TEST REPORT

Part 15 Subpart E 15.407

Equipment under test mini-PCIe WiFi Module

Model name WiMi310

FCC ID ZD7-WIMI310

Applicant Nimbus, Inc.

Manufacturer Nimbus, Inc.

Date of test(s) 2017.06.08 ~ 2017.06.19

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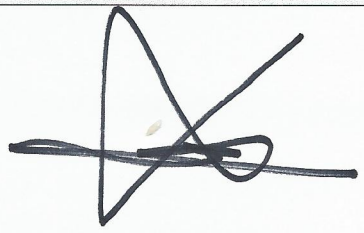
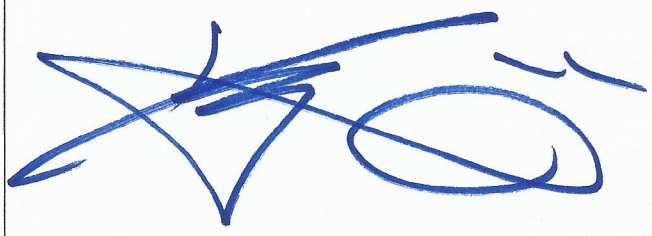
Issued to
Nimbus, Inc.
Suit 619 Hanshin S-meca, 1359 Gwanpyeong-dong,
Daejeon, South Korea
Tel. +82-42-330-0755 / Fax. +82-42-936-0752

Issued by
KES Co., Ltd.
C-3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, Korea
473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	Report approval by :
	
Kwon-se Kim Test engineer	Jeff Do Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2017.06.28	KES-RF-17T0062	Initial

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1. General information

Applicant:	Nimbus, Inc.
Applicant address:	Suit 619 Hanshin S-meca, 1359 Gwanpyeong-dong, Daejeon, South Korea
Test site:	KES Co., Ltd.
Test site address:	C-3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
FCC rule part(s):	15.407
FCC ID:	ZD7-WIMI310
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	mini-PCIe WiFi Module
Frequency range	5 190 ㎒ ~ 5 230 ㎒ (11an_HT40) 5 755 ㎒ ~ 5 795 ㎒ (11an_HT40)
Model:	WiMi310
Modulation technique	OFDM
Number of channels	2ch : 5 190 ㎒ ~ 5 230 ㎒, 2ch : 5 755 ㎒ ~ 5795 ㎒
Antenna specification	UNII-1 : Dipole Antenna & 5.81 ㏈i UNII-3 : Dipole Antenna & 6.26 ㏈i
Power source	DC 5.0 V

1.2. Information about derivative model

N/A

1.3. Test configuration

The **Nimbus, Inc. mini-PCIe WiFi Module FCC ID: ZD7-WIMI310** was tested per the guidance of KDB 789033 D02 v01r04 and KDB 662911 D01 v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

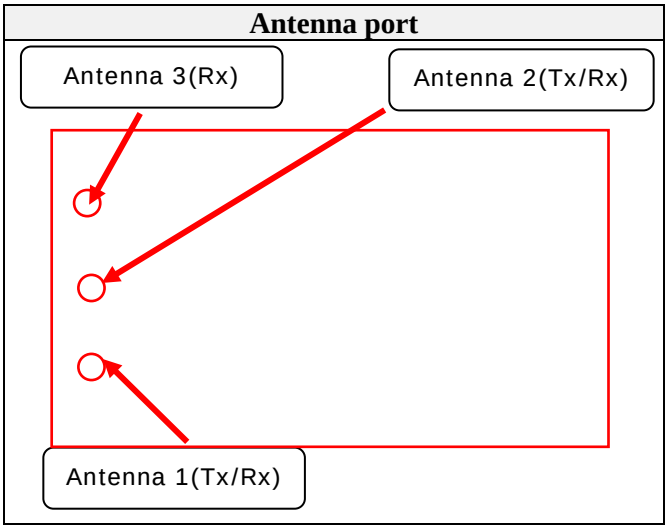
1.4. Antenna information

Mode	SISO			MIMO	
	Antenna 1	Antenna 2	Antenna 3	Antenna 1 + 2	Antenna 1 + 2 + 3
UNII-1	✕	✕	✕	✔	✕
UNII-3	✕	✕	✕	✔	✕

✔ = Support; ✕ = Not support

Note.

1. This device employs MIMO technology using UNII-1 and UNII-3 band output port as antenna port 1 and 2 are using transceiver and antenna port 3 is using only receiver.
2. Antenna port1 and 2 can transmit simultaneously and does not support legacy mode.



1.5. Directional antenna gain(Worst-case)

Band	Antenna 1(dBi)	Antenna 2(dBi)	Directional gain(dBi)
UNII-1	5.81	5.81	5.81[Note2]
UNII-3	6.26	6.26	6.26[Note2]

Note.

1. Directional gain(Corrected signal with unequal antenna gain and equal transmit power)
   $10\log[(10^{G1/20}+10^{G2/20}+\ldots+10^{GN/20})^2/N^{Ant}]$ dBi
2. Directional gain(completely uncorrelated signal with unequal antenna gain and equal transmit power)
   $10\log[(10^{G1/10}+10^{G2/10}+\ldots+10^{GN/10})/N^{Ant}]$ dBi
3. Directional gain(Spatial multiplexing)
   $G_{ANT\ Max}+10\log(N_{ANT}/N_{SS})$ dBi

1.6. Accessory information

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

1.7. Device modifications

N/A

1.8. Frequency/channel operations

UNII-1		UNII-3	
Ch.	**Frequency (㎒)**	**Ch.**	**Frequency (㎒)**
38	5 190	151	5 755
46	5 230	159	5 795

Table 1.8-1. 802.11an_HT40 mode

1.9. Maximum average output power

Refer to the average output power

Note.

1. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates as provided by the client were: HT40 : **MCS8 for UNII-1 and UNII-3**
3. This report contains the worst case data from the following mode of the test in 40 ㎒ signal bandwidth.

2. Summary of tests

Reference	Parameter	Test results
15.407(a)	26 dB bandwidth	Pass
15.407(e)	6 dB bandwidth	Pass
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Power spectral density	Pass
15.407(g)	Frequency stability	Pass
15.205 15.209	Radiated restricted band and emission	Pass
15.407(d)	General field strength limit (Restricted bands and radiated emission limit)	Pass
15.207	AC power line conducted emissions	Pass

3. Test results

3.1. Emission bandwidth (26 dB bandwidth)

Test procedure

KDB 789033 D02 v01r04– Section C.1

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Limit

N/A

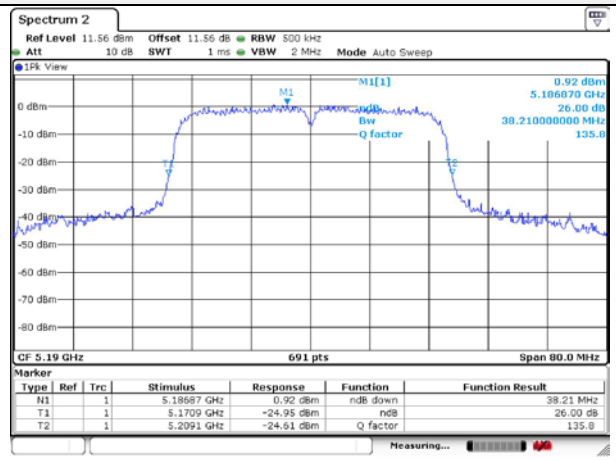
In the result,
DFS requirements are not applicable in the 5 150 ㎒ ~ 5 250 ㎒.

Test results

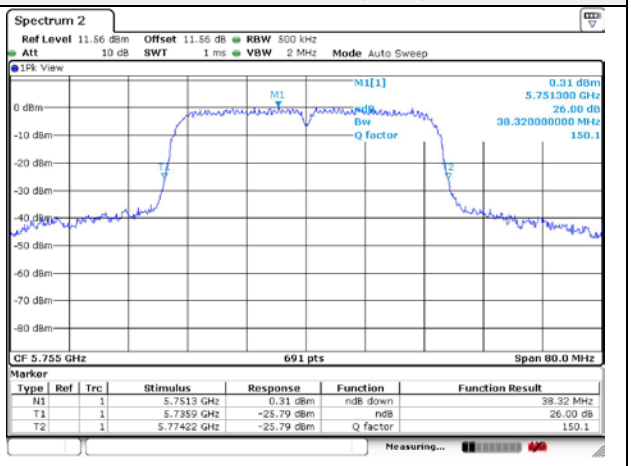
Antenna port	Frequency(㎒)	Mode	26 dB bandwidth(㎒)
1	5 190	HT 40	38.21
	5 230		38.09
	5 755		38.32
	5 795		38.32
2	5 190		38.78
	5 230		38.55
	5 755		38.78
	5 795		38.78

Antenna port 1

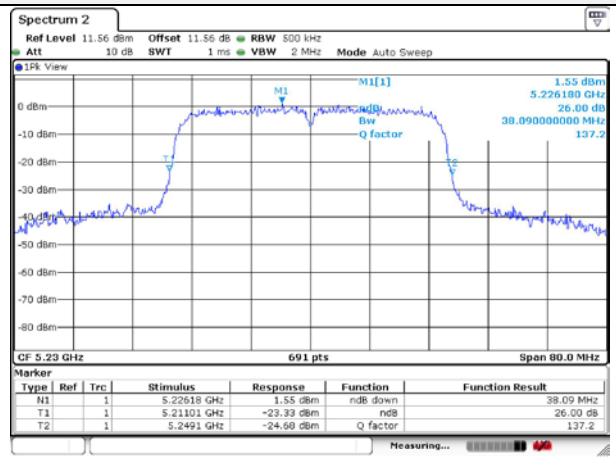
UNII-1_HT40(Low)



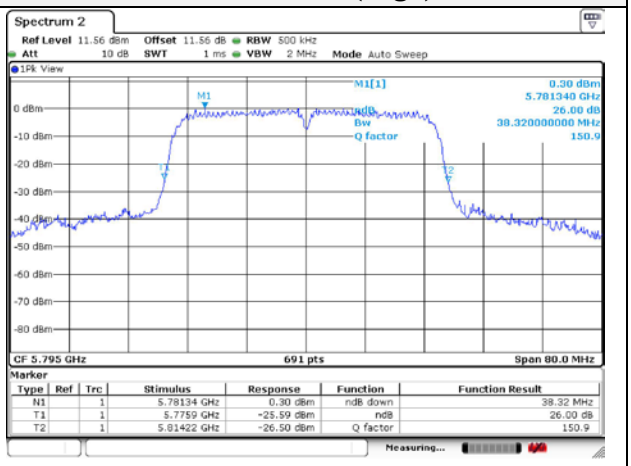
UNII-3_HT40(Low)



