FCC Test Report

Report No.:	RF191231C14-6
FCC ID:	C3K1899
Test Model:	1899
Contains Wi-Fi Module Model No.:	1957
Contains FCC ID:	C3K1957
Received Date:	Dec. 31, 2019
Test Date:	Jan. 16, 2020 ~ Mar. 11, 2020
Issued Date:	Mar. 13, 2020
Applicant:	Microsoft Corporation
Address:	One Microsoft Way Redmond, WA 98052-6399, U.S.A
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location (1):	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
Test Location (2):	B2F., No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan
FCC Registration / Designation Number:	788550 / TW0003 427177 / TW0011

Testing Laboratory
2021

Table of Contents

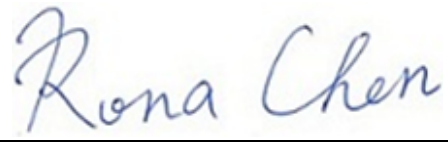
Release Control Record

Issue No.	Description	Date Issued
RF191231C14-6	Original Release	Mar. 13, 2020

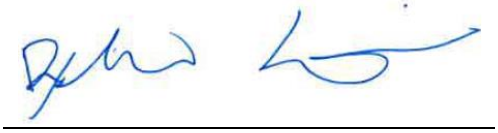
1 Certificate of Conformity

Product:	Portable Computing Device
Brand:	Microsoft
Test Model:	1899
Sample Status:	Engineering Sample
Applicant:	Microsoft Corporation
Test Date:	Jan. 16, 2020 ~ Mar. 11, 2020
Standards:	47 CFR FCC Part 15, Subpart E (Section 15.407) ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by :  , **Date:** Mar. 13, 2020

Rona Chen / Specialist

Approved by :  , **Date:** Mar. 13, 2020

Dylan Chiou / Senior Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
FCC Clause	**Test Item**	**Result**	**Remarks**
15.407(b)(6)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -23.54 dB at 0.22985 MHz.
15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -5.77 dB at 11650 MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	-	Reference only
15.407(a)(1/2/3)	Peak Power Spectral Density	Pass	Meet the requirement of limit.
15.407(e)	6 dB Bandwidth	Pass	Meet the requirement of limit. (U-NII-3 Band only)
15.407(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is I-pex not a standard connector..

Note:

1. For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOBE test plots were recorded in Annex A.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	**Frequency**	**Expanded Uncertainty (k=2) (±)**
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Portable Computing Device
Brand	Microsoft
Test Model	1899
FCC ID	C3K1899
Contains Wi-Fi Module Model No.	1957
Contains FCC ID	C3K1957
Status of EUT	Engineering Sample
Power Supply Rating	120 Vac (Adapter)
Modulation Type	64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11n: up to 72.2 Mbps
Operating Frequency	5180 ~ 5240 MHz, 5745 ~ 5825 MHz
Number of Channel	5180 ~ 5240 MHz: 4 for 802.11n (HT20) 5745 ~ 5825 MHz: 5 for 802.11n (HT20)
Output Power	0.873 mW for 5180 ~ 5240 MHz 0.881 mW for 5745 ~ 5825 MHz
Antenna Type	PIFA antenna with -0.2 dBi gain (5180 ~ 5240 MHz) PIFA antenna with 0.7 dBi gain (5745 ~ 5825 MHz)
Antenna Connector	I-pex
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below
Test Tool	QA_Tool_Release_V1.2

Note:

1. This report is for accessory radio only.
2. The EUT provides1 completed transmitter and 1 receiver.

Modulation Mode	Tx Function
802.11n (HT20)	1TX

3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	Microsoft (Chicony)	1932	I/P: 100-240 Vac, 50-60 Hz, 1.92 A O/P: 15 Vdc, 8 A / 5 Vdc, 1.5A 1.4m power cable w/o core
Top Battery	Dynapack	DYNH02	7.57 Vdc
Base Battery	Simplo	G3HTA063H	11.36 Vdc

4. Power setting is as below:

802.11n (HT20)	
Channel	**Power Setting**
36	15
40	15
48	15
149	18
157	18
165	18

* These are Hex value settings in the tool.

5. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

For 5180 ~ 5240 MHz

4 channels are provided for 802.11n (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220
40	5200	48	5240

For 5745 ~ 5825 MHz:

5 channels are provided for 802.11n (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	161	5805
153	5765	165	5825
157	5785		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1 GHz **RE<1G:** Radiated Emission below 1 GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Note:
1. The EUT had been pre-tested on the positioned of Notebook Mode and each 3 axis for Tablet Mode. The worst case was found when positioned on **NB Mode**.
2. "-" means no effect.

Radiated Emission Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
-	5745-5825	802.11n (HT20)	149 to 165	149, 157, 165	OFDM	BPSK	6.5

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5745-5825	802.11n (HT20)	149 to 165	165	OFDM	BPSK	6.5

Radiated Emission Test (Co-located):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Module	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
Accessory Radio + Intel	5745-5825	802.11n (HT20)	149 to 165	165	OFDM	BPSK	6.5
	5745-5825	802.11ax (HE40)	102 to 142	142	OFDMA	BPSK	MCS0
Accessory Radio + Intel	5745-5825	802.11n (HT20)	149 to 165	165	OFDM	BPSK	6.5
	2412-2462	802.11n (HT20)	1 to 11	6	OFDM	BPSK	6.5

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5745-5825	802.11n (HT20)	149 to 165	165	OFDM	BPSK	6.5

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
-	5745-5825	802.11n (HT20)	149 to 165	149, 157, 165	OFDM	BPSK	6.5

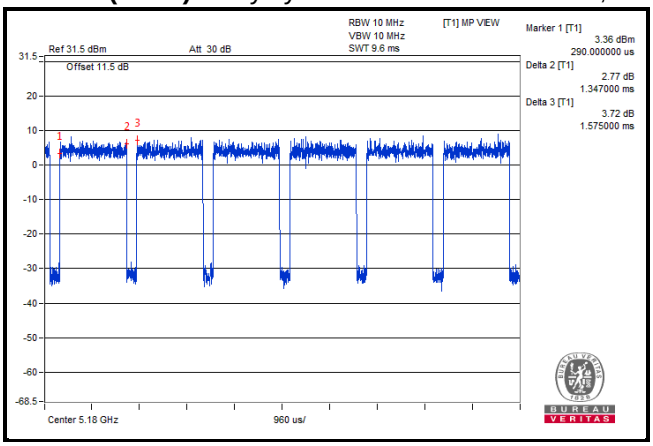
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Jones Chang
APCM	25 deg. C, 65 % RH	120 Vac, 60 Hz	Frank Liu

3.3 Duty Cycle of Test Signal

MODULATION TYPE: BPSK

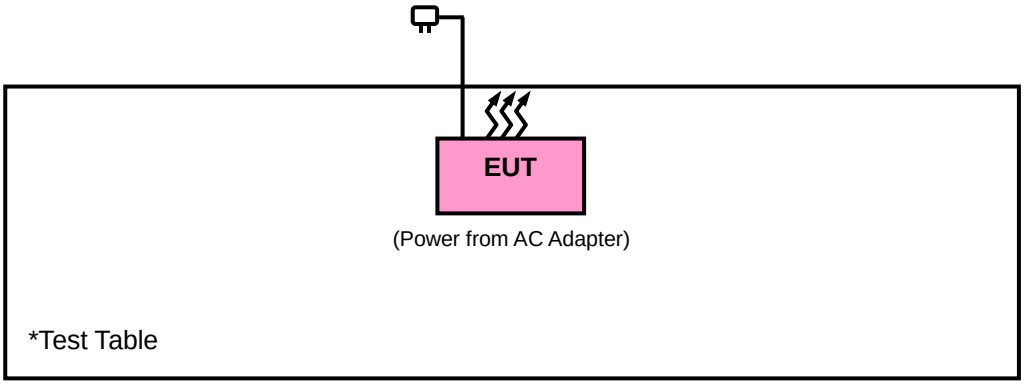
802.11n (HT20): Duty cycle = 1.347/1.575 = 0.855, Duty factor = 10 * log(1/0.855) = 0.68



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test Standard:

FCC Part 15, Subpart E (15.407)
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.1.2 Limits of Unwanted Emission Out of the Restricted Bands

<table>
<tr><th colspan="3">Applicable To</th><th colspan="2">Limit</th></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedures New Rules v02r01</td><td colspan="2">Field Strength at 3 m</td></tr>
<tr><td>PK: 74 (dBµV/m)</td><td>AV: 54 (dBµV/m)</td></tr>
<tr><th>Frequency Band</th><th colspan="2">Applicable To</th><th>EIRP Limit</th><th>Equivalent Field Strength at 3 m</th></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK: -27 (dBm/MHz)</td><td rowspan="3">PK: 68.2 (dBµV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK:-27 (dBm/MHz) *1
PK:10 (dBm/MHz) *2
PK:15.6 (dBm/MHz) *3
PK:27 (dBm/MHz) *4</td><td>PK: 68.2 (dBµV/m) *1
PK:105.2 (dBµV/m) *2
PK: 110.8 (dBµV/m) *3
PK:122.2 (dBµV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*1 beyond 75 MHz or more above of the band edge.
*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.
*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.
*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
</table>

Note:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ µV/m, where P is the eirp (Watts).

4.1.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 26, 2019	Aug. 25, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100980	May 07, 2019	May 06, 2020
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 12, 2019	Nov. 11, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 24, 2019	Nov. 23, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	EM-6879	269	Sep. 16, 2019	Sep. 15, 2020
MXG Vector signal generator Agilent	N5182B	MY53050430	Nov. 25, 2019	Nov. 24, 2020
Preamplifier Agilent	310N	187226	Jun. 18, 2019	Jun. 17, 2020
Preamplifier Agilent	83017A	MY39501357	Jun. 18, 2019	Jun. 17, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 08, 2019	Oct. 07, 2020
Power Meter Anritsu	ML2495A	1012010	Sep. 04, 2019	Sep. 03, 2020
Power Sensor Anritsu	MA2411B	1315050	Sep. 04, 2019	Sep. 03, 2020
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 18, 2019	Jun. 17, 2020
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 18, 2019	Jun. 17, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	Sep. 06, 2019	Sep. 05, 2020
AC Power Source	6905S	1991553	NA	NA
Digital Multimeter Fluke	87-III	70360742	Sep. 27, 2019	Sep. 26, 2020

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HsinTien Chamber 1.

4.1.4 Test Procedures

For Radiated Emission below 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

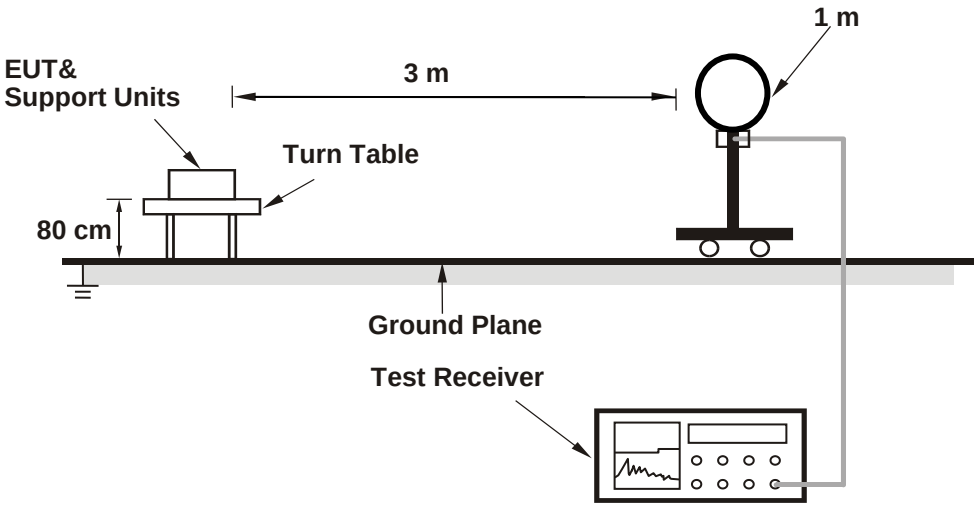
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz. (11n (HT20): RBW = 1 MHz, VBW = 1 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.5 Deviation from Test Standard

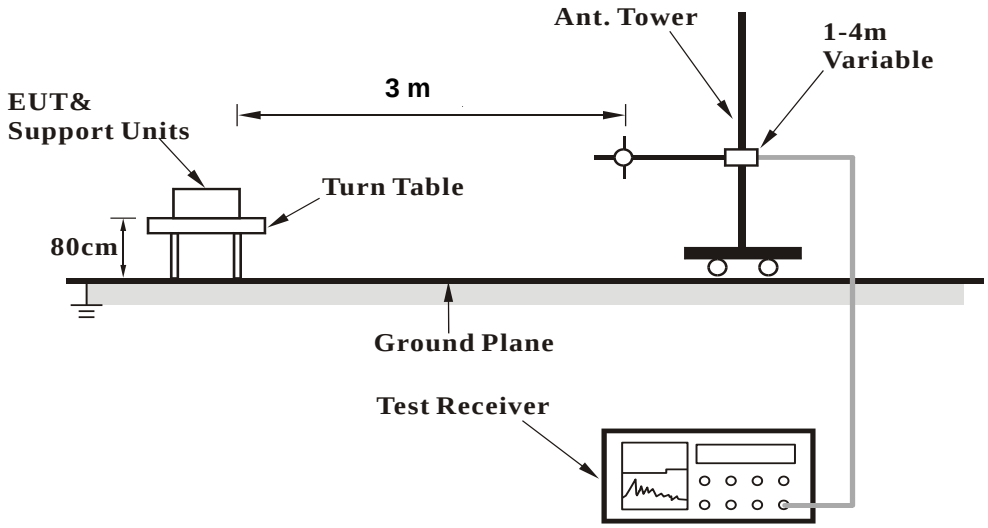
No deviation.

