FCC Test Report

Report No.:	RF130725E01F
FCC ID:	Q87-EA6900V11
Test Model:	EA6900 V1.1
Received Date:	May 04, 2016
Test Date:	May 04 to 10, 2016
Issued Date:	Aug. 19, 2016
Applicant:	Linksys LLC
Address:	121 Theory Drive Irvine California 92617 United States
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan 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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Report Issue History Record

Issue No.	Reason for Change	Date Issued
RF130725E01A RF130725E01A-1	Original	Feb. 17, 2014
RF130725E01E	Upgraded the standard to section 15.407 under new rule for U-NII-1 and U-NII-3 band.	May 19, 2016
RF130725E01F	Upgraded the standard to section 15.407 under new rule (16-24) for U-NII-3 band.	Aug. 19, 2016

Release Control Record

Issue No.	Description	Date Issued
RF130725E01F	Original release.	Aug. 19, 2016

1 Certificate of Conformity

Product:	Linksys Smart Wi-Fi Router AC1900
Brand:	Linksys
Test Model:	EA6900 V1.1
Sample Status:	ENGINEERING SAMPLE
Applicant:	Linksys LLC
Test Date:	May 04 to 10, 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:** Aug. 19, 2016

Midoli Peng / Specialist

Approved by : _____ , **Date:** Aug. 19, 2016

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 -3.3dB at 38.87MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	Pass	Meet the requirement
15.407(a)(1/2/3)	Peak Power Spectral Density	Pass	Meet the requirement of limit.
15.407(e)	6dB bandwidth	Pass	Meet the requirement of limit. (U-NII-3 Band only)
15.407(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is RSMA not a standard connector.

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

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	5.19 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.43 dB
	6GHz ~ 18GHz	3.49 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Linksys Smart Wi-Fi Router AC1900
Brand	Linksys
Test Model	EA6900 V1.1
Status of EUT	ENGINEERING SAMPLE
Driver Version	v6.37.14.62
Power Supply Rating	DC 12V from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only 256QAM for OFDM in 11ac mode and HT(40) mode in 2.4GHz
Modulation Technology	DSSS,OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1300Mbps
Operating Frequency	**2.4GHz:** 2.412GHz ~ 2.462GHz **5GHz:** 5.18GHz ~ 5.24GHz, 5.745GHz ~ 5.825GHz
Number of Channel	**2.4GHz:** 11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40) **5GHz:** 9 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 4 for 802.11n (HT40), 802.11ac (VHT40) 2 for 802.11ac (VHT80)
Output Power	**2.4GHz:** 986.826mW **5GHz (5.18 ~ 5.24GHz):** **CDD Mode** 484.282mW **STBC Mode** 484.282mW **Beamforming Mode** 562.98mW **5GHz (5.745 ~ 5.825GHz):** **CDD Mode** 989.626mW **STBC Mode** 989.626mW **Beamforming Mode** 878.596mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC Class II change. The difference compared with the Report No.: RF130725E01E is as the following:
   - ◆ Upgrade the standard to section 15.407 under new rule (16-24) for U-NII-3 band.
2. According to above conditions, all test items of U-NII-3 band need to be performed, except for AC power conducted emission test item. And all data was verified to meet the requirements.
3. There are 2.4GHz and 5GHz WLAN technology used for the EUT.
4. The EUT has two different RJ45 XFRM Transformer types could be chosen and please refer the below table:

Type 1 (Vendor: MINGTEK)			
Vendor P/N	Different	Vendor	Location
HN1878CG	TRANSFORMER VARIABLE COILS,DIP,350UH,HN1878CG	MINGTEK	T1
HN3678CG	TRANSFORMER VARIABLE COILS,DIP,350UH,HN3678CG	MINGTEK	T2, T3
Type 2 (Vendor: MYJWD)			
Vendor P/N	Different	Vendor	Location
DG18107-1 G	TRANSFORMER,DIP,350UH,16.8*8.5*11.85MM,18PIN,DG18107-1 G	MYJWD	T1
DG36005-1 G	TRANSFORMER,DIP,350UH,32.7*8.5*11.85MM,36PIN	MYJWD	T2, T3
From the above types, the worst case was found in **Type 2 (Vendor: MYJWD)**. Therefore only the test data of the type were recorded in this report.			

5. The EUT need to be supplied with power adapter and following three different brands could be chosen:

Item	Brand	Model	Spec.
1	Ktec	KSAS0451200350HU	AC Input : 100-240V, 1.2A, 50-60Hz DC Output : 12V, 3.5A DC output cable(unshielded ,1.5m)
2	LEI	MU42-1120350-A1	AC Input : 100-240V, 1.5A, 50-60Hz DC Output : 12V, 3.5A DC cable(unshielded ,1.5m)
3	LEI	MU42-3120350-A1	AC Input : 100-240V, 1.5A, 50/60Hz DC Output : 12V, 3.5A DC cable(unshielded, 1.5m)

In original report, from the above adapters, the Adapter 3 chosen for final test. Therefore only the test data of the modes were recorded in this report.

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

Transmitter Circuit	Brand	Antenna Type	Peak Gain(dBi) (Include cable loss)		Connecter Type	Cable Loss (dB)	Cable Length (mm)
			For 2.4GHz (2.4GHz to 2.4835GHz)	For 5GHz (Band 1: 5.18 to 5.24GHz Band 4: 5.745 to 5.85GHz)			
Right Side Chain (0)	Galtronics	Dipole	1.3	5G Band1: 0.87 5G Band4: 1.95	R-SMA	NA	168
In center Chain (1)	Galtronics	Dipole	1.1	5G Band1: 0.47 5G Band4: 1.55	R-SMA	NA	262
Left Side Chain (2)	Galtronics	Dipole	1.1	5G Band1: 0.47 5G Band4: 1.55	R-SMA	NA	260
Note: From the above antennas, Chain (0) was selected as representative antenna for the 802.11a/b/g test and its data was recorded in this report.							

7. The EUT incorporates a MIMO function.

MODULATION MODE	TX/RX FUNCTION
802.11b	1TX (Diversity) /3RX
802.11g	1TX (Diversity) /3RX
802.11n (HT20)	3TX/3RX (CDD Mode)
	3TX/3RX (STBC Mode)
	3TX/3RX (Beam forming Mode)
802.11n (HT40)	3TX/3RX (CDD Mode)
	3TX/3RX (STBC Mode)
	3TX/3RX (Beam forming Mode)
802.11a	1TX (Diversity) /3RX
802.11ac (VHT20)	3TX/3RX (CDD Mode)
	3TX/3RX (STBC Mode)
	3TX/3RX (Beam forming Mode)
802.11ac (VHT40)	3TX/3RX (CDD Mode)
	3TX/3RX (STBC Mode)
	3TX/3RX (Beam forming Mode)
802.11ac (VHT80)	3TX/3RX (CDD Mode)
	3TX/3RX (STBC Mode)
	3TX/3RX (Beam forming Mode)
Note: 1. 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)	

8. When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 23.
9. When the EUT operating in 802.11ac and support 256QAM of VHT40 for 2.4GHz, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 9.
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 5745 ~ 5825MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11n (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

NOTE: 1. The test mode was reference to the worst case in the original test report.

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
CDD Mode						
MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
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

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.

CDD Mode						
MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11ac (VHT20)	5745-5825	149 to 165	157	OFDM	BPSK	6.5

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
CDD Mode						
MODE	**FREQ. BAND (MHz)**	**AVAILABLE CHANNEL**	**TESTED CHANNEL**	**MODULATION TECHNOLOGY**	**MODULATION TYPE**	**DATA RATE (Mbps)**
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
STBC Mode						
MODE	**FREQ. BAND (MHz)**	**AVAILABLE CHANNEL**	**TESTED CHANNEL**	**MODULATION TECHNOLOGY**	**MODULATION TYPE**	**DATA RATE (Mbps)**
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
Beamforming Mode						
MODE	**FREQ. BAND (MHz)**	**AVAILABLE CHANNEL**	**TESTED CHANNEL**	**MODULATION TECHNOLOGY**	**MODULATION TYPE**	**DATA RATE (Mbps)**
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

