TEST REPORT

KCTL Inc.
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 443-390, Korea
TEL: 82 70 5008 1021
FAX: 82 505 299 8311

http://www.kctl.co.kr

1. Applicant

Name:	HUMAX Co., Ltd
Address:	(Yubang-dong)2, Yeongmun-ro, Cheoin-gu Yongin-si, Gyeonggi-do, Korea

2. Sample Description:

FCC ID:	O6ZC41W-500
Type of equipment:	Wireless Client
Basic Model:	C41W-500

3. Date of Test: June 02 ~ June 03, 2016

4. Test method used: FCC Part 15 Subpart E, 15.407

5. Test Results

Test Item:	Refer to page 8
Result:	Refer to page 9 ~ page 39
Measurement Uncertainty:	Refer to page 8

This result shown in this report refers only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by Name: AHN, BYUNG WOO	Reviewed by Name: SON, MIN GI

2016. 06. 09

KCTL Inc.

[Contents]

1. Client information

Applicant:	HUMAX Co., Ltd
Address:	(Yubang-dong)2, Yeongmun-ro, Cheoin-gu Yongin-si, Gyeonggi-do, Korea
Telephone number:	+82-31-776-6368
Facsimile number:	+82-31-776-6149
Contact person:	CHAN HEON, JEONG / jungch@humaxdigital.com

Manufacturer:	HUMAX Co., Ltd
Address:	(Yubang-dong)2, Yeongmun-ro, Cheoin-gu Yongin-si, Gyeonggi-do, Korea

2. Laboratory information

Address

KCTL Inc.
65 Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea (443-390)
Telephone Number: +82-70-5008-1016 Facsimile Number: +82-505-299-8311

Certificate

KOLAS No.: KT231
FCC Site Designation No: KR0040
FCC Site Registration No: 687132
VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849
IC Site Registration No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant	HUMAX Co., Ltd
Address of Applicant	(Yubang-dong)2, Yeongmun-ro, Cheoin-gu Yongin-si, Gyeonggi-do, Korea
Manufacturer	HUMAX Co., Ltd
Address of Manufacturer	(Yubang-dong)2, Yeongmun-ro, Cheoin-gu Yongin-si, Gyeonggi-do, Korea
Type of equipment	Wireless Client
Basic Model	C41W-500
Serial number	N/A

3.2 General description

Frequency Range	2.4 ㎓: 2 425 ㎒ ~ 2 475 ㎒ (RF4CE), 5 ㎓: 5 190 ~ 5 230 ㎒, 5 270 ~ 5 310 ㎒, 5 510 ~ 5 670 ㎒, 5 755 ~ 5 795 ㎒ (WiFi 5G)
Type of Modulation	2.4 ㎓: O-QPSK (RF4CE), 5 ㎓: OFDM (WiFi 5G)
Number of Channels	2.4 ㎓: 2 425 ㎒ ~ 2 475 ㎒ : 3 ch (RF4CE), 5 ㎓: 5 190 ~ 5 230 ㎒ : 2 (WiFi 5G), 5 270 ~ 5 310 ㎒ : 2 (WiFi 5G), 5 510 ~ 5 670 ㎒ : 5 (WiFi 5G), 5 755 ~ 5 795 ㎒ : 2 (WiFi 5G)
Type of Antenna	Integral Embedded Antenna(Wi-Fi), Integral PCB antenna(RF4CE)
Antenna Gain	2.4 ㎓: 2 425 ㎒ ~ 2 475 ㎒ : Ant0: 2.89 ㏈i, Ant1: 2.26 ㏈i (RF4CE), 5 ㎓: 5 190 ~ 5 230 ㎒ : 1.9 ㏈i (WiFi 5G), 5 270 ~ 5 310 ㎒ : 2.5 ㏈i (WiFi 5G), 5 510 ~ 5 670 ㎒ : 2.9 ㏈i (WiFi 5G), 5 755 ~ 5 795 ㎒ : 3.0 ㏈i (WiFi 5G)
Transmit Power	18.21 ㏈m
Power supply	AC 120 V
Product SW/HW version	0x7E6 / V2.1
Radio SW/HW version	V2.1 / v35.2.0.48
Test SW Version	Teraterm
RF power setting in TEST SW	Band 1: 15

Note :
1. The above EUT information was declared by the manufacturer.
2. Since this report is for Class Ⅱ permissive change(C2PC) regarding 5G Band 1, refer to the original test report (Report #: EMC- FCC- R0108-2, Test Lab: EMC Compliance) for other modes.

3.3 Test frequency

* 802.11n_HT40

Frequency	Band 1
Low frequency	5 190 ㎒
Middle frequency	-
High frequency	5 230 ㎒

3.4 Test Voltage

Mode	Voltage
Norminal voltage	AC 120 V

3.5 Duty Factor

Frequncy [㎒]	Duty cycle [%]	Duty cycle factor [dB]
5 190	75.55	1.22
5 230	79.00	1.02

* Duty cycle factor=10log(1/Duty cycle)

4. Summary of test results

4.1 Standards & results

FCC Rule	IC Rule	Parameter	Report Section	Test Result
15.203 15.407(a)(1)(2)(3)	-	Antenna Requirement	5.1	C
15.403(i),15.407(e)	RSS-247, 5.1 RSS-GEN, 6.6	Bandwidth Measurement	5.2	C
15.407(a)(1)(2)	RSS-247, 5.4	Maximum Conducted Output Power	5.3	C
15.407(a)(1)(2)(5)	RSS-247, 5.3, (2)	Peak Power Spectral Density	5.4	C
15.205(a), 15.209(a), 15.407(b)(1), 15.407(b)(2), 15.407(b)(3)	RSS-247, 5.5 RSS-GEN, 8.9, 10	Spurious Emission, Band Edge and Restricted bands	5.5	C
15.407(g)	RSS-GEN, 6.11	Frequency Stability	5.6	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	5.7	C
15.407(h)	RSS-247, 6.3	Dynamic Frequency Selection	-	N/A1)

Note: C = complies
NC = Not complies
NT = Not tested
NA = Not Applicable
N/A1): Refer to the original test report (Report #: EMC- FCC- R0108-2, Test Lab: EMC Compliance)

* The general test methods used to test this device is ANSI C63.10:2013

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 ㎒ ~ 300 ㎒:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 ㎒ ~ 1 000 ㎒:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
	1 ㎓ ~ 25 ㎓:	+ 6.03 dB, - 6.05 dB
Conducted Emissions	9 ㎑ ~ 150 ㎑:	3.75 dB
	150 ㎑ ~ 30 ㎒:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.407(a)(1)(2)(3), If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result

-Complied

The transmitter has an integral PCB antenna and the total directional peak gain of the antenna exceeds 6.0 dBi

	5 150 ㎒ Band
ANT 1 Gain	1.9 dBi
ANT 2 Gain	1.9 dBi
ANT 3 Gain	1.9 dBi
ANT 4 Gain	1.9 dBi

According to KDB 662911 D01 Multiple Transmitter Output v02r01
- Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 ㎒ for any NANT;

Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less, for 20-㎒ channel widths with NANT ≥ 5.

