Partial FCC Test Report

Report No.:	RF191231C14
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. 09, 2020 ~ Apr. 08, 2020
Issued Date:	Apr. 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:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

Testing Laboratory
2021

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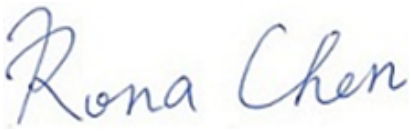
Release Control Record

Issue No.	Description	Date Issued
RF191231C14	Original Release	Apr. 13, 2020

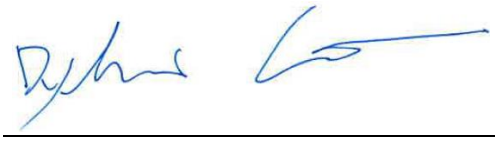
1 Certificate of Conformity

Product:	Portable Computing Device
Brand:	Microsoft
Test Model:	1899
Sample Status:	Engineering Sample
Applicant:	Microsoft Corporation
Test Date:	Jan. 09, 2020 ~ Apr. 08, 2020
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 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:** Apr. 13, 2020

Rona Chen / Specialist

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

Dylan Chiou / Senior Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	**Test Item**	**Result**	**Remarks**
15.207	AC Power Conducted Emission	N/A	Refer to Note
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -8.66 dB at 210.09 MHz.
	Conducted Band Edge Measurement	Pass	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note
---	Occupied Bandwidth Measurement	N/A	Refer to Note
15.247(b)	Conducted Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note
15.203	Antenna Requirement	N/A	Refer to Note

Note:

1. This report is issued as a partial report. The test item, test mode, and test method are in accordance with client's requirement. Only Radiated Emissions, Conducted Power and Conducted Band Edge test results were recorded in this report.
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	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 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	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM for OFDMA
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 360 Mbps 802.11ax: up to 573.5 Mbps
Operating Frequency	2412 ~ 2472 MHz
Number of Channel	13 for 802.11n (HT20) / (VHT20), 802.11ax (HE20) 9 for 802.11n (HT40) / (VHT40), 802.11ax (HE40)
Output Power	37.099 mW
Antenna Type	Refer to Note as below
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	TX Function
802.11b	1TX (SISO)
802.11g	1TX (SISO)
802.11n (HT20)	2TX (MIMO)
802.11n (HT40)	2TX (MIMO)
802.11n (VHT20)	2TX (MIMO)
802.11n (VHT40)	2TX (MIMO)
802.11ax (HE20)	2TX (MIMO)
802.11ax (HE40)	2TX (MIMO)

2. 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

3. The antenna information is listed as below.

Ant. Type	Manufacturer	Parts Number	Antenna Gain (dBi)				
			2.4 GHz	5.15~5.25 GHz	5.25~5.35 GHz	5.47~5.725 GHz	5.725~5.85 GHz
PIFA	FIT	Main Antenna: 1415-07H40QS	2.12	3.34	3.34	3.12	2.57
		Aux. Antenna: 1415-061C0QS	2.26	3.36	3.31	3.47	3.51

4. Test Cable Loss is listed as below.

Frequency (MHz)	Mini Ipx (dB)
2400	-0.84
2440	-0.99
2480	0.89

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

13 channels are provided for 802.11b, 802.11g, 802.11n (HT20) / (VHT20), 802.11ax (HE20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

9 channels are provided for 802.11n (HT40) / (VHT40), 802.11ax (HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	8	2447
4	2427	9	2452
5	2432	10	2457
6	2437	11	2462
7	2442		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To		Description
	RE	APCM	
-	√	√	-

Where **APCM:** Antenna Port Conducted Measurement **RE:** Radiated Emission

Radiated 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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11ax (HE20)	1 to 13	11, 12, 13	OFDMA	BPSK	MCS0
-	802.11n (HT40)	3 to 11	11	OFDM	BPSK	13.5
-	802.11ax (HE40)	3 to 11	11	OFDMA	BPSK	MCS0

* After the pretest, only the worst case channel was presented in the report.

Bandedge Measurement:

☒ 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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11ax (HE20)	1 to 13	11, 12, 13	OFDMA	BPSK	MCS0
-	802.11n (HT40)	3 to 11	11	OFDM	BPSK	13.5
-	802.11ax (HE40)	3 to 11	11	OFDMA	BPSK	MCS0

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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11ax (HE20)	1 to 13	11, 12, 13	OFDMA	BPSK	MCS0
-	802.11n (HT40)	3 to 11	11	OFDM	BPSK	13.5
-	802.11ax (HE40)	3 to 11	11	OFDMA	BPSK	MCS0

* For above tests of 802.11ax Mode were tested on full bandwidth.

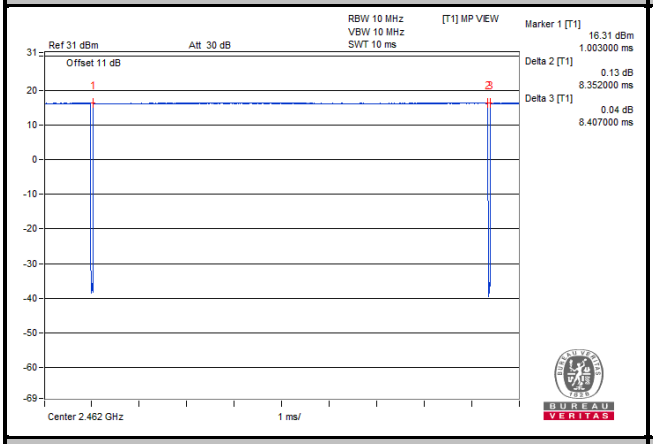
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
APCM	25 deg. C, 65 % RH	120 Vac, 60 Hz	Leo Tsai
RE	25 deg. C, 65 % RH	120 Vac, 60 Hz	Charles Hsiao

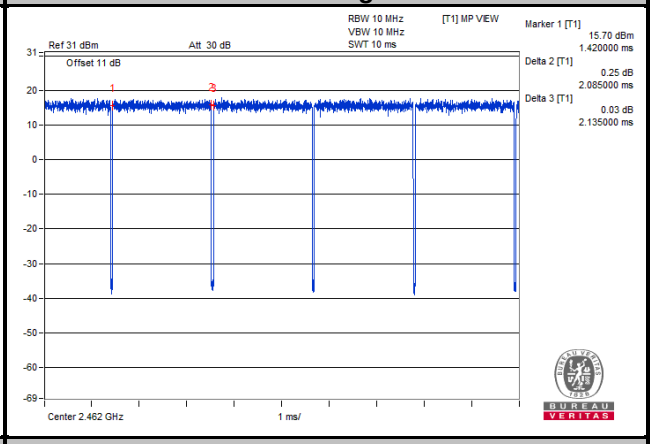
3.3 Duty Cycle of Test Signal

802.11b: Duty cycle of test signal is ≥ 98 %, duty factor is not required.
802.11g: Duty cycle of test signal is ≥ 98 %, duty factor is not required.
802.11n (HT20): Duty cycle of test signal is ≥ 98 %, duty factor is not required.
802.11n (HT40): Duty cycle of test signal is ≥ 98 %, duty factor is not required.
802.11ax (HE20): Duty cycle of test signal is ≥ 98 %, duty factor is not required.
802.11ax (HE40): Duty cycle of test signal is ≥ 98 %, duty factor is not required.

