FCC Test Report

Report No.:	RF160901E04A-1
FCC ID:	Z3M-E2100
Test Model:	E2100
Received Date:	Sep. 01, 2016
Test Date:	Oct. 24 to Nov. 11, 2016
Issued Date:	Mar. 06, 2017
Applicant:	Greenwave Systems Pte. Ltd.
Address:	10 Science Park Road, #02-07/08, The Alpha (Science Park II), Singapore 117684
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 R.O.C.
Test Location (1):	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

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Release Control Record

Issue No.	Description	Date Issued
RF160901E04A-1	Original release.	Mar. 06, 2017

1 Certificate of Conformity

Product:	Wi-Fi Extender
Brand:	NA
Test Model:	E2100
Sample Status:	MASS-PRODUCTION
Applicant:	Greenwave Systems Pte. Ltd.
Test Date:	Oct. 24 to Nov. 11, 2016
Standard:	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 EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Mar. 06, 2017

Midoli Peng / Specialist

Approved by : _____ , **Date:** Mar. 06, 2017

May Chen / Manager

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 -0.2 dB at 5470.00MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is i-pex(MHF) not a standard connector.

Note: 1. *For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOBE test plots were recorded in Annex A.

2. This report is prepared for FCC Class II change.

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	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wi-Fi Extender
Brand	NA
Test Model	E2100
Status of EUT	MASS-PRODUCTION
Power Supply Rating	DC 12V from power adapter
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode
Modulation Technology	OFDM
Transfer Rate	802.11a: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1733.3Mbps
Operating Frequency	5.18~5.24GHz, 5.26~5.32GHz, 5.50~5.72GHz, 5.745~5.825GHz
Number of Channel	802.11a, 802.11n (HT20), 802.11ac (VHT20): 25 802.11n (HT40), 802.11ac (VHT40): 12 802.11ac (VHT80): 6
Output Power	**For 15.407:** **CDD Mode :** 5180-5240MHz : 767.196mW 5260-5320MHz : 249.65mW 5500-5720MHz : 231.867mW 5745-5825MHz : 897.877mW **SDM Mode :** 5180-5240MHz : 767.196mW 5260-5320MHz : 249.65mW 5500-5700MHz : 230.622mW 5745-5825MHz : 819.587mW **BF Mode :** 5180-5240MHz : 767.196mW 5260-5320MHz : 249.65mW 5500-5720MHz : 230.622mW 5745-5825MHz : 819.587mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1
Data Cable Supplied	NA

Note:

1. This is a supplementary report of Report No.: RF160901E04-1. The differences between them are as below information:
   - ◆ Enabled the Master function of DFS band by the software control.
   - ◆ The manufacturer swap the antenna (antenna no. 5G-8 & 5G-7 ; 5G-4 & 5G-3)
2. This report is prepared for FCC class II permissive change. Only Radiated Emissions and Transmit Power were presented in this test report.

3. The EUT has two kind of 5GHz filter. Detail as described in table below:

Item	Supplier	Remark	Description
SKU #1	Sangshin	W+S	5GHz filter passive filter (pin to pin & same design)
SKU #2	Partron	W+P	5GHz filter passive filter (pin to pin & same design)

From the above items, SKU #1 was selected as representative type for the test and its data was recorded in this report.

4. The EUT has three radio transceivers as below table:

Radio	Band
Radio 1	2.4GHz
Radio 2	5GHz<U-NII-1 & U-NII-2A>
Radio 3	5GHz<U-NII-2C & U-NII-3>
Remark: This device can support different category application which switched to master mode or client mode by software.	

5. Simultaneously transmission condition.

Condition	**Technology**		
1	WLAN (2.4GHz)	WLAN (5GHz <U-NII-1 & U-NII-2A>)	WLAN (5GHz <U-NII-2C & U-NII-3>)
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.			

6. The EUT must be supplied with a power adapter as following table:

Brand	Model No.	Spec.
NA	MU36-D120300-A1	Input: 100-240Vac, 50-60Hz, 1.5A Output: 12Vdc, 3A DC output cable (Unshielded, 1.8m)

7. The antennas provided to the EUT, please refer to the following table:

No.	PCB Chain No	Brand	Antenna Gain(dBi) Including cable loss	Frequency range (GHz~GHz)	Antenna Type	Connector type	Cable Length (mm)
2G-1	Chain 2	WNC	4.62	2.4~2.4835	Dipole	i-pex(MHF)	75
2G-2	Chain 1	WNC	3.33	2.4~2.4835	Dipole	i-pex(MHF)	52
2G-3	Chain 0	WNC	3.63	2.4~2.4835	Dipole	i-pex(MHF)	187
5G-5	Chain 3	WNC	3.24	5.15~5.25	Dipole	i-pex(MHF)	171
			3.24	5.25~5.35			
5G-6	Chain 2	WNC	4.39	5.15~5.25	Dipole	i-pex(MHF)	187
			4.58	5.25~5.35			
5G-8	Chain 1	WNC	4.63	5.15~5.25	Dipole	i-pex(MHF)	237
			4.07	5.25~5.35			
5G-7	Chain 0	WNC	3.68	5.15~5.25	Dipole	i-pex(MHF)	228
			3.62	5.25~5.35			
5G-1	Chain 3	WNC	3.45	5.47~5.725	Dipole	i-pex(MHF)	43
			3.45	5.725~5.85			
5G-2	Chain 2	WNC	4.28	5.47~5.725	Dipole	i-pex(MHF)	37
			4.47	5.725~5.85			
5G-4	Chain 1	WNC	2.71	5.47~5.725	Dipole	i-pex(MHF)	90
			2.95	5.725~5.85			
5G-3	Chain 0	WNC	4.01	5.47~5.725	Dipole	i-pex(MHF)	73
			3.54	5.725~5.85			

8. The Directional gain table:

Frequency (MHz)	Max Gain (dBi)
UNII-1 band	3.97
UNII-2A band	4.29
UNII-2C band	5.21
UNII-3 band	4.88

Note:

1. Non-TxBF mode & TxBF mode antenna gain refer to KDB 662911 F 2) f) (ii)

$$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

9. The EUT incorporates a MIMO function:

MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	4TX	4RX
802.11n (HT20)	MCS 0~7	4TX	4RX
	MCS 8~15	4TX	4RX
	MCS 16~23	4TX	4RX
	MCS 24~31	4TX	4RX
802.11n (HT40)	MCS 0~7	4TX	4RX
	MCS 8~15	4TX	4RX
	MCS 16~23	4TX	4RX
	MCS 24~31	4TX	4RX
802.11ac (VHT20)	MCS0~8 Nss=1	4TX	4RX
	MCS0~8 Nss=2	4TX	4RX
	MCS0~9 Nss=3	4TX	4RX
	MCS0~8 Nss=4	4TX	4RX
802.11ac (VHT40)	MCS0~9 Nss=1	4TX	4RX
	MCS0~9 Nss=2	4TX	4RX
	MCS0~9 Nss=3	4TX	4RX
	MCS0~9 Nss=4	4TX	4RX
802.11ac (VHT80)	MCS0~9 Nss=1	4TX	4RX
	MCS0~9 Nss=2	4TX	4RX
	MCS0~9 Nss=3	4TX	4RX
	MCS0~9 Nss=4	4TX	4RX

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. 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)

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

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	5290 MHz

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	138	5690 MHz
122	5610 MHz		

FOR 5745 ~ 5825MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775 MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

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

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

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.

Radio 2 – CDD mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11ac (VHT80)	5180-5240	42	42	OFDM	BPSK	29.3
802.11ac (VHT80)	5260-5320	58	58	OFDM	BPSK	29.3
Radio 3 – CDD mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11ac (VHT80)	5500-5720	106 to 138	106, 122, 138	OFDM	BPSK	29.3
802.11ac (VHT80)	5745-5825	155	155	OFDM	BPSK	29.3

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.

Radio 2 – CDD mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11ac (VHT80)	5180-5240 5260-5320	58	58	OFDM	BPSK	29.3
Radio 3 – CDD mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11ac (VHT80)	5500-5720 5745-5825	155	155	OFDM	BPSK	29.3

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.

Transmit Power Measurment						
Radio 2 – CDD mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11ac (VHT20)		36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11ac (VHT40)		38 to 46	38, 46	OFDM	BPSK	13.5
802.11ac (VHT80)		42	42	OFDM	BPSK	29.3
802.11a	5260-5320	52 to 64	52, 60, 64	OFDM	BPSK	6
802.11ac (VHT20)		52 to 64	52, 60, 64	OFDM	BPSK	6.5
802.11ac (VHT40)		54 to 62	54, 62	OFDM	BPSK	13.5
802.11ac (VHT80)		58	58	OFDM	BPSK	29.3
Radio 3– CDD mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11a	5500-5720	100 to 144	100, 116, 140, 144	OFDM	BPSK	6
802.11ac (VHT20)		100 to 144	100, 116, 140, 144	OFDM	BPSK	6.5
802.11ac (VHT40)		102 to 142	102, 110, 134, 142	OFDM	BPSK	13.5
802.11ac (VHT80)		106 to 138	106, 122, 138	OFDM	BPSK	29.3
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
802.11ac (VHT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3
Radio 2 –SDM, BF mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11ac (VHT20)	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11ac (VHT40)		38 to 46	38, 46	OFDM	BPSK	13.5
802.11ac (VHT80)		42	42	OFDM	BPSK	29.3
802.11ac (VHT20)	5260-5320	52 to 64	52, 60, 64	OFDM	BPSK	6.5
802.11ac (VHT40)		54 to 62	54, 62	OFDM	BPSK	13.5
802.11ac (VHT80)		58	58	OFDM	BPSK	29.3
Radio 3–SDM, BF mode						
Mode	**FREQ. Band (MHz)**	**Available Channel**	**Tested Channel**	**Modulation Technology**	**Modulation Type**	**Data Rate (Mbps)**
802.11ac (VHT20)	5500-5720	100 to 144	100, 116, 140, 144	OFDM	BPSK	6.5
802.11ac (VHT40)		102 to 142	102, 110, 134, 142	OFDM	BPSK	13.5
802.11ac (VHT80)		106 to 138	106, 122, 138	OFDM	BPSK	29.3
802.11ac (VHT20)	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3

