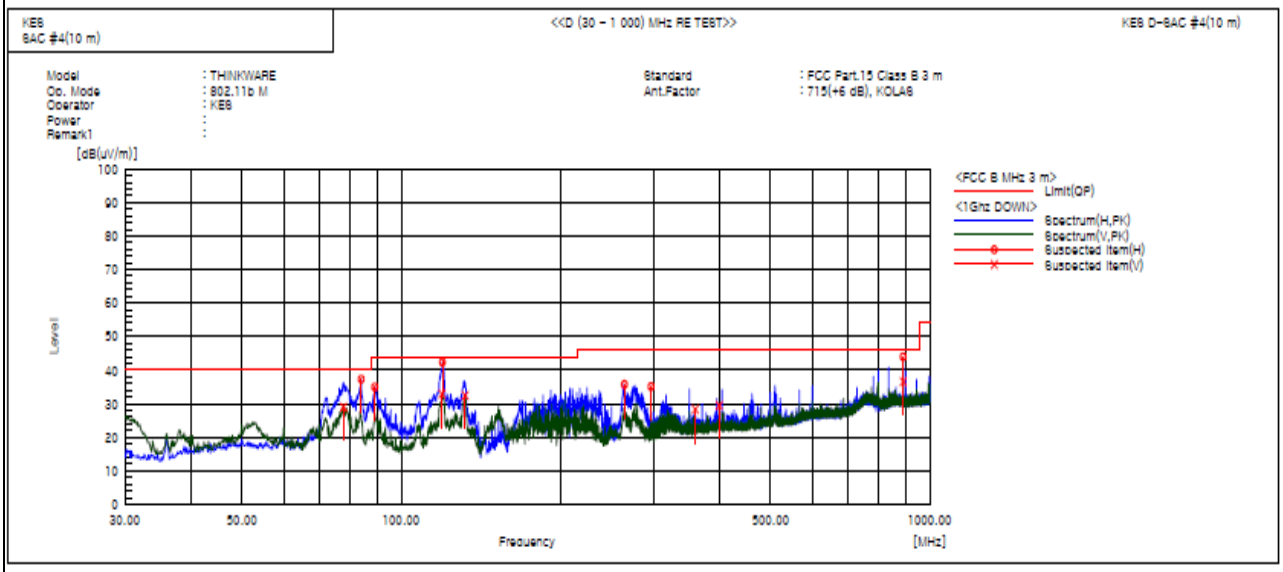
Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.009	V	80.1	19.3	99.4	128.5	29.1	100.0	287.0	
2	0.320	V	36.4	20.3	56.7	97.5	40.8	100.0	241.0	
3	0.579	V	34.2	20.9	55.1	72.4	17.3	100.0	116.0	

Test results (Below 1 000 ㎒)

Mode:	802.11b
Distance of measurement:	3 meter
Channel:	06 (Worst case)

Horizontal // Vertical



No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	84.078	H	64.6	-27.3	37.3	40.0	2.7	200.0	176.0	
2	89.170	H	60.7	-25.7	35.0	43.5	8.5	200.0	183.0	
3	119.725	H	67.1	-24.8	42.3	43.5	1.2	200.0	199.0	
4	264.619	H	56.6	-20.9	35.7	46.0	10.3	100.0	313.0	
5	296.993	H	55.1	-20.0	35.1	46.0	10.9	100.0	209.0	
6	890.875	H	51.7	-7.7	44.0	46.0	2.0	100.0	213.0	
7	77.773	V	57.1	-28.1	29.0	40.0	11.0	400.0	295.0	
8	119.483	V	57.7	-24.8	32.9	43.5	10.6	400.0	287.0	
9	132.214	V	59.0	-26.6	32.4	43.5	11.1	150.0	161.0	
10	360.043	V	45.7	-17.4	28.3	46.0	17.7	100.0	175.0	
11	400.055	V	46.1	-16.6	29.5	46.0	16.5	100.0	342.0	
12	890.875	V	44.2	-7.7	36.5	46.0	9.5	150.0	129.0	

Test results (Above 1 000 ㎒)

Mode: 802.11b

Distance of measurement: 3 meter

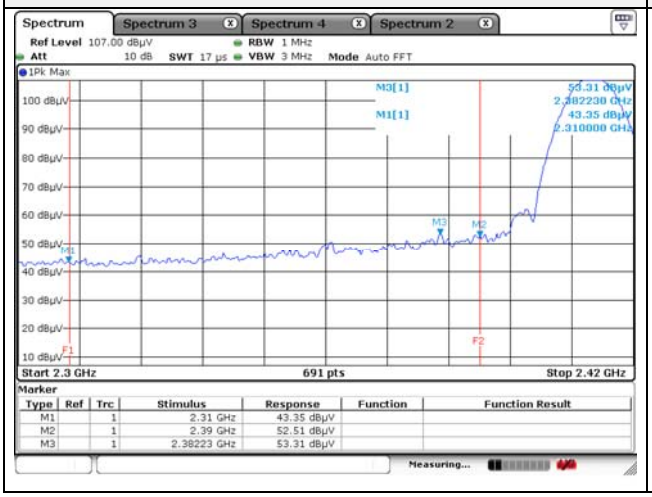
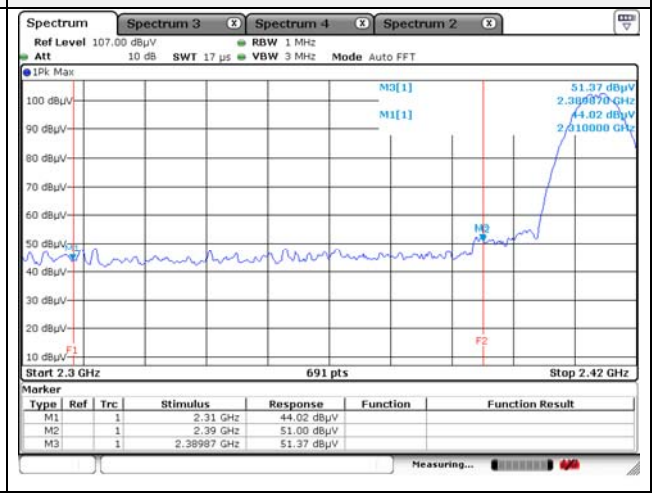
Channel: 01

- **Spurious**

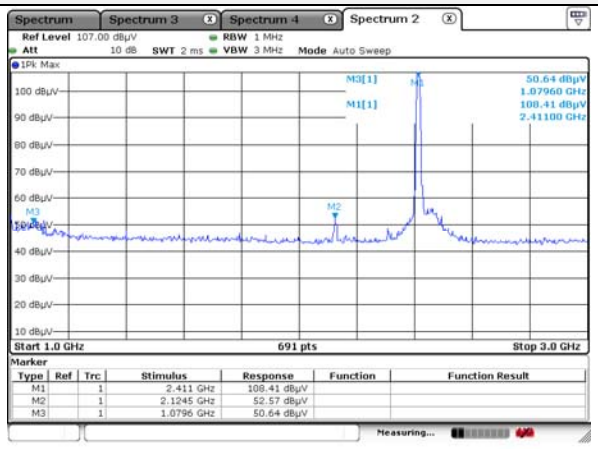
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1079.60	50.64	Peak	H	-8.19	-	42.45	74.00	31.55
2124.50	52.57	Peak	H	-0.67	-	51.90	74.00	22.10
1172.20	52.82	Peak	V	-7.67	-	45.15	74.00	28.85
2121.60	47.73	Peak	V	-0.68	-	47.05	74.00	26.95
4824.00	51.77	Peak	H	7.14	-	58.91	74.00	15.09
4824.00	37.46	Average	H	7.14	-	44.60	54.00	9.40
4824.00	52.69	Peak	V	7.14	-	59.83	74.00	14.17
4824.00	34.49	Average	V	7.14	-	42.45	74.00	31.55

- **Band edge**

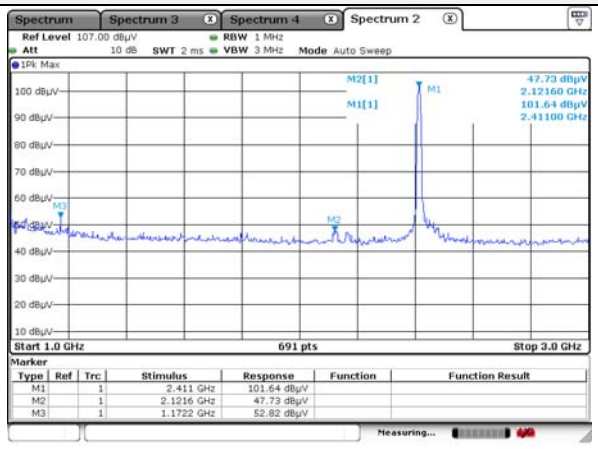
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2382.23	53.31	Peak	H	-0.15	-	53.16	74.00	20.84
2389.87	51.37	Peak	V	-0.13	-	51.24	74.00	22.76

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	

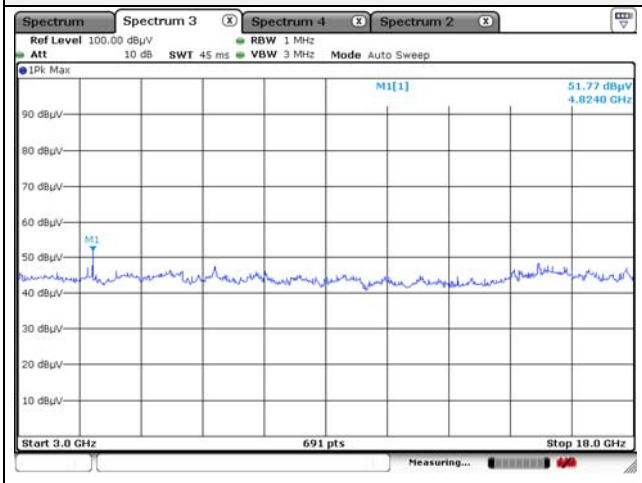
Horizontal // Peak for 1 ㎓ to 3 ㎓



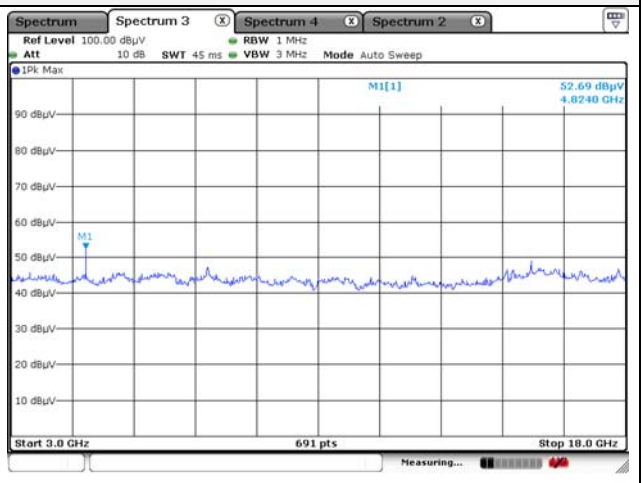
Vertical // Peak for 1 ㎓ to 3 ㎓



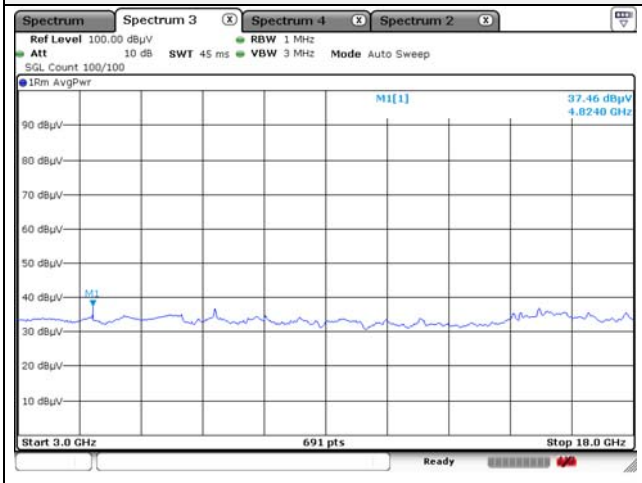
Horizontal // Peak for 3 ㎓ to 18 ㎓



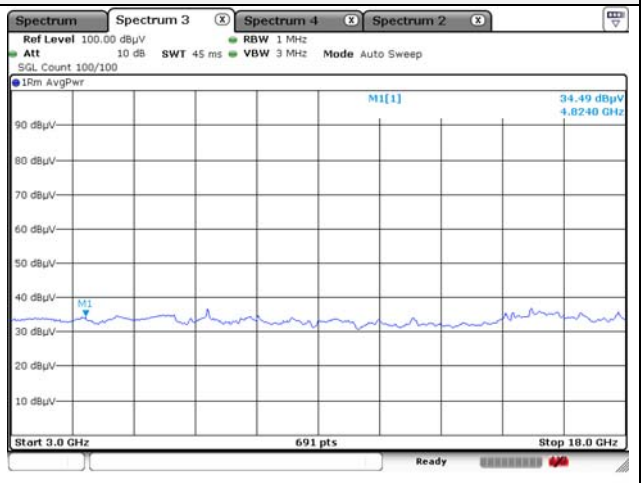
Vertical // Peak for 3 ㎓ to 18 ㎓



Horizontal // Average for 3 ㎓ to 18 ㎓



Vertical // Average for 3 ㎓ to 18 ㎓



Note.