4.1.6 Test Setup

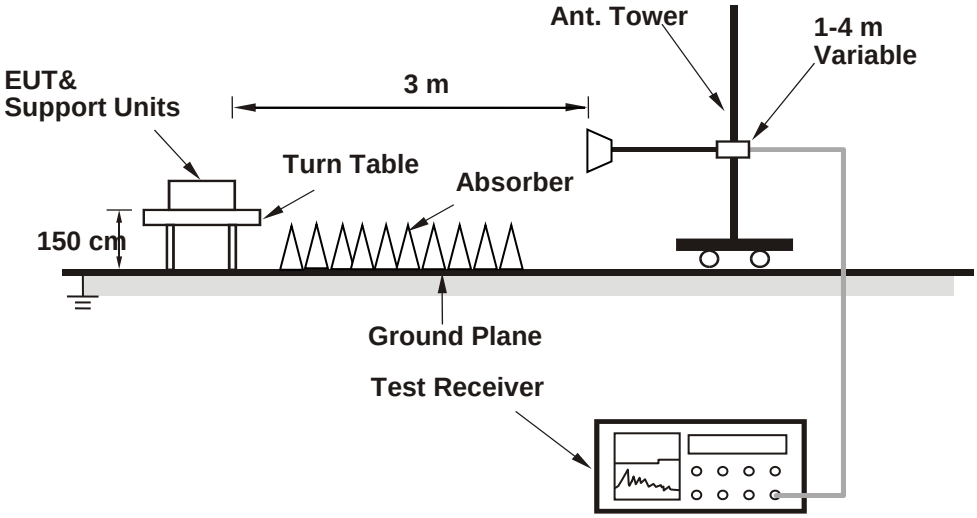
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.7 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

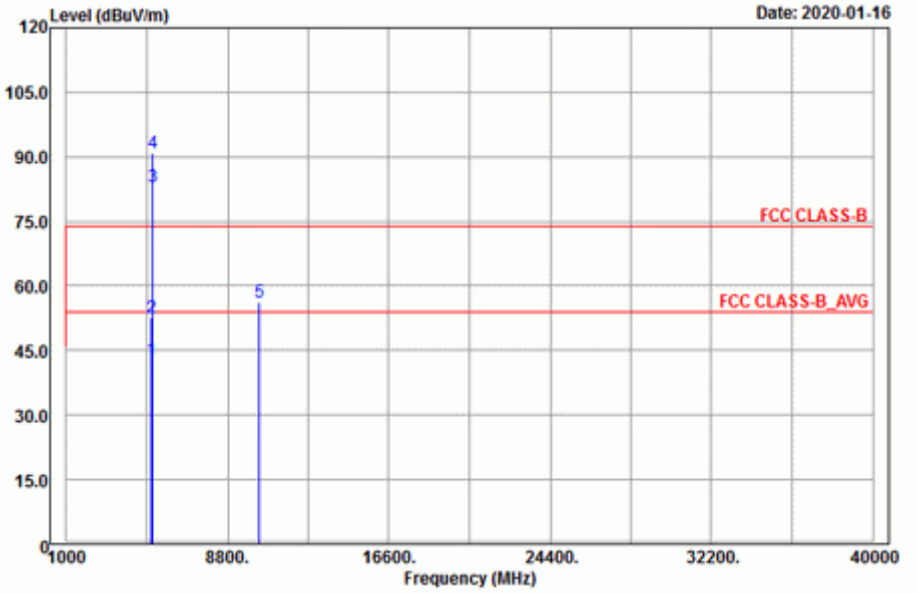
4.1.8 Test Results

Above 1 GHz Data：

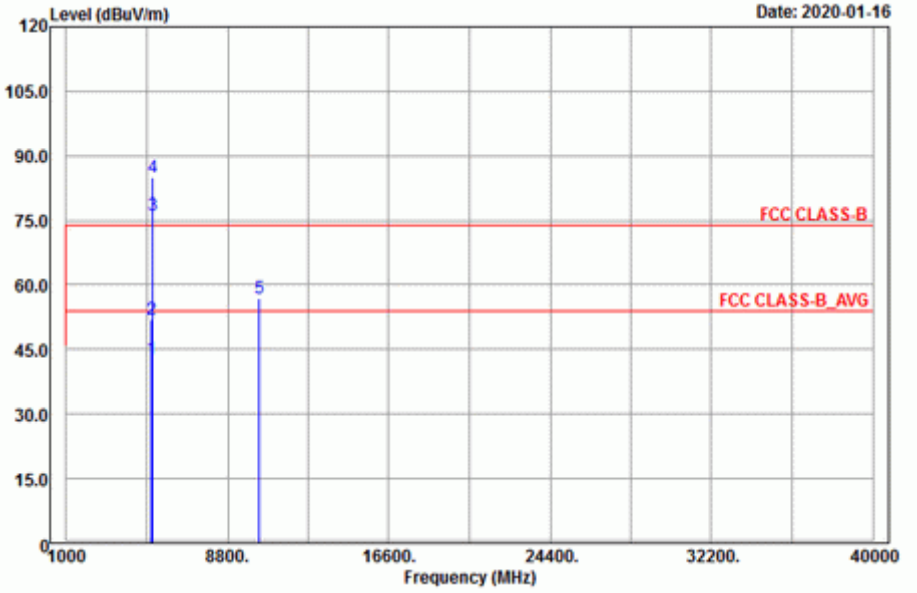
802.11n (HT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 36	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

Horizontal



Vertical



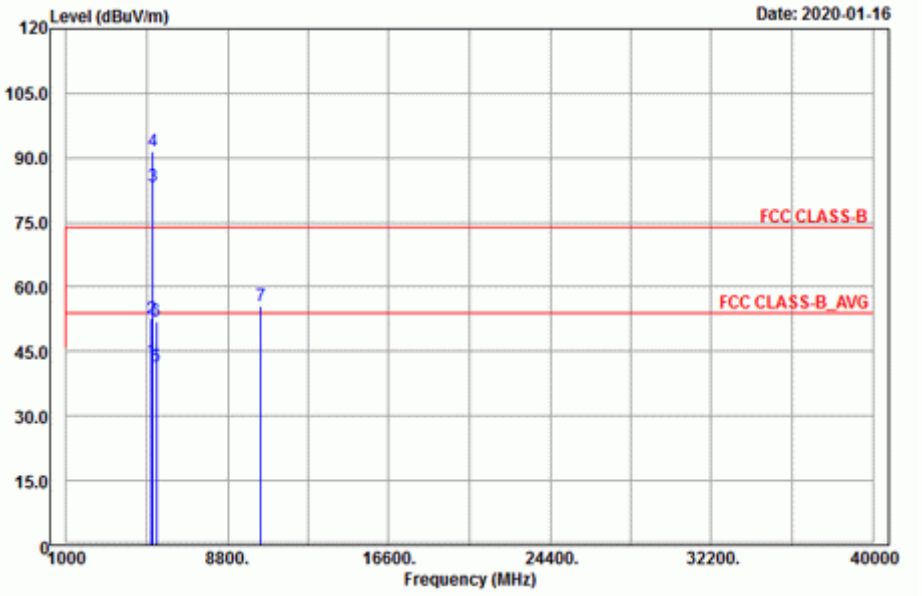
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5110.1	42.76	32.8	9.96	54	-11.24	252	316	Average
5110.1	52.54	42.58	9.96	74	-21.46	252	316	Peak
5180	83.05	72.93	10.12			252	316	Average
5180	91.06	80.94	10.12			252	316	Peak
*10360	56.21	40.19	16.02	68.2	-11.99	183	207	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5120.6	42.71	32.74	9.97	54	-11.29	303	0	Average
5120.6	52.11	42.14	9.97	74	-21.89	303	0	Peak
5180	76.34	66.22	10.12			303	0	Average
5180	84.93	74.81	10.12			303	0	Peak
*10360	57.05	41.03	16.02	68.2	-11.15	145	178	Peak

Remarks:

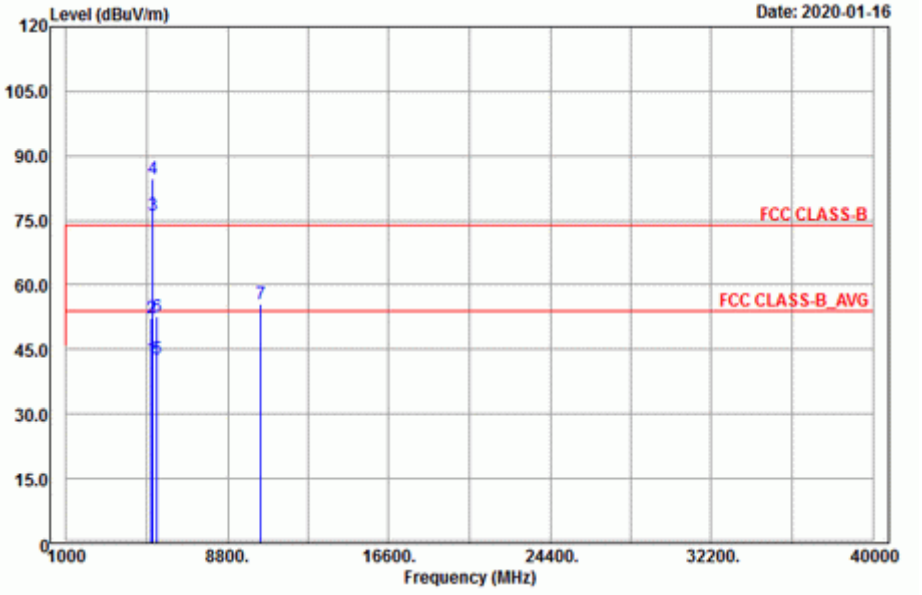
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5180 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit
5. Band 5250-5350MHz of unwanted emissions please refer to report of Annex B.

EUT Test Condition		Measurement Detail	
Channel	Channel 40	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

Horizontal



Vertical



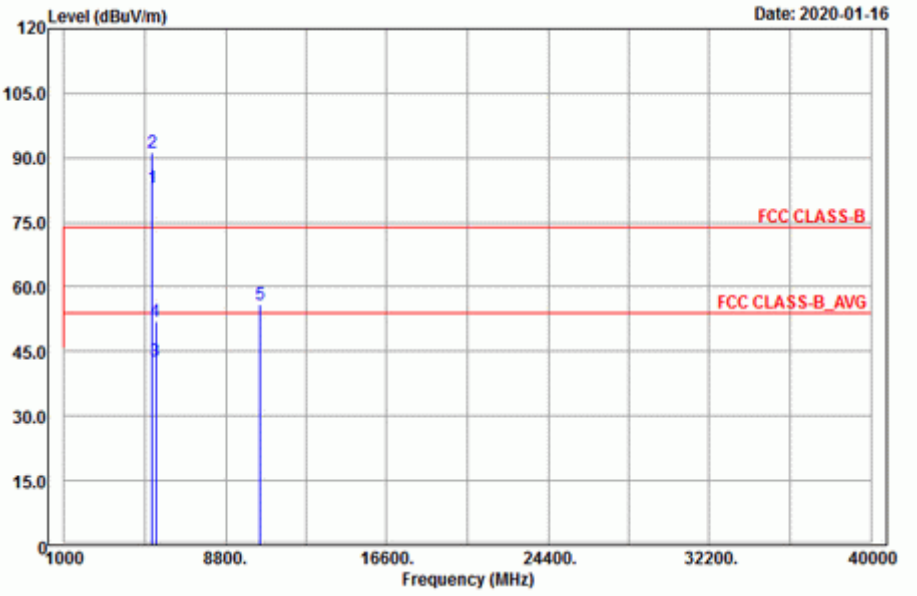
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5134.55	42.93	32.93	10	54	-11.07	252	316	Average
5134.55	52.8	42.8	10	74	-21.2	252	316	Peak
5200	83.51	73.35	10.16			252	316	Average
5200	91.59	81.43	10.16			252	316	Peak
5374.75	41.63	31.34	10.29	54	-12.37	252	316	Average
5374.75	52.08	41.79	10.29	74	-21.92	252	316	Peak
*10400	55.7	39.52	16.18	68.2	-12.5	190	231	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5110.55	42.69	32.73	9.96	54	-11.31	303	0	Average
5110.55	52.35	42.39	9.96	74	-21.65	303	0	Peak
5200	76.3	66.14	10.16			303	0	Average
5200	84.84	74.68	10.16			303	0	Peak
5396.42	42.81	32.44	10.37	54	-11.19	303	0	Average
5396.42	52.58	42.21	10.37	74	-21.42	303	0	Peak
*10400	55.59	39.41	16.18	68.2	-12.61	154	223	Peak