For power measurements on all other devices:

Array Gain = 10 log(NANT/NSS) dB.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(NANT/NSS) dB.

For 5 150 ㎒ Band Total gain = 7.92 dBi (individual gain(1.9 dBi) + Array gain(6.02 dBi))

Maximum conducted output power and maximum power spectral density were reduced by the amount in dB because the directional gain of the antenna exceeds 6 dBi.

5.2 Maximum Conducted Output Power

5.2.1 Regulation

According to §15.407(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 ㎓, the maximumConducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (2) For the 5.25-5.35 ㎓ and 5.47-5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBthat the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (3) For the band 5.725-5.85 ㎓, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2.2 Measurement Procedure

These test measurement settings are specified in section C of 789033 D02 General UNII Test Procedures.

5.2.2.1 Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

(i) Measure the duty cycle, x, of the transmitter output signal as described in section II.B.

(ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(iii) Set RBW = 1 MHz.

(iv) Set VBW ≥ 3 MHz.

(v) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(vi) Sweep time = auto.

(vii) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.

(viii) Do not use sweep triggering. Allow the sweep to "free run."

(ix) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.

(x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(xi) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25%.

5.2.4 Test Result

-Complied

-802.11n_HT40_Band 1_MIMO (ANT 1+2+3+4)

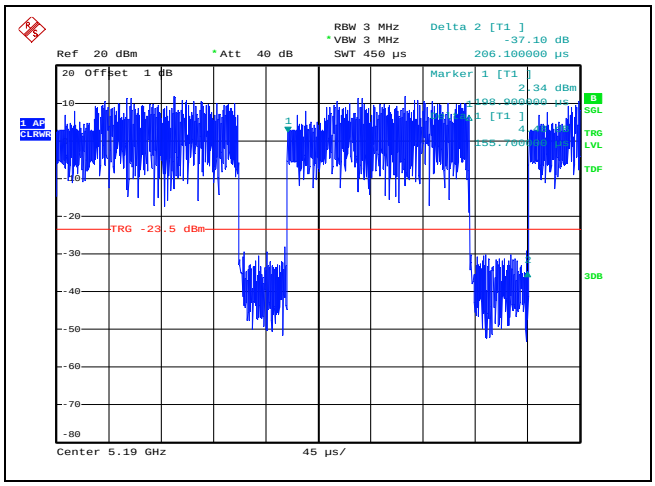
Frequency [㎒]	Result [dBm] Ant1	Result [dBm] Ant2	Result [dBm] Ant3	Result [dBm] Ant4	Result [dBm]	D.C.C.F [dB]	Total result [dBm]	Limit [dBm]	Margin [dB]
5 190	11.41	10.88	10.46	11.09	16.99	1.22	18.21	30.00	11.79
5 230	11.07	10.15	11.03	10.92	16.83	1.02	17.85	30.00	12.15

Note:
1. D.C.C.F = Duty cycle correction factor = 10log(1/Duty Cycle)

5.2.4 Test Plot

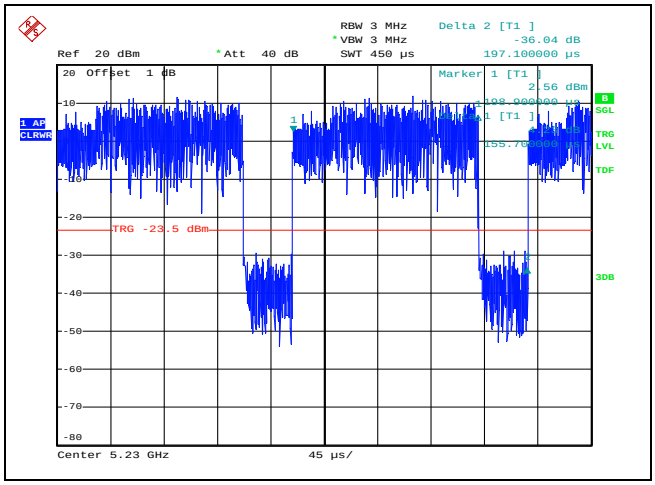
Figure 1. Duty Cycle

-5 190 ㎒



-On time : 0.16 ms
-Period : 0.21 ms
-Duty Cycle : 0.755 5
-D.C.C.F : 1.22 dB

-5 230 ㎒



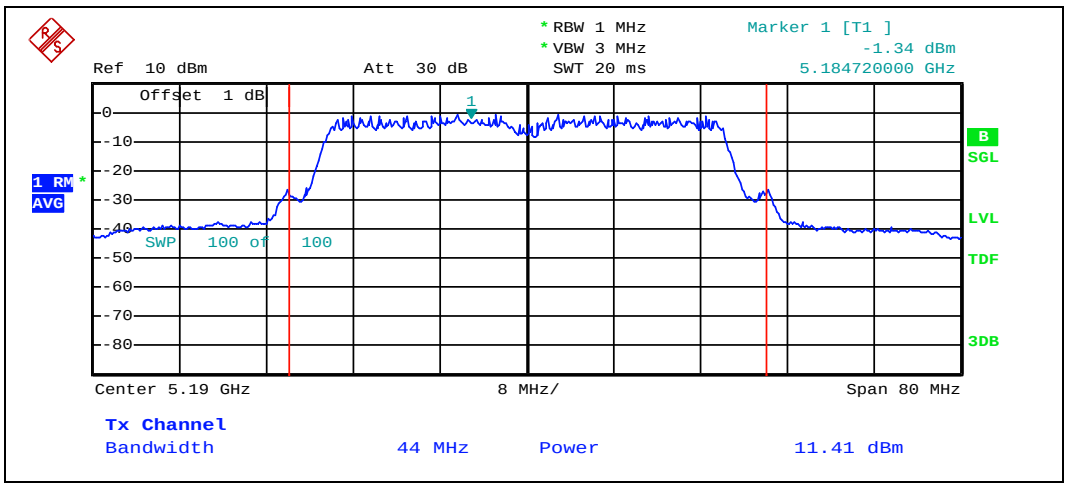
-On time : 0.16 ms
-Period : 0.20 ms
-Duty Cycle : 0.790 0
-D.C.C.F : 1.02 dB