1. Average test would be performed if the peak result were greater than the average limit.

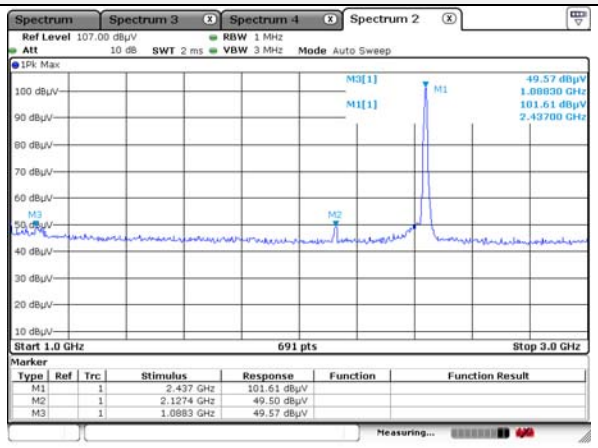
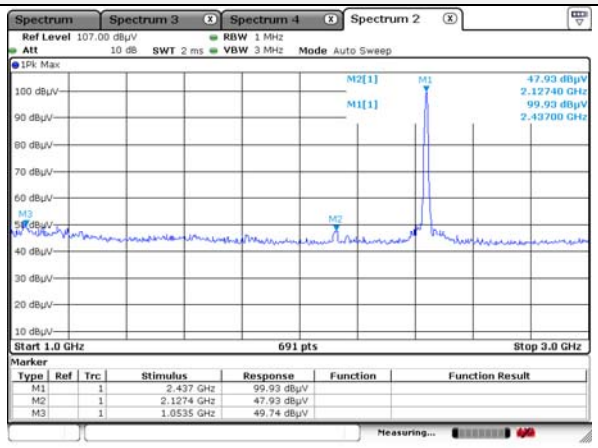
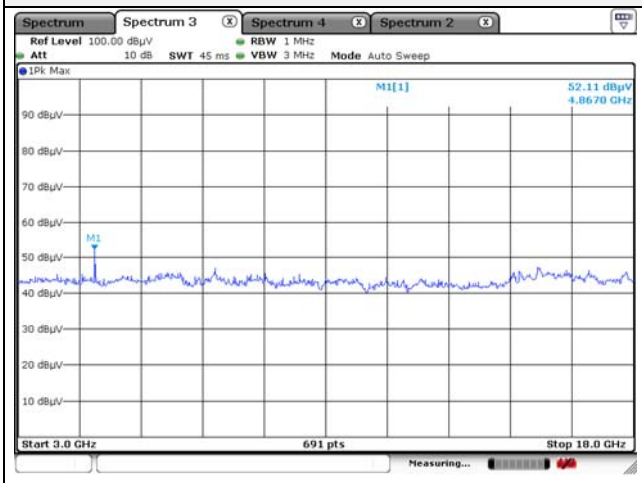
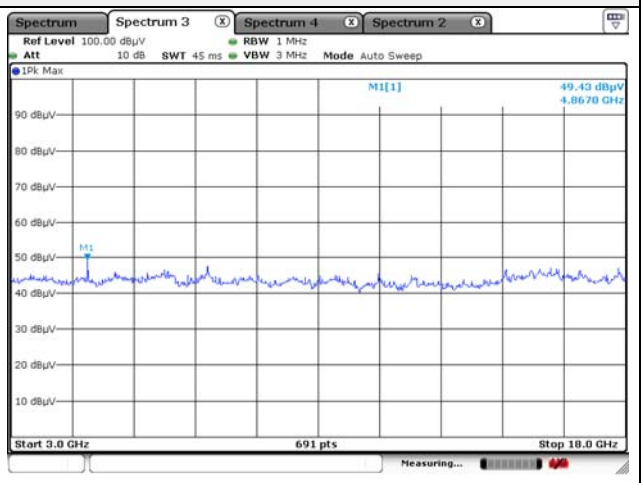
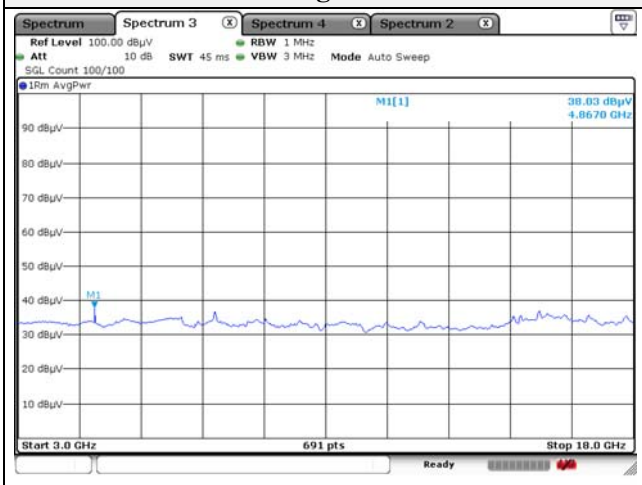
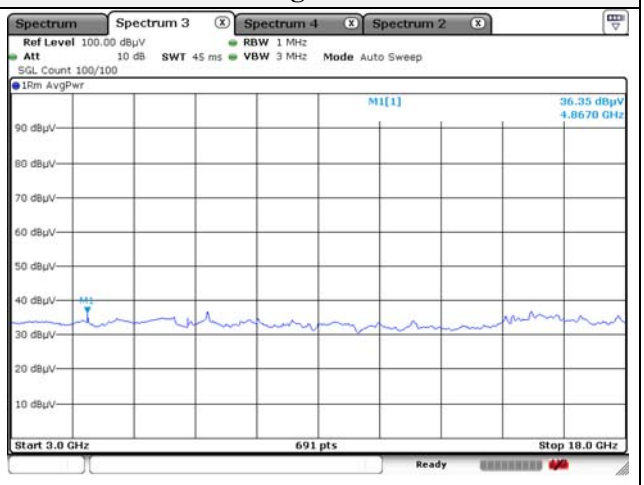
Mode: 802.11b

Distance of measurement: 3 meter

Channel: 06

- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1088.30	49.57	Peak	H	-8.14	-	41.43	74.00	32.57
2127.40	49.50	Peak	H	-0.67	-	48.83	74.00	25.17
1053.50	49.74	Peak	V	-8.34	-	41.40	74.00	32.60
2127.40	47.93	Peak	V	-0.67	-	47.26	74.00	26.74
4867.00	52.11	Peak	H	7.46	-	59.57	74.00	14.43
4867.00	38.03	Average	H	7.46	-	45.49	54.00	8.51
4867.00	49.43	Peak	V	7.46	-	56.89	74.00	17.11
4867.00	36.35	Average	V	7.46	-	43.81	54.00	10.19

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11b

Distance of measurement: 3 meter

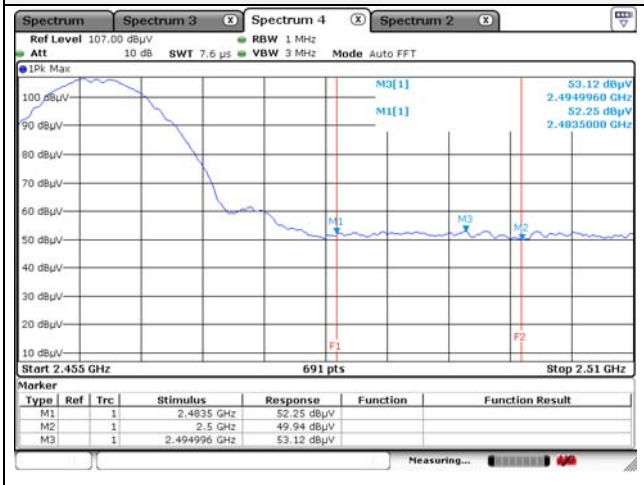
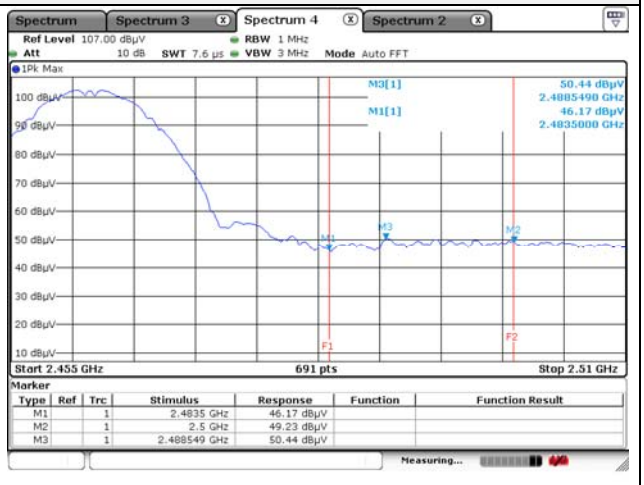
Channel: 11

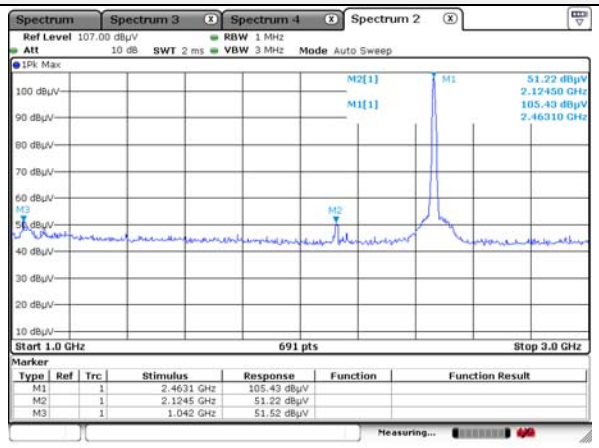
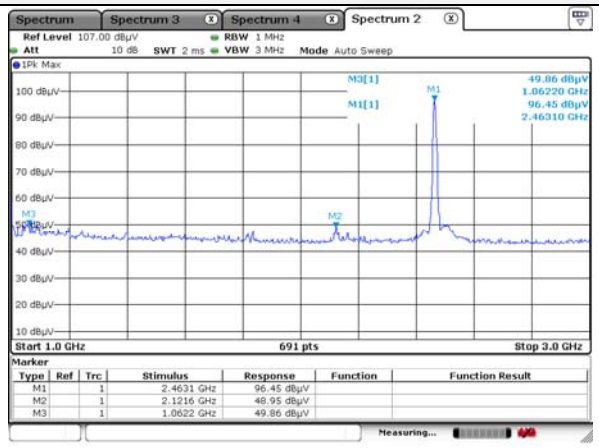
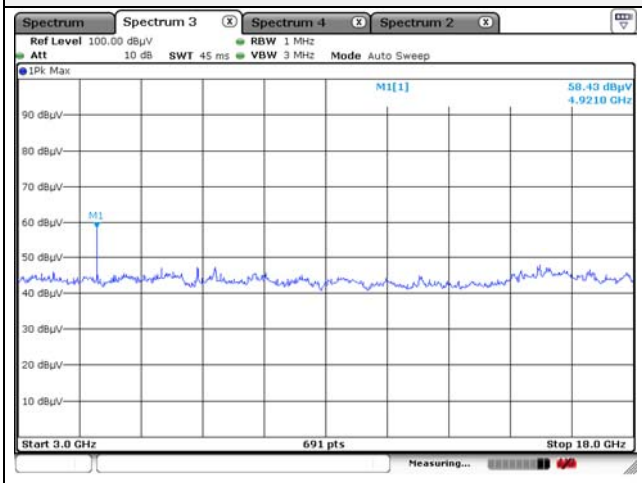
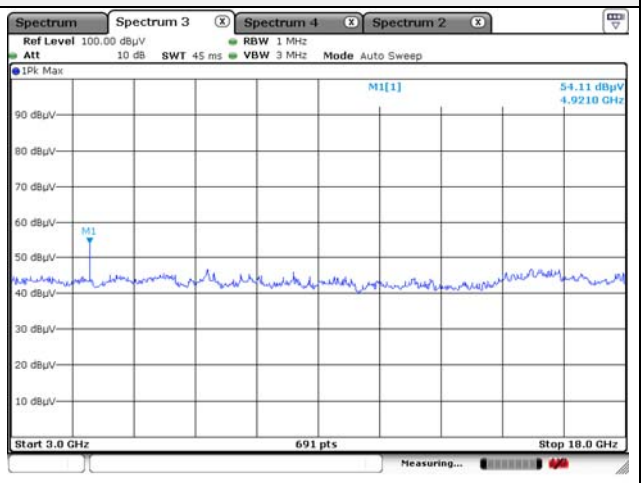
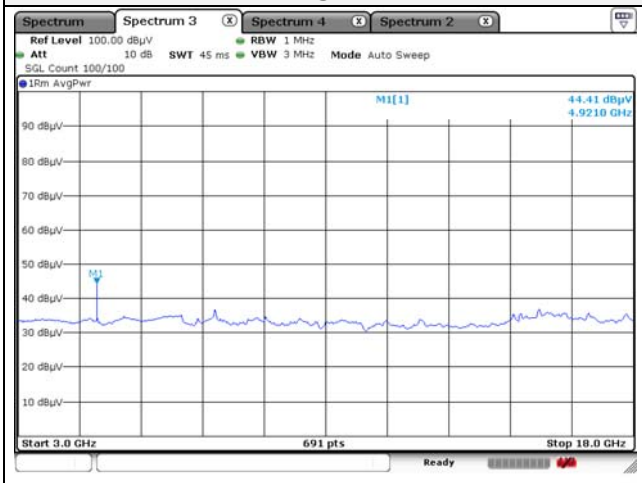
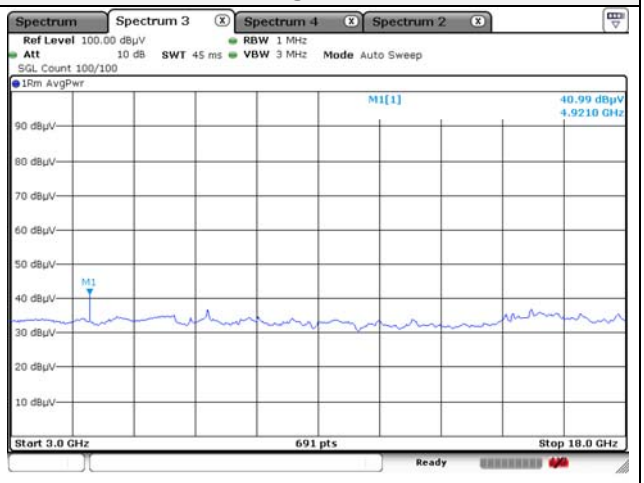
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1042.00	51.52	Peak	H	-8.40	-	43.12	74.00	30.88
2124.50	51.22	Peak	H	-0.67	-	50.55	74.00	23.45
1062.20	49.86	Peak	V	-8.29	-	41.57	74.00	32.43
2121.60	48.95	Peak	V	-0.68	-	48.27	74.00	25.73
4921.00	58.43	Peak	H	7.86	-	66.29	74.00	7.71
4921.00	44.41	Average	H	7.86	-	52.27	54.00	1.73
4921.00	54.11	Peak	V	7.86	-	61.97	74.00	12.03
4921.00	40.99	Average	V	7.86	-	48.85	54.00	5.15