Remarks:

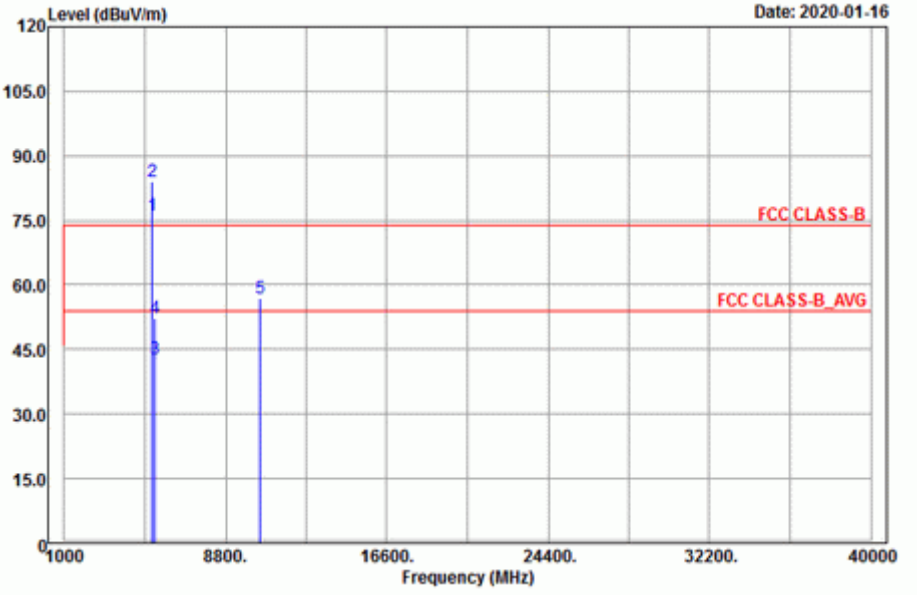
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5200 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit
5. Band 5250-5350MHz of unwanted emissions please refer to report of Annex B.

EUT Test Condition		Measurement Detail	
Channel	Channel 48	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

Horizontal



Vertical



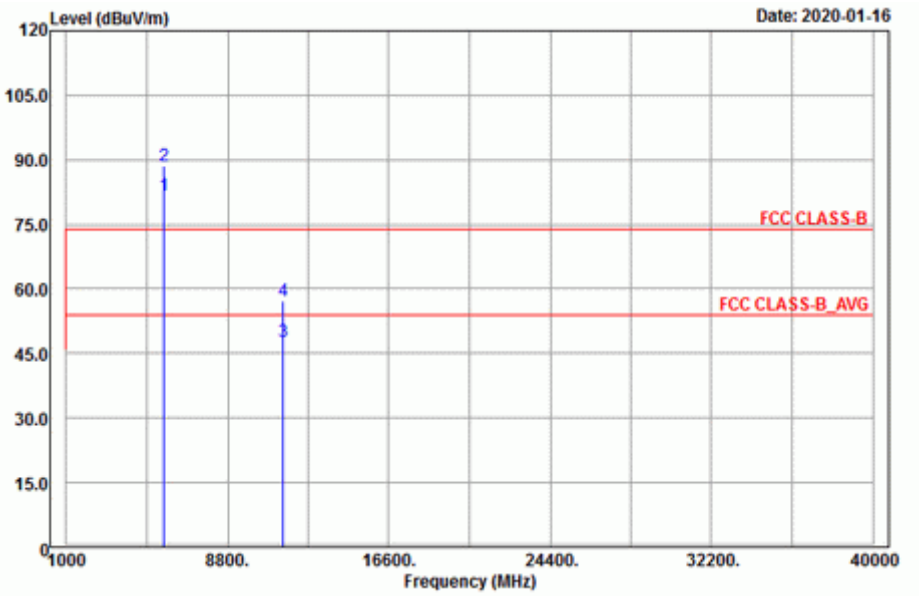
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5240	82.95	72.81	10.14			252	316	Average
5240	91.21	81.07	10.14			252	316	Peak
5422.49	42.69	32.27	10.42	54	-11.31	252	316	Average
5422.49	52.15	41.73	10.42	74	-21.85	252	316	Peak
*10480	55.96	40.06	15.9	68.2	-12.24	129	46	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5240	76.25	66.11	10.14			303	0	Average
5240	84.12	73.98	10.14			303	0	Peak
5384.21	42.7	32.36	10.34	54	-11.3	303	0	Average
5384.21	52.34	42	10.34	74	-21.66	303	0	Peak
*10480	56.88	40.98	15.9	68.2	-11.32	175	106	Peak

Remarks:

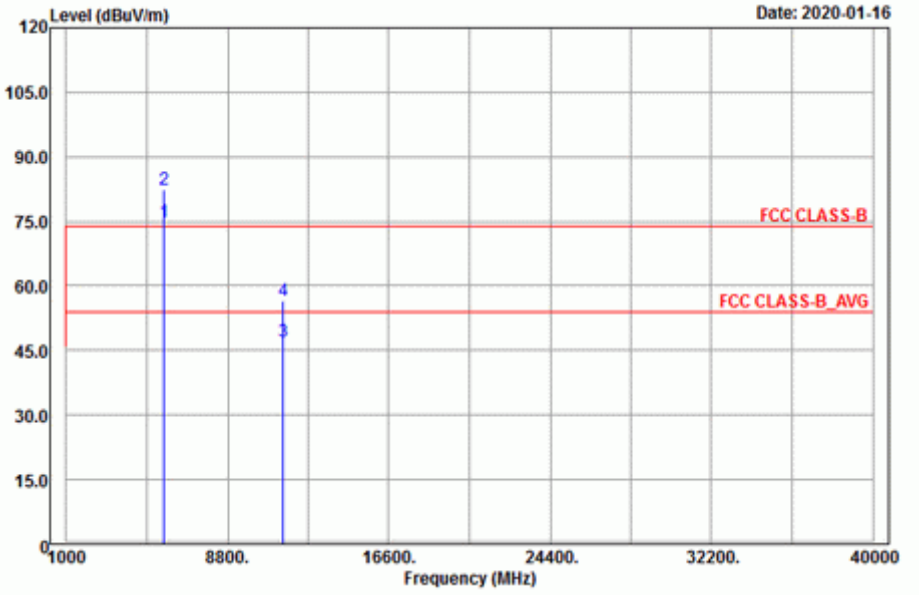
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5240 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit
5. Band 5250-5350MHz of unwanted emissions please refer to report of Annex B.

EUT Test Condition		Measurement Detail	
Channel	Channel 149	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

<Spurious Emission>
Horizontal



Vertical



<Spurious Emission>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5745	81.85	70.97	10.88			236	293	Average
5745	88.61	77.73	10.88			236	293	Peak
11490	47.73	31.26	16.47	54	-6.27	152	82	Average
11490	57.15	40.68	16.47	74	-16.85	152	82	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5745	74.84	63.96	10.88			224	38	Average
5745	82.55	71.67	10.88			224	38	Peak
11490	46.93	30.46	16.47	54	-7.07	138	171	Average
11490	56.6	40.13	16.47	74	-17.4	138	171	Peak

<Out of Band Emission (OOBE)>

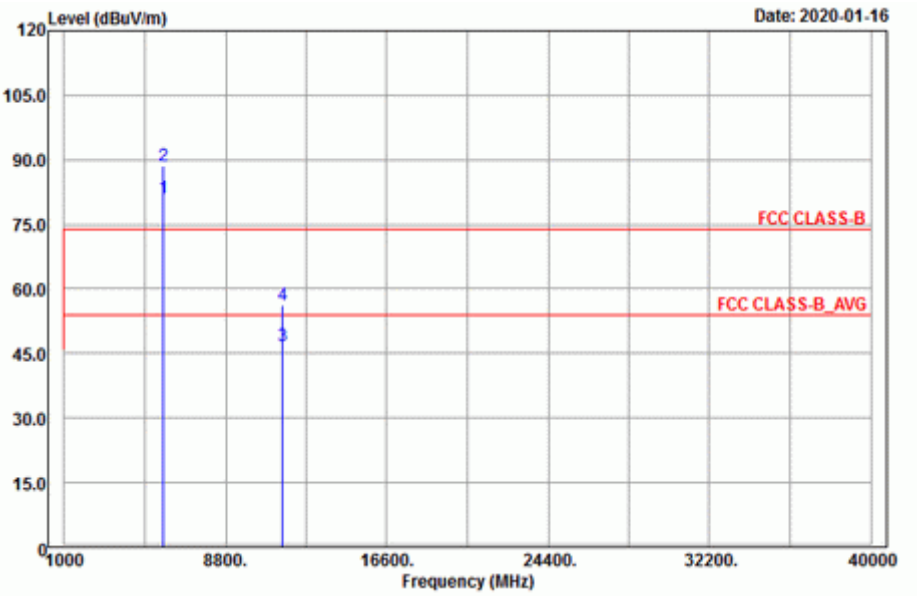
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
*5572.975	53.71	43.01	10.7	68.2	-14.49	236	293	Peak
5652.25	50.89	40.02	10.87	69.86	-18.97	236	293	Peak
5920.525	51.4	40.31	11.09	71.51	-20.11	236	293	Peak
*5981.425	52.74	41.48	11.26	68.2	-15.46	236	293	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
*5531.5	52.36	41.72	10.64	68.2	-15.84	224	38	Peak
5654.35	49.66	38.79	10.87	71.42	-21.76	224	38	Peak
5920	51.68	40.59	11.09	71.9	-20.22	224	38	Peak
*5928.925	52.72	41.61	11.11	68.2	-15.48	224	38	Peak

Remarks:

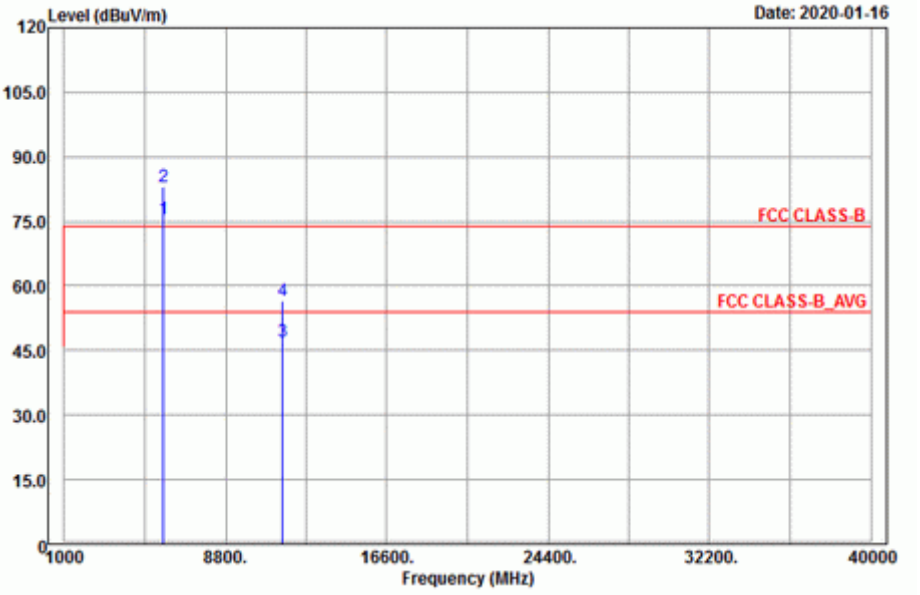
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5745 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit

EUT Test Condition		Measurement Detail	
Channel	Channel 157	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

<Spurious Emission>
Horizontal



Vertical



<Spurious Emission>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5785	81.06	70.25	10.81			236	293	Average
5785	88.45	77.64	10.81			236	293	Peak
11570	46.81	30.32	16.49	54	-7.19	129	136	Average
11570	56.37	39.88	16.49	74	-17.63	129	136	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5785	75.39	64.58	10.81			224	38	Average
5785	82.98	72.17	10.81			224	38	Peak
11570	47.11	30.62	16.49	54	-6.89	128	234	Average
11570	56.59	40.1	16.49	74	-17.41	128	234	Peak

