

FCC Test Report

Report No.: RF191227E01B R1

FCC ID: C3K1889

Test Model: 1889

Received Date: June 09, 2020

Test Date: July 09, 2020

Issued Date: Nov. 19, 2020

Applicant: Microsoft Corporation

Address: One Microsoft Way, Redmond, Washington 98052-6399, United States

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

Test Location : E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF191227E01B	Original release.	Oct. 16, 2020
RF191227E01B R1	Added the description in page 21.	Nov. 19, 2020

1 Certificate of Conformity

Product: Dual-band wireless accessory radio

Brand: Microsoft

Test Model: 1889

Sample Status: ENGINEERING SAMPLE

Applicant: Microsoft Corporation

Test Date: July 09, 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 EMC characteristics under the conditions specified in this report.

Prepared by :  _____, **Date:** _____ Nov. 19, 2020
Claire Kuan / Specialist

Approved by :  _____, **Date:** _____ Nov. 19, 2020
Clark Lin / Technical Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -7.96dB at 129.91MHz.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. This report is prepared for supplementary report.

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) (\pm)
Conducted Emissions	9kHz ~ 40GHz	2.5 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Dual-band wireless accessory radio
Brand	Microsoft
Test Model	1889
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3.3Vdc from host equipment
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	OFDM
Transfer Rate	802.11n: up to 72.2 Mbps
Operating Frequency	2.4GHz: 2.412 ~ 2.462GHz 5GHz: 5.18 ~ 5.24 GHz, 5.745 ~ 5.825 GHz
Number of Channel	2.4GHz: 802.11n (HT20): 11 5GHz: 802.11n (HT20): 9
Output Power	2.4GHz: 87.498 mW 5.18 ~ 5.24GHz: 10.116 mW 5.745 ~ 5.825GHz: 10.447 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

- This report is prepared for FCC class II change. The difference compared with the Report No.: RF191227E01 as the following:

- ◆ Modifying antenna's matching circuit and updating antenna gain as follows:

Antenna No.	Transmitter Circuit	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length
MAIN	0	2.88	2.4 ~ 2.4835GHz	PCB	NA	NA
		4.2	5.15~5.25GHz (5G B1)	PCB	NA	NA
		3.64	5.25~5.35GHz (5G B2)	PCB	NA	NA
		4.18	5.47~5.725GHz (5G B3)	PCB	NA	NA
		4.29	5.725~5.85GHz (5G B4)	PCB	NA	NA
DIV	1	---	2.4 ~ 2.4835GHz	PCB	NA	NA
		3.64	5.15~5.25GHz (5G B1)	PCB	NA	NA
		4.2	5.25~5.35GHz (5G B2)	PCB	NA	NA
		4.09	5.47~5.725GHz (5G B3)	PCB	NA	NA
		3.05	5.725~5.85GHz (5G B4)	PCB	NA	NA

- According to above conditions, only Radiated Emissions (Conducted Measurement) and conducted power test need to be performed. And all data was verified to meet the requirements.

3. The EUT incorporates function as following.

2.4GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11n (HT20)	1TX (Fixed Chain 0)	1RX
5GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11n (HT20)	1TX (Fixed Chain 0)	2RX

4. 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.

5. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

11 channels are provided for 802.11n (HT20):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE \geq 1G	RE<1G	APCM	
-	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1GHz & Bandedge Measurement **RE<1G**: Radiated Emission below 1GHz
APCM: Antenna Port Conducted Measurement

Note: In the original test report, the EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane (for below 1GHz)** and **X-plane (for above 1GHz)**.

Radiated Emission Test (Above 1GHz):

- 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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate (Mbps)
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Radiated Emission Test (Below 1GHz):

- 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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate (Mbps)
802.11n (HT20)	1 to 11	11	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.