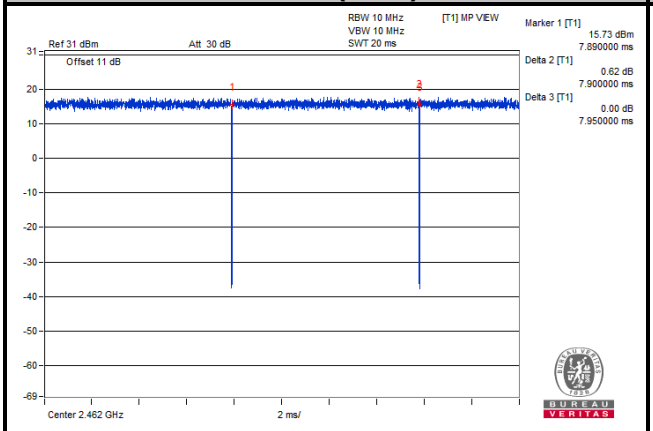
802.11b



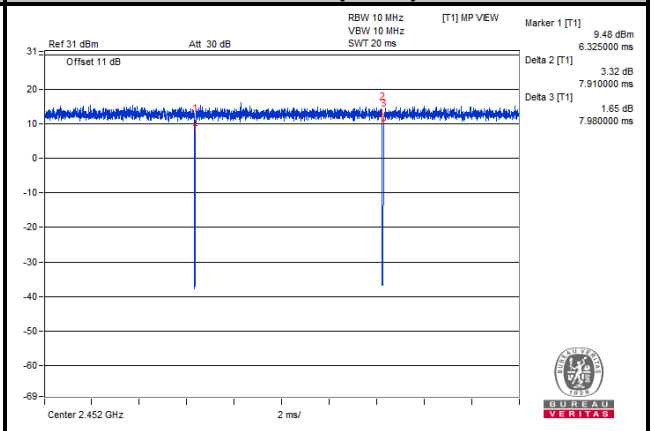
802.11g



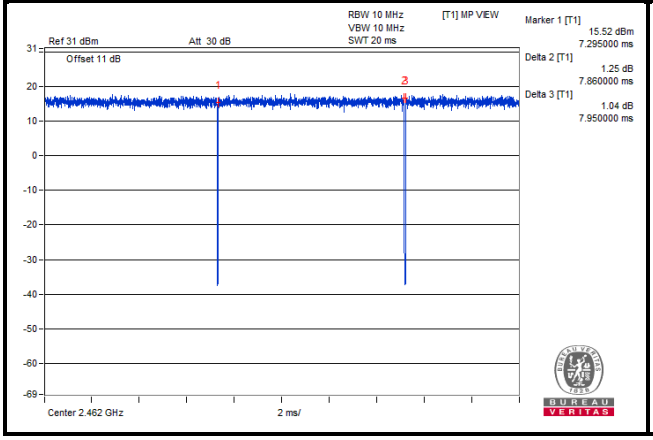
802.11n (HT20)



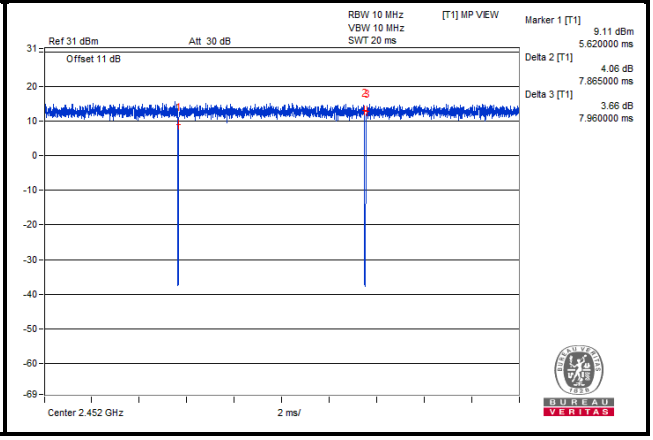
802.11n (HT40)



802.11ax (HE20)



802.11ax (HE40)



3.4 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 C (15.247)
ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 Meas Guidance v05r02
KDB 662911 D01 Multiple Transmitter Output 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. Other emissions shall be at least 20 dB below the highest level of the desired power:

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 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
			Mar. 18, 2020	Mar. 17, 2021
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 12, 2019	Dec. 11, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100980	Apr. 23, 2019	Apr. 22, 2020
Broadband Horn Antenna SCHWARZBECK	BBHA 9170	148	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Nov. 08, 2019	Nov. 07, 2020
Fixed Attenuator WORKEN	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Preamplifier EMCI	EMC001340	980201	Oct. 14, 2019	Oct. 13, 2020
Preamplifier EMCI	EMC 012645	980115	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 330H	980112	Oct. 08, 2019	Oct. 07, 2020
Peak Power Analyzer KEYSIGHT	8990B	MY51000485	Jan. 15, 2019	Jan. 14, 2020
			Jan. 14, 2020	Jan. 13, 2021
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 15, 2019	Jul 14, 2020
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-8000&3000	140811+170717	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1000(140807)	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 08, 2019	Oct. 07, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	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 Chamber 10.

4.1.3 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:

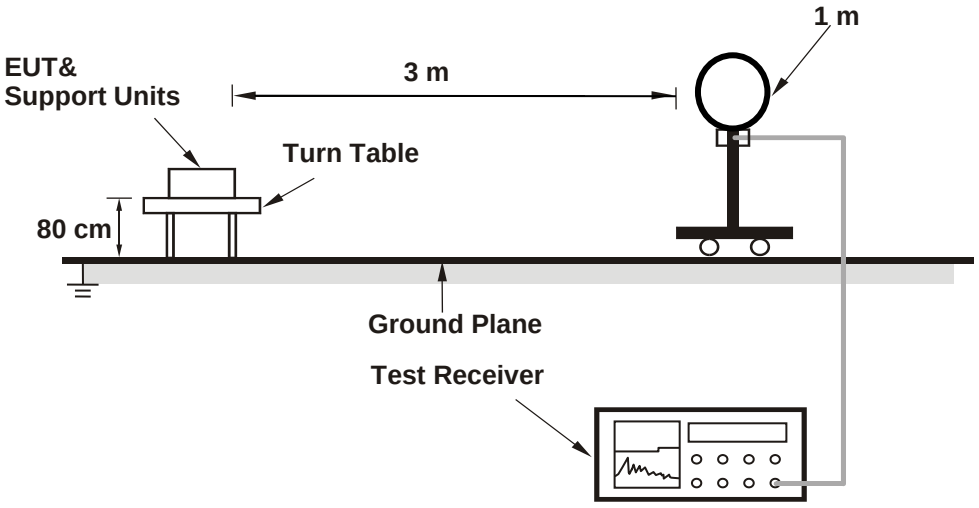
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) 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. (11ax (HE20): RBW = 1 MHz, VBW = 3 kHz ; 11n (HT40): RBW = 1 MHz, VBW = 3 kHz ; 11ax (HE40): RBW = 1 MHz, VBW = 3 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

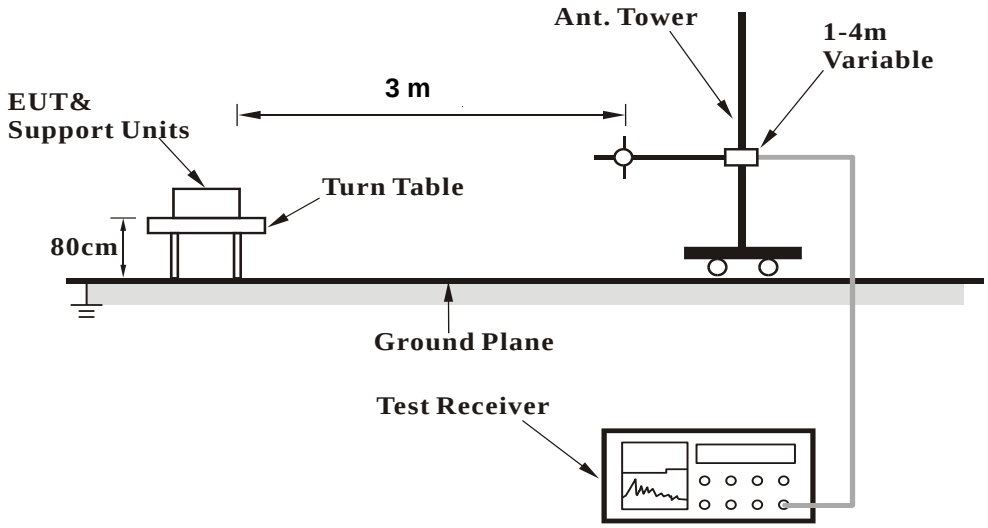
No deviation.