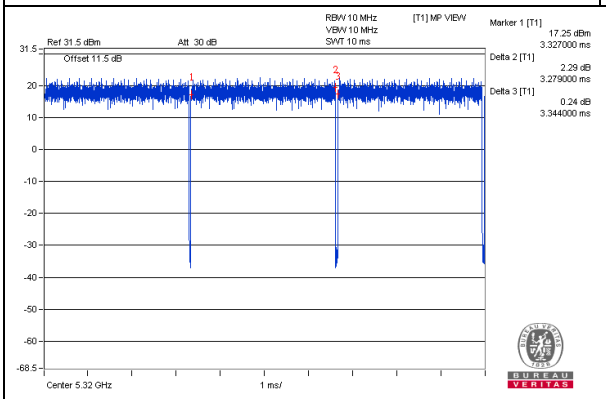
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	24deg. C, 63%RH 24deg. C, 65%RH	120Vac, 60Hz	Gary Cheng Jyunchun Lin
RE<1G	23deg. C, 62%RH	120Vac, 60Hz	Jyunchun Lin
APCM	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

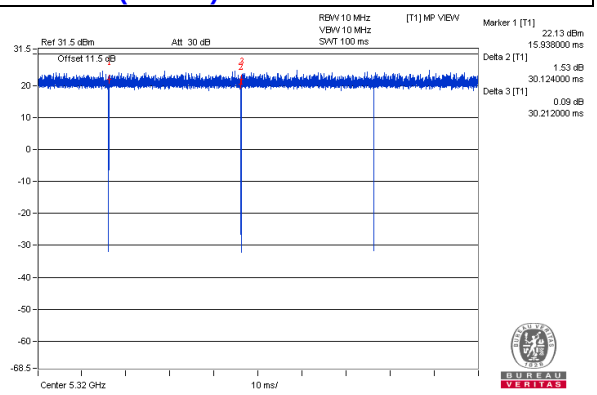
3.3 Duty Cycle of Test Signal

Duty cycle of test signal is ≥ 98 %, duty factor is not required.
802.11a: Duty cycle = 3.279 ms/3.344 ms = 0.981
802.11ac (VHT20): Duty cycle = 30.124 ms/30.212 ms = 0.997
802.11ac (VHT40): Duty cycle = 14.544 ms/14.619 ms = 0.995
802.11ac (VHT80): Duty cycle = 6.7 ms/6.768 ms = 0.99

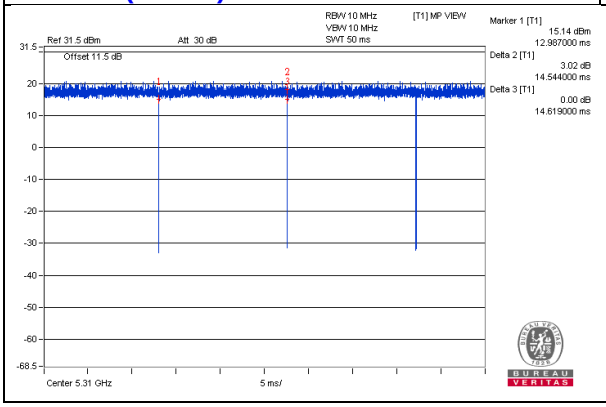
802.11a



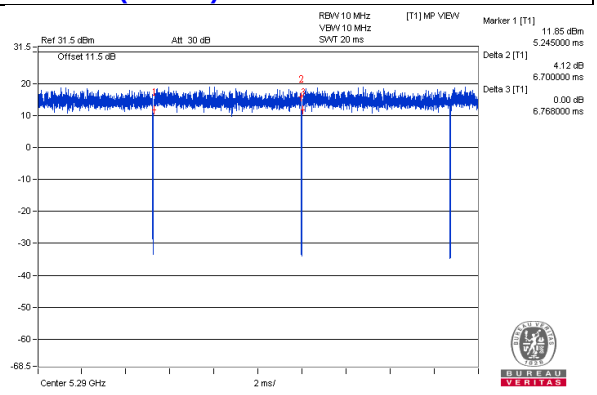
802.11ac (VHT20)



802.11ac (VHT40)



802.11ac (VHT80)



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.

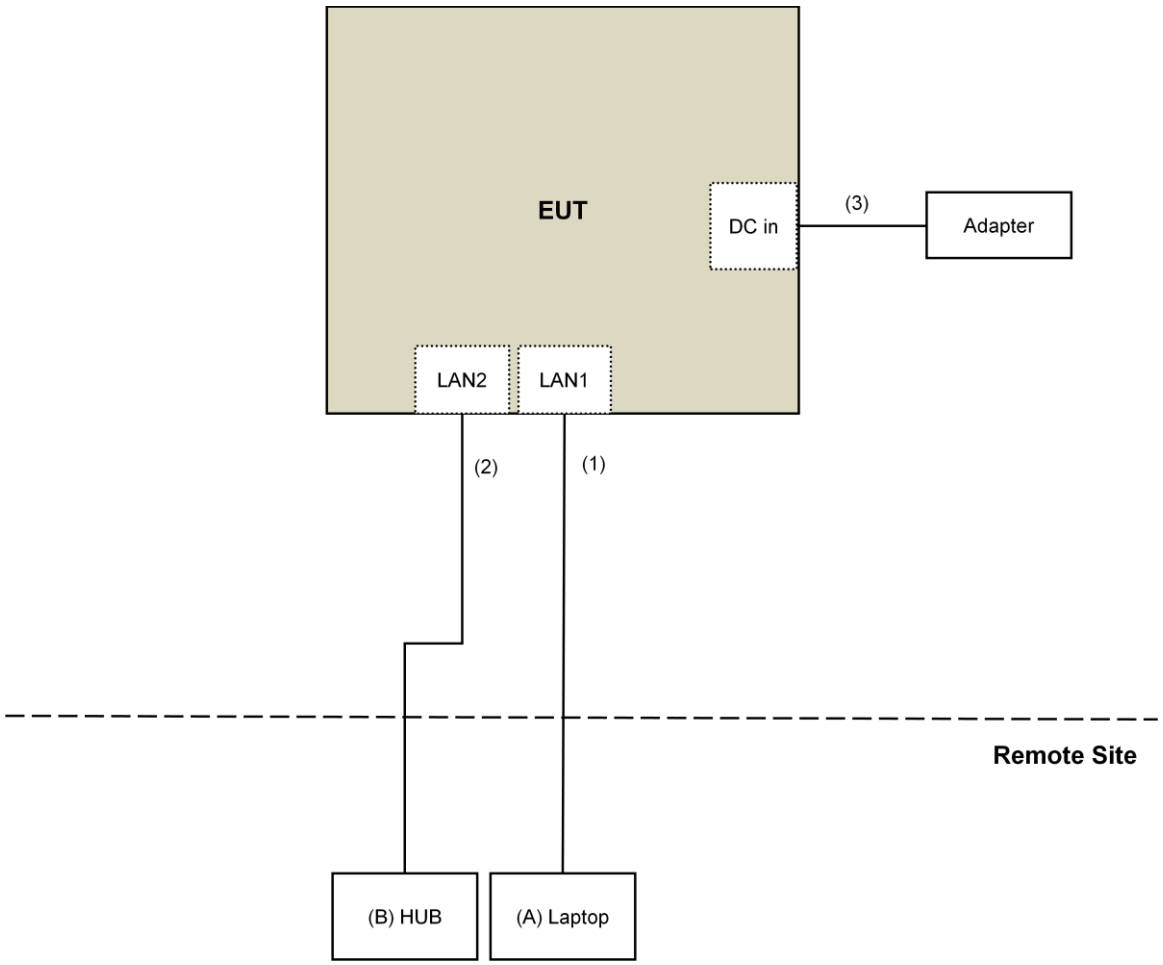
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E5430	4YV4VY1	FCC DoC	Provided by Lab
B.	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC	Provided by Lab

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.	RJ-45 Cable	1	10	No	0	Provided by Lab
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	DC Cable	1	1.8	No	0	Supplied by client

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standard

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 v01r03
KDB 662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10-2013

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

NOTE: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

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">KDB 789033 D02 General UNII Test Procedure New Rules v01r03</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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-156	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Jan. 20, 2016	Jan. 19, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 29, 2016	July 28, 2017
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Jan. 08, 2016	Jan. 07, 2017
RF Cable	SUCOFLEX 102	36432/2 36441/2	Jan. 16, 2016	Jan. 15, 2017
Software	ADT_Radiated _V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Spectrum Analyzer R&S	FSP40	100036	Jan. 27, 2016	Jan. 26, 2017
AC Power Source Extech Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 03, 2015	Dec. 02, 2016
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2015	Nov. 09, 2016

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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 3.
4. The FCC Site Registration No. is 147459
5. The CANADA Site Registration No. is 20331-1
6. Loop antenna was used for all emissions below 30 MHz
7. Tested Date: Oct. 24 to Nov. 04, 2016

4.1.3 Test Procedure

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. Both X and Y axes 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:

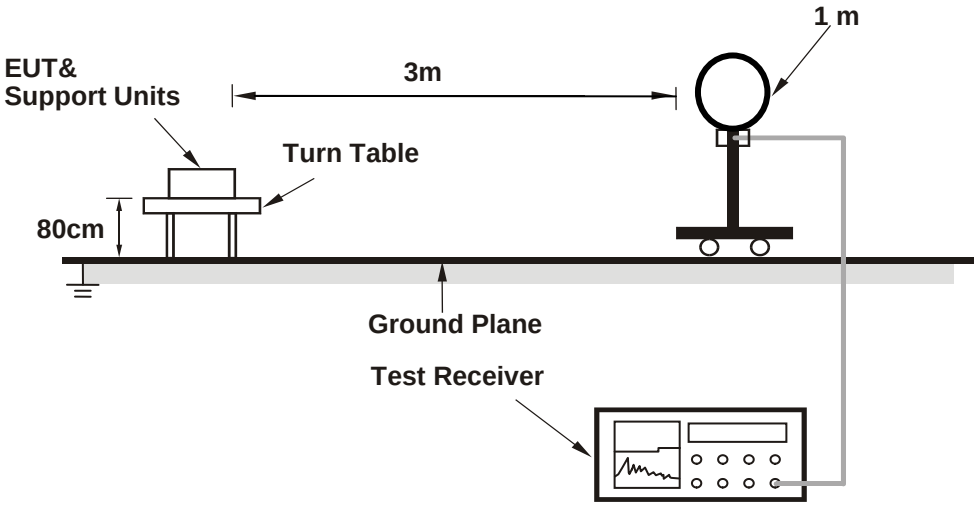
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

