FCC TEST REPORT

Test report No.:	EMC- FCC- R0184
FCC ID:	PPNHDWX-100-R
Type of equipment:	Wireless HDMI Extender
Model Name:	HDWX-100-R
Applicant:	OPTICIS Co., Ltd.
Max.RF Output Power:	15.65 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.407
Frequency Range:	5 150 MHz ~ 5 250 MHz 5 725 MHz ~ 5 825 MHz
Test result:	Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of receipt: 2014. 07. 15

Date of test: 2014. 09. 29 ~ 10.07

Issued date: 2014. 10.21

Tested by: KIM, SUNG SIN

Approved by: YU, SANG HOON

[Contents]

1. Client information

Applicant:	OPTICIS Co., Ltd.
Address:	501 Byoksan Technopia, 560, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-716 Rep. of KOREA
Telephone number:	+ 82-31-737-8033
Facsimile number :	+ 82-31-737-8039
Contact person:	Keum-Hee Lee / khlee@opticis.com

Manufacturer :	OPTICIS Co., Ltd.
Address:	501 Byoksan Technopia, 560, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-716 Rep. of KOREA

2. Laboratory information

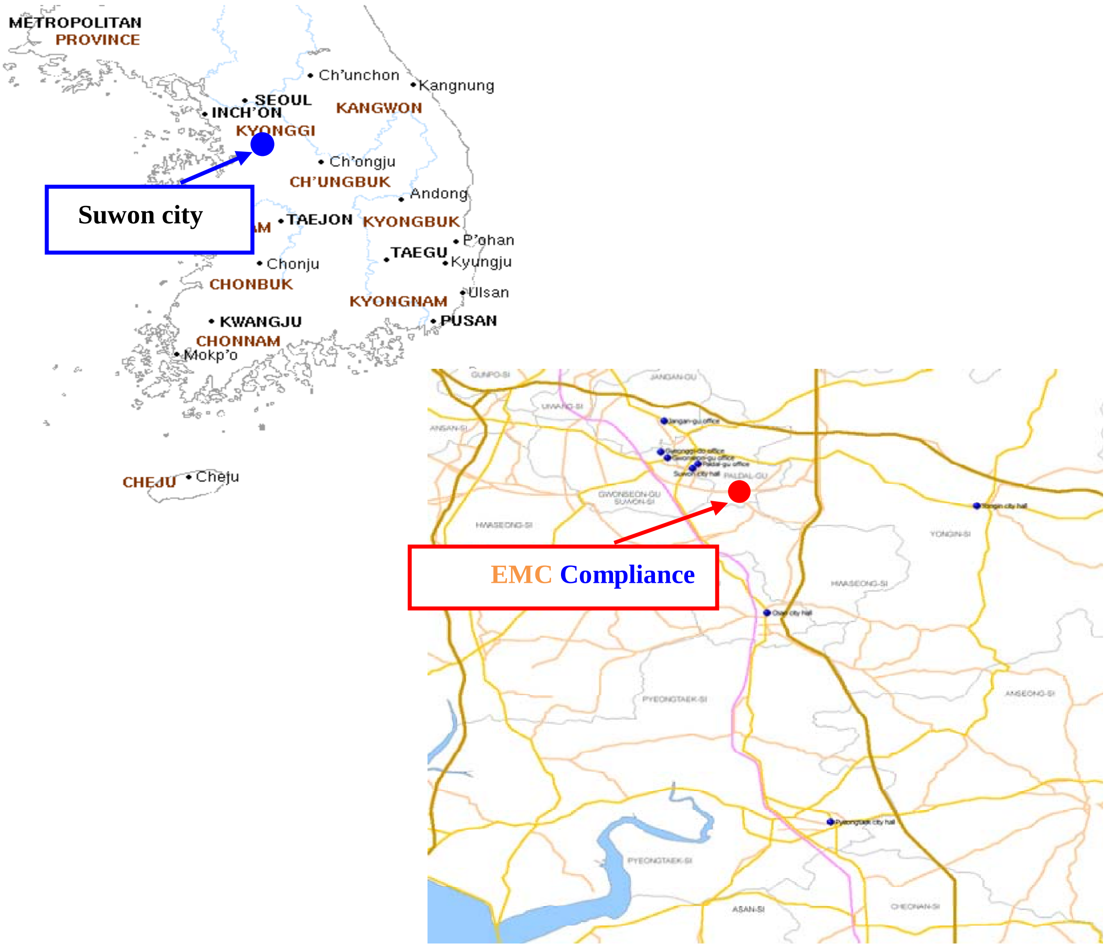
Address

EMC compliance Ltd.
480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
Telephone Number: 82-070-5008-1021   Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231
FCC Site Registration No.: KR0040
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 :	OPTICIS Co., Ltd.
Address of Applicant:	501 Byoksan Technopia, 560, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-716 Rep. of KOREA
Manufacturer:	OPTICIS Co., Ltd.
Address of Manufacturer:	501 Byoksan Technopia, 560, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-716 Rep. of KOREA
Type of equipment:	Wireless HDMI Extender
Basic Model:	HDWX-100-R
Serial number:	Proto Type

3.2 General description

Communication	802.11n HT40
Frequency Range	5 190 ~ 5 230 ㎒ 5 755 ~ 5 795 ㎒
Type of Modulation (Technologies)	64QAM, 16QAM, QPSK, BPSK(OFDM)
Channel capacity	5 230 ㎒: 1 ch(802.11n_HT40) 5 755 ~ 5 795 ㎒: 2 ch(802.11n_HT40)
Antenna Gain	5 190 ~ 5 230 ㎒: 6.0 dBi 5 755 ~ 5 795 ㎒: 8.0 dBi
Type of Antenna	PCB Antenna
Firmware version	H/W : HDWX-100R Rev2.1 S/W : HDWX_100_US_U304_V20_20141010
Power supply	DC 5 V
Operating temperature	0 ~ 50 °C

3.3 Test frequency

For all teset items, the low, middle and high channels of the modes were tested with above worst case data rate.

5 150~5 250 (㎒) : 802.11n HT40

	CH	Frequency
Band Width	40 ㎒	
Low frequency	-	-
Middle frequency	-	-
High frequency	46	5 230 ㎒

5 755 ~ 5 795 (㎒) : 802.11n HT40

	CH	Frequency
Band Width	40 ㎒	
Low frequency	151	5 755 ㎒
Middle frequency	-	-
High frequency	159	5 795 ㎒

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 12 V

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4. Summary of test results

4.1 Standards & results

FCC Rule	IC Rule (RSS-GEN)	Parameter	Report Section	Test Result
15.203 15.407(a)(1)(2)(3)	N/A	Antenna Requirement	5.1	C
15.403(i),15.407(e)	4.6	Bandwidth Measurement	5.2	C
15.407(a)(1)(2)	4.8	Maximum Conducted Output Power	5.3	C
15.407(a)(1)(2)(5)	N/A	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)	4.9	Spurious Emission, Band Edge and Restricted bands	5.6	C
15.407(g)	4.7	Frequency Stability	5.7	C
15.207(a)	N/A	Conducted Emissions	5.8	C
15.407(h)	N/A	Dynamic Freqyency Selection	5.9	N/A
15.407(f), 1.1307(b)(1)	N/A	RF Exposure	5.10	C
N/A	4.10	Receiver Spurious Emission (Radiated)	5.11	C

Note: C = complies
NC = Not complies
NT = Not tested
NA = Not Applicable

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = KUc (K = 2)	
Conducted RF power	± 1.30 dB	
Occupied Channel Bandwidth	± 3.04 kHz	
Radiated Spurious emissions	30 MHz ~ 180 MHz	± 3.16 dB
	180 MHz ~ 4 GHz	± 3.05 dB
	4 GHz ~ 40 GHz	± 3.12 dB

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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.
The total directional peak gain of the antenna exceeds 6.0 dBi

	5 230 MHz	5 755 ~ 5 795 MHz
ANT Gain	6.0 dBi	8.0 dBi

According to KDB 662911 D01 Multiple Transmitter Output v02r01

- Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

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

Array Gain = 10 log(N_{ANT}/Nss) dB.

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \le 2$;

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

Array Gain = 5 log(N_{ANT}/Nss) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \ge 5$.

For power measurements on all other devices:

Array Gain = 10 log(N_{ANT}/Nss) dB.

Total gain = 8.0 dBi (individual gain(8.0 dBi) + Array gain(0 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.

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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 ㏈i. In addition, the maximum power spectral density shall not exceed 17 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

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 f) of section C of 789033 D02 General UNII Test Procedures.

5.2.2.1 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 ㏈m 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 percent).