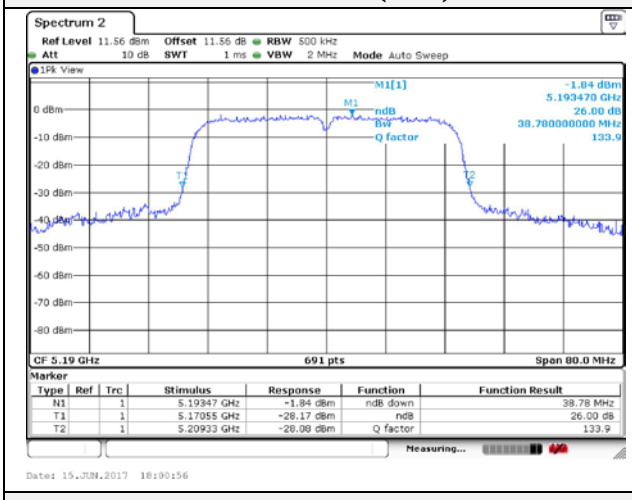
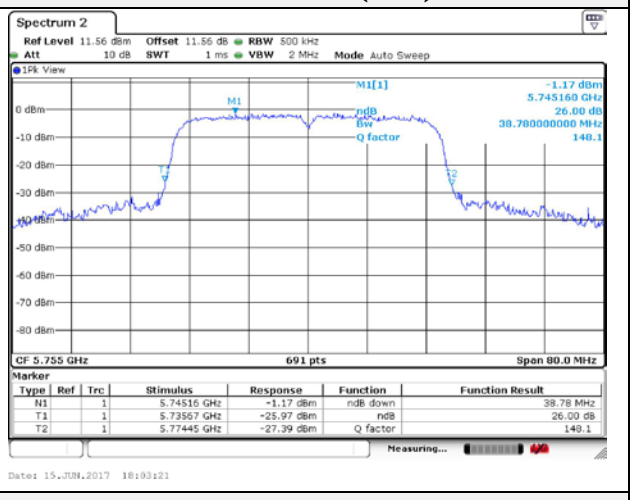
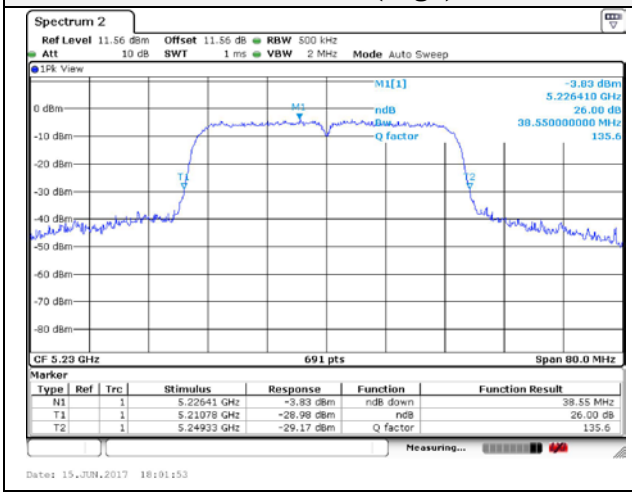
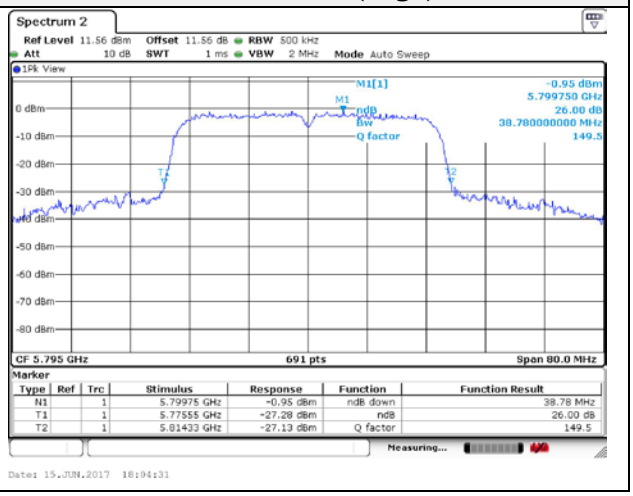
UNII-1_HT40(High)



UNII-3_HT40(High)



Antenna port 2

UNII-1_HT40(Low)	UNII-3_HT40(Low)
	
UNII-1_HT40(High)	**UNII-3_HT40(High)**
	

3.2. 6 dB bandwidth

Test procedure

KDB 789033 D02 v01r04– Section C.2

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

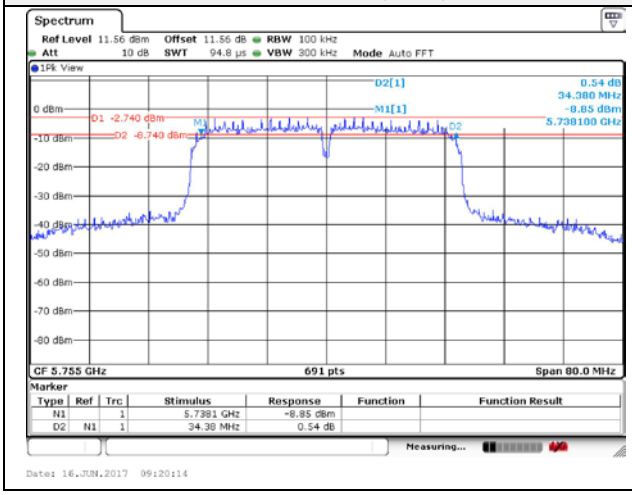
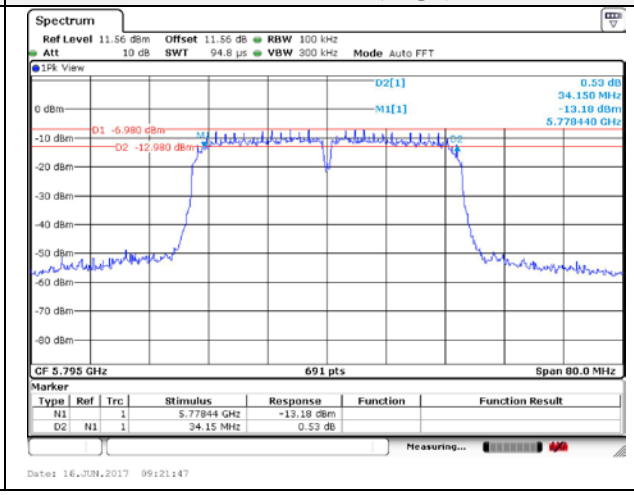
Limit

Within the 5.725-5.85 ㎓ band, the minimum 6 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

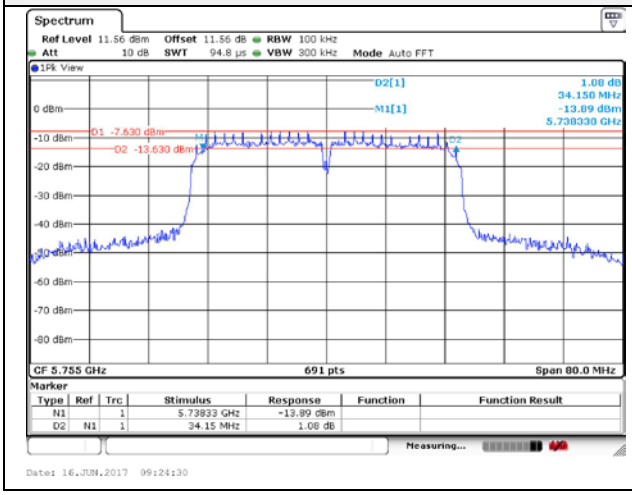
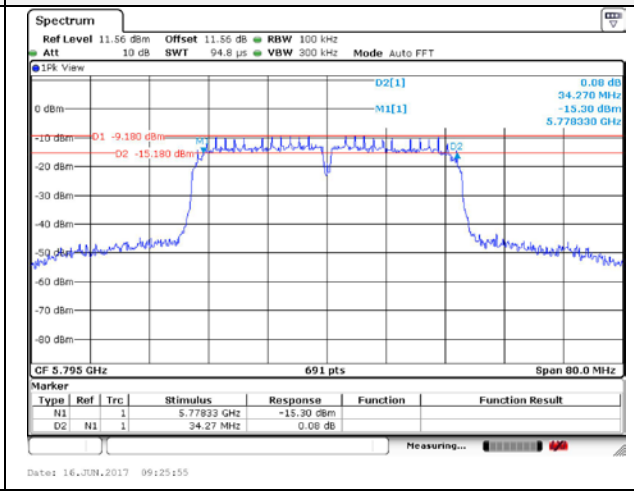
Test results

Antenna port	Frequency(㎒)	Mode	6 ㏈ bandwidth(㎒)
1	5 755	HT 40	34.38
	5 795		34.15
2	5 755		34.15
	5 795		34.27

Antenna port 1

UNII-3_HT40(Low)	UNII-3_HT40(High)
	

Antenna port 2

UNII-3_HT40(Low)	UNII-3_HT40(High)
	

3.3. Maximum conducted output power

Test procedure

KDB 789033 D02 v01r04– Section E.3.a) or b)

Method PM (Measurement using an RF average power meter):

i. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

ii. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

iii. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

iv. Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25 %).

Method PM-G (Measurement using a gated RF average power meter):

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 the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

Limit

Band	EUT Category		Limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	250 mW(24 dBm)
UNII-2A			250 mW or 11 dBm + 10logB Note1
UNII-2C			250 mW or 11 dBm + 10logB Note1
UNII-3	✓		1 W (30 dBm)

Note.

1. B is the 26 dB emission bandwidth.

Test results

Frequency (㎒)	Detector mode	Output power(㏈m)				Limit
		Antenna port				
		1 Note 3	2 Note 3	DCF Note1	Sum 1+2 Note2	
5 190	AV	8.62	8.38	0.33	11.49	24.00
5 230	AV	8.39	8.25		11.33	24.00
5 755	AV	10.38	10.19	0.97	13.30	29.74
5 795	AV	10.32	10.15		13.25	29.74

Note.

1. Refer to the page 26 on this report.
2. Sum = $10\log(10^{Ant0/10}+10^{Ant1/10}\cdots 10^{Ant\ N/10})$
3. DCF in Measured value is included.
4. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceed 6 ㏈i.

3.4. Power spectral density

Test procedure

KDB 789033 D02 v01r04 – Section F

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…." (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
   a) If Method SA-2 or SA-2 Alternative was used, add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum.
   b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 ㏈ to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 ㎒ reference bandwidth.
5. For devices operating in the bands 5.15-5.25 ㎓, 5.25-5.35 ㎓, and 5.47-5.725 ㎓, the above procedures make use of 1 ㎒ RBW to satisfy directly the 1 ㎒ reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 ㎓, the rules specify a measurement bandwidth of 500 ㎑. Many spectrum analyzers do not have 500 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 ㎒, or 500 ㎑, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ bandwidth, the following adjustments to the procedures apply:

   a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a)
   b) Set VBW ≥ 3 RBW.
   c) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 10 log (500 ㎑/RBW) to the measured result, whereas RBW (< 500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   d) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10 log (1 ㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
   e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
6. In case of band crossing channels 138, 142 and 144, the measurement is complied with section D of KDB 644545_D03 v01.

Note.

As a practical matter, it is recommended to use reduced RBW of 100 ㎑ for the sections 5.c) and 5.d) above, since RBW=100 ㎑ is available on nearly all spectrum analyzers.