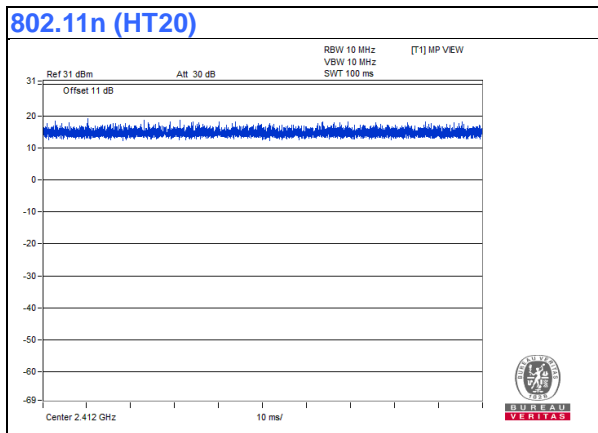
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate (Mbps)
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Test Condition:

Applicable To	Environmental Conditions	Input Power (System)	Tested By
RE\geq1G	25deg. C, 65%RH	120Vac, 60Hz	Nelson Teng
RE<1G	25deg. C, 75%RH	120Vac, 60Hz	Nelson Teng
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

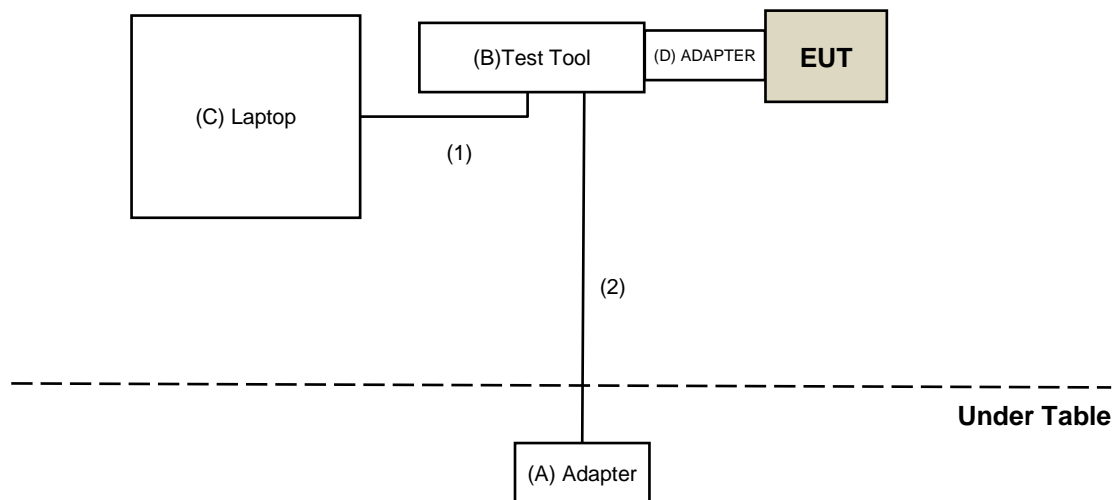
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Adapter	PHIHONG	PSC15A-050	NA	NA	Supplied by client
B.	Test Tool	MediaTek Inc.	NA	NA	NA	Supplied by client
C.	Laptop	DELL	E5430	GM1SKV1	FCC DoC	Provided by Lab
D.	ADAPTER	MediaTek Inc.	M1096761-001	NA	NA	Supplied by client

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Type B Cable	1	1.8	Yes	0	Provided by Lab
2.	DC Cable	1	1.5	No	0	Supplied by client

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 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 15.247 Meas Guidance v05r02

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 (Conducted 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 20dB 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 1000MHz, 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 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	May 29, 2020	May 28, 2021
Spectrum Analyzer Keysight	N9030A	MY54490679	July 17, 2019	July 16, 2020
Power meter Anritsu	ML2495A	1529002	July 26, 2019	July 25, 2020
Power sensor Anritsu	MA2411B	1339443	July 26, 2019	July 25, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 14, 2020	Apr. 13, 2021
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

Note:

- NOTE:**
1. The test was performed in Oven room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 09, 2020

4.1.3 Test Procedures

Following FCC KDB 558074 D01 DTS Meas Guidance:
Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on antenna-port conducted measurements in conjunction with cabinet emissions tests are permitted to demonstrate compliance.

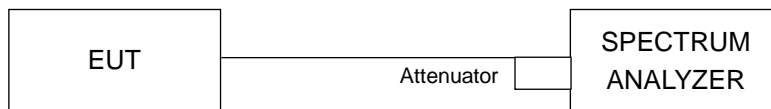
The following steps was performed:

- a. Cabinet emissions measurements. Radiated measurement was performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna was replaced by a termination matching the nominal impedance of the antenna.
- b. Conducted tests was performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT
- c. EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater

4.1.4 Deviation from Test Standard

No deviation.