<Out of Band Emission (OOBE)>

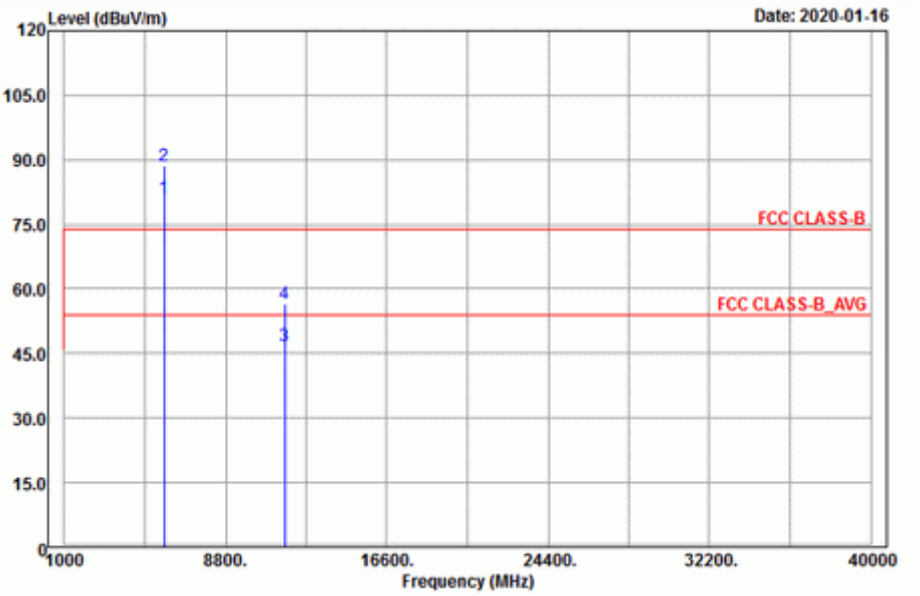
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
*5584.525	52.88	42.15	10.73	68.2	-15.32	236	293	Peak
5659.6	51.81	40.94	10.87	75.3	-23.49	236	293	Peak
5923.15	51.66	40.55	11.11	69.57	-17.91	236	293	Peak
*5991.925	52.29	40.96	11.33	68.2	-15.91	236	293	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
*5601.325	53.21	42.45	10.76	68.2	-14.99	224	38	Peak
5656.975	51.79	40.92	10.87	73.36	-21.57	224	38	Peak
5911.075	53.28	42.21	11.07	78.5	-25.22	224	38	Peak
*6003.475	52.12	40.79	11.33	68.2	-16.08	224	38	Peak

Remarks:

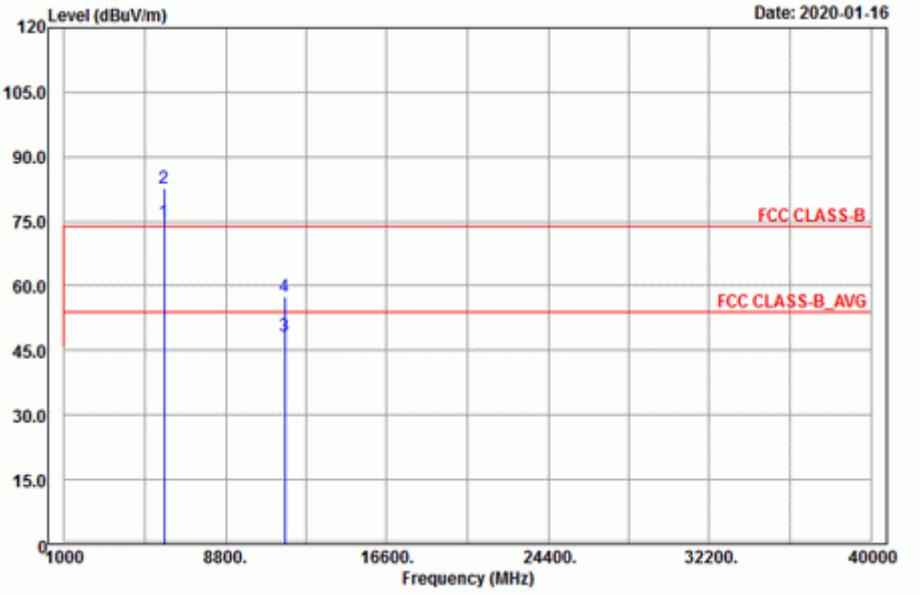
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5785 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit

EUT Test Condition		Measurement Detail	
Channel	Channel 165	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

<Spurious Emission>
Horizontal



Vertical



<Spurious Emission>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5825	80.94	70.06	10.88			236	293	Average
5825	88.47	77.59	10.88			236	293	Peak
11650	46.88	30.1	16.78	54	-7.12	107	59	Average
11650	56.43	39.65	16.78	74	-17.57	107	59	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5825	75	64.12	10.88			224	38	Average
5825	82.85	71.97	10.88			224	38	Peak
11650	**48.23**	**31.45**	**16.78**	**54**	**-5.77**	**127**	**343**	**Average**
11650	57.65	40.87	16.78	74	-16.35	127	343	Peak

<Out of Band Emission (OOBE)>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
*5632.825	52.07	41.24	10.83	68.2	-16.13	236	293	Peak
5652.25	50.8	39.93	10.87	69.86	-19.06	236	293	Peak
5921.05	51.59	40.5	11.09	71.12	-19.53	236	293	Peak
*5963.575	52.18	40.95	11.23	68.2	-16.02	236	293	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
*5584	52.61	41.88	10.73	68.2	-15.59	224	38	Peak
5652.25	50.67	39.8	10.87	69.86	-19.19	224	38	Peak
5913.175	51.22	40.15	11.07	76.95	-25.73	224	38	Peak
*5982.475	52.09	40.83	11.26	68.2	-16.11	224	38	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5825 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit

9 kHz ~ 30 MHz Data:

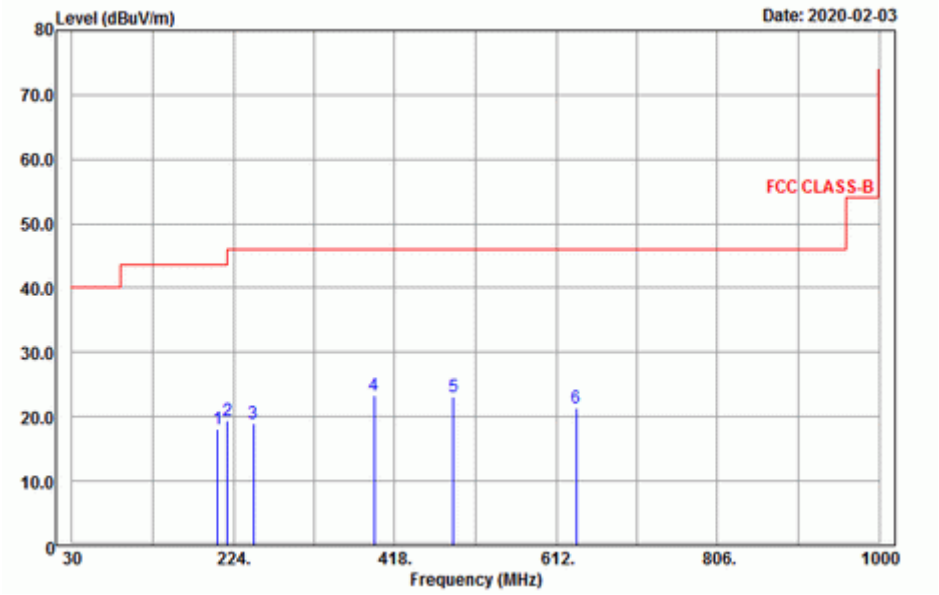
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

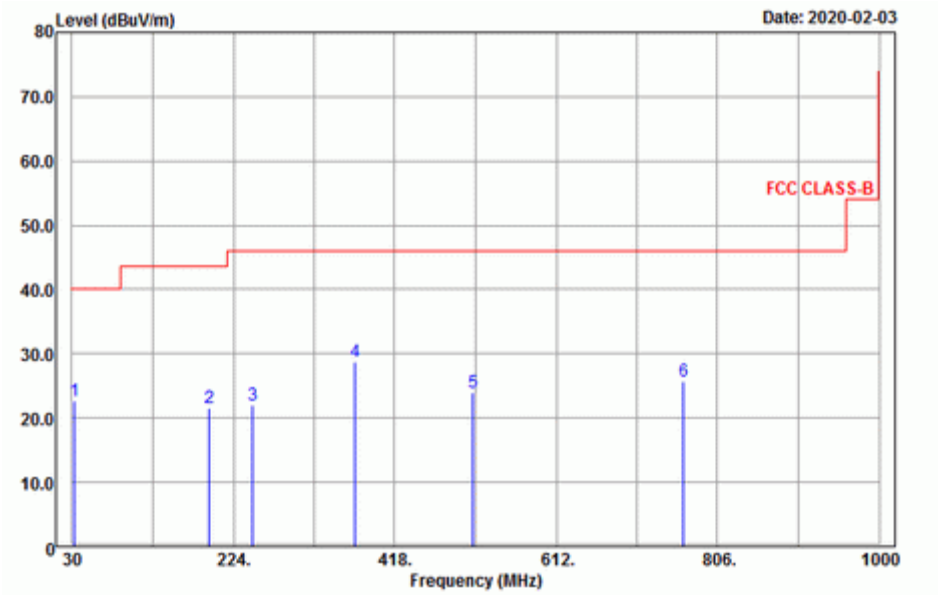
802.11n (HT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 165	**Frequency Range**	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
204.96	18.18	36.36	-18.18	43.5	-25.32	142	204	Peak
217.11	19.37	37.29	-17.92	46	-26.63	115	86	Peak
247.89	18.87	35.74	-16.87	46	-27.13	195	185	Peak
393.1	23.28	37.34	-14.06	46	-22.72	131	289	Peak
488.3	23.02	35.56	-12.54	46	-22.98	161	195	Peak
636	21.29	31.62	-10.33	46	-24.71	164	222	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
32.7	22.78	40.76	-17.98	40	-17.22	199	207	Peak
194.97	21.68	40.07	-18.39	43.5	-21.82	187	175	Peak
246.81	22.04	38.93	-16.89	46	-23.96	181	306	Peak
370	28.71	43.09	-14.38	46	-17.29	136	175	Peak
512.1	24.07	36.26	-12.19	46	-21.93	105	165	Peak
765.5	25.62	33.87	-8.25	46	-20.38	189	51	Peak

Remarks:

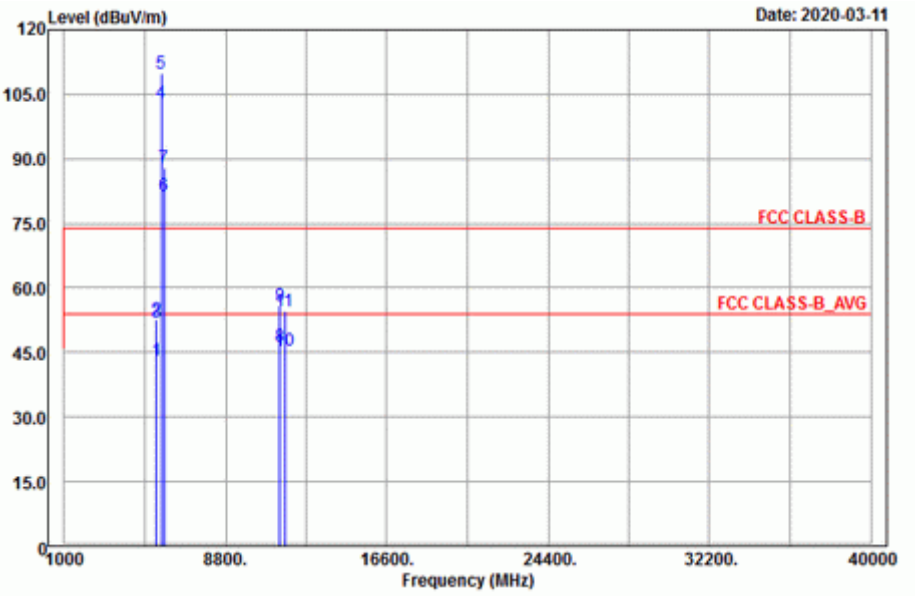
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. The emission levels of other frequencies were very low against the limit

Co-located Data:

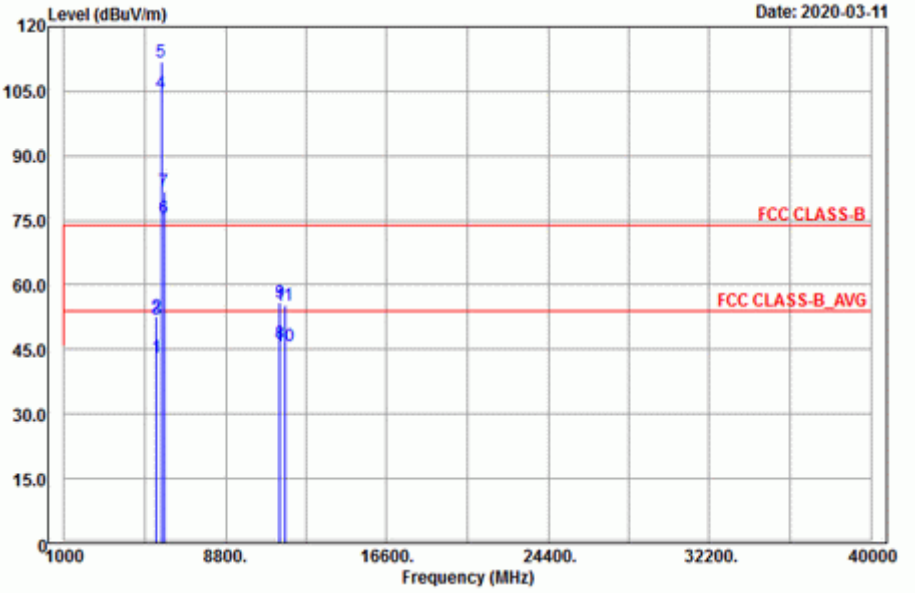
Accessory Radio WLAN 5GHz 802.11n (HT20)_CH165 + Intel WLAN 5GHz 802.11ax (HE40)_CH142:

EUT Test Condition		Measurement Detail	
Channel	Channel 165 + 142	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

<Spurious Emission>
Horizontal



Vertical



<Spurious Emission>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5460	43.22	31.94	11.28	54	-10.78	155	292	Average
5460	52.69	41.41	11.28	74	-21.31	155	292	Peak
*5470	52.05	40.75	11.3	68.2	-16.15	155	292	Peak
5710	102.9	91.21	11.69			155	292	Average
5710	109.79	98.1	11.69			155	292	Peak
5825	81.36	69.7	11.66			236	288	Average
5825	87.87	76.21	11.66			236	288	Peak
11420	46.39	30.13	16.26	54	-7.61	105	187	Average
11420	55.94	39.68	16.26	74	-18.06	105	187	Peak
11650	45.3	28.52	16.78	54	-8.7	169	243	Average
11650	54.75	37.97	16.78	74	-19.25	169	243	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5460	43.19	31.91	11.28	54	-10.81	183	345	Average
5460	52.77	41.49	11.28	74	-21.23	183	345	Peak
*5470	51.99	40.69	11.3	68.2	-16.21	183	345	Peak
5710	104.69	93	11.69			183	345	Average
5710	111.75	100.06	11.69			183	345	Peak
5825	75.41	63.75	11.66			234	346	Average
5825	81.87	70.21	11.66			234	346	Peak
11420	46.42	30.16	16.26	54	-7.58	102	323	Average
11420	56	39.74	16.26	74	-18	102	323	Peak
11650	45.87	29.09	16.78	54	-8.13	145	106	Average
11650	55.41	38.63	16.78	74	-18.59	145	106	Peak

<Out of Band Emission (OOBE)>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5579.8	52.99	42.28	10.71	68.2	-15.21	236	288	Peak
5655.4	51.99	41.12	10.87	72.2	-20.21	236	288	Peak
5918.425	51.23	40.14	11.09	73.07	-21.84	236	288	Peak
5970.4	51.72	40.47	11.25	68.2	-16.48	236	288	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5639.65	54.11	43.28	10.83	68.2	-14.09	234	346	Peak
5653.3	52.8	41.93	10.87	70.64	-17.84	234	346	Peak
5922.625	51.01	39.9	11.11	69.96	-18.95	234	346	Peak
5996.65	51.72	40.39	11.33	68.2	-16.48	234	346	Peak

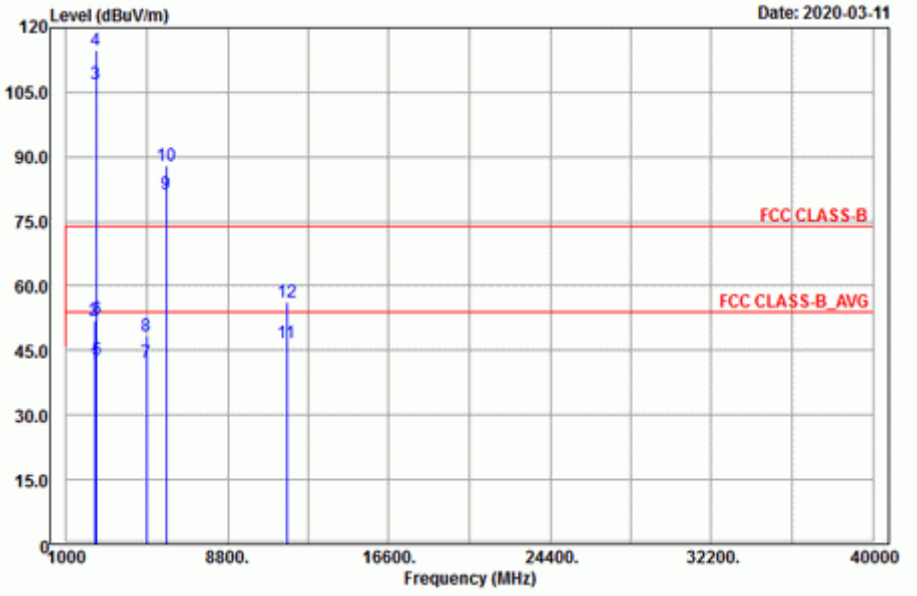
Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 5710 MHz & 5825 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit

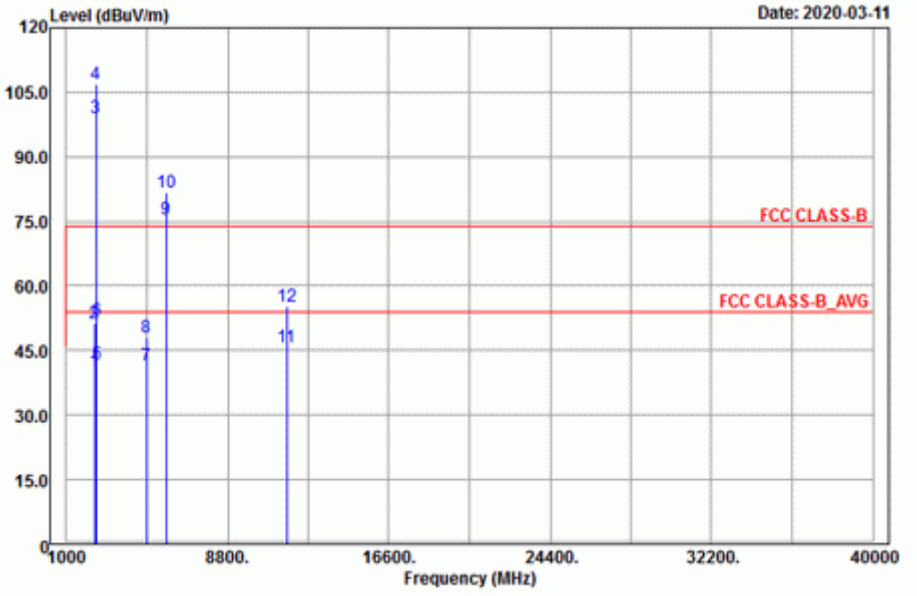
Accessory Radio WLAN 5GHz 802.11n (HT20)_CH165 + Intel WLAN 2.4GHz 802.11n (HT20)_CH6:

EUT Test Condition		Measurement Detail	
Channel	Channel 165 + 6	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

<Spurious Emission>
Horizontal



Vertical



<Spurious Emission>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2390	41.96	36.95	5.01	54	-12.04	260	6	Average
2390	51.93	46.92	5.01	74	-22.07	260	6	Peak
2437	107.02	101.91	5.11			260	6	Average
2437	114.88	109.77	5.11			260	6	Peak
2483.5	42.71	37.52	5.19	54	-11.29	260	6	Average
2483.5	52.42	47.23	5.19	74	-21.58	260	6	Peak
4874	42.03	31.82	10.21	54	-11.97	181	64	Average
4874	48.43	38.22	10.21	74	-25.57	181	64	Peak
5825	81.26	69.6	11.66			236	288	Average
5825	87.8	76.14	11.66			236	288	Peak
11650	46.68	29.9	16.78	54	-7.32	108	131	Average
11650	56.31	39.53	16.78	74	-17.69	108	131	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2390	40.19	35.18	5.01	54	-13.81	323	105	Average
2390	51.21	46.2	5.01	74	-22.79	323	105	Peak
2437	99.09	93.98	5.11			323	105	Average
2437	106.83	101.72	5.11			323	105	Peak
2483.5	41.79	36.6	5.19	54	-12.21	323	105	Average
2483.5	51.93	46.74	5.19	74	-22.07	323	105	Peak
4874	41.57	31.36	10.21	54	-12.43	137	154	Average
4874	47.94	37.73	10.21	74	-26.06	137	154	Peak
5825	75.4	63.74	11.66			234	346	Average
5825	81.89	70.23	11.66			234	346	Peak
11650	45.66	28.88	16.78	54	-8.34	145	172	Average
11650	55.13	38.35	16.78	74	-18.87	145	172	Peak

<Out of Band Emission (OOBE)>

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5591.35	51.88	41.15	10.73	68.2	-16.32	236	288	Peak
5653.3	50.66	39.79	10.87	70.64	-19.98	236	288	Peak
5920.525	49.62	38.53	11.09	71.51	-21.89	236	288	Peak
6013.975	51.94	40.59	11.35	68.2	-16.26	236	288	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
5644.9	51.96	41.13	10.83	68.2	-16.24	234	346	Peak
5651.2	50.85	39.98	10.87	69.09	-18.24	234	346	Peak
5923.15	50.51	39.4	11.11	69.57	-19.06	234	346	Peak
5936.275	51.79	40.63	11.16	68.2	-16.41	234	346	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2437 MHz & 5825 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The emission levels of other frequencies were very low against the limit

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 21, 2019	Feb. 20, 2020
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

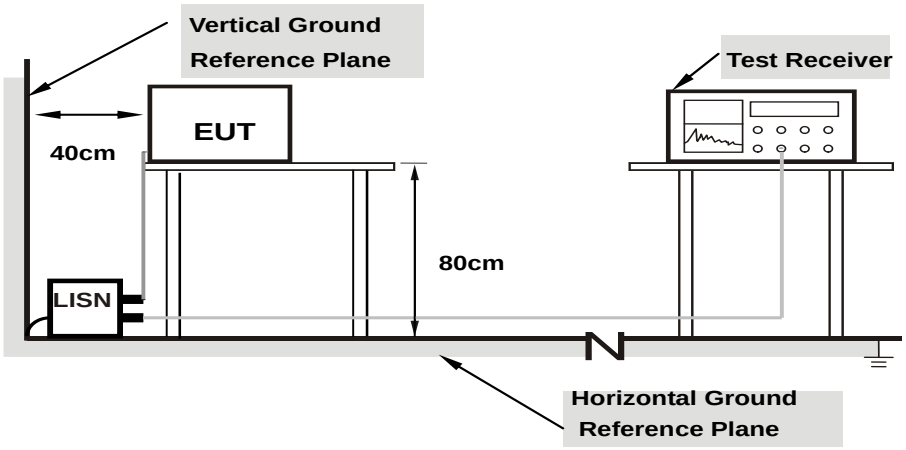
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit -20 dB) was not recorded.