Limit

Band	EUT Category		Limit
UNII-1		Outdoor access point	17 dBm/㎒
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	11 dBm/㎒
UNII-2A			11 dBm/㎒
UNII-2C			11 dBm/㎒
UNII-3	✓		30 dBm/500 ㎑

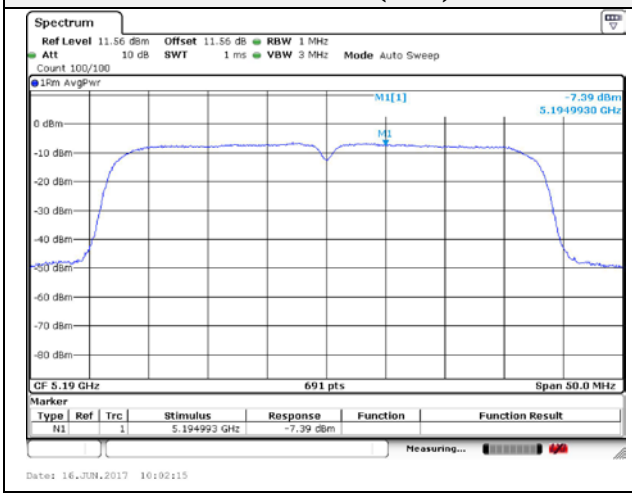
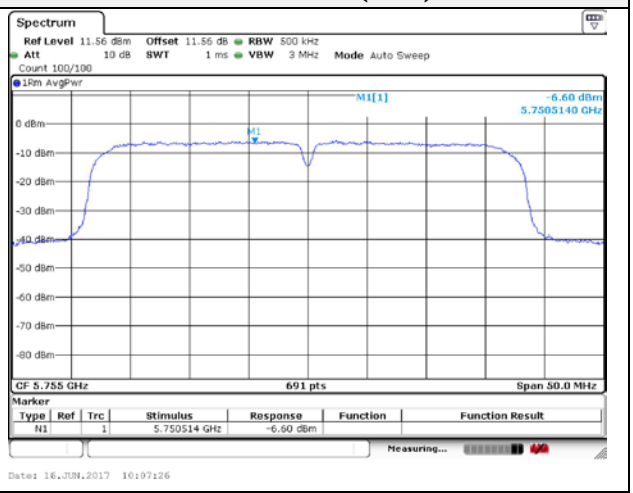
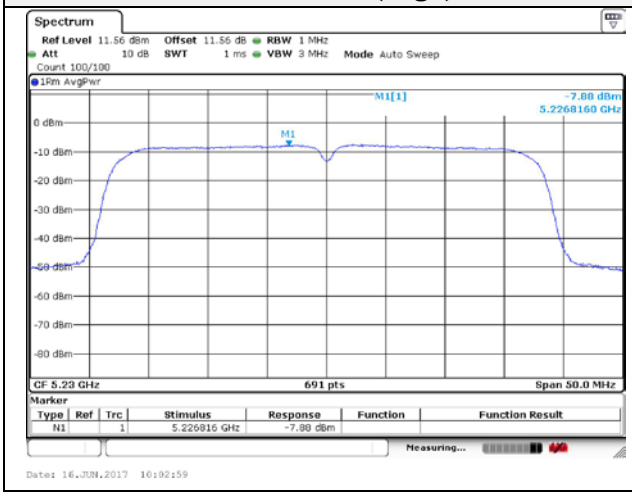
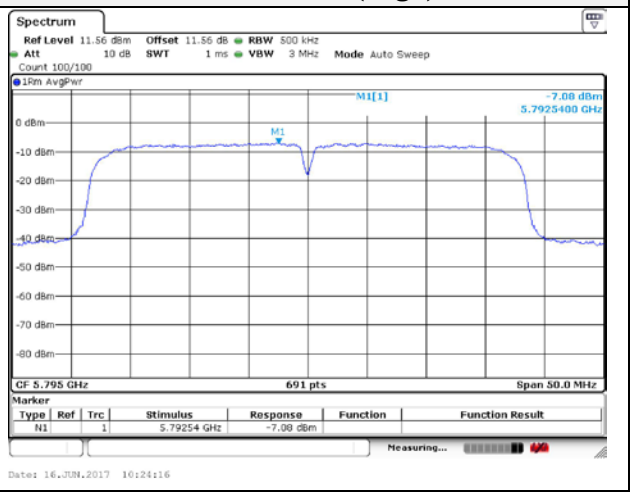
Test results

Frequency (㎒)	Detector mode	Power spectral density(dBm)					Limit (dBm)
		Antenna port					
		1 Note 4	2 Note 4	RBWF Note1	DCF Note2	Sum 1+2 Note3	
5 190	AV	-7.06	-7.52	-	0.33	-4.27	11.00
5 230	AV	-7.55	-7.37			-4.45	11.00
5 755	AV	-5.63	-6.09		0.97	-2.84	29.74
5 795	AV	-6.11	-6.14			-3.11	29.74

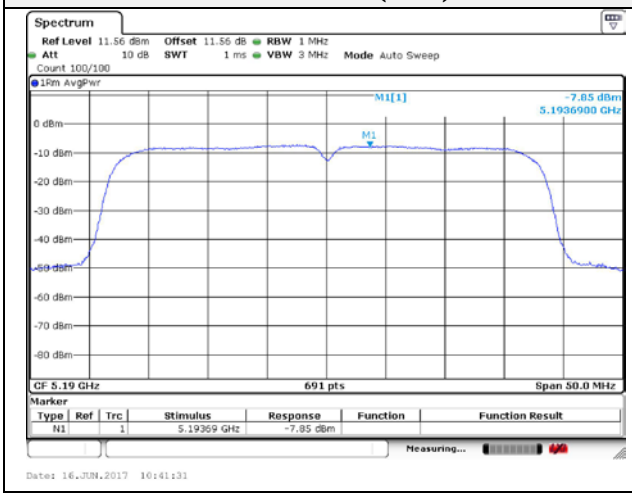
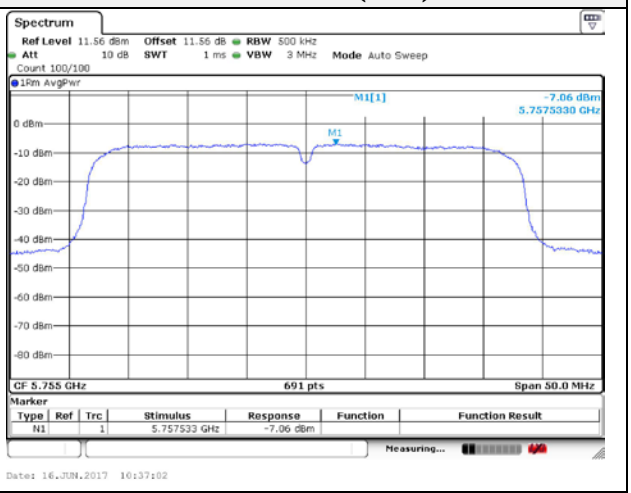
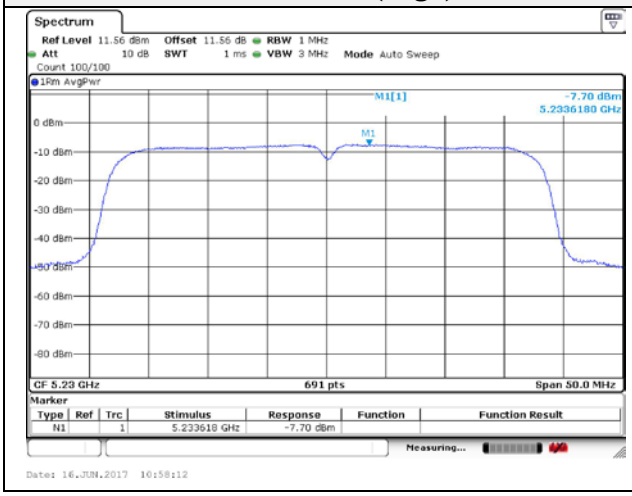
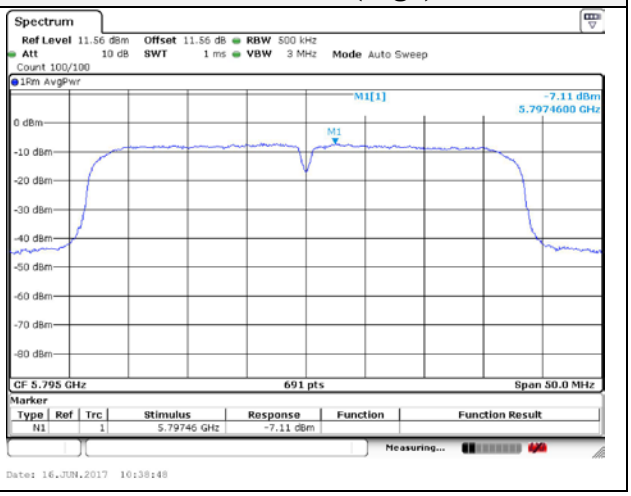
Note.

1. UNII-1 = 10log(1 ㎒ /1 ㎒)
   UNII-3 = 10log(500 ㎑ /500 ㎑)
2. Refer to the page 26 on this report.
3. Sum = $10\log(10^{Ant0/10}+10^{Ant1/10}\cdots 10^{Ant N/10})$
4. DCF in Measured value is included.
5. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi.

Antenna port 1

UNII-1_HT40(Low)	UNII-3_HT40(Low)
	
UNII-1_HT40(High)	**UNII-3_HT40(High)**
	

Antenna port 2

UNII-1_HT40(Low)	UNII-3_HT40(Low)
	
UNII-1_HT40(High)	**UNII-3_HT40(High)**
	

3.5. Frequency Stability

Test procedure

ANSI C63.10-2013, clause 6.8.1

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
7. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

Limit

N/A

Mode: UNII-1

Operating frequency: 5 190 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 5.0	-20	Startup	5 189.978 220	-21 780	-0.000 420
			2 minutes	5 189.979 956	-20 044	-0.000 386
			5 minutes	5 189.969 411	-30 589	-0.000 589
			10 minutes	5 189.958 653	-41 347	-0.000 797
100 %		-10	Startup	5 189.979 044	-20 956	-0.000 404
			2 minutes	5 189.979 709	-20 291	-0.000 391
			5 minutes	5 189.979 912	-20 088	-0.000 387
			10 minutes	5 189.976 236	-23 764	-0.000 458
100 %		0	Startup	5 189.979 305	-20 695	-0.000 399
			2 minutes	5 189.976 237	-23 763	-0.000 458
			5 minutes	5 189.972 561	-27 439	-0.000 529
			10 minutes	5 189.970 444	-29 556	-0.000 569
100 %		10	Startup	5 189.980 407	-19 593	-0.000 378
			2 minutes	5 189.980 021	-19 979	-0.000 385
			5 minutes	5 189.974 126	-25 874	-0.000 499
			10 minutes	5 189.968 435	-31 565	-0.000 608
100 %		20	Startup	5 189.963 822	-36 178	-0.000 697
			2 minutes	5 189.961 917	-38 083	-0.000 734
			5 minutes	5 189.959 597	-40 403	-0.000 778
			10 minutes	5 189.956 433	-43 567	-0.000 839
100 %		22	Startup	5 189.963 152	-36 848	-0.000 710
			2 minutes	5 189.963 089	-36 911	-0.000 711
			5 minutes	5 189.962 884	-37 116	-0.000 715
			10 minutes	5 189.962 715	-37 285	-0.000 718
100 %		30	Startup	5 189.964 866	-35 134	-0.000 677
			2 minutes	5 189.964 221	-27 439	-0.000 529
			5 minutes	5 189.960 574	-39 426	-0.000 760
			10 minutes	5 189.957 977	-42 023	-0.000 810
100 %		40	Startup	5 189.957 631	-42 369	-0.000 816
			2 minutes	5 189.957 233	-42 767	-0.000 824
			5 minutes	5 189.957 144	-42 856	-0.000 826
			10 minutes	5 189.956 962	-43 038	-0.000 829
100 %		50	Startup	5 189.960 435	-39 565	-0.000 762
			2 minutes	5 189.959 374	-40 626	-0.000 783
			5 minutes	5 189.958 209	-41 791	-0.000 805
			10 minutes	5 189.957 193	-42 807	-0.000 825
85 %	DC 4.25	22	Startup	5 189.958 698	-41 302	-0.000 796
			2 minutes	5 189.958 758	-41 242	-0.000 795
			5 minutes	5 189.959 377	-40 623	-0.000 783
			10 minutes	5 189.960 549	-39 451	-0.000 760
115 %	DC 5.75	22	Startup	5 189.960 203	-39 797	-0.000 767
			2 minutes	5 189.961 133	-38 867	-0.000 749
			5 minutes	5 189.962 247	-37 753	-0.000 727
			10 minutes	5 189.963 459	-36 541	-0.000 704