4.1.5 Test Setup



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

4.1.6 EUT Operating Conditions

- a. Connected the EUT with the Laptop which is placed on testing table.
- b. Controlling software (MT7663 QA 0.0.2.6) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results (Conducted Measurement)

Radiated versus Conducted Measurement	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement
<p><u>For Radiated measurement:</u> 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)</p> <p><u>For Conducted measurement:</u> The level of unwanted emissions was measured as their power in a specified load (conducted spurious emissions).</p> <p>Note: In order to obtain results more easily, change max hold to view as following. It has no effect on the result.</p>	

Conducted Measurement Factor
<p>a. The composite gain will be used (Composite gain = 4.29dBi)</p> <p>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.</p> <p>c. For the band edge the gain for the specific band may have been used.</p> <p>d. In restricted bands below 1000 MHz, add upper bound on ground plane reflection: For $f = 30 - 1000$ MHz, add 4.7 dB.</p> <p>Note: The conducted emission test was considered some factor to compute test result.</p>

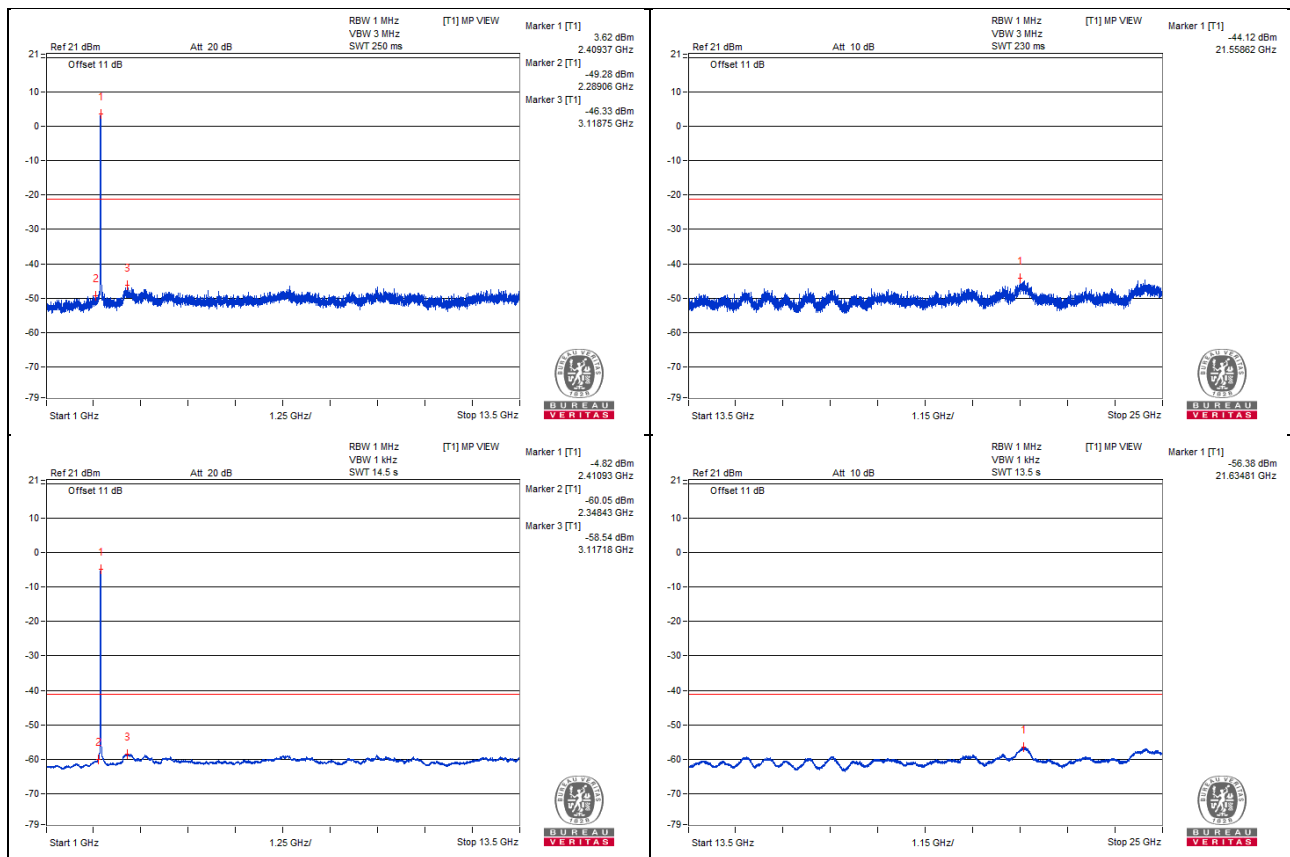
802.11n (HT20) - Channel 1

Conducted spurious emission table