Note: All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

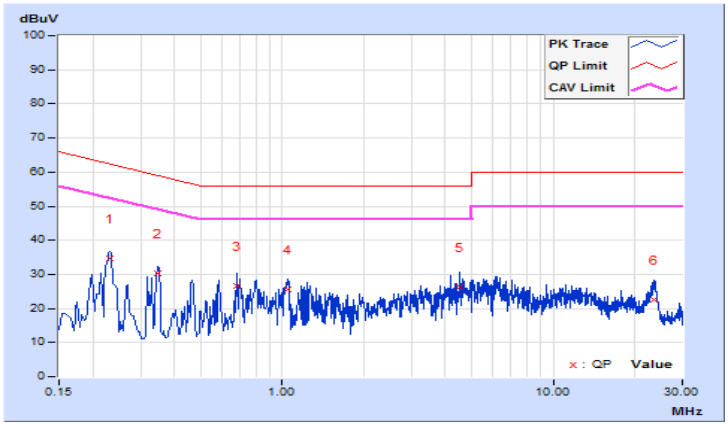
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 75%RH
Tested by	Jones Chang	Test Date	2020/2/4

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.22985**	**9.66**	**25.17**	**19.26**	**34.83**	**28.92**	**62.46**	**52.46**	**-27.63**	**-23.54**
2	0.34577	9.68	20.61	13.72	30.29	23.40	59.06	49.06	-28.77	-25.66
3	0.67800	9.71	16.75	6.08	26.46	15.79	56.00	46.00	-29.54	-30.21
4	1.04830	9.73	15.83	6.28	25.56	16.01	56.00	46.00	-30.44	-29.99
5	4.53800	9.85	16.48	6.17	26.33	16.02	56.00	46.00	-29.67	-29.98
6	23.60200	10.00	12.66	6.46	22.66	16.46	60.00	50.00	-37.34	-33.54

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

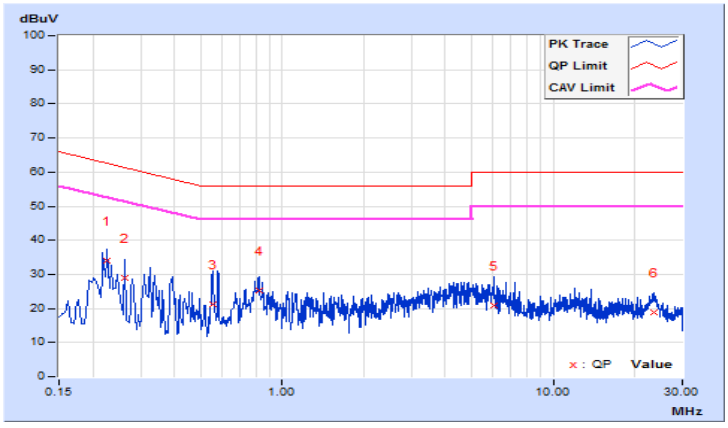


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 75%RH
Tested by	Jones Chang	Test Date	2020/2/4

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.22600	9.64	24.26	12.20	33.90	21.84	62.60	52.60	-28.70	-30.76
2	0.26200	9.65	19.33	1.88	28.98	11.53	61.37	51.37	-32.39	-39.84
3	0.55400	9.67	11.67	1.15	21.34	10.82	56.00	46.00	-34.66	-35.18
4	0.82200	9.69	15.47	8.49	25.16	18.18	56.00	46.00	-30.84	-27.82
5	6.06600	9.84	11.06	1.91	20.90	11.75	60.00	50.00	-39.10	-38.25
6	23.47400	10.08	8.86	2.10	18.94	12.18	60.00	50.00	-41.06	-37.82

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



4.3 Transmit Power Measurement

4.3.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p ≦ 125 mW (21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
		Indoor Access Point	1 Watt (30 dBm)
	√	Mobile and Portable client device	250 mW (24 dBm)
U-NII-2A	-		250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-2C	-		250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-3	√		1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

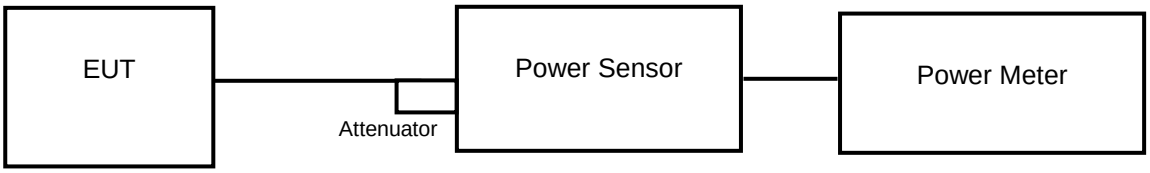
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

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

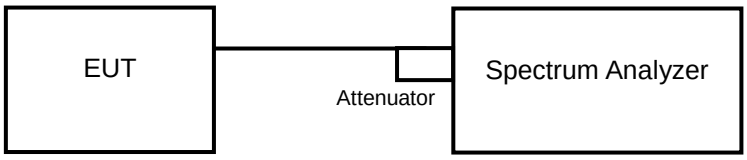
For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.3.2 Test Setup

<Power Output Measurement>



<26 dB Bandwidth>



4.3.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.3.4 Test Procedure

Average Power Measurement

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

Note: Test item have been performed as per the ANSI C63.10, 12.3.3.2.

26 dB Bandwidth

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 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Results

Power Output:

802.11n (HT20)

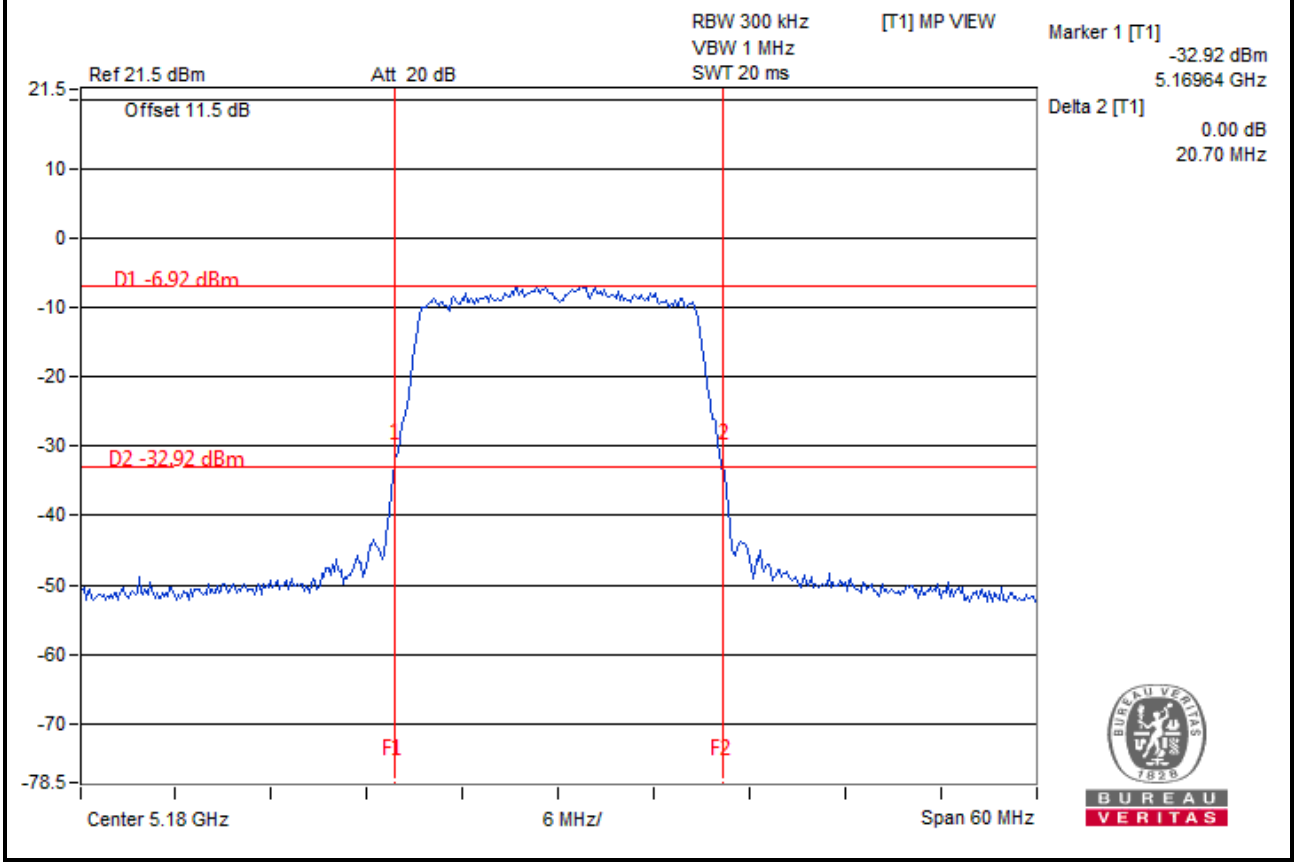
Channel	Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass / Fail
36	5180	0.8356	-0.78	24	Pass
40	5200	0.873	-0.59	24	Pass
48	5240	0.867	-0.62	24	Pass
149	5745	0.877	-0.57	30	Pass
157	5785	0.873	-0.59	30	Pass
165	5825	0.881	-0.55	30	Pass

26 dB Bandwidth:

802.11n (HT20)

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	20.70
40	5200	20.42
48	5240	20.59

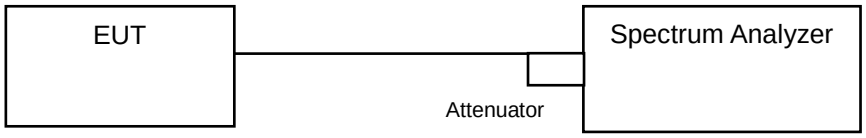
Spectrum Plot of Worst Value



Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

4.4 Occupied Bandwidth Measurement (99%)

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.4.3 Test Procedure

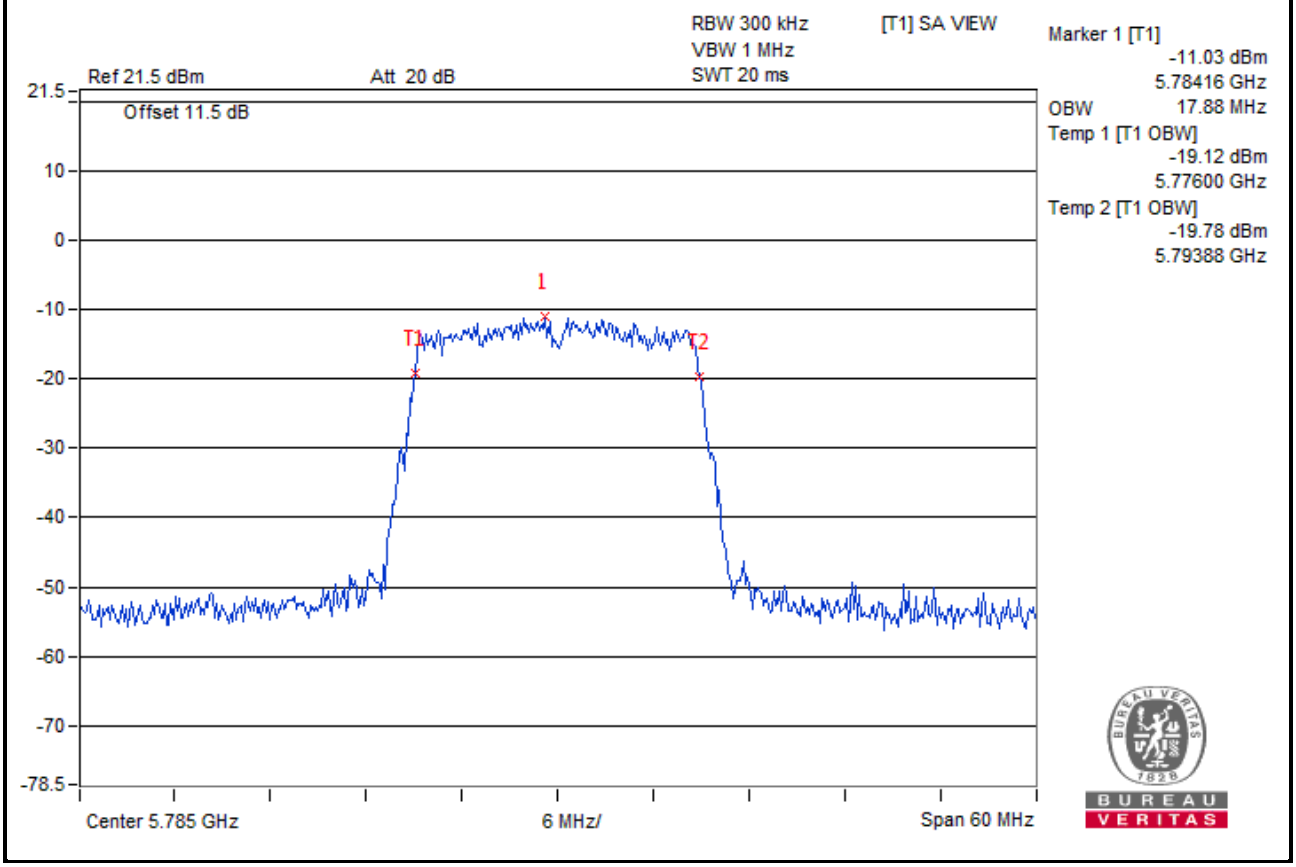
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to SAMPLE. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.4 Test Results

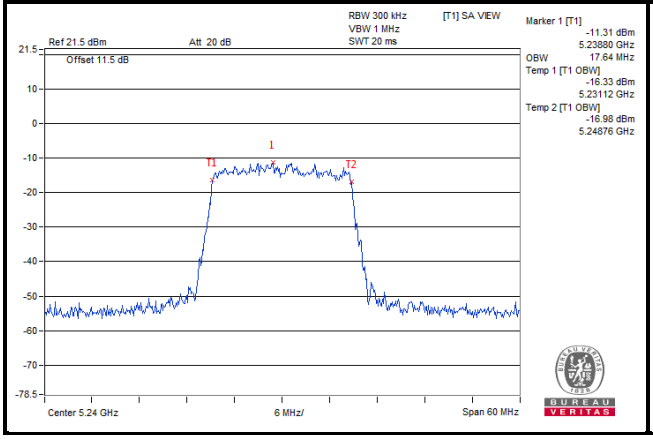
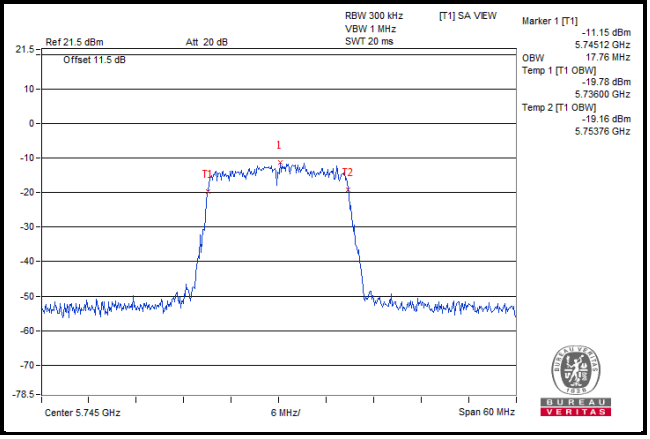
802.11n (HT20)

