

Partial FCC Test Report (Spot Check)

Report No.: RFBGTL-WTW-P20100274-3

FCC ID: RX3-WBU053LGABT

Test Model: WBU053-LGABT

Received Date: Oct. 21, 2020

Test Date: Oct. 31 ~ Nov. 10, 2020

Issued Date: Nov. 11, 2020

Applicant: Hon Hai Precision Industry Co., Ltd.

Address: No.151, Sec. 1, Nankan Rd., Lujhu Dist., Taoyuan County 33859, Taiwan
(R.O.C.)

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



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Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Summary of Test Results	5
2.1 Measurement Uncertainty.....	5
2.2 Modification Record.....	5
3 General Information	6
3.1 General Description of EUT.....	6
3.2 Description of Test Modes.....	7
3.2.1 Test Mode Applicability and Tested Channel Detail.....	8
3.3 Description of Support Units.....	9
3.3.1 Configuration of System under Test.....	9
3.4 General Description of Applied Standards and References.....	9
4 Test Types and Results	10
4.1 Radiated Emission and Bandedge Measurement.....	10
4.1.1 Limits of Radiated Emission and Bandedge Measurement.....	10
4.1.2 Test Instruments.....	11
4.1.3 Test Procedures.....	12
4.1.4 Deviation from Test Standard.....	13
4.1.5 Test Set Up.....	13
4.1.6 EUT Operating Conditions.....	14
4.1.7 Test Results.....	15
4.2 Conducted Output Power Measurement.....	18
4.2.1 Limits of Conducted Output Power Measurement.....	18
4.2.2 Test Setup.....	18
4.2.3 Test Instruments.....	18
4.2.4 Test Procedures.....	18
4.2.5 Deviation from Test Standard.....	18
4.2.6 EUT Operating Conditions.....	18
4.2.7 Test Results.....	19
5 Pictures of Test Arrangements	20
Annex A- Band Edge Measurement	21
Appendix – Information of the Testing Laboratories	22

Release Control Record

Issue No.	Description	Date Issued
RFBGTL-WTW-P20100274-3	Original Release	Nov. 11, 2020

1 Certificate of Conformity

Product: 802.11a/b/g/n 2T2R with Bluetooth combo wireless module

Brand: Foxconn

Test Model: WBU053-LGABT

Sample Status: Engineering Sample

Applicant: Hon Hai Precision Industry Co., Ltd.

Test Date: Oct. 31 ~ Nov. 10, 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:** Nov. 11, 2020
Polly Chien / Specialist

Approved by : , **Date:** Nov. 11, 2020
Bruce Chen / 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	Without AC power port of the EUT
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.95 dB at 2483.5 MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note
15.247(b)	Conducted power	N/A	Refer to Note
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note:

1. This report is a partial report, only spot check test items such as Radiated Emissions and Conducted Power test chosen the worst channel of original report was were performed for this report. Refer to original report for the other test data.
2. For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
3. 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) (\pm)
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	802.11a/b/g/n 2T2R with Bluetooth combo wireless module
Brand	Foxconn
Test Model	WBU053-LGABT
Status of EUT	Engineering Sample
Power Supply Rating	3.0 ~3.6 Vdc
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
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 300 Mbps
Operating Frequency	2412 ~ 2462 MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	70.242 mW
Antenna Type	Refer to note as below
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. This report is a partial report, only spot check test items such as Radiated Spurious Emissions and Conducted Power test were performed for this report. Other testing data please refer to BV CPS report no.: RF191230C15. Differences compared with the original report are adding BT function, WLAN antennas and updating model, product name.
2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx Function
802.11b	2TX
802.11g	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