4.1.5 Test Set Up

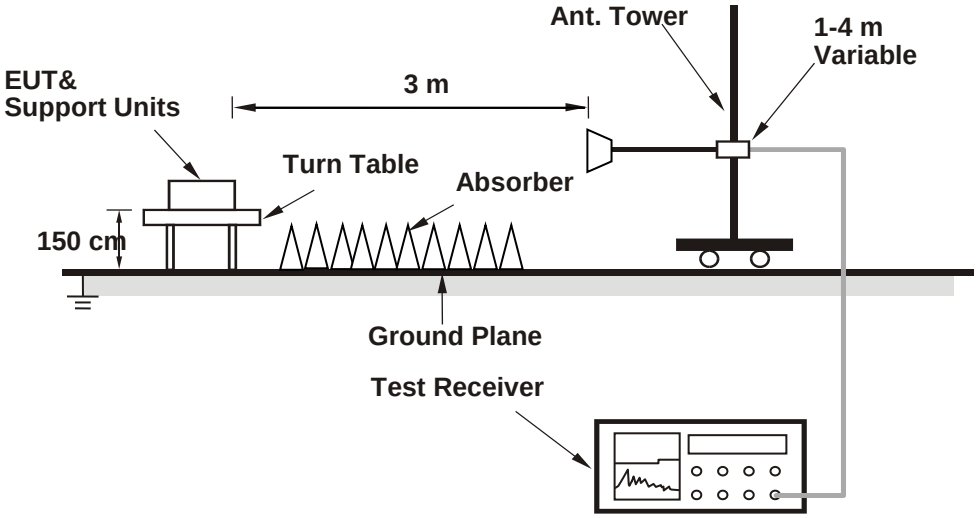
<Radiated Emission below 30 MHz>



<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).

4.1.6 EUT Operating Conditions

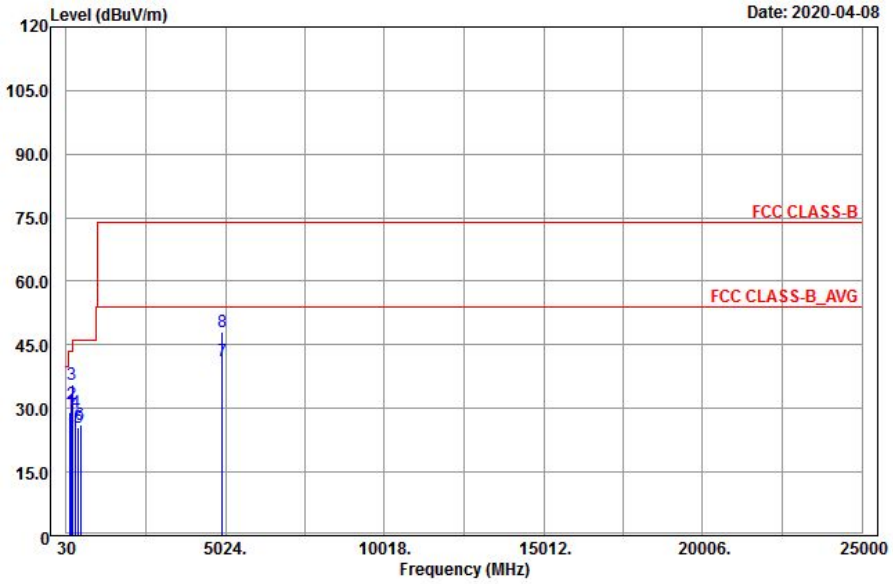
a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

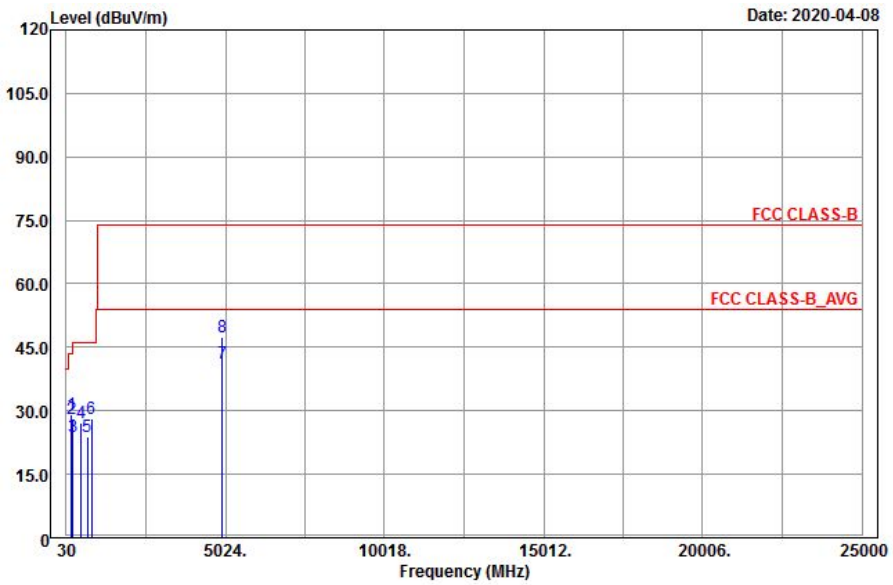
802.11ax (HE20)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Charles Hsiao

Horizontal



Vertical



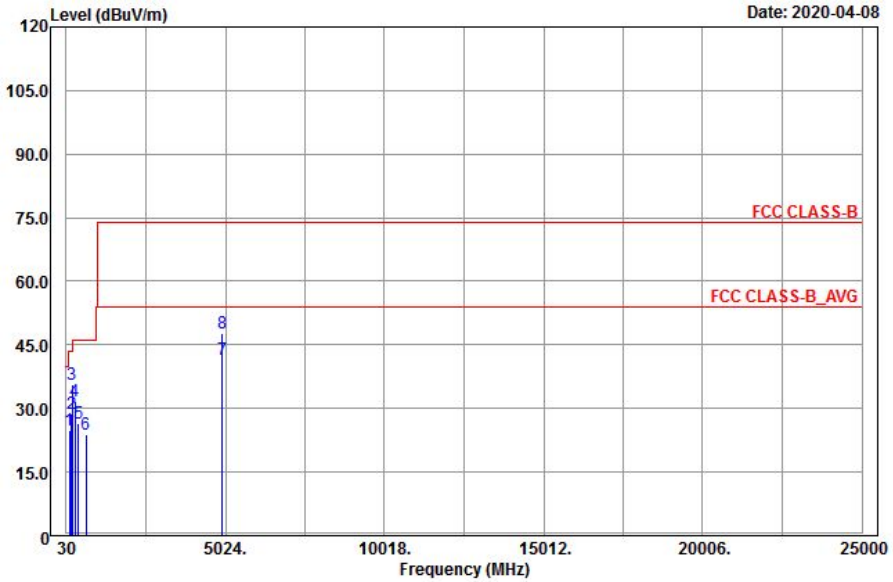
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
149.61	29.25	50.23	-20.98	43.5	-14.25	135	5	Peak
199.83	31.22	49.47	-18.25	43.5	-12.28	110	104	Peak
221.97	35.72	53.48	-17.76	46	-10.28	185	2	Peak
316.8	29.1	44.67	-15.57	46	-16.9	164	215	Peak
410.6	25.63	39.38	-13.75	46	-20.37	151	115	Peak
472.9	26.21	39.08	-12.87	46	-19.79	134	106	Peak
4924	41.35	31.1	10.25	54	-12.65	148	255	Average
4924	48.2	37.95	10.25	74	-25.8	148	255	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
184.17	29.08	48.32	-19.24	43.5	-14.42	174	17	Peak
217.92	28.06	45.96	-17.9	46	-17.94	110	244	Peak
231.96	23.77	41.11	-17.34	46	-22.23	134	263	Peak
488.3	27.07	39.61	-12.54	46	-18.93	187	28	Peak
696.9	23.78	33.03	-9.25	46	-22.22	164	164	Peak
826.4	28.28	35.48	-7.2	46	-17.72	105	252	Peak
4924	41.31	31.06	10.25	54	-12.69	137	205	Average
4924	47.27	37.02	10.25	74	-26.73	137	205	Peak