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	2409.37 PK	103.17	*		3.62	4.29	7.91
2	2289.06 PK	50.27	74	-23.73	-49.28	4.29	-44.99
3	3118.75 PK	53.22	#		-46.33	4.29	-42.04
4	21558.62 PK	55.43	#		-44.12	4.29	-39.83
5	2410.93 AV	94.73	*		-4.82	4.29	-0.53
6	2348.43 AV	39.5	54	-14.5	-60.05	4.29	-55.76
7	3117.18 AV	41.01	#		-58.54	4.29	-54.25
8	21634.81 AV	43.17	#		-56.38	4.29	-52.09

Note :

1. Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.
2. * : Fundamental frequency, the limit was restricted at the output power.
3. # : Non-restricted frequency, the limit was restricted at the conducted out of band emission.

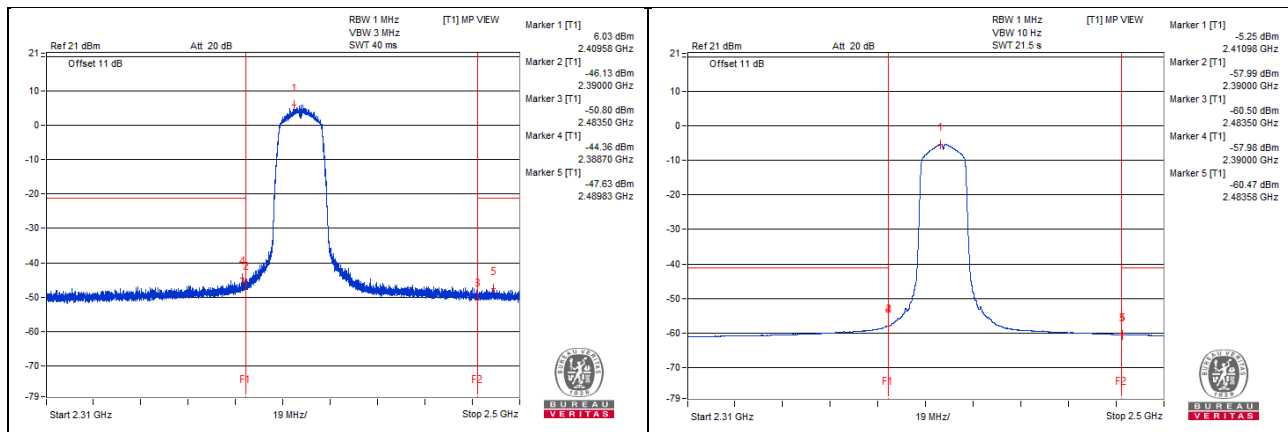


Bandedge table

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	2409.58 PK	104.17	*		6.03	2.88	8.91
2	2390 PK	52.01	74	-21.99	-46.13	2.88	-43.25
3	2483.5 PK	47.34	74	-26.66	-50.8	2.88	-47.92
4	2388.7 PK	53.78	74	-20.22	-44.36	2.88	-41.48
5	2489.83 PK	50.51	74	-23.49	-47.63	2.88	-44.75
6	2410.98 AV	92.89	*		-5.25	2.88	-2.37
7	2390 AV	40.15	54	-13.85	-57.99	2.88	-55.11
8	2483.5 AV	37.64	54	-16.36	-60.5	2.88	-57.62
9	2390 AV	40.16	54	-13.84	-57.98	2.88	-55.1
10	2483.58 AV	37.67	54	-16.33	-60.47	2.88	-57.59

Note :

- Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.
- * : Fundamental frequency, the limit was restricted at the output power.