3. The antenna information is listed as below. (New antennas are shaded in grey.)

WLAN Antenna									
Ant. Type	Parts Number	Cable Length	Antenna Gain (dBi)						
			2400 MHz	2450 MHz	2500 MHz	5150 MHz	5500 MHz	5850 MHz	
PIFA	WLAN 0	790128B00-600-G	600m	-0.58	1.12	1.78	-1.30	0.07	-0.78
		790128C00-600-G	295m	1.48	3.16	2.05	1.11	2.56	1.56
		79012CE00-600-G	450m	-0.93	0.74	0.142	0.03	1.73	-1.09
	WLAN 1	79012AL00-600-G	700m	1.19	1.63	1.97	2.56	-0.37	-0.11
		790128C00-600-G	295m	1.48	3.16	2.05	1.11	2.56	1.56
		79012CE00-600-G	450m	-0.93	0.74	0.142	0.03	1.73	-1.09

* For 2.4G and 5G Band 2, 3, 4 : during testing to set Chain 0 and Chain 1 are Part # 790128C00-600-G.
 * For 5G Band 1 : during testing to set Chain 0 is Part # 790128C00-600-G and Chain 1 is Part # 79012AL00-600-G.
 * Only the antenna which has the maximum gain were chosen as a representative for the final test.

4. 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.
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

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

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

7 channels are provided for 802.11n (HT40):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To			Description
	RE \geq 1G	RE<1G	P	
-	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1 GHz **RE<1G**: Radiated Emission below 1 GHz
P: Conducted Output Power Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11g	1 to 11	11	OFDM	BPSK	6.0

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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11g	1 to 11	11	OFDM	BPSK	6.0

Conducted Output Power 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)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0

Test Condition:

Applicable To	Environmental Conditions	Input Power (System)	Tested by
RE \geq 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
P	25 deg. C, 60 % RH	3.3 Vdc	Luke Chen

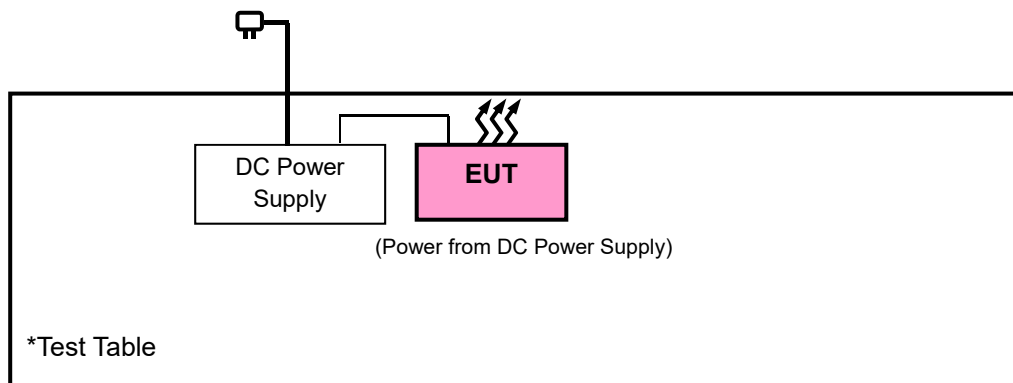
3.3 Description of Support Units

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.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	DC Power Supply	Topward	3303D	803136	N/A

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

3.3.1 Configuration of System under Test



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, 2020	Mar. 17, 2021
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 12, 2019	Dec. 11, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 16, 2020	Apr. 15, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100980	Apr. 20, 2020	Apr. 19, 2021
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
			Nov. 06, 2020	Nov. 05, 2021
Fixed Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	Apr. 14, 2020	Apr. 13, 2021
Loop Antenna	EM-6879	269	Sep. 17, 2020	Sep. 16, 2021
Preamplifier EMCI	EMC001340	980201	Oct. 21, 2020	Oct. 20, 2021
Bluetooth Tester	CBT	100946	Aug. 06, 2020	Aug. 05, 2022
Preamplifier EMCI	EMC 012645	980115	Oct. 07, 2020	Oct. 06, 2021
Preamplifier EMCI	EMC 184045	980116	Oct. 07, 2020	Oct. 06, 2021
Preamplifier EMCI	EMC 330H	980112	Oct. 07, 2020	Oct. 06, 2021
Power Meter Anritsu	ML2495A	1012010	Sep. 01, 2020	Aug. 31, 2021
Power Sensor Anritsu	MA2411B	1315050	Sep. 01, 2020	Aug. 31, 2021
RF Coaxial Cable EMCI	EMC104-SM-SM-8000	171005	Oct. 07, 2020	Oct. 06, 2021
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1000(140807)	Oct. 07, 2020	Oct. 06, 2021
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 07, 2020	Oct. 06, 2021
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
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 13, 2020	Jul. 12, 2021