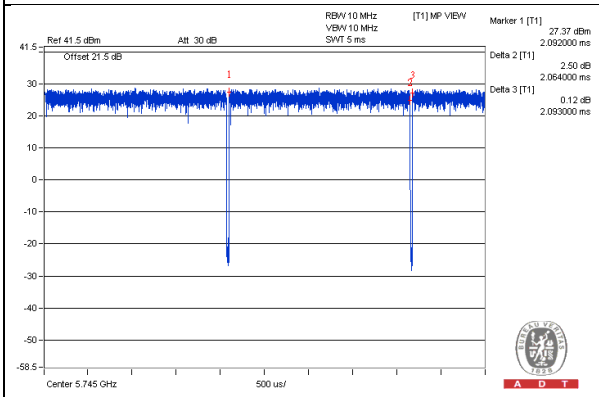
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	24deg. C, 74%RH	120Vac, 60Hz	Andy Ho
RE<1G	23deg. C, 66%RH	120Vac, 60Hz	Tim Ho
APCM	24deg. C, 64%RH	120Vac, 60Hz	Robert Cheng

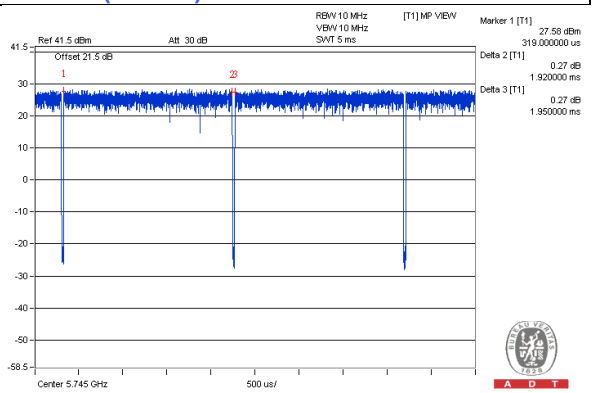
3.3 Duty Cycle of Test Signal

If duty cycle of test signal is ≥ 98 %, duty factor is not required.
If duty cycle of test signal is < 98%, duty factor shall be considered.
802.11a: Duty cycle = 2.064 ms/2.093 ms = 0.986
802.11n (VHT20): Duty cycle = 1.92 ms/1.95 ms = 0.985
802.11n (VHT40): Duty cycle = 0.955 ms/0.973 ms = 0.982
802.11ac (VHT80): Duty cycle = 0.459 ms/0.491 ms = 0.935, Duty factor = 10 * log(1/0.935) = 0.29

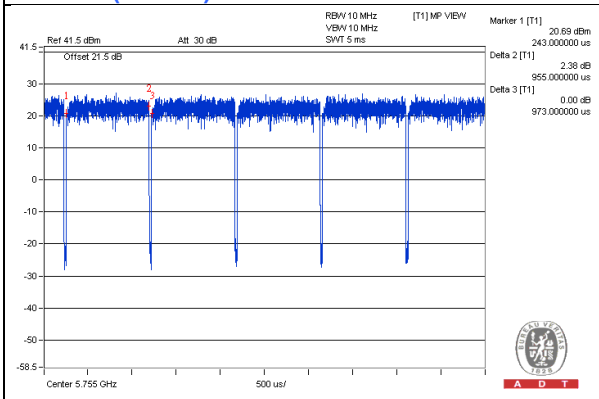
802.11a



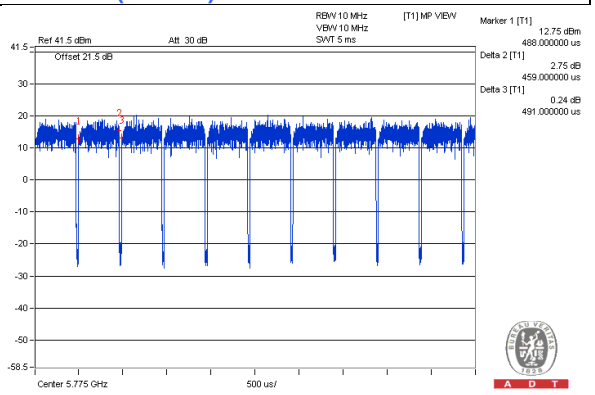
802.11n (VHT20)



802.11n (VHT40)



802.11ac (VHT80)



3.4 Description of Support Units

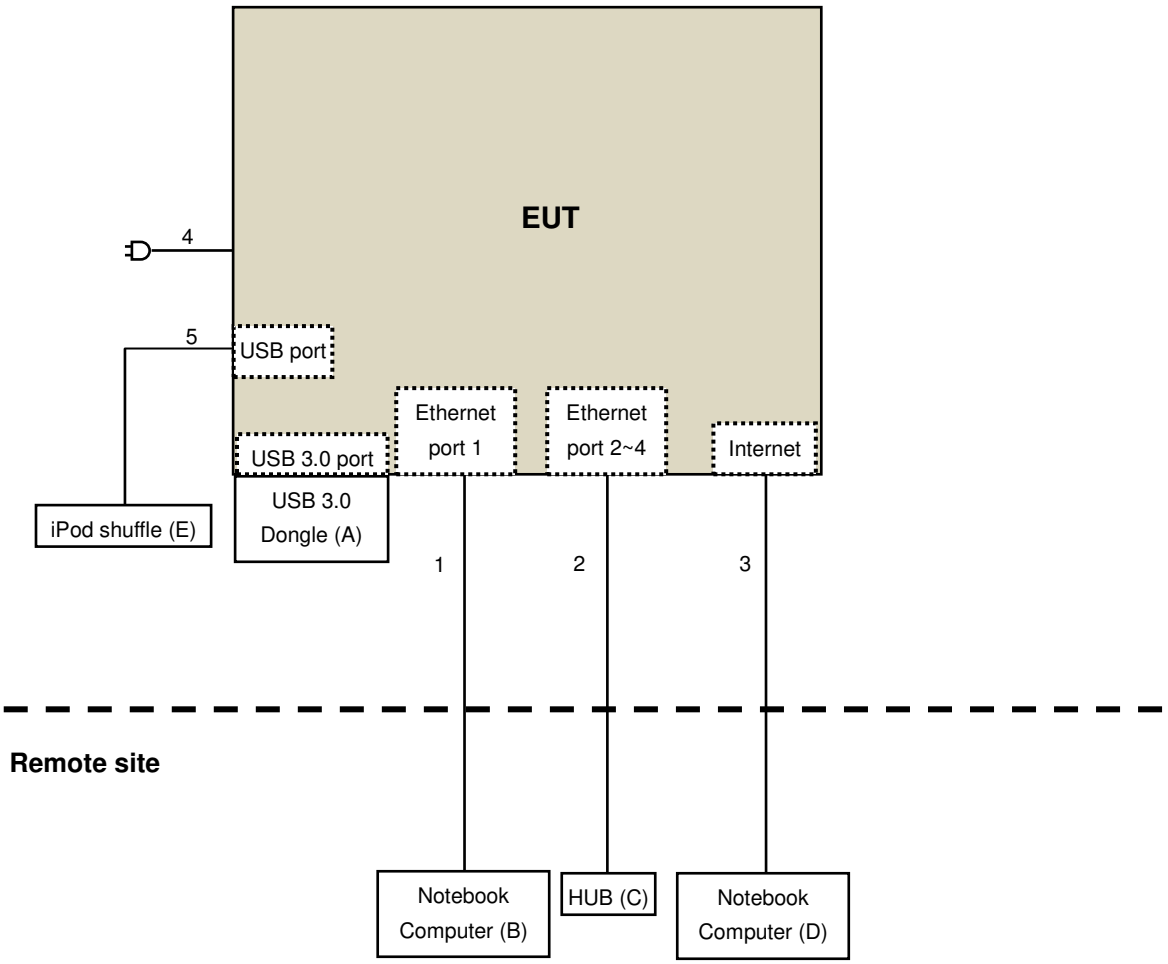
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	USB 3.0 Dongle	TCELL	TC-025-005	NA	NA	Provided by Lab
B.	Notebook Computer	HP	Pavilion 14-ab023TU	5CD5340WXZ	NA	Provided by Lab
C.	HUB	PCI	FX-05EA	NA	NA	Provided by Lab
D.	Notebook Computer	DELL	E5430	HL3SKV1	FCC DoC	Provided by Lab
E.	iPod shuffle	Apple	MD778TA/A	CC4JG680F4T1	NA	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.	RJ45 cable	1	10	No	0	Provided by Lab
2.	RJ45 cable	3	10	No	0	Provided by Lab
3.	RJ45 cable	1	10	No	0	Provided by Lab
4.	DC cable	1	1.5	No	0	Supplied by Client
5.	USB cable	1	0.1	Yes	0	Provided by Lab

