FCC TEST REPORT

Test report No.:	EMC- FCC- R0190
FCC ID:	2ACIK-HSM25C
Type of equipment:	Miracast Dongle
Model Name:	HSM25C
Applicant:	Hanshin Information Technology Co.,Ltd.
Max.RF Output Power:	2.30 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.407
Frequency Range:	5 745 ㎒ ~ 5 825 ㎒ 5 755 ㎒ ~ 5 795 ㎒
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. 10. 23

Date of test: 2014. 11. 05 ~ 11.07

Issued date: 2014. 11. 12

Tested by: KIM, SUNG SIN

Approved by: YU, SANG HOON

[Contents]

1. Client information

Applicant:	Hanshin Information Technology Co.,Ltd.
Address:	201 IT VENTURE TOWER, 694 Taprip-Dong, Yuseong-Gu, Daejeon, S. Korea
Telephone number:	+82-42-933-8507
Facsimile number:	+82-42-933-8509
Contact person:	Shin, Hyeon Seob / shs@icreon.kr

Manufacturer:	Hanshin Information Technology Co.,Ltd.
Address:	201 IT VENTURE TOWER, 694 Taprip-Dong, Yuseong-Gu, Daejeon, S. Korea

2. Laboratory information

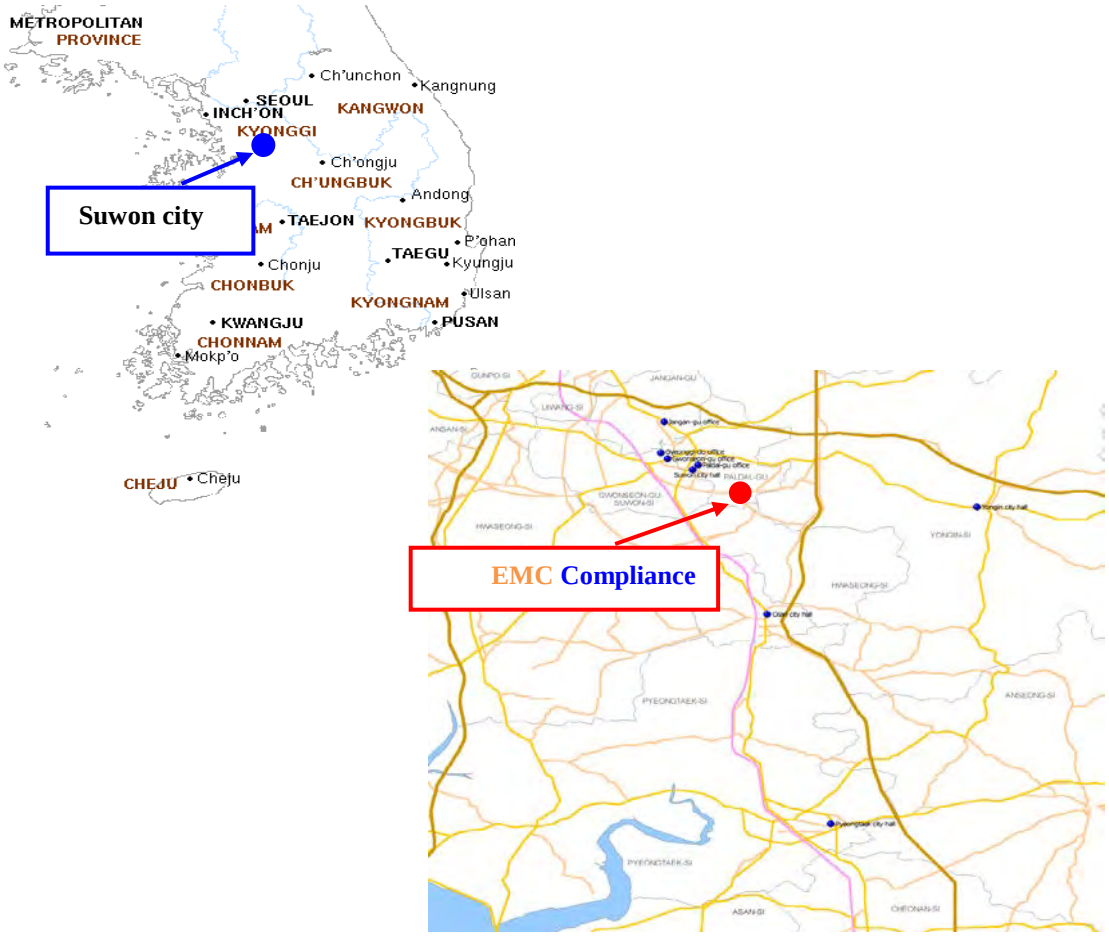
Address

EMC compliance Ltd.
480-5, Sin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Telephone Number: 82-070-5008-1021 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231
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:	Hanshin Information Technology Co.,Ltd.
Address of Applicant	201 IT VENTURE TOWER, 694 Taprip-Dong, Yuseong-Gu, Daejeon, S. Korea
Manufacturer#1	Hanshin Information Technology Co.,Ltd.
Address of Manufacturer	201 IT VENTURE TOWER, 694 Taprip-Dong, Yuseong-Gu, Daejeon, S. Korea
Type of equipment	Miracast Dongle
Basic Model	HSM25C
Serial number	N/A

3.2 General description

Communication	802.11/nHT20(MIMO)/n HT40(MIMO)
Frequency Range	5 745 ㎒ ~ 5 825 ㎒ 5 755 ㎒ ~ 5 795 ㎒
Type of Modulation (Technologies)	64QAM, 16QAM, QPSK, BPSK(OFDM)
Channel capacity	5 745 ~ 5 795 ㎒: 5 ch(802.11n_HT20) 5 755 ~ 5 795 ㎒: 2 ch(802.11n_HT40)
Antenna Gain	1.57 dBi
Type of Antenna	PCB Antenna
Power supply	DC 5 V
Operating temperature	-20 ~ 50 °C

3.3 Test frequency

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

5 745~5 825 (㎒) : 802.11n HT20

	CH	Frequency
Band Width	20 ㎒	
Low frequency	149	5 745 ㎒
Middle frequency	157	5 785 ㎒
High frequency	165	5 825 ㎒

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 5 V

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(f), 1.1307(b)(1)	N/A	RF Exposure	5.10	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

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 not exceeds 6.0 dBi

	5 745 ~ 5 825 ㎒
ANT Gain	1.57 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(NANT/Nss) dB.

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 2;

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.

Total gain = 1.57 dBi (individual gain(1.57 dBi) + Array gain(0 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) (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 dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10 log(1/0.25) if the duty cycle is 25 percent).

5.2.4 Test Result

-Complied

802.11n_HT20 MIMO

Frequency [㎒]	Average Power [dBm]		Duty Factor [dB]	Result [dBm]	Limit [dBm]
	Ant1	Ant2			
5 745	-1.31	-2.17	1.00	2.29	30.00
5 785	-1.22	-2.74	1.00	2.10	30.00
5 825	-1.08	-2.45	1.00	2.30	30.00

802.11n_HT40 MIMO

Frequency [㎒]	Average Power [dBm]		Duty Factor [dB]	Result [dBm]	Limit [dBm]
	Ant1	Ant2			
5 755	-5.12	-5.93	1.44	-1.05	30.00
5 795	-4.88	-6.41	1.44	-1.13	30.00

-NOTE:

1. Total power calculation = 10 log(10^(Ant1 power/10) + 10^(Ant2 power/10)).
2. 20 ㎒ BW : Duty cycle = 0.79, Duty cycle factor = 10 log(1/duty cycle) = 10 log(1/0.79) = 1.00 dB.
   40 ㎒ BW : Duty cycle = 0.72, Duty cycle factor = 10 log(1/duty cycle) = 10 log(1/0.72) = 1.44 dB.
3. Result = Ant1 power + Ant2 power + Duty Factor

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.

5.3.3 Test Result

-Complied

802.11n_HT20 MIMO

Frequency [㎒]	6 dB Bandwidth [㎒]		OBW [㎒]	
	ANT 1	ANT 2	ANT 1	ANT 2
5 745	17.72	17.66	17.59	17.63
5 785	17.70	17.60	17.61	17.61
5 825	17.65	17.65	17.61	17.62

802.11n_HT40 MIMO

Frequency [㎒]	6 dB Bandwidth [㎒]		OBW [㎒]	
	ANT 1	ANT 2	ANT 1	ANT 2
5 755	36.53	36.09	36.42	36.02
5 795	36.32	36.02	36.43	36.00

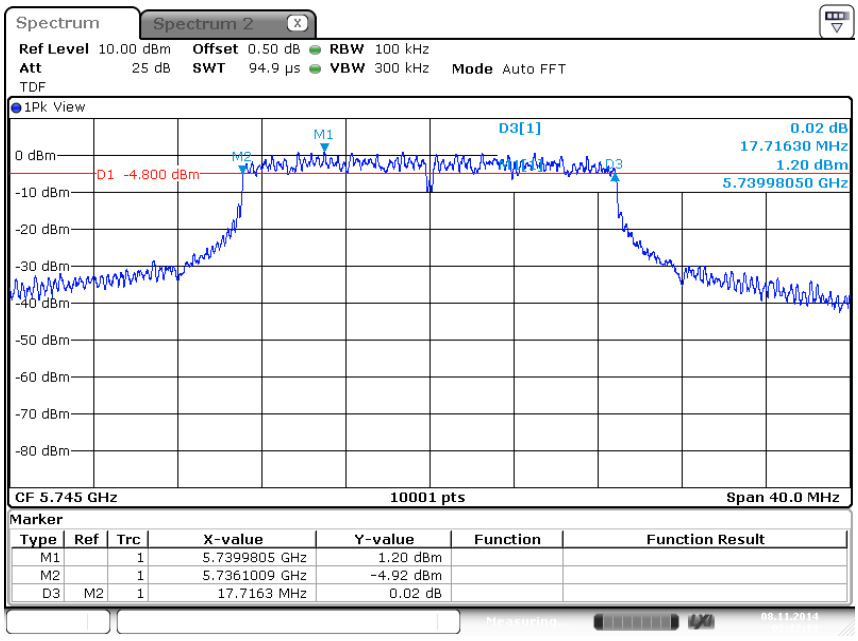
5.3.4 Test Plot

Figure 1. Bandwidth Measurement

802.11n_HT20 MIMO

-5 745 ㎒

ANT 1(EBW)