Note: 1. The calibration interval of the above test instruments is 12 / 24 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:

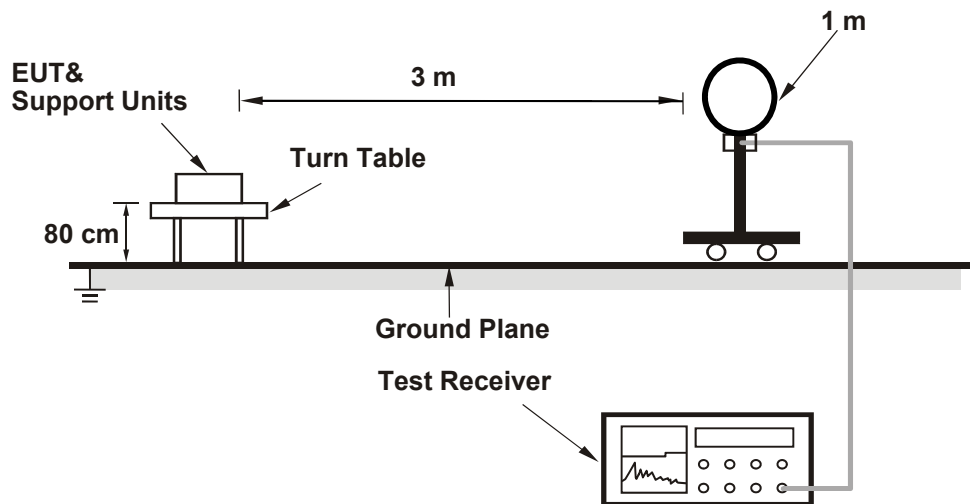
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
(11b: RBW = 1 MHz, VBW = 300 Hz ; 11g: RBW = 1 MHz, VBW = 1 kHz ;
11n (HT20): RBW = 1 MHz, VBW = 1 kHz ; 11n (HT40): 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

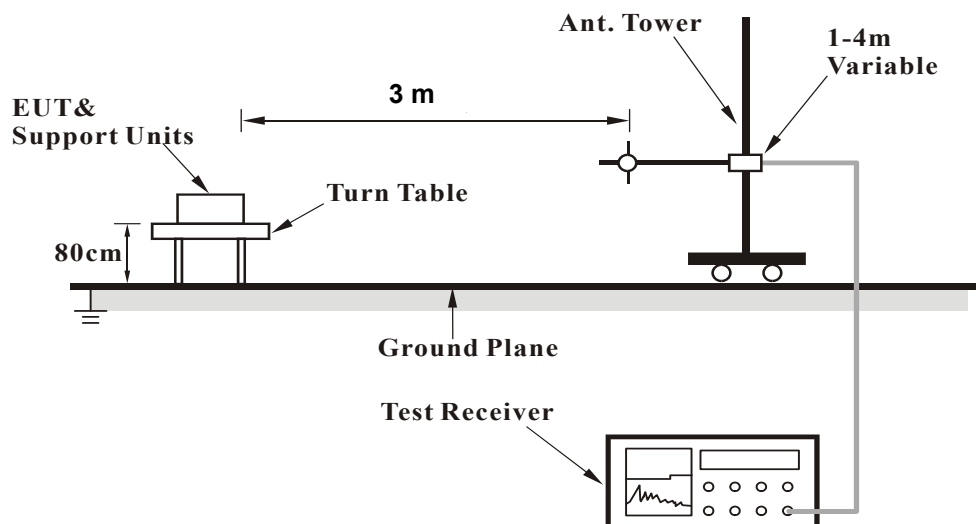
No deviation.