Channel	Channel Frequency (99%) (MHz)	Occupied Bandwidth (99%) (MHz)
36	5180	17.76
40	5200	17.76
48	5240	17.64
149	5745	17.76
157	5785	17.88
165	5825	17.76

Spectrum Plot of Worst Value



Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

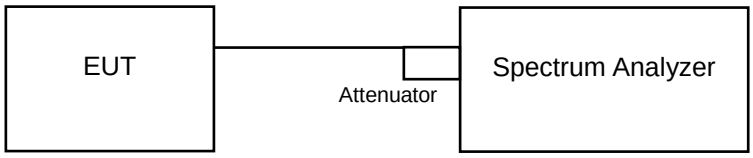
Spectrum Plot for Nearby DFS Band	
Ch 48 (5240 MHz)	Ch 149 (5745 MHz)
	

4.5 Peak Power Spectral Density Measurement

4.5.1 Limits of Peak Power Spectral Density Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17 dBm/MHz
		Fixed point-to-point Access Point	
		Indoor Access Point	
	√	Mobile and Portable client device	11 dBm/MHz
U-NII-2A	-		11 dBm/MHz
U-NII-2C	-		11 dBm/MHz
U-NII-3	√		30 dBm/500 kHz

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.5.4 Test Procedures

For U-NII-1 band:

Using method SA-2

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS
3. Sweep time = auto, trigger set to “free run”.
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and add 10 log (1/duty cycle)

※For U-NII-3:

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 RBW, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz / 300 kHz).
5. Sweep time = auto, trigger set to “free run”.
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value and add 10 log (1/duty cycle)

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

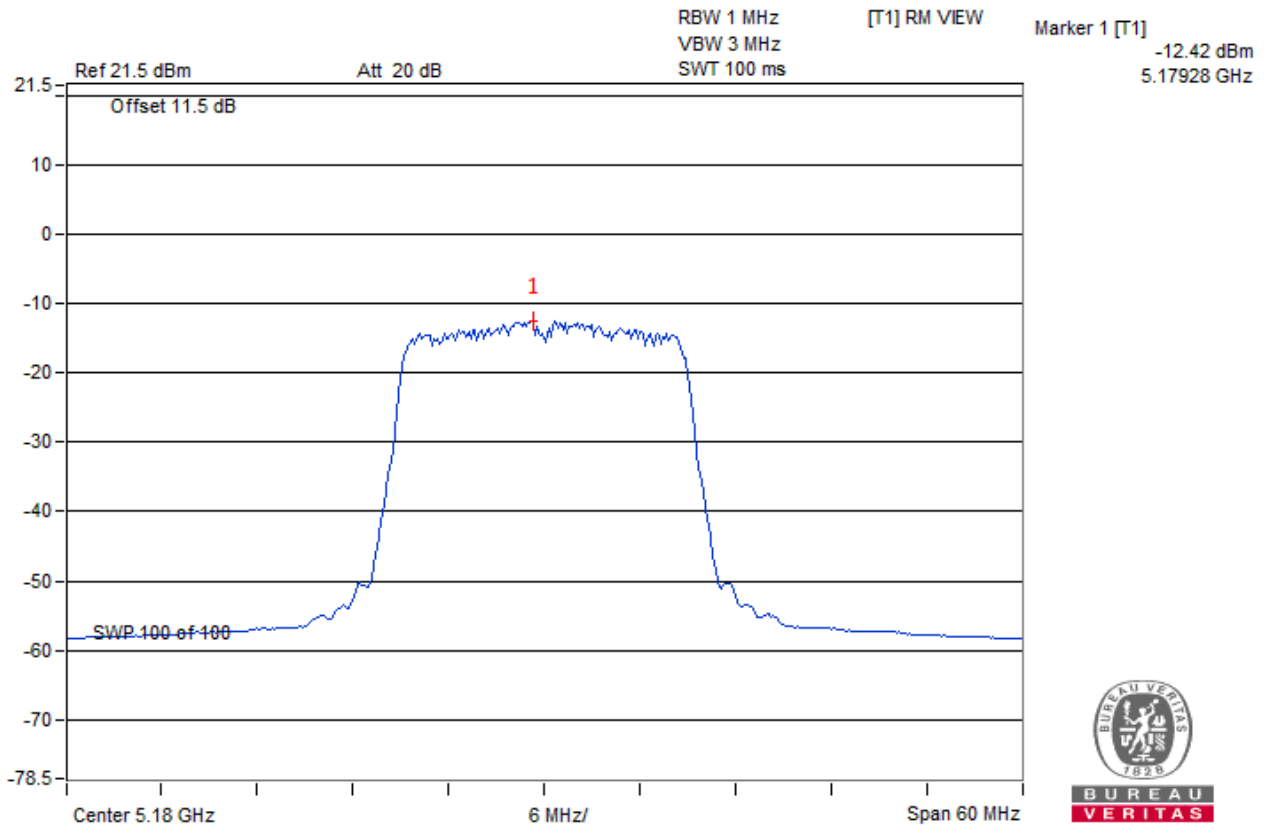
For U-NII-1 Band

802.11n (HT20)

Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/MHz)	Duty Factor (dB)	PSD with Duty Factor (dBm/MHz)	Maximum Limit (dBm/MHz)	Pass / Fail
36	5180	-12.42	0.68	-11.74	11	Pass
40	5200	-12.52	0.68	-11.84	11	Pass
48	5240	-12.65	0.68	-11.97	11	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value



Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

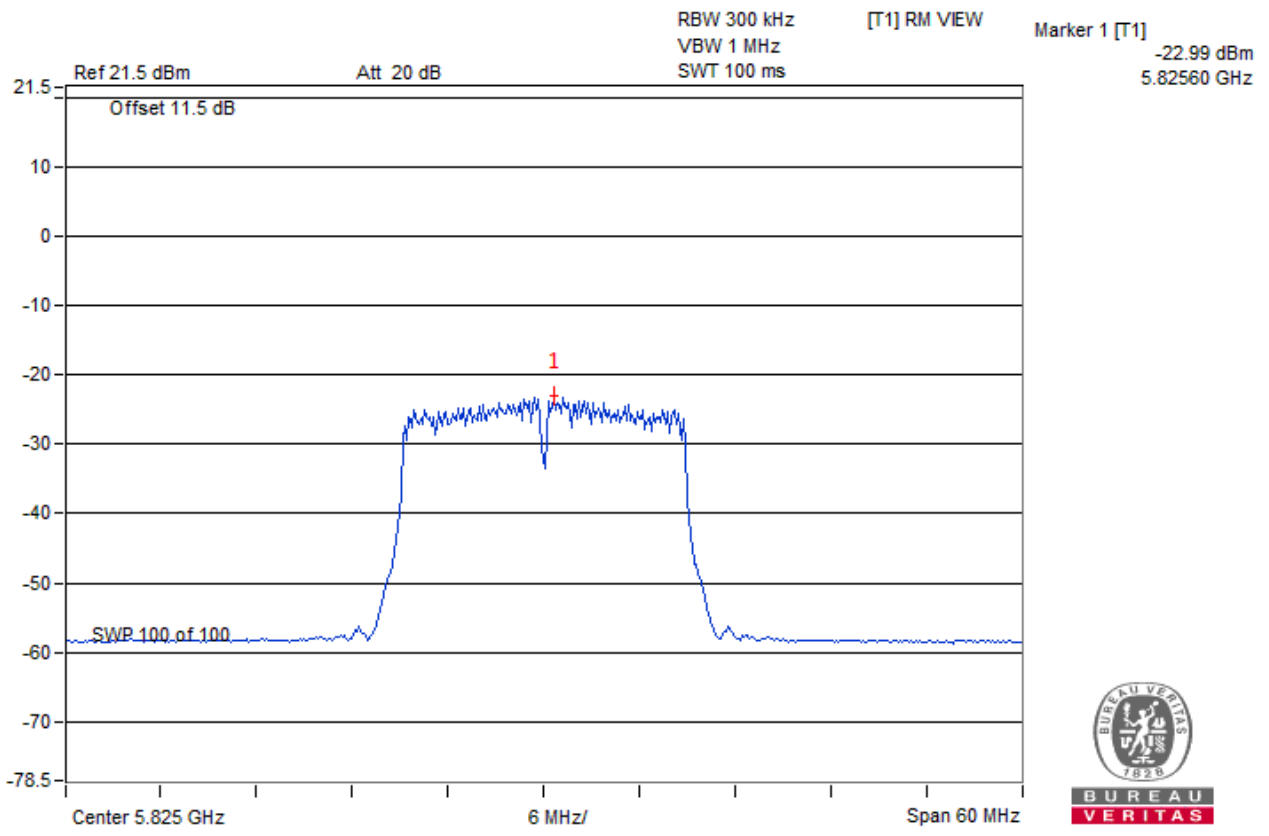
For U-NII-3 Band

802.11n (HT20)

Channel	Frequency (MHz)	PSD w/o Duty Factor		Duty Factor (dB)	PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		(dBm/300 kHz)	(dBm/500 kHz)				
149	5745	-23.77	-21.55	0.68	-20.87	30	Pass
157	5785	-23.51	-21.29	0.68	-20.61	30	Pass
165	5825	-22.99	-20.77	0.68	-20.09	30	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value



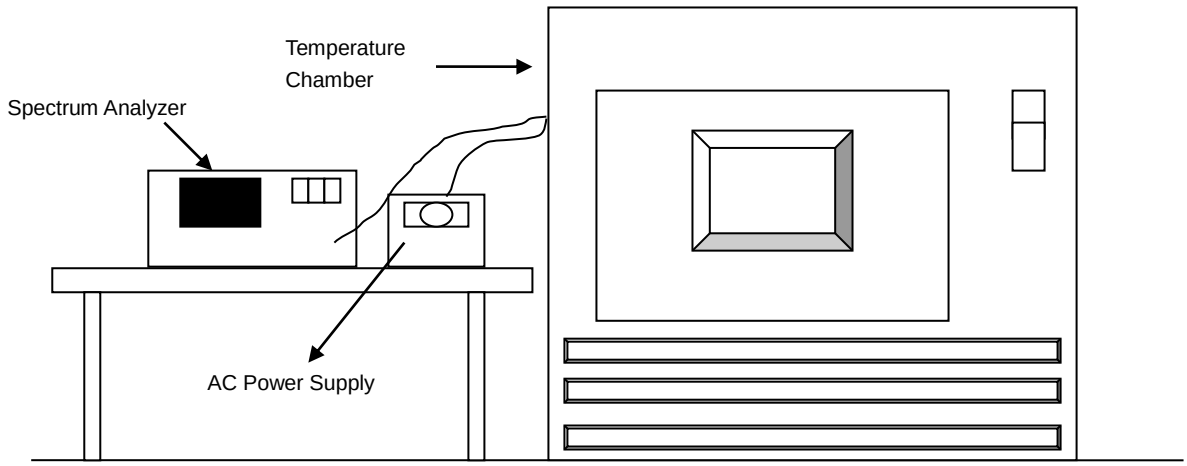
Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

4.6 Frequency Stability

4.6.1 Limit of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within band of operation.

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.6.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
b. Turn the EUT on and couple its output to a spectrum analyzer.
c. Turn the EUT off and set the chamber to the highest temperature specified.
d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
e. Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

4.6.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
35	120	5179.9962	PASS	5179.9945	PASS	5179.9978	PASS	5179.998	PASS
30	120	5179.9875	PASS	5179.9843	PASS	5179.9844	PASS	5179.9877	PASS
20	120	5179.9778	PASS	5179.9795	PASS	5179.9786	PASS	5179.9813	PASS
10	120	5179.9783	PASS	5179.9798	PASS	5179.9819	PASS	5179.9801	PASS
0	120	5180.0209	PASS	5180.0182	PASS	5180.0163	PASS	5180.0208	PASS

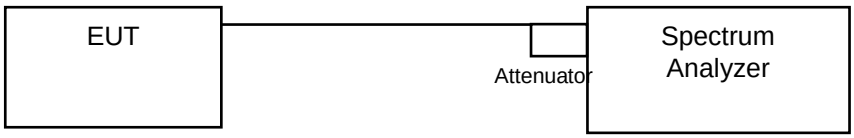
Frequency Stability Versus Voltage									
Operating Frequency: 5180 MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
20	138	5179.9772	PASS	5179.9797	PASS	5179.9783	PASS	5179.9806	PASS
	120	5179.9778	PASS	5179.9795	PASS	5179.9786	PASS	5179.9813	PASS
	102	5179.9774	PASS	5179.98	PASS	5179.9783	PASS	5179.9808	PASS