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5.2.4 Test Result

-Complied

802.11n 40 ㎒

5 230 ㎒

Average Power (dBm)		C.L (dB)	Duty Factor	Result	Limit (dBm)	Margin (dBm)
Ant1	Ant2					
10.90	10.00	1.00	1.18	15.65	30.00	11.82

5 755 ㎒

Average Power (dBm)		C.L (dB)	Duty Factor	Result	Limit (dBm)	Margin (dBm)
Ant1	Ant2					
10.40	10.30	1.00	1.16	15.52	28.00	9.95

5 795 ㎒

Average Power (dBm)		C.L (dB)	Duty Factor	Result	Limit (dBm)	Margin (dBm)
Ant1	Ant2					
10.00	10.30	1.00	1.16	15.33	28.00	10.15

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer exceeds 6.0 dBi, there is needed to reduce the output power.(This device is NANT = 2, Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 2)
   5 755 ㎒ : 30 dBm – 2 dB (8 dBi (directional gain) – 6 dBi) = 28 dBm
   5 795 ㎒ : 30 dBm – 2 dB (8 dBi (directional gain) – 6 dBi) = 28 dBm
2. Total power calculation = 10 log(10^(Ant1 power/10) + 10^(Ant2 power/10)).
3. 5 230 ㎒ : Duty cycle = 0.7617, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.7617) = 1.18 dB.
   5 755 ㎒ : Duty cycle = 0.7649, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.7649) = 1.16 dB.
   5 795 ㎒ : Duty cycle = 0.7649, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.7649) = 1.16 dB.
4. Result = Ant1 power + Ant2 power + C.L + Duty Factor

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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 theemission. 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.

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5.3.3 Test Result

-Complied

Frequency	26 dB Bandwidth		OBW	
	ANT 1	ANT 2	ANT 1	ANT 2
5 230	39.83	40.41	36.47	36.70

Frequency	6 dB Bandwidth		OBW	
	ANT 1	ANT 2	ANT 1	ANT 2
5 755	36.45	36.44	36.24	36.34
5 795	36.44	36.44	36.24	37.28

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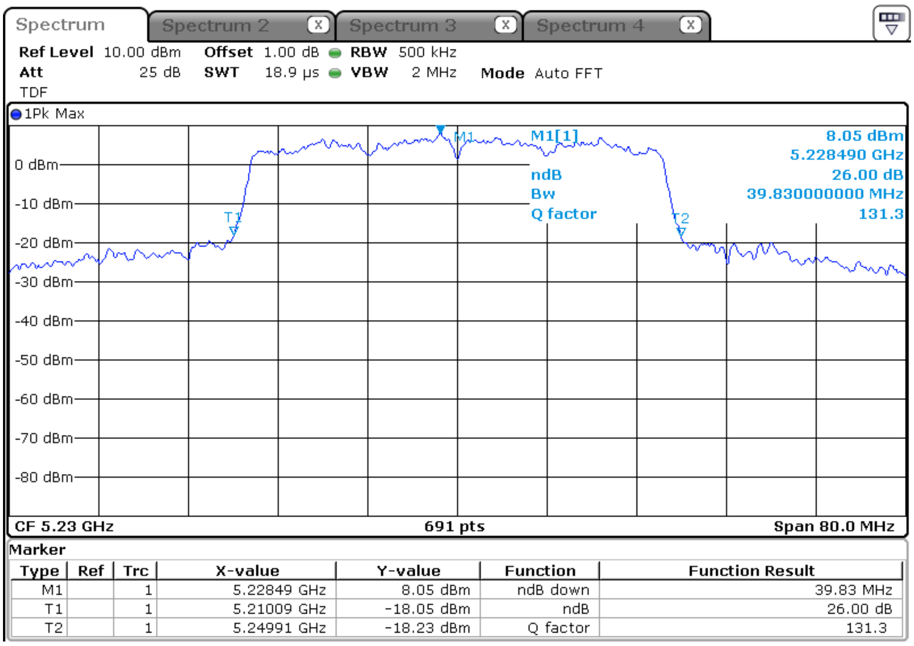
5.3.4 Test Plot

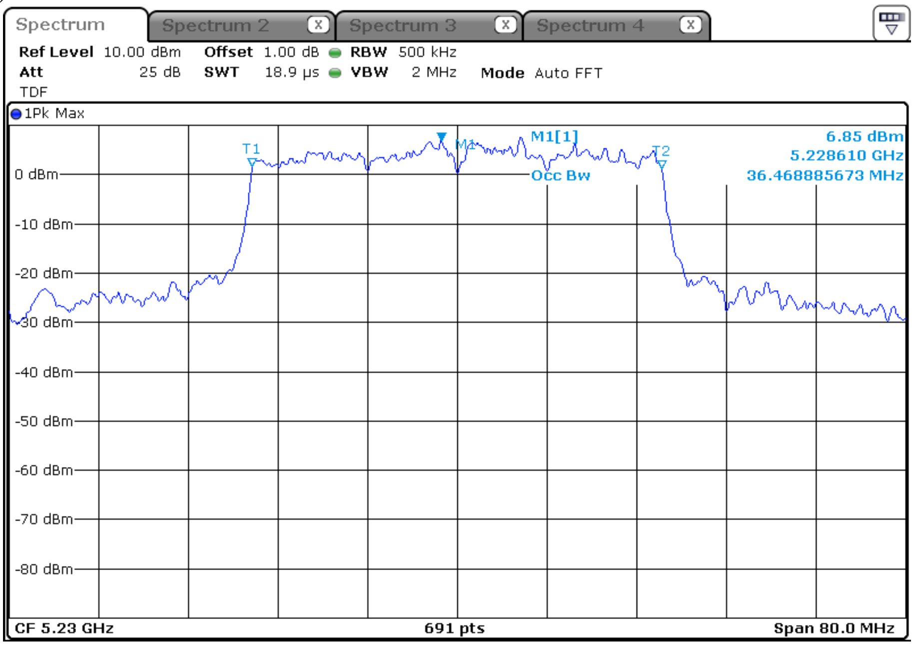
Figure 1. Bandwidth Measurement

-5 230 ㎒

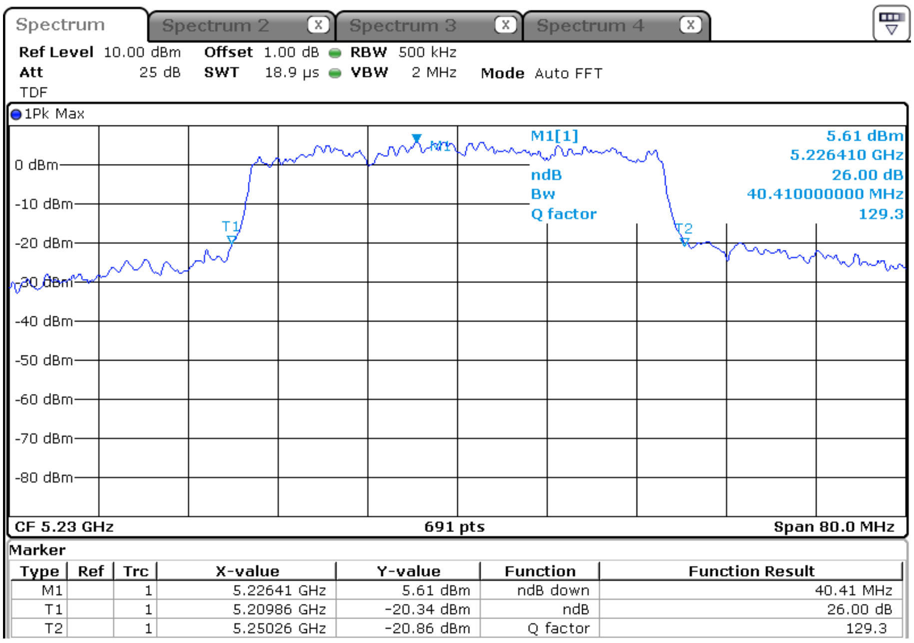
ANT 1(EBW)



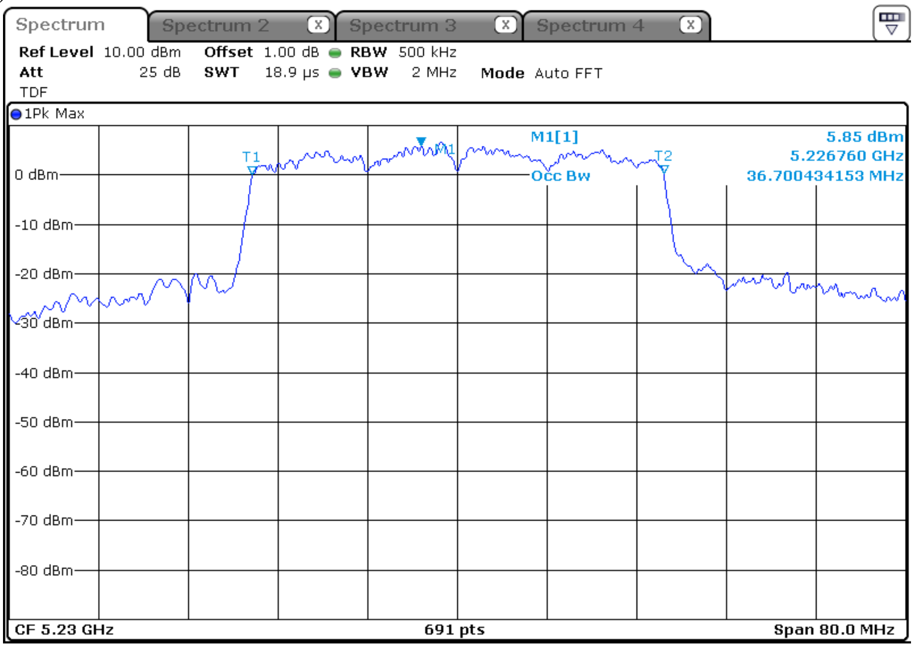
ANT 1(OBW)