4.1.5 Test Set Up

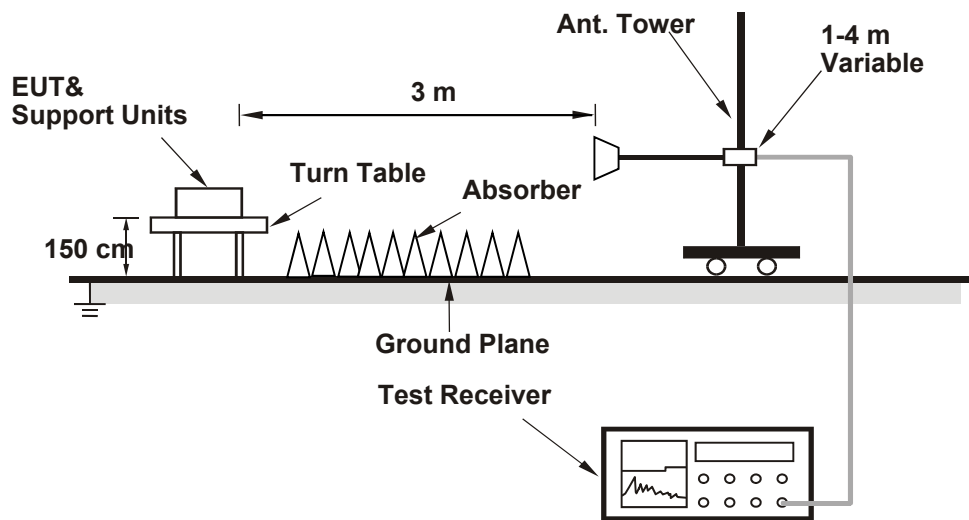
<Radiated Emission below 30 MHz>



<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

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

4.1.7 Test Results

Above 1 GHz Data :
802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

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
2462	100.98	106.79	-5.81	-----	-----	183	204	Average
2462	107.08	112.89	-5.81	-----	-----	183	204	Peak
2483.5	53.05	58.75	-5.7	54	-0.95	183	204	Average
2483.5	68.17	73.87	-5.7	74	-5.83	183	204	Peak
4924	41.34	56.85	-15.51	54	-12.66	102	3	Average
4924	49.12	64.63	-15.51	74	-24.88	102	3	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
2462	99.11	104.92	-5.81	-----	-----	204	181	Average
2462	105.64	111.45	-5.81	-----	-----	204	181	Peak
2483.5	51.36	57.06	-5.7	54	-2.64	204	181	Average
2483.5	64.5	70.2	-5.7	74	-9.5	204	181	Peak
4924	39.72	55.23	-15.51	54	-14.28	133	208	Average
4924	46.57	62.08	-15.51	74	-27.43	133	208	Peak

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.
- 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:

802.11g

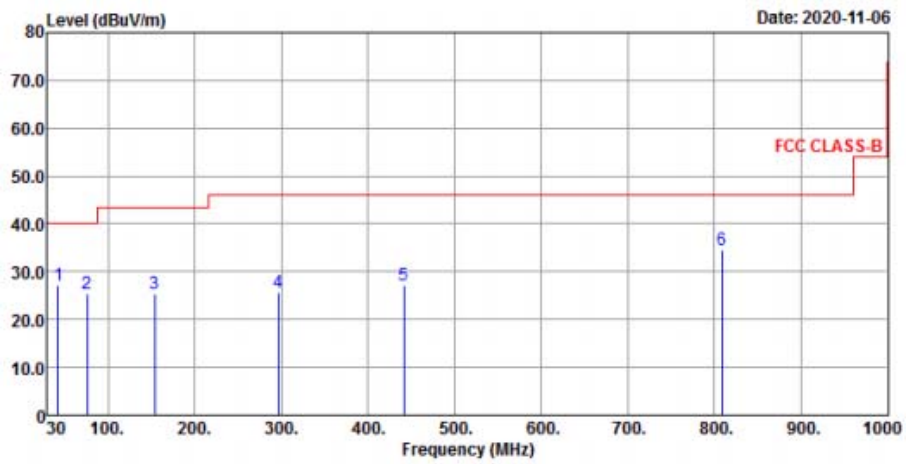
EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