Mode: UNII-3

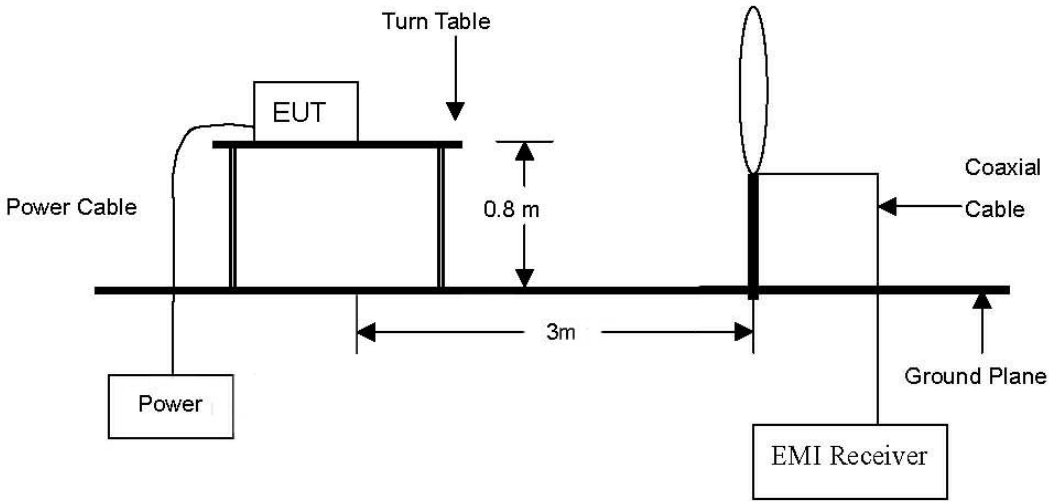
Operating frequency: 5 755 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 5.0	-20	Startup	5 754.966 569	-33 431	-0.000 581
			2 minutes	5 754.968 201	-31 799	-0.000 553
			5 minutes	5 754.970 558	-29 442	-0.000 512
			10 minutes	5 754.977 191	-22 809	-0.000 396
100 %		-10	Startup	5 754.975 574	-24 426	-0.000 424
			2 minutes	5 754.975 372	-24 628	-0.000 428
			5 minutes	5 754.977 427	-22 573	-0.000 392
			10 minutes	5 754.973 432	-26 568	-0.000 462
100 %		0	Startup	5 754.977 768	-22 232	-0.000 386
			2 minutes	5 754.977 305	-22 695	-0.000 394
			5 minutes	5 754.973 687	-26 313	-0.000 457
			10 minutes	5 754.968 941	-31 059	-0.000 540
100 %		10	Startup	5 754.963 936	-36 064	-0.000 627
			2 minutes	5 754.960 144	-39 856	-0.000 693
			5 minutes	5 754.956 613	-43 387	-0.000 754
			10 minutes	5 754.953 038	-46 962	-0.000 816
100 %		20	Startup	5 754.968 969	-31 031	-0.000 539
			2 minutes	5 754.396 635	-33 649	-0.000 585
			5 minutes	5 754.965 773	-34 227	-0.000 595
			10 minutes	5 754.962 398	-37 602	-0.000 653
100 %		22	Startup	5 754.959 433	-40 567	-0.000 705
			2 minutes	5 754.959 311	-40 689	-0.000 707
			5 minutes	5 754.959 022	-40 978	-0.000 712
			10 minutes	5 754.958 945	-41 055	-0.000 713
100 %		30	Startup	5 754.953 835	-46 165	-0.000 802
			2 minutes	5 754.953 401	-46 599	-0.000 810
			5 minutes	5 754.957 221	-42 779	-0.000 743
			10 minutes	5 754.963 299	-36 701	-0.000 638
100 %		40	Startup	5 754.951 806	-48 194	-0.000 837
			2 minutes	5 754.952 112	-47 888	-0.000 832
			5 minutes	5 754.952 477	-47 523	-0.000 826
			10 minutes	5 754.953514	-46 486	-0.000 808
100 %		50	Startup	5 754.957 239	-42 761	-0.000 743
			2 minutes	5 754.956 551	-43 449	-0.000 755
			5 minutes	5 754.953 224	-46 776	-0.000 813
			10 minutes	5 754.952 376	-47 624	-0.000 828
85 %	DC 4.25	22	Startup	5 754.956 124	-43 876	-0.000 762
			2 minutes	5 754.958 831	-41 169	-0.000 715
			5 minutes	5 754.960 240	-39 760	-0.000 691
			10 minutes	5 754.962 220	-37 780	-0.000 656
115 %	DC 5.75	22	Startup	5 754.961 450	-38 550	-0.000 670
			2 minutes	5 754.965 270	-34 730	-0.000 603
			5 minutes	5 754.966 680	-33 320	-0.000 579
			10 minutes	5 754.970 310	-29 690	-0.000 516

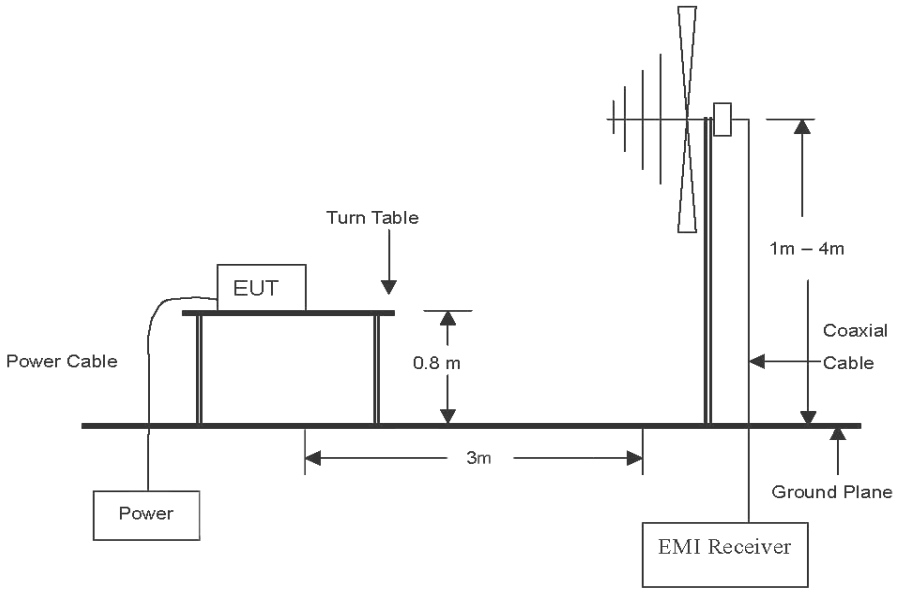
3.6. Radiated restricted band and emissions

Test setup

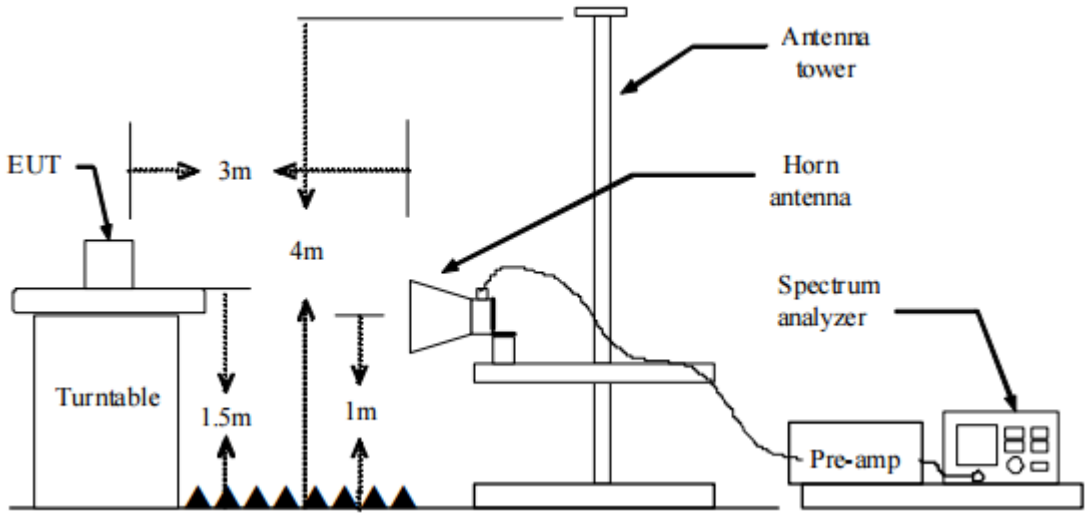
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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. 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 ㎒

1. Spectrum analyzer settings for f < 1 ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 120 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
2. Spectrum analyzer settings for f ≥1 ㎓: Peak
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW = 3 ㎒ (≥ 3 x RBW)
   ④ Detector = peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
   ⑦ Trace was allowed to stabilize

3. Spectrum analyzer settings for f ≥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. f <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/Ds)$
   f ≥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
2. 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.
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 ㏈ of respective limits were not reported.
9. All channels, modes (e.g. 802.11a, 802.11n (20 ㎒/40 ㎒ BW), 802.11ac (20 ㎒/40 ㎒ /80 ㎒)), and modulations/data rates were investigated among all UNII bands. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

10. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are 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 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 ㎓ band: all emissions outside of the 5.15–5.35 ㎓ band shall not exceed an e.i.r.p of –27 ㏈m/㎒.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 ㎓ band shall not exceed an e.i.r.p. of −27 ㏈m/㎒.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 ㎓ band shall not exceed an e.i.r.p. of −27 ㏈m/㎒.
(4) For transmitters operating in the 5.725-5.85 GHz band:
i) All emissions shall be limited to a level of −27 ㏈m/㎒ at 75 ㎒ or more above or below the band edge increasing linearly to 10 ㏈m/㎒ at 25 ㎒ above or below the band edge, and from 25 ㎒ above or below the band edge increasing linearly to a level of 15.6 ㏈m/㎒ at 5 ㎒ above or below the band edge, and from 5 ㎒ above or below the band edge increasing linearly to a level of 27 ㏈m/㎒ at the band edge.
ii) Devices certified before March 2, 2017 with antenna gain greater than 10 ㏈i 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 ㏈i 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 ㎒. 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 ㎒.
(6) Unwanted emissions below 1 ㎓ 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 v01r04, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set RBW ≥ 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.