Figure 2. Maximum Conducted Output Power

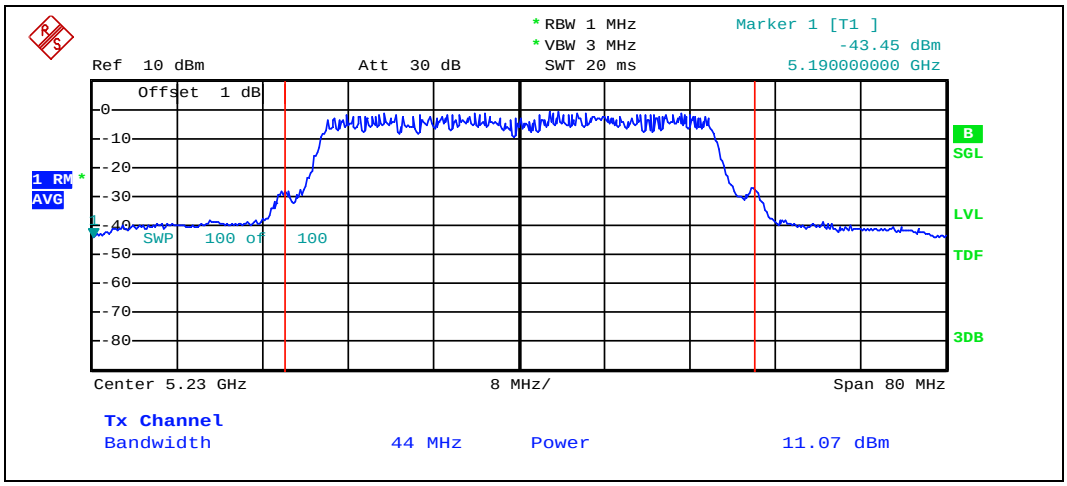
* 802.11n_HT40_Band 1

-5 190 ㎒

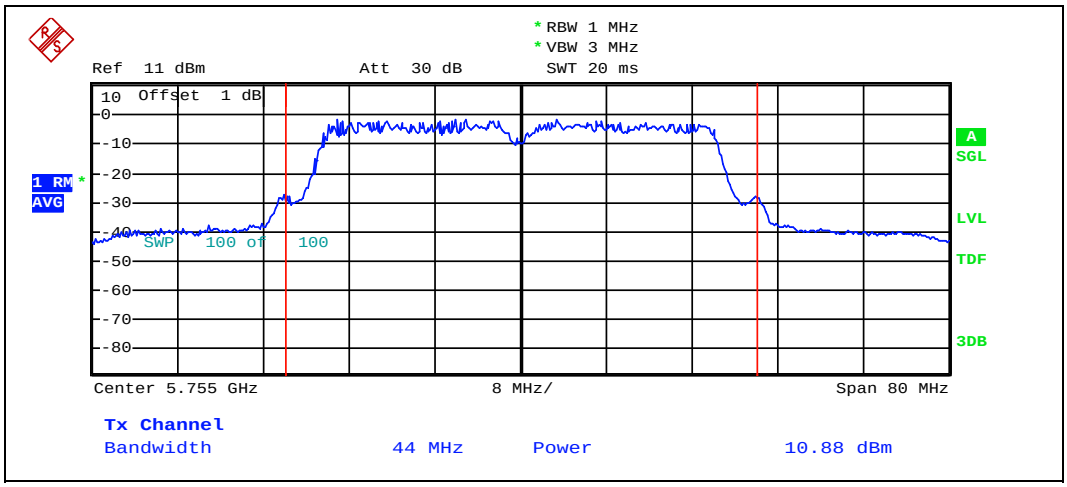
ANT 1



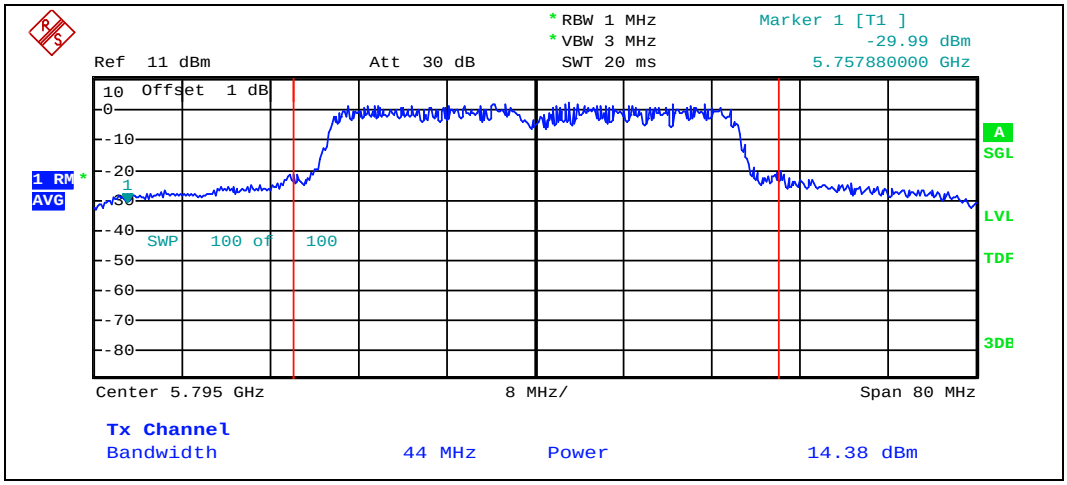
ANT 2



ANT 3

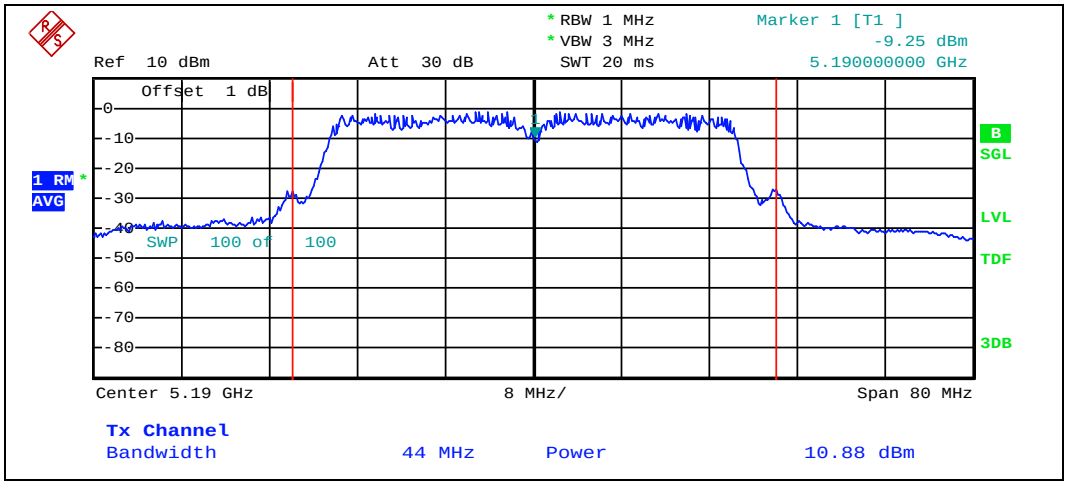


ANT 4

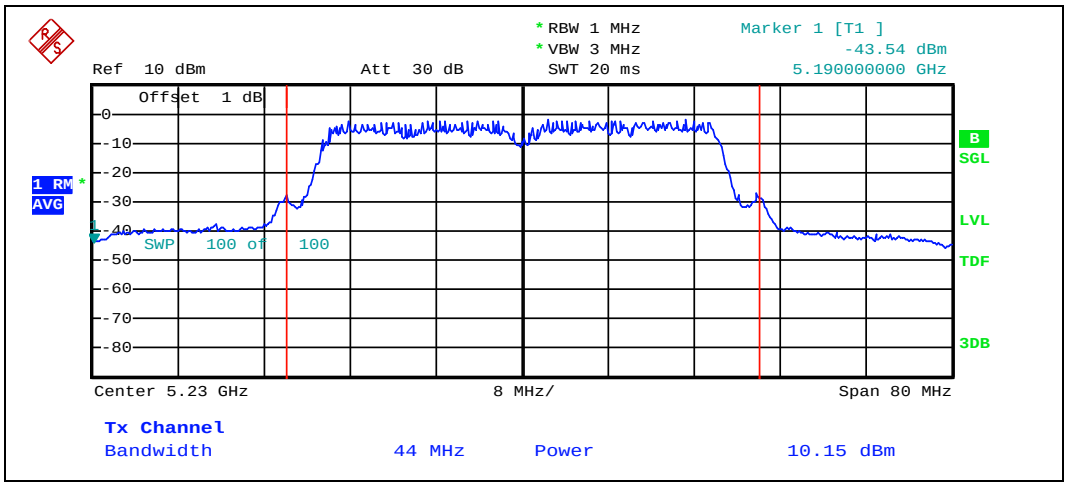


-5 230 ㎒

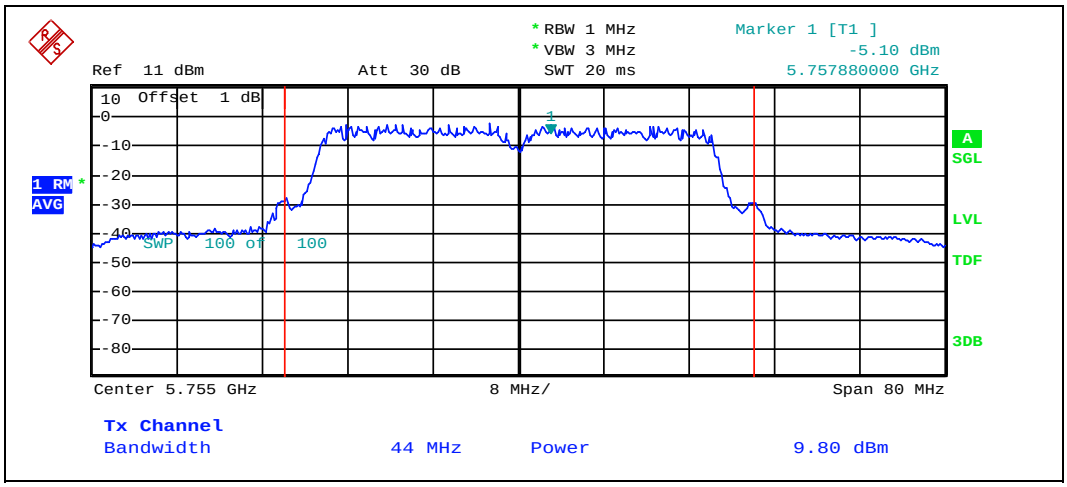
ANT 1



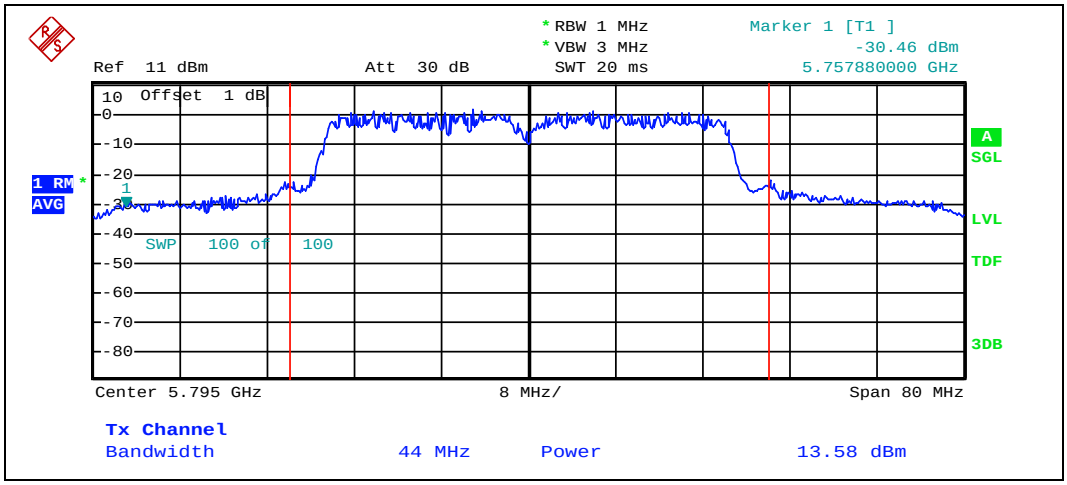
ANT 2



ANT 3



ANT 4



5.3 Bandwidth Measurement

5.3.1 Regulation

According to §15.403,(i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 ㏈ down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

According to §15.407,(e) Within the 5.725-5.85 ㎓ band, the minimum 6 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

5.3.2 Measurement Procedure

1.Emission Bandwidth (EBW)

a)Set RBW = approximately 1% of the emission bandwidth.
b)Set the VBW > RBW.
c)Detector = Peak.
d)Trace mode = max hold.
e)Measure the maximum width of the emission that is 26 ㏈ down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeatmeasurement as needed until the RBW/EBW ratio is approximately 1%.