ANT 2(EBW)

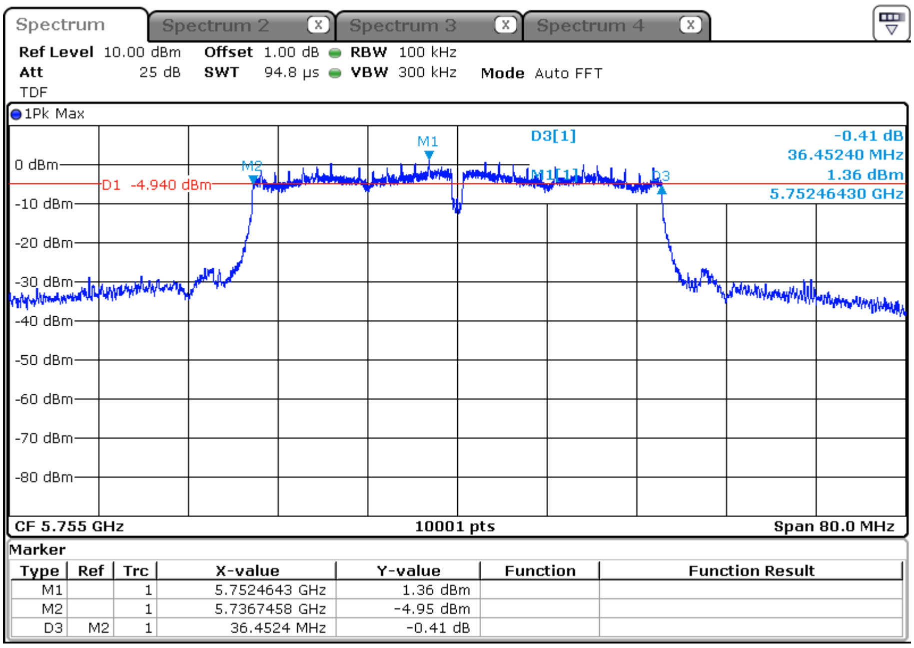


ANT 2(OBW)

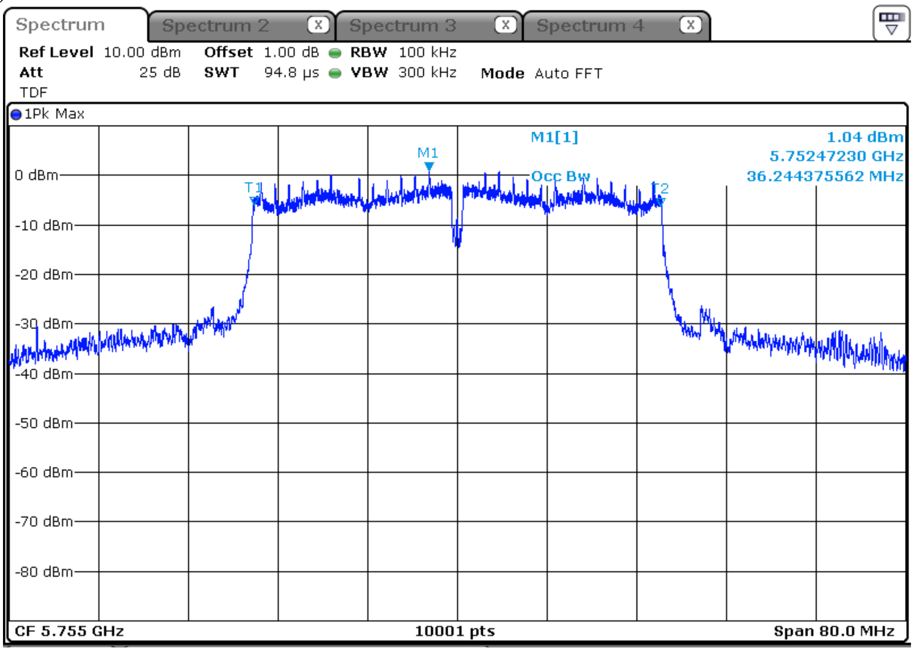


-5 755 ㎒

ANT 1(EBW)



ANT 1(OBW)



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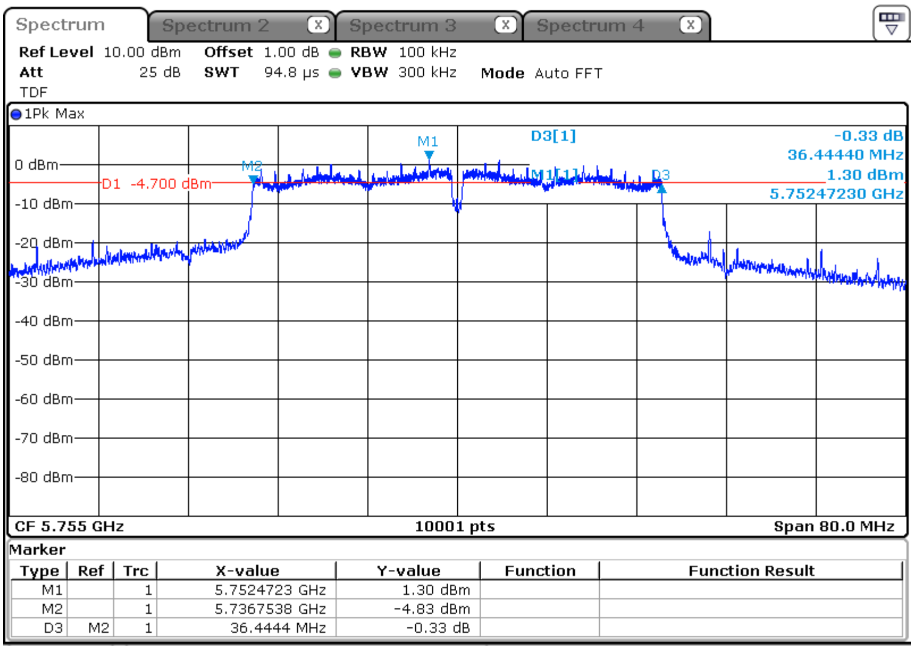
ANT 2(EBW)



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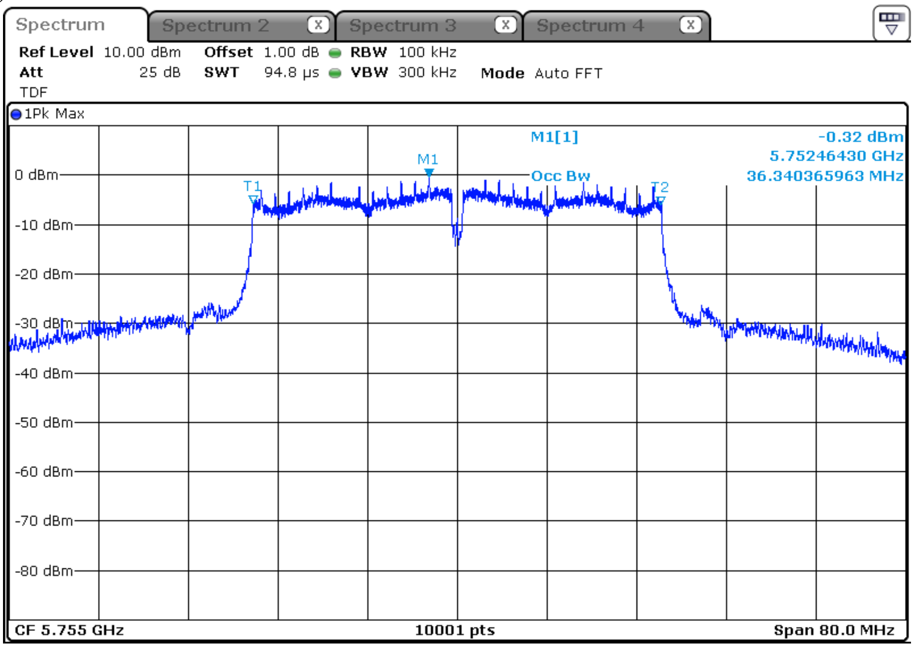