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="2">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="2" rowspan="2">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	MY54450088	July 24, 2015	July 23, 2016
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-01	Nov. 11, 2015	Nov. 10, 2016
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 02, 2016	Apr. 01, 2017
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Jan. 19, 2016	Jan. 18, 2017
Pre-Amplifier Agilent	8449B	3008A01922	Sep. 19, 2015	Sep. 18, 2016
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150318 150323 150324	Mar. 30, 2016	Mar. 29, 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_V8.7.07	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	NA	NA
Power meter Anritsu	ML2495A	0824006	May 25, 2015	May 24, 2016
Power sensor Anritsu	MA2411B	0738172	May 25, 2015	May 24, 2016
Spectrum Analyzer R&S	FSP40	100036	Jan. 27, 2016	Jan. 26, 2017
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 03, 2015	Dec. 02, 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. Loop antenna was used for all emissions below 30 MHz.
4. The test was performed in 966 Chamber No. 4.
5. The FCC Site Registration No. is 292998
6. The CANADA Site Registration No. is 20331-2
5 Tested Date: May 09 to 13, 2016

4.1.3 Test Procedure

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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:

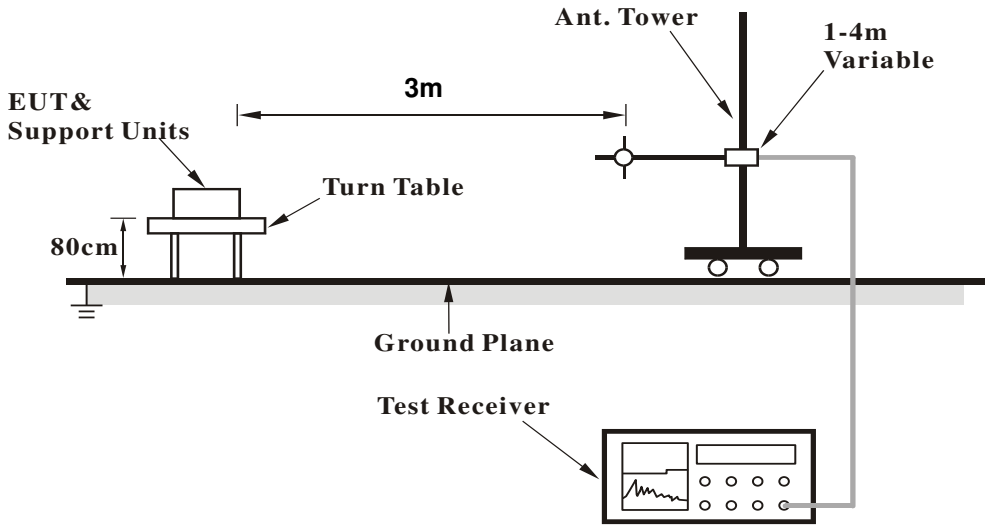
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

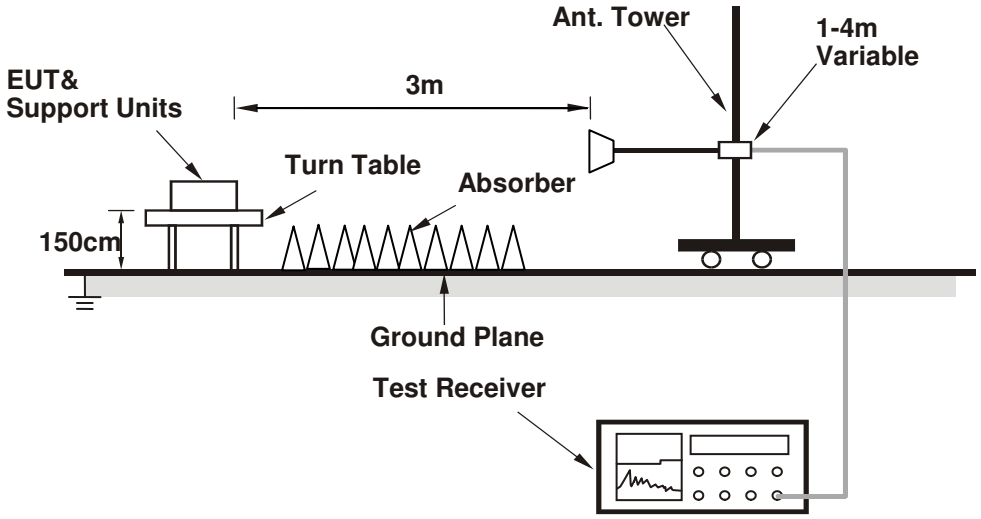
No deviation.

4.1.5 Test Setup

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Condition

a. Placed the EUT on testing table.

b. Connect the EUT with the support unit B~D (Notebook Computer) which is placed in a remote area.

c. The communication partner run test program “MTool 2.0.1.1” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data：

802.11a

CHANNEL	TX Channel 149	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	*5745.00	110.5 PK			2.24 H	39	107.68	2.82
2	*5745.00	99.9 AV			2.24 H	39	97.08	2.82
3	11490.00	50.3 PK	74.0	-23.7	1.61 H	126	36.84	13.46
4	11490.00	37.7 AV	54.0	-16.3	1.61 H	126	24.24	13.46
5	#17235.00	56.3 PK	74.0	-17.7	1.88 H	253	37.85	18.45
6	#17235.00	42.8 AV	54.0	-11.2	1.88 H	253	24.35	18.45
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	*5745.00	116.5 PK			2.11 V	252	113.68	2.82
2	*5745.00	105.7 AV			2.11 V	252	102.88	2.82
3	11490.00	51.1 PK	74.0	-22.9	1.46 V	206	37.64	13.46
4	11490.00	38.3 AV	54.0	-15.7	1.46 V	206	24.84	13.46
5	#17235.00	55.9 PK	74.0	-18.1	1.57 V	227	37.45	18.45
6	#17235.00	43.1 AV	54.0	-10.9	1.57 V	227	24.65	18.45

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 157	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	*5785.00	110.7 PK			1.45 H	217	107.81	2.89
2	*5785.00	99.2 AV			1.45 H	217	96.31	2.89
3	11570.00	50.7 PK	74.0	-23.3	1.65 H	128	37.46	13.24
4	11570.00	38.1 AV	54.0	-15.9	1.65 H	128	24.86	13.24
5	#17355.00	55.7 PK	74.0	-18.3	1.87 H	255	36.60	19.10
6	#17355.00	42.4 AV	54.0	-11.6	1.87 H	255	23.30	19.10
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	*5785.00	117.7 PK			1.98 V	249	114.81	2.89
2	*5785.00	106.2 AV			1.98 V	249	103.31	2.89
3	11570.00	51.1 PK	74.0	-22.9	1.47 V	189	37.86	13.24
4	11570.00	38.5 AV	54.0	-15.5	1.47 V	189	25.26	13.24
5	#17355.00	56.2 PK	74.0	-17.8	1.56 V	218	37.10	19.10
6	#17355.00	42.9 AV	54.0	-11.1	1.56 V	218	23.80	19.10

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 165	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	*5825.00	109.5 PK			1.41 H	206	106.56	2.94
2	*5825.00	99.6 AV			1.41 H	206	96.66	2.94
3	11650.00	50.5 PK	74.0	-23.5	1.61 H	120	37.29	13.21
4	11650.00	38.1 AV	54.0	-15.9	1.61 H	120	24.89	13.21
5	#17475.00	56.0 PK	74.0	-18.0	1.90 H	262	36.57	19.43
6	#17475.00	42.7 AV	54.0	-11.3	1.90 H	262	23.27	19.43
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	*5825.00	116.5 PK			2.13 V	248	113.56	2.94
2	*5825.00	106.6 AV			2.13 V	248	103.66	2.94
3	11650.00	50.6 PK	74.0	-23.4	1.48 V	202	37.39	13.21
4	11650.00	38.4 AV	54.0	-15.6	1.48 V	202	25.19	13.21
5	#17475.00	56.5 PK	74.0	-17.5	1.52 V	241	37.07	19.43
6	#17475.00	43.7 AV	54.0	-10.3	1.52 V	241	24.27	19.43

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.