For the band 5.150-5250 ㎓

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor(㏈)
802.11n_HT40	0.362 3	0.391 3	0.926	92.59	0.33

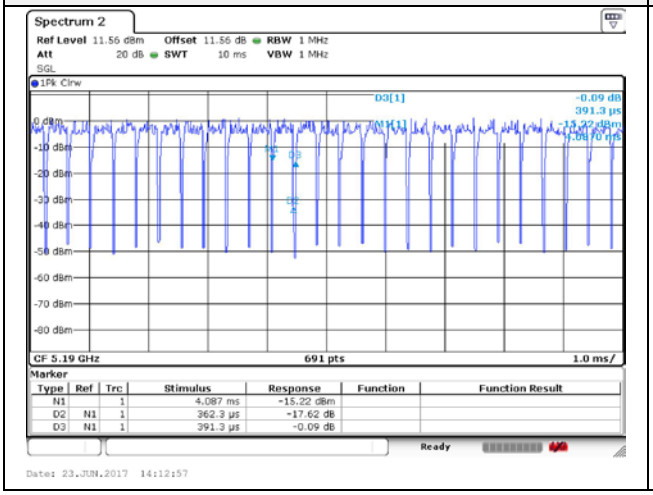
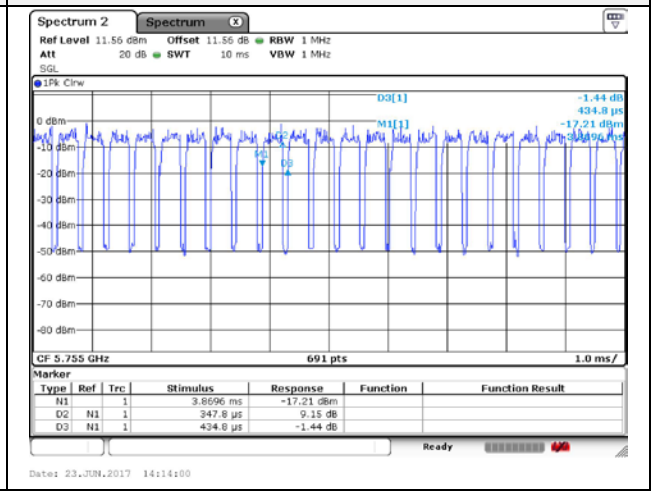
For the band 5.725-5850 ㎓

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor(㏈)
802.11n_HT40	0.347 8	0.434 8	0.799	79.99	0.97

Note:

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

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

UNII-1_HT40	UNII-3_HT40
	

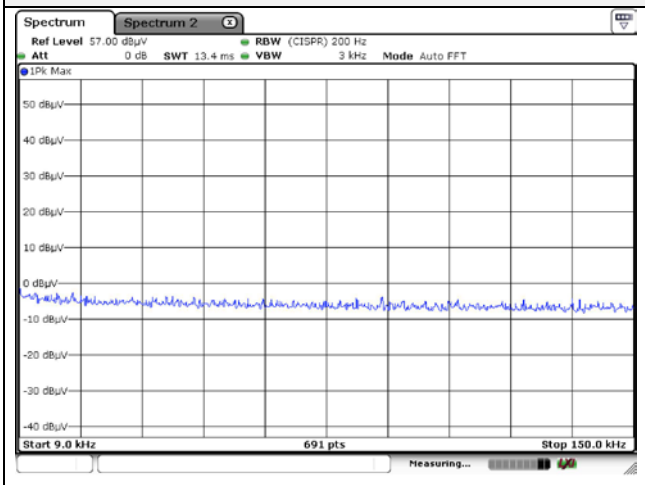
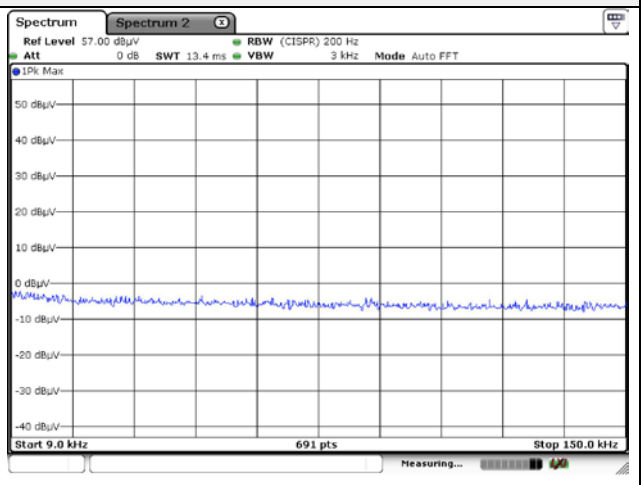
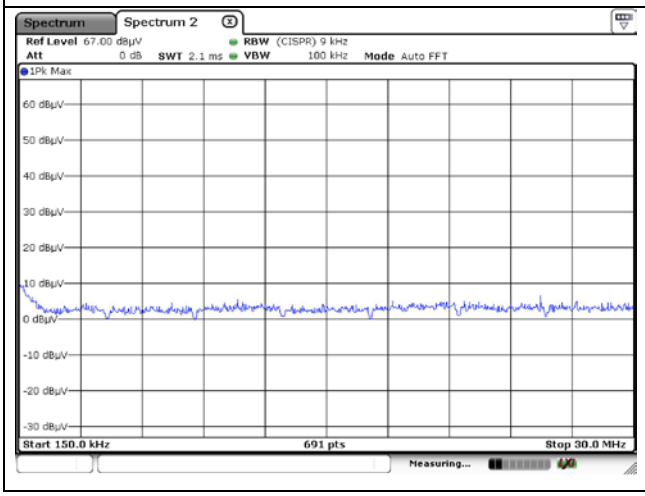
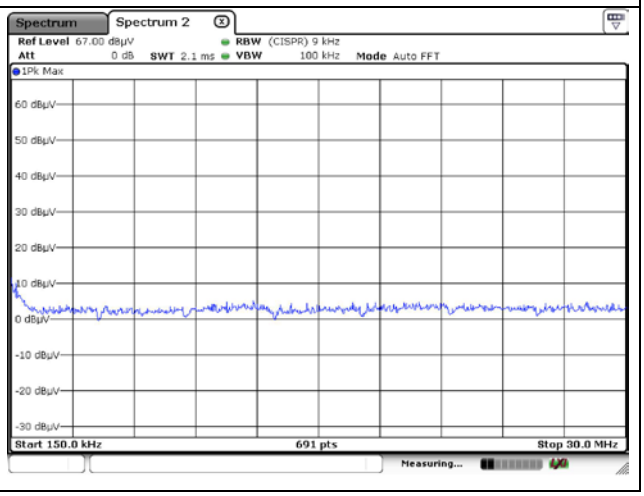
Test results (Below 30 ㎒) – Worst case

Mode: UNII-3(HT40)

Distance of measurement: 3 meter

Channel: 151

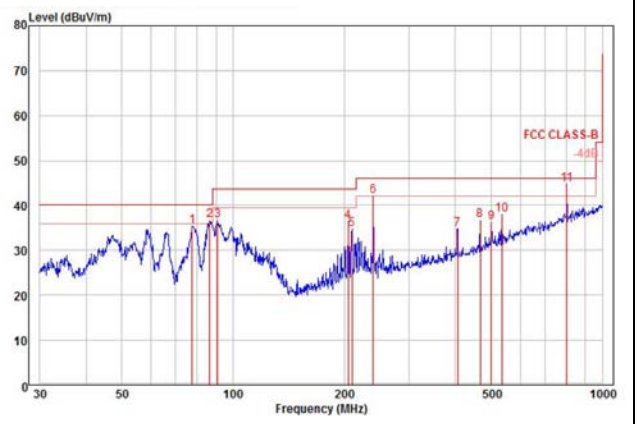
Frequency (㎒)	Level (dB㎶)	Ant. Pol. (H/V)	CF (dB)	F_d (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
No spurious emissions were detected within 20 dB of the limit							

Horizontal	Vertical
	
	

Test results (Below 1 000 ㎒) – Worst case

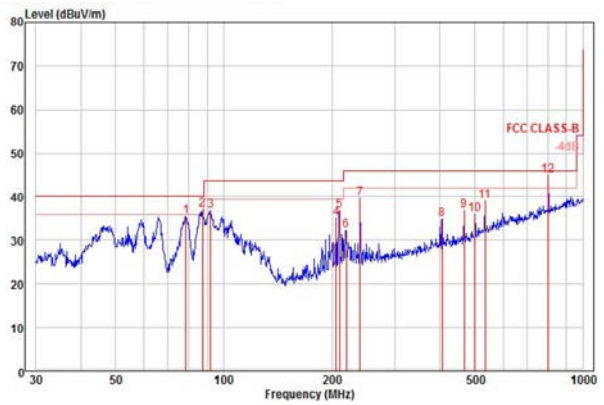
Mode:	UNII-3(HT40)
Distance of measurement:	3 meter
Channel:	151

Horizontal



	Freq	Level	Read Level	Ant Factor	Cable Loss	Preamp Factor	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dB	dB	dBuV/m	dB		
1	77.59	35.41	26.86	7.69	0.86	0.00	40.00	-4.59		horizontal
2 !	86.50	36.72	27.06	8.76	0.90	0.00	40.00	-3.28		horizontal
3	90.86	36.59	25.84	9.83	0.92	0.00	43.50	-6.91		horizontal
4	204.96	36.46	23.69	11.40	1.37	0.00	43.50	-7.04		horizontal
5	210.05	34.66	21.75	11.51	1.40	0.00	43.50	-8.84		horizontal
6 !	239.99	42.13	28.46	12.13	1.54	0.00	46.00	-3.87		horizontal
7	406.09	34.67	16.78	15.79	2.10	0.00	46.00	-11.33		horizontal
8	467.24	36.69	17.81	16.64	2.24	0.00	46.00	-9.31		horizontal
9	501.18	36.18	16.69	17.13	2.36	0.00	46.00	-9.82		horizontal
10	533.83	37.96	17.62	17.84	2.50	0.00	46.00	-8.04		horizontal
11 pp	801.79	44.70	20.65	20.82	3.23	0.00	46.00	-1.30		horizontal

Vertical



	Freq	Level	Read Level	Ant Factor	Cable Loss	Preamp Factor	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dB	dB	dBuV/m	dB		
1	78.41	35.56	27.21	7.48	0.87	0.00	40.00	-4.44		vertical
2 !	87.42	36.98	27.08	9.00	0.90	0.00	40.00	-3.02		vertical
3	92.14	36.81	25.79	10.08	0.94	0.00	43.50	-6.69		vertical
4	205.68	35.19	22.40	11.42	1.37	0.00	43.50	-8.31		vertical
5	210.05	36.74	23.83	11.51	1.40	0.00	43.50	-6.76		vertical
6	219.08	32.31	19.17	11.70	1.44	0.00	46.00	-13.69		vertical
7	239.99	39.75	26.08	12.13	1.54	0.00	46.00	-6.25		vertical
8	406.09	34.97	17.08	15.79	2.10	0.00	46.00	-11.03		vertical
9	467.24	36.74	17.86	16.64	2.24	0.00	46.00	-9.26		vertical
10	501.18	35.98	16.49	17.13	2.36	0.00	46.00	-10.02		vertical
11	533.83	38.97	18.63	17.84	2.50	0.00	46.00	-7.03		vertical
12 pp	801.79	44.98	20.93	20.82	3.23	0.00	46.00	-1.02		vertical

Test results (Above 1 000 ㎒)

Mode: UNII-1(HT40)

Distance of measurement: 3 meter

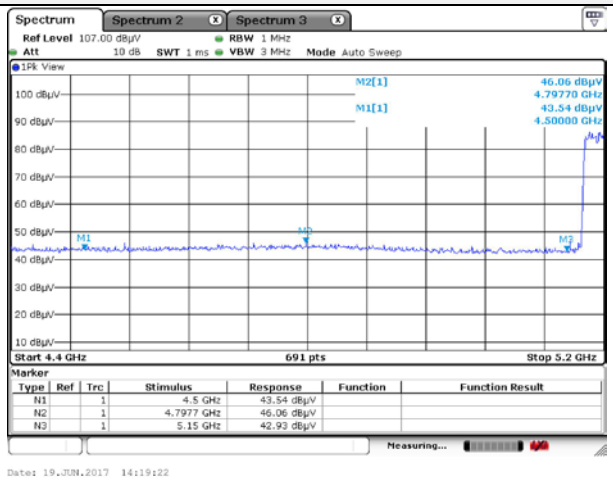
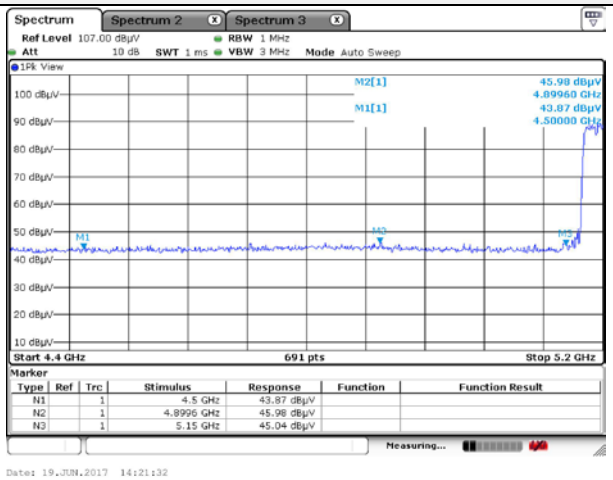
Channel: 38

