FCC Test Report

(Spot Check)

Report No.:	RF190507C02-1
FCC ID:	MSQI01WDX
Original FCC ID:	MSQI01WD
Test Model:	ASUS_I01WDX
Received Date:	May 07, 2019
Test Date:	May 11 ~ May 17, 2019
Issued Date:	May 29, 2019
Applicant:	ASUSTek COMPUTER INC.
Address:	4F, No. 150, LI-TE Rd., PEITOU, TAIPEI 112, TAIWAN
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)
FCC Registration / Designation Number:	788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RF190507C02-1	Original release	May 29, 2019

1 Certificate of Conformity

Product:	ASUS Phone
Brand:	ASUS
Test Model:	ASUS_I01WDX
Sample Status:	Identical Prototype
Applicant:	ASUSTek COMPUTER INC.
Test Date:	May 11 ~ May 17, 2019
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 : Pettie Chen , **Date:** May 29, 2019

Pettie Chen / Senior Specialist

Approved by : Bruce Chen , **Date:** May 29, 2019

Bruce Chen / 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) (1/2/3/4(i/ii)/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.5dB at 5725.00MHz.
15.407(a)(1/2/3)	Max Average Transmit 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.

2.1 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) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	ASUS Phone
Brand	ASUS
Test Model	ASUS_I01WDX
Sample Status	Identical Prototype
Power Supply Rating	3.85 Vdc (Battery) 5 or 9 Vdc (Adapter) 5 Vdc (Host equipment)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps
Operating Frequency	5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5720MHz, 5745 ~ 5825MHz
Number of Channel	5180 ~ 5240MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5260 ~ 5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5500 ~ 5720MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 12 802.11n (HT40), 802.11ac (VHT40): 6 802.11ac (VHT80): 3 5745 ~ 5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1
Output Power	5180 ~ 5240MHz: 64.477mW 5260 ~ 5320MHz: 66.303mW 5500 ~ 5720MHz: 55.600mW 5745 ~ 5825MHz: 67.348mW
Antenna Type	Refer to Note as below
Antenna Connector	Refer to Note as below
Accessory Device	Refer to Note as below
Cable Supplied	Refer to Note as below

Note:

1. This report is a supplementary report to the original BV CPS report no.: RF190114C07-1. Exhibit prepared for FCC Spot Check Verification report, the format, test items and amount of spot-check test data are decided by applicant's engineering judgment, for more details please refer to declaration letter exhibit. Conducted power and radiated emission verification test based on the worst channel refer to origingal report.
2. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function
802.11a	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX
802.11ac (VHT20)	2TX
802.11ac (VHT40)	2TX
802.11ac (VHT80)	2TX

* The modulation and bandwidth are similar for 802.11n mode for 20MHz/40MHz and 802.11ac mode for 20MHz/40MHz, therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

3. The EUT accessories list refers to EUT Photo.pdf.
4. The following antennas were provided to the EUT.

Ant. No.	Type	Connector	Gain (dBi)				
			2.4GHz	5.15-5.25 GHz	5.25-5.35 GHz	5.47-5.725 GHz	5.725-5.85 GHz
GPSL1/BT/WLAN Antenna-0	PIFA	NA	-3.5	-3.7	-4.7	-1.4	-2.5
GPSL5/WLAN Antenna-1	PIFA	NA	-2.3	-2.2	-1.1	-0.7	-0.4

3.2 Description of Test Modes

For 5180 ~ 5240MHz:

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

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

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

For 5260 ~ 5320MHz:

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
58	5290MHz

For 5500 ~ 5720MHz:

12 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	144	5720 MHz

6 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channels are provided for 802.11ac (VHT80):

Channel	Frequency	Channel	Frequency
106	5530 MHz	122	5610 MHz
138	5690 MHz		

For 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

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

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to			Description
	RE≥1G	RE<1G	P	
-	√	√	√	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement RE<1G: Radiated Emission below 1GHz

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 **X-plane**.