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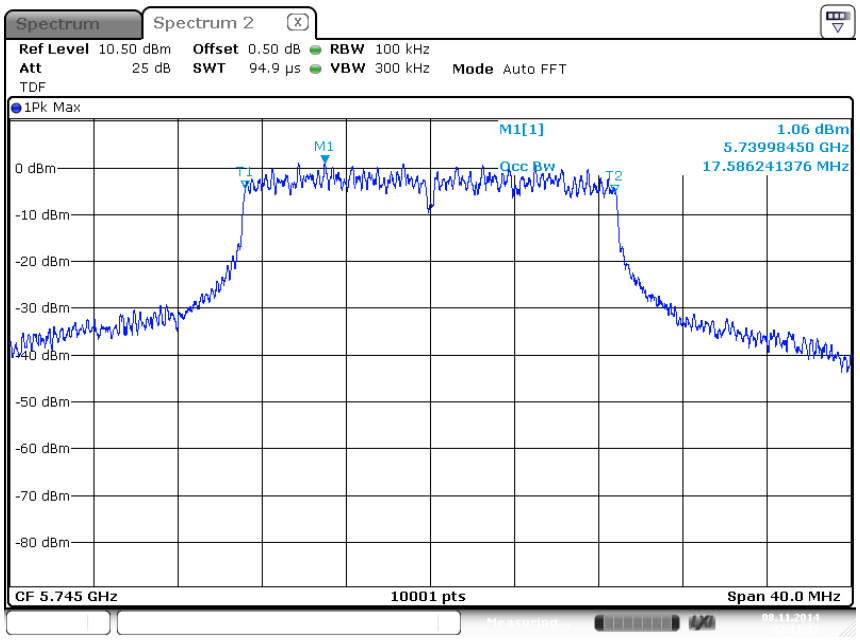
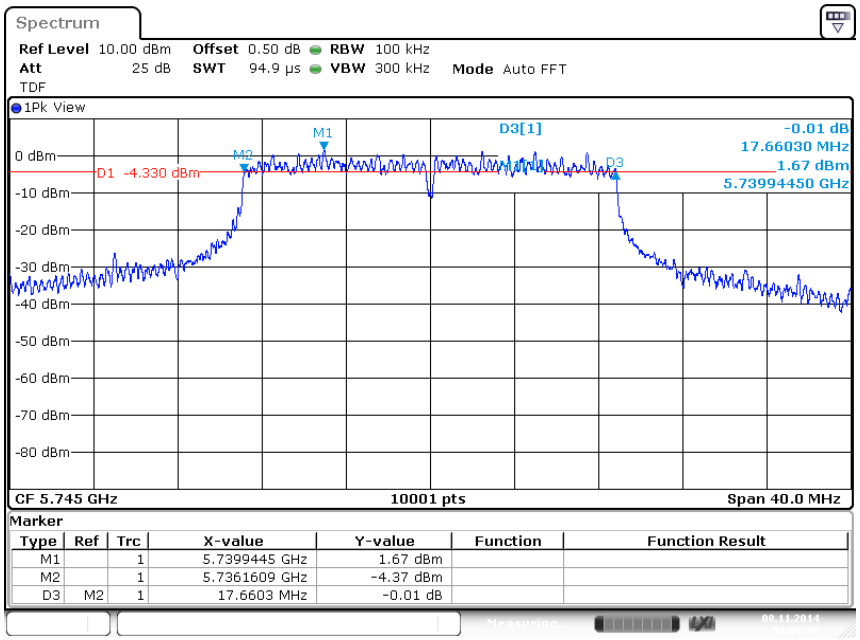


ANT 2(EBW)



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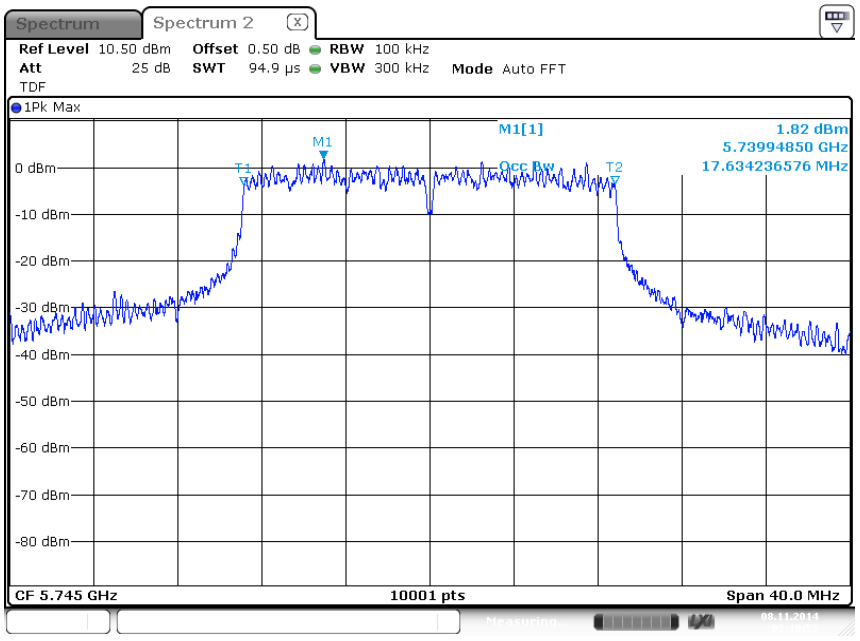
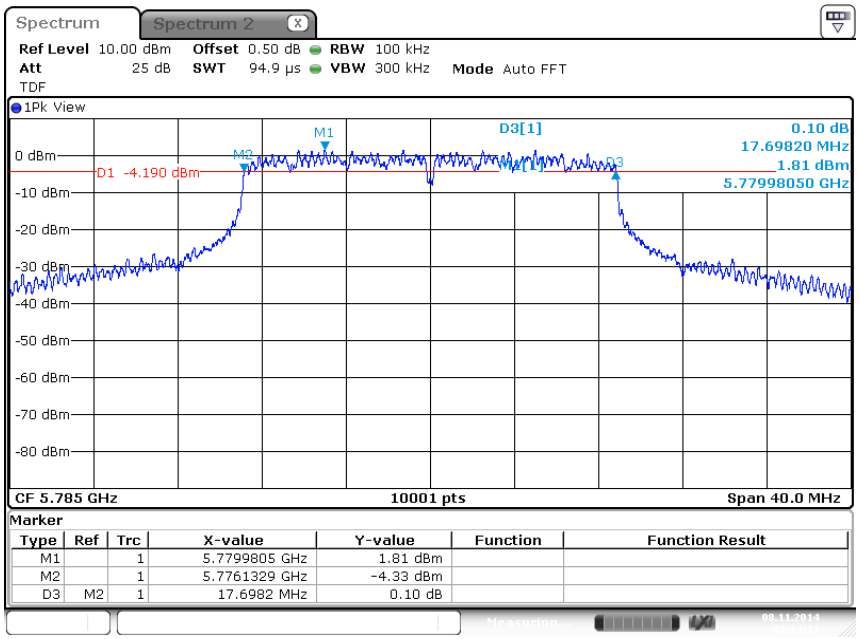


-5 785 ㎒

ANT 1(EBW)



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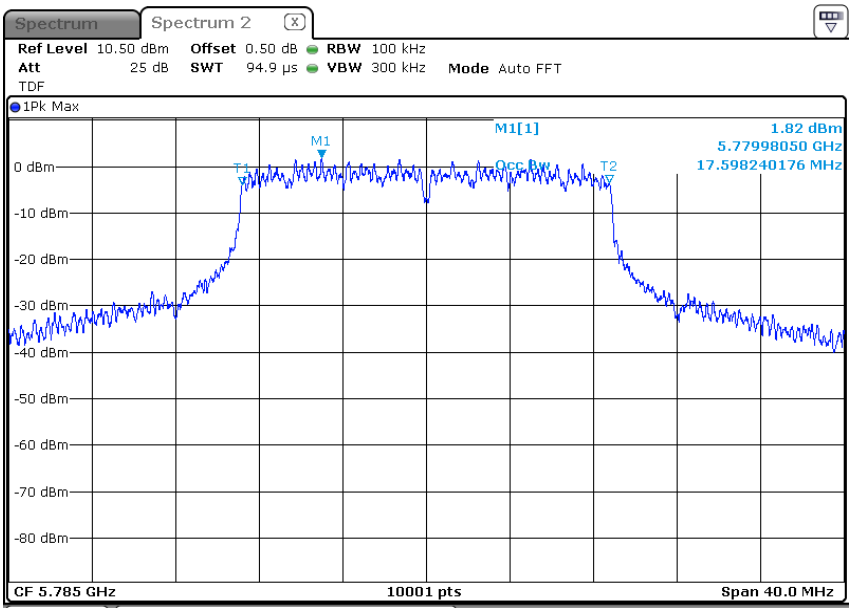