2.Minimum Emission Bandwidth for the band 5.725 - 5.85 ㎓

Section 15.407(e) specifies the minimum 6 ㏈ emission bandwidth of at least 500 ㎑ for theband 5.715-5.85 ㎓. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 ㎑.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associatedwith the two outermost amplitude points (upper and lower frequencies) that are attenuated by6 ㏈ relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

5.3.3 Test Result

-Complied

-802.11n_HT40_Band 1

Frequency [㎒]	26 dB Bandwidth [㎒]	OBW [㎒]
5 190	44.64	36.32
5 230	44.64	36.32

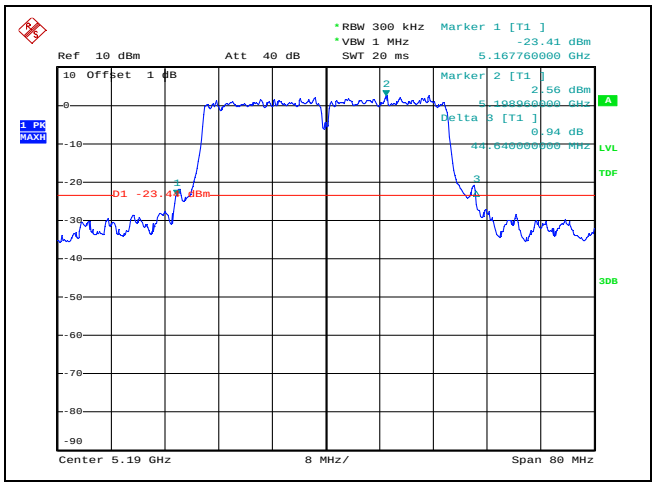
5.3.4 Test Plot

Figure 1. Plot of Bandwidth Measurement

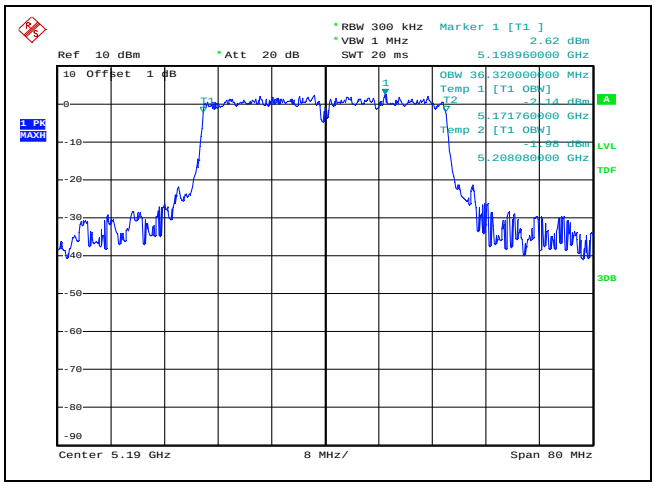
* 802.11n_HT40_Band 1

-5 190 ㎒

EBW

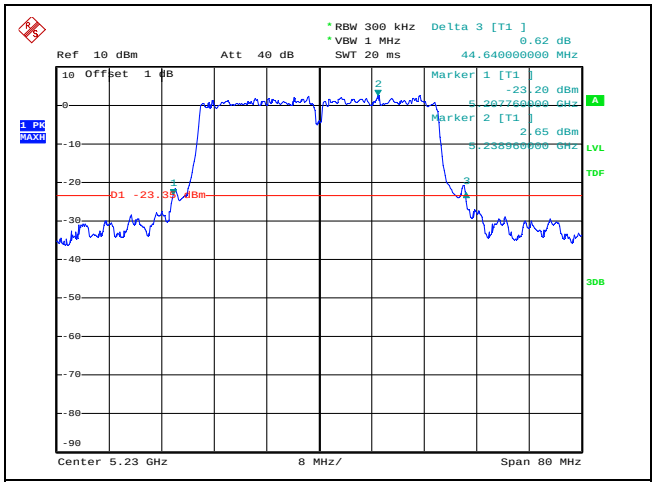


OBW

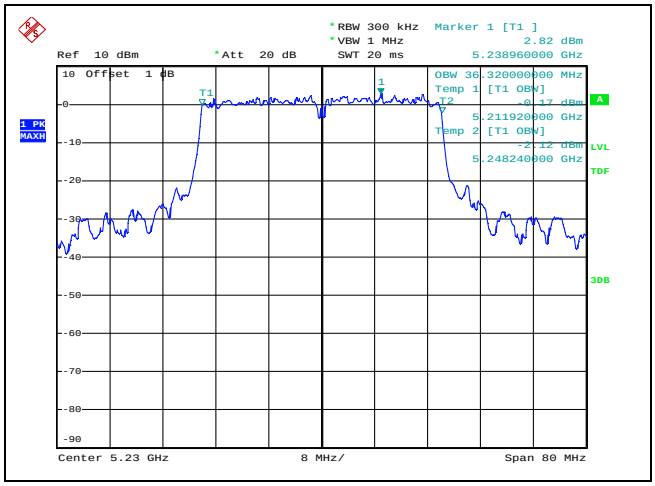


-5 230 ㎒

EBW



OBW



5.4 Peak Power Spectral Density

5.4.1 Regulation

According to §15.407(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 ㎓, the maximumConducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (2) For the 5.25-5.35 ㎓ and 5.47-5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dBthat the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (3) For the band 5.725-5.85 ㎓, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.4.2 Measurement Procedure

These test measurement settings are specified in section F of 789033 D02 General UNII Test Procedures New Rules v01.

5.4.2.1 Maximum power spectral density (PSD)

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).
c) Set VBW ≥ 3 RBW.
d) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 10log(500㎑/RBW) to the measured result, whereas RBW (< 500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
e) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10log(1㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
f) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

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.

5.4.3 Test Result

-Complied

-802.11n_HT40_Band 1_MIMO (ANT 1+2+3+4)

Frequency [㎒]	Result [dBm/㎒] Ant1	Result [dBm/㎒] Ant2	Result [dBm/㎒] Ant3	Result [dBm/㎒] Ant4	D.C.C.F [dB]	Total result [dBm/㎒]	Limit [dBm]	Margin [dB]
5 190	-0.74	-1.44	-1.32	-0.98	1.22	6.13	15.08	8.95
5 230	-1.04	-1.91	-1.16	-1.30	1.02	5.70	15.08	9.37

Note:
1. Since the directional antenna gain exceeds 6.0 dBi (Total Antenna Gain: 7.92 dBi (Band 1)), the limit was reduced.
2. D.C.C.F = Duty cycle correction factor