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2495.00	53.12	Peak	H	0.10	-	53.22	74.00	20.78
2488.55	50.44	Peak	V	0.08	-	50.52	74.00	23.48

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11g

Distance of measurement: 3 meter

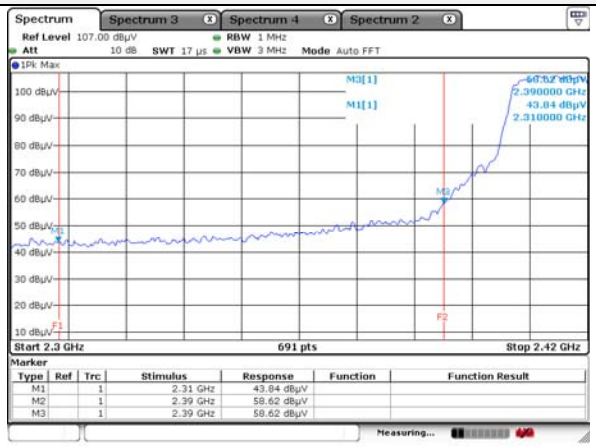
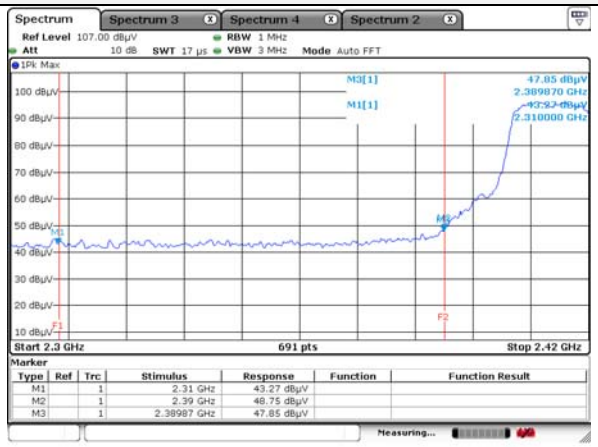
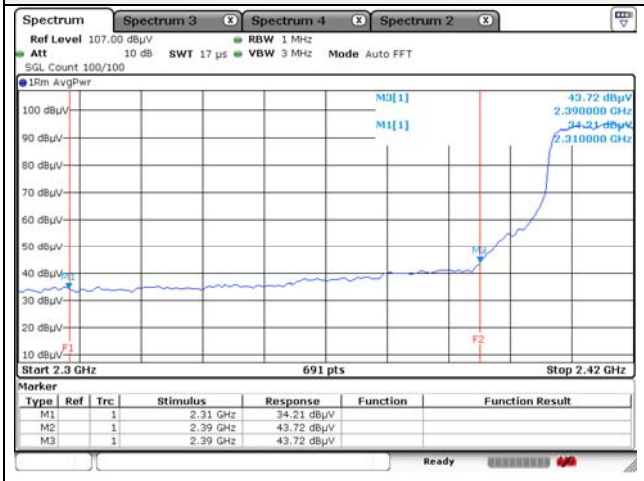
Channel: 01

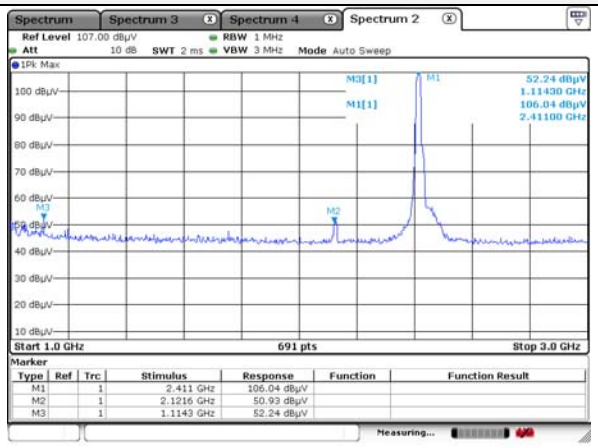
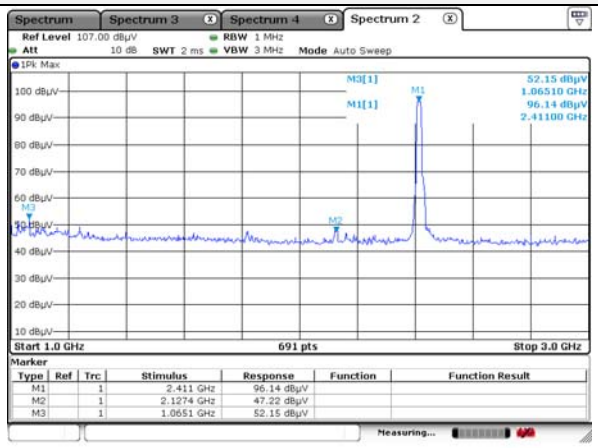
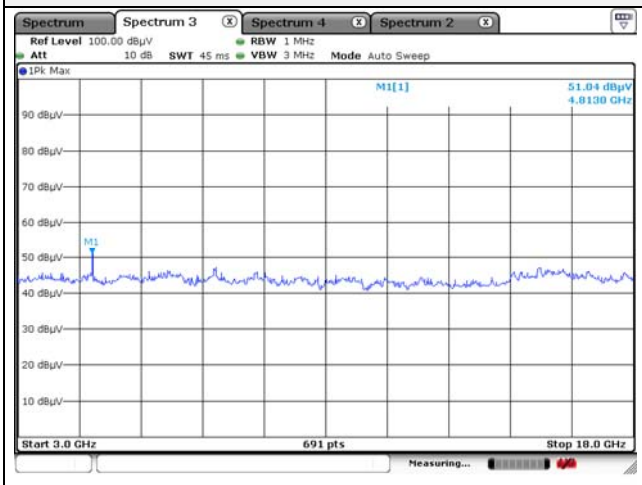
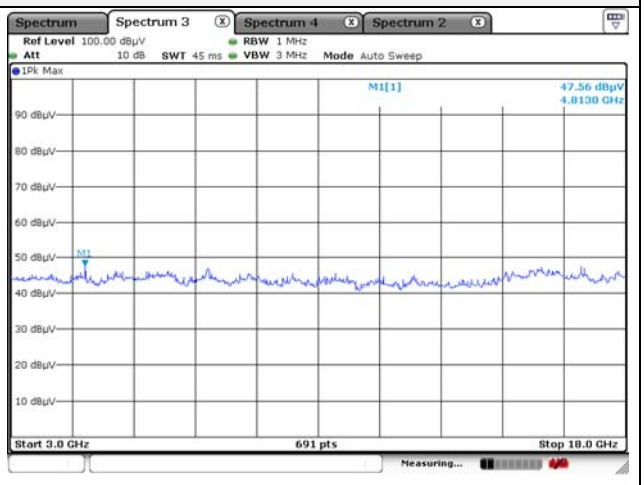
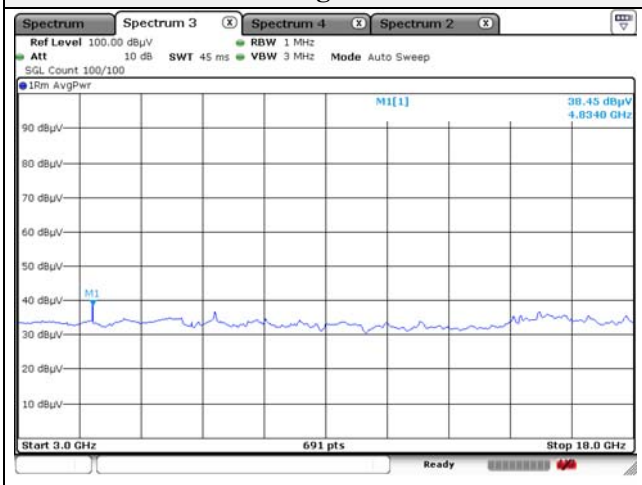
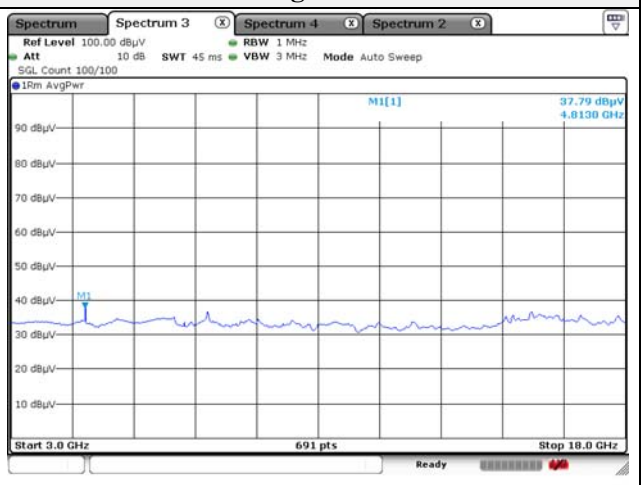
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1114.30	52.24	Peak	H	-8.00	-	44.24	74.00	29.76
2121.60	50.93	Peak	H	-0.68	-	50.25	74.00	23.75
1065.10	52.15	Peak	V	-8.27	-	43.88	74.00	30.12
2127.40	47.22	Peak	V	-0.67	-	46.55	74.00	27.45
4813.00	51.04	Peak	H	7.06	-	58.10	74.00	15.90
4813.00	47.56	Peak	V	7.06	-	54.62	74.00	19.38
4834.00	38.45	Average	H	7.22	-	45.67	54.00	8.33
4813.00	37.79	Average	V	7.06	-	44.85	54.00	9.15

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2390.00	58.62	Peak	H	-0.13	-	58.49	74.00	15.51
2390.00	43.72	Average	H	-0.13	-	43.59	54.00	10.41
2390.00	48.75	Peak	V	-0.13	-	48.62	74.00	25.38

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Restricted band // Horizontal // Average	**Restricted band // Vertical // Average**
	N/A

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

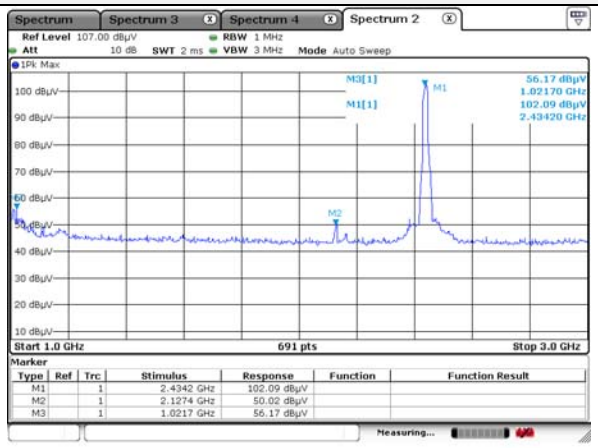
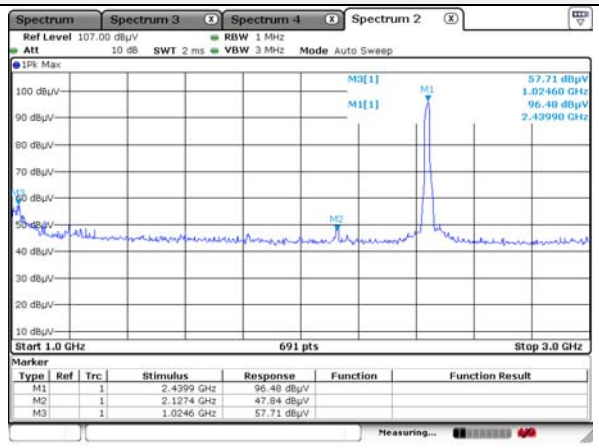
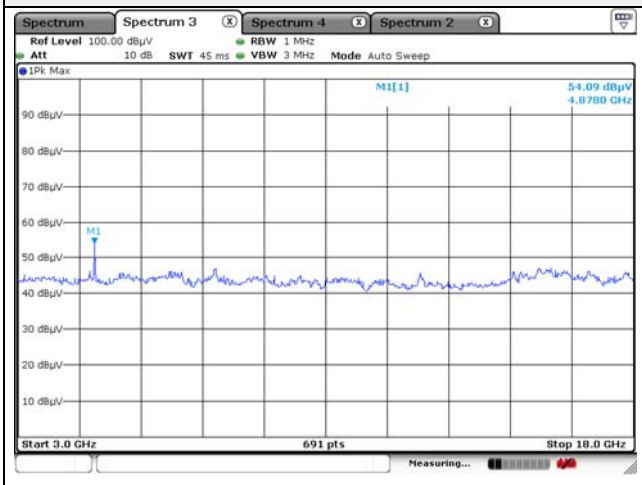
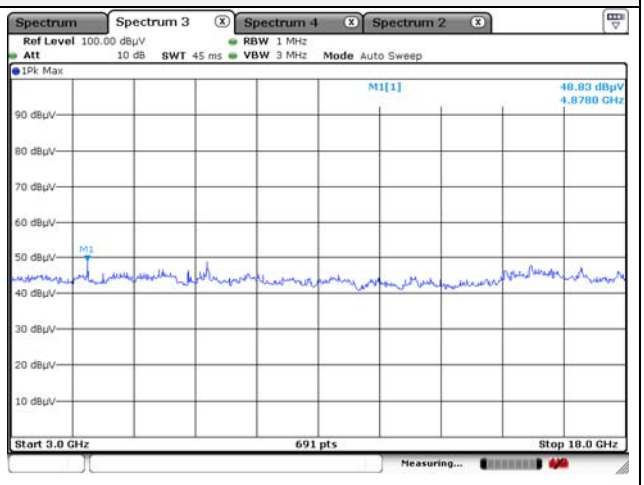
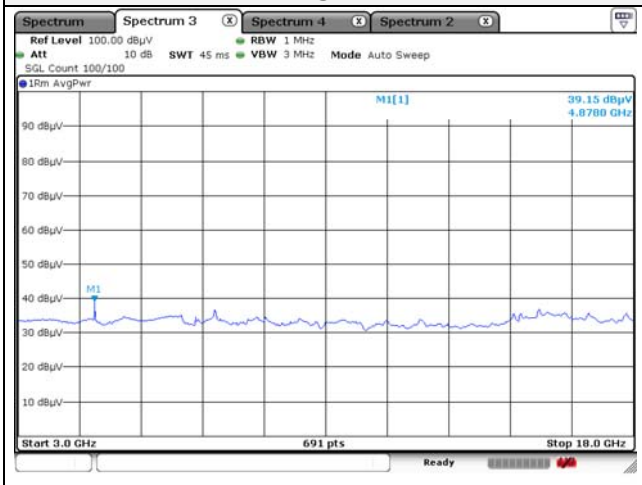
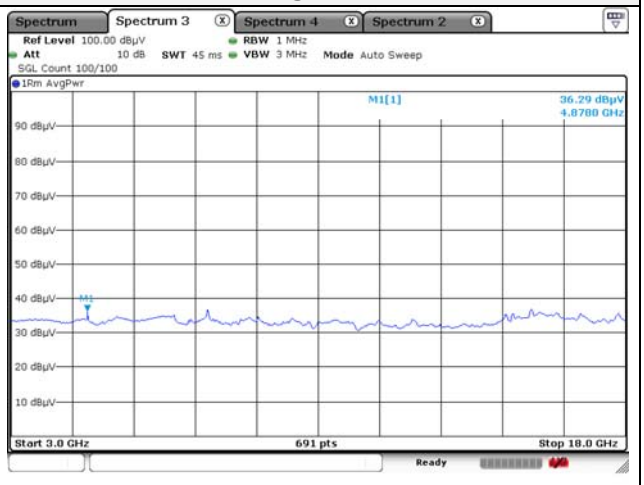
Mode: 802.11g