4.7 6 dB Bandwidth Measurement

4.7.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set resolution bandwidth (RBW) = 100 kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

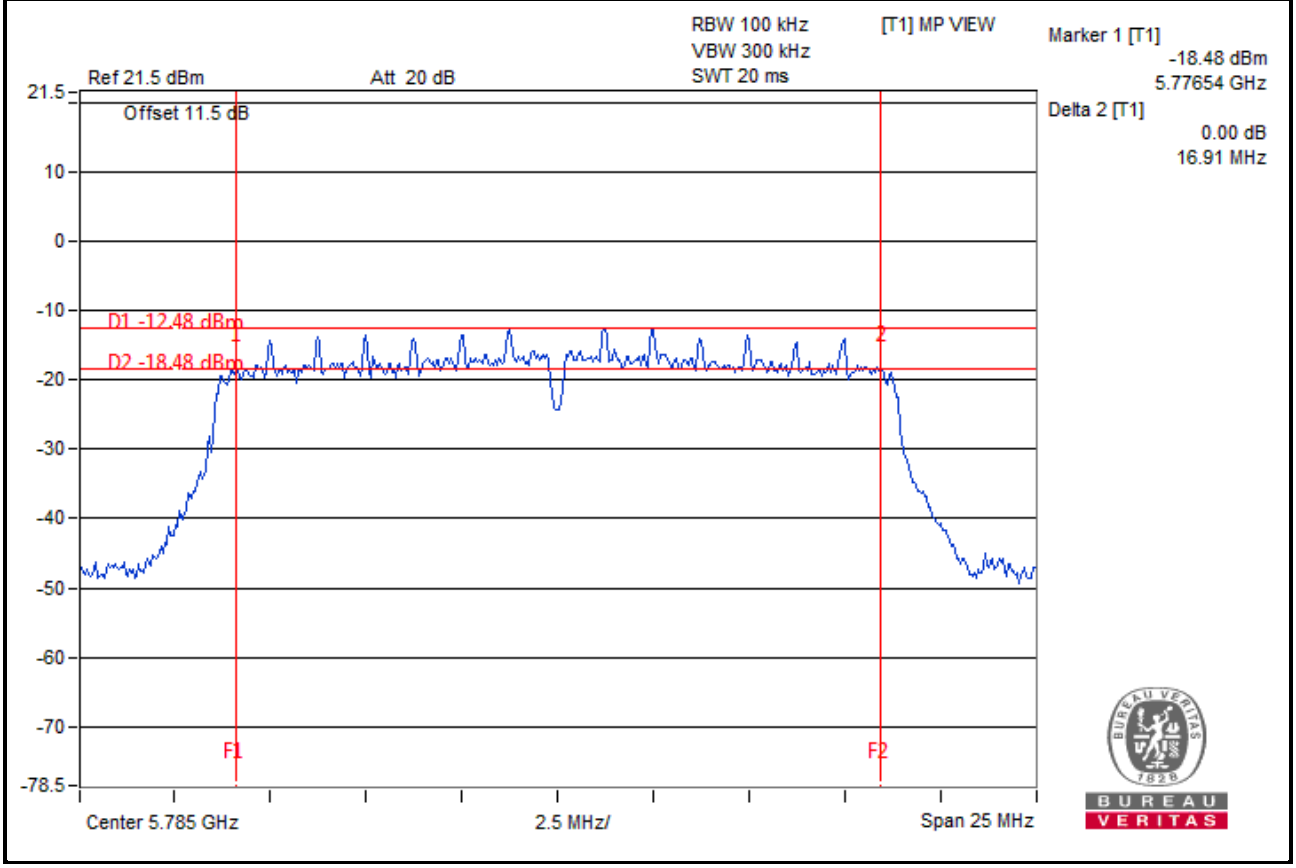
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.7.7 Test Results

802.11n (HT20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	17.10	0.5	Pass
157	5785	16.91	0.5	Pass
165	5825	17.03	0.5	Pass

Spectrum Plot of Worst Value



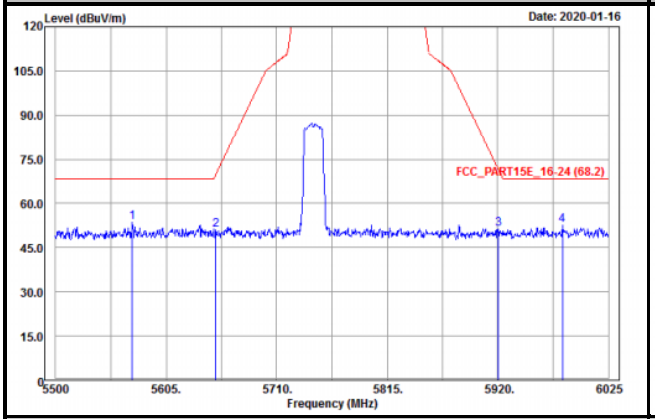
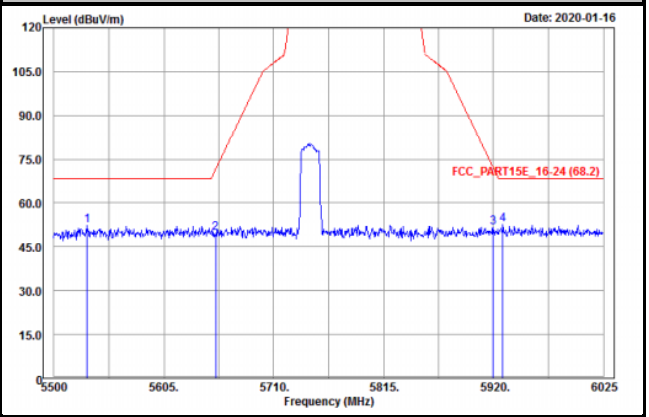
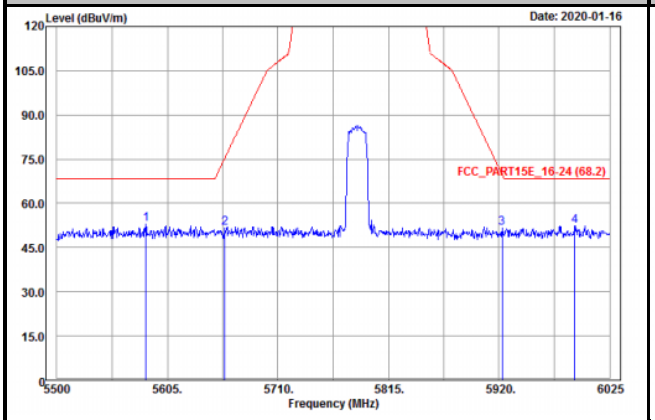
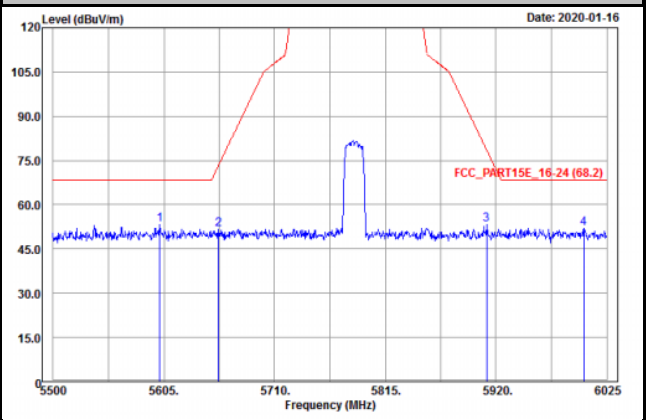
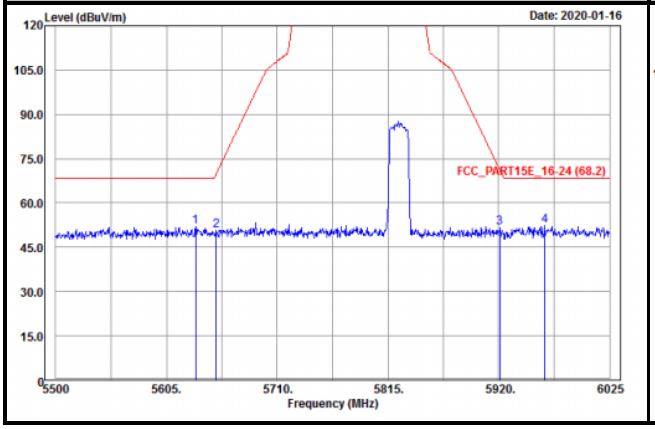
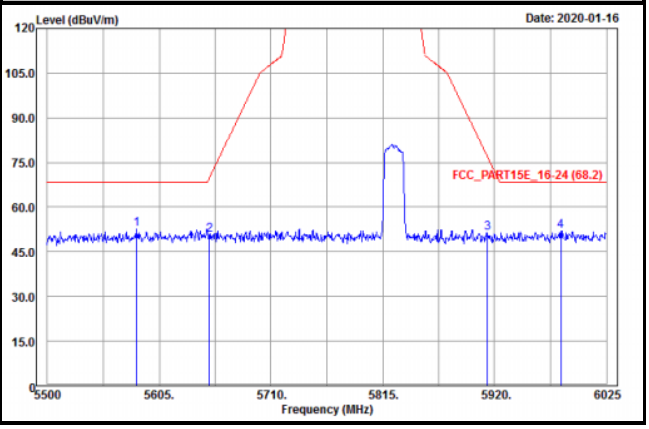
Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Annex A- Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

802.11n (HT20)

Ch 149	
Horizontal	Vertical
	
Ch 157	
Horizontal	Vertical
	
Ch 165	
Horizontal	Vertical
	

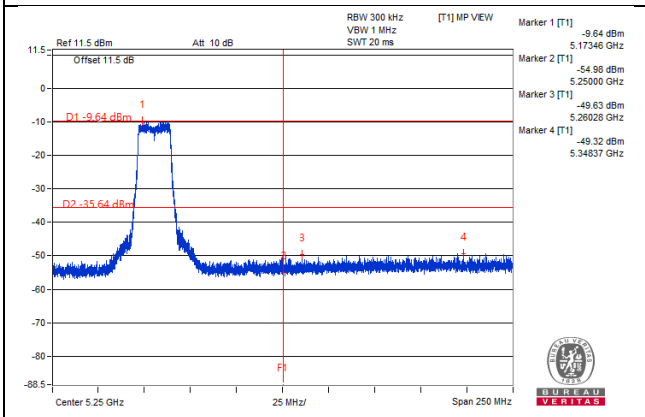
Annex B- Conducted Emissions in 5250-5350 MHz Band marker-delta ≥ 26dBc

The test plots shall address as below for reference.

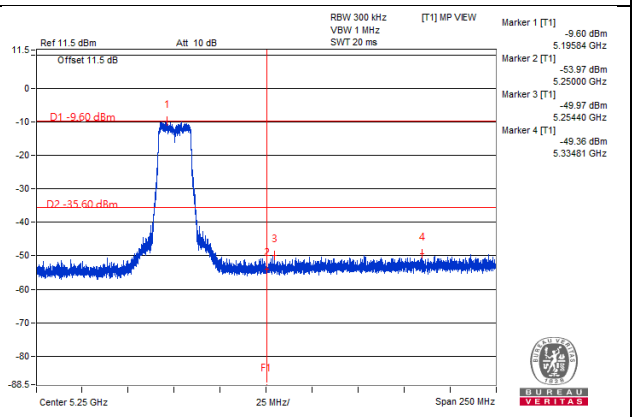
802.11n (HT20)

CH 36 5180 MHz

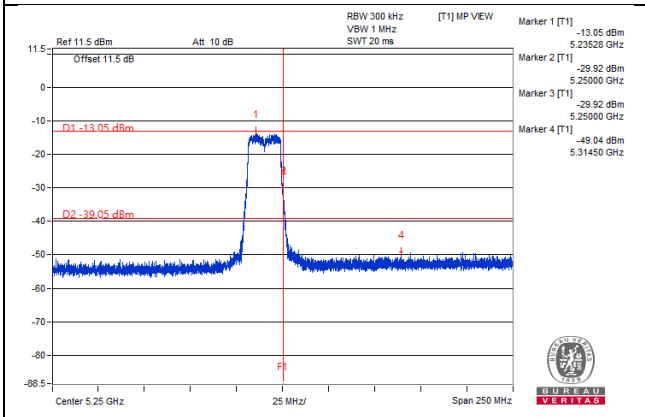
CH 36 5180 MHz



CH 40 5200 MHz



CH 48 5240 MHz



Note: No unwanted emissions that fall into the band 5250-5350 MHz

Note:

1. No unwanted emissions that fall into the band 5250-5350 MHz
2. Fundamental Emissions of 99% OBW are not fall into the band 5250-5350 MHz, therefore DFS is not required, please refer to report page 47 for detail test plots.

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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