- **Spurious**

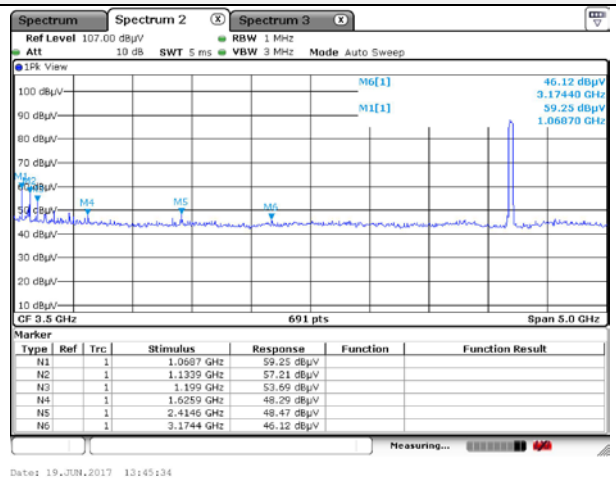
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1068.70	59.25	Peak	H	-8.70	-	50.55	74.00	23.45
1133.90	57.21	Peak	H	-8.28	-	48.93	74.00	25.07
1199.00	53.69	Peak	H	-7.86	-	45.83	74.00	28.17
1625.90	48.29	Peak	H	-4.74	-	43.55	74.00	30.45
2414.60	48.47	Peak	H	-0.17	-	48.30	74.00	25.70
3174.40	46.12	Peak	H	1.77	-	47.89	74.00	26.11
1068.70	57.36	Peak	V	-8.70	-	48.66	74.00	25.34
1133.90	61.45	Peak	V	-8.28	-	53.17	74.00	20.83
1199.00	55.83	Peak	V	-7.86	-	47.97	74.00	26.03
1466.70	49.46	Peak	V	-6.18	-	43.28	74.00	30.72
2125.20	47.75	Peak	V	-0.72	-	47.03	74.00	26.97
2667.90	48.66	Peak	V	0.60	-	49.26	74.00	24.74

- **Band edge**

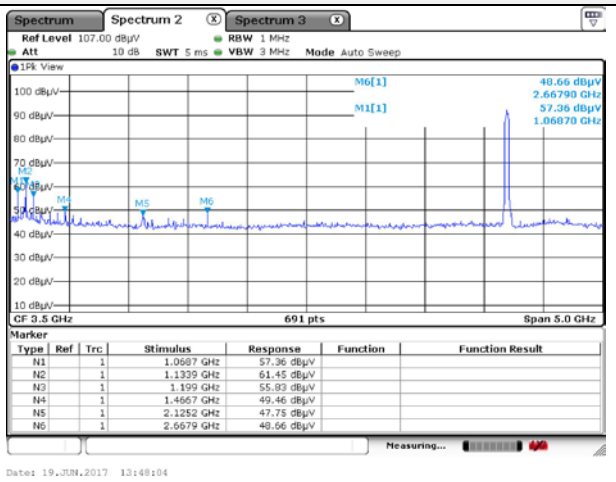
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4797.70	46.06	Peak	H	7.54	-	53.60	74.00	20.40
4899.60	45.98	Peak	V	8.33	-	54.31	74.00	19.69

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

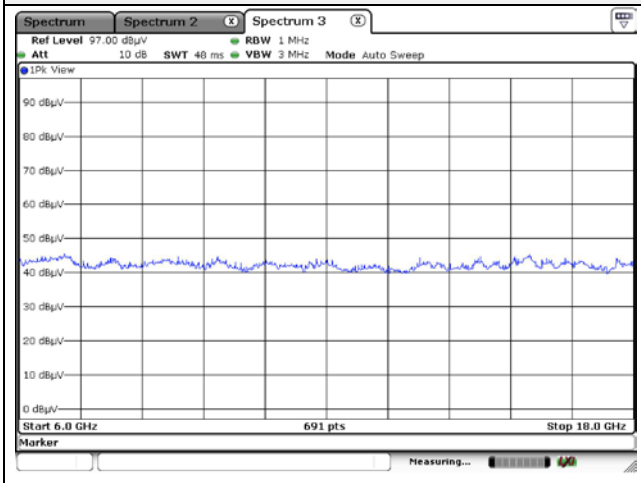
Horizontal // Peak for 1 ㎓ to 6 ㎓



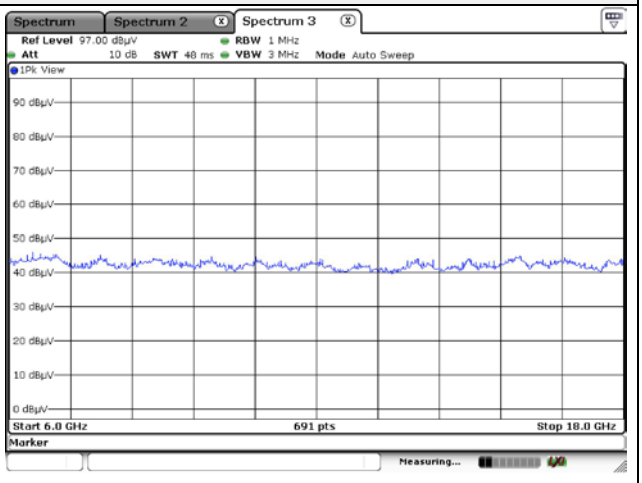
Vertical // Peak for 1 ㎓ to 6 ㎓



Horizontal // Peak for 6 ㎓ to 18 ㎓



Vertical // Peak for 6 ㎓ to 18 ㎓



Note.
1. No spurious emission were detected above 6 ㎓.

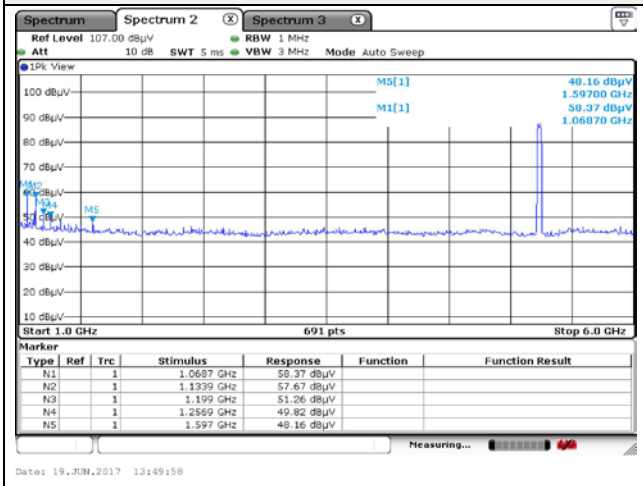
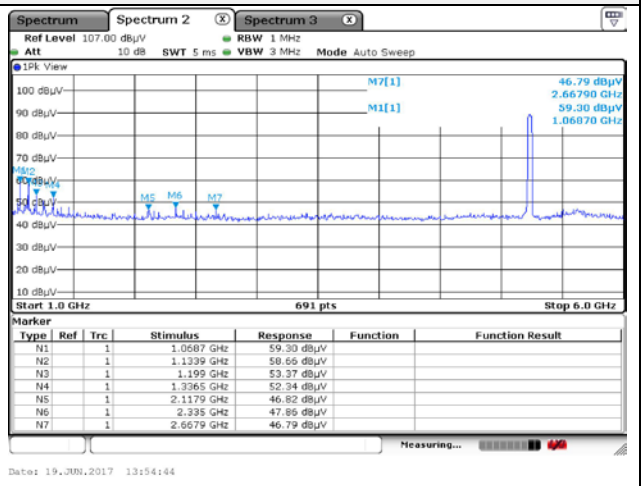
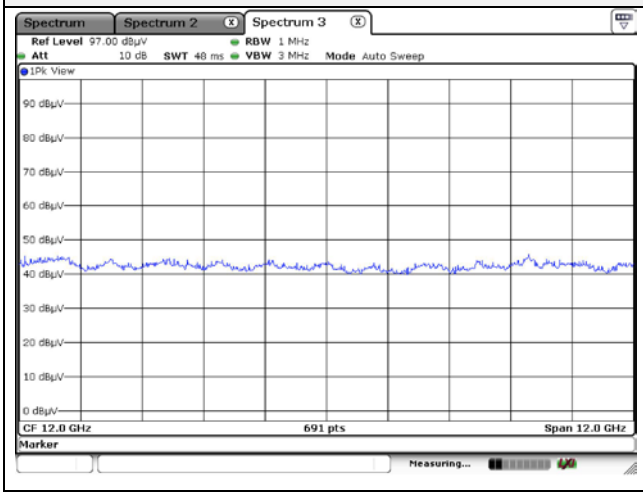
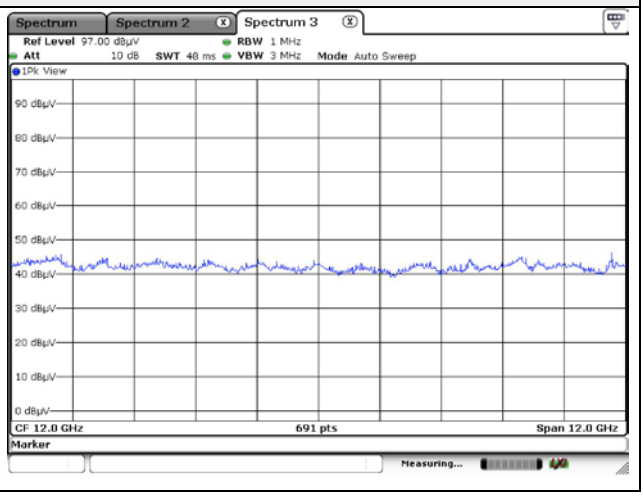
Mode: UNII-1(HT40)

Distance of measurement: 3 meter

Channel: 46

- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1068.70	58.37	Peak	H	-8.70	-	49.67	74.00	24.33
1133.90	57.67	Peak	H	-8.28	-	49.39	74.00	24.61
1199.00	51.26	Peak	H	-7.86	-	43.40	74.00	30.60
1256.90	49.82	Peak	H	-7.49	-	42.33	74.00	31.67
1597.60	48.16	Peak	H	-5.02	-	43.14	74.00	30.86
1068.70	59.30	Peak	V	-8.70	-	50.60	74.00	23.40
1133.90	58.66	Peak	V	-8.28	-	50.38	74.00	23.62
1199.00	53.37	Peak	V	-7.86	-	45.51	74.00	28.49
1336.50	52.34	Peak	V	-6.98	-	45.36	74.00	28.64
2117.90	46.82	Peak	V	-0.74	-	46.08	74.00	27.92
2335.00	47.86	Peak	V	-0.32	-	47.54	74.00	26.46
2667.90	46.79	Peak	V	0.60	-	47.39	74.00	26.61

Horizontal // Peak for 1 ㎓ to 6 ㎓	Vertical // Peak for 1 ㎓ to 6 ㎓
	
Horizontal // Peak for 6 ㎓ to 18 ㎓	**Vertical // Peak for 6 ㎓ to 18 ㎓**
	

Note.
1. No spurious emission were detected above 6 ㎓.