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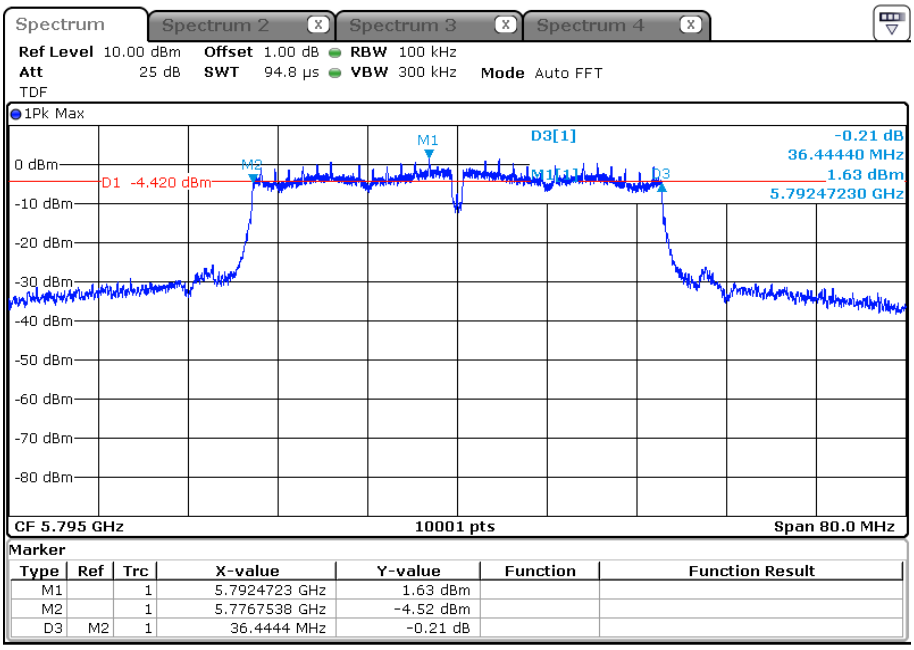
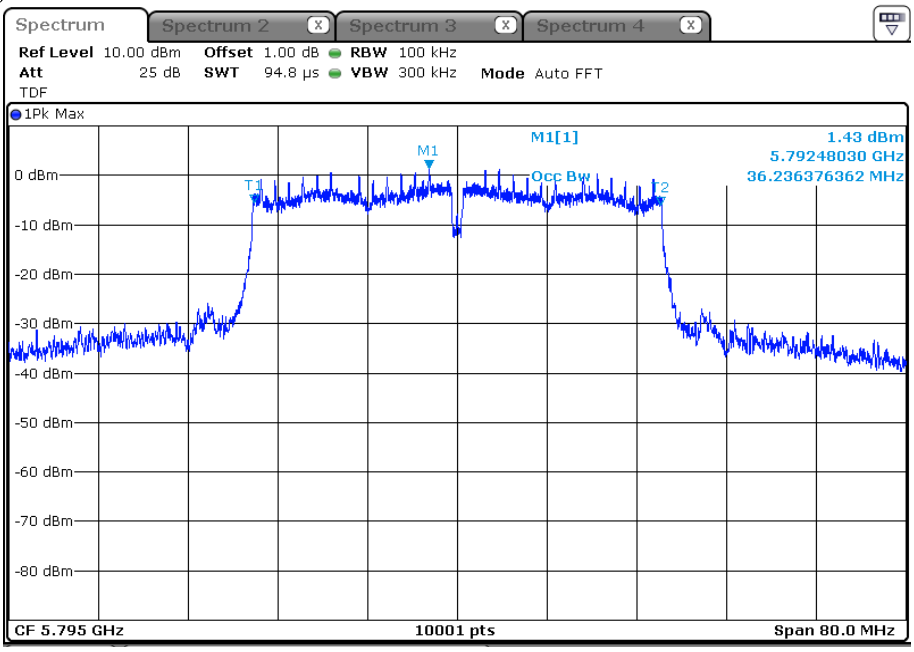
-5 795 ㎒

ANT 1(EBW)



Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.7924723 GHz	1.63 dBm		
M2		1	5.7767538 GHz	-4.52 dBm		
D3	M2	1	36.4444 MHz	-0.21 dB		

ANT 1(OBW)



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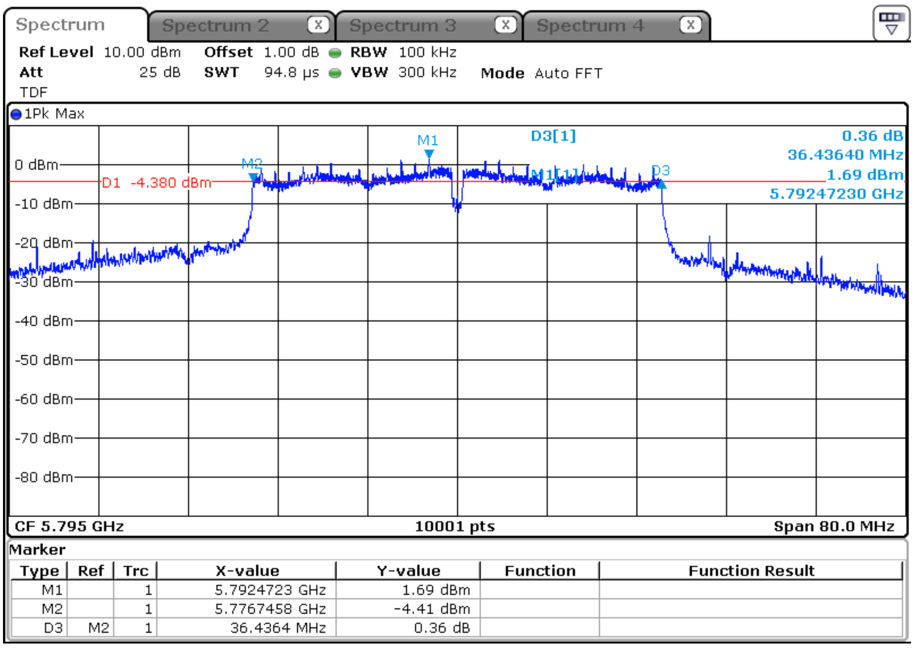
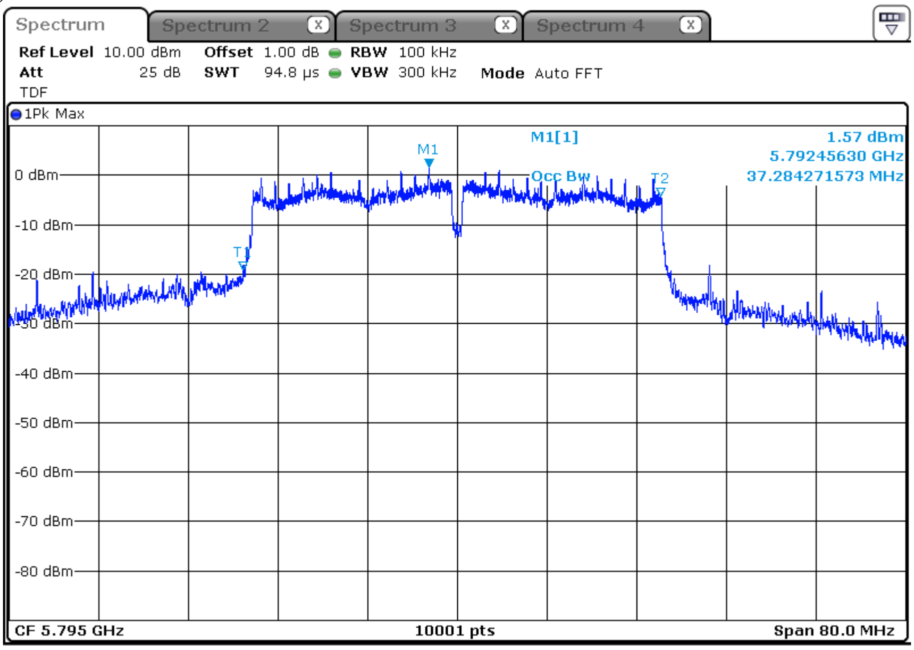
ANT 2(EBW)



ANT 2(OBW)



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5.4 Peak Power Spectral Density

5.4.1 Regulation

According to §15.407 (a)(1)(ii) the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.
According to §15.407(a)(3) the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.4.2 Measurement Procedure

These test measurement settings are specified in section E 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 dB to the final result to compensate for the difference between linear averaging and power averaging.

4. The result is the Maximum PSD over 1 MHz reference bandwidth.

5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "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 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply: a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).