Distance of measurement: 3 meter

Channel: 06

- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1021.70	56.17	Peak	H	-8.52	-	47.65	74.00	26.35
2127.40	50.02	Peak	H	-0.67	-	49.35	74.00	24.65
1024.60	57.71	Peak	V	-8.50	-	49.21	74.00	24.79
2127.40	47.84	Peak	V	-0.67	-	47.17	74.00	26.83
4878.00	54.09	Peak	H	7.54	-	61.63	74.00	12.37
4878.00	48.83	Peak	V	7.54	-	56.37	74.00	17.63
4878.00	39.15	Average	H	7.54	-	46.69	54.00	7.31
4878.00	36.29	Average	V	7.54	-	43.83	54.00	10.17

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11g

Distance of measurement: 3 meter

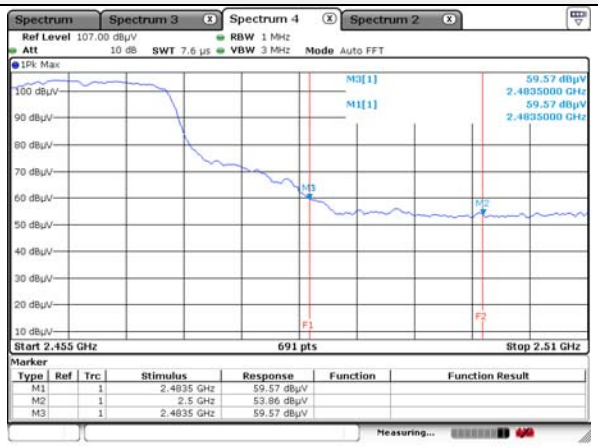
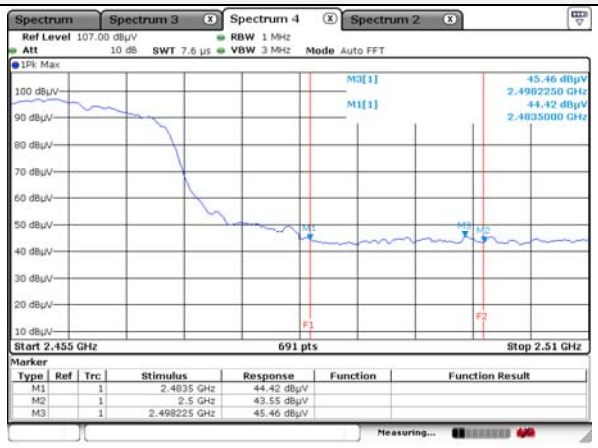
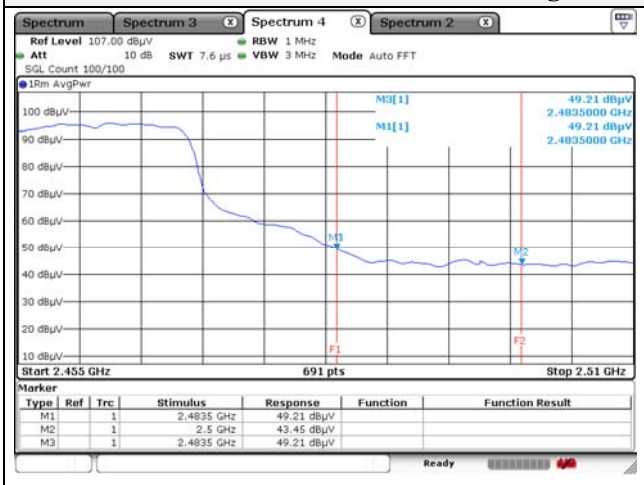
Channel: 11

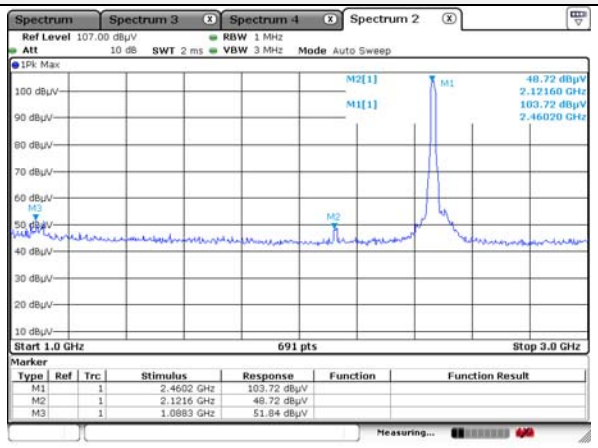
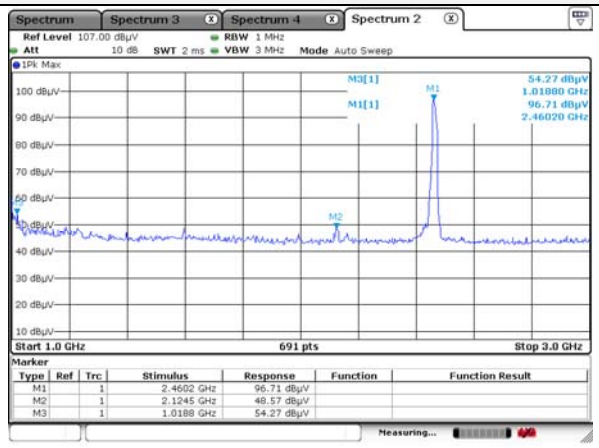
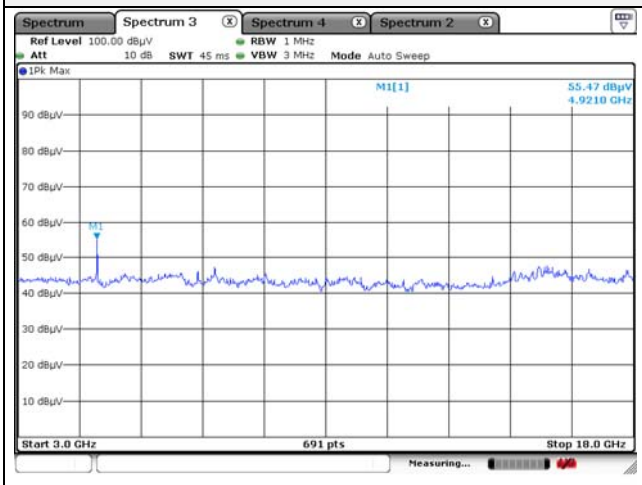
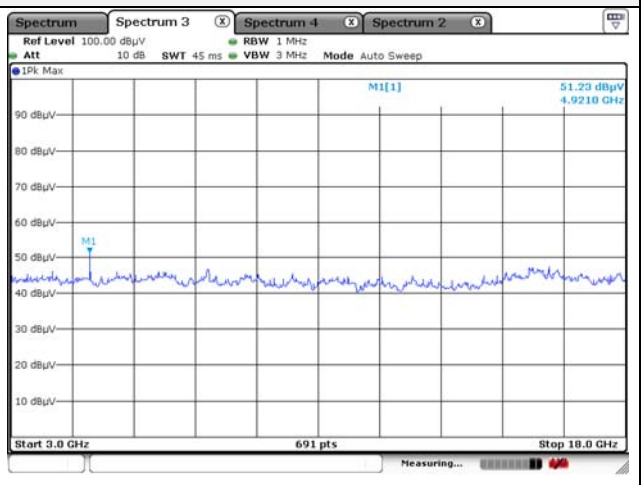
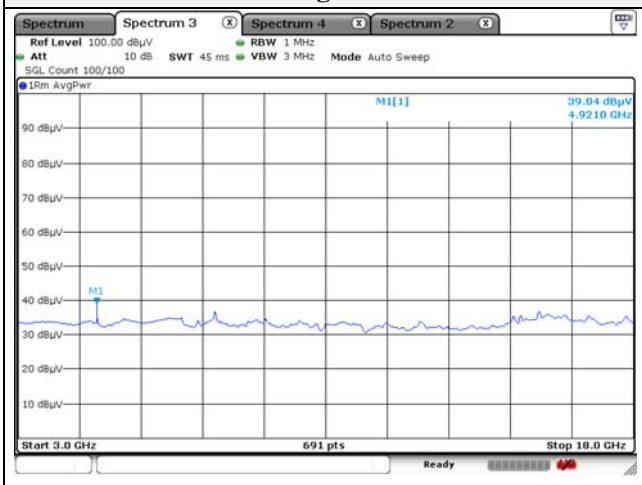
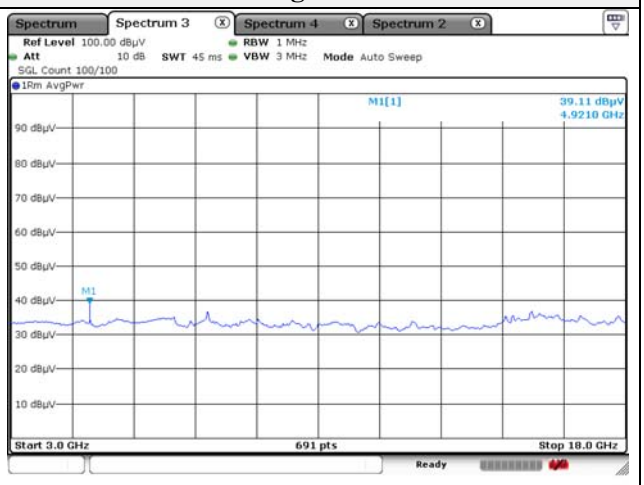
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1088.30	51.84	Peak	H	-8.14	-	43.70	74.00	30.30
2121.60	48.72	Peak	H	-0.68	-	48.04	74.00	25.96
1018.80	54.27	Peak	V	-8.53	-	45.74	74.00	28.26
2124.50	48.57	Peak	V	-0.67	-	47.90	74.00	26.10
4921.00	55.47	Peak	H	7.86	-	63.33	74.00	10.67
4921.00	51.23	Peak	V	7.86	-	59.09	74.00	14.91
4921.00	39.04	Average	H	7.86	-	46.90	54.00	7.10
4921.00	39.11	Average	V	7.86	-	46.97	54.00	7.03

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2483.50	59.57	Peak	H	0.07	-	59.64	74.00	14.36
2498.23	45.46	Peak	V	0.11	-	45.57	74.00	28.43
2483.50	49.21	Average	H	0.07	-	49.28	54.00	4.72

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Restricted band // Horizontal // Average	**Restricted band // Vertical // Average**
	N/A

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11n(HT20)

Distance of measurement: 3 meter

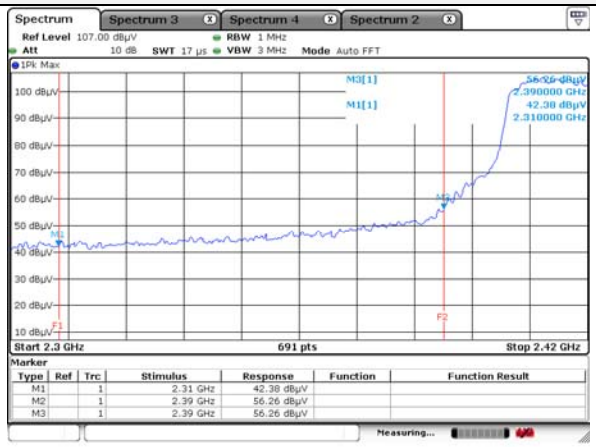
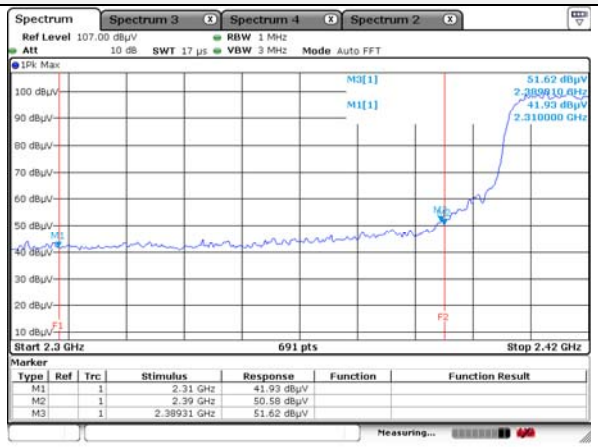
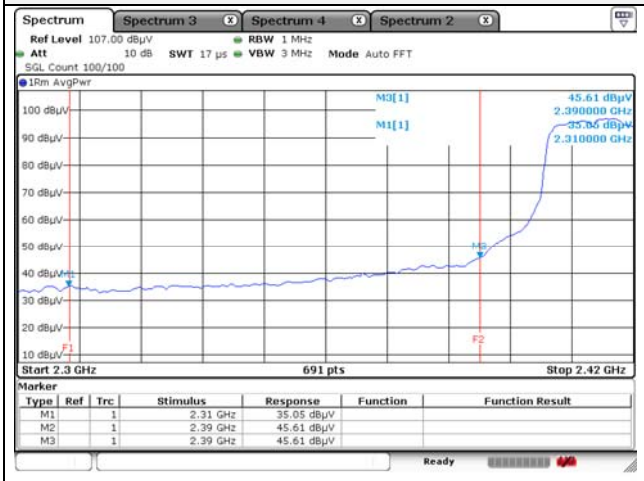
Channel: 01