Remarks:

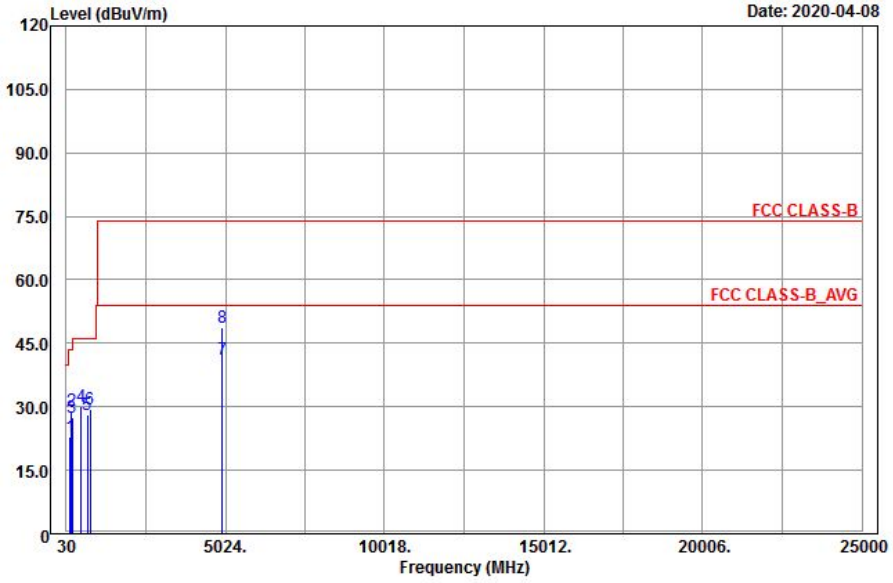
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 12	**Frequency Range**	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Charles Hsiao

Horizontal



Vertical



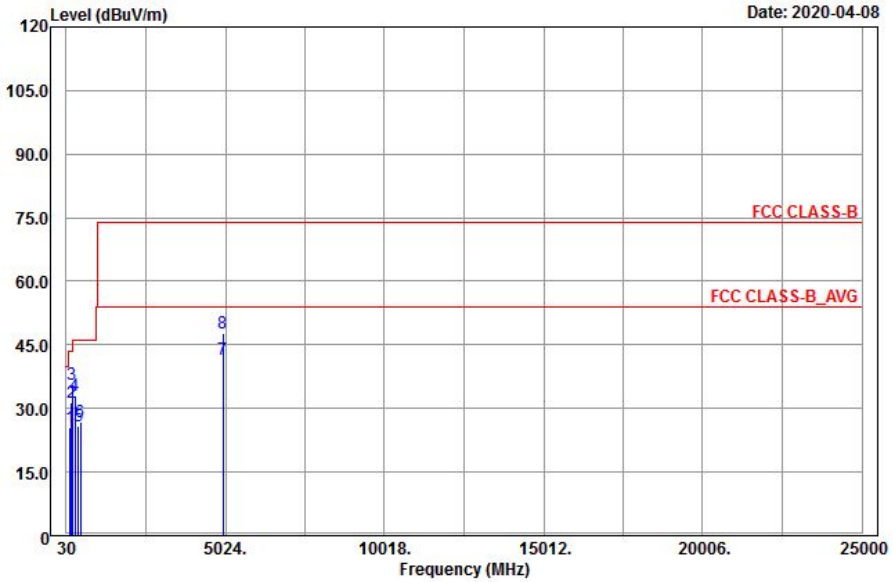
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
128.01	24.98	45.26	-20.28	43.5	-18.52	128	205	Peak
183.36	28.73	48.07	-19.34	43.5	-14.77	183	336	Peak
217.38	35.78	53.7	-17.92	46	-10.22	127	174	Peak
307.7	31.59	47.29	-15.7	46	-14.41	134	188	Peak
402.2	26.47	40.36	-13.89	46	-19.53	150	246	Peak
639.5	23.96	34.26	-10.3	46	-22.04	164	177	Peak
4934	41.48	31.22	10.26	54	-12.52	180	277	Average
4934	47.81	37.55	10.26	74	-26.19	180	277	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
155.82	22.88	43.64	-20.76	43.5	-20.62	155	287	Peak
183.63	29.26	48.6	-19.34	43.5	-14.24	183	28	Peak
217.92	27.54	45.44	-17.9	46	-18.46	134	305	Peak
487.6	30.13	42.7	-12.57	46	-15.87	187	1	Peak
686.4	28.05	37.41	-9.36	46	-17.95	190	344	Peak
778.8	29.53	37.66	-8.13	46	-16.47	105	24	Peak
4934	41.29	31.03	10.26	54	-12.71	134	263	Average
4934	48.65	38.39	10.26	74	-25.35	134	263	Peak

Remarks:

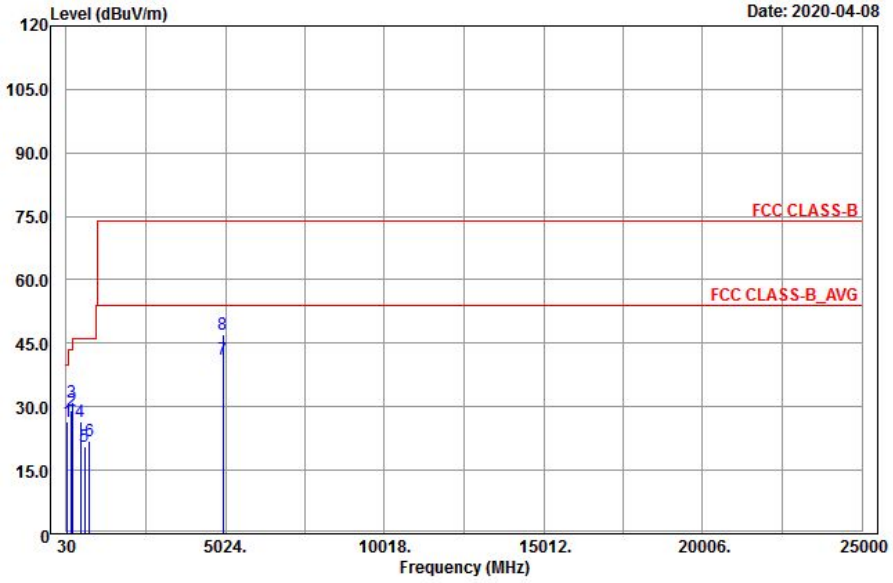
1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 13	**Frequency Range**	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Charles Hsiao

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
155.82	25.42	46.18	-20.76	43.5	-18.08	124	7	Peak
203.07	31.45	49.65	-18.2	43.5	-12.05	105	288	Peak
222.78	35.62	53.33	-17.71	46	-10.38	134	166	Peak
311.2	32.89	48.48	-15.59	46	-13.11	134	311	Peak
405	25.87	39.71	-13.84	46	-20.13	105	241	Peak
484.8	26.76	39.37	-12.61	46	-19.24	148	175	Peak
4944	41.4	31.05	10.35	54	-12.6	114	17	Average
4944	47.88	37.53	10.35	74	-26.12	114	17	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
58.89	26.39	42.39	-16	40	-13.61	105	252	Peak
184.71	29.15	48.39	-19.24	43.5	-14.35	167	199	Peak
216.84	31.16	49.08	-17.92	46	-14.84	177	154	Peak
474.3	26.37	39.21	-12.84	46	-19.63	143	26	Peak
612.2	20.73	31.17	-10.44	46	-25.27	121	208	Peak
757.1	21.98	30.31	-8.33	46	-24.02	105	15	Peak
4944	41.21	30.86	10.35	54	-12.79	134	174	Average
4944	46.99	36.64	10.35	74	-27.01	134	174	Peak