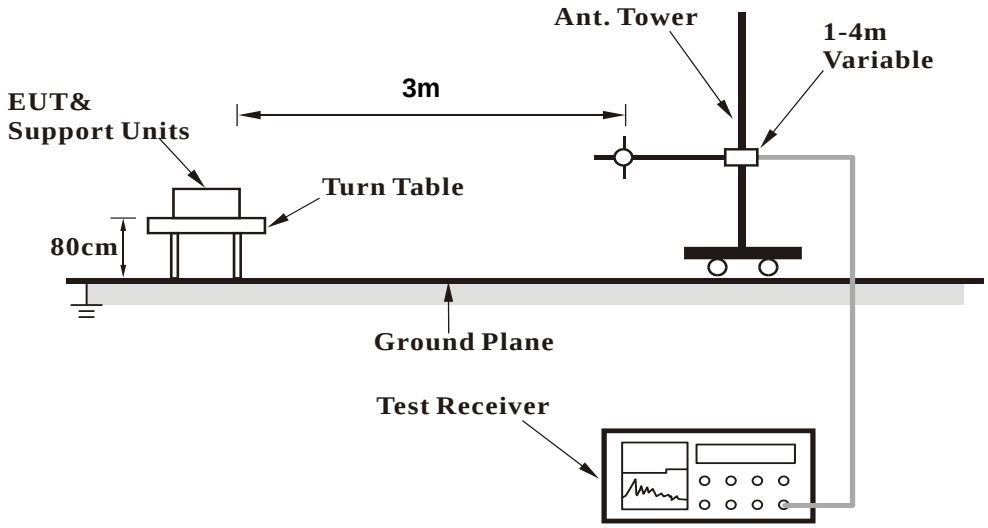
No deviation.

4.1.5 Test Setup

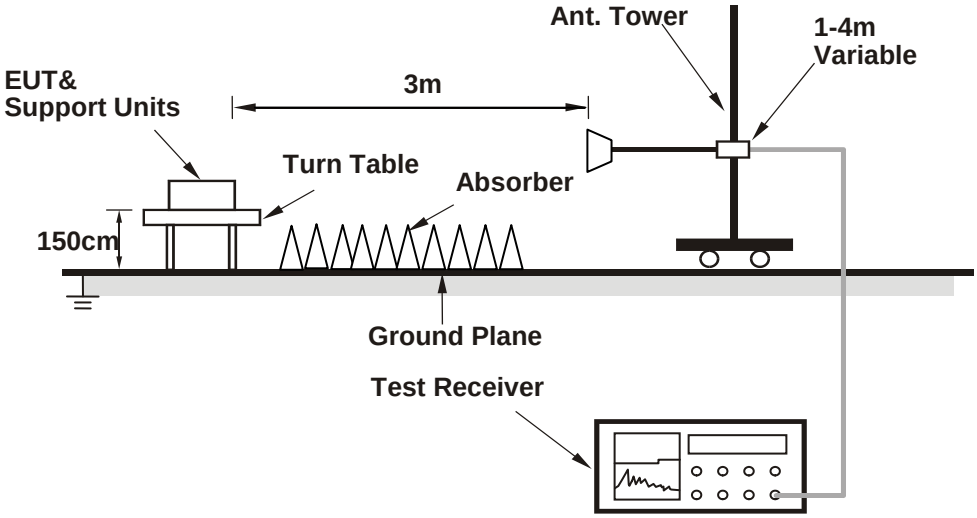
For Radiated emission below 30MHz



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 Condition

1. Connect the EUT with the support unit A (Laptop) which is placed on remote site.
2. The communication partner run test program “Telnet paste command .txt” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

Radio 2

802.11ac (VHT80)

CHANNEL	TX Channel 42	**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	5150.00	70.0 PK	74.0	-4.0	1.02 H	50	67.0	3.0
2	5150.00	52.2 AV	54.0	-1.8	1.02 H	50	49.2	3.0
3	*5210.00	107.5 PK			1.02 H	50	104.4	3.1
4	*5210.00	97.3 AV			1.02 H	50	94.2	3.1
5	5350.00	53.4 PK	74.0	-20.6	1.02 H	50	50.1	3.3
6	5350.00	41.8 AV	54.0	-12.2	1.02 H	50	38.5	3.3
7	#10420.00	57.1 PK	74.0	-16.9	2.67 H	217	45.1	12.0
8	#10420.00	44.4 AV	54.0	-9.6	2.67 H	217	32.4	12.0
9	15630.00	57.6 PK	74.0	-16.4	1.72 H	321	45.3	12.3
10	15630.00	44.8 AV	54.0	-9.2	1.72 H	321	32.5	12.3
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	5150.00	73.1 PK	74.0	-0.9	1.18 V	184	70.1	3.0
2	5150.00	53.5 AV	54.0	-0.5	1.18 V	184	50.5	3.0
3	*5210.00	109.6 PK			1.18 V	184	106.5	3.1
4	*5210.00	99.1 AV			1.18 V	184	96.0	3.1
5	5350.00	55.5 PK	74.0	-18.5	1.18 V	184	52.2	3.3
6	5350.00	43.7 AV	54.0	-10.3	1.18 V	184	40.4	3.3
7	#10420.00	54.9 PK	74.0	-19.1	3.72 V	243	42.9	12.0
8	#10420.00	42.5 AV	54.0	-11.5	3.72 V	243	30.5	12.0
9	15630.00	55.3 PK	74.0	-18.7	2.29 V	250	43.0	12.3
10	15630.00	43.0 AV	54.0	-11.0	2.29 V	250	30.7	12.3

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.

CHANNEL	TX Channel 58	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	5150.00	56.1 PK	74.0	-17.9	1.00 H	40	53.1	3.0
2	5150.00	41.3 AV	54.0	-12.7	1.00 H	40	38.3	3.0
3	*5290.00	108.2 PK			1.00 H	40	105.0	3.2
4	*5290.00	97.2 AV			1.00 H	40	94.0	3.2
5	5350.00	70.7 PK	74.0	-3.3	1.00 H	40	67.4	3.3
6	5350.00	52.1 AV	54.0	-1.9	1.00 H	40	48.8	3.3
7	#10580.00	56.7 PK	74.0	-17.3	2.58 H	188	44.6	12.1
8	#10580.00	44.2 AV	54.0	-9.8	2.58 H	188	32.1	12.1
9	15870.00	56.9 PK	74.0	-17.1	1.76 H	324	45.3	11.6
10	15870.00	44.4 AV	54.0	-9.6	1.76 H	324	32.8	11.6
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	5150.00	56.9 PK	74.0	-17.1	1.04 V	190	53.9	3.0
2	5150.00	42.0 AV	54.0	-12.0	1.04 V	190	39.0	3.0
3	*5290.00	109.4 PK			1.04 V	190	106.2	3.2
4	*5290.00	98.6 AV			1.04 V	190	95.4	3.2
5	5350.00	71.5 PK	74.0	-2.5	1.04 V	190	68.2	3.3
6	5350.00	53.6 AV	54.0	-0.4	1.04 V	190	50.3	3.3
7	#10580.00	54.6 PK	74.0	-19.4	3.74 V	273	42.5	12.1
8	#10580.00	41.7 AV	54.0	-12.3	3.74 V	273	29.6	12.1
9	15870.00	55.1 PK	74.0	-18.9	2.35 V	236	43.5	11.6
10	15870.00	42.7 AV	54.0	-11.3	2.35 V	236	31.1	11.6

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.

Radio 3

802.11ac (VHT80)

CHANNEL	TX Channel 106	**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	#5470.00	70.4 PK	74.0	-3.6	2.31 H	61	67.0	3.4
2	**#5470.00**	**53.8 AV**	**54.0**	**-0.2**	**2.31 H**	**61**	**50.4**	**3.4**
3	*5530.00	107.5 PK			2.31 H	61	104.0	3.5
4	*5530.00	97.6 AV			2.31 H	61	94.1	3.5
5	#5725.00	54.7 PK	74.0	-19.3	2.31 H	61	51.0	3.7
6	#5725.00	42.2 AV	54.0	-11.8	2.31 H	61	38.5	3.7
7	11060.00	56.5 PK	74.0	-17.5	2.62 H	218	43.7	12.8
8	11060.00	43.7 AV	54.0	-10.3	2.62 H	218	30.9	12.8
9	#16590.00	57.9 PK	74.0	-16.1	1.75 H	315	43.9	14.0
10	#16590.00	44.9 AV	54.0	-9.1	1.75 H	315	30.9	14.0
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	#5470.00	69.4 PK	74.0	-4.6	2.10 V	65	66.0	3.4
2	#5470.00	52.3 AV	54.0	-1.7	2.10 V	65	48.9	3.4
3	*5530.00	107.0 PK			2.10 V	65	103.5	3.5
4	*5530.00	96.7 AV			2.10 V	65	93.2	3.5
5	#5725.00	54.7 PK	74.0	-19.3	2.10 V	65	51.0	3.7
6	#5725.00	41.8 AV	54.0	-12.2	2.10 V	65	38.1	3.7
7	11060.00	54.5 PK	74.0	-19.5	3.66 V	279	41.7	12.8
8	11060.00	41.7 AV	54.0	-12.3	3.66 V	279	28.9	12.8
9	#16590.00	57.3 PK	74.0	-16.7	2.38 V	215	43.3	14.0
10	#16590.00	44.4 AV	54.0	-9.6	2.38 V	215	30.4	14.0

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.