802.11n (HT20) - Channel 6

Conducted spurious emission table

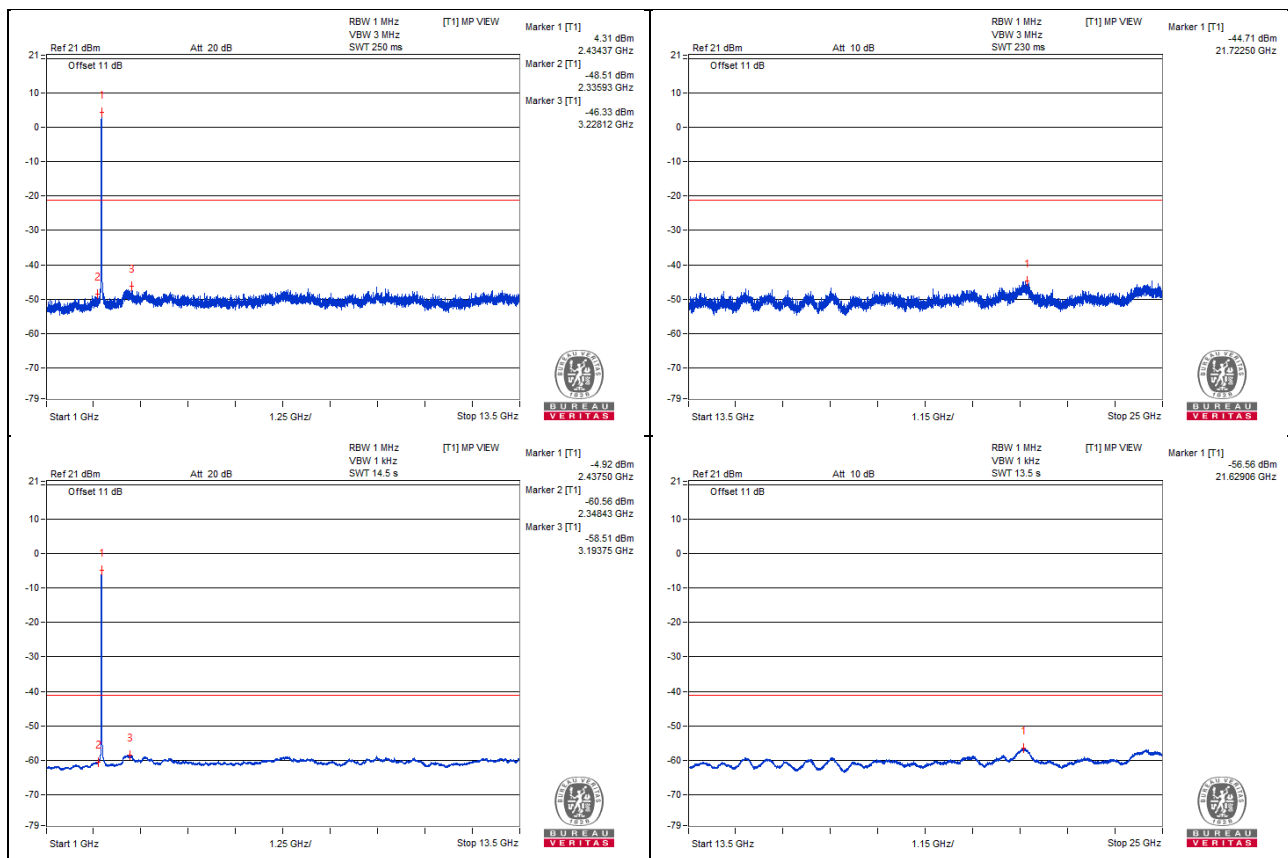
No.	Frequency (MHz)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	2434.37 PK	103.86	*		4.31	4.29	8.6
2	2335.93 PK	51.04	74	-22.96	-48.51	4.29	-44.22
3	3228.12 PK	53.22	#		-46.33	4.29	-42.04
4	21722.5 PK	54.84	#		-44.71	4.29	-40.42
5	2437.5 AV	94.63	*		-4.92	4.29	-0.63
6	2348.43 AV	38.99	54	-15.01	-60.56	4.29	-56.27
7	3193.75 AV	41.04	#		-58.51	4.29	-54.22
8	21629.06 AV	42.99	#		-56.56	4.29	-52.27

Note :

1. Emission Level (dBUV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.

2. * : Fundamental frequency, the limit was restricted at the output power.