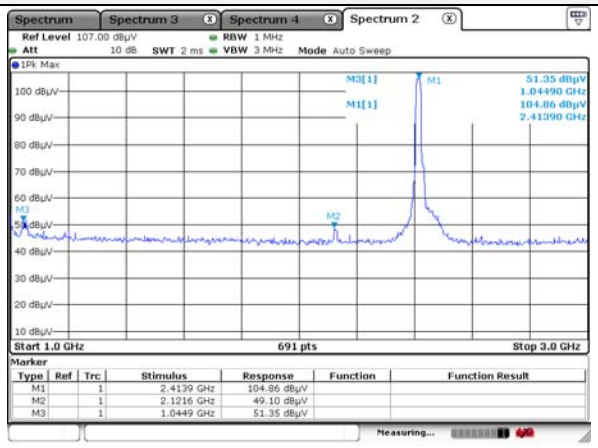
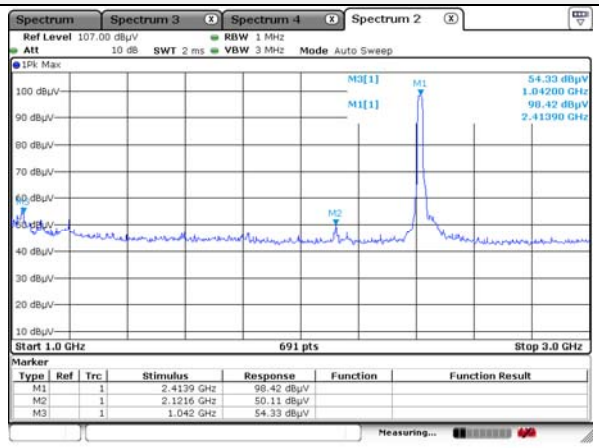
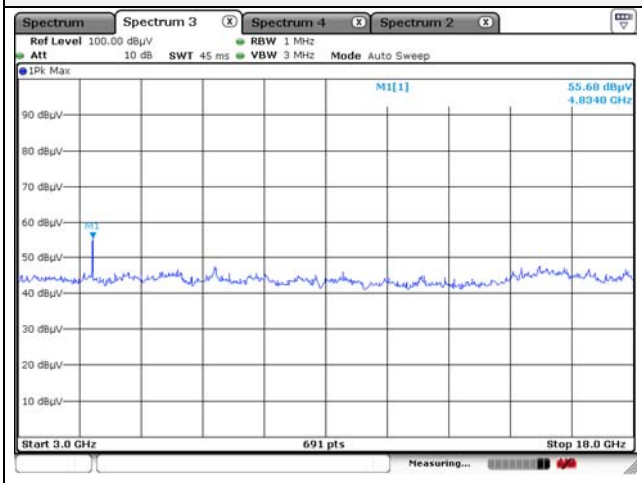
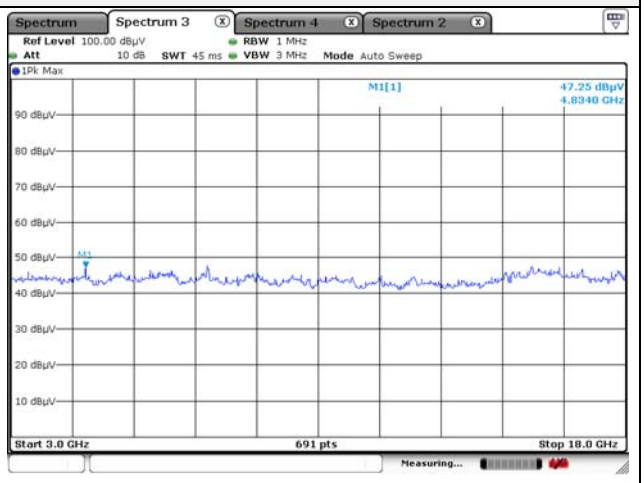
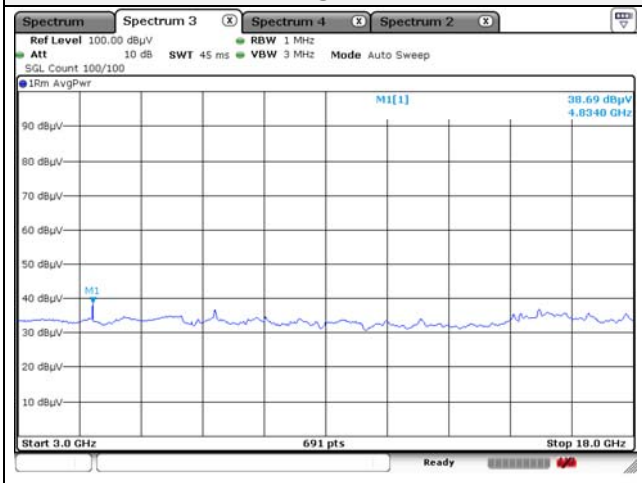
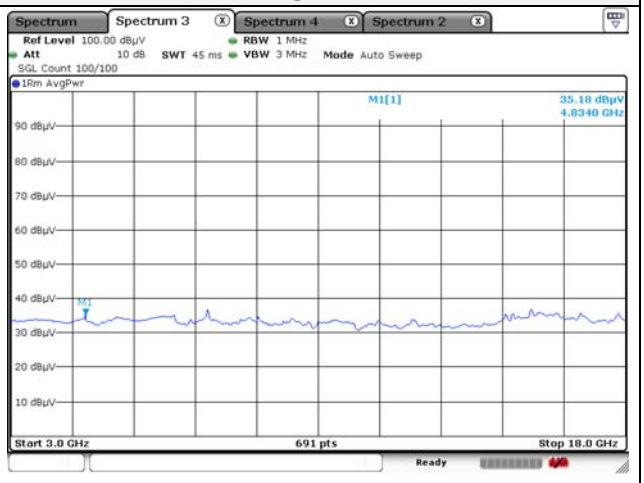
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1044.90	51.35	Peak	H	-8.39	-	42.96	74.00	31.04
2121.60	49.10	Peak	H	-0.68	-	48.42	74.00	25.58
1042.00	54.33	Peak	V	-8.40	-	45.93	74.00	28.07
2121.60	50.11	Peak	V	-0.68	-	49.43	74.00	24.57
4834.00	55.68	Peak	H	7.22	-	62.90	74.00	11.10
4834.00	47.25	Peak	V	7.22	-	54.47	74.00	19.53
4834.00	38.69	Average	H	7.22	-	45.91	54.00	8.09
4834.00	35.18	Average	V	7.22	-	42.40	54.00	11.60

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2390.00	56.26	Peak	H	-0.13	-	56.13	74.00	17.87
2389.31	51.62	Peak	V	-0.13	-	51.49	74.00	22.51
2390.00	45.61	Average	H	-0.13	-	45.48	54.00	8.52

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Restricted band // Horizontal // Average	**Restricted band // Vertical // Average**
	N/A

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

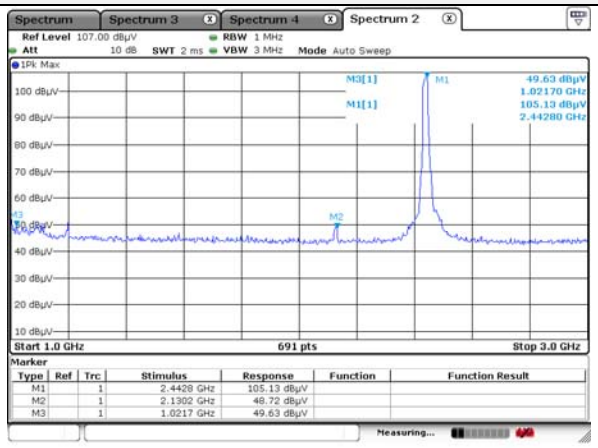
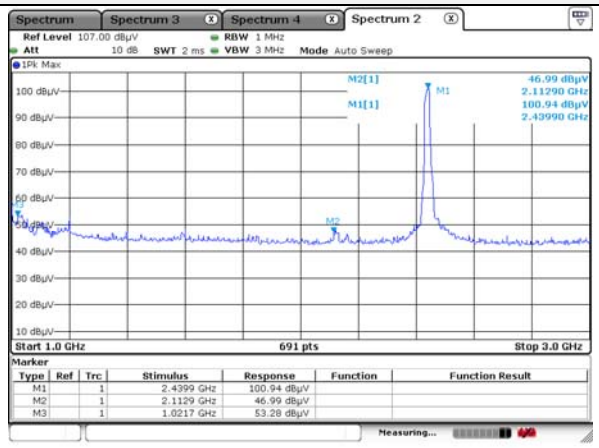
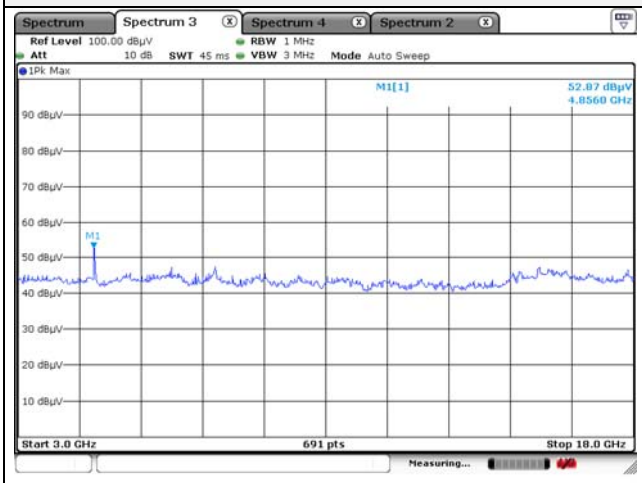
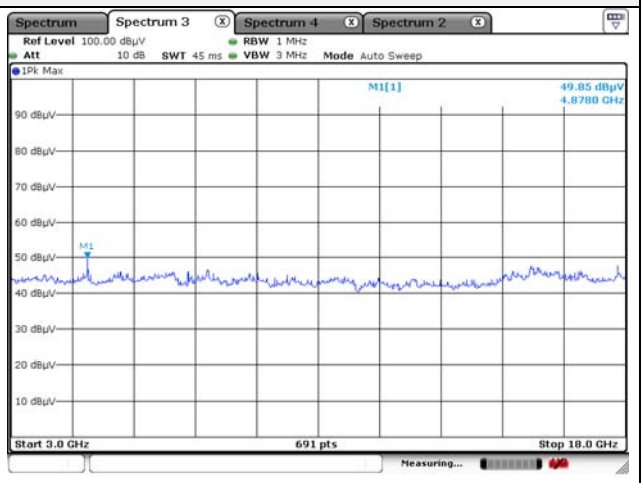
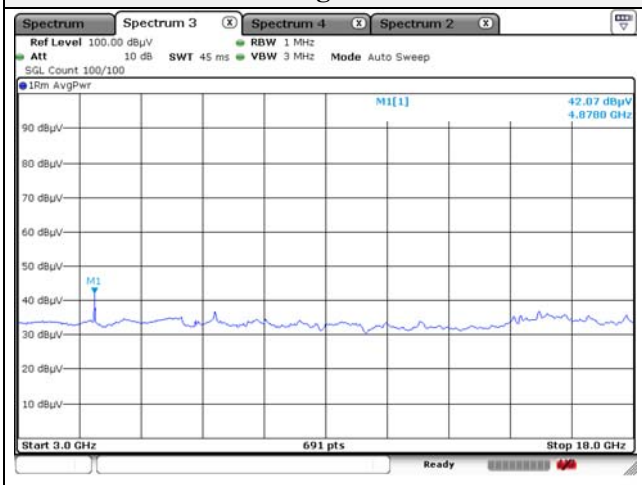
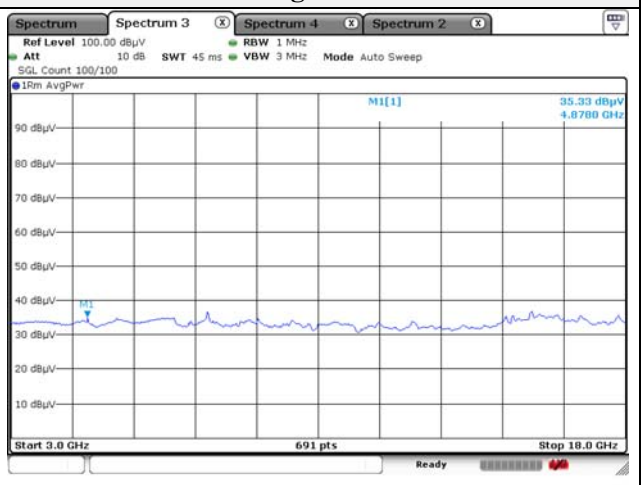
Mode: 802.11n(HT20)

Distance of measurement: 3 meter

Channel: 06

- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1021.70	49.63	Peak	H	-8.52	-	41.11	74.00	32.89
2130.20	48.72	Peak	H	-0.66	-	48.06	74.00	25.94
1021.70	53.28	Peak	V	-8.52	-	44.76	74.00	29.24
2112.90	46.99	Peak	V	-0.70	-	46.29	74.00	27.71
4856.00	52.87	Peak	H	7.38	-	60.25	74.00	13.75
4878.00	49.85	Peak	V	7.54	-	57.39	74.00	16.61
4878.00	42.07	Average	H	7.54	-	49.61	54.00	4.39
4878.00	35.33	Average	V	7.54	-	42.87	54.00	11.13

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11n(HT20)