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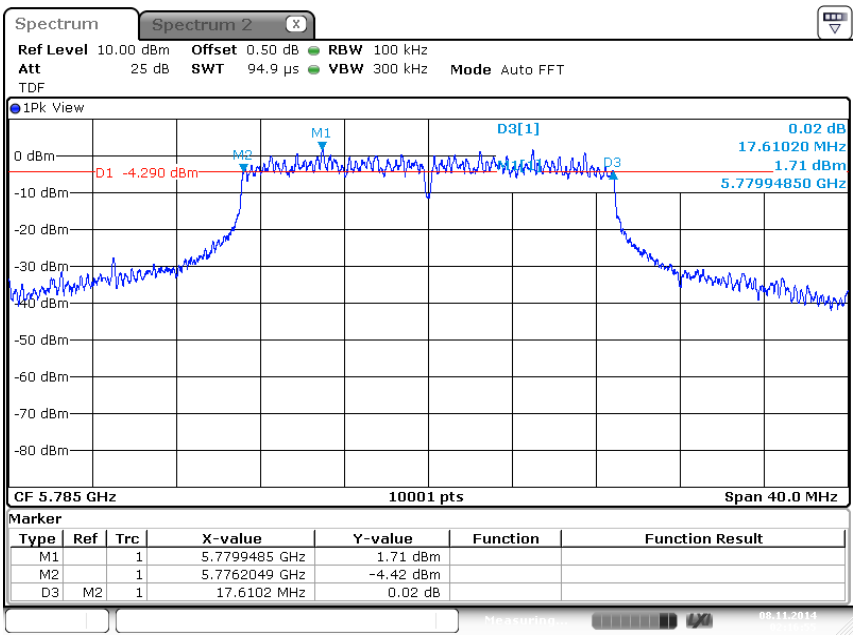

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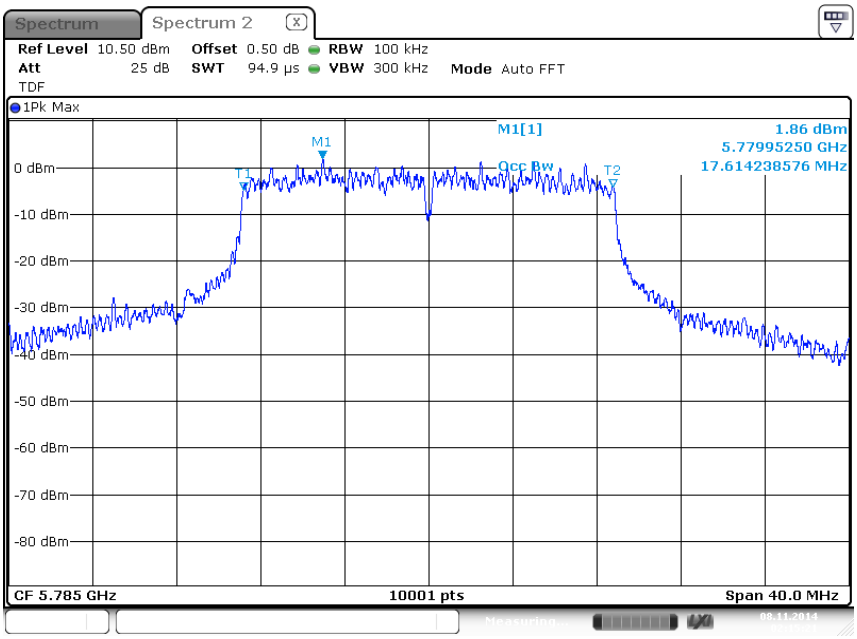
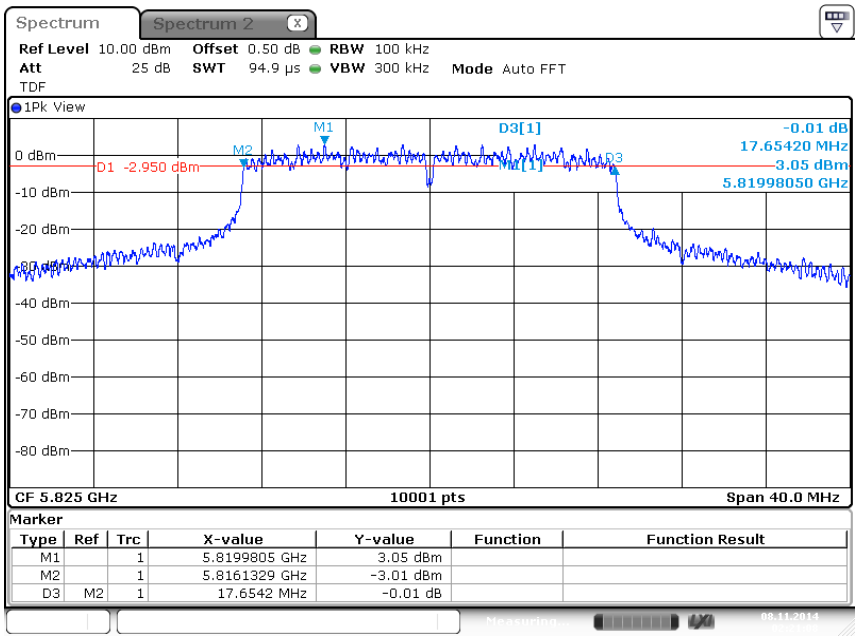


-5 825 ㎒

ANT 1(EBW)



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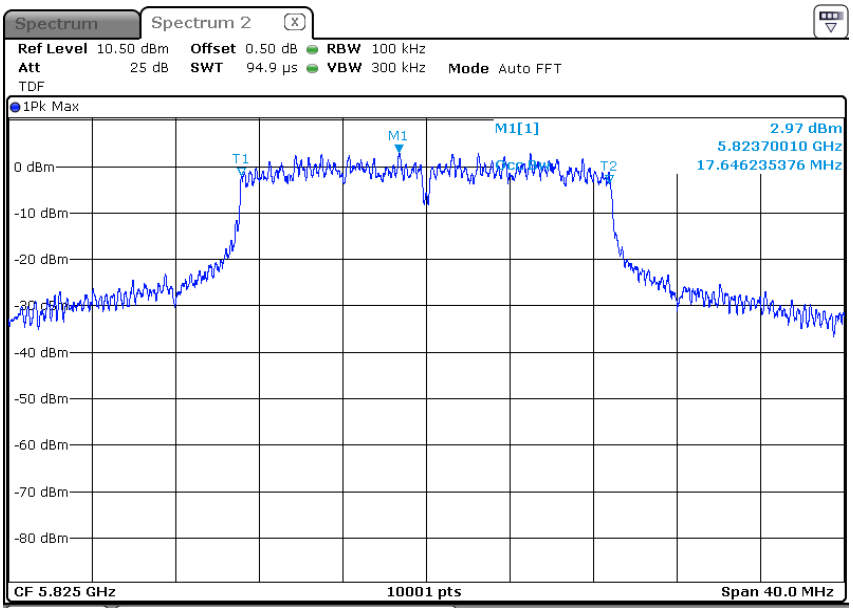

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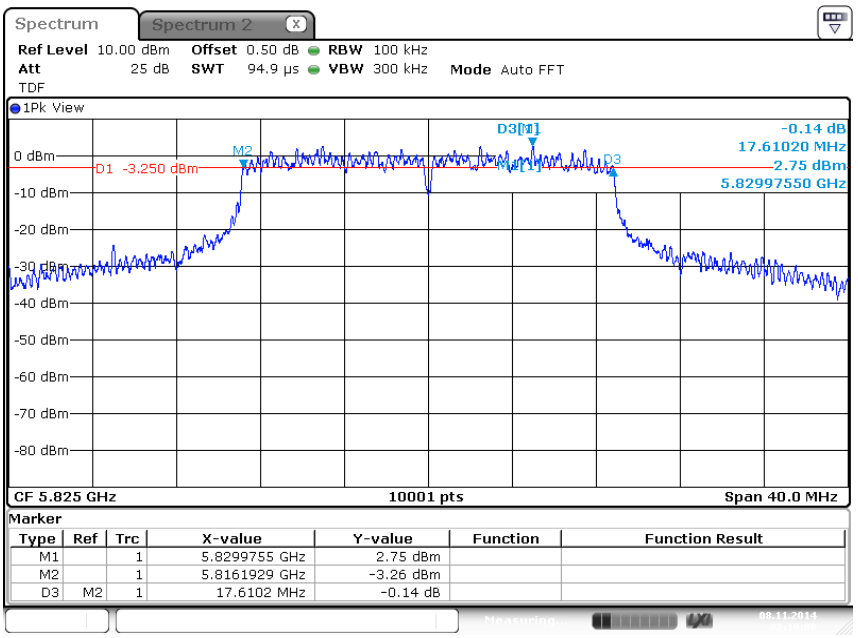