802.11ac (VHT20)

CHANNEL	TX Channel 149	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	*5745.00	113.0 PK			2.47 H	360	110.18	2.82
2	*5745.00	102.7 AV			2.47 H	360	99.88	2.82
3	11490.00	50.0 PK	74.0	-24.0	1.62 H	115	36.54	13.46
4	11490.00	37.7 AV	54.0	-16.3	1.62 H	115	24.24	13.46
5	#17235.00	55.5 PK	74.0	-18.5	1.84 H	259	37.05	18.45
6	#17235.00	42.5 AV	54.0	-11.5	1.84 H	259	24.05	18.45
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	*5745.00	120.6 PK			2.26 V	252	117.78	2.82
2	*5745.00	110.2 AV			2.26 V	252	107.38	2.82
3	11490.00	50.6 PK	74.0	-23.4	1.47 V	225	37.14	13.46
4	11490.00	38.5 AV	54.0	-15.5	1.47 V	225	25.04	13.46
5	#17235.00	56.4 PK	74.0	-17.6	1.56 V	230	37.95	18.45
6	#17235.00	43.2 AV	54.0	-10.8	1.56 V	230	24.75	18.45

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 157	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	*5785.00	112.1 PK			2.52 H	360	109.21	2.89
2	*5785.00	102.2 AV			2.52 H	360	99.31	2.89
3	11570.00	50.8 PK	74.0	-23.2	1.60 H	142	37.56	13.24
4	11570.00	38.1 AV	54.0	-15.9	1.60 H	142	24.86	13.24
5	#17355.00	55.4 PK	74.0	-18.6	1.92 H	242	36.30	19.10
6	#17355.00	42.1 AV	54.0	-11.9	1.92 H	242	23.00	19.10
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	*5785.00	118.9 PK			1.39 V	276	116.01	2.89
2	*5785.00	109.0 AV			1.39 V	276	106.11	2.89
3	11570.00	54.4 PK	74.0	-19.6	1.50 V	168	41.16	13.24
4	11570.00	41.5 AV	54.0	-12.5	1.50 V	168	28.26	13.24
5	#17355.00	56.2 PK	74.0	-17.8	1.49 V	234	37.10	19.10
6	#17355.00	43.0 AV	54.0	-11.0	1.49 V	234	23.90	19.10

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 165	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	*5825.00	112.4 PK			2.49 H	360	109.46	2.94
2	*5825.00	102.3 AV			2.49 H	360	99.36	2.94
3	11650.00	50.3 PK	74.0	-23.7	1.60 H	125	37.09	13.21
4	11650.00	37.9 AV	54.0	-16.1	1.60 H	125	24.69	13.21
5	#17475.00	55.5 PK	74.0	-18.5	1.90 H	248	36.07	19.43
6	#17475.00	42.3 AV	54.0	-11.7	1.90 H	248	22.87	19.43
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	*5825.00	119.9 PK			1.17 V	277	116.96	2.94
2	*5825.00	110.1 AV			1.17 V	277	107.16	2.94
3	11650.00	50.7 PK	74.0	-23.3	1.50 V	210	37.49	13.21
4	11650.00	38.4 AV	54.0	-15.6	1.50 V	210	25.19	13.21
5	#17475.00	56.9 PK	74.0	-17.1	1.58 V	235	37.47	19.43
6	#17475.00	43.6 AV	54.0	-10.4	1.58 V	235	24.17	19.43

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.

802.11ac (VHT40)

CHANNEL	TX Channel 151	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	*5755.00	110.2 PK			2.55 H	360	107.36	2.84
2	*5755.00	99.2 AV			2.55 H	360	96.36	2.84
3	11510.00	50.2 PK	74.0	-23.8	1.55 H	134	36.77	13.43
4	11510.00	38.3 AV	54.0	-15.7	1.55 H	134	24.87	13.43
5	#17265.00	55.6 PK	74.0	-18.4	1.92 H	266	37.04	18.56
6	#17265.00	41.6 AV	54.0	-12.4	1.92 H	266	23.04	18.56
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	*5755.00	117.7 PK			1.33 V	277	114.86	2.84
2	*5755.00	106.7 AV			1.33 V	277	103.86	2.84
3	11510.00	50.8 PK	74.0	-23.2	1.51 V	196	37.37	13.43
4	11510.00	38.6 AV	54.0	-15.4	1.51 V	196	25.17	13.43
5	#17265.00	55.5 PK	74.0	-18.5	1.55 V	232	36.94	18.56
6	#17265.00	41.4 AV	54.0	-12.6	1.55 V	232	22.84	18.56

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 159	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	*5795.00	109.6 PK			2.58 H	360	106.68	2.92
2	*5795.00	98.6 AV			2.58 H	360	95.68	2.92
3	11590.00	50.2 PK	74.0	-23.8	1.56 H	111	37.02	13.18
4	11590.00	38.3 AV	54.0	-15.7	1.56 H	111	25.12	13.18
5	#17385.00	54.9 PK	74.0	-19.1	1.84 H	241	35.58	19.32
6	#17385.00	40.9 AV	54.0	-13.1	1.84 H	241	21.58	19.32
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	*5795.00	117.1 PK			1.32 V	276	114.18	2.92
2	*5795.00	106.1 AV			1.32 V	276	103.18	2.92
3	11590.00	50.8 PK	74.0	-23.2	1.56 V	196	37.62	13.18
4	11590.00	38.6 AV	54.0	-15.4	1.56 V	196	25.42	13.18
5	#17385.00	55.2 PK	74.0	-18.8	1.57 V	229	35.88	19.32
6	#17385.00	41.4 AV	54.0	-12.6	1.57 V	229	22.08	19.32

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.

802.11ac (VHT80)

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	106.9 PK			2.56 H	360	104.02	2.88
2	*5775.00	94.0 AV			2.56 H	360	91.12	2.88
3	11550.00	50.1 PK	74.0	-23.9	1.51 H	129	36.80	13.30
4	11550.00	38.2 AV	54.0	-15.8	1.51 H	129	24.90	13.30
5	#17325.00	55.3 PK	74.0	-18.7	1.91 H	254	36.42	18.88
6	#17325.00	41.1 AV	54.0	-12.9	1.91 H	254	22.22	18.88
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	114.4 PK			2.13 V	253	111.52	2.88
2	*5775.00	101.5 AV			2.13 V	253	98.62	2.88
3	11550.00	50.7 PK	74.0	-23.3	1.53 V	204	37.40	13.30
4	11550.00	39.0 AV	54.0	-15.0	1.53 V	204	25.70	13.30
5	#17325.00	55.6 PK	74.0	-18.4	1.58 V	236	36.72	18.88
6	#17325.00	41.7 AV	54.0	-12.3	1.58 V	236	22.82	18.88

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:

802.11ac (VHT20)

CHANNEL	TX Channel 157	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 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	32.53	35.2 QP	40.0	-4.8	1.00 H	314	45.12	-9.88
2	163.22	32.2 QP	43.5	-11.4	1.44 H	231	40.77	-8.62
3	294.42	32.8 QP	46.0	-13.2	1.04 H	285	40.90	-8.07
4	599.94	32.2 QP	46.0	-13.8	1.45 H	326	32.75	-0.58
5	750.12	33.0 QP	46.0	-13.0	1.06 H	323	31.16	1.88
6	999.93	32.9 QP	54.0	-21.1	1.10 H	336	28.04	4.83
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	**38.87**	**36.7 QP**	**40.0**	**-3.3**	**1.13 V**	**29**	**45.90**	**-9.21**
2	74.55	32.8 QP	40.0	-7.2	1.44 V	177	44.77	-12.00
3	102.28	31.4 QP	43.5	-12.1	1.37 V	345	44.02	-12.64
4	204.65	29.5 QP	43.5	-14.0	1.11 V	214	41.41	-11.88
5	849.89	32.3 QP	46.0	-13.7	1.00 V	24	29.30	3.03
6	999.93	35.4 QP	54.0	-18.6	1.09 V	108	30.59	4.83

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)

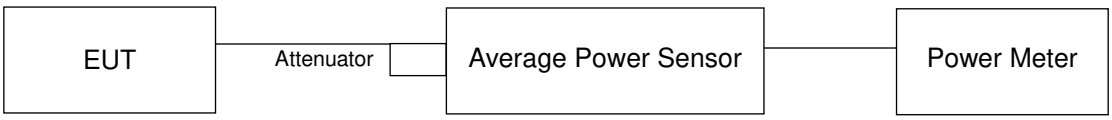
*B is the 26 dB emission bandwidth in megahertz

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



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

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.