CHANNEL	TX Channel 122	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	*5610.00	110.2 PK			2.40 H	67	106.6	3.6
2	*5610.00	100.3 AV			2.40 H	67	96.7	3.6
3	#5725.00	61.4 PK	74.0	-12.6	2.40 H	67	57.7	3.7
4	#5725.00	49.5 AV	54.0	-4.5	2.40 H	67	45.8	3.7
5	11220.00	59.5 PK	74.0	-14.5	2.59 H	180	47.0	12.5
6	11220.00	47.8 AV	54.0	-6.2	2.59 H	180	35.3	12.5
7	#16830.00	58.9 PK	74.0	-15.1	1.88 H	324	44.3	14.6
8	#16830.00	46.3 AV	54.0	-7.7	1.88 H	324	31.7	14.6
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	*5610.00	109.7 PK			2.17 V	77	106.1	3.6
2	*5610.00	99.5 AV			2.17 V	77	95.9	3.6
3	#5725.00	60.9 PK	74.0	-13.1	2.17 V	77	57.2	3.7
4	#5725.00	49.3 AV	54.0	-4.7	2.17 V	77	45.6	3.7
5	11220.00	57.3 PK	74.0	-16.7	3.63 V	291	44.8	12.5
6	11220.00	44.3 AV	54.0	-9.7	3.63 V	291	31.8	12.5
7	#16830.00	57.6 PK	74.0	-16.4	2.25 V	231	43.0	14.6
8	#16830.00	45.1 AV	54.0	-8.9	2.25 V	231	30.5	14.6

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.

CHANNEL	TX Channel 138	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	#5470.00	56.9 PK	74.0	-17.1	2.16 H	77	53.5	3.4
2	#5470.00	45.5 AV	54.0	-8.5	2.16 H	77	42.1	3.4
3	*5690.00	108.2 PK			2.16 H	77	104.5	3.7
4	*5690.00	98.9 AV			2.16 H	77	95.2	3.7
5	#5850.00	61.9 PK	74.0	-12.1	2.16 H	77	58.1	3.8
6	#5850.00	49.3 AV	54.0	-4.7	2.16 H	77	45.5	3.8
7	11380.00	61.6 PK	74.0	-12.4	1.66 H	284	49.1	12.5
8	11380.00	46.8 AV	54.0	-7.2	1.66 H	284	34.3	12.5
9	#17070.00	63.2 PK	74.0	-10.8	1.54 H	301	46.8	16.4
10	#17070.00	48.0 AV	54.0	-6.0	1.54 H	301	31.6	16.4
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	#5470.00	56.6 PK	74.0	-17.4	1.45 V	41	53.2	3.4
2	#5470.00	45.3 AV	54.0	-8.7	1.45 V	41	41.9	3.4
3	*5690.00	105.7 PK			1.45 V	41	102.0	3.7
4	*5690.00	94.1 AV			1.45 V	41	90.4	3.7
5	#5850.00	60.3 PK	74.0	-13.7	1.45 V	41	56.5	3.8
6	#5850.00	47.2 AV	54.0	-6.8	1.45 V	41	43.4	3.8
7	11380.00	55.5 PK	74.0	-18.5	3.60 V	291	43.0	12.5
8	11380.00	44.4 AV	54.0	-9.6	3.60 V	291	31.9	12.5
9	#17070.00	63.4 PK	74.0	-10.6	2.35 V	272	47.0	16.4
10	#17070.00	48.0 AV	54.0	-6.0	2.35 V	272	31.6	16.4

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.

CHANNEL	TX Channel 155	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	*5775.00	114.6 PK			2.35 H	68	110.9	3.7
2	*5775.00	102.3 AV			2.35 H	68	98.6	3.7
3	11550.00	62.8 PK	74.0	-11.2	1.58 H	300	50.6	12.2
4	11550.00	49.2 AV	54.0	-4.8	1.58 H	300	37.0	12.2
5	#17325.00	61.3 PK	74.0	-12.7	1.54 H	37	44.6	16.7
6	#17325.00	47.1 AV	54.0	-6.9	1.54 H	37	30.4	16.7
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	*5775.00	112.0 PK			3.01 V	197	108.3	3.7
2	*5775.00	100.7 AV			3.01 V	197	97.0	3.7
3	11550.00	59.8 PK	74.0	-14.2	2.54 V	216	47.6	12.2
4	11550.00	46.6 AV	54.0	-7.4	2.54 V	216	34.4	12.2
5	#17325.00	61.7 PK	74.0	-12.3	2.39 V	305	45.0	16.7
6	#17325.00	46.2 AV	54.0	-7.8	2.39 V	305	29.5	16.7

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.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz Data:

Radio 2

802.11ac (VHT80)

CHANNEL	TX Channel 58	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	288.00	37.2 QP	46.0	-8.8	1.00 H	111	45.0	-7.8
2	296.00	38.9 QP	46.0	-7.1	1.00 H	138	46.4	-7.5
3	480.01	31.1 QP	46.0	-14.9	2.00 H	274	34.0	-2.9
4	500.00	36.4 QP	46.0	-9.6	1.50 H	159	39.0	-2.6
5	688.00	32.6 QP	46.0	-13.4	1.00 H	71	31.4	1.2
6	875.00	34.4 QP	46.0	-11.6	1.50 H	130	30.5	3.9
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	157.00	33.3 QP	43.5	-10.2	1.00 V	72	41.2	-7.9
2	296.00	36.2 QP	46.0	-9.8	1.50 V	182	43.7	-7.5
3	375.01	31.2 QP	46.0	-14.8	1.00 V	79	36.7	-5.5
4	480.00	31.4 QP	46.0	-14.6	1.00 V	157	34.3	-2.9
5	500.02	34.7 QP	46.0	-11.3	1.00 V	93	37.3	-2.6
6	875.00	33.8 QP	46.0	-12.2	1.50 V	326	29.9	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.
4. Margin value = Emission Level – Limit value

Radio 3

802.11ac (VHT80)

CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	288.00	36.9 QP	46.0	-9.1	1.00 H	86	44.7	-7.8
2	296.00	39.1 QP	46.0	-6.9	1.00 H	121	46.6	-7.5
3	479.98	30.6 QP	46.0	-15.4	2.00 H	293	33.5	-2.9
4	500.01	36.0 QP	46.0	-10.0	1.50 H	126	38.6	-2.6
5	688.02	32.0 QP	46.0	-14.0	1.00 H	27	30.8	1.2
6	874.99	34.6 QP	46.0	-11.4	1.50 H	75	30.7	3.9
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	157.00	33.0 QP	43.5	-10.5	1.00 V	41	40.9	-7.9
2	296.00	36.4 QP	46.0	-9.6	1.50 V	152	43.9	-7.5
3	375.03	30.3 QP	46.0	-15.7	1.00 V	25	35.8	-5.5
4	480.01	30.8 QP	46.0	-15.2	1.00 V	111	33.7	-2.9
5	500.00	35.1 QP	46.0	-10.9	1.00 V	38	37.7	-2.6
6	875.02	33.3 QP	46.0	-12.7	1.50 V	360	29.4	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.
4. Margin value = Emission Level – Limit value

4.2 Transmit Power Measurment

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

Note: This device can support different category application which switched to master mode or client mode by software.

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

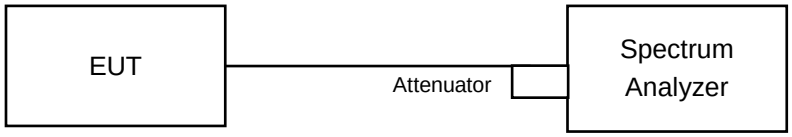
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

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

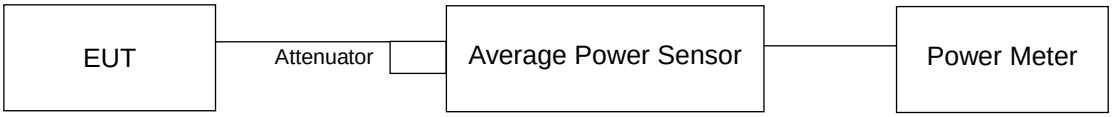
4.2.2 Test Setup

FOR POWER OUTPUT MEASUREMENT

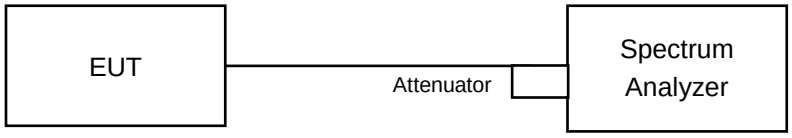
For channel straddling 5725MHz:



For other channels:



FOR 26dB OCCUPIED 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

For channel straddling 5725MHz:

Method SA-1

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW =1MHz.
3. Set the VBW ≥ 3 x RBW.
4. Number of points in sweep ≥ 2 Span / RBW.
5. Sweep time = auto.
6. Set trigger to free run (duty cycle ≥ 98 percent)
7. Detector = RMS.
8. Trace average at least 100 traces in power averaging mode
9. Compute power by integrating the spectrum across the 26 dB EBW of the signal.

For other channels:

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. Duty factor is not added to measured value.