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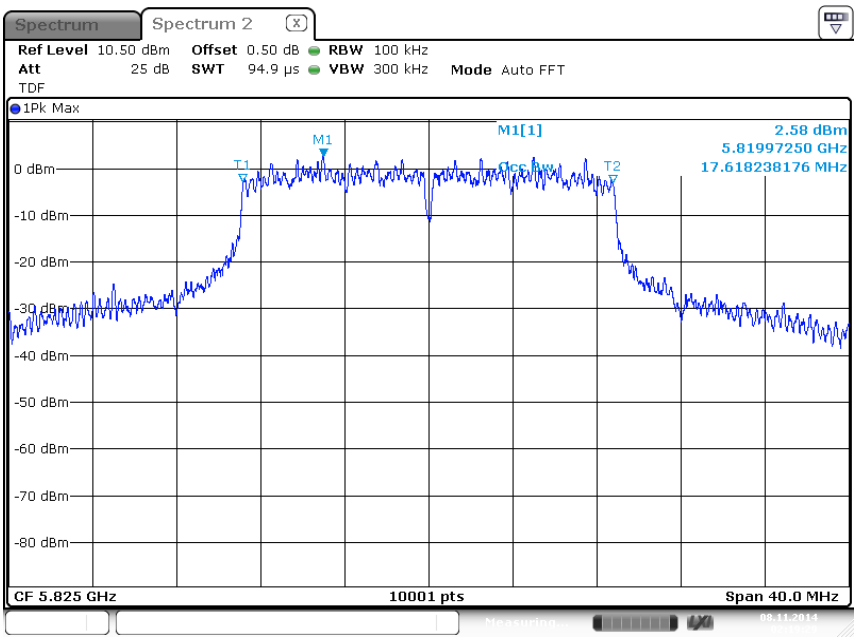

802.11n_HT40 MIMO

-5 755 ㎒

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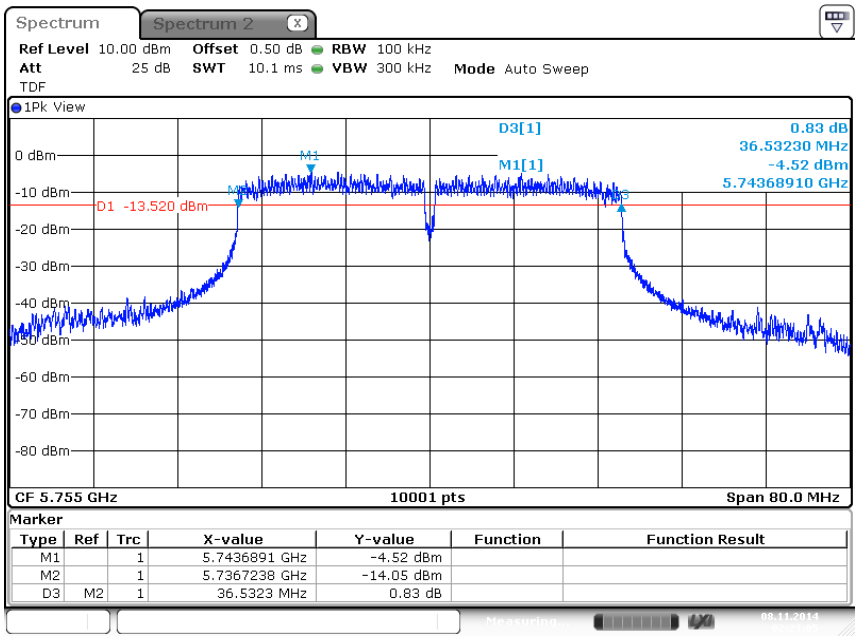

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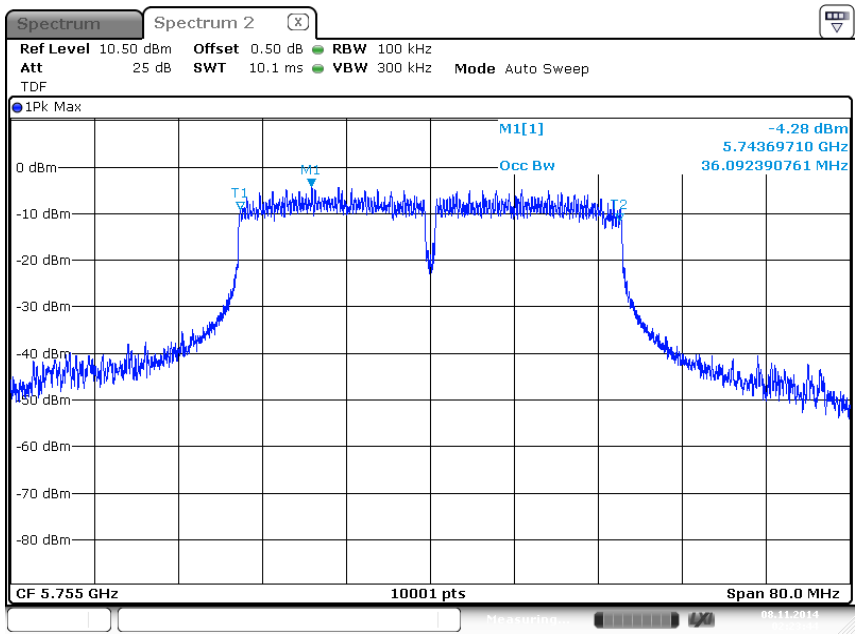

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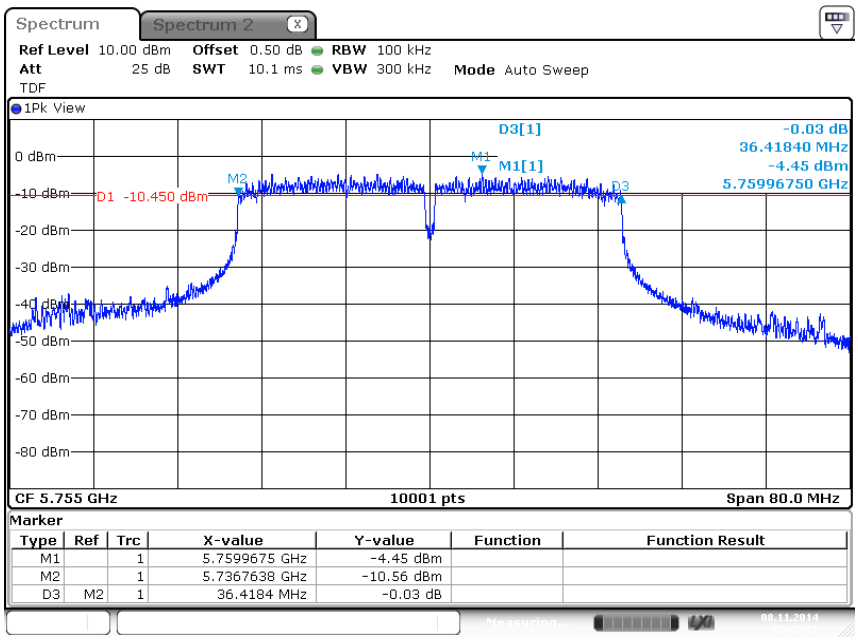
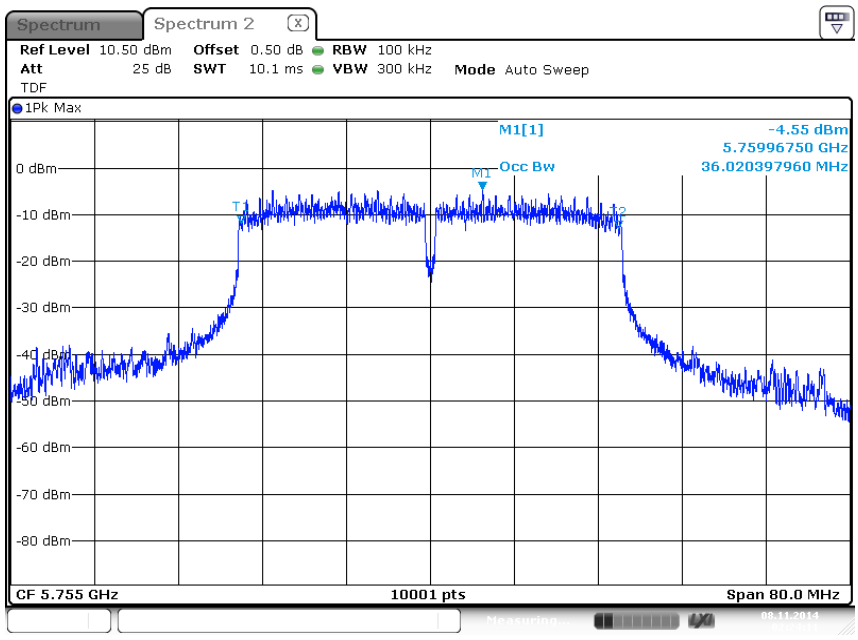
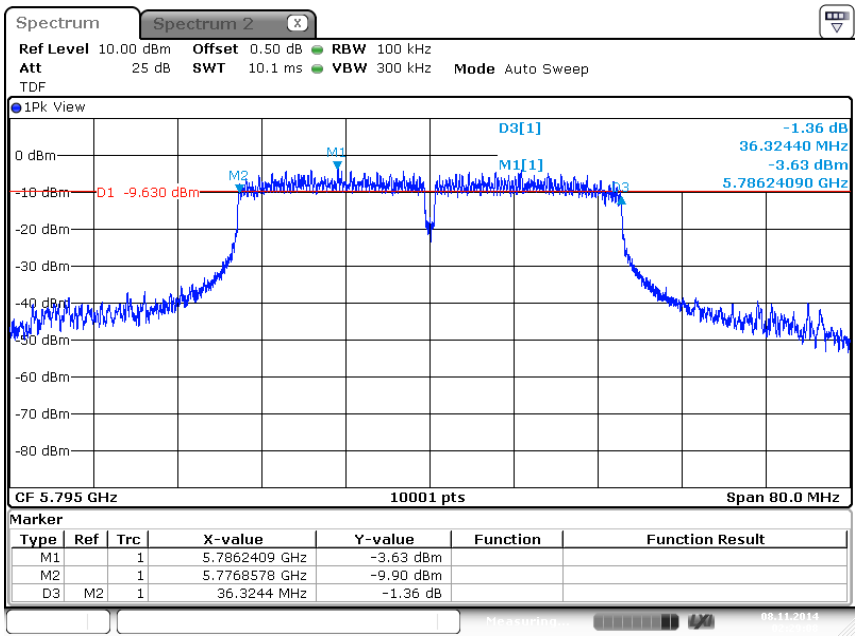