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

802.11a

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
149	5745	369.828	25.68	30	Pass
157	5785	372.392	25.71	30	Pass
165	5825	368.978	25.67	30	Pass

CDD Mode

802.11n (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
149	5745	24.96	25.53	24.90	979.632	29.91	30	Pass
157	5785	24.98	25.59	24.95	989.626	29.95	30	Pass
165	5825	24.93	25.48	24.84	969.144	29.86	30	Pass

802.11n (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
151	5755	24.86	25.43	24.88	962.946	29.84	30	Pass
159	5795	24.79	25.39	24.72	943.723	29.75	30	Pass

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				
155	5775	22.32	23.48	23.26	605.288	27.82	30	Pass

STBC Mode

802.11n (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
149	5745	24.96	25.53	24.90	979.632	29.91	30	Pass
157	5785	24.98	25.59	24.95	989.626	29.95	30	Pass
165	5825	24.93	25.48	24.84	969.144	29.86	30	Pass

802.11n (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
151	5755	24.86	25.43	24.88	962.946	29.84	30	Pass
159	5795	24.79	25.39	24.72	943.723	29.75	30	Pass

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				
155	5775	22.32	23.48	23.26	605.288	27.82	30	Pass

Beamforming Mode

802.11n (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
149	5745	24.46	25.01	24.41	872.269	29.41	29.54	Pass
157	5785	24.47	25.07	24.43	878.596	29.44	29.54	Pass
165	5825	24.43	24.98	24.37	865.634	29.37	29.54	Pass

Note: 1. For 5745-5825MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2$ / 3] = 6.46dBi > 6dBi , so the power limit shall be reduced to 30-(6.46-6) = 29.54dBm.

802.11n (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
151	5755	24.36	24.96	24.41	862.285	29.36	29.54	Pass
159	5795	24.32	24.94	24.34	853.929	29.31	29.54	Pass

Note: 1. For 5745-5825MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2$ / 3] = 6.46dBi > 6dBi , so the power limit shall be reduced to 30-(6.46-6) = 29.54dBm.

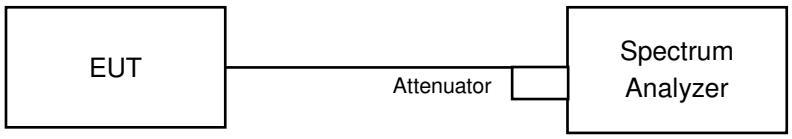
802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
155	5775	22.32	23.48	23.26	605.288	27.82	29.54	Pass

Note: 1. For 5745-5825MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2$ / 3] = 6.46dBi > 6dBi , so the power limit shall be reduced to 30-(6.46-6) = 29.54dBm.

4.3 Occupied Bandwidth Measurement

4.3.1 Test Setup



4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to SAMPLE. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 %of the total mean power of a given emission.

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)
149	5745	22.68
157	5785	23.76
165	5825	25.68

CDD Mode

802.11n (VHT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
149	5745	20.40	24.96	24.24
157	5785	22.08	26.52	27.00
165	5825	26.28	28.20	27.60

802.11n (VHT40)

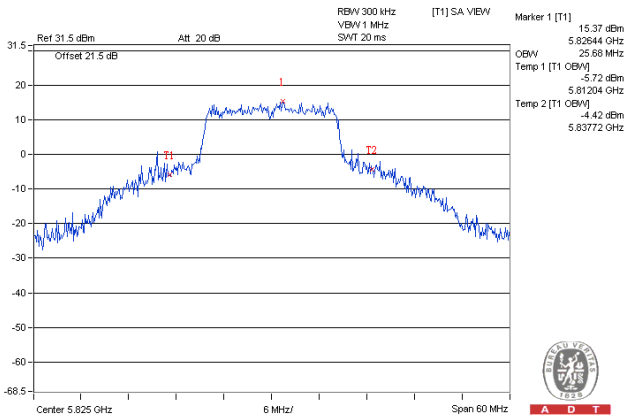
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
151	5755	47.60	57.00	54.80
159	5795	52.00	59.20	57.00

802.11n (VHT80)

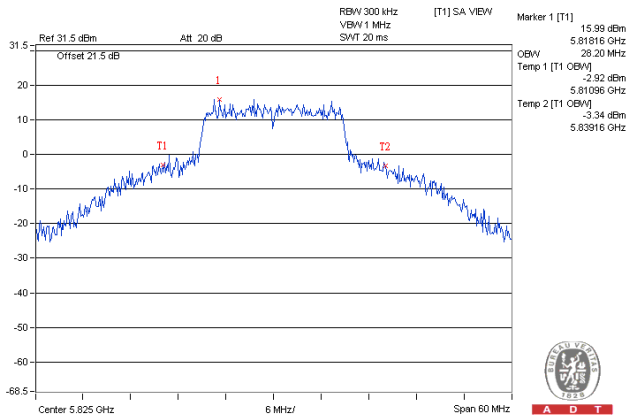
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
155	5775	75.84	76.32	76.32

Spectrum Plot of Worst Value

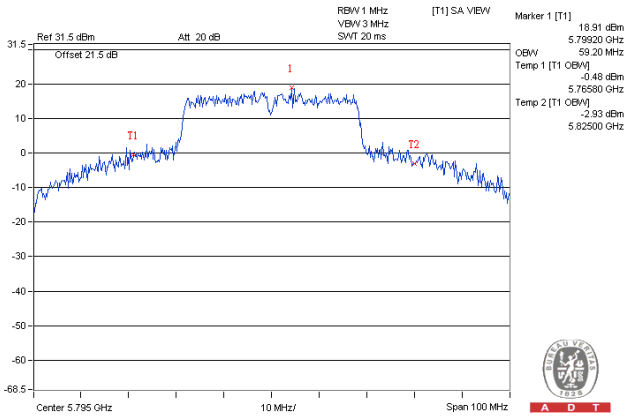
802.11a / CH165



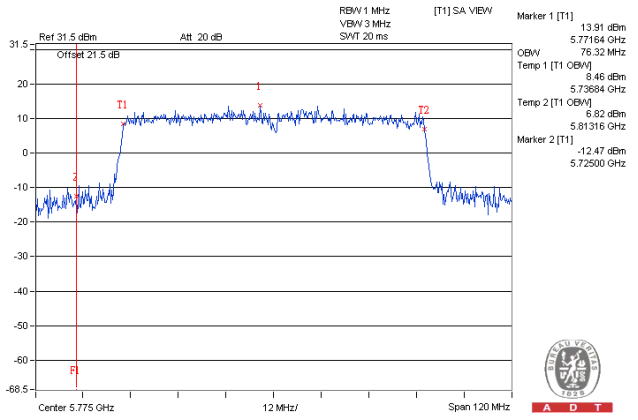
802.11n (VHT20)_Chain 1 / CH165



802.11n (VHT40)_Chain 1 / CH159



802.11n (VHT80)_Chain 1 / CH155

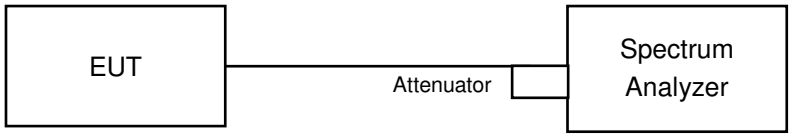


4.4 Peak Power Spectral Density Measurement

4.4.1 Limits of Peak Power Spectral Density Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17dBm/ MHz
		Fixed point-to-point Access Point	
		Indoor Access Point	
		Mobile and Portable client device	11dBm/ MHz
U-NII-2A			11dBm/ MHz
U-NII-2C			11dBm/ MHz
U-NII-3	√		30dBm/ 500kHz

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedure

For 802.11a / 802.11ac (VHT20) / 802.11ac (VHT40)

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz)
5. Sweep time = auto, trigger set to “free run”.
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value

For 802.11ac (VHT80)

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz)
5. Sweep time = auto, trigger set to “free run”.
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value and add 10 log (1/duty cycle)

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Condition

Same as Item 4.3.6.

4.4.7 Test Results

802.11a

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
149	5745	4.07	6.29	30	Pass
157	5785	4.04	6.26	30	Pass
165	5825	3.76	5.98	30	Pass

802.11n (VHT20)

TX chain	Chan.	Chan. Freq. (MHz)	PSD		10 log (N=3) dB	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
			(dBm/300kHz)	(dBm/500kHz)				
0	149	5745	2.98	5.20	4.77	9.97	29.54	Pass
	157	5785	2.89	5.11	4.77	9.88	29.54	Pass
	165	5825	3.03	5.25	4.77	10.02	29.54	Pass
1	149	5745	3.50	5.72	4.77	10.49	29.54	Pass
	157	5785	3.20	5.42	4.77	10.19	29.54	Pass
	165	5825	3.29	5.51	4.77	10.28	29.54	Pass
2	149	5745	2.92	5.14	4.77	9.91	29.54	Pass
	157	5785	2.85	5.07	4.77	9.84	29.54	Pass
	165	5825	2.64	4.86	4.77	9.63	29.54	Pass

Note: 1. Directional gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$ + $10^{G2/20}$)^2 / 3] = 6.46dBi > 6dBi, therefore the limit needs to reduce, so the power density limit shall be reduced to 30-(6.46-6) = 29.54dBm.