Mode: UNII-3(HT40)

Distance of measurement: 3 meter

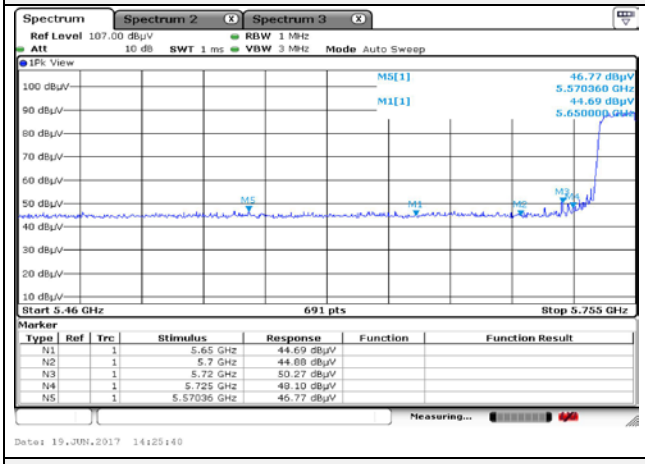
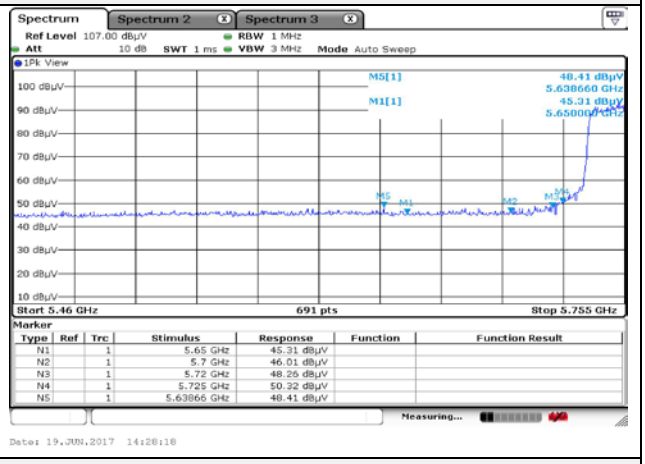
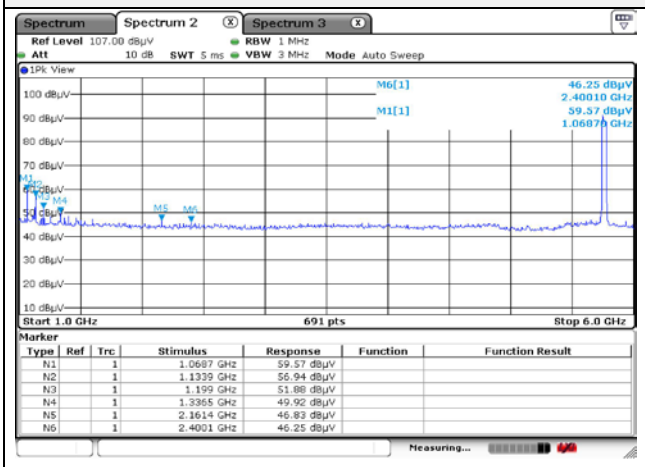
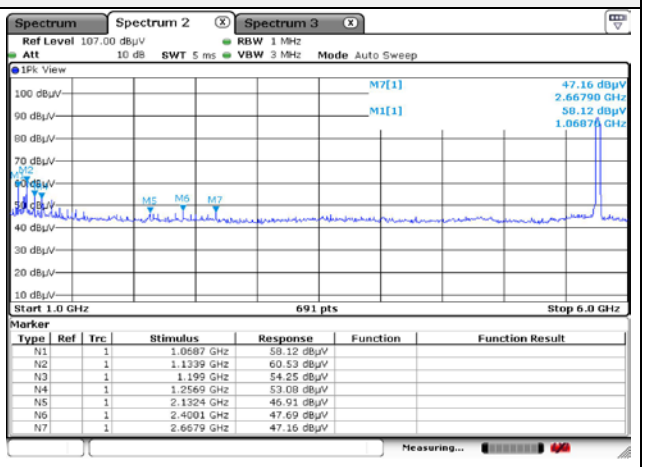
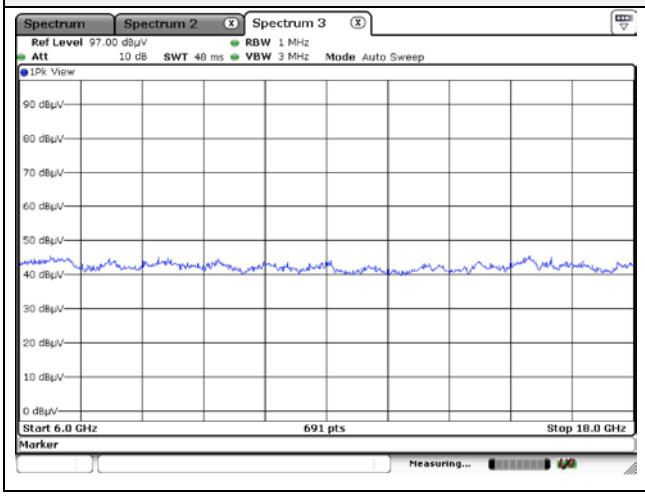
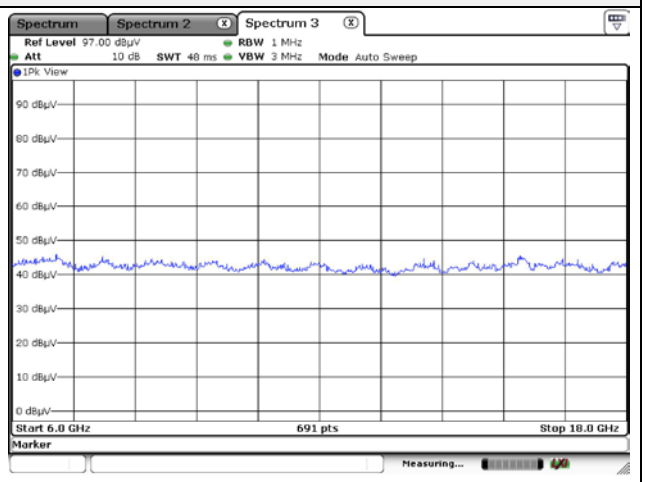
Channel: 151

- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1068.70	59.57	Peak	H	-8.70	-	50.87	74.00	23.13
1133.90	56.94	Peak	H	-8.28	-	48.66	74.00	25.34
1199.00	51.88	Peak	H	-7.86	-	44.02	74.00	29.98
1336.50	49.92	Peak	H	-6.98	-	42.94	74.00	31.06
2161.40	46.83	Peak	H	-0.65	-	46.18	74.00	27.82
2400.10	46.25	Peak	H	-0.20	-	46.05	74.00	27.95
1068.70	58.12	Peak	V	-8.70	-	49.42	74.00	24.58
1133.90	60.53	Peak	V	-8.28	-	52.25	74.00	21.75
1199.00	54.25	Peak	V	-7.86	-	46.39	74.00	27.61
1256.90	53.08	Peak	V	-7.49	-	45.59	74.00	28.41
2132.40	46.91	Peak	V	-0.71	-	46.20	74.00	27.80
2400.10	47.69	Peak	V	-0.20	-	47.49	74.00	26.51
2667.90	47.16	Peak	V	0.60	-	47.76	74.00	26.24

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5720.00	50.27	Peak	H	10.83	-	61.10	110.80	49.70
5570.36	46.77	Peak	H	9.62	-	56.39	68.20	11.81
5725.00	50.32	Peak	V	10.87	-	61.19	122.20	61.01
5638.66	48.41	Peak	V	10.15	-	58.56	68.20	9.64

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	
Horizontal // Peak for 1 ㎓ to 6 ㎓	**Vertical // Peak for 1 ㎓ to 6 ㎓**
	
Horizontal // Peak for 6 ㎓ to 18 ㎓	**Vertical // Peak for 6 ㎓ to 18 ㎓**
	

Note.
1. No spurious emission were detected above 6 ㎓.

Mode: UNII-3(HT40)

Distance of measurement: 3 meter

Channel: 159

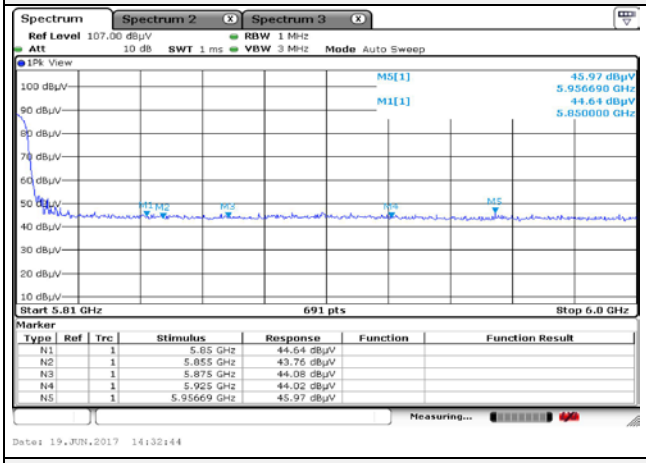
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1068.70	59.56	Peak	H	-8.70	-	50.86	74.00	23.14
1133.90	56.74	Peak	H	-8.28	-	48.46	74.00	25.54
1199.00	52.02	Peak	H	-7.86	-	44.16	74.00	29.84
1336.50	51.00	Peak	H	-6.98	-	44.02	74.00	29.98
2400.10	46.99	Peak	H	-0.20	-	46.79	74.00	27.21
2581.00	46.28	Peak	H	0.28	-	46.56	74.00	27.44
1068.70	59.34	Peak	V	-8.70	-	50.64	74.00	23.36
1133.90	59.36	Peak	V	-8.28	-	51.08	74.00	22.92
1199.00	51.87	Peak	V	-7.86	-	44.01	74.00	29.99
1336.50	51.43	Peak	V	-6.98	-	44.45	74.00	29.55
1531.80	48.54	Peak	V	-5.66	-	42.88	74.00	31.12
2132.40	47.82	Peak	V	-0.71	-	47.11	74.00	26.89
2400.10	48.28	Peak	V	-0.20	-	48.08	74.00	25.92
2667.90	46.80	Peak	V	0.60	-	47.40	74.00	26.60
3709.80	45.81	Peak	V	2.71	-	48.52	74.00	25.48

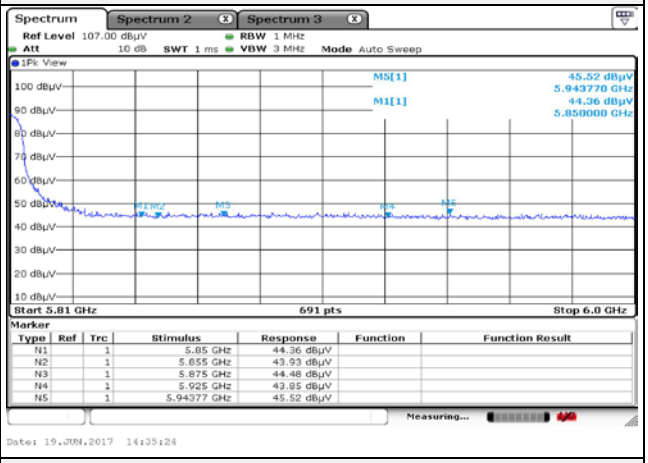
- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5850.00	44.64	Peak	H	11.78	-	56.42	122.20	65.78
5956.69	45.97	Peak	H	12.36	-	58.33	68.20	9.87
5875.00	44.48	Peak	V	11.91	-	56.39	105.20	48.81
5943.77	45.52	Peak	V	12.29	-	57.81	68.20	10.39