ANT 2(OBW)



-5 795 ㎒

ANT 1(EBW)



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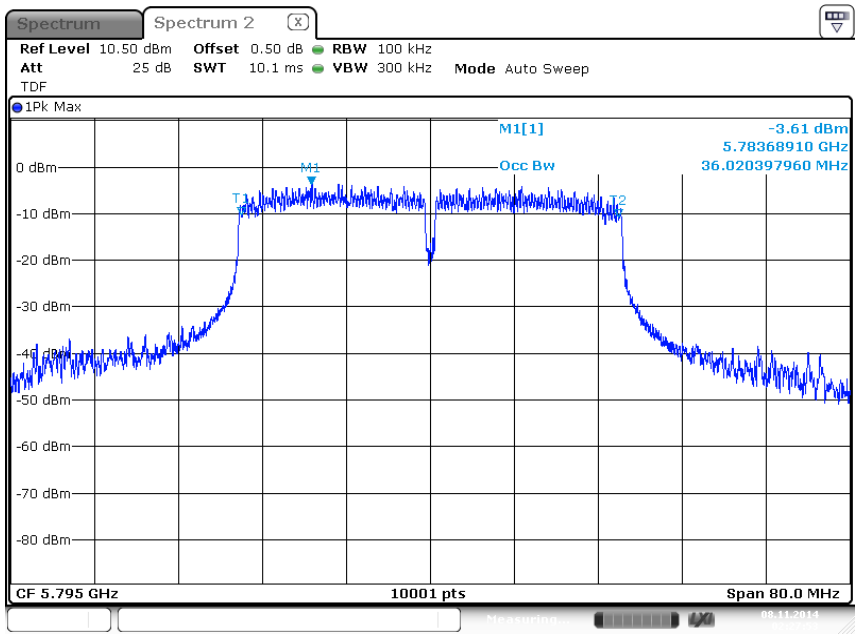

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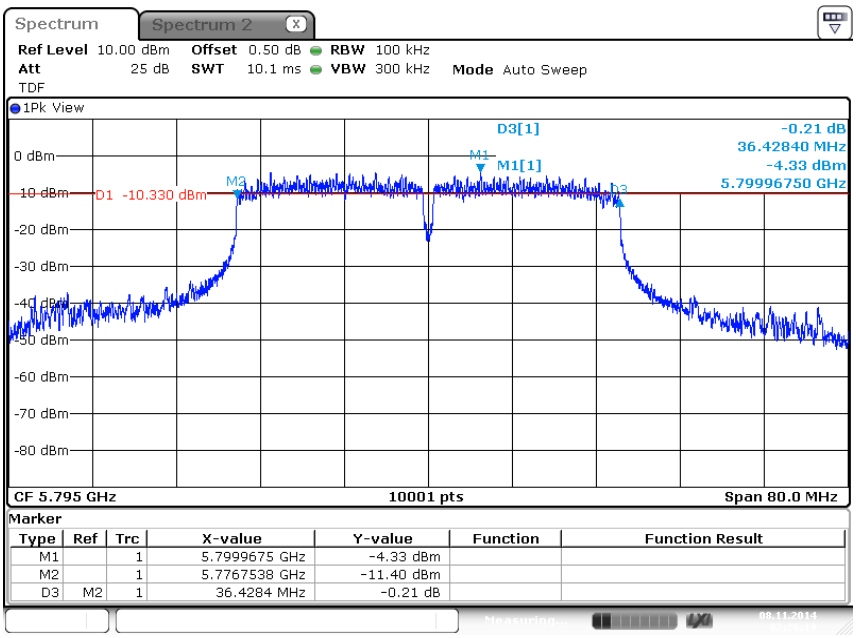

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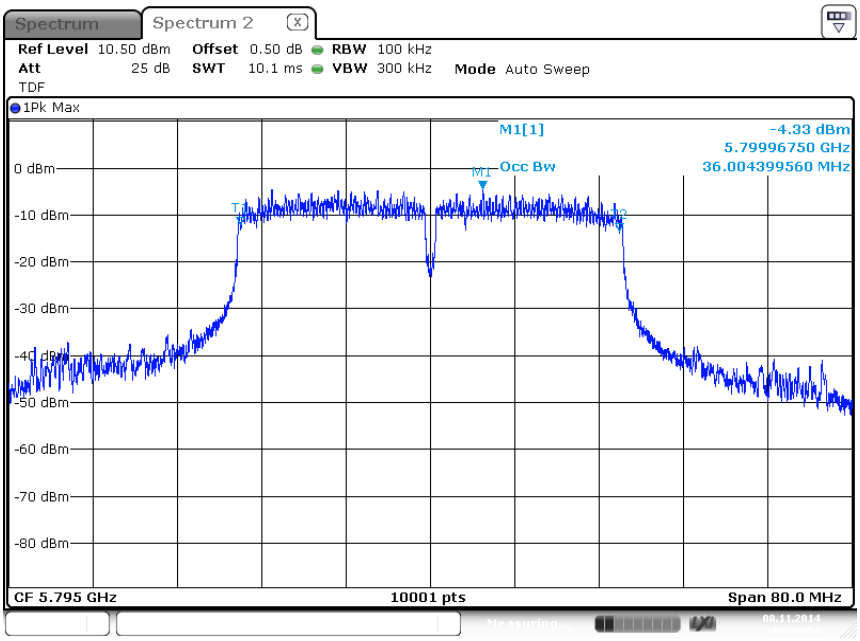


5.4 Peak Power Spectral Density

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-㎑ 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 ㎒ reference bandwidth.

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

b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 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.

5.4.3 Test Result

-Complied

802.11n_HT20_MIMO

Frequency [㎒]	Reading [dBm]		Duty Cycle [dB]	result [dBm]	Limit [dBm]
	Ant1	Ant2			
5 745	-1.42	-1.09	1.00	2.76	30.00
5 785	-0.86	-1.28	1.00	2.95	30.00
5 825	-0.05	-0.27	1.00	3.85	30.00

802.11n HT40_MIMO

Frequency [㎒]	Reading [dBm]		Duty Cycle [dB]	result [dBm]	Limit [dBm]
	Ant1	Ant2			
5755	-8.78	-7.52	1.44	-3.65	30.00
5795	-8.46	-7.59	1.44	-3.55	30.00

-NOTE:
1. Total PPSD calculation = 10log(10^(Ant1 PSD / 10) + 10^(Ant2 PSD / 10))
2. 20 ㎒ BW : Duty cycle = 0.793 8, Duty cycle factor = 10 log(1/duty cycle) = 10 log(1/0.7938) = 1.00 dB.
   40 ㎒ BW : Duty cycle = 0.717 4, Duty cycle factor = 10 log(1/duty cycle) = 10 log(1/0.7174) = 1.44 dB.
3. Result = Ant1 power + Ant2 power + C.L + Duty Factor