FOR 26dB OCCUPIED BANDWIDTH

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. 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 Condition

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

For UNII-1 & UNII-2A
Radio 2
CDD Mode

802.11a

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
36	5180	22.29	22.74	21.93	22.33	684.323	28.35	30.00	Pass
40	5200	22.35	22.73	21.94	22.42	690.187	28.39	30.00	Pass
48	5240	22.54	22.77	21.91	22.36	696.133	28.43	30.00	Pass
52	5260	17.41	17.53	17.60	17.50	225.483	23.53	24.00	Pass
60	5300	17.12	17.55	17.63	17.78	226.33	23.55	24.00	Pass
64	5320	17.53	17.55	17.64	17.52	228.079	23.58	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
52	5260	23.00	23.41	23.13	23.39
60	5300	23.09	23.46	23.09	23.30
64	5320	23.06	23.51	22.56	23.25

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
52	5260	23.00	24.61 > 24
60	5300	23.09	24.63 > 24
64	5320	22.56	24.53 > 24

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
36	5180	21.66	21.53	21.33	21.68	571.85	27.57	30.00	Pass
40	5200	22.20	22.31	21.81	22.43	662.865	28.21	30.00	Pass
48	5240	22.57	23.08	22.01	23.51	767.196	28.85	30.00	Pass
52	5260	17.25	17.31	17.22	17.50	215.872	23.34	24.00	Pass
60	5300	17.85	17.27	17.00	16.73	211.504	23.25	24.00	Pass
64	5320	17.26	16.93	17.27	16.83	204.056	23.10	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
52	5260	24.74	24.69	23.92	24.80
60	5300	24.68	24.94	24.13	24.09
64	5320	23.10	24.86	23.91	24.31

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
52	5260	23.92	24.78 > 24
60	5300	24.09	24.81 > 24
64	5320	23.10	24.63 > 24

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
38	5190	17.87	18.50	17.89	17.92	255.492	24.07	30.00	Pass
46	5230	22.57	22.37	22.01	23.21	721.567	28.58	30.00	Pass
54	5270	17.19	17.44	17.35	17.42	217.356	23.37	24.00	Pass
62	5310	17.65	16.87	17.22	16.73	206.672	23.15	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
54	5270	44.31	44.09	43.69	43.17
62	5310	43.84	44.29	43.62	43.51

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
54	5270	43.17	27.35 > 24
62	5310	43.51	27.38 > 24

802.11ac (VHT80)

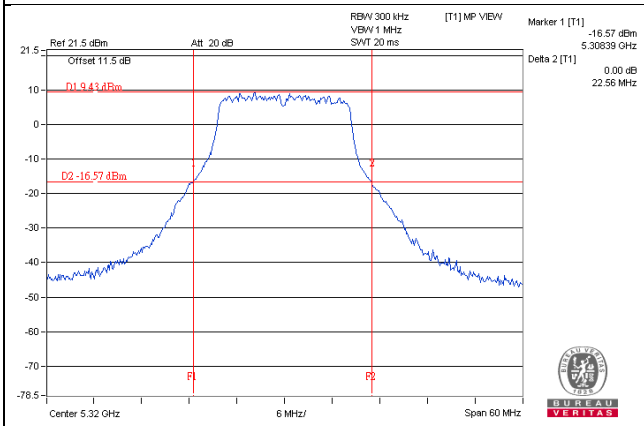
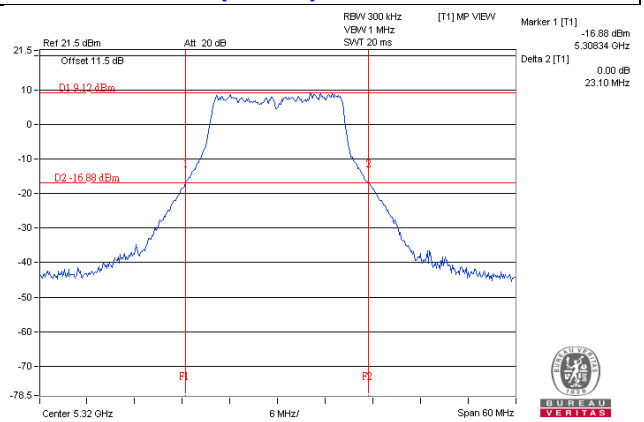
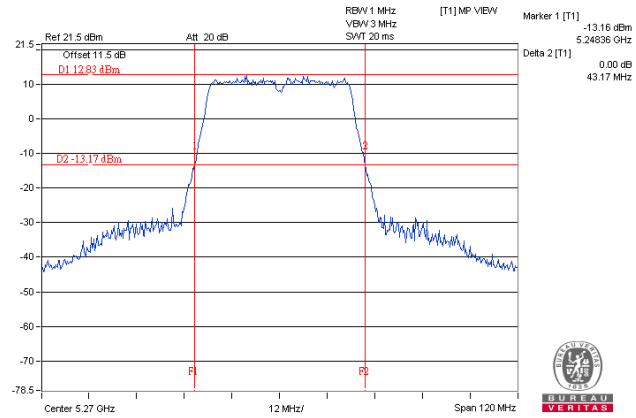
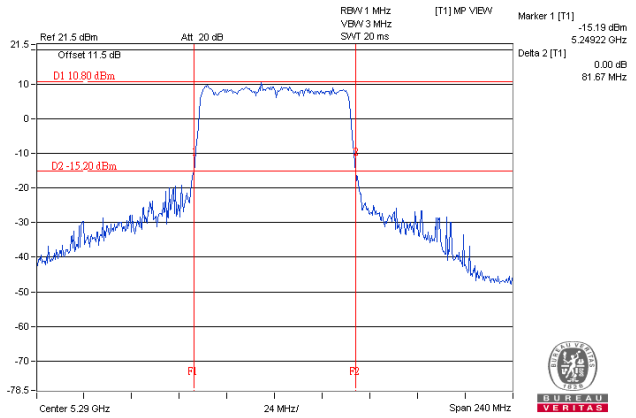
Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
42	5210	17.91	18.28	17.63	18.35	255.434	24.07	30.00	Pass
58	5290	17.52	18.21	17.48	18.51	249.65	23.97	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
58	5290	83.54	81.67	83.04	82.29

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
58	5290	81.67	30.12 > 24

Spectrum Plot of Worst Value	
802.11a / Chain 2 – CH64	**802.11ac (VHT20) / Chain 0 – CH64**
	
802.11ac (VHT40) / Chain 3 – CH54	**802.11ac (VHT80) / Chain 1 – CH58**
	

Radio 2
SDM Mode

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
36	5180	21.66	21.53	21.33	21.68	571.85	27.57	30.00	Pass
40	5200	22.20	22.31	21.81	22.43	662.865	28.21	30.00	Pass
48	5240	22.57	23.08	22.01	23.51	767.196	28.85	30.00	Pass
52	5260	17.25	17.31	17.22	17.50	215.872	23.34	24.00	Pass
60	5300	17.85	17.27	17.00	16.73	211.504	23.25	24.00	Pass
64	5320	17.26	16.93	17.27	16.83	204.056	23.10	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
52	5260	24.74	24.69	23.92	24.80
60	5300	24.68	24.94	24.13	24.09
64	5320	23.10	24.86	23.91	24.31

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
52	5260	23.92	24.78 > 24
60	5300	24.09	24.81 > 24
64	5320	23.10	24.63 > 24

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
38	5190	17.87	18.50	17.89	17.92	255.492	24.07	30.00	Pass
46	5230	22.57	22.37	22.01	23.21	721.567	28.58	30.00	Pass
54	5270	17.19	17.44	17.35	17.42	217.356	23.37	24.00	Pass
62	5310	17.65	16.87	17.22	16.73	206.672	23.15	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
54	5270	44.31	44.09	43.69	43.17
62	5310	43.84	44.29	43.62	43.51

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
54	5270	43.17	27.35 > 24
62	5310	43.51	27.38 > 24

802.11ac (VHT80)

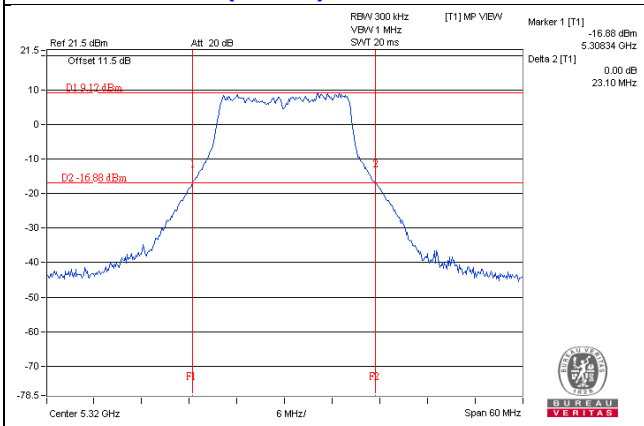
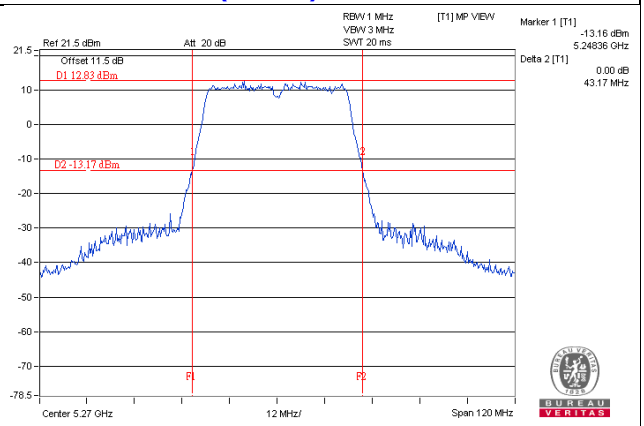
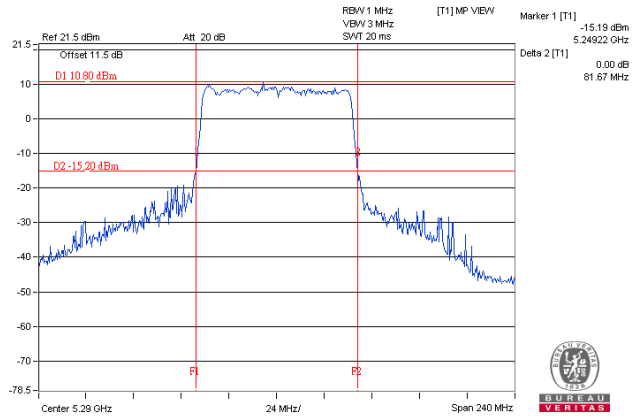
Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
42	5210	17.91	18.28	17.63	18.35	255.434	24.07	30.00	Pass
58	5290	17.52	18.21	17.48	18.51	249.65	23.97	24.00	Pass

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
58	5290	83.54	81.67	83.04	82.29

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
58	5290	81.67	30.12 > 24

Spectrum Plot of Worst Value	
802.11ac (VHT20) / Chain 0 – CH64	**802.11ac (VHT40) / Chain 3 – CH54**
	
802.11ac (VHT80) / Chain 1 – CH58	
	

Radio 2
BF Mode

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
36	5180	21.66	21.53	21.33	21.68	571.85	27.57	30.00	Pass
40	5200	22.20	22.31	21.81	22.43	662.865	28.21	30.00	Pass
48	5240	22.57	23.08	22.01	23.51	767.196	28.85	30.00	Pass
52	5260	17.25	17.31	17.22	17.50	215.872	23.34	24.00	Pass
60	5300	17.85	17.27	17.00	16.73	211.504	23.25	24.00	Pass
64	5320	17.26	16.93	17.27	16.83	204.056	23.10	24.00	Pass

Note: 1. For U-NII-1 band: Directional gain =3.97dBi < 6dBi, so the power limit shall not be reduced.