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b) Set VBW ≥ 3 RBW.
c) 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.
d) 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.
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.

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.

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5.4.3 Test Result

-Complied

802.11n 40 ㎒

5 230 ㎒

Frequency (㎒)	Reading (dBm)		C.L (dB)	Duty Cycle (dB)	Total result (dBm)	Limit (dBm)	Margin (dB)
	Ant1	Ant2					
5 230	-0.63	-1.68	1.00	1.18	4.05	14.00	10.42

5 755 ㎒

Frequency (㎒)	Reading (dBm)		C.L (dB)	Duty Cycle (dB)	Total result (dBm)	Limit (dBm)	Margin (dB)
	Ant1	Ant2					
5 755	-3.94	-3.88	1.00	1.16	1.26	25.00	24.21

5 795 ㎒

Frequency (㎒)	Reading (dBm)		C.L (dB)	Duty Cycle (dB)	Total result (dBm)	Limit (dBm)	Margin (dB)
	Ant1	Ant2					
5 795	-3.26	-3.87	1.00	1.16	1.61	25.00	23.86

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer exceeds 6.0 dBi, there is needed to reduce the output power.(This device is NANT = 2, Array Gain = 3.0 dB (i.e., no array gain) for NANT ≤ 2)
   For 5.2㎓ band , PSD limit is 17-3= 14dBm/㎒ (individual gain is 6dBi , array gain is 3dBi)
   For 5.8㎓ Band , PSD limit is 30-2-3= 25dBm/500㎑ (individual gain is 8dBi , array gain is 3dBi)
2. Total PPSD calculation = 10log(10^(Ant1 PSD / 10) + 10^(Ant2 PSD / 10))
3. 5 230 ㎒ : Duty cycle = 0.7617, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.7617) = 1.18 dB.
   5 755 ㎒ : Duty cycle = 0.7649, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.7649) = 1.16 dB.
   5 795 ㎒ : Duty cycle = 0.7649, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.7649) = 1.16 dB.
4. Result = Ant1 power + Ant2 power + C.L + Duty Factor

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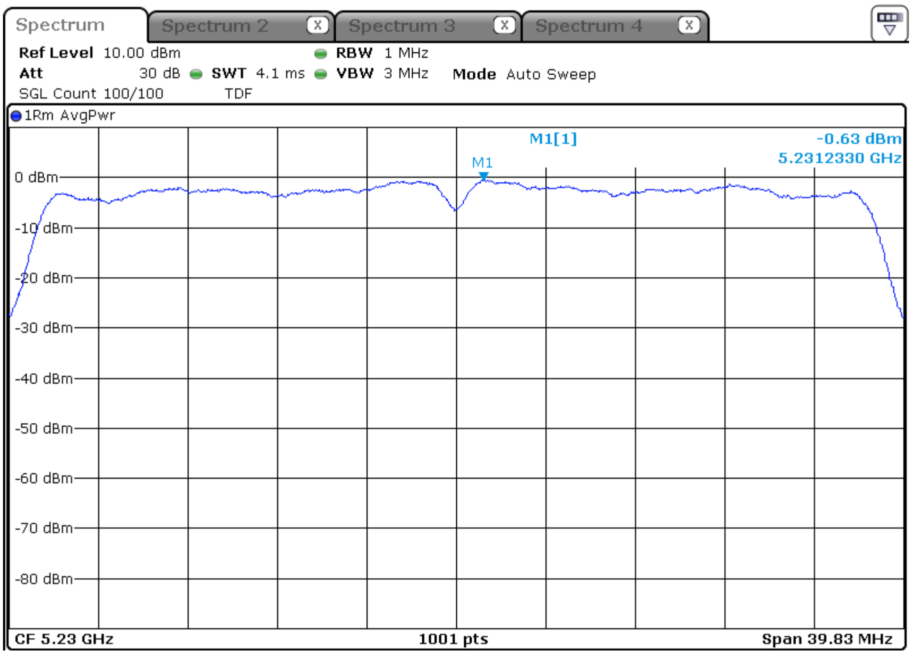
5.4.4 Test Plot

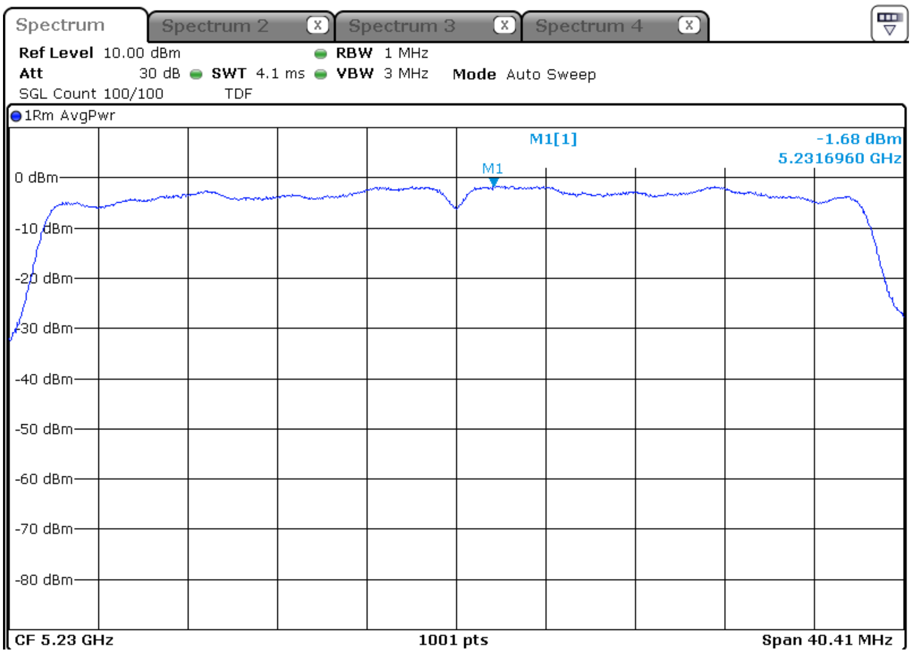
Figure 2. Plot of the Peak Power Spectral Density (Conducted)

- 5 230 ㎒

ANT 1



ANT 2



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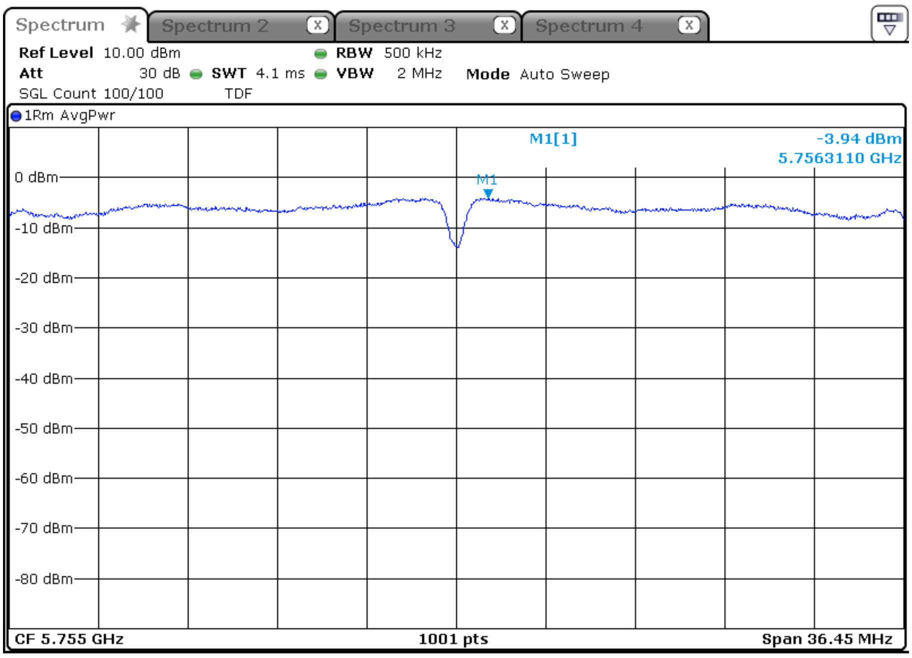
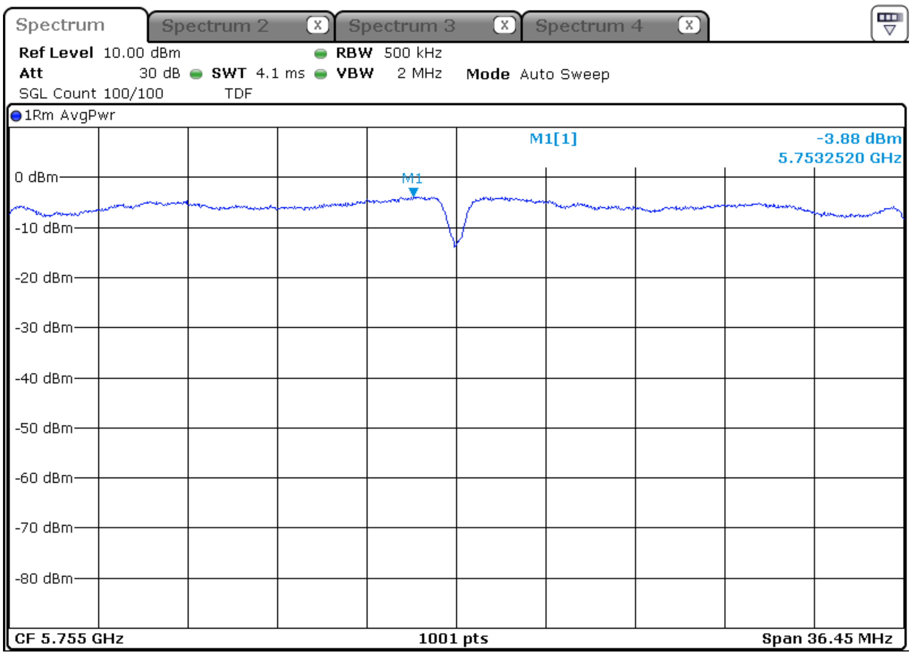
- 5 755 ㎒