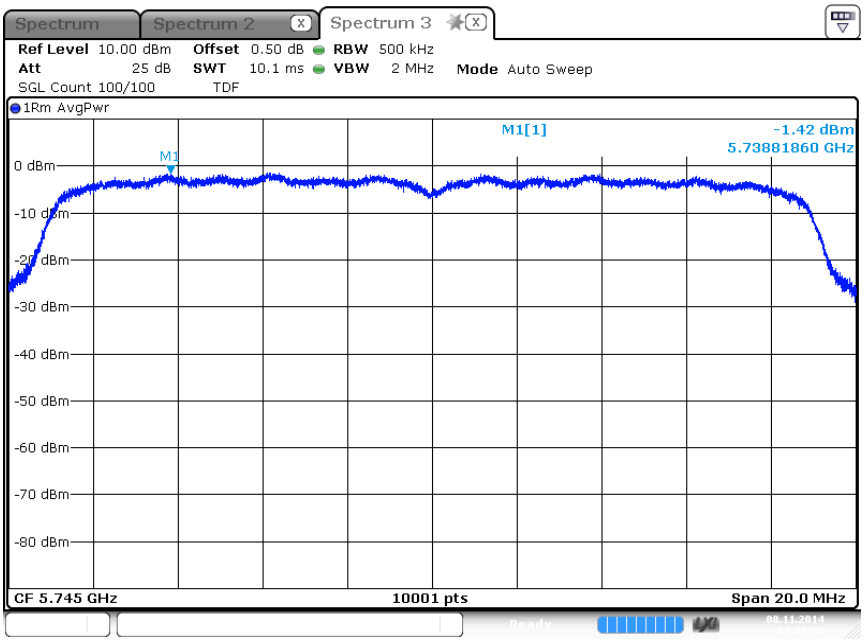
5.4.4 Test Plot

Figure 2. Plot of the Peak Power Spectral Density

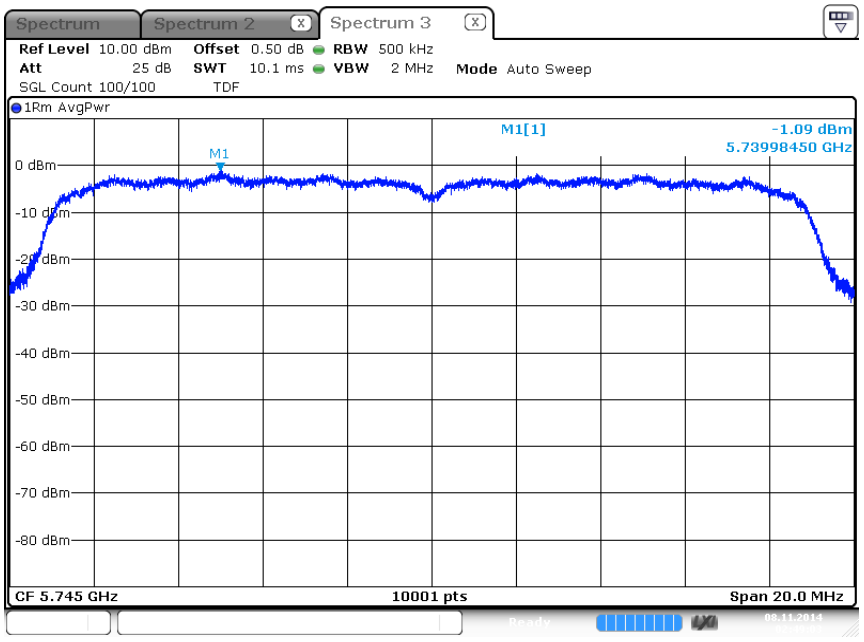
802.11n_HT20 MIMO

- 5 745 ㎒

ANT 1

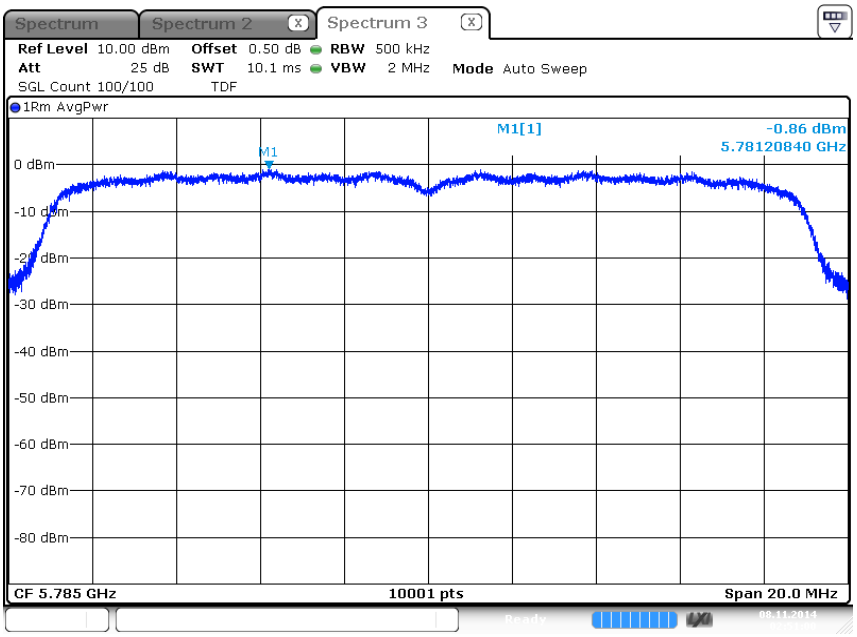


ANT 2

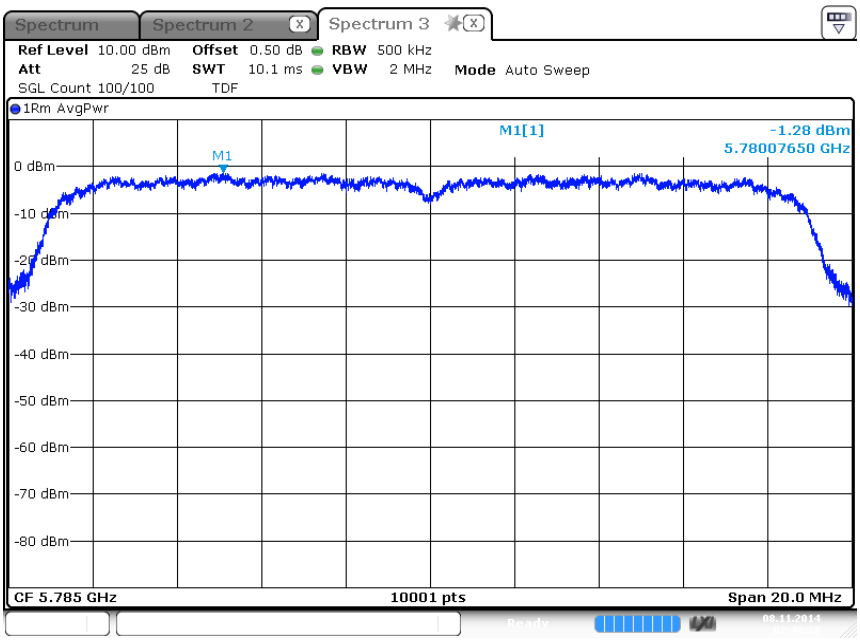


- 5 785 ㎒

ANT 1

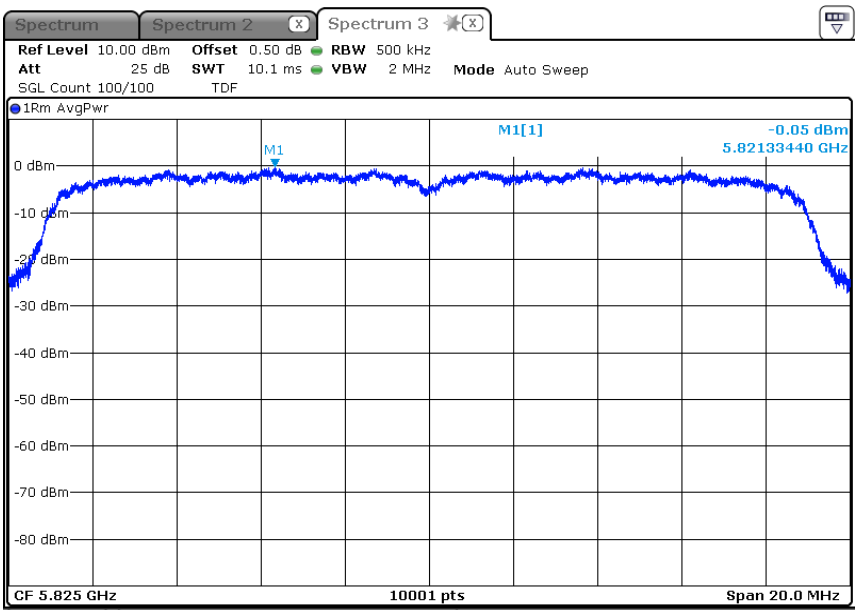


ANT2

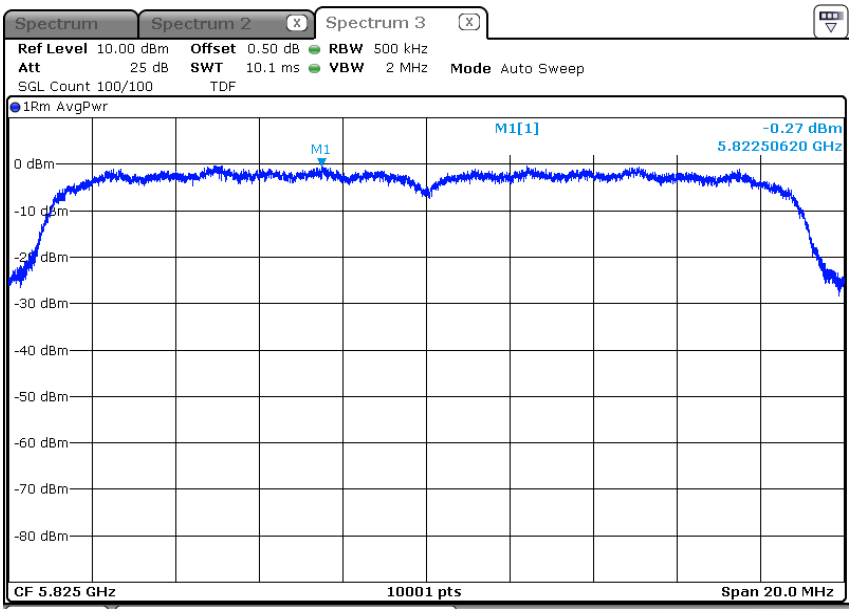


-5 825㎒

ANT 1



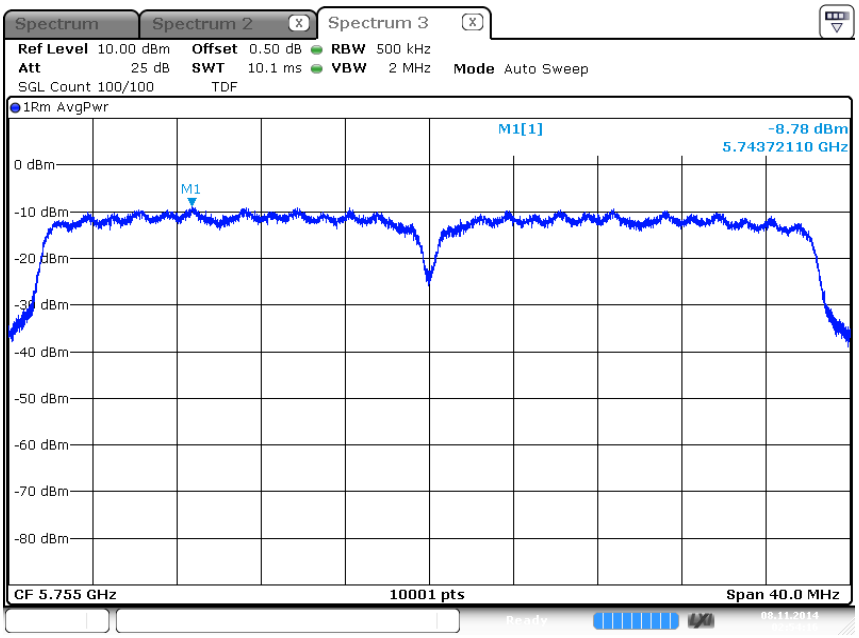
ANT 2



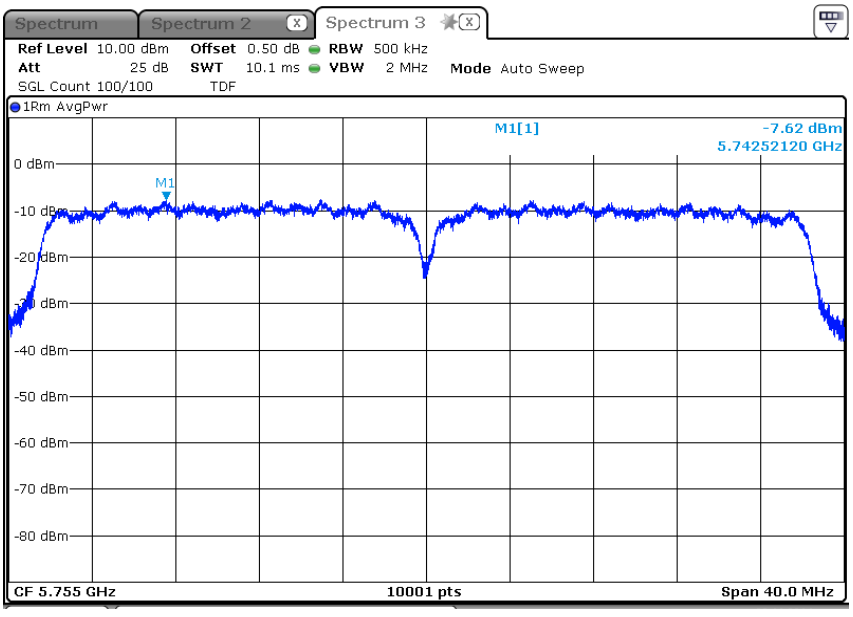
802.11n_HT40 MIMO

-5 755 ㎒

ANT 1

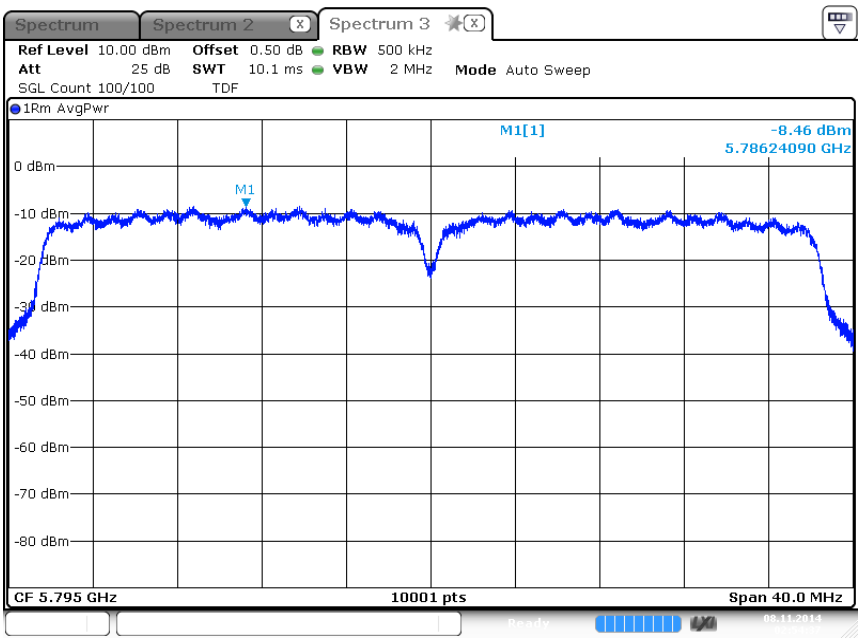


ANT 2

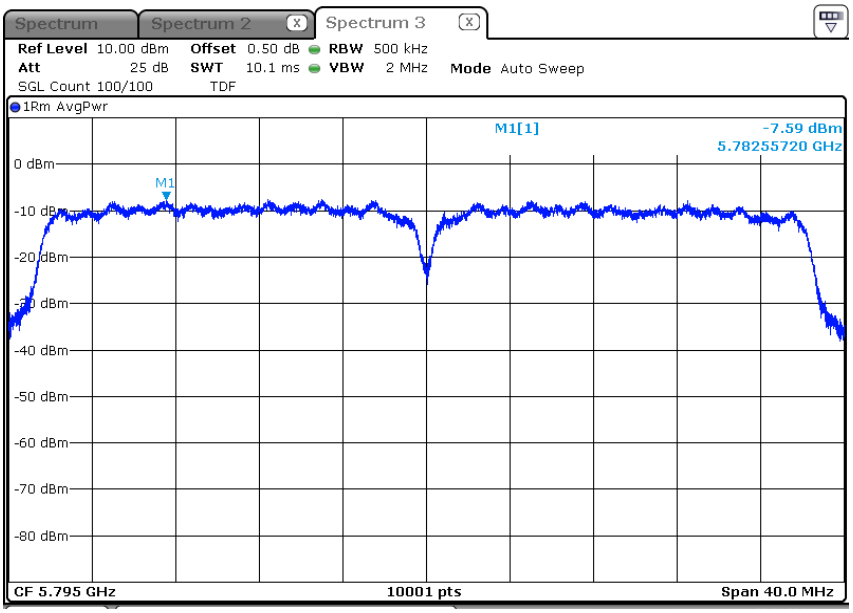


-5 795 ㎒

ANT 1



ANT 2



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

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

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

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_HT20 MIMO

-5 785 ㎒ (Worst Case)

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㎓							
567.0	1 000	V	39.8	-5.5	34.3	46.0	11.7
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-

Note:

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

802.11n_HT20 MIMO

-5 745 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1㎓							
*5 723.8	1 000	V	48.9	-0.1	48.8	78.2	29.4
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-

*Asterisks mean Out of Bandwidth

802.11n_HT20 MIMO

-5 785 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1㎓							
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-

-5 825 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1㎓							
*3 566.44	1000	V	39.2	-3.4	35.8	68.2	32.4
Above 4 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
Above 6 ㎓	**Not Detected**	-	-	-	-	-	-