2. For U-NII-2A band: Directional gain =4.29dBi < 6dBi, so the power limit shall not be reduced.

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
52	5260	24.74	24.69	23.92	24.80
60	5300	24.68	24.94	24.13	24.09
64	5320	23.10	24.86	23.91	24.31

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
52	5260	23.92	24.78 > 24
60	5300	24.09	24.81 > 24
64	5320	23.10	24.63 > 24

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
38	5190	17.87	18.50	17.89	17.92	255.492	24.07	30.00	Pass
46	5230	22.57	22.37	22.01	23.21	721.567	28.58	30.00	Pass
54	5270	17.19	17.44	17.35	17.42	217.356	23.37	24.00	Pass
62	5310	17.65	16.87	17.22	16.73	206.672	23.15	24.00	Pass

Note: 1. For U-NII-1 band: Directional gain =3.97dBi < 6dBi, so the power limit shall not be reduced.

2. For U-NII-2A band: Directional gain =4.29dBi < 6dBi, so the power limit shall not be reduced.

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
54	5270	44.31	44.09	43.69	43.17
62	5310	43.84	44.29	43.62	43.51

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
54	5270	43.17	27.35 > 24
62	5310	43.51	27.38 > 24

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
42	5210	17.91	18.28	17.63	18.35	255.434	24.07	30.00	Pass
58	5290	17.52	18.21	17.48	18.51	249.65	23.97	24.00	Pass

Note: 1. For U-NII-1 band: Directional gain =3.97dBi < 6dBi, so the power limit shall not be reduced.

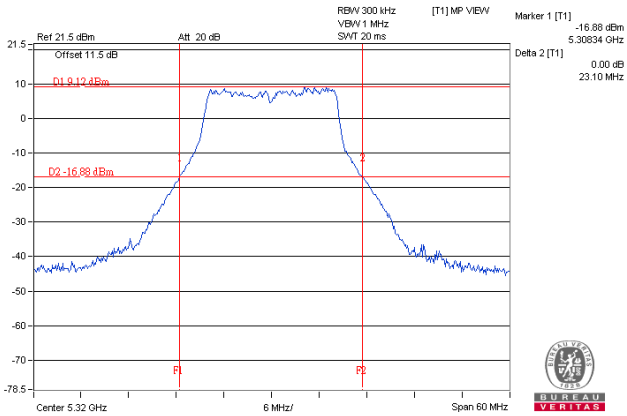
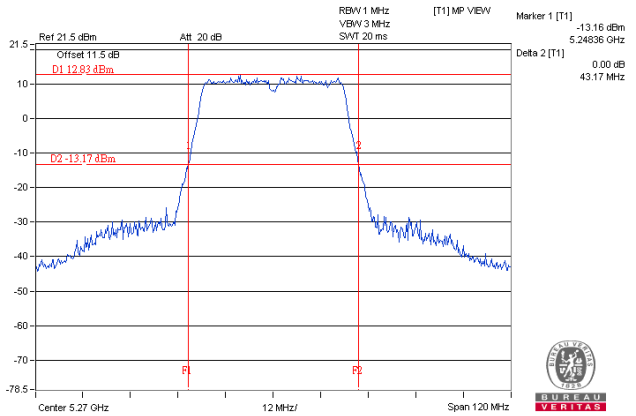
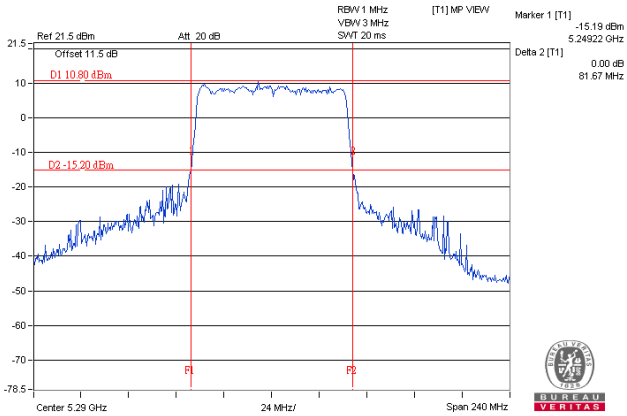
2. For U-NII-2A band: Directional gain =4.29dBi < 6dBi, so the power limit shall not be reduced.

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
58	5290	83.54	81.67	83.04	82.29

Note: For U-NII-2A Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2A >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
58	5290	81.67	30.12 > 24

Spectrum Plot of Worst Value	
802.11ac (VHT20) / Chain 0 – CH64	**802.11ac (VHT40) / Chain 3 – CH54**
	
802.11ac (VHT80) / Chain 1 – CH58	
	

For UNII-2C & UNII-3:
Radio 3
CDD Mode
802.11a

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
100	5500	17.83	17.03	17.65	17.96	231.867	23.65	24.00	Pass
116	5580	17.75	17.51	17.34	17.52	226.624	23.55	24.00	Pass
140	5700	18.05	16.97	17.12	17.62	222.933	23.48	24.00	Pass
*144 (UNII-2C Band)	5720	14.13	12.84	13.88	13.66	92.774	19.67	23.16	Pass
*144 (UNII-3 Band)	5720	8.51	7.12	8.11	7.64	24.527	13.90	30.00	Pass
149	5745	23.31	23.08	23.12	23.45	843.95	29.26	30.00	Pass
157	5785	23.74	23.22	23.58	23.49	897.877	29.53	30.00	Pass
165	5825	23.36	23.07	23.11	23.09	827.886	29.18	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
144	5720	117.301	20.69
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
100	5500	23.18	23.71	23.02	23.03
116	5580	23.35	23.49	23.05	22.77
140	5700	23.19	23.68	23.60	22.83
144 (UNII-2C Band)	5720	16.55	16.79	16.94	16.47

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
100	5500	23.02	24.62 > 24
116	5580	22.77	24.57 > 24
140	5700	22.83	24.58 > 24
144 (UNII-2CBand)	5720	16.47	23.16 < 24

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
100	5500	17.64	17.26	17.21	17.99	226.84	23.56	24.00	Pass
116	5580	17.54	17.41	17.24	17.96	227.318	23.57	24.00	Pass
140	5700	17.92	16.76	17.15	17.23	214.093	23.31	24.00	Pass
*144 (UNII-2C Band)	5720	13.90	12.91	13.87	13.95	93.299	19.70	23.31	Pass
*144 (UNII-3 Band)	5720	8.96	7.75	8.54	8.35	27.811	14.44	30.00	Pass
149	5745	22.30	22.21	22.03	22.34	667.149	28.24	30.00	Pass
157	5785	23.34	23.01	22.93	23.17	819.587	29.14	30.00	Pass
165	5825	23.08	22.89	22.74	22.81	776.689	28.90	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
144	5720	121.11	20.83
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
100	5500	25.33	25.07	24.25	24.50
116	5580	25.12	24.98	24.60	24.28
140	5700	25.37	24.89	24.57	24.37
144 (UNII-2C Band)	5720	17.59	17.74	17.22	17.03

Note: ForU-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
100	5500	24.25	24.84 > 24
116	5580	24.28	24.85 > 24
140	5700	24.37	24.86 > 24
144 (UNII-2C Band)	5720	17.03	23.31 < 24

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
102	5510	17.81	17.12	17.44	18.01	230.622	23.63	24.00	Pass
110	5500	17.59	17.36	17.26	18.02	228.46	23.59	24.00	Pass
134	5670	16.93	16.92	17.02	17.63	206.814	23.16	24.00	Pass
*142 (UNII-2C Band)	5710	14.90	13.64	14.25	14.55	109.141	20.38	24.00	Pass
*142 (UNII-3 Band)	5710	4.68	3.95	4.56	4.38	11.021	10.42	30.00	Pass
151	5755	23.20	22.79	22.83	23.11	795.549	29.01	30.00	Pass
159	5795	23.10	22.81	22.78	23.07	787.598	28.96	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
142	5710	120.162	20.8
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
102	5510	44.24	44.07	44.08	43.87
118	5590	44.41	44.19	44.24	43.80
134	5670	44.65	43.95	44.19	44.27
142 (UNII-2C Band)	5710	37.16	37.24	36.78	36.70

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB <U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
102	5510	43.87	27.42 > 24
118	5590	43.80	27.41 > 24
134	5670	43.95	27.42 > 24
142 (UNII-2CBand)	5710	36.70	26.64 > 24

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
106	5530	17.52	17.12	17.21	17.59	218.031	23.39	24.00	Pass
122	5610	17.36	17.19	17.04	17.66	215.737	23.34	24.00	Pass
*138 (UNII-2C Band)	5690	14.99	14.94	14.83	15.05	125.137	20.97	24.00	Pass
*138 (UNII-3 Band)	5690	0.44	1.77	1.56	1.30	5.391	7.32	30.00	Pass
155	5775	23.15	22.72	22.68	23.03	779.868	28.92	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