3. # : Non-restricted frequency, the limit was restricted at the conducted out of band emission.

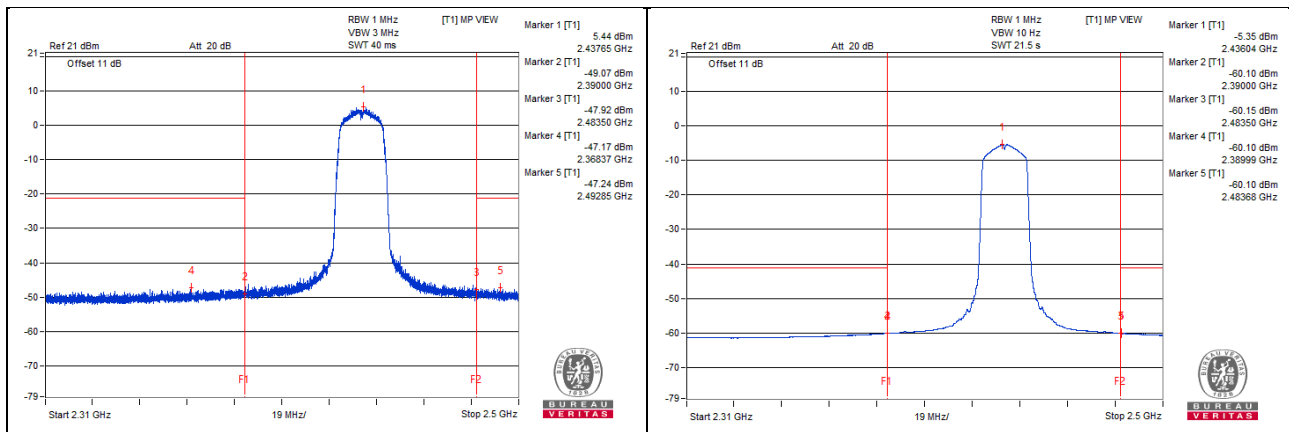


Bandedge table

No.	Frequency (MHz)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	2437.65 PK	103.58	*		5.44	2.88	8.32
2	2390 PK	49.07	74	-24.93	-49.07	2.88	-46.19
3	2483.5 PK	50.22	74	-23.78	-47.92	2.88	-45.04
4	2368.37 PK	50.97	74	-23.03	-47.17	2.88	-44.29
5	2492.85 PK	50.9	74	-23.1	-47.24	2.88	-44.36
6	2436.04 AV	92.79	*		-5.35	2.88	-2.47
7	2390 AV	38.04	54	-15.96	-60.1	2.88	-57.22
8	2483.5 AV	37.99	54	-16.01	-60.15	2.88	-57.27
9	2389.99 AV	38.04	54	-15.96	-60.1	2.88	-57.22
10	2483.68 AV	38.04	54	-15.96	-60.1	2.88	-57.22

Note :

1. Emission Level (dBUV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.
2. * : Fundamental frequency, the limit was restricted at the output power.