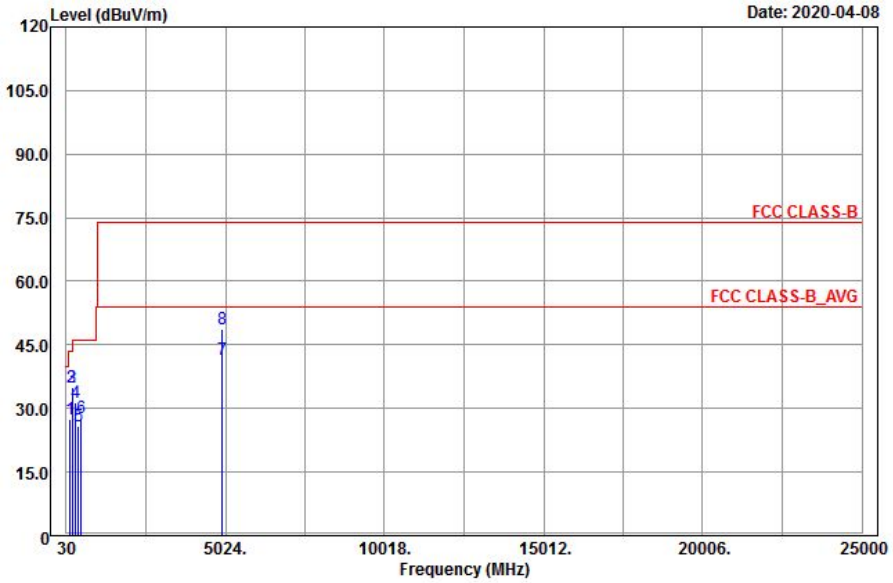
Remarks:

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.

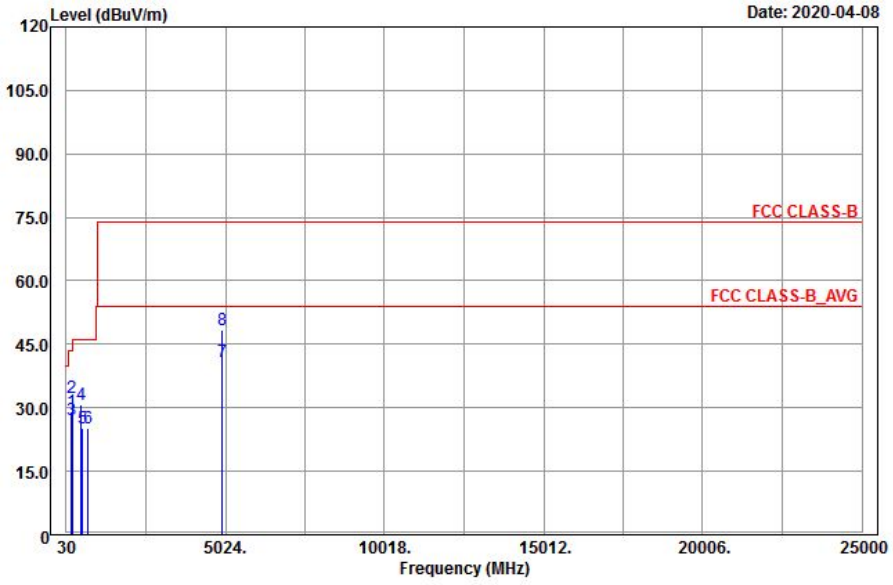
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Charles Hsiao

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
156.09	27.4	48.16	-20.76	43.5	-16.1	134	18	Peak
210.09	34.84	52.98	-18.14	43.5	-8.66	105	24	Peak
222.51	35.07	52.83	-17.76	46	-10.93	187	178	Peak
316.8	31.33	46.9	-15.57	46	-14.67	105	34	Peak
407.1	25.92	39.73	-13.81	46	-20.08	124	240	Peak
487.6	27.93	40.5	-12.57	46	-18.07	145	166	Peak
4924	41.5	31.25	10.25	54	-12.5	124	177	Average
4924	48.86	38.61	10.25	74	-25.14	124	177	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
184.17	29.08	48.32	-19.24	43.5	-14.42	105	27	Peak
214.95	32.42	50.41	-17.99	43.5	-11.08	195	24	Peak
224.13	27.15	44.81	-17.66	46	-18.85	122	314	Peak
492.5	30.8	43.25	-12.45	46	-15.2	164	199	Peak
547.1	25.04	36.66	-11.62	46	-20.96	154	174	Peak
711.6	25.04	34.06	-9.02	46	-20.96	124	240	Peak
4924	41	30.75	10.25	54	-13	187	7	Average
4924	48.4	38.15	10.25	74	-25.6	187	7	Peak

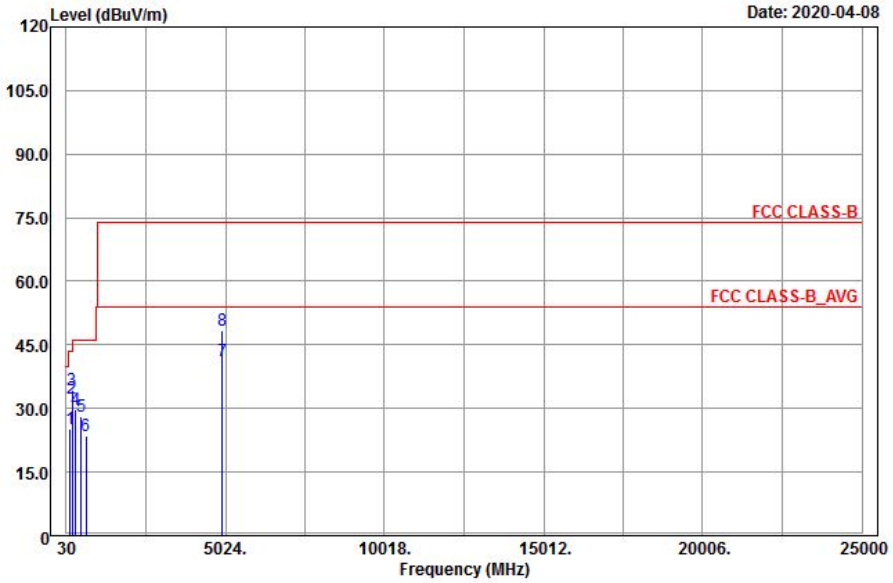
Remarks:

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.

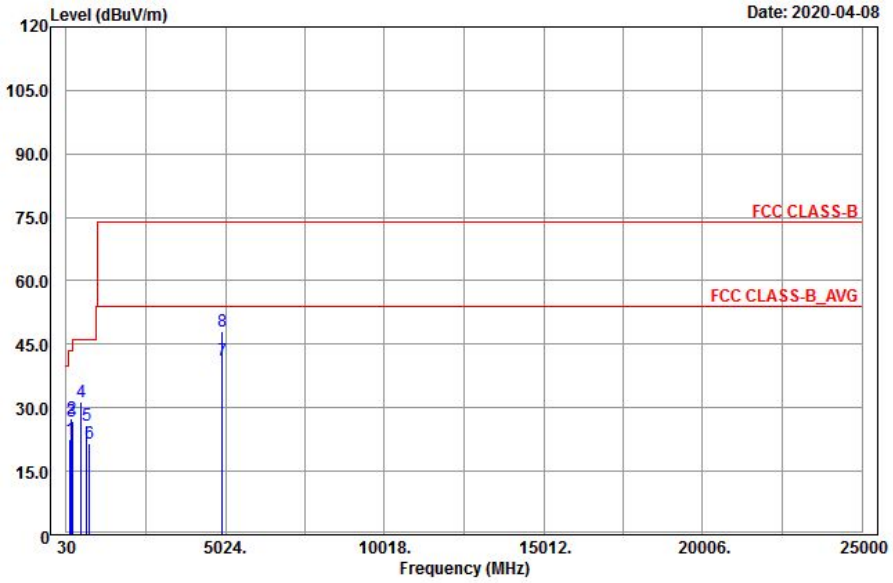
802.11ax (HE40)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Charles Hsiao