802.11n (VHT40)

TX chain	Chan.	Chan. Freq. (MHz)	PSD		10 log (N=3) dB	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
			(dBm/300kHz)	(dBm/500kHz)				
0	151	5755	-0.09	2.13	4.77	6.90	29.54	Pass
	159	5795	0.10	2.32	4.77	7.09	29.54	Pass
1	151	5755	0.52	2.74	4.77	7.51	29.54	Pass
	159	5795	0.34	2.56	4.77	7.33	29.54	Pass
2	151	5755	-0.03	2.19	4.77	6.96	29.54	Pass
	159	5795	-0.08	2.14	4.77	6.91	29.54	Pass

Note: 1. Directional gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$ + $10^{G2/20}$)^2 / 3] = 6.46dBi > 6dBi, therefore the limit needs to reduce, so the power density limit shall be reduced to 30-(6.46-6) = 29.54dBm.

802.11ac (VHT80)

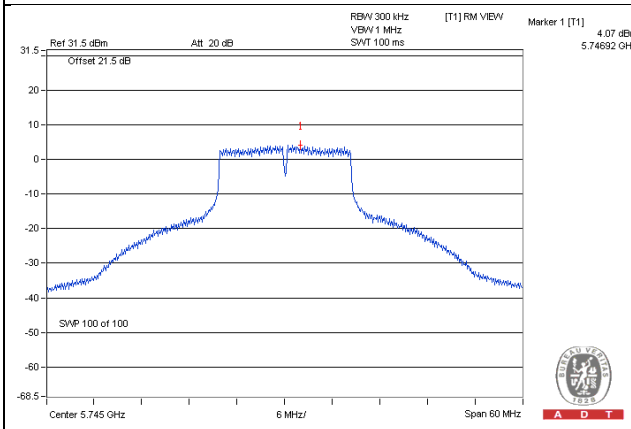
TX chain	Channel	Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	10 log (N=3) dB	Duty Factor (dB)	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
0	155	5775	-5.97	-3.75	4.77	0.29	1.31	29.54	Pass
1	155	5775	-4.67	-2.45	4.77	0.29	2.61	29.54	Pass
2	155	5775	-5.04	-2.82	4.77	0.29	2.24	29.54	Pass

Note: 1. Directional gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$ + $10^{G2/20}$)^2 / 3] = 6.46dBi > 6dBi, therefore the limit needs to reduce, so the power density limit shall be reduced to 30-(6.46-6) = 29.54dBm.

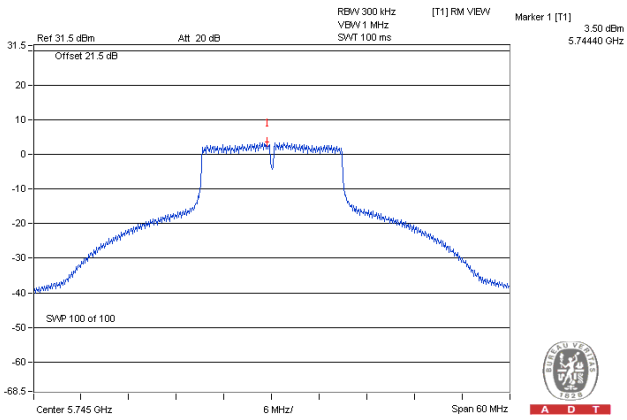
2. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

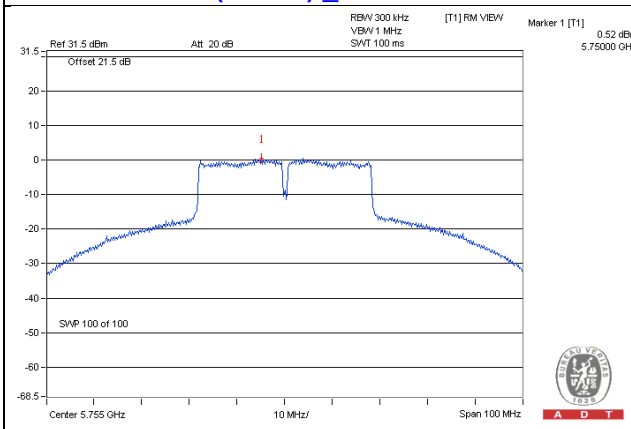
802.11a / CH149



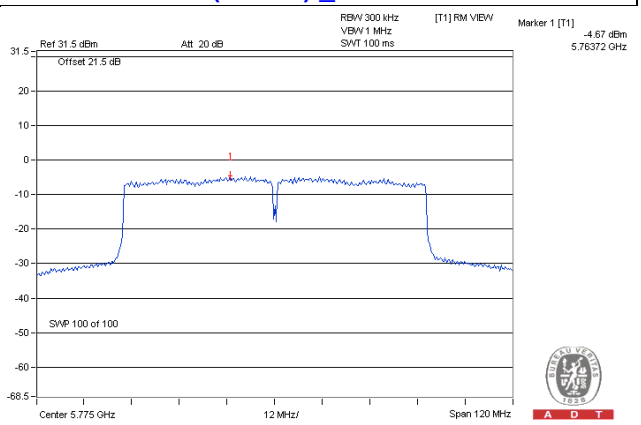
802.11n (VHT20)_Chain 1 / CH149



802.11n (VHT40) _Chain 1 / CH151



802.11ac (VHT80) _Chain 1 / CH155

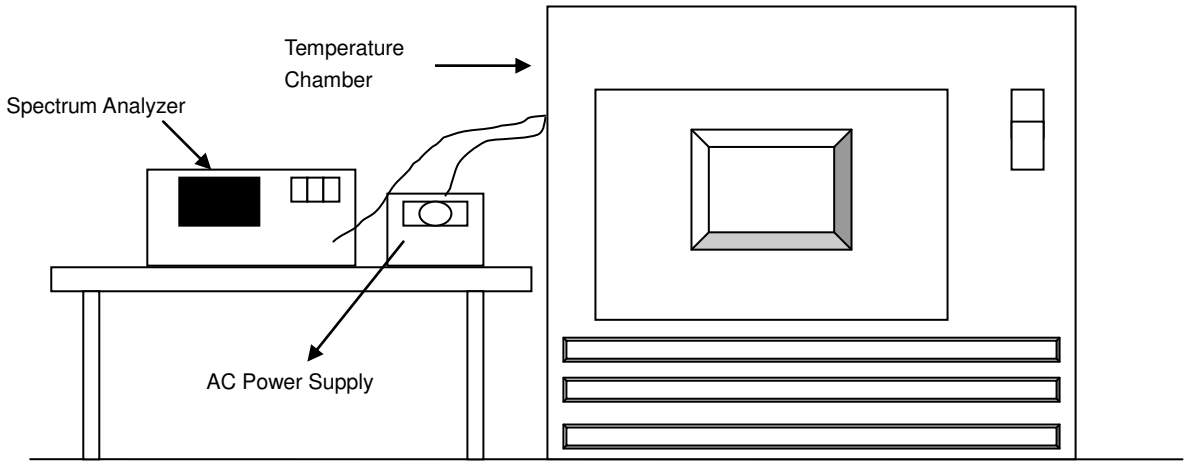


4.5 Frequency Stability Measurement

4.5.1 Limits of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within band of operation

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
b. Turn the EUT on and couple its output to a spectrum analyzer.
c. Turn the EUT off and set the chamber to the highest temperature specified.
d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

4.5.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5745 MHz									
TEMP. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail
50	120	5744.9866	Pass	5744.9856	Pass	5744.9863	Pass	5744.9836	Pass
40	120	5745.0209	Pass	5745.0219	Pass	5745.0247	Pass	5745.021	Pass
30	120	5745.0292	Pass	5745.0248	Pass	5745.0266	Pass	5745.0275	Pass
20	120	5744.9922	Pass	5744.9877	Pass	5744.9911	Pass	5744.9914	Pass
10	120	5745.0068	Pass	5745.0071	Pass	5745.0069	Pass	5745.0089	Pass
0	120	5745.0159	Pass	5745.0126	Pass	5745.0137	Pass	5745.0138	Pass
-10	120	5745.0146	Pass	5745.014	Pass	5745.0184	Pass	5745.0158	Pass
-20	120	5745.0112	Pass	5745.0096	Pass	5745.0137	Pass	5745.0119	Pass
-30	120	5745.0013	Pass	5745.0006	Pass	5745.0033	Pass	5745.003	Pass