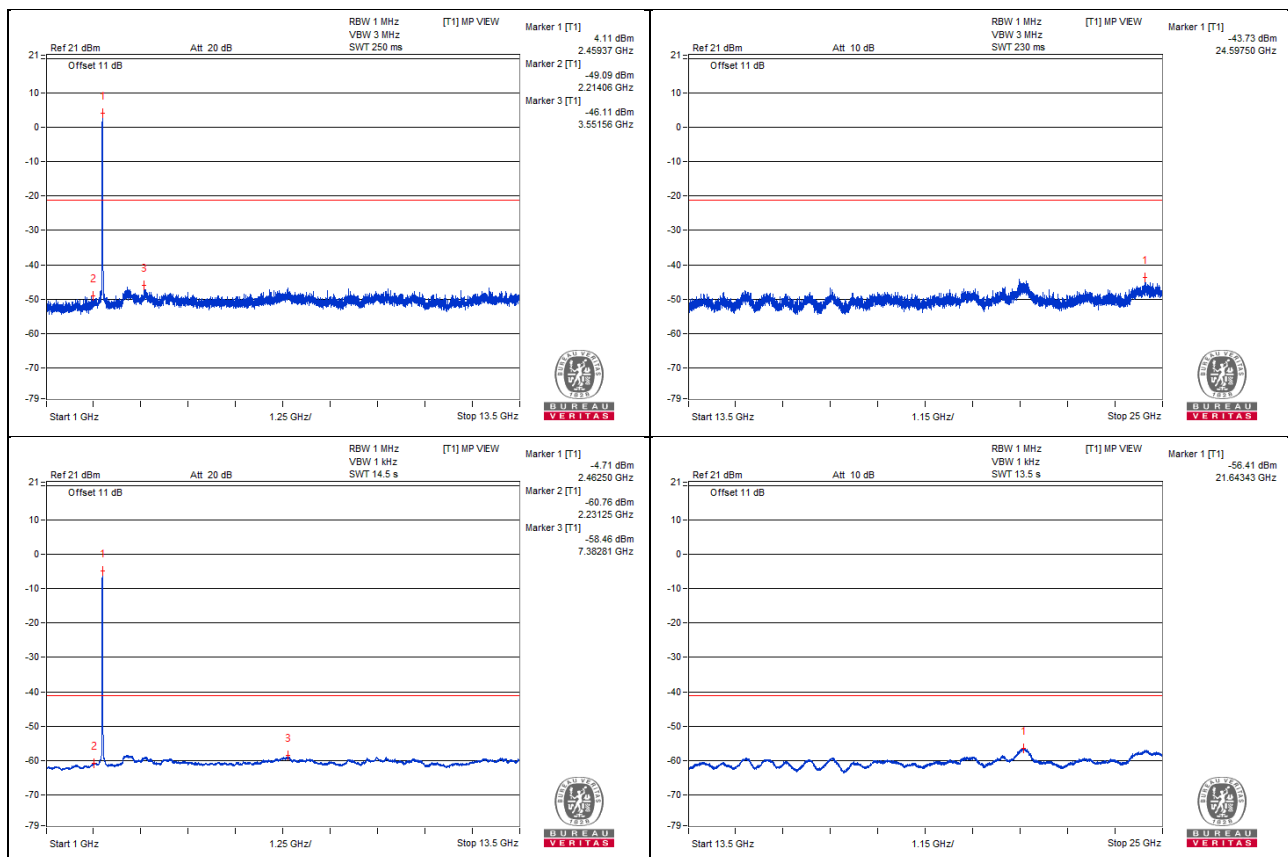
802.11n (HT20) - Channel 11

Conducted spurious emission table

No.	Frequency (MHz)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	2459.37 PK	103.66	*		4.11	4.29	8.4
2	2214.06 PK	50.46	74	-23.54	-49.09	4.29	-44.8
3	3551.56 PK	53.44	74	-20.56	-46.11	4.29	-41.82
4	24597.5 PK	55.82	#		-43.73	4.29	-39.44
5	2462.5 AV	94.84	*		-4.71	4.29	-0.42
6	2231.25 AV	38.79	54	-15.21	-60.76	4.29	-56.47
7	7382.81 AV	41.09	54	-12.91	-58.46	4.29	-54.17
8	21643.43 AV	43.14	#		-56.41	4.29	-52.12

Note :

1. Emission Level (dBUV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.
2. * : Fundamental frequency, the limit was restricted at the output power.
3. # : Non-restricted frequency, the limit was restricted at the conducted out of band emission.