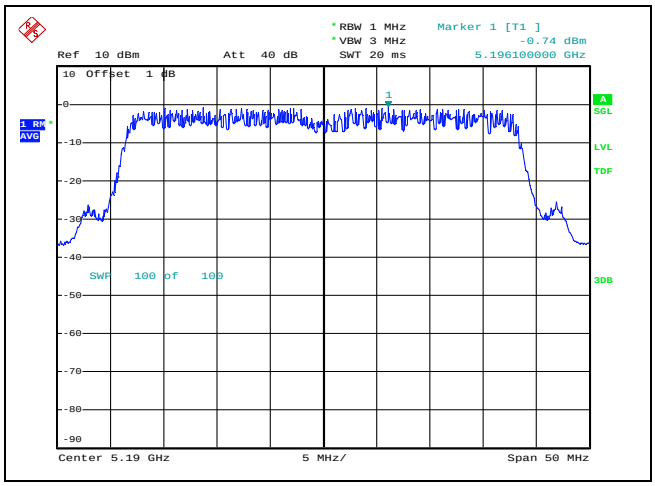
5.4.4 Test Plot

Figure 2. Plot of the Power Spectral Density

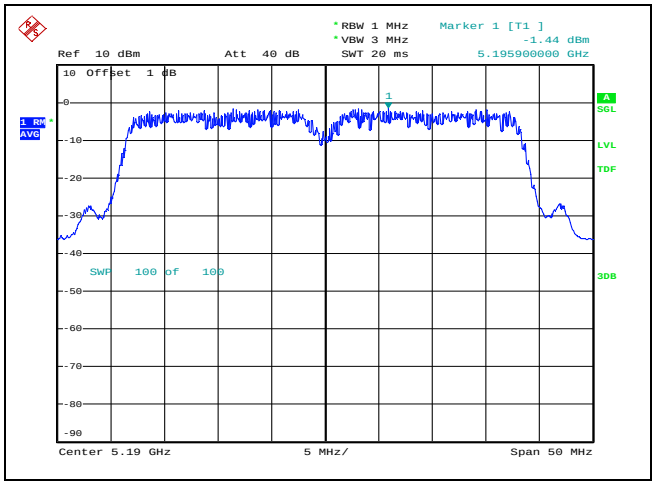
* 802.11n_HT40_Band 1

-5 190 ㎒

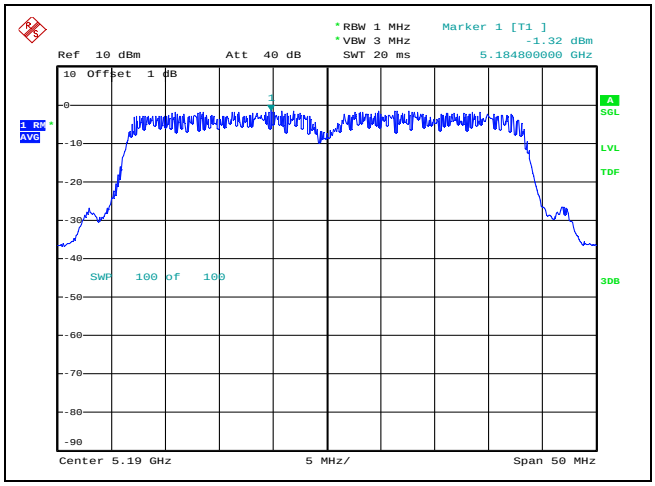
ANT 1



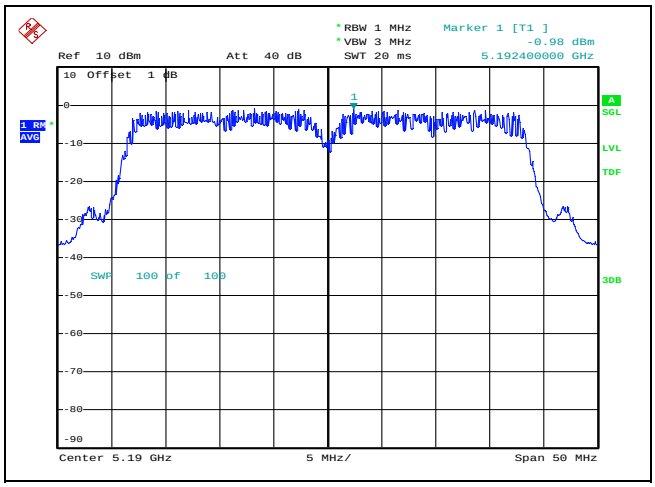
ANT 2



ANT 3

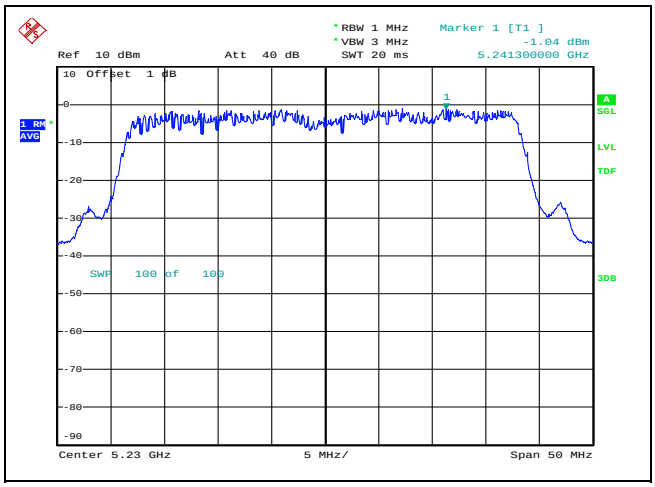


ANT 4

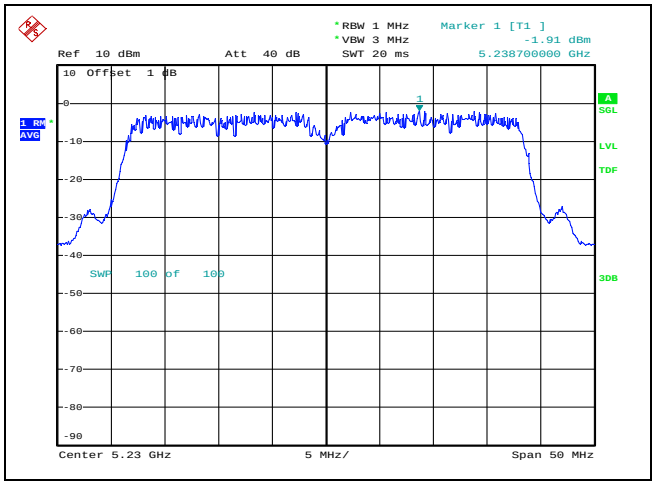


-5 230 ㎒

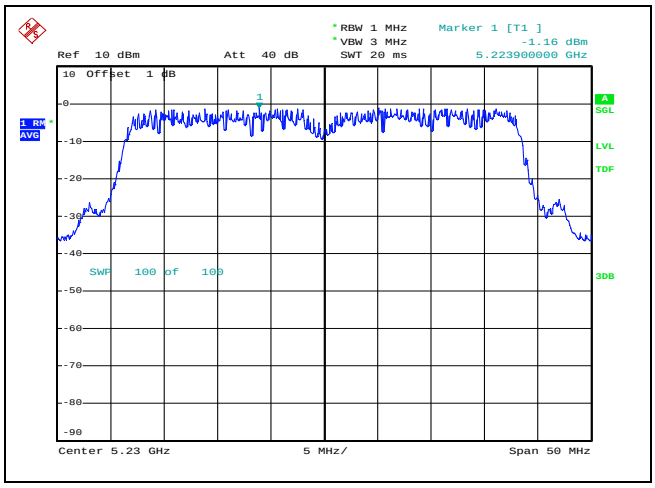
ANT 1



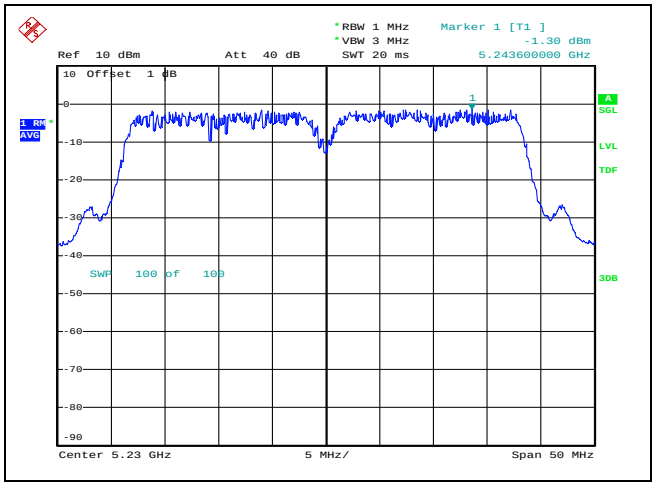
ANT2



ANT 3



ANT 4



5.5 Spurious Emission, Band Edge And Restricted Bands

5.5.1 Regulation

According to §15.407(b)(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 EIRP of -27 dBm/㎒.

According to §15.407(b) (2) For transmitters operating in the 5.25-5.35 ㎓band: All emissions outside of the 5.15-5.35 ㎓band shall not exceed an e.i.r.p. of −27 dBm/㎒.

According to §15.407(b) For transmitters operating in the 5.47-5.725 ㎓band: All emissions outside of the 5.47-5.725 ㎓band shall not exceed an e.i.r.p. of −27 dBm/㎒.

According to §15.407(b) (4) For transmitters operating in the 5.725-5.85 ㎓ band: All emissions within the frequency range from the band edge to 10 ㎒ above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/㎒; for frequencies 10 ㎒ or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/㎒.

According to §15.407(b)(6) Unwanted emissions below 1 ㎓ must comply with the general field strength limits set forth in §15.209.

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

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

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 ㎒ are based on the average value of measured emissions.

According to §15.407(b)(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 block edges as the design of the equipment permits.

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

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

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

5.5.2 Measurement Procedure

These test measurement settings are specified in section G of 789033 D02 General UNII Test Procedures New Rules v01.
For all radiated emissions tests, measurements must correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

5.5.2.1 Unwanted Emissions in the Restricted Bands & Outside of the Restricted Bands

(1) For all measurements, follow the requirements in section II.G.3.,
"General Requirements for Unwanted Emissions Measurements".
(2) At frequencies below 1000 ㎒, use the procedure described in section II.G.4.,
"Procedure for Unwanted Emissions Measurements Below 1000 ㎒".
(3) At frequencies above 1000 ㎒, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

(4) Unwanted Emissions that fall Outside of the Restricted Bands
As specified in § 15.407(b), emissions above 1000 ㎒ that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/㎒ (or -17 dBm/㎒ as specified in § 15.407(b)(4)).
However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/㎒ or -17 dBm/㎒ maximum emission limit.

a) If radiated measurements are performed, field strength is then converted to EIRP as follows:
(i) EIRP = ((E*d)^2) / 30
where: • E is the field strength in V/m; • d is the measurement distance in meters;
• EIRP is the equivalent isotropically radiated power in watts.