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
42.61	27.22	39.2	-11.98	40	-12.78	130	346	Peak
75.59	25.34	40.66	-15.32	40	-14.66	127	232	Peak
154.16	25.34	36.9	-11.56	43.5	-18.16	119	254	Peak
296.75	25.72	37	-11.28	46	-20.28	121	199	Peak
441.28	27.09	33.72	-6.63	46	-18.91	112	287	Peak
808.91	34.53	32.65	1.88	46	-11.47	133	217	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
45.52	30.26	42.04	-11.78	40	-9.74	102	284	Peak
96.93	26.19	42.86	-16.67	43.5	-17.31	107	163	Peak
217.21	21.69	36.67	-14.98	46	-24.31	123	358	Peak
429.64	23.53	30.64	-7.11	46	-22.47	104	354	Peak
634.31	29.99	31.73	-1.74	46	-16.01	100	282	Peak
859.35	31.1	28.51	2.59	46	-14.9	139	214	Peak

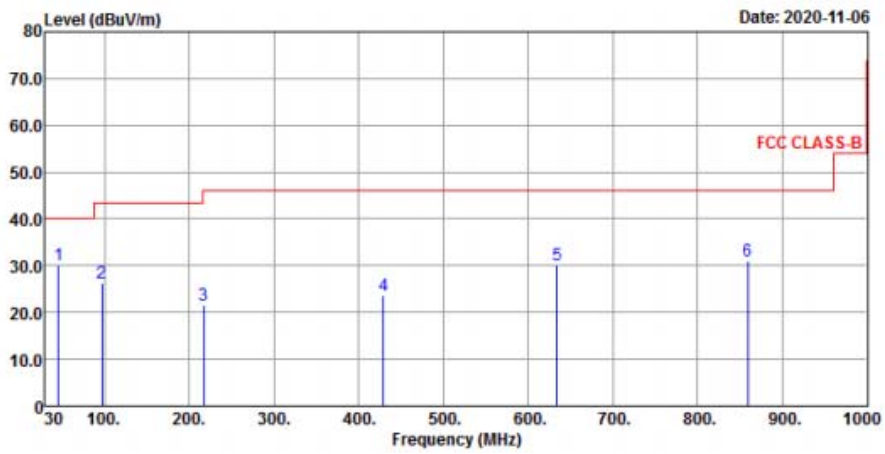
Remarks:

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

Horizontal



Vertical



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,

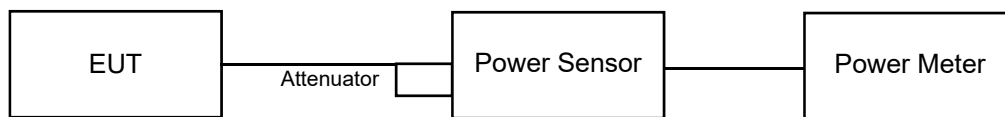
Array Gain = 0 dB (i.e., no array gain) for NANT \leq 4;

Array Gain = 0 dB (i.e., no array gain) for channel widths \geq 40 MHz for any NANT;

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

For power measurements on all other devices: Array Gain = $10 \log(\text{NANT}/\text{NSS})$ 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.