* Asterisks mean Out of Bandwidth

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

802.11n_HT40 MIMO

-5 775 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1㎓							
*5 720.4	1 000	V	49.3	-0.1	49.2	78.2	29.0
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
Above 1 ㎓	**Not Detected**	-	-	-	-	-	-

* Asterisks mean Out of Bandwidth

-5 795 ㎒

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1㎓							
*5 850.25	1 000	V	38.8	0.2	39.0	68.2	29.2
Above 6 ㎓	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1㎓							
Above 6 ㎓	**Not Detected**	-	-	-	-	-	-

* Asterisks mean Out of Bandwidth

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

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.

5.7.3 Test Result

-complied

802.11n_HT20 MIMO

-5 745 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 745 007 798	-779 8	-0.000 1
100		-20	5 745 009 498	-949 8	-0.000 2
100		-10	5 745 016 832	-168 32	-0.000 3
100		0	5 745 026 803	-268 03	-0.000 5
100		10	5 745 030 407	-304 07	-0.000 5
100		20	5 745 031 608	-316 08	-0.000 6
100		30	5 745 035 204	-352 04	-0.000 6
100		40	5 745 019 974	-199 74	-0.000 3
100		50	5 745 019 505	-195 05	-0.000 3
85	4.25	20	5 745 031 937	-319 37	-0.000 6
115	5.75	20	5 745 028 825	-288 25	-0.000 5

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 744 975 735	24 265	0.000 4
100		-20	5 744 987 258	12 742	0.000 2
100		-10	5 744 954 712	45 288	0.000 8
100		0	5 744 987 248	12 752	0.000 2
100		10	5 744 998 424	1 576	0.000 0
100		20	5 744 997 246	2 754	0.000 0
100		30	5 744 981 538	18 462	0.000 3
100		40	5 744 963 254	36 746	0.000 6
100		50	5 744 959 845	40 155	0.000 7
85	4.25	20	5 744 991 248	8 752	0.000 2
115	5.75	20	5 744 997 285	2 715	0.000 0