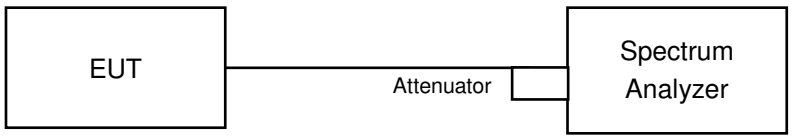
Frequency Stability Versus Voltage									
Operating Frequency: 5745 MHz									
TEMP. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail
20	138	5744.9911	Pass	5744.988	Pass	5744.9906	Pass	5744.9909	Pass
	120	5744.9922	Pass	5744.9877	Pass	5744.9911	Pass	5744.9914	Pass
	102	5744.9932	Pass	5744.9884	Pass	5744.9902	Pass	5744.9917	Pass

4.6 6dB Bandwidth Measurment

4.6.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

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

4.6.7 Test Results

802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	16.41	0.5	Pass
157	5785	16.38	0.5	Pass
165	5825	16.38	0.5	Pass

CDD Mode

802.11n (VHT20)

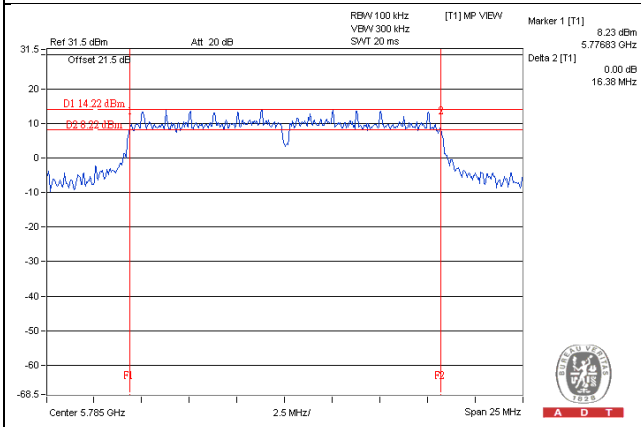
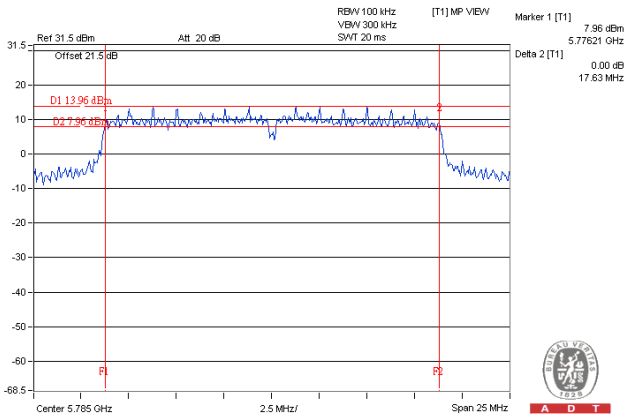
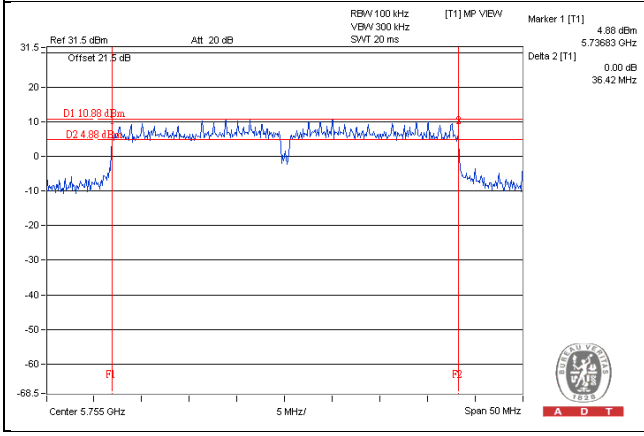
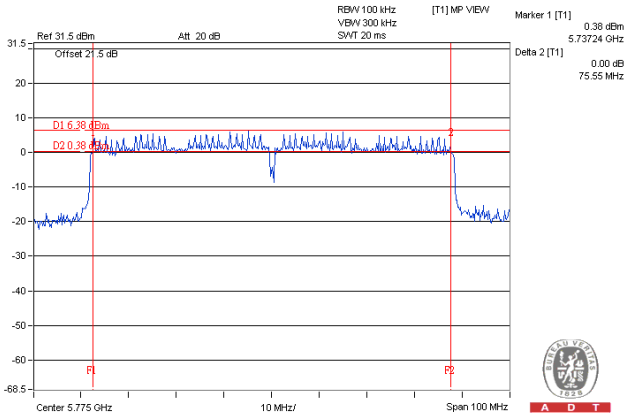
Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
149	5745	17.65	17.68	17.65	0.5	Pass
157	5785	17.64	17.63	17.65	0.5	Pass
165	5825	17.65	17.64	17.65	0.5	Pass

802.11n (VHT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
151	5755	36.44	36.44	36.42	0.5	Pass
159	5795	36.47	36.46	36.47	0.5	Pass

802.11ac (VHT80)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
155	5775	76.00	76.17	75.55	0.5	Pass

Spectrum Plot of Worst Value	
802.11a / CH157	**802.11n (VHT20)_Chain 1 / CH157**
	
802.11n (VHT40) _Chain 2 / CH151	**802.11ac (VHT80) _Chain 2 / CH155**
	

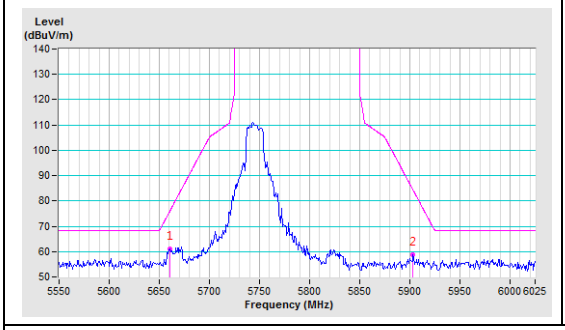
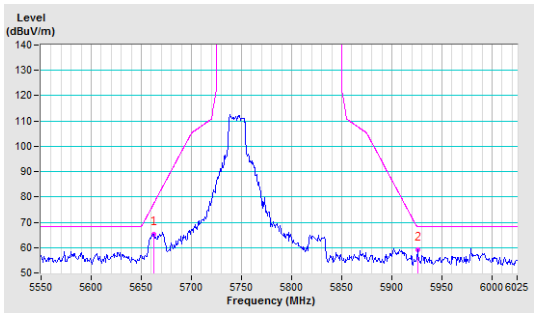
5 Pictures of Test Arrangements

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

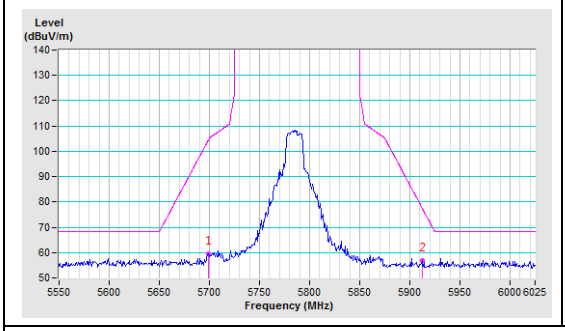
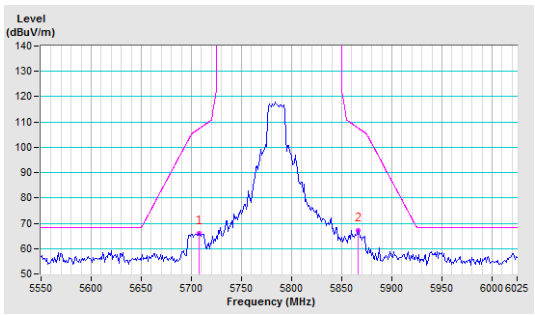
Annex A- Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

802.11a

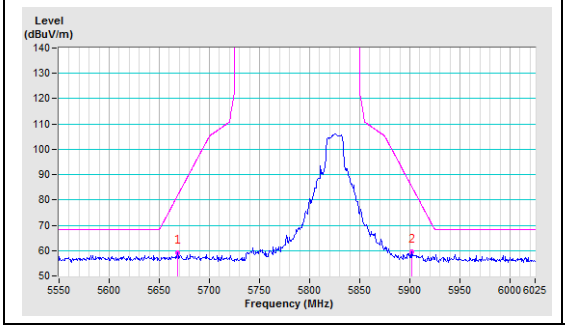
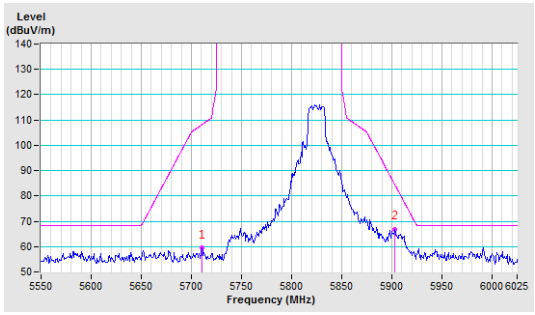
CH 149 5745 MHz