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

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

Peak Power

802.11b

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.38	15.53	70.242	18.47	30	Pass
6	2437	15.13	15.47	67.821	18.31	30	Pass
11	2462	15.31	15.51	69.526	18.42	30	Pass

Average Power

802.11b

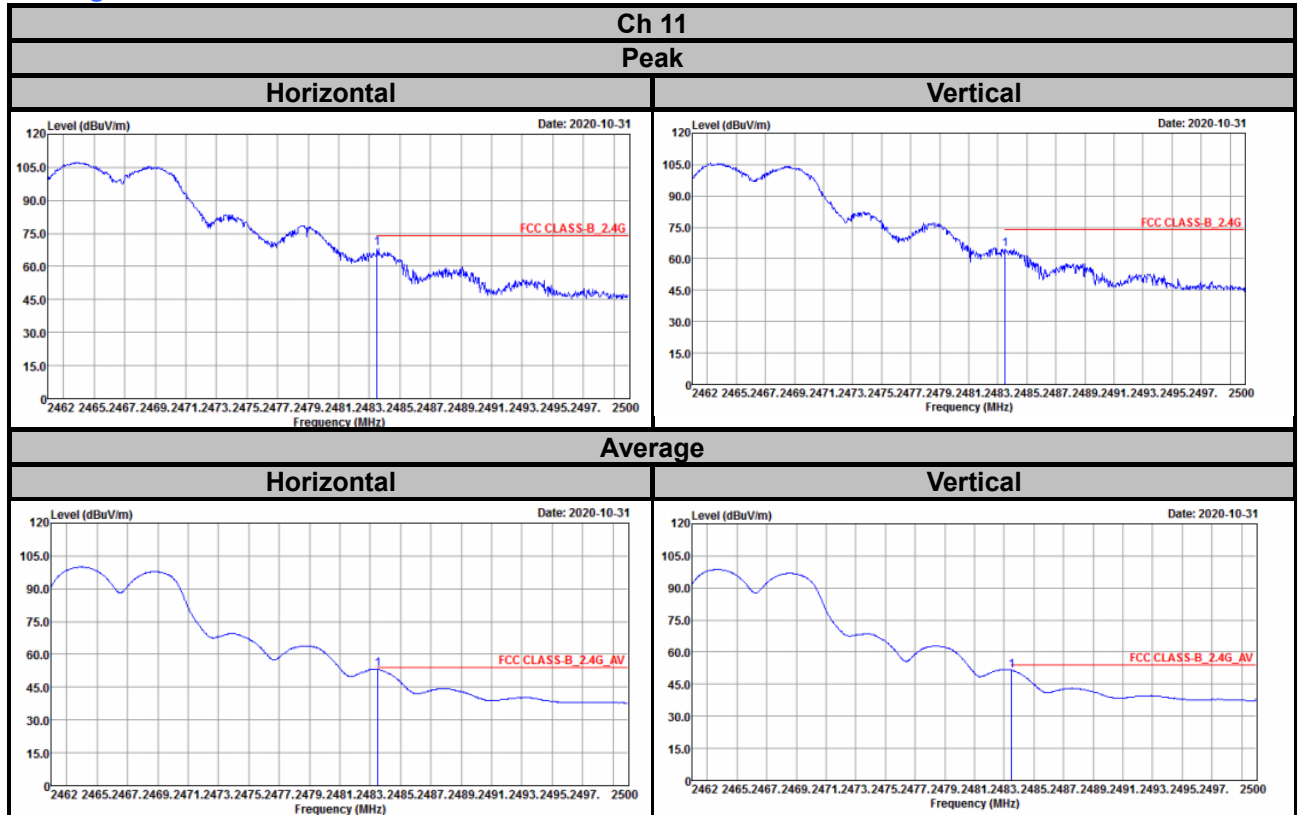
Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	13.29	14.85	51.880	17.15
6	2437	13.02	14.93	51.162	17.09
11	2462	13.25	14.98	52.612	17.21

5 Pictures of Test Arrangements

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

Annex A- Band Edge Measurement

802.11g



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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