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.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11n (HT40)	5180-5240	38 to 46	134	OFDM	13.5
-	802.11n (HT40)	5260-5320	54 to 62		OFDM	13.5
-	802.11n (HT40)	5500-5720	102 to 142		OFDM	13.5
-	802.11n (HT40)	5745-5825	151 to 159		OFDM	13.5

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.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11n (HT40)	5180-5240	38 to 46	134	OFDM	13.5
-	802.11n (HT40)	5260-5320	54 to 62		OFDM	13.5
-	802.11n (HT40)	5500-5720	102 to 142		OFDM	13.5
-	802.11n (HT40)	5745-5825	151 to 159		OFDM	13.5

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	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	6.0
	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	6.5
	802.11n (HT40)		38 to 46	38, 46	OFDM	13.5
	802.11ac (VHT80)		42	42	OFDM	29.3
-	802.11a	5260-5320	52 to 64	52, 60, 64	OFDM	6.0
	802.11n (HT20)		52 to 64	52, 60, 64	OFDM	6.5
	802.11n (HT40)		54 to 62	54, 62	OFDM	13.5
	802.11ac (VHT80)		58	58	OFDM	29.3
-	802.11a	5500-5720	100 to 144	100, 116, 140, 144	OFDM	6.0
	802.11n (HT20)		100 to 144	100, 116, 140, 144	OFDM	6.5
	802.11n (HT40)		102 to 142	102, 110, 134, 142	OFDM	13.5
	802.11ac (VHT80)		106 to 138	106, 122, 138	OFDM	29.3
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	6.0
	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	6.5
	802.11n (HT40)		151 to 159	151, 159	OFDM	13.5
	802.11ac (VHT80)		155	155	OFDM	29.3

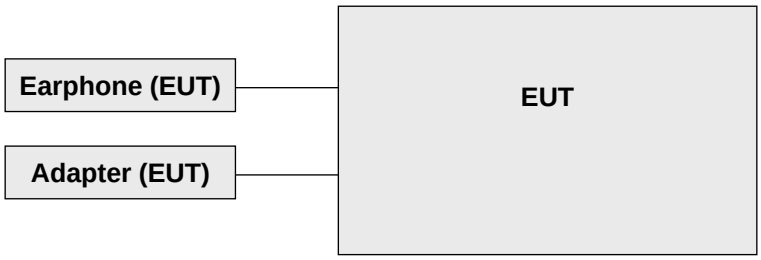
Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE≥1G	22 deg. C, 66% RH	120Vac, 60Hz	Greg Lin
RE<1G	24 deg. C, 64% RH	120Vac, 60Hz	Match Tsui
P	25 deg. C, 60% RH	120Vac, 60Hz	Chris Lin

3.3 Description of Support Units

The EUT has been tested as an independent unit.

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

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

FCC Part 15, Subpart E (15.407)
KDB 789033 D02 General UNII Test Procedure New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10:2013

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

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 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.

Limits of unwanted emission out of the restricted bands

<table>
<tr><td colspan="3">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK: 74 (dBμV/m)</td><td>AV: 54 (dBμV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></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).

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	May 29, 2018	May 28, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	100115	Jan. 21, 2019	Jan. 20, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 25, 2018	Sep. 24, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Nov. 22, 2018	Nov. 21, 2019
HORN Antenna SCHWARZBECK	9120D	209	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 25, 2018	Nov. 24, 2019
Loop Antenna TESEQ	HLA 6121	45745	Jun. 14, 2018	Jun. 13, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Aug. 21, 2018	Aug. 20, 2019
Preamplifier KEYSIGHT (Above 1GHz)	83017A	MY53270295	Jul. 02, 2018	Jul. 01, 2019
RF signal cable WOKEN	8D-FB	Cable-CH3-01	Aug. 21, 2018	Aug. 20, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Aug. 21, 2018	Aug. 20, 2019
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM-SM-8000	Cable-CH3-03 (309224+170907)	Aug. 21, 2018	Aug. 20, 2019
Software BV ADT	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Nov. 14, 2018	Nov. 13, 2019
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 17, 2018	Jul. 16, 2019