Horiontal	Vertical
	

CH 157 5785 MHz

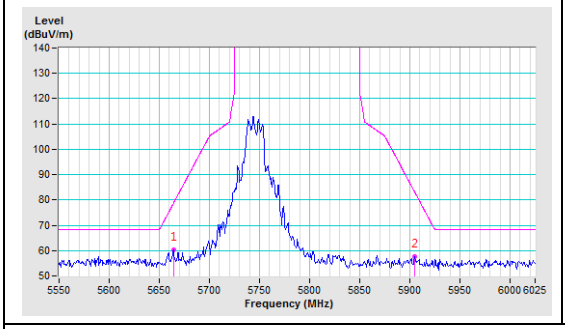
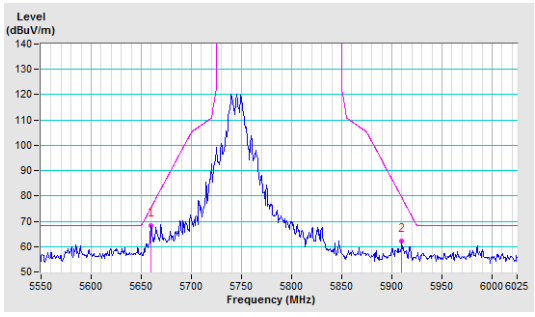
Horiontal	Vertical
	

CH 165 5825 MHz

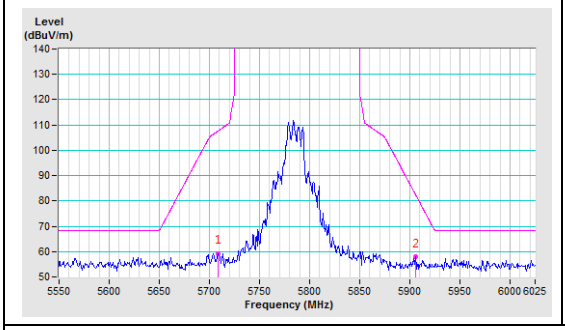
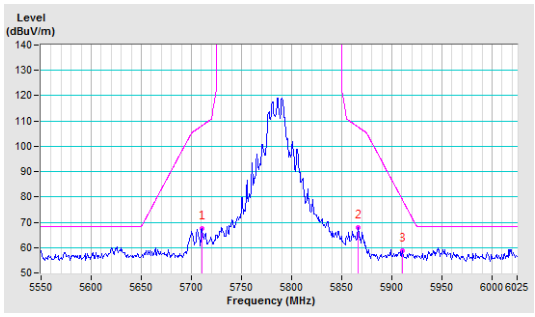
Horiontal	Vertical
	

802.11ac (VHT20)

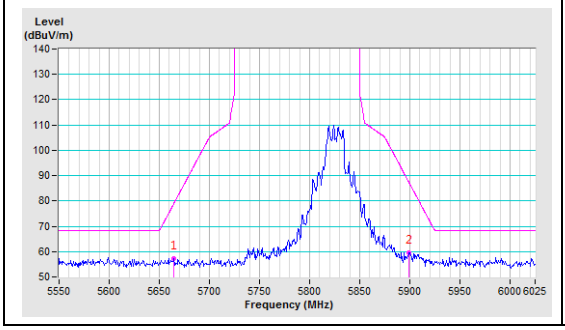
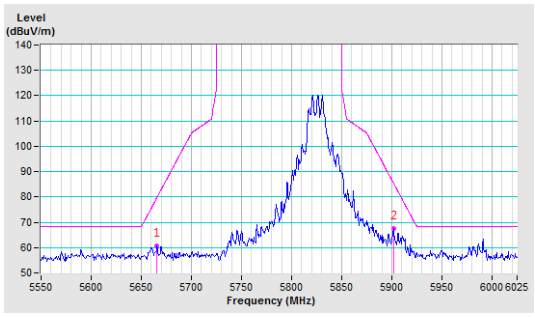
CH 149 5745 MHz

Horiontal	Vertical
	

CH 157 5785 MHz

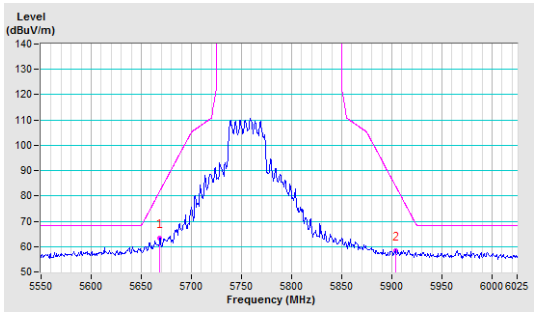
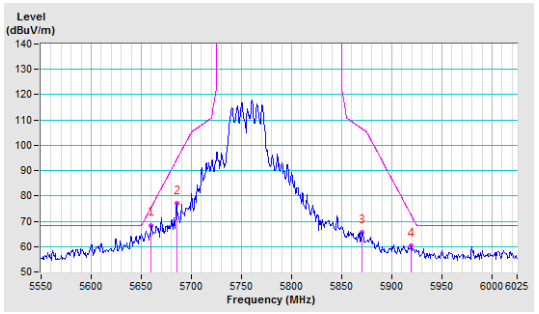
Horiontal	Vertical
	

CH 165 5825 MHz

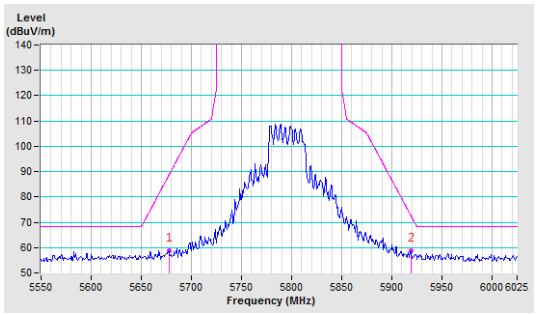
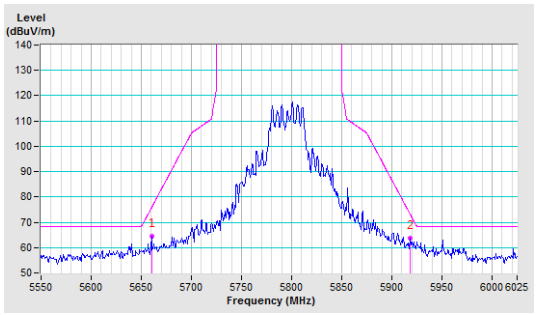
Horiontal	Vertical
	

802.11ac (HT40)

CH 151 5755 MHz

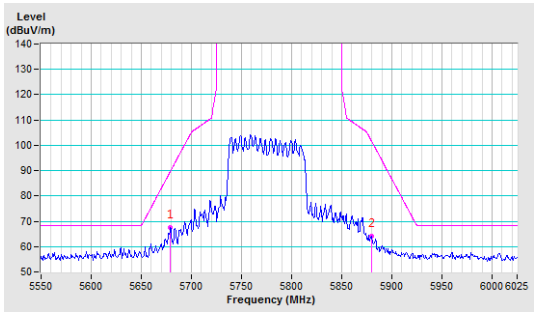
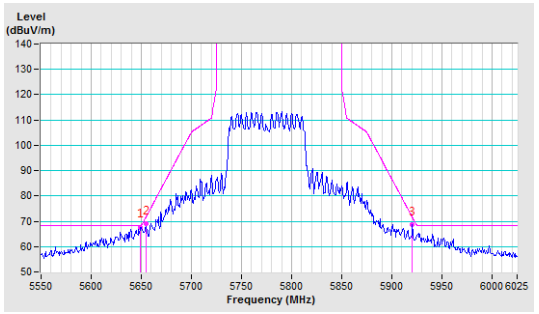
Horiontal	Vertical
	

CH 159 5795 MHz

Horiontal	Vertical
	

802.11ac (HT80)

CH 155 5755 MHz

Horiontal	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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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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