- 5 785 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 784 966 324	33 676	0.000 6
100		-20	5 785 063 433	-634 33	-0.001 1
100		-10	5 785 052 353	-523 53	-0.000 9
100		0	5 785 107 345	-107 345	-0.001 9
100		10	5 784 993 452	6 548	0.000 1
100		20	5 784 963 323	36 677	0.000 6
100		30	5 785 012 234	-122 34	-0.000 2
100		40	5 784 972 865	27 135	0.000 5
100		50	5 784 996 557	3 443	0.000 1
85	4.25	20	5 784 951 453	48 547	0.000 8
115	5.75	20	5 784 951 432	48 568	0.000 8

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 784 962 345	376 55	0.000 7
100		-20	5 785 064 453	-644 53	-0.001 1
100		-10	5 785 052 323	-523 23	-0.000 9
100		0	5 785 102 345	-102 345	-0.001 8
100		10	5 784 997 427	2 573	0.000 0
100		20	5 784 964 793	35 207	0.000 6
100		30	5 785 015 683	-156 83	-0.000 3
100		40	5 784 972 342	27 658	0.000 5
100		50	5 784 996 557	3 443	0.000 1
85	4.25	20	5 784 954 112	45 888	0.000 8
115	5.75	20	5 784 953 452	46 548	0.000 8

- 5 825 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 824 908 707	91 293	0.001 6
100		-20	5 825 100 186	-100 186	-0.001 7
100		-10	5 825 024 377	-243 77	-0.000 4
100		0	5 825 056 898	-568 98	-0.001 0
100		10	5 825 004 588	-458 8	-0.000 1
100		20	5 824 909 249	90 751	0.001 6
100		30	5 824 988 588	11 412	0.000 2
100		40	5 824 940 577	59 423	0.001 0
100		50	5 824 934 901	65 099	0.001 1
85	4.25	20	5 824 909 832	90 168	0.001 6
115	5.75	20	5 824 947 797	52 203	0.000 9

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 824 945 717	54 283	0.000 9
100		-20	5 825 024 719	-247 19	-0.000 4
100		-10	5 825 004 696	-469 6	-0.000 1
100		0	5 825 052 206	-522 06	-0.000 9
100		10	5 825 064 599	-645 99	-0.001 1
100		20	5 824 943 510	56 490	0.001 0
100		30	5 824 944 277	55 723	0.001 0
100		40	5 824 909 156	90 844	0.001 6
100		50	5 824 960 777	39 223	0.000 7
85	4.25	20	5 824 949 698	50 302	0.000 9
115	5.75	20	5 824 925 077	74 923	0.001 3

802.11n_HT40 MIMO

- 5 755 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 754 966 584	33 416	0.000 6
100		-20	5 755 063 953	-639 53	-0.001 1
100		-10	5 755 052 345	-523 45	-0.000 9
100		0	5 755 107 912	-107 912	-0.001 9
100		10	5 754 996 446	3 554	0.000 1
100		20	5 754 963 673	36 327	0.000 6
100		30	5 755 012 578	-125 78	-0.000 2
100		40	5 754 972 216	27 784	0.000 5
100		50	5 754 996 744	3 256	0.000 1
85	4.25	20	5 754 951 221	48 779	0.000 8
115	5.75	20	5 754 951 823	48 177	0.000 8

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 754 976 345	23 655	0.000 4
100		-20	5 755 036 753	-367 53	-0.000 6
100		-10	5 755 028 885	-288 85	-0.000 5
100		0	5 755 012 864	-128 64	-0.000 2
100		10	5 754 992 823	7 177	0.000 1
100		20	5 754 976 234	23 766	0.000 4
100		30	5 755 008 112	-811 2	-0.000 1
100		40	5 754 932 688	67 312	0.001 2
100		50	5 754 912 051	87 949	0.001 5
85	4.25	20	5 754 962 495	37 505	0.000 7
115	5.75	20	5 754 978 222	21 778	0.000 4

- 5 795 ㎒

ANT 1

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 794 908 453	91 547	0.001 6
100		-20	5 795 099 932	-999 32	-0.001 7
100		-10	5 795 024 123	-241 23	-0.000 4
100		0	5 795 056 644	-566 44	-0.001 0
100		10	5 795 004 334	-433 4	-0.000 1
100		20	5 794 908 995	91 005	0.001 6
100		30	5 794 988 334	11 666	0.000 2
100		40	5 794 940 323	59 677	0.001 0
100		50	5 794 934 647	65 353	0.001 1
85	4.25	20	5 794 909 578	90 422	0.001 6
115	5.75	20	5 794 947 543	52 457	0.000 9

ANT 2

Voltage (%)	Power (V_{DC})	Temp. (°C)	Reading Frequency (㎐)	Frequency Error (㎐)	Frequency Error (%)
100	5.00	20	5 794 945 463	54 537	0.000 9
100		-20	5 795 024 465	-244 65	-0.000 4
100		-10	5 795 004 442	-444 2	-0.000 1
100		0	5 795 051 952	-519 52	-0.000 9
100		10	5 795 064 345	-643 45	-0.001 1
100		20	5 794 943 256	56 744	0.001 0
100		30	5 794 944 023	55 977	0.001 0
100		40	5 794 908 902	91 098	0.001 6
100		50	5 794 960 523	39 477	0.000 7
85	4.25	20	5 794 949 444	50 556	0.000 9
115	5.75	20	5 794 924 823	75 177	0.001 3

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 (㏈μV)	
	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.

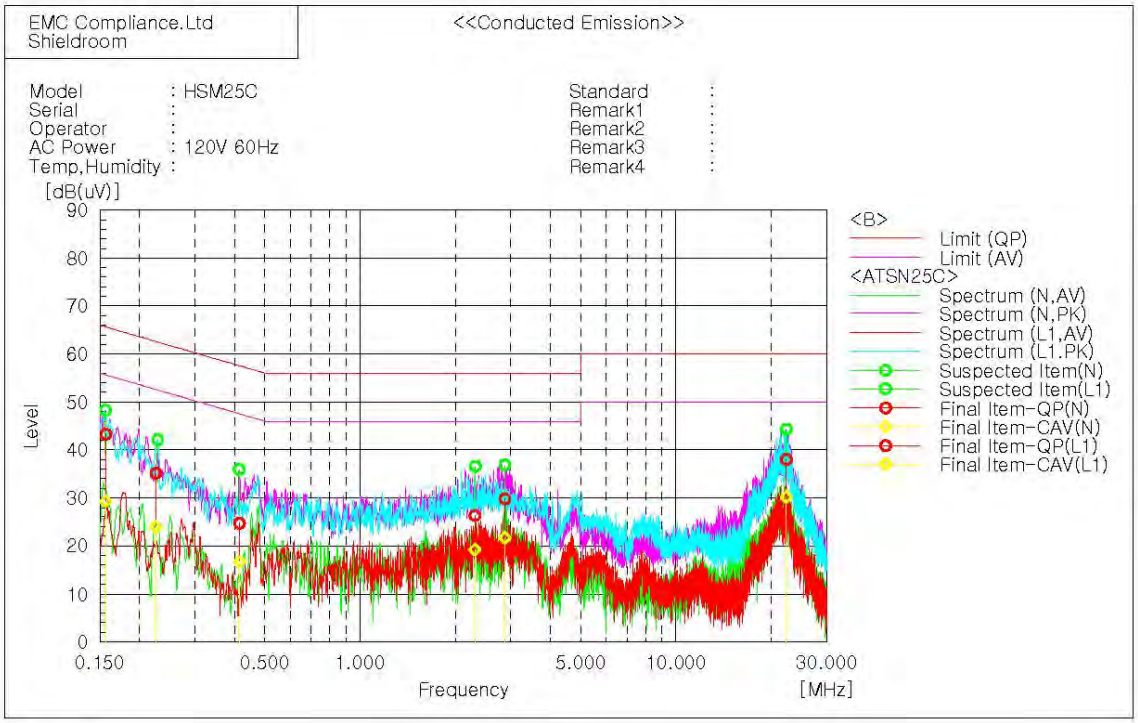
5.8.2 Measurement Procedure

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.

5.8.3 Test Result

802.11n_HT20 MIMO

- 5 785 ㎒



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	0.41521	14.8	6.9	9.9	24.7	16.8	57.5	47.5	32.8	30.7
2	2.31206	16.6	9.6	9.7	26.3	19.3	56.0	46.0	29.7	26.7
3	2.87663	20.1	12.1	9.7	29.8	21.8	56.0	46.0	26.2	24.2

--- 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	0.15654	33.5	19.5	9.8	43.3	29.3	65.6	55.6	22.3	26.3
2	0.22544	25.3	14.2	9.8	35.1	24.0	62.6	52.6	27.5	28.6
3	22.34139	28.1	20.3	9.9	38.0	30.2	60.0	50.0	22.0	19.8

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV30	101437	14.12.31
■	Amplifier	Sonoma Instrument	310N	293004	15.09.25
■	Spectrum Analyzer	R&S	FSV40	100989	15.01.29
■	Broadband Preamplifier	Schwarzbeck	BBV9718	216	15.08.12
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	16.05.14
■	Horn Antenna	ETS - Lindgren	3117	9155787	15.02.26
■	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
■	Frequency Counter	HP	53150A	US39250565	15.09.11
■	Temp & Humid Chmber	ESPEC CORP.	SH-661	92004048	15.03.10
■	Wideband Power Sensor	R&S	NRP-Z81	100677	15.05.28
■	EMI Test Receiver	R&S	ESCI	100710	15.10.13
■	Line Impedence Stabilisation Network	Schwarzbeck	NNLK8121	8121-472	15.06.24
■	Two-Line-V-Network	R&S	ENV216	101352	15.01.02