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 3.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

4.1.3 Test Procedures

For Radiated emission below 30MHz

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 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detect 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:

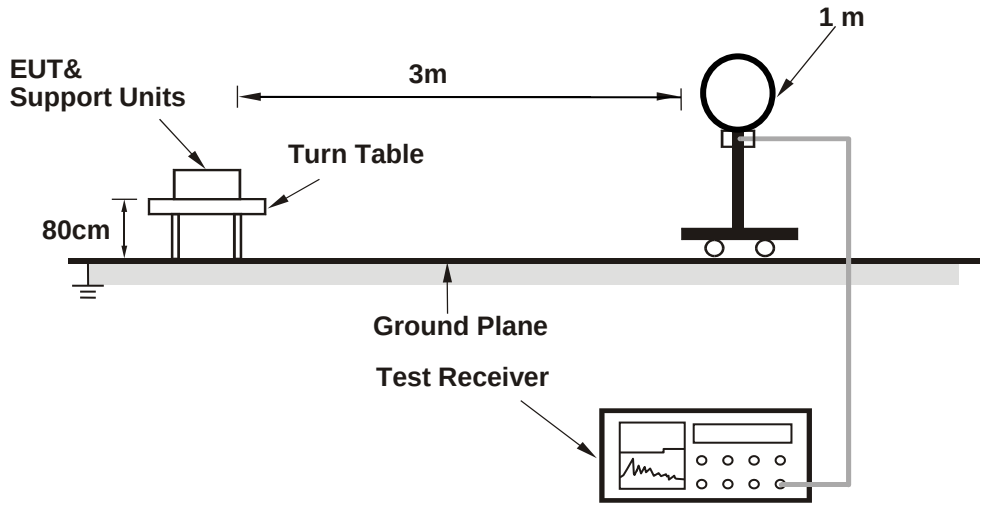
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

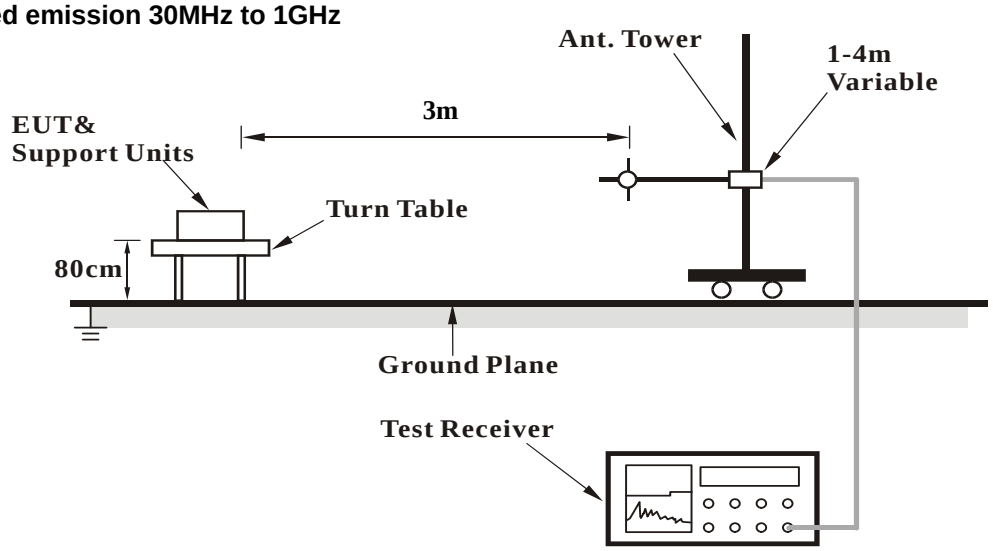
No deviation.