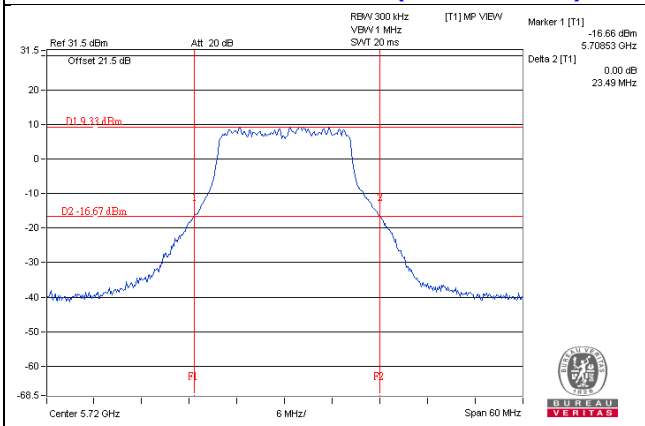
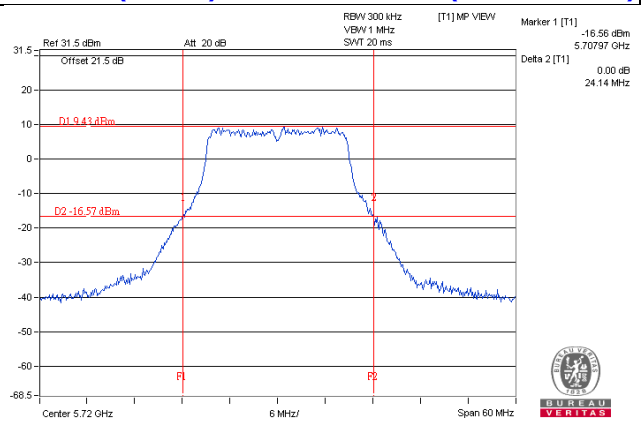
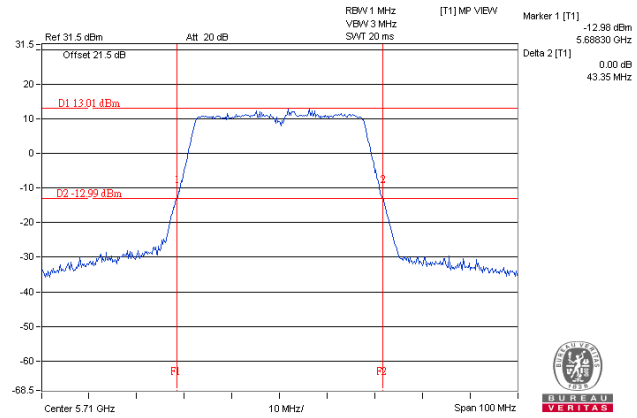
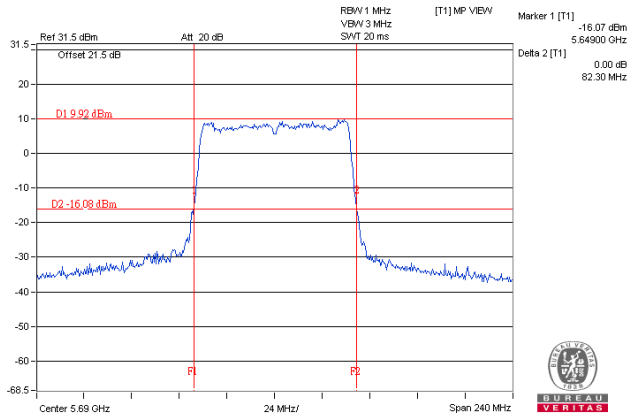
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
138	5690	130.528	21.16
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
106	5530	83.13	82.50	83.52	83.05
122	5610	83.85	83.27	83.01	82.65
138 (UNII-2C Band)	5690	76.52	76.00	76.19	76.63

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
106	5530	82.50	30.16 > 24
122	5610	82.65	30.17 > 24
138 (UNII-2C Band)	5690	76.00	29.8 > 24

Spectrum Plot of Worst Value	
802.11a / Chain 3 - CH144 (UNII-2C Band)	**802.11ac (VHT20) / Chain 3 - CH144 (UNII-2C Band)**
	
802.11ac (VHT40) / Chain 3 - CH142 (UNII-2C Band)	**802.11ac (VHT80) / Chain 1 - CH138 (UNII-2C Band)**
	

NOTE:

For CH144 (UNII-2C Band) = 5725MHz - Marker 1
For CH142 (UNII-2C Band) = 5725MHz - Marker 1
For CH138 (UNII-2C Band) = 5725MHz - Marker 1

Radio 3
SDM Mode

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
100	5500	17.64	17.26	17.21	17.99	226.84	23.56	24.00	Pass
116	5580	17.54	17.41	17.24	17.96	227.318	23.57	24.00	Pass
140	5700	17.92	16.76	17.15	17.23	214.093	23.31	24.00	Pass
*144 (UNII-2C Band)	5720	13.90	12.91	13.87	13.95	93.299	19.70	23.31	Pass
*144 (UNII-3 Band)	5720	8.96	7.75	8.54	8.35	27.811	14.44	30.00	Pass
149	5745	22.30	22.21	22.03	22.34	667.149	28.24	30.00	Pass
157	5785	23.34	23.01	22.93	23.17	819.587	29.14	30.00	Pass
165	5825	23.08	22.89	22.74	22.81	776.689	28.90	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
144	5720	121.11	20.83
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
100	5500	25.33	25.07	24.25	24.50
116	5580	25.12	24.98	24.60	24.28
140	5700	25.37	24.89	24.57	24.37
144 (UNII-2CBand)	5720	17.59	17.74	17.22	17.03

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
100	5500	24.25	24.84 > 24
116	5580	24.28	24.85 > 24
140	5700	24.37	24.86 > 24
144 (UNII-2C Band)	5720	17.03	23.31 < 24

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
102	5510	17.81	17.12	17.44	18.01	230.622	23.63	24.00	Pass
110	5500	17.59	17.36	17.26	18.02	228.46	23.59	24.00	Pass
134	5670	16.93	16.92	17.02	17.63	206.814	23.16	24.00	Pass
*142 (UNII-2C Band)	5710	14.90	13.64	14.25	14.55	109.141	20.38	24.00	Pass
*142 (UNII-3 Band)	5710	4.68	3.95	4.56	4.38	11.021	10.42	30.00	Pass
151	5755	23.20	22.79	22.83	23.11	795.549	29.01	30.00	Pass
159	5795	23.10	22.81	22.78	23.07	787.598	28.96	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
142	5710	120.162	20.8
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
102	5510	44.24	44.07	44.08	43.87
118	5590	44.41	44.19	44.24	43.80
134	5670	44.65	43.95	44.19	44.27
142 (UNII-2C Band)	5710	37.16	37.24	36.78	36.70

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB <U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
102	5510	43.87	27.42 > 24
118	5590	43.80	27.41 > 24
134	5670	43.95	27.42 > 24
142 (UNII-2C Band)	5710	36.70	26.64 > 24

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
106	5530	17.52	17.12	17.21	17.59	218.031	23.39	24.00	Pass
122	5610	17.36	17.19	17.04	17.66	215.737	23.34	24.00	Pass
*138 (UNII-2C Band)	5690	14.99	14.94	14.83	15.05	125.137	20.97	24.00	Pass
*138 (UNII-3 Band)	5690	0.44	1.77	1.56	1.30	5.391	7.32	30.00	Pass
155	5775	23.15	22.72	22.68	23.03	779.868	28.92	30.00	Pass

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

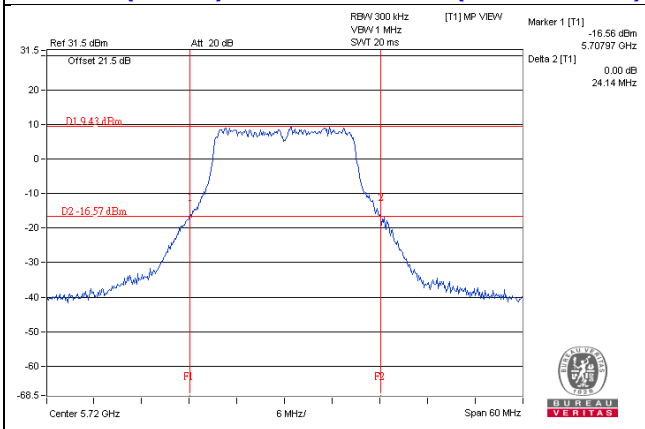
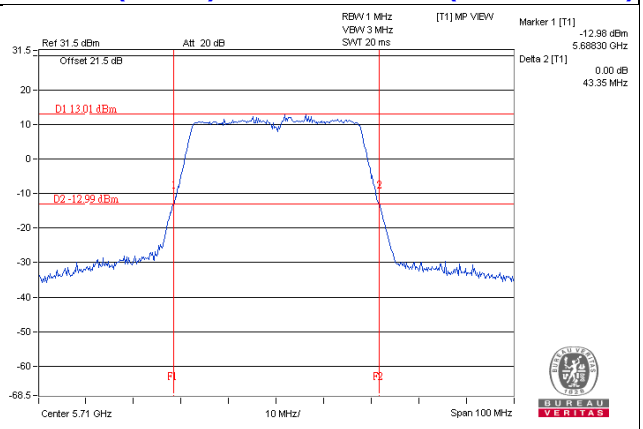
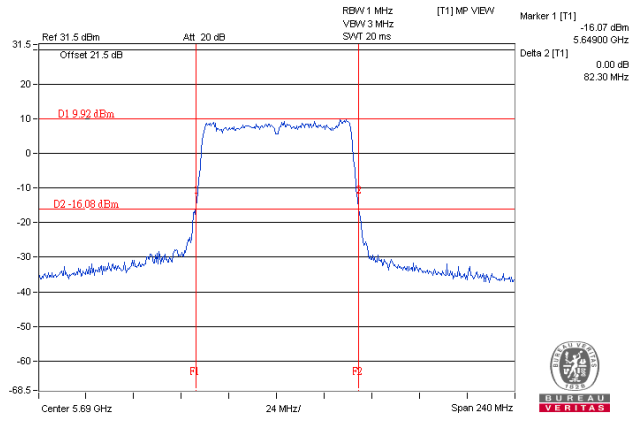
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
138	5690	130.528	21.16
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
106	5530	83.13	82.50	83.52	83.05
122	5610	83.85	83.27	83.01	82.65
138 (UNII-2C Band)	5690	76.52	76.00	76.19	76.63