Distance of measurement: 3 meter

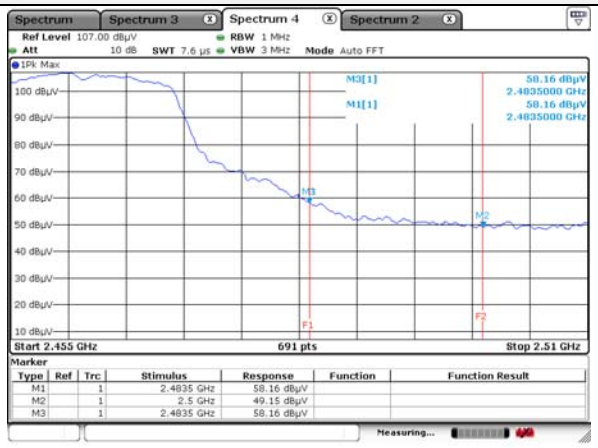
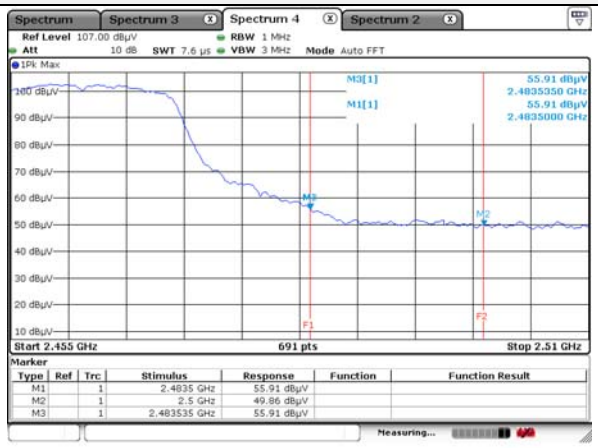
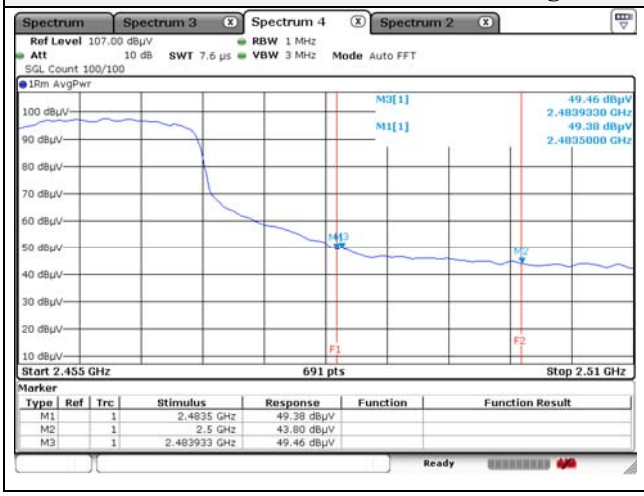
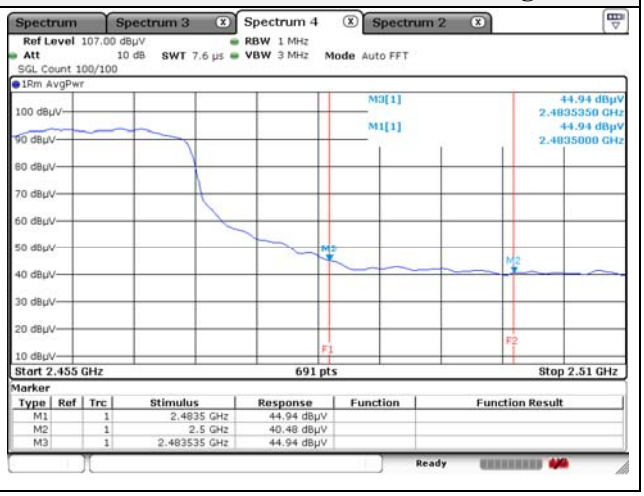
Channel: 11

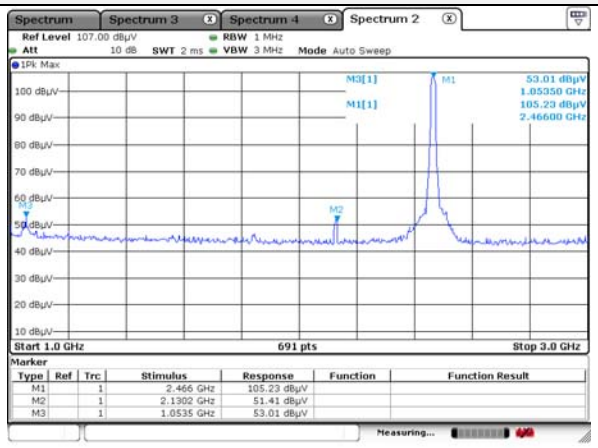
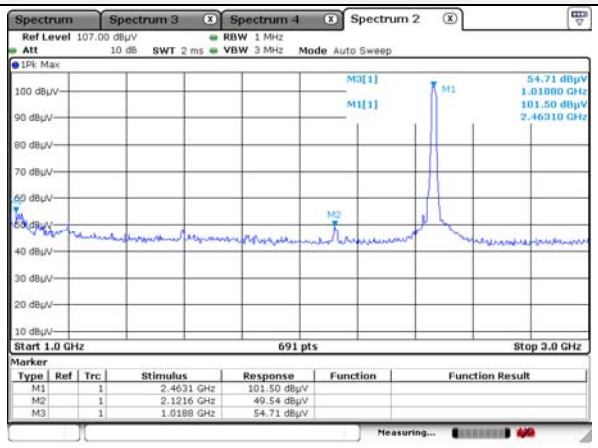
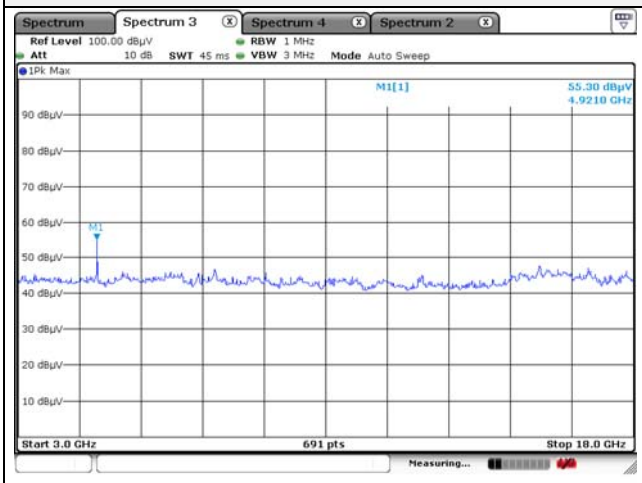
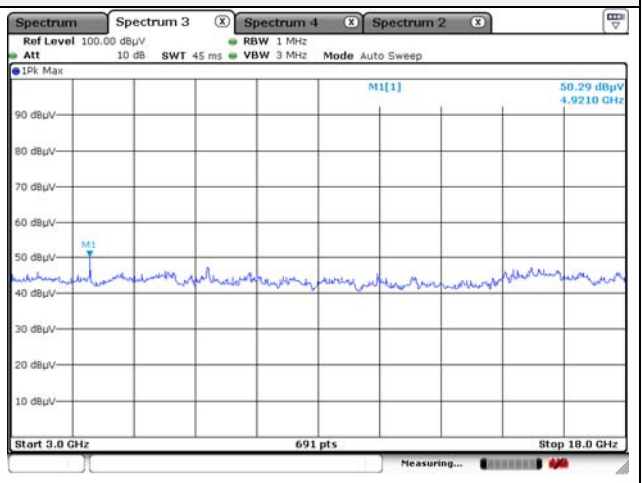
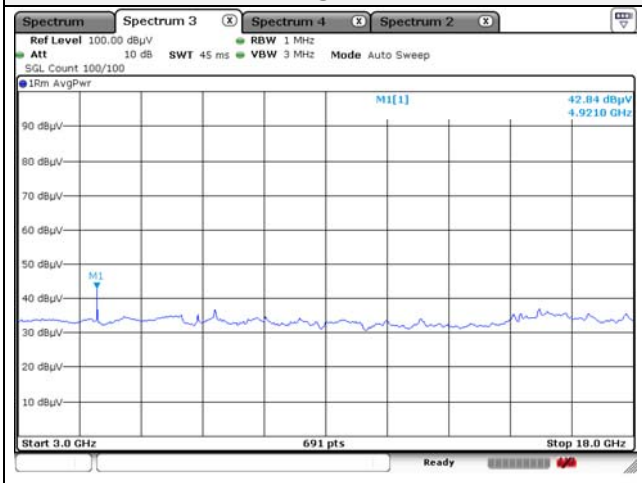
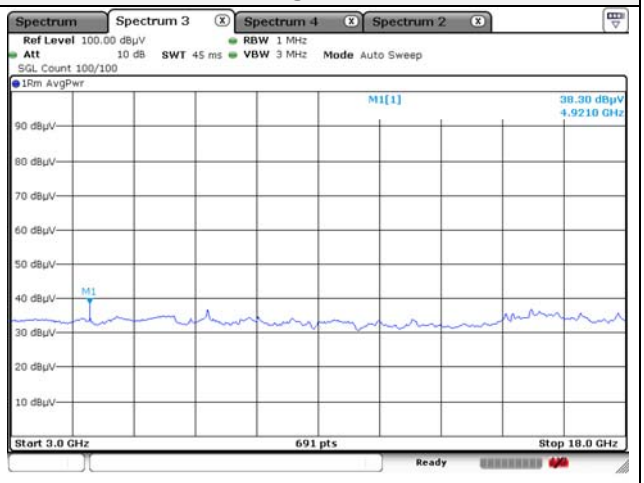
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1053.50	53.01	Peak	H	-8.34	-	44.67	74.00	29.33
2130.20	51.41	Peak	H	-0.66	-	50.75	74.00	23.25
1018.80	54.71	Peak	V	-8.53	-	46.18	74.00	27.82
2121.60	49.54	Peak	V	-0.68	-	48.86	74.00	25.14
4921.00	55.30	Peak	H	7.86	-	63.16	74.00	10.84
4921.00	50.29	Peak	V	7.86	-	58.15	74.00	15.85
4921.00	42.84	Average	H	7.86	-	50.70	54.00	3.30
4921.00	38.30	Average	V	7.86	-	46.16	54.00	7.84

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2483.50	58.16	Peak	H	0.07	-	58.23	74.00	15.77
2483.54	55.91	Peak	V	0.07	-	55.98	74.00	18.02
2483.93	49.46	Average	H	0.07	-	49.53	54.00	4.47
2483.54	44.94	Average	V	0.07	-	45.01	54.00	8.99

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Restricted band // Horizontal // Average	**Restricted band // Vertical // Average**
	

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11n(HT40)

Distance of measurement: 3 meter

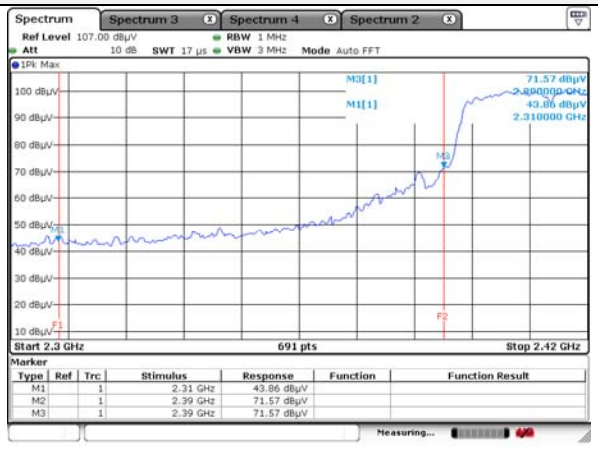
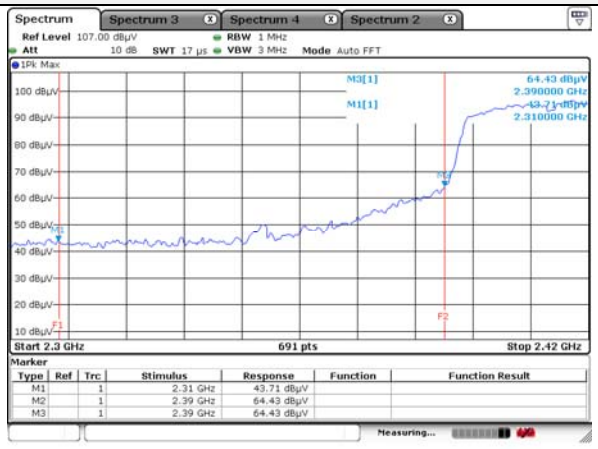
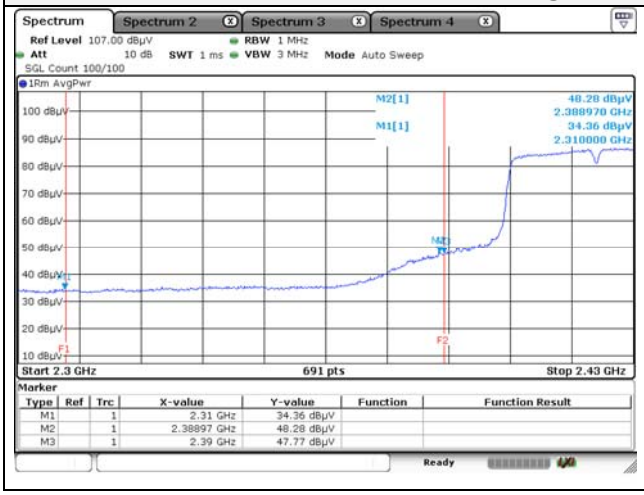
Channel: 03