4.1.5 Test Setup

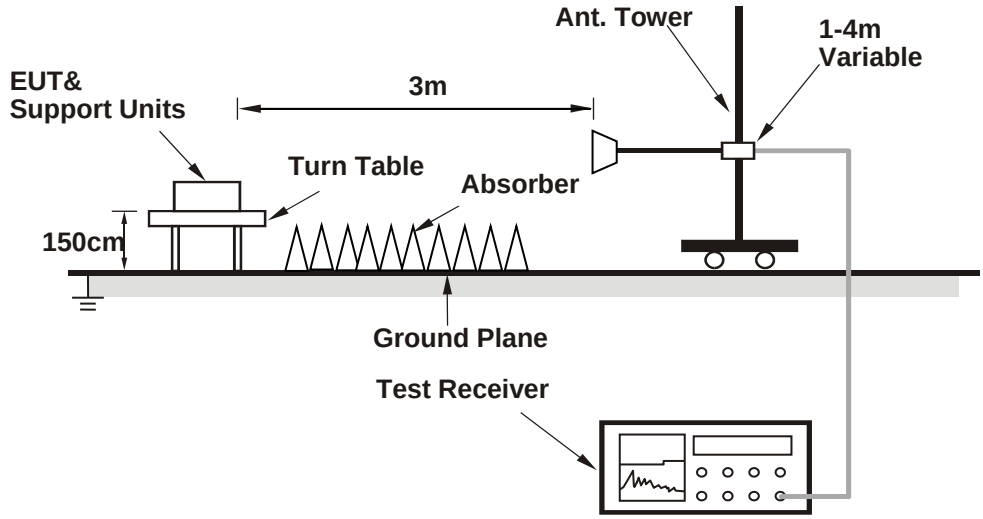
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz data:

802.11n (HT40)

CHANNEL	TX Channel 134	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5670.00	101.3 PK			1.32 H	207	62.8	38.5
2	*5670.00	90.8 AV			1.32 H	207	52.3	38.5
3	#5725.00	65.3 PK	68.2	-2.9	1.49 H	216	61.2	4.1
4	11340.00	58.4 PK	74.0	-15.6	2.17 H	268	41.8	16.6
5	11340.00	45.2 AV	54.0	-8.8	2.17 H	268	28.6	16.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5670.00	102.1 PK			3.52 V	104	63.6	38.5
2	*5670.00	91.6 AV			3.52 V	104	53.1	38.5
3	**#5725.00**	**66.7 PK**	**68.2**	**-1.5**	**3.61 V**	**114**	**62.6**	**4.1**
4	11340.00	58.8 PK	74.0	-15.2	1.76 V	247	42.2	16.6
5	11340.00	45.7 AV	54.0	-8.3	1.76 V	247	29.1	16.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency
6. " # ": The radiated frequency is out of the restricted band

Below 1GHz Worst-Case Data:

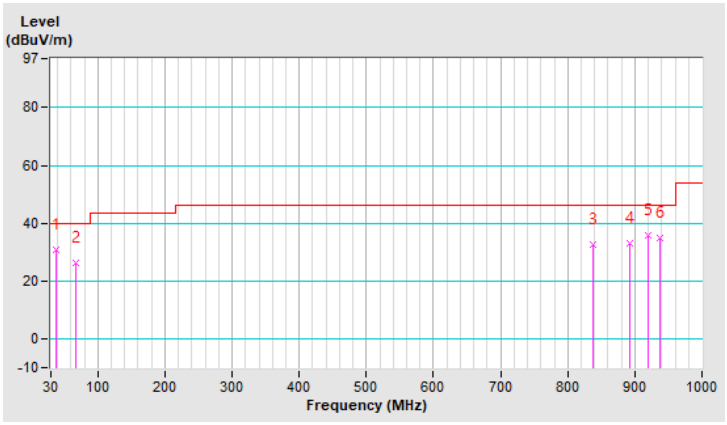
802.11n (HT40)