(ii) Working in dB units, the above equation is equivalent to:
EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
(iii) Or, if d is 3 meters:
EIRP[dBm] = E[dBμV/m] - 95.2

5.5.2.2 Spurious Radiated Emissions:

1. The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 ㎑ to 30 ㎒ using the loop antenna, and from 30 to 1000 ㎒ using the TRILOG broadband antenna, and from 1 000 ㎒ to 40 000 ㎒ using the horn antenna.
4. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
5. The 0.8m height is measurement for below 1 ㎓ and 1.5m is for above 1 ㎓ measurement.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.

5.5.3 Test Result

-complied

1. Band-edge & Conducted Spurious Emissions was shown in figure 3.
   Note: We took the insertion loss of the cable into consideration within the measuring instrument.
2. Measured value of the Field strength of spurious Emissions (Radiated)
3. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

*** Below 1 ㎓ data (Worst-case: 5 190 Band)**

802.11n HT40_Lowest Channel

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒ (3m Distance)							
-	**Not Detected**	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 ㎓							
90.50	120	H	44.80	-18.10	26.70	43.50	16.80
292.99	120	V	48.10	-10.90	37.20	46.00	8.80
Above 300.00	**Not Detected**	-	-	-	-	-	-

*** Above 1 ㎓ data**

802.11n_HT40 (5 190 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
※ 5 149.98	1 000	V	71.90	-2.40	69.50	74.00	4.50
10 388.44	1 000	V	43.50	4.20	47.70	88.20	40.50
Above 11 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
※ 5 149.98	1 000	V	53.90	-2.40	51.50	54.00	2.50
10 388.44	1 000	V	30.90	4.20	35.10	68.20	33.10
Above 11 000.00	Not Detected	-	-	-	-	-	-

※ This sign means restricted band.

802.11n_HT40 (5 230 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
1 024.98	1 000	V	66.00	-16.30	49.70	88.20	38.50
# 5 374.33	1 000	V	55.30	-2.50	52.80	88.20	35.40
6 972.94	1 000	V	46.40	-0.10	46.30	88.20	41.90
10 467.02	1 000	V	43.20	4.10	47.30	88.20	40.90
Above 11 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
1 024.98	1 000	V	52.70	-16.30	36.40	68.20	31.80
# 5 374.33	1 000	V	41.30	-2.50	38.80	68.20	29.40
6 972.94	1 000	V	31.80	-0.10	31.70	68.20	36.50
10 467.02	1 000	V	33.90	4.10	38.00	68.20	30.20
Above 11 000.00	Not Detected	-	-	-	-	-	-

This hash means Band Edge.

5.6 Frequency Stability

5.6.1 Regulation

According to §15.407 (g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

5.6.2 Measurement Procedure

The frequency stability of the carrier frequency of the intentional radiator shall be maintained all conditions of normal operation as specified in the users manual. The frequency stability shall be maintained over a temperature variation of specified in the users manual at normal supply voltage, and over a variation in the primary supply voltage of specified in the users manual of the rated supply voltage at a temperature of 20 °C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

1. The EUT was placed inside the environmental test chamber.
2. The temperature was incremented by 10 °C intervals from lowest temperature.
3. Each increase step of temperature measured the frequency.
4. The test temperature was set 20°C and the supply voltage was then adjusted on the EUT from 85 % to 115% and the frequency record.