ANT 1



ANT2



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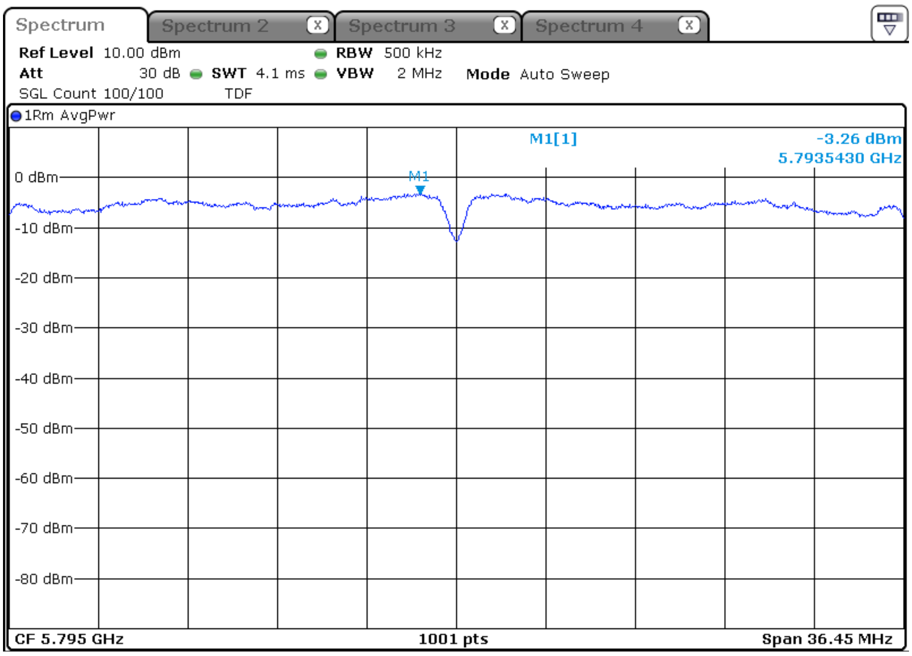
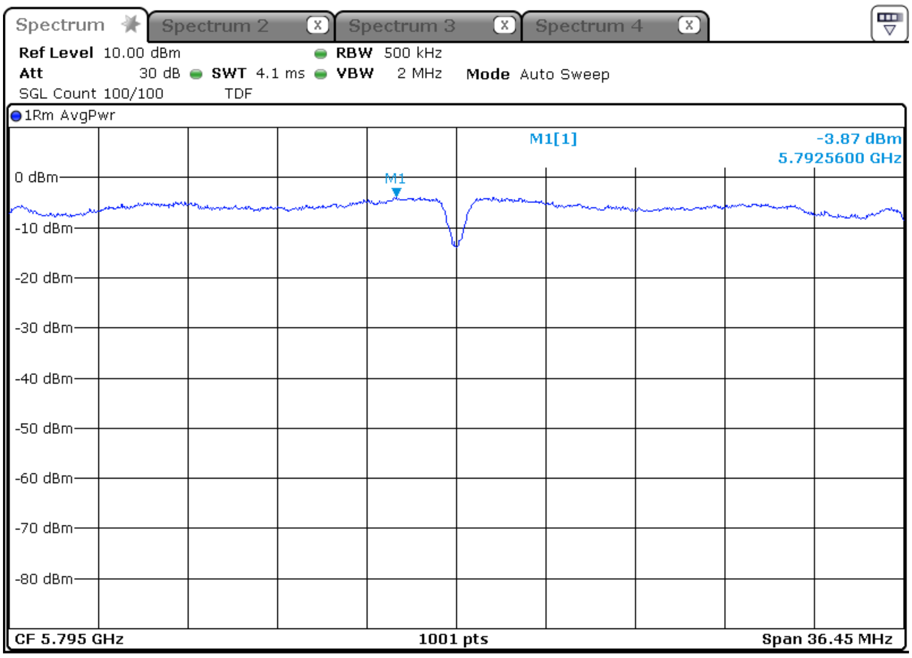
-5 795㎒

ANT 1



ANT 2



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5.6 Spurious Emission, Band Edge and Restricted Bands

5.6.1 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 ㏈m/㎒.

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	2400/F(㎑)	300
0.490 -1.705	24000/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.

5.6.2 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).

5.6.2.1 Unwanted Emissions in the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3., “General Requirements for Unwanted Emissions Measurements”.
b) At frequencies below 1000 ㎒, use the procedure described in section II.G.4., “Procedure for Unwanted Emissions Measurements Below 1000 ㎒”.
c) At frequencies above 1000 ㎒, measurements performed using the peak and average measurement procedures d escribed 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.
d) For conducted measurements above 1000 ㎒, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KdB Publication 412172):
(i) E[dBµV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules;
(ii) E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.
e) For conducted measurements below 1000 ㎒, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 ㎒ and 1000 ㎒, or an additional 6 dB shall be added for frequencies below 30 ㎒.2

(2) Unwanted Emissions that fall Outside of the Restricted Bands
a) For all measurements, follow the requirements in section II.G.3., “General Requirements for Unwanted Emissions Measurements”.
b) At frequencies below 1000 ㎒, use the procedure described in section II.G.4., “Procedure for Unwanted Emissions Measurements Below 1000 ㎒”.
c) At frequencies above 1000 ㎒, use the procedure for maximum emissions described in section II.G.5., “Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 ㎒”.
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.
d) 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

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(3) General Requirements for Unwanted Emissions Measurements
The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:
a) EUT Duty Cycle
(i) The EUT shall be configured or modified to transmit continuously except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.
(ii) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:
• The EUT shall be configured to operate at the maximum achievable duty cycle.
• Measure the duty cycle, x, of the transmitter output signal as described in section II.B.
• Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
• The test report shall include the following additional information:
◦ The reason for the duty cycle limitation.
◦ The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
◦ The sweep time and the amount of time used for trace stabilization during max-hold measurements for maximum e) mission measurements.
(iii) Reduction of the measured emission amplitude levels to account for operational duty cycle is not permitted. Compliance is based on emission levels occurring during transmission – not on an average across on and off times of the transmitter.
b) Radiated versus Conducted Measurements.
The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:
(i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.
(ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.
(iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in ㏈i) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 ㏈i, whichever is greater.3 However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20 percent of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 ㏈i be selected.
(iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:
• Compute EIRP for each output, as described in (iii), above.
• Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by 10 log(NANT), where NANT is the number of outputs.
• Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.4

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c) Direction of maximum emission.
For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

d) Band edge measurements.
Unwanted band-edge emissions may be measured using either of the special band-edge measurement techniques (the marker-delta or integration methods) described below. Note that the marker-delta method is primarily a radiated measurement technique that requires the 99% occupied bandwidth edge to be within 2 ㎒ of the authorized band edge, whereas the integration method can be used in either a radiated or conducted measurement without any special requirement with regards to the displacement of the unwanted emission(s) relative to the authorized bandwidth.

(i) Marker-Delta Method.
The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 ㎒ of the authorized band-edge..

(ii) Integration Method
• For maximum emissions measurements, follow the procedures described in section II.G.5., "Procedures for Unwanted Maximum Emissions Measurements above 1000 ㎒", except for the following changes:
◦ Set RBW = 100 ㎑
◦ Set VBW ≥ 3 · RBW
◦ Perform a band-power integration across the 1 ㎒ bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.
• For average emissions measurements, follow the procedures described in section II.G.6., "Procedures for Average Unwanted Emissions Measurements above 1000 ㎒", except for the following changes:
◦ Set RBW = 100 ㎑
◦ Set VBW ≥ 3 · RBW
◦ Perform a band-power integration across the 1 ㎒ bandwidth in which the band-edge emission level is to be measured.