CHANNEL	TX Channel 134	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	38.73	30.7 QP	40.0	-9.3	1.00 H	43	41.1	-10.4
2	66.86	26.4 QP	40.0	-13.6	1.00 H	288	37.4	-11.0
3	837.04	32.4 QP	46.0	-13.6	1.00 H	265	30.1	2.3
4	892.33	33.1 QP	46.0	-12.9	1.49 H	90	30.3	2.8
5	919.49	35.7 QP	46.0	-10.3	1.00 H	240	32.0	3.7
6	936.95	34.8 QP	46.0	-11.2	1.49 H	325	30.9	3.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report

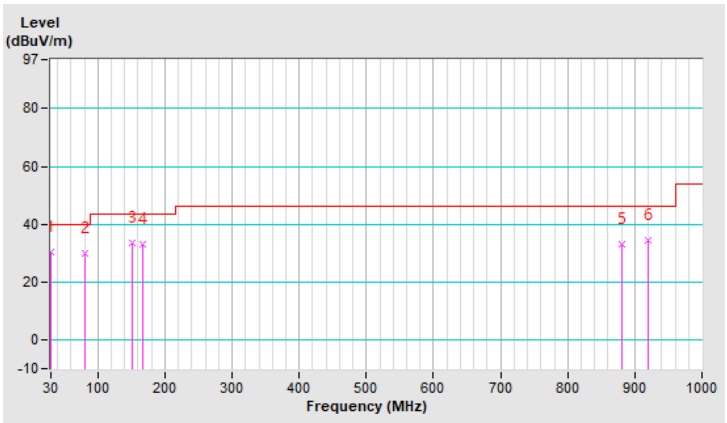


CHANNEL	TX Channel 134	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	30.00	30.4 QP	40.0	-9.6	1.00 V	204	41.6	-11.2
2	81.41	30.0 QP	40.0	-10.0	1.50 V	184	44.3	-14.3
3	152.22	33.7 QP	43.5	-9.8	1.50 V	283	43.1	-9.4
4	166.77	33.2 QP	43.5	-10.3	1.50 V	140	42.5	-9.3
5	880.69	32.9 QP	46.0	-13.1	1.00 V	210	30.3	2.6
6	919.49	34.4 QP	46.0	-11.6	1.00 V	5	30.7	3.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report



4.2 Transmit Power Measurement

4.2.1 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 ≦ 125mW(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	250mW (24 dBm)
U-NII-2A	√		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	√		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	√		1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

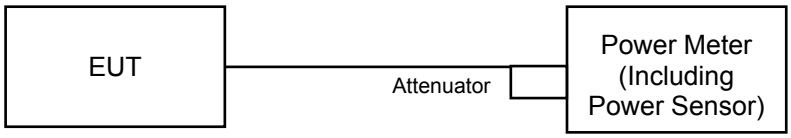
Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

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 $N_{ANT} \geq 5$.

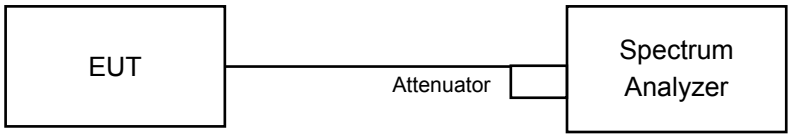
For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.2.2 Test Setup

For Power Output



For 26dB Bandwidth



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

For Average Power Measurement

Method PM is 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 and set the detector to average. Duty factor is not added to measured value.

For 26dB 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%.

4.2.5 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 Result

Power Output:

802.11a

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	14.72	15.23	62.991	17.99	24.00	Pass
40	5200	14.83	15.13	62.993	17.99	24.00	Pass
48	5240	14.90	15.26	64.477	18.09	24.00	Pass
52	5260	14.89	15.03	62.674	17.97	24.00	Pass
60	5300	15.08	15.27	65.862	18.19	24.00	Pass
64	5320	15.20	15.21	66.303	18.22	24.00	Pass
100	5500	14.52	14.20	54.617	17.37	24.00	Pass
116	5580	14.51	14.13	54.131	17.33	24.00	Pass
140	5700	14.50	14.38	55.600	17.45	24.00	Pass
144	5720 (For U-NII-2C)	11.46	11.33	27.579	14.41	23.06	Pass
144	5720 (For U-NII-3)	4.90	4.86	6.152	7.89	30.00	Pass
149	5745	14.98	14.95	62.738	17.98	30.00	Pass
157	5785	15.43	15.11	67.348	18.28	30.00	Pass
165	5825	15.32	15.10	66.400	18.22	30.00	Pass