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
106	5530	82.50	30.16 > 24
122	5610	82.65	30.17 > 24
138 (UNII-2C Band)	5690	76.00	29.8 > 24

Spectrum Plot of Worst Value	
802.11ac (VHT20) / Chain 3 - CH144 (UNII-2C Band)	**802.11ac (VHT40) / Chain 3 - CH142 (UNII-2C Band)**
	
802.11ac (VHT80) / Chain 1 - CH138 (UNII-2C Band)	
	

NOTE:

For CH144 (UNII-2C Band) = 5725MHz - Marker 1
For CH142 (UNII-2C Band) = 5725MHz - Marker 1
For CH138 (UNII-2C Band) = 5725MHz - Marker 1

Radio 3
BF Mode
802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
100	5500	17.64	17.26	17.21	17.99	226.84	23.56	24.00	Pass
116	5580	17.54	17.41	17.24	17.96	227.318	23.57	24.00	Pass
140	5700	17.92	16.76	17.15	17.23	214.093	23.31	24.00	Pass
*144 (UNII-2C Band)	5720	13.90	12.91	13.87	13.95	93.299	19.70	23.31	Pass
*144 (UNII-3 Band)	5720	8.96	7.75	8.54	8.35	27.811	14.44	30.00	Pass
149	5745	22.30	22.21	22.03	22.34	667.149	28.24	30.00	Pass
157	5785	23.34	23.01	22.93	23.17	819.587	29.14	30.00	Pass
165	5825	23.08	22.89	22.74	22.81	776.689	28.90	30.00	Pass

Note: 1.*Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

2. For U-NII-2C band: Directional gain =5.21dBi < 6dBi i, so the power limit shall not be reduced limit.

3. For U-NII-3 band: Directional gain =4.88dBi < 6dBi, so the power limit shall not be reduced limit.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
144	5720	121.11	20.83
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
100	5500	25.33	25.07	24.25	24.50
116	5580	25.12	24.98	24.60	24.28
140	5700	25.37	24.89	24.57	24.37
144 (UNII-2C Band)	5720	17.59	17.74	17.22	17.03

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
100	5500	24.25	24.84 > 24
116	5580	24.28	24.85 > 24
140	5700	24.37	24.86 > 24
144 (UNII-2C Band)	5720	17.03	23.31 < 24

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
102	5510	17.81	17.12	17.44	18.01	230.622	23.63	24.00	Pass
118	5590	17.59	17.36	17.26	18.02	228.46	23.59	24.00	Pass
134	5670	16.93	16.92	17.02	17.63	206.814	23.16	24.00	Pass
*142 (UNII-2C Band)	5710	14.90	13.64	14.25	14.55	109.141	20.38	24.00	Pass
*142 (UNII-3 Band)	5710	4.68	3.95	4.56	4.38	11.021	10.42	30.00	Pass
151	5755	23.20	22.79	22.83	23.11	795.549	29.01	30.00	Pass
159	5795	23.10	22.81	22.78	23.07	787.598	28.96	30.00	Pass

Note: 1.*Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

2. For U-NII-2C band: Directional gain =5.21dBi < 6dBi i, so the power limit shall not be reduced limit.

3. For U-NII-3 band: Directional gain =4.88dBi < 6dBi, so the power limit shall not be reduced limit.

The Total Power for the straddle channel:

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
142	5710	120.162	20.8
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
102	5510	44.24	44.07	44.08	43.87
118	5590	44.41	44.19	44.24	43.80
134	5670	44.65	43.95	44.19	44.27
142 (UNII-2C Band)	5710	37.16	37.24	36.78	36.70

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB <U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
102	5510	43.87	27.42 > 24
118	5590	43.80	27.41 > 24
134	5670	43.95	27.42 > 24
142 (UNII-2C Band)	5710	36.70	26.64 > 24

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
106	5530	17.52	17.12	17.21	17.59	218.031	23.39	24.00	Pass
122	5610	17.36	17.19	17.04	17.66	215.737	23.34	24.00	Pass
*138 (UNII-2C Band)	5690	14.99	14.94	14.83	15.05	125.137	20.97	24.00	Pass
*138 (UNII-3 Band)	5690	0.44	1.77	1.56	1.30	5.391	7.32	30.00	Pass
155	5775	23.15	22.72	22.68	23.03	779.868	28.92	30.00	Pass

Note: 1.*Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

2. For U-NII-2C band: Directional gain =5.21dBi < 6dBi i, so the power limit shall not be reduced limit.

3. For U-NII-3 band: Directional gain =4.88dBi < 6dBi, so the power limit shall not be reduced limit.

The Total Power for the straddle channel:

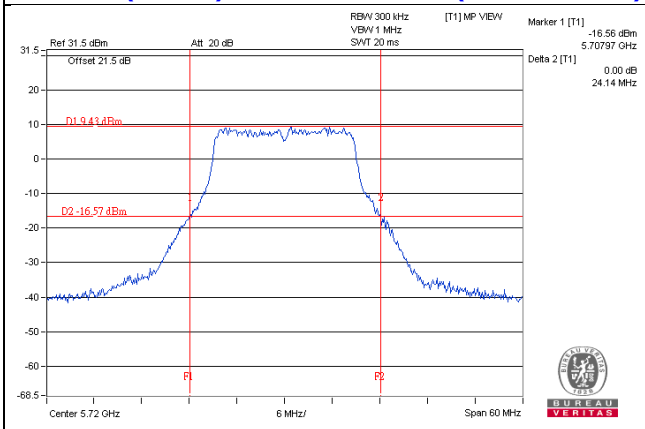
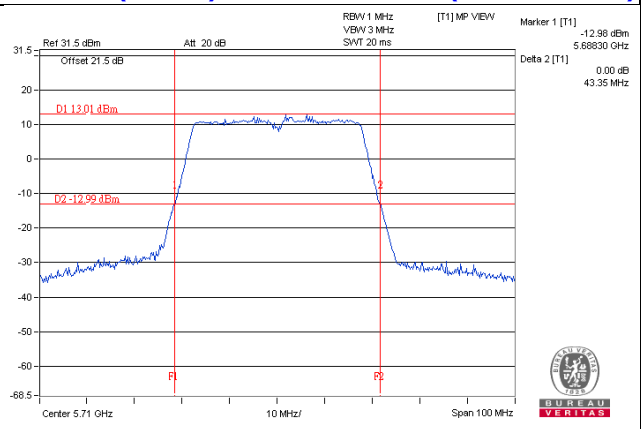
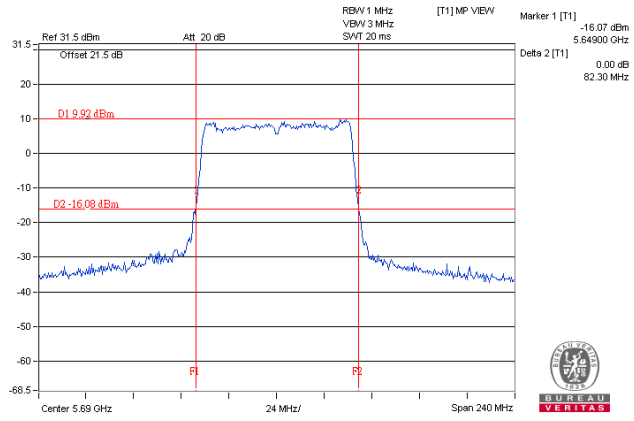
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
138	5690	130.528	21.16
Note: The total power was calculated through formula and record the value for reference only.			

26dB OCCUPIED BANDWIDTH

Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
106	5530	83.13	82.50	83.52	83.05
122	5610	83.85	83.27	83.01	82.65
138 (UNII-2C Band)	5690	76.52	76.00	76.19	76.63

Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Power Limit = 11dBm + 10logB < U-NII-2C >			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
106	5530	82.50	30.16 > 24
122	5610	82.65	30.17 > 24
138 (UNII-2C Band)	5690	76.00	29.8 > 24

Spectrum Plot of Worst Value	
802.11ac (VHT20) / Chain 3 - CH144 (UNII-2C Band)	**802.11ac (VHT40) / Chain 3 - CH142 (UNII-2C Band)**
	
802.11ac (VHT80) / Chain 1 - CH138 (UNII-2C Band)	
	

NOTE:

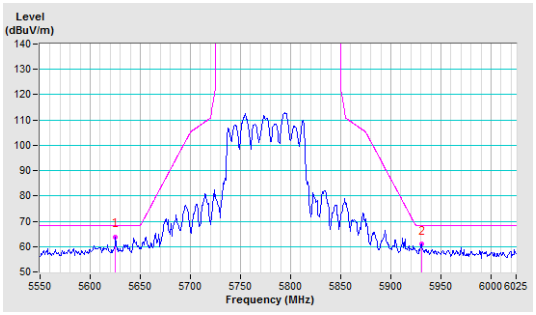
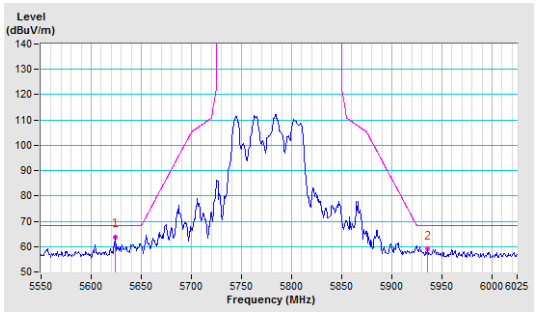
For CH144 (UNII-2C Band) = 5725MHz - Marker 1
For CH142 (UNII-2C Band) = 5725MHz - Marker 1
For CH138 (UNII-2C Band) = 5725MHz - Marker 1

5 Pictures of Test Arrangements

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

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

802.11ac (VHT80)

CH 155 5775 MHz	
Horizontal	**Vertical**
	

Appendix – Information on 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 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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