(4) Procedure for Unwanted Emissions Measurements below 1000 ㎒
a) Follow the requirements in section II.G.3., "General Requirements for Unwanted Emissions Measurements".
b) Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

(5) Procedure for Unwanted Maximum Emissions Measurements above 1000 ㎒
a) Follow the requirements in section II.G.3., "General Requirements for Unwanted Emissions Measurements".
b) Maximum emission levels are measured by setting the analyzer as follows:
(i) RBW = 1 ㎒.
(ii) VBW ≥ 3 ㎒.
(iii) Detector = Peak.
(iv) Sweep time = auto.
(v) Trace mode = max hold.
(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

(6) Procedures for Average Unwanted Emissions Measurements above 1000 ㎒
a) Follow the requirements in section II.G.3., "General Requirements for Unwanted Emissions Measurements".
b) Average emission levels shall be measured using one of the following two methods.
c) Method AD (Average Detection): Primary method

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(i) RBW = 1 ㎒.
(ii) VBW ≥ 3 ㎒.
(iii) 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 the condition is not satisfied, the detector mode shall be set to peak.
(iv) Averaging type = power (i.e., RMS)
As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
(v) Sweep time = auto.
(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 100 traces shall be averaged.)
(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, 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:
• If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 3 ㏈ must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 ㏈ must be added to the measured emission levels.
• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

d) Method VB (Averaging using reduced video bandwidth): Alternative method.
(i) RBW = 1 ㎒.
(ii) Video bandwidth.
• If the EUT is configured to transmit with duty cycle ≥ 98 percent, set VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10 ㎐.
• If the EUT duty cycle is < 98 percent, set VBW ≥ 1/T, where T is defined in section II.B.1.a).
(iii) Video bandwidth mode or display mode
• The instrument shall be set to ensure that video filtering is applied in the power domain. Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).
• As an alternative, the analyzer may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or ㏈ domain). Some analyzers require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode.
(iv) Detector = Peak.
(v) Sweep time = auto.
(vi) Trace mode = max hold.
(vii) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the duty cycle. For example, use at least 200 traces if the duty cycle is 25 percent. (If a specific emission is demonstrated to be continuous—i.e., 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 50 traces shall be averaged.)

5.6.2.2 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.

- Sample calculation

The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.

The sample calculation is as follow:

Result = M.R + C.F(A.F + C.L +3 ㏈ Att – A.G)
M.R = Meter Reading
C.F = Correction Factor
A.F = Antenna Factor
C.L = Cable Loss
A.G = Amplifier Gain
3 ㏈ Att = 3 ㏈ Attenuator
If M.R is 30 ㏈, A.F 12 ㏈, C.L 5 ㏈, 3 ㏈, A.G 35 ㏈

The result is Peak and Quasi-peak: 30 + 12 + 5 + 3 – 35 = 15 ㏈(㎶/m)

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5.6.3 Test Result

-complied

Measured value of the Field strength of spurious Emissions and outside of the restricted bands (Radiated).

-The Measuring below 30 ㎒ was detected too small. (More than 20 ㏈ below the limit)

802.11n 40 ㎒ (MIMO)

-5 230㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒ (3m Distance)							
below 30 ㎒	**Not Detected**	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1㎓							
30.7	1 000	V	43.7	-17.5	26.2	40.0	13.8
52.3	1 000	V	38.1	-13.7	24.4	40.0	15.6
61.4	1 000	V	36.0	-15.2	20.8	40.0	19.2
74.3	1 000	V	44.2	-19.4	24.8	40.0	15.2
135.0	1 000	V	39.7	-18.9	20.8	43.5	22.7
222.7	1 000	H	38.9	-14.0	24.9	46.0	21.1
371.2	1 000	H	34.2	-10.2	24.0	46.0	22.0
519.7	1 000	V	36.2	-7.2	29.0	46.0	17.0
668.3	1 000	H	32.3	-4.8	27.5	46.0	18.5
816.8	1 000	H	33.0	-2.6	30.4	46.0	15.6
Peak DATA. Emissions above 1㎓							
4 973.8	1 000	H	34.3	7.1	41.4	74.0	32.6
*5 101.3	1 000	H	36.1	7.4	43.5	74.0	30.5
*5 354.1	1 000	H	40.7	8.2	48.9	74.0	25.1
Above 6 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
4 973.8	1 000	H	35.8	7.1	42.9	54.0	11.1
*5 101.3	1 000	H	36.4	7.4	43.8	54.0	10.2
*5 354.1	1 000	H	36.3	8.2	44.5	54.0	9.5
Above 6 ㎓	**Not Detected**	-	-	-	-	-	-

*Restricted Band

Note:

1. This measurement was performed the worst case data were reported.

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802.11n 40 ㎒ (MIMO)

-5 755 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒ (3m Distance)							
below 30 ㎒	**Not Detected**	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1㎓							
30.7	1 000	V	41.4	-17.5	23.9	40.0	16.1
47.2	1 000	V	35.4	-13.6	21.8	40.0	18.2
51.8	1 000	V	34.6	-13.6	21.0	40.0	19.0
74.3	1 000	V	41.8	-19.4	22.4	40.0	17.6
110.6	1 000	V	37.8	-15.8	22.0	43.5	21.5
140.5	1 000	V	37.2	-19.0	18.2	43.5	25.3
222.7	1 000	H	40.3	-14.0	26.3	46.0	19.7
371.2	1 000	H	32.7	-10.2	22.5	46.0	23.5
519.7	1 000	V	34.9	-7.2	27.7	46.0	18.3
668.3	1 000	V	32.0	-4.8	27.2	46.0	18.8
Peak DATA. Emissions above 1㎓							
*5 082.1	1 000	H	36.6	6.5	43.1	74.0	30.9
*5 434.9	1 000	V	36.5	7.1	43.6	74.0	30.4
5 568.8	1 000	H	34.0	8.9	42.9	74.0	31.1
6 117.0	1 000	H	34.3	10.9	45.2	74.0	28.8
Above 7 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
*5 082.1	1 000	H	32.6	6.5	39.1	54.0	14.9
*5 434.9	1 000	V	30.6	7.1	37.7	54.0	16.3
5 568.8	1 000	H	35.1	8.9	44.0	54.0	10.0
6 117.5	1 000	H	33.3	10.9	44.2	54.0	9.8
Above 7 ㎓	**Not Detected**	-	-	-	-	-	-

*Restricted Band

Note:
1. This measurement was performed the worst case data were reported.

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802.11n 40 ㎒ (MIMO)

- 5 795 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒ (3m Distance)							
below 30 ㎒	**Not Detected**	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1㎓							
30.7	1 000	V	41.4	-17.5	23.9	40.0	16.1
47.2	1 000	V	35.4	-13.6	21.8	40.0	18.2
51.8	1 000	V	34.6	-13.6	21.0	40.0	19.0
74.3	1 000	V	41.8	-19.4	22.4	40.0	17.6
110.6	1 000	V	37.8	-15.8	22.0	43.5	21.5
140.5	1 000	V	37.2	-19.0	18.2	43.5	25.3
222.7	1 000	H	40.3	-14.0	26.3	46.0	19.7
371.2	1 000	H	32.7	-10.2	22.5	46.0	23.5
519.7	1 000	V	34.9	-7.2	27.7	46.0	18.3
668.3	1 000	V	32.0	-4.8	27.2	46.0	18.8
Peak DATA. Emissions above 1㎓							
*5 094.9	1 000	H	37.5	7.6	45.1	74.0	28.9
*5 447.6	1 000	V	36.1	8.0	44.1	74.0	29.9
5 466.8	1 000	H	35.8	8.6	44.4	74.0	29.6
6 202.0	1 000	H	33.2	11.1	44.3	74.0	29.7
Above 7 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
*5 094.9	1 000	H	32.8	7.6	40.4	54.0	13.6
*5 447.6	1 000	V	30.6	8.0	38.6	54.0	15.4
5 466.8	1 000	H	37.0	8.6	45.6	54.0	8.4
6 202.0	1 000	H	33.7	11.1	44.8	54.0	9.2
Above 7 ㎓	**Not Detected**	-	-	-	-	-	-

*Restricted Band

Note:
1. This measurement was performed the worst case data were reported.

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5.7 Frequency Stability

5.7.1 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.

5.7.2 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.