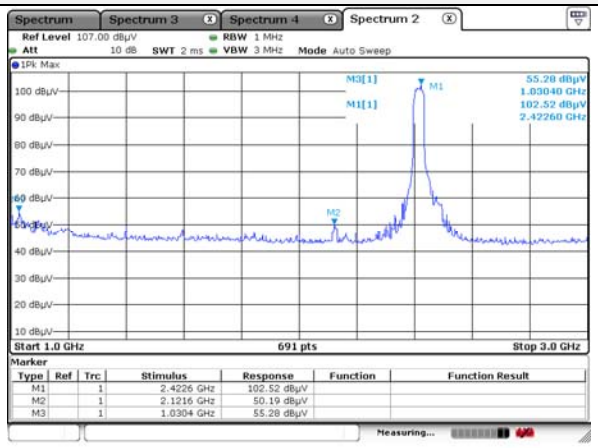
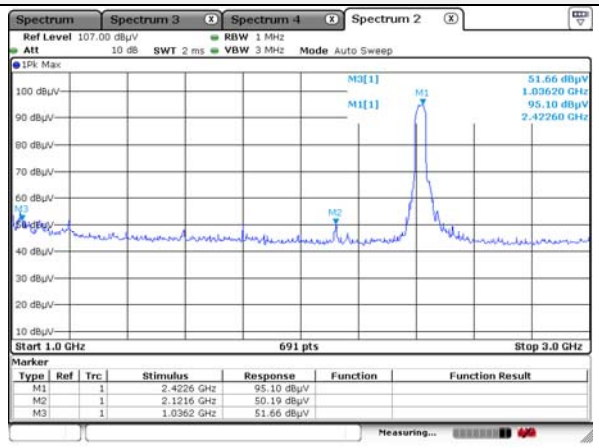
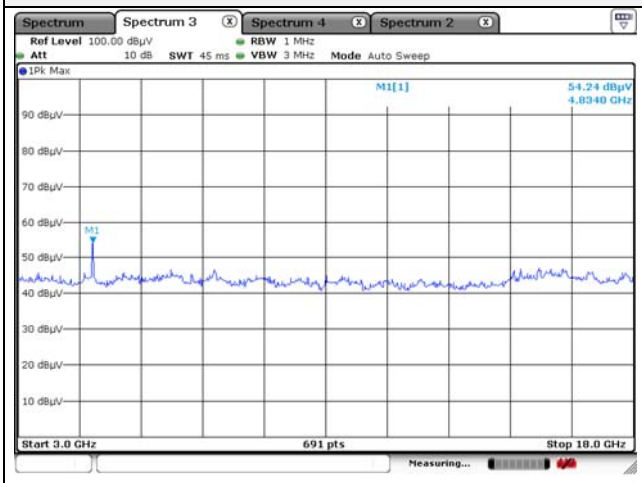
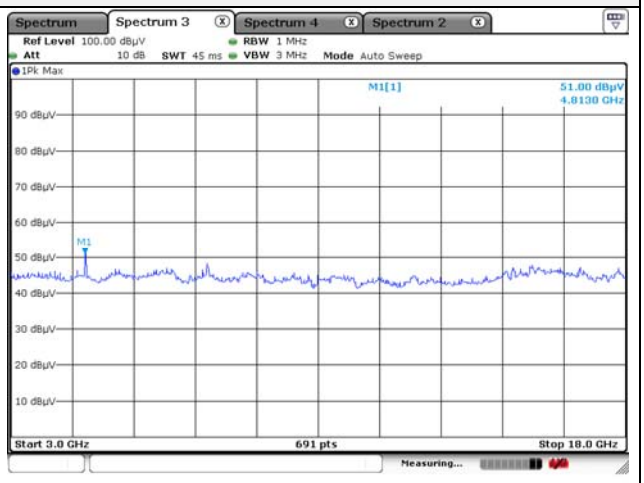
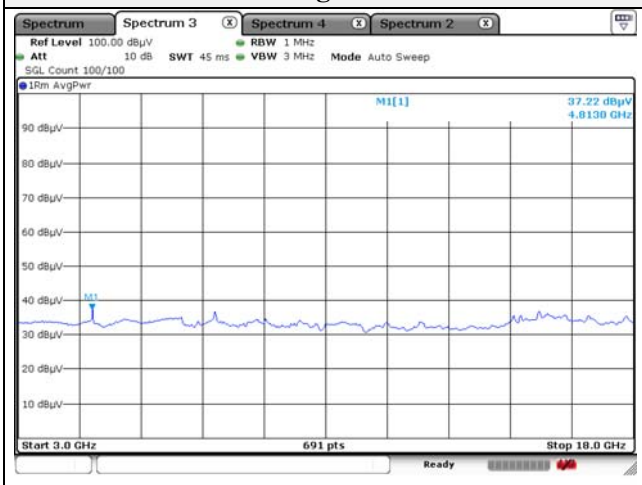
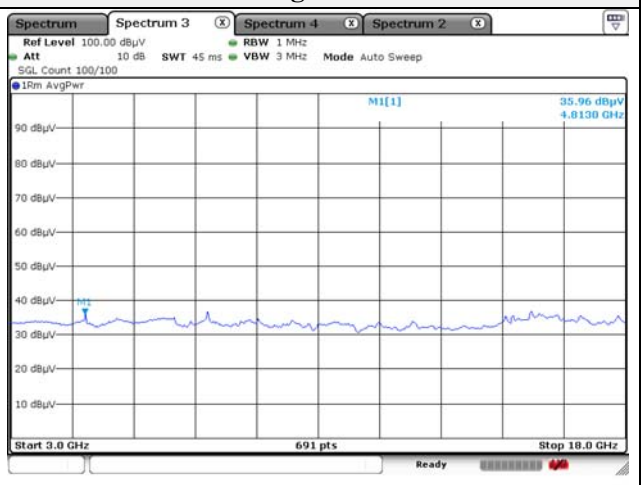
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1030.40	55.28	Peak	H	-8.47	-	46.81	74.00	27.19
2121.60	50.19	Peak	H	-0.68	-	49.51	74.00	24.49
1036.20	51.66	Peak	V	-8.44	-	43.22	74.00	30.78
2121.60	50.19	Peak	V	-0.68	-	49.51	74.00	24.49
4834.00	54.24	Peak	H	7.22	-	61.46	74.00	12.54
4813.00	51.00	Peak	V	7.06	-	58.06	74.00	15.94
4813.00	37.22	Average	H	7.06	-	44.28	54.00	9.72
4813.00	35.96	Average	V	7.06	-	43.02	54.00	10.98

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2390.00	71.57	Peak	H	-0.13	-	71.44	74.00	2.56
2390.00	64.43	Peak	V	-0.13	-	64.30	74.00	9.70
2388.97	48.28	Average	H	-0.14	-	48.14	54.00	5.86
2390.00	47.11	Average	V	-0.13	-	46.98	54.00	7.02

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Restricted band // Horizontal // Average	**Restricted band // Vertical // Average**
	

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

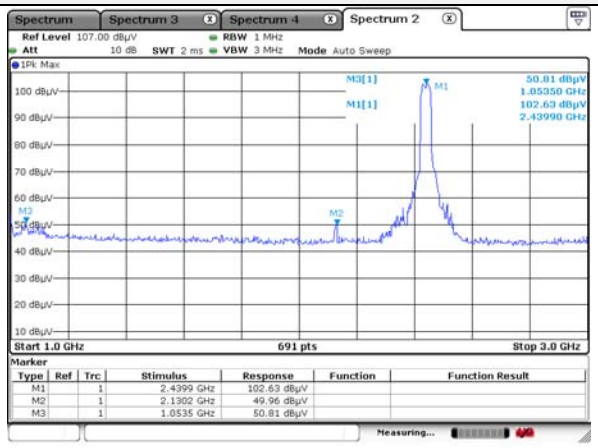
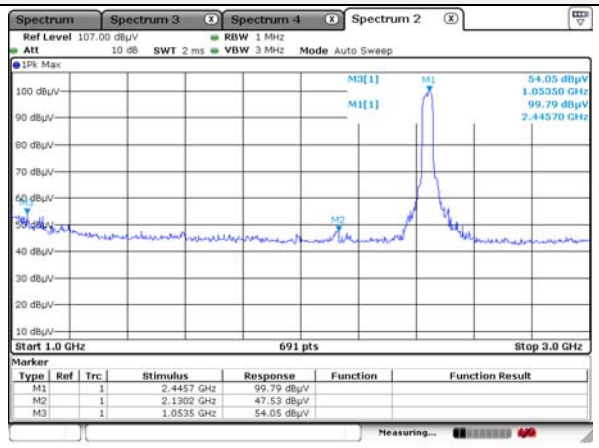
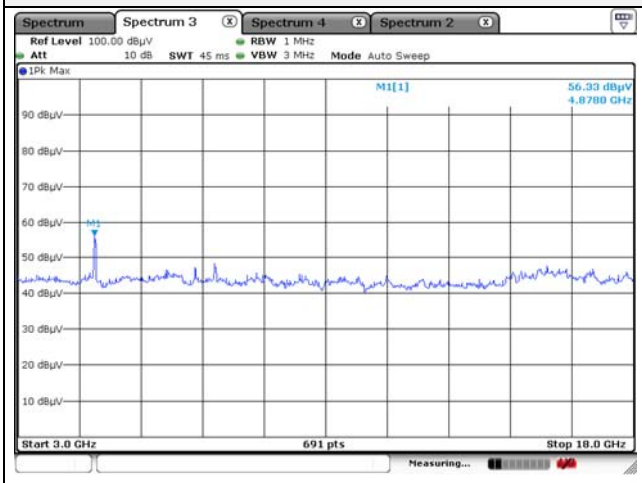
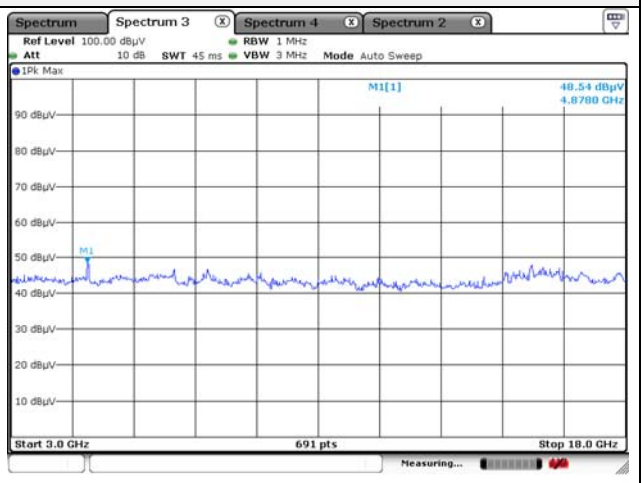
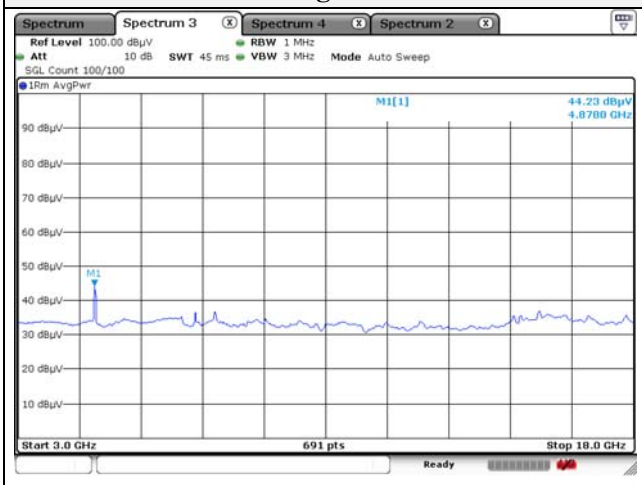
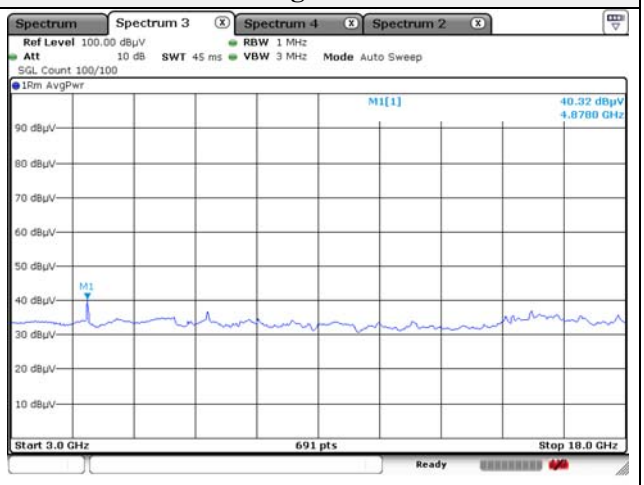
Mode: 802.11n(HT40)

Distance of measurement: 3 meter

Channel: 06

- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1053.50	50.81	Peak	H	-8.34	-	42.47	74.00	31.53
2130.20	49.96	Peak	H	-0.66	-	49.30	74.00	24.70
1053.50	54.05	Peak	V	-8.34	-	45.71	74.00	28.29
2130.20	47.53	Peak	V	-0.66	-	46.87	74.00	27.13
4878.00	56.33	Peak	H	7.54	-	63.87	74.00	10.13
4878.00	48.54	Peak	V	7.54	-	56.08	74.00	17.92
4878.00	44.23	Average	H	7.54	-	51.77	54.00	2.23
4878.00	40.32	Average	V	7.54	-	47.86	54.00	6.14

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11n(HT40)

Distance of measurement: 3 meter

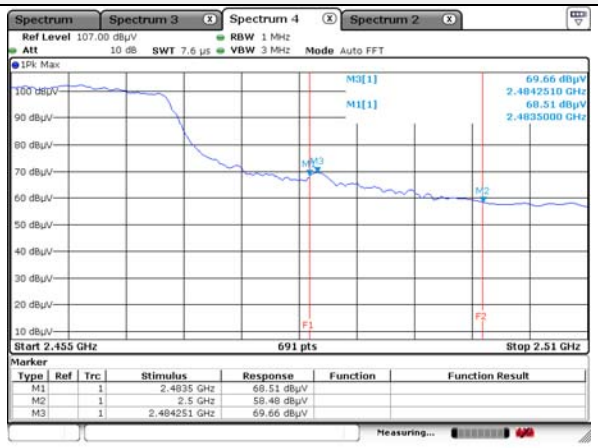
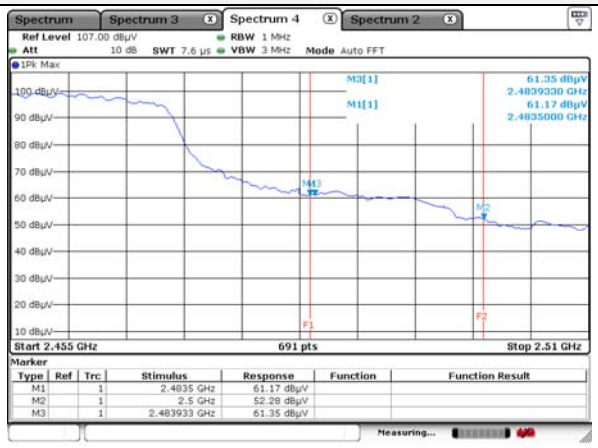
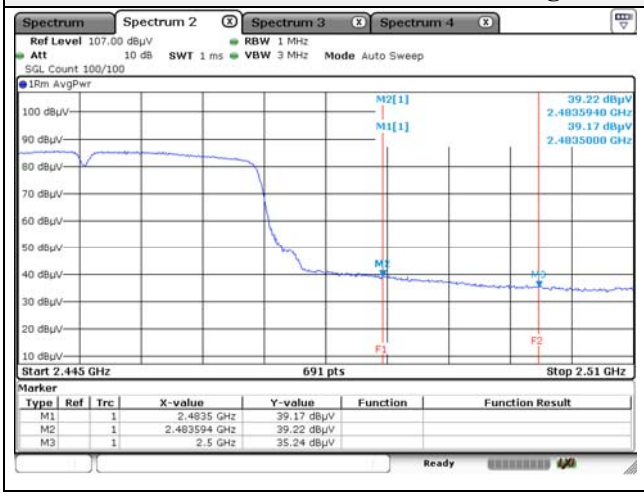
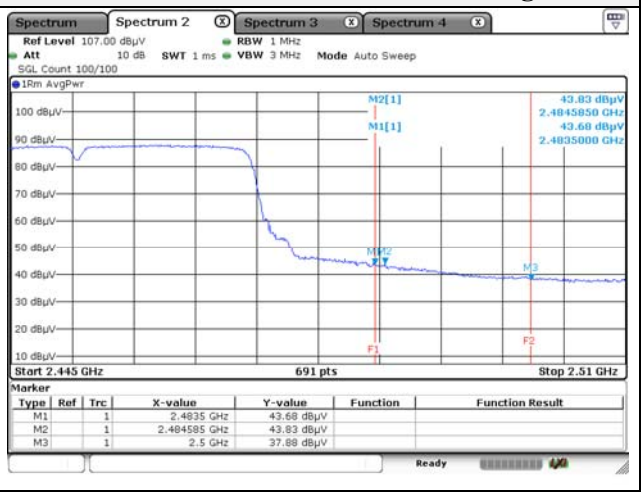
Channel: 09