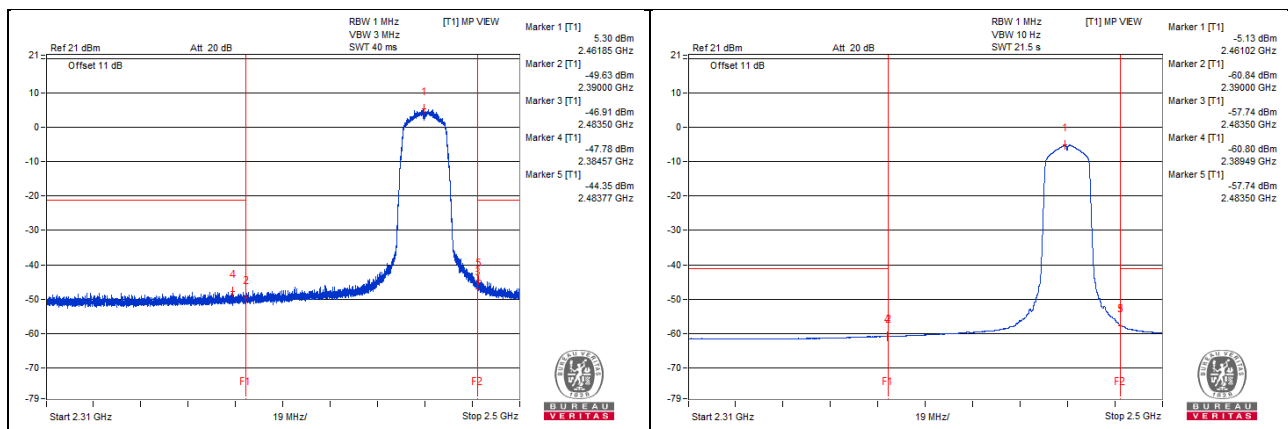


Bandedge table

No.	Frequency (MHz)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	2461.85 PK	103.44	*		5.3	2.88	8.18
2	2390 PK	48.51	74	-25.49	-49.63	2.88	-46.75
3	2483.5 PK	51.23	74	-22.77	-46.91	2.88	-44.03
4	2384.57 PK	50.36	74	-23.64	-47.78	2.88	-44.9
5	2483.77 PK	53.79	74	-20.21	-44.35	2.88	-41.47
6	2461.02 AV	93.01	*		-5.13	2.88	-2.25
7	2390 AV	37.3	54	-16.7	-60.84	2.88	-57.96
8	2483.5 AV	40.4	54	-13.6	-57.74	2.88	-54.86
9	2389.49 AV	37.34	54	-16.66	-60.8	2.88	-57.92
10	2483.5 AV	40.4	54	-13.6	-57.74	2.88	-54.86

Note :

- Emission Level (dBUV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.
- * : Fundamental frequency, the limit was restricted at the output power.

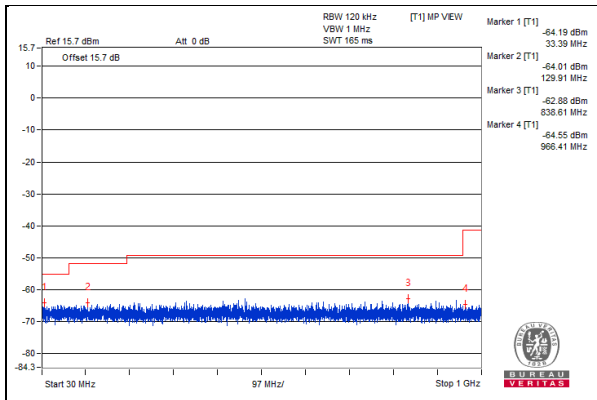


Below 1GHz Data
802.11n (HT20) - Channel 11
Conducted spurious emission table

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBm)	Correction Factor (dB)	EIRP Level (dBm)
1	33.39	35.36	#		-64.19	4.29	-59.9
2	129.91	35.54	43.5	-7.96	-64.01	4.29	-59.72
3	838.61	36.67	46	-9.33	-62.88	4.29	-58.59
4	966.41	35	54	-19	-64.55	4.29	-60.26

Note :

1. Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8
d = measurement distance in 3 meters.
2. # : Non-restricted frequency, the limit was restricted at the conducted out of band emission.
3. The emission level was including the the appropriate maximum ground reflection factor 4.7dB.

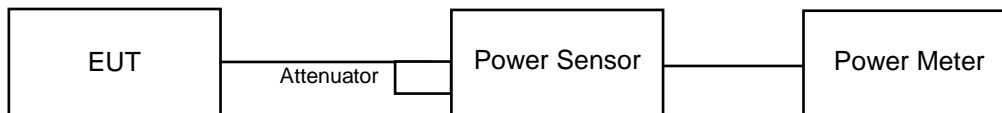


4.2 Conducted Output Power Measurement

4.2.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

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.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

Same as Item 4.3.6.

4.2.7 Test Results

802.11n (HT20)

FOR PEAK POWER

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	82.414	19.16	30	Pass
6	2437	83.56	19.22	30	Pass
11	2462	87.498	19.42	30	Pass

FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	10.423	10.18
6	2437	10.471	10.20
11	2462	10.691	10.29

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

Tel: 886-3-3183232

Fax: 886-3-3270892

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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