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
156.09	25.29	46.05	-20.76	43.5	-18.21	156	208	Peak
204.96	32.43	50.61	-18.18	43.5	-11.07	111	162	Peak
223.32	34.25	51.96	-17.71	46	-11.75	122	241	Peak
314	29.76	45.35	-15.59	46	-16.24	134	222	Peak
489	27.96	40.49	-12.53	46	-18.04	161	14	Peak
639.5	23.42	33.72	-10.3	46	-22.58	165	8	Peak
4924	41.1	30.85	10.25	54	-12.9	155	25	Average
4924	48.3	38.05	10.25	74	-25.7	155	25	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
156.36	22.64	43.4	-20.76	43.5	-20.86	146	14	Peak
187.41	27.41	46.38	-18.97	43.5	-16.09	124	205	Peak
218.19	26.78	44.68	-17.9	46	-19.22	113	314	Peak
489.7	31.52	44.03	-12.51	46	-14.48	148	305	Peak
678	25.79	35.32	-9.53	46	-20.21	134	288	Peak
757.8	21.5	29.82	-8.32	46	-24.5	174	157	Peak
4924	41.25	31	10.25	54	-12.75	167	19	Average
4924	47.94	37.69	10.25	74	-26.06	167	19	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.

4.2 Conducted Output Power Measurement

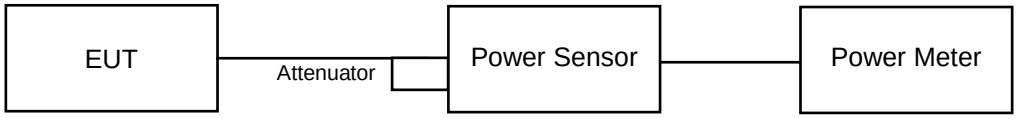
4.2.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)
Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20 MHz channel widths with NANT ≥ 5.

For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

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

4.2.7 Test Results

802.11ax (HE20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
11	2462	12.51	12.85	37.099	15.69	30	Pass
12	2467	11.56	11.45	28.286	14.52	30	Pass
13	2472	7.23	7.89	11.436	10.58	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
11	2462	6.88	7.44	10.422	10.18	30	Pass

802.11ax (HE40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
11	2462	6.81	7.44	10.344	10.15	30	Pass

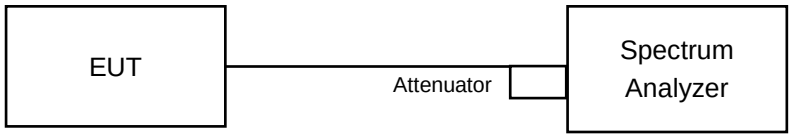
4.3 Conducted Bandedge Measurement

4.3.1 Limits of Conducted Bandedge Measurement

Radiated versus Conducted Measurement	
☒ Conducted measurement	☐ Radiated measurement
For Radiated measurement: The level of unwanted emissions was measured when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation) For Conducted measurement: The level of unwanted emissions was measured as their power in a specified load (conducted spurious emissions).	

Conducted Measurement Factor
a. The composite gain will be used when signal support the correlated signal. (Composite gain = 3.62dBi + 10log(2) = 6.63dBi)
b. For the out of band spurious the gain for the specific band may have been used rather than the highest gain across all bands.
c. For the band edge the gain for the specific band may have been used.
d. In restricted bands below 1000 MHz, add upper bound on ground plane reflection: For f = 30 – 1000 MHz, add 4.7 dB.
Note: The conducted emission test was considered some factor to compute test result.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Deviation from Test Standard

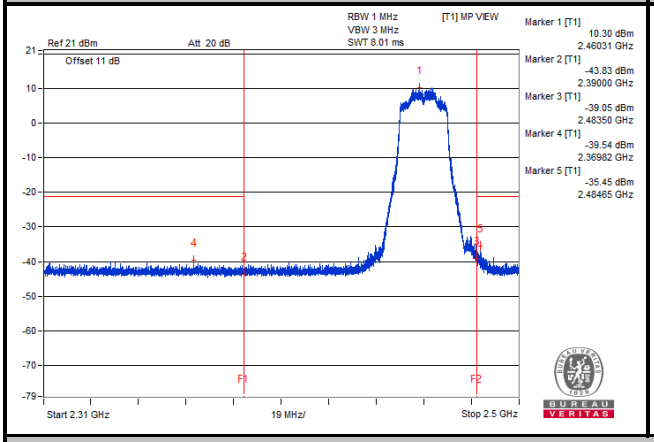
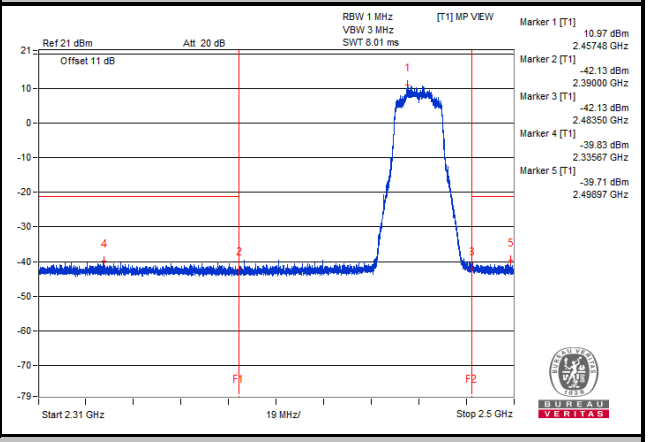
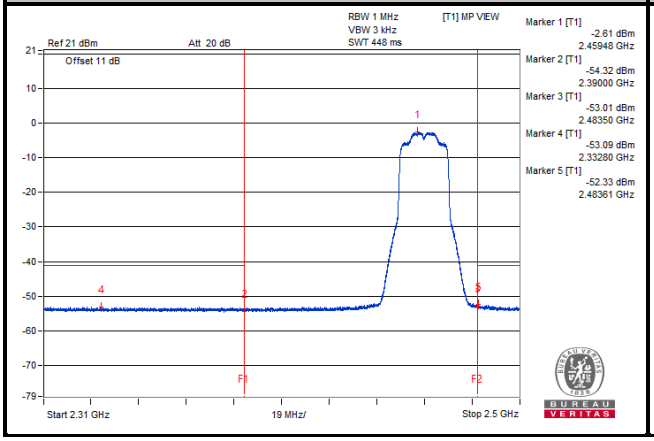
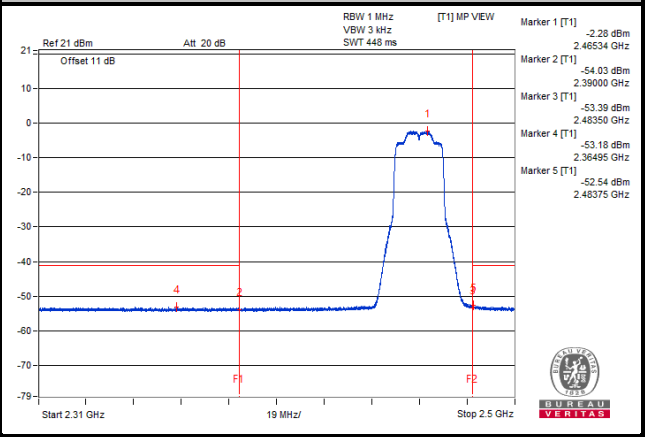
No deviation.