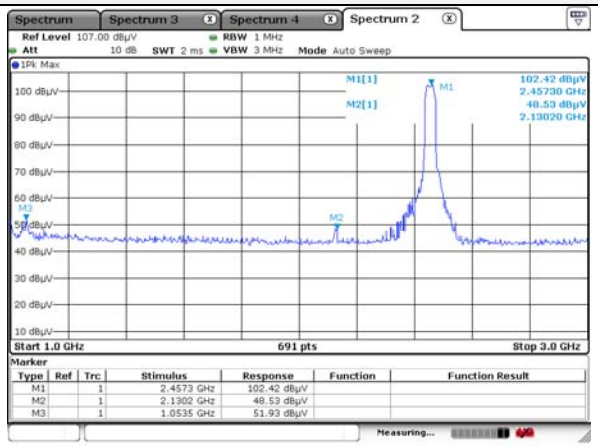
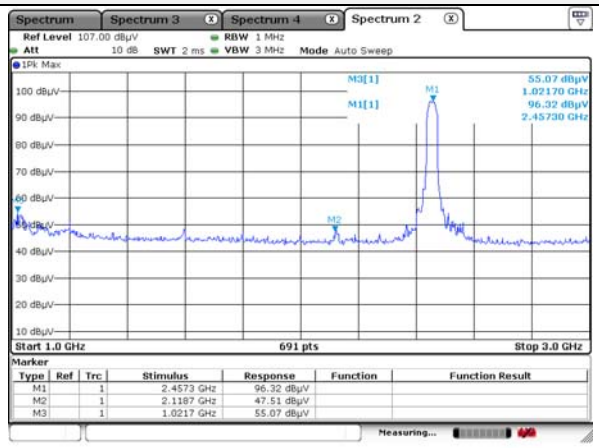
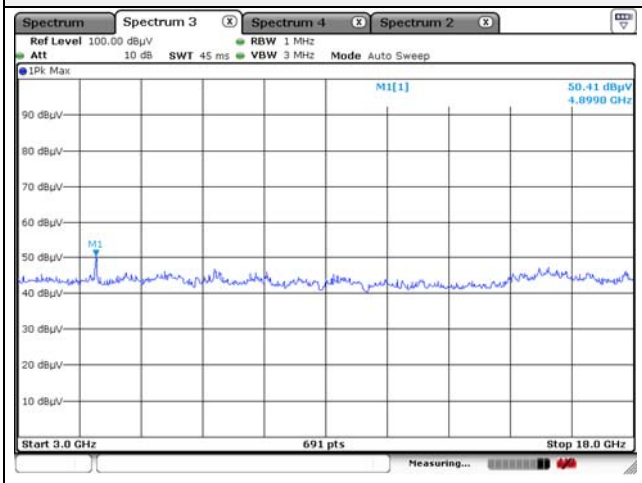
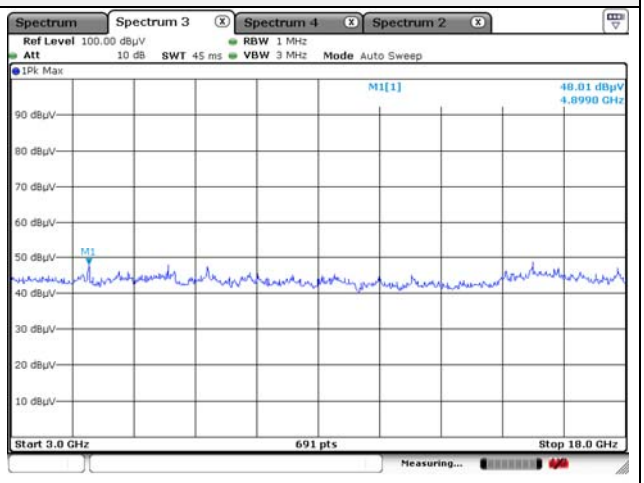
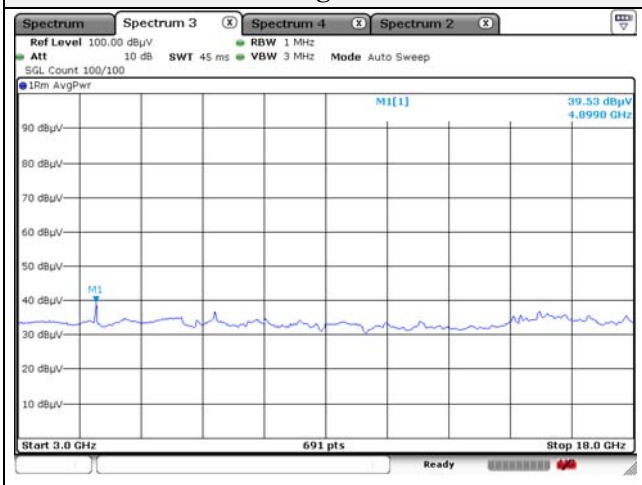
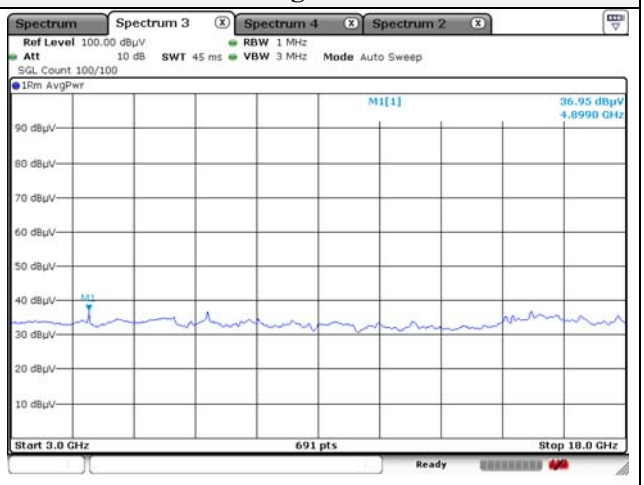
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1053.50	51.93	Peak	H	-8.34	-	43.59	74.00	30.41
2130.20	48.53	Peak	H	-0.66	-	47.87	74.00	26.13
1021.70	55.07	Peak	V	-8.52	-	46.55	74.00	27.45
2118.70	47.51	Peak	V	-0.69	-	46.82	74.00	27.18
4899.00	50.41	Peak	H	7.70	-	58.11	74.00	15.89
4899.00	48.01	Peak	V	7.70	-	55.71	74.00	18.29
4899.00	39.53	Average	H	7.70	-	47.23	54.00	6.77
4899.00	36.95	Average	V	7.70	-	44.65	54.00	9.35

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2484.25	69.66	Peak	H	0.07	-	69.73	74.00	4.27
2483.93	61.35	Peak	V	0.07	-	61.42	74.00	12.58
2483.59	39.22	Average	H	0.07	-	39.29	54.00	14.71
2484.59	43.83	Average	V	0.08	-	43.91	54.00	10.09

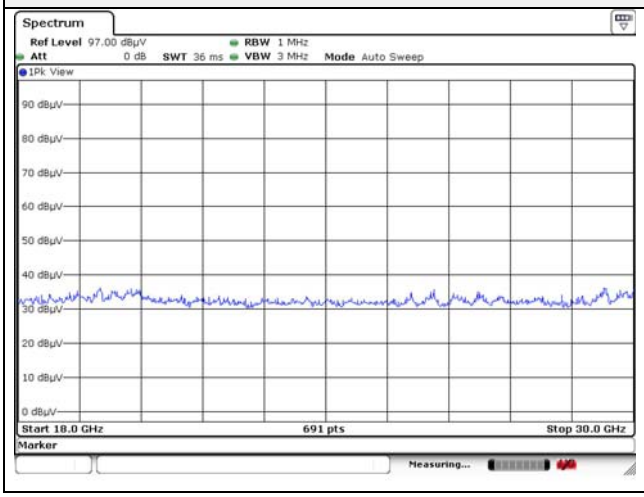
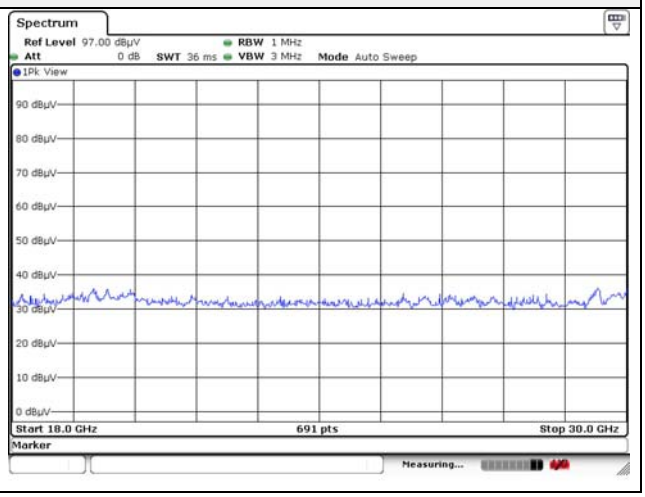
Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Restricted band // Horizontal // Average	**Restricted band // Vertical // Average**
	

Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	
Horizontal // Average for 3 ㎓ to 18 ㎓	**Vertical // Average for 3 ㎓ to 18 ㎓**
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

Test results (18 ㎓ to 30 ㎓) – Worst case

Mode:	802.11b
Distance of measurement:	3 meter
Channel:	6 (Worst case)

Horizontal	Vertical
	

Note.
No spurious emission were detected above 18 ㎓.

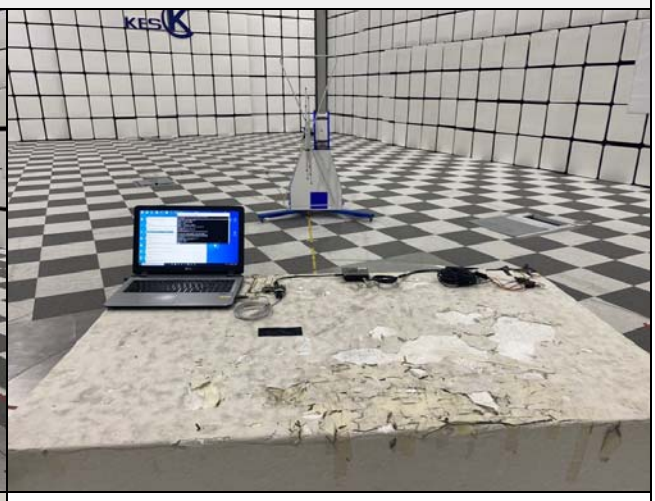
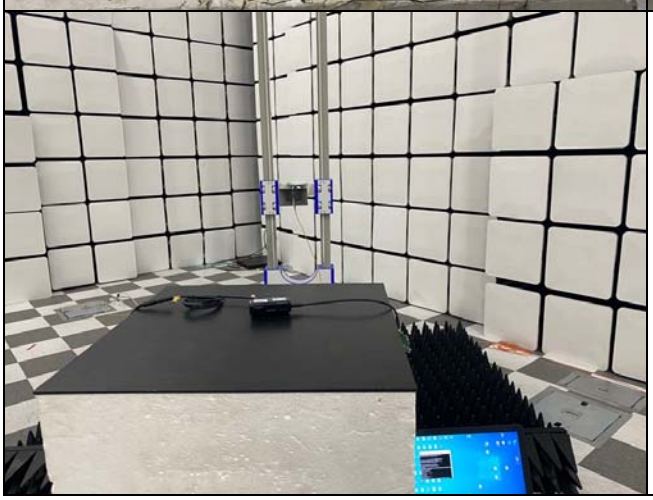
Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV30	101389	1 year	2021.01.15
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2021.01.15
DC Power Supply	Agilent	6632B	US36351824	1 year	2021.01.14
Power Meter	Anritsu	ML2495A	1438001	1 year	2021.01.14
Pulse Power Sensor	Anritsu	MA2411B	1339205	1 year	2021.01.14
Attenuator	KEYSIGHT	8493C	82506	1 year	2021.01.14
Loop Antenna	Schwarzbeck	FMZB1513	225	2 years	2021.02.15
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	715	2 years	2020.09.20
Horn Antenna	A.H	SAS-571	414	2 years	2021.02.11
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	2 years	2021.02.19
Preamplifier	R&S	SCU01	100603	1 year	2020.11.25
Preamplifier	AGILENT	8449B	3008A01742	1 year	2021.01.02
EMI Test Receiver	R&S	ESU26	100551	1 year	2021.04.01
EMI TEST RECEIVER	R & S	ESR3	101781	1 year	2021.01.10
PULSE LIMITER	R & S	ESH3-Z2	101915	1 year	2021.01.02

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	LGS53	306QCZP560949

Appendix B. Test setup photos

Radiated	
	
	Blank

The end of test report.