Note:

For U-NII-2A, U-NII-2C Band:

Chain 0

1. 11dBm + 10log (23.17) = 24.64 > 24dBm
2. 11dBm + 10log (23.03) = 24.62 > 24dBm
3. 11dBm + 10log (22.20) = 24.46 > 24dBm
4. 11dBm + 10log (22.51) = 24.52 > 24dBm
5. 11dBm + 10log (23.56) = 24.72 > 24dBm
6. 11dBm + 10log (23.17) = 24.64 > 24dBm
7. 11dBm + 10log (5725.00 - 5708.74) = 23.11 < 24dBm

Chain 1

1. 11dBm + 10log (22.82) = 24.58 > 24dBm
2. 11dBm + 10log (22.85) = 24.58 > 24dBm
3. 11dBm + 10log (22.65) = 24.55 > 24dBm
4. 11dBm + 10log (22.44) = 24.51 > 24dBm
5. 11dBm + 10log (22.00) = 24.42 > 24dBm
6. 11dBm + 10log (22.39) = 24.50 > 24dBm
7. 11dBm + 10log (5725.00 - 5708.93) = 23.06 < 24dBm

For Reference only-Power meter value
The power value was measured by power meter with average sensor

Chan.	Freq. (MHz)	Conducted Power (mW)	Conducted Power (dBm)
144	5720	35.24	15.47

802.11n (HT20)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	14.03	13.56	47.992	16.81	24.00	Pass
40	5200	13.85	14.05	49.676	16.96	24.00	Pass
48	5240	14.01	14.17	51.298	17.10	24.00	Pass
52	5260	14.23	14.12	52.308	17.19	24.00	Pass
60	5300	14.23	14.01	51.662	17.13	24.00	Pass
64	5320	14.32	14.11	52.803	17.23	24.00	Pass
100	5500	13.80	13.09	44.359	16.47	24.00	Pass
116	5580	13.68	13.00	43.287	16.36	24.00	Pass
140	5700	13.56	13.13	43.258	16.36	24.00	Pass
144	5720 (For U-NII-2C)	10.38	10.52	22.186	13.46	23.20	Pass
144	5720 (For U-NII-3)	4.43	4.30	5.465	7.38	30.00	Pass
149	5745	14.17	14.03	51.415	17.11	30.00	Pass
157	5785	14.37	14.15	53.354	17.27	30.00	Pass
165	5825	14.24	14.12	52.369	17.19	30.00	Pass

Note:
For U-NII-2A, U-NII-2C Band:
Chain 0
1. 11dBm + 10log (25.26) = 25.02 > 24dBm
2. 11dBm + 10log (23.18) = 24.65 > 24dBm
3. 11dBm + 10log (24.90) = 24.96 > 24dBm
4. 11dBm + 10log (24.00) = 24.80 > 24dBm
5. 11dBm + 10log (23.93) = 24.78 > 24dBm
6. 11dBm + 10log (23.69) = 24.74 > 24dBm
7. 11dBm + 10log (5725.00 - 5708.37) = 23.20 < 24dBm

Chain 1
1. 11dBm + 10log (23.42) = 24.69 > 24dBm
2. 11dBm + 10log (23.66) = 24.74 > 24dBm
3. 11dBm + 10log (23.79) = 24.76 > 24dBm
4. 11dBm + 10log (23.35) = 24.68 > 24dBm
5. 11dBm + 10log (24.78) = 24.94 > 24dBm
6. 11dBm + 10log (23.31) = 24.67 > 24dBm
7. 11dBm + 10log (5725.00 - 5708.33) = 23.21 < 24dBm