4.3.5 EUT Operating Condition

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

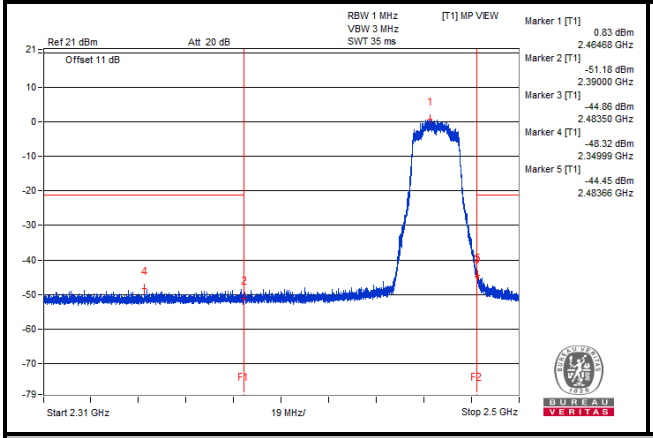
4.3.6 Test Results

802.11ax (HE20)

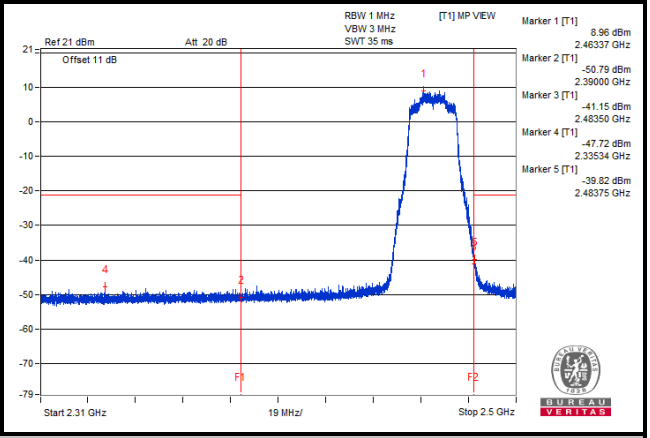
Peak	
Ch 11_Chain 0	Ch 11_Chain 1
	
Average	
Ch 11_Chain 0	Ch 11_Chain 1
	

Peak

Ch 12_Chain 0

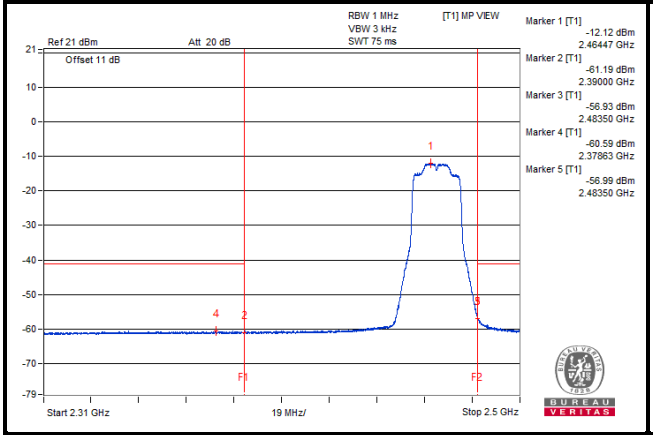


Ch 12_Chain 1

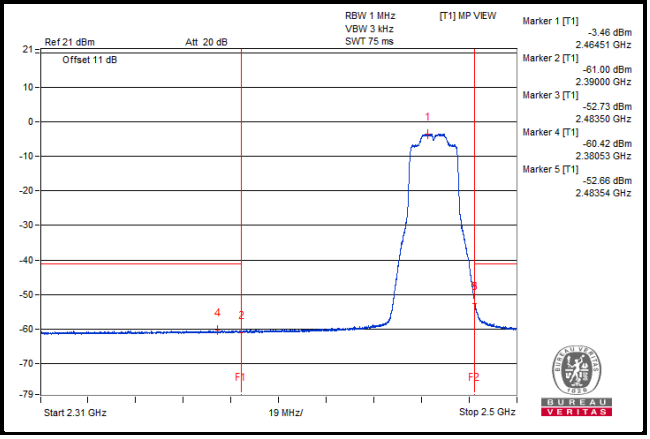


Average

Ch 12_Chain 0

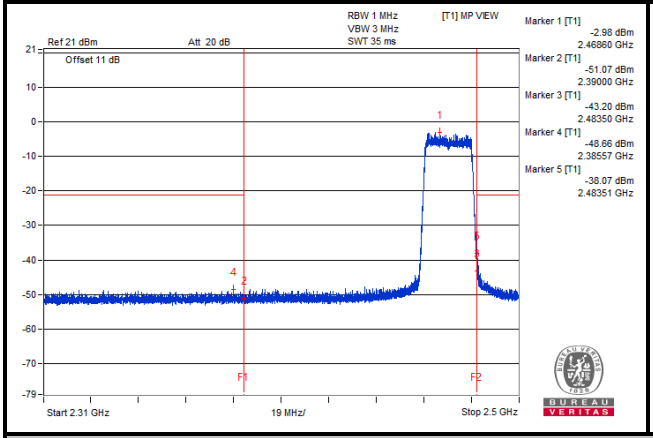


Ch 12_Chain 1

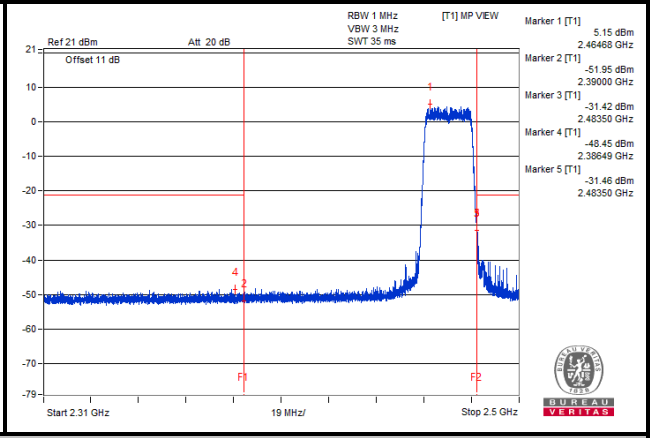


Peak

Ch 13_Chain 0

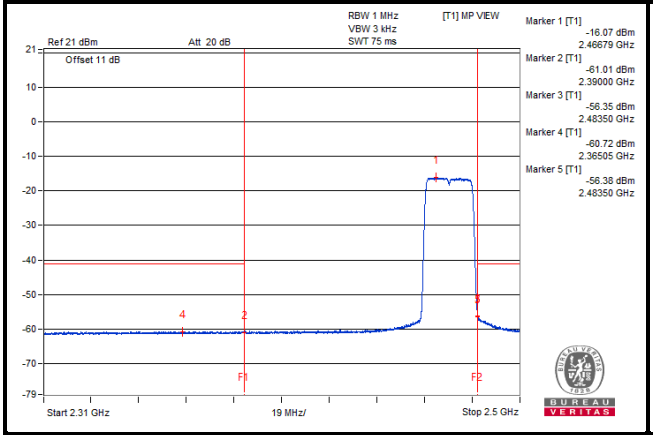


Ch 13_Chain 1

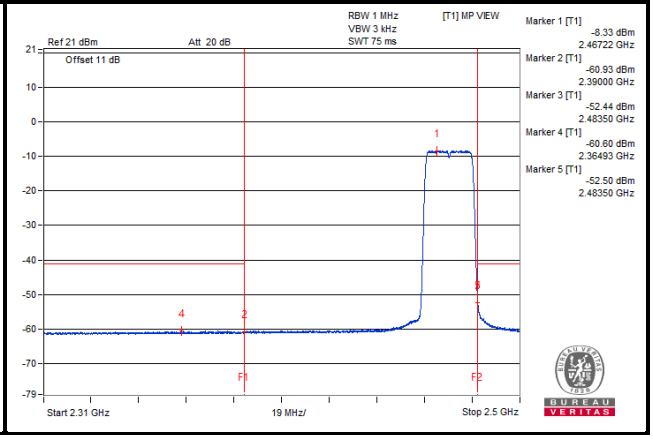


Average

Ch 13_Chain 0



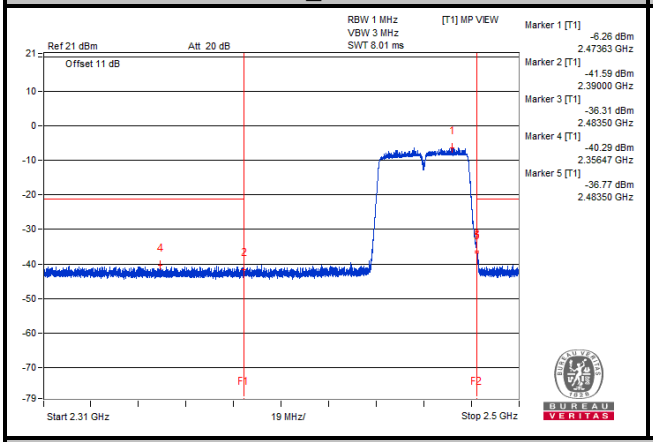
Ch 13_Chain 1



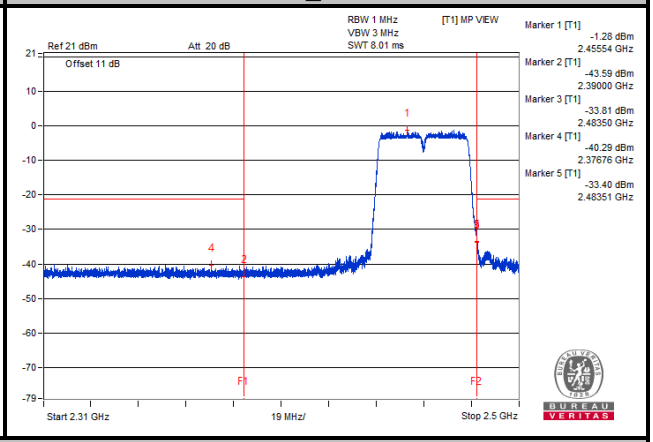
802.11n (HT40)

Peak