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5.7.3 Test Result

-complied

-5 235 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.0	20	5 229 972 000	28 000	0.000 5
100		-20	5 230 091 950	-91 950	-0.001 8
100		-10	5 230 099 950	-99 950	-0.001 9
100		0	5 230 079 950	-79 950	-0.001 5
100		10	5 230 040 000	-40 000	-0.000 8
100		20	5 229 972 000	28 000	0.000 5
100		30	5 230 008 000	-8 000	-0.000 2
100		40	5 230 043 950	-43 950	-0.000 8
100		50	5 229 996 000	4 000	0.000 1
90	4.5	20	5 229 979 000	21 000	0.000 4
110	5.5	20	5 229 961 000	39 000	0.000 7

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.0	20	5 230 008 000	-8 000	-0.000 2
100		-20	5 230 135 950	-135 950	-0.002 6
100		-10	5 230 115 950	-115 950	-0.002 2
100		0	5 230 044 000	-44 000	-0.000 8
100		10	5 230 151 950	-151 950	-0.002 9
100		20	5 230 008 000	-8 000	-0.000 2
100		30	5 230 071 950	-71 950	-0.001 4
100		40	5 230 043 950	-43 950	-0.000 8
100		50	5 230 032 000	-32 000	-0.000 6
90	4.5	20	5 230 001 500	-1 500	0.000 0
110	5.5	20	5 230 011 000	-11 000	-0.000 2

- 5 755 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.0	20	5 754 960 000	40 000	0.000 8
100		-20	5 755 063 950	-63 950	-0.001 2
100		-10	5 755 052 000	-52 000	-0.001 0
100		0	5 755 107 950	-107 950	-0.002 1
100		10	5 754 996 000	4 000	0.000 1
100		20	5 754 960 000	40 000	0.000 8
100		30	5 755 012 000	-12 000	-0.000 2
100		40	5 754 972 000	28 000	0.000 5
100		50	5 754 996 000	4 000	0.000 1
90	4.5	20	5 754 951 200	48 800	0.000 9
110	5.5	20	5 754 951 800	48 200	0.000 9

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.0	20	5 754 976 000	24 000	0.000 5
100		-20	5 755 036 000	-36 000	-0.000 7
100		-10	5 755 028 000	-28 000	-0.000 5
100		0	5 755 012 000	-12 000	-0.000 2
100		10	5 754 992 000	8 000	0.000 2
100		20	5 754 976 000	24 000	0.000 5
100		30	5 755 008 000	-8 000	-0.000 2
100		40	5 754 932 000	68 000	0.001 3
100		50	5 754 912 050	87 950	0.001 7
90	4.5	20	5 754 962 400	37 600	0.000 7
110	5.5	20	5 754 978 200	21 800	0.000 4

- 5 795 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.0	20	5 794 908 050	91 950	0.001 8
100		-20	5 795 099 950	-99 950	-0.001 9
100		-10	5 795 024 000	-24 000	-0.000 5
100		0	5 795 056 000	-56 000	-0.001 1
100		10	5 795 004 000	-4 000	-0.000 1
100		20	5 794 908 050	91 950	0.001 8
100		30	5 794 988 000	12 000	0.000 2
100		40	5 794 940 050	59 950	0.001 1
100		50	5 794 934 000	66 000	0.001 3
90	4.5	20	5 794 909 000	91 000	0.001 7
110	5.5	20	5 794 947 500	52 500	0.001 0

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.0	20	5 794 940 000	60 000	0.001 1
100		-20	5 795 020 000	-20 000	-0.000 4
100		-10	5 795 004 000	-4 000	-0.000 1
100		0	5 795 051 950	-51 950	-0.001 0
100		10	5 795 064 000	-64 000	-0.001 2
100		20	5 794 940 000	60 000	0.001 1
100		30	5 794 944 050	55 950	0.001 1
100		40	5 794 908 900	91 100	0.001 7
100		50	5 794 960 050	39 950	0.000 8
90	4.5	20	5 794 949 400	50 600	0.001 0
110	5.5	20	5 794 924 800	75 200	0.001 4

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5.8 Conducted Emission

5.8.1 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 ohms 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 (dBμV)	
	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.

5.8.2 Measurement Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm 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.

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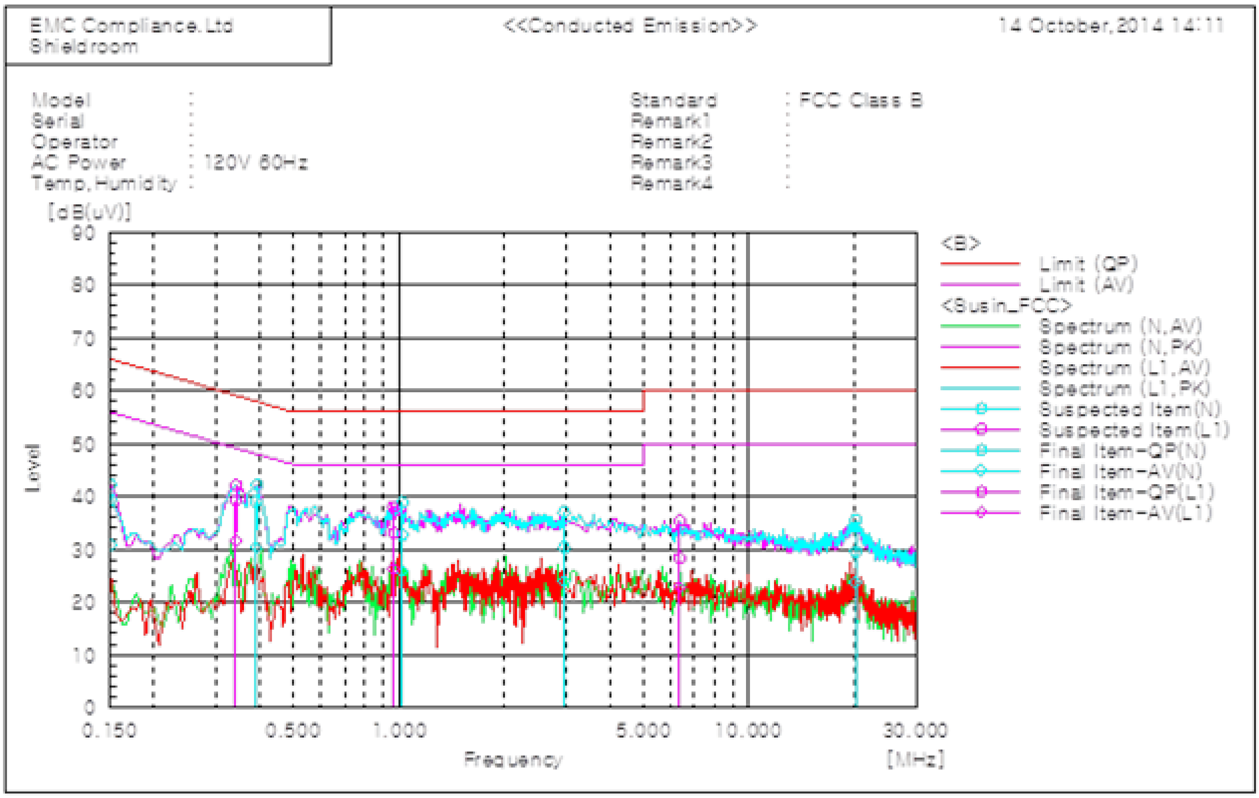
5.8.3 Test Result



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	0.15005	29.4	20.7	10.1	39.5	30.8	66.0	56.0	26.5	25.2
2	0.39156	28.8	20.2	10.2	39.0	30.4	58.0	48.0	19.0	17.6
3	1.02232	22.7	15.8	10.0	32.7	25.8	56.0	46.0	23.3	20.2
4	2.97364	20.5	14.0	9.8	30.3	23.8	56.0	46.0	25.7	22.2
5	20.22932	19.3	13.6	10.2	29.5	23.8	60.0	50.0	30.5	26.2

--- 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	0.34194	29.2	21.6	10.1	39.3	31.7	59.2	49.2	19.9	17.5
2	0.96928	23.1	16.3	10.0	33.1	26.3	56.0	46.0	22.9	19.7
3	6.34862	18.7	13.0	9.8	28.5	22.8	60.0	50.0	31.5	27.2

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	EMI Test Receiver	R&S	RSCI	100001	15.07.14
■	LISN	R&S	ENV216	101352	15.01.02
■	Amplifier	Sonoma Instrument	310N	293004	14.10.31
■	Spectrum Analyzer	R&S	FSV40	100989	15.01.29
■	Spectrum Analyzer	R&S	FSP40	100209	14.10.21
■	Broadband Preamplifier	Schwarzbeck	BBV9718	216	15.08.12
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	14.07.18
■	Horn Antenna	ETS - Lindgren	3115	62589	14.11.11
■	Attenuator	HP	8491A	16861	15.07.01
■	Highpass Filter	Wainwright Instruments GmbH	WHKX6.5 /18G-8SS	2	15.06.19
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-
■	Signal generator	R&S	SMR40	100007	15.06.10
■	Horn antenna	ETS.lindgren	3116	00086635	15.02.26
■	Broadband Preamplifier	Schwarzbeck	BBV9721	2	15.05.09