For Reference only-Power meter value
The power value was measured by power meter with average sensor

Chan.	Freq. (MHz)	Conducted Power (mW)	Conducted Power (dBm)
144	5720	27.102	14.33

802.11n (HT40)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
38	5190	14.21	13.79	50.296	17.02	24.00	Pass
46	5230	13.91	13.87	48.982	16.90	24.00	Pass
54	5270	14.13	13.99	50.943	17.07	24.00	Pass
62	5310	14.33	14.21	53.465	17.28	24.00	Pass
102	5510	13.45	12.92	41.719	16.20	24.00	Pass
110	5550	13.46	12.89	41.636	16.19	24.00	Pass
134	5670	13.52	13.03	42.581	16.29	24.00	Pass
142	5710 (For U-NII-2C)	9.42	9.60	17.870	12.52	24.00	Pass
142	5710 (For U-NII-3)	-1.02	-1.44	1.508	1.79	30.00	Pass
151	5755	14.15	13.70	49.444	16.94	30.00	Pass
159	5795	14.20	13.95	51.134	17.09	30.00	Pass

Note:
For U-NII-2A, U-NII-2C Band:
Chain 0
1. 11dBm + 10log (41.96) = 27.22 > 24dBm
2. 11dBm + 10log (42.14) = 27.24 > 24dBm
3. 11dBm + 10log (42.14) = 27.24 > 24dBm
4. 11dBm + 10log (42.04) = 27.23 > 24dBm
5. 11dBm + 10log (42.22) = 27.25 > 24dBm
6. 11dBm + 10log (5725.00 - 5689.11) = 26.54 > 24dBm

Chain 1
1. 11dBm + 10log (42.02) = 27.23 > 24dBm
2. 11dBm + 10log (41.97) = 27.22 > 24dBm
3. 11dBm + 10log (42.49) = 27.28 > 24dBm
4. 11dBm + 10log (42.67) = 27.30 > 24dBm
5. 11dBm + 10log (42.24) = 27.25 > 24dBm
6. 11dBm + 10log (5725.00 - 5688.89) = 26.57 > 24dBm

For Reference only-Power meter value
The power value was measured by power meter with average sensor

Chan.	Freq. (MHz)	Conducted Power (mW)	Conducted Power (dBm)
142	5710	20.845	13.19

802.11ac (VHT80)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
42	5210	13.03	12.87	39.455	15.96	24.00	Pass
58	5290	13.07	13.08	40.600	16.09	24.00	Pass
106	5530	12.52	12.08	34.008	15.32	24.00	Pass
122	5610	12.54	12.15	34.353	15.36	24.00	Pass
138	5690 (For U-NII-2C)	8.03	8.15	12.885	11.10	24.00	Pass
138	5690 (For U-NII-3)	-5.13	-5.76	0.572	-2.42	30.00	Pass
155	5775	13.38	13.06	42.007	16.23	30.00	Pass

Note:
For U-NII-2A, U-NII-2C Band:
Chain 0
1. 11dBm + 10log (83.39) = 30.21 > 24dBm
2. 11dBm + 10log (84.41) = 30.26 > 24dBm
3. 11dBm + 10log (84.64) = 30.27 > 24dBm
4. 11dBm + 10log (5725.00 - 5647.94) = 29.87 > 24dBm

Chain 1
1. 11dBm + 10log (83.82) = 30.23 > 24dBm
2. 11dBm + 10log (83.57) = 30.22 > 24dBm
3. 11dBm + 10log (84.14) = 30.25 > 24dBm
4. 11dBm + 10log (5725.00 - 5648.75) = 29.82 > 24dBm

For Reference only-Power meter value
The power value was measured by power meter with average sensor

Chan.	Freq. (MHz)	Conducted Power (mW)	Conducted Power (dBm)
138	5690	13.932	11.44

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 and approved according to ISO/IEC 17025.

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

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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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