Ch 11_Chain 0

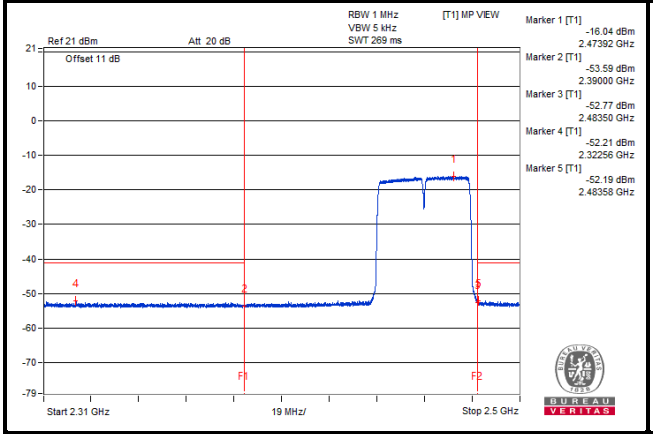


Ch 11_Chain 1

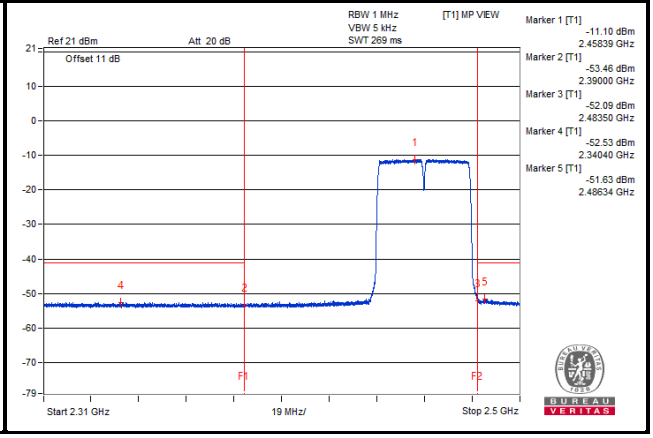


Average

Ch 11_Chain 0



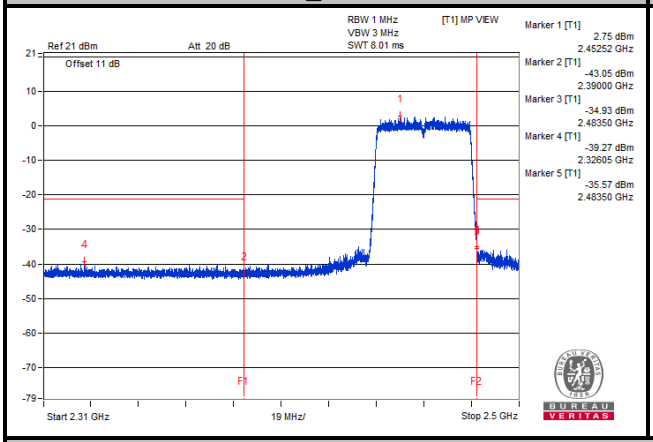
Ch 11_Chain 1



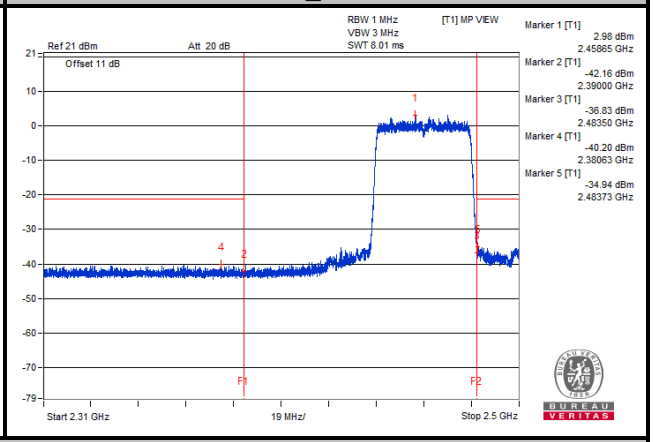
802.11ax (HE40)

Peak

Ch 11_Chain 0

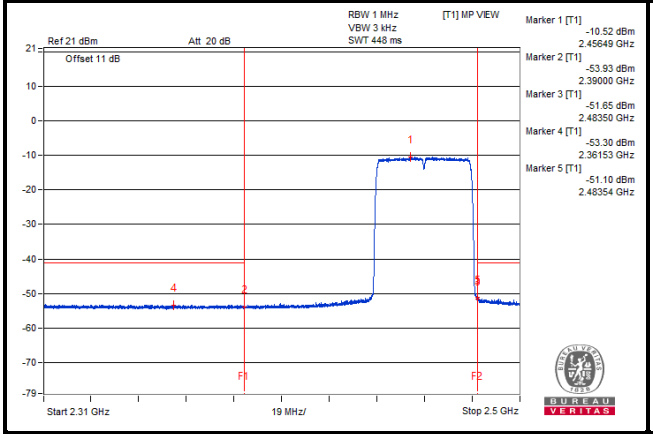


Ch 11_Chain 1

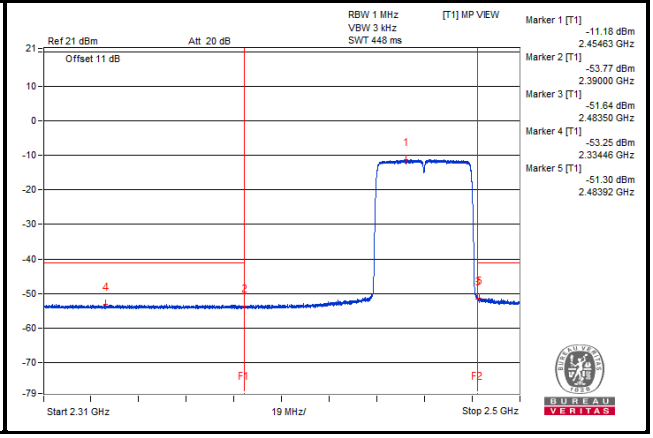


Average

Ch 11_Chain 0



Ch 11_Chain 1



5 Pictures of Test Arrangements

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

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.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
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The address and road map of all our labs can be found in our web site also.

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