5.6.3 Test Result

-Complied

-5 190 ㎒

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [㎐]	Frequency Error [㎐]	Frequency Error [%]
100	120	-20	5 190 018 918	18 918	0.000 4
		-10	5 190 020 077	20 077	0.000 4
		0	5 190 015 254	15 254	0.000 3
		10	5 190 003 887	3 887	0.000 1
		20	5 189 994 367	-5 633	-0.000 1
		30	5 189 977 048	-22 952	-0.000 4
		40	5 189 969 401	-30 599	-0.000 6
		50	5 189 963 261	-36 739	-0.000 7
85	102	20	5 189 994 342	-5 658	-0.000 1
115	138	20	5 189 994 321	-5 679	-0.000 1

-5 230 ㎒

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [㎐]	Frequency Error [㎐]	Frequency Error [%]
100	120	-20	5 230 018 720	18 720	0.000 4
		-10	5 230 020 158	20 158	0.000 4
		0	5 230 017 032	17 032	0.000 3
		10	5 230 003 907	3 907	0.000 1
		20	5 229 990 333	-9 667	-0.000 2
		30	5 229 980 570	-19 430	-0.000 4
		40	5 229 966 408	-33 592	-0.000 6
		50	5 229 963 061	-36 939	-0.000 7
85	102	20	5 229 990 310	-9 690	-0.000 2
115	138	20	5 229 990 299	-9 701	-0.000 2

5.7 Conducted Emission

5.7.1 Regulation

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 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (㎒)	Conducted limit (dB㎶)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.7.2 Measurement Procedure

1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ away from the vertical wall and 1.5m away from the side wall of the shielded room.

2) Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.

3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.

4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.

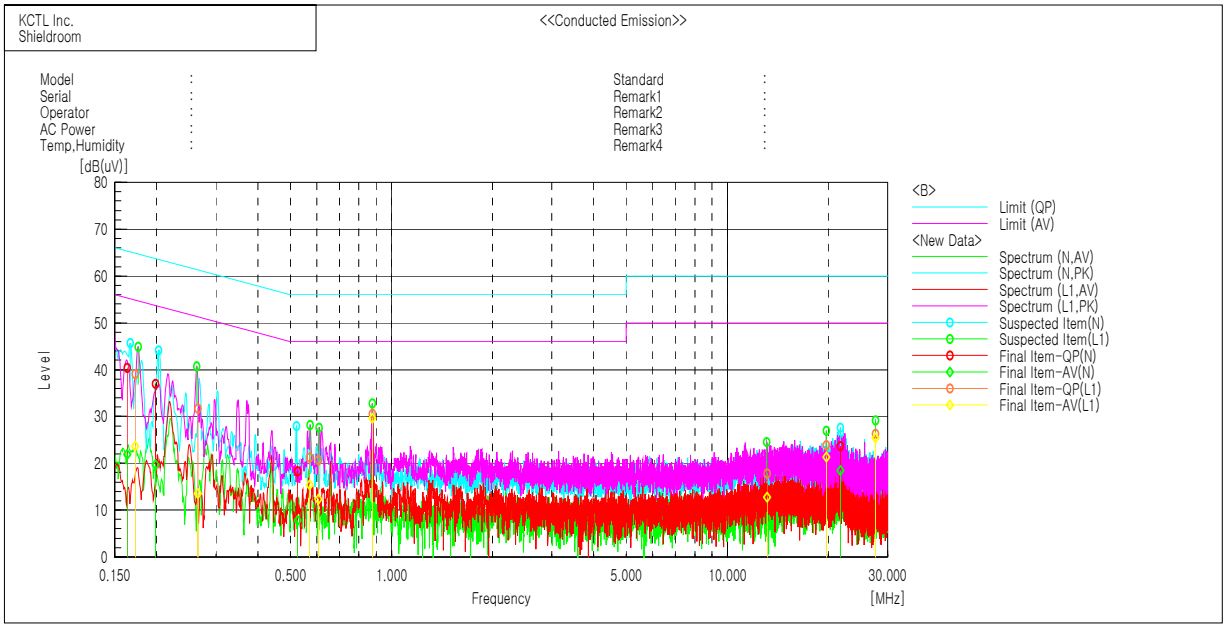
5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 ㎑ or to QUASI-PEAK and AVERAGE within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

5.7.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

*Conducted worst-case data : 802.11n_HT40_5 190 ㎒



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.16349	30.7	12.2	9.7	40.4	21.9	65.3	55.3	24.9	33.4
2	0.19862	27.1	9.8	9.9	37.0	19.7	63.7	53.7	26.7	34.0
3	21.71354	13.7	8.6	9.9	23.6	18.5	60.0	50.0	36.4	31.5
4	0.52484	8.4	-2.1	9.9	18.3	7.8	56.0	46.0	37.7	38.2

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.2649	22.1	3.9	9.6	31.7	13.5	61.3	51.3	29.6	37.8
2	0.17244	29.3	13.9	9.8	39.1	23.7	64.8	54.8	25.7	31.1
3	0.87672	20.7	19.8	9.8	30.5	29.6	56.0	46.0	25.5	16.4
4	0.57036	11.4	5.5	9.9	21.3	15.4	56.0	46.0	34.7	30.6
5	0.60628	10.8	2.4	9.9	20.7	12.3	56.0	46.0	35.3	33.7
6	27.58878	16.5	15.7	9.8	26.3	25.5	60.0	50.0	33.7	24.5
7	13.11621	8.0	3.0	9.8	17.8	12.8	60.0	50.0	42.2	37.2
8	19.70318	14.1	11.6	9.8	23.9	21.4	60.0	50.0	36.1	28.6

6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	SPECTRUM ANALYZER	R & S	FSV30	100808	16.09.02
■	AC POWER SUPPLY	KIKUSUI	PCR2000W	GB001619	16.10.12
■	TEMP & HUMID CHAMBER	Myeongseong R&P	CTHC-51P-DT	20150824-2	16.10.02
■	VECTOR SIGNAL GENERATOR	R & S	SMBV100A	257566	17.01.07
■	SIGNAL GENERATOR	R & S	SMR40	100007	16.06.15
■	Test Receiver	ESCI	100710	R&S	16.09.01
■	TWO-LINE V-NETWORK	ENV216	101352	R&S	16.09.02
■	Test Receiver	R & S	ESCI	101428	16.09.02
■	Bi-Log Ant.	TESEQ	CBL 6112D	37876	16.08.28
■	LOOP Antenna	R & S	HFH2-Z2	100355	18.03.03
■	AMPLIFIER	SONOMA INSTRUMENT	310N	293004	16.09.02
■	Coaxial Fixed Attenuator	HP	8491A	16861	16.06.29
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	HORN ANTENNA	ETS-LINDGREN	3117-PA	OO161083	16.11.12
■	SPECTRUM ANALYZER	R & S	FSP40	100209	16.11.12