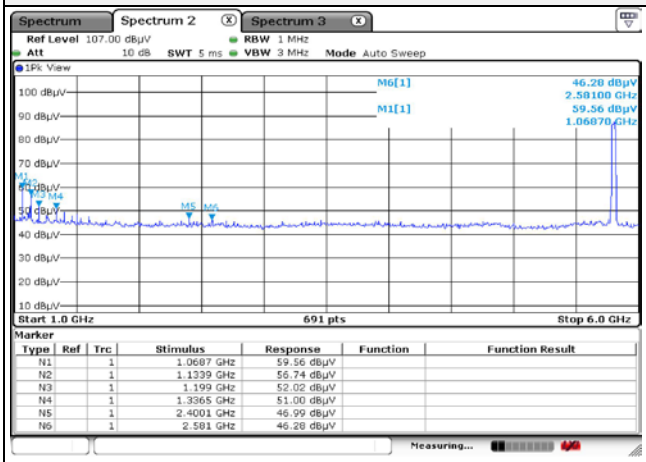
Restricted band // Horizontal // Peak



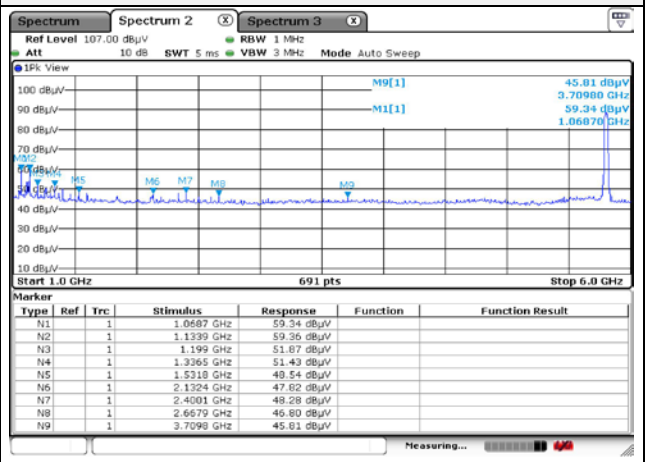
Restricted band // Vertical // Peak



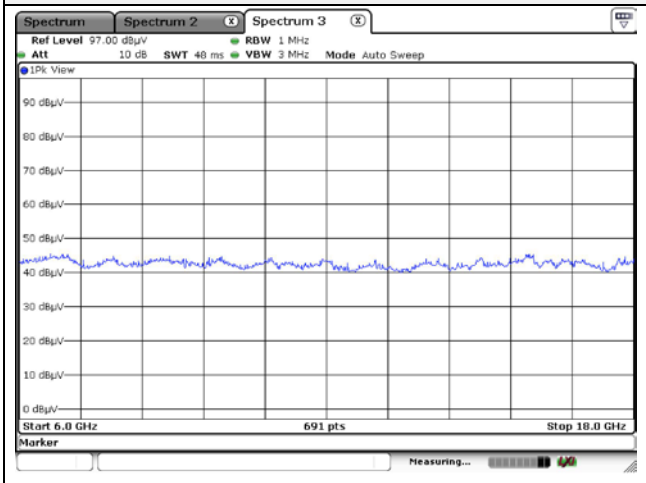
Horizontal // Peak for 1 ㎓ to 6 ㎓



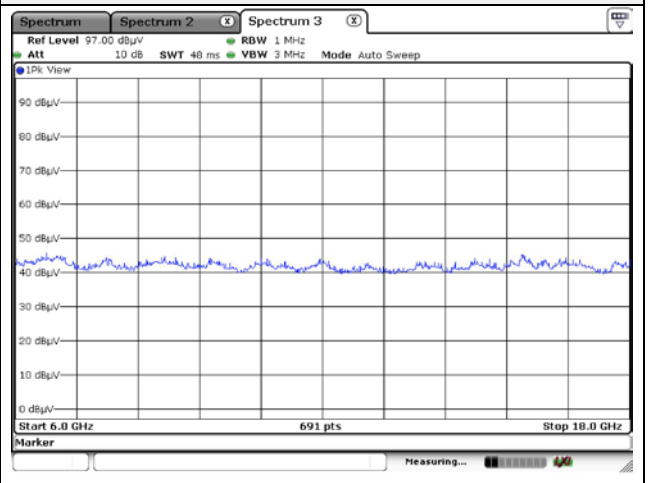
Vertical // Peak for 1 ㎓ to 6 ㎓



Horizontal // Peak for 6 ㎓ to 18 ㎓



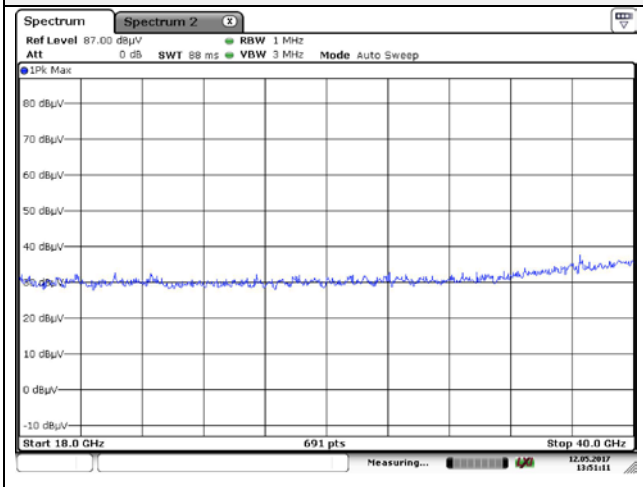
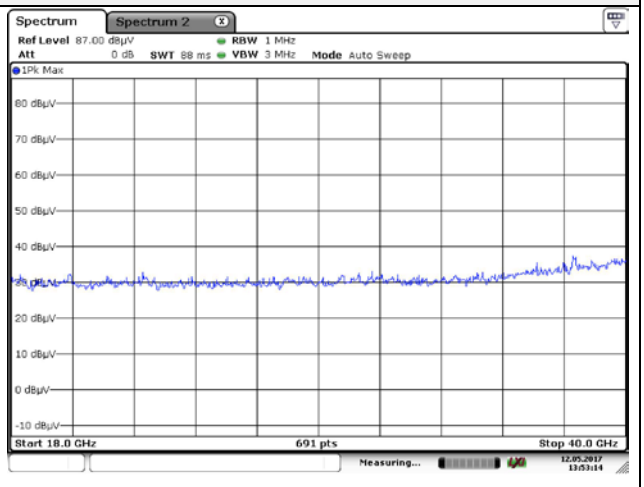
Vertical // Peak for 6 ㎓ to 18 ㎓



Note.
1. No spurious emission were detected above 6 ㎓

Test results (18 ㎓ to 40 ㎓) – Worst case

Mode:	UNII-3(HT40)
Distance of measurement:	3 meter
Channel:	151

Horizontal	Vertical
	

Note.
1. No spurious emission were detected above 18 ㎓.

3.7. AC conducted emissions

Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

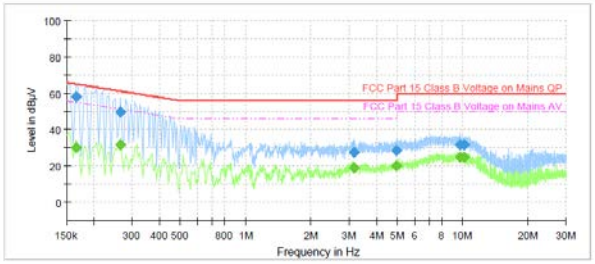
Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

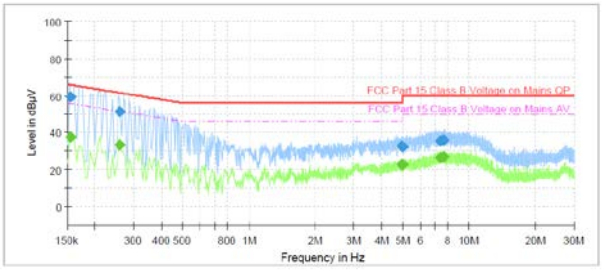
Note:

1. All AC line conducted spurious emission are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and the appropriate frequencies. All data rates and modes were investigated for conducted spurious emission. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.
3. Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

Test results

Hot Line





Neutral Line

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.165000	---	30.06	55.21	25.15	1000.0	9.000	L1	21.0
0.165000	57.98	---	65.21	7.23	1000.0	9.000	L1	21.0
0.265000	---	32.00	51.27	19.27	1000.0	9.000	L1	20.8
0.265000	49.88	---	61.27	11.39	1000.0	9.000	L1	20.8
3.175000	---	19.09	46.00	26.91	1000.0	9.000	L1	19.7
3.175000	27.41	---	56.00	28.59	1000.0	9.000	L1	19.7
4.935000	---	20.35	46.00	25.65	1000.0	9.000	L1	19.7
4.935000	28.72	---	56.00	27.28	1000.0	9.000	L1	19.7
9.745000	---	25.03	50.00	24.97	1000.0	9.000	L1	19.9
9.745000	31.79	---	60.00	28.21	1000.0	9.000	L1	19.9
10.210000	---	24.80	50.00	25.20	1000.0	9.000	L1	19.9
10.210000	31.64	---	60.00	28.36	1000.0	9.000	L1	19.9

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.155000	---	37.76	55.73	17.97	1000.0	9.000	N	21.0
0.155000	59.54	---	65.73	6.19	1000.0	9.000	N	21.0
0.260000	---	33.22	51.43	18.21	1000.0	9.000	N	20.8
0.260000	51.59	---	61.43	9.84	1000.0	9.000	N	20.8
4.960000	---	22.77	46.00	23.23	1000.0	9.000	N	19.7
4.960000	32.62	---	56.00	23.38	1000.0	9.000	N	19.7
4.975000	---	22.76	46.00	23.24	1000.0	9.000	N	19.7
4.975000	32.51	---	56.00	23.49	1000.0	9.000	N	19.7
7.445000	---	26.71	50.00	23.29	1000.0	9.000	N	19.8
7.445000	35.51	---	60.00	24.49	1000.0	9.000	N	19.8
7.630000	---	27.02	50.00	22.98	1000.0	9.000	N	19.8
7.630000	35.81	---	60.00	24.19	1000.0	9.000	N	19.8

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV40	101002	1 year	2017.07.06
Spectrum Analyzer	R&S	FSV30	101389	1 year	2018.01.23
Signal Generator	ANRITSU	68369B	992113	1 year	2018.02.20
Power Meter	Anritsu	ML2495A	1438001	1 year	2018.01.23
Pluse Power Sensor	Anritsu	MA2411B	1339205	1 year	2018.01.23
Loop antenna	SCHWARZBECK	FMZB1513	225	2 years	2019.05.10
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	9168-714	2 years	2018.11.28
Horn Antenna	A.H	SAS-571	414	2 years	2019.02.15
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170550	2 years	2019.02.15
Preamplifier	SCHWARZBECK	BBV-9718	9718-246	1 year	2017.10.14
Preamplifier	HP	8449B	3008A00538	1 year	2017.07.05
Broadband Amplifier	SCHWARZBECK	BBV-9721	PS9721-003	1 year	2018.01.23
High Pass Filter	Wainwright Instrument	WHNK6.0/26.5G-6SS	1	1 year	2017.07.05
Attenuator	KEYSIGHT	8493C	82507	1 year	2018.01.23
EMI Test Receiver	R&S	ESU26	100552	1 year	2018.04.19
EMI Test Receiver	R&S	ESR3	101781	1 year	2018.04.27
Temperature & Humidity Chamber	Daehan Engineering	DH-1000	DH1000060628	1 year	2018.01.20
LISN	R&S	ENV216	101137	1 year	2018.02.03

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	Samsung Electronics Co., Ltd.	NT-R540-PS35S	ZSME93AZ700280W