

FCC Test Report

Report No.: RF141229E04E-1 R1

FCC ID: Q87-WRT1200AC

Test Model: WRT1200AC

Series Model: WRT1200AC V2

Received Date: Mar. 25, 2016

Test Date: Mar. 25 ~ May 11, 2016

Issued Date: Jun. 14, 2016

Applicant: Linksys LLC

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

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Report Issue History Record

Issue No.	Reason for Change	Date Issued
RF141229E04-1	Original release.	Mar. 13, 2015
RF141229E04D-1	<ol style="list-style-type: none"> 1. Upgrade the standard to section 15.407 under new rule for U-NII-3 band. 2. Removed the original adapter "Model : MU30-5120250-A1 and MU30-P120250-A1" 3. Added one Model No.: WRT1200AC V2 	May 04, 2016
RF141229E04E-1	Upgrade the standard to section 15.407 under new rule (16-24) for U-NII-3 band.	May 19, 2016
RF141229E04E-1 R1	Modified the series model from WRT1200ACV2 to WRT1200AC V2.	Jun. 14, 2016

Release Control Record

Issue No.	Description	Date Issued
RF141229E04E-1	Original release	May 19, 2016
RF141229E04E-1 R1	Modified the series model from WRT1200ACV2 to WRT1200AC V2.	Jun. 14, 2016

1 Certificate of Conformity

Product: 802.11ac Router
Brand: Linksys
Test Model: WRT1200AC
Series Model: WRT1200AC V2
Sample Status: Engineering Sample
Applicant: Linksys LLC
Test Date: Mar. 25 ~ May 11, 2016
Standards: 47 CFR FCC Part 15, Subpart E (Section 15.407)
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  , Date: Jun. 14, 2016
Polly Chien / Specialist

Approved by :  , Date: Jun. 14, 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 -0.26 at 5924.30MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
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 R-SMA not a standard connector.

*For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOB 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) (\pm)
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.43 dB
	200MHz ~ 1000MHz	3.65 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	3.88 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	802.11ac Router
Brand	Linksys
Test Model	WRT1200AC
Series Model	WRT1200AC V2
Model Difference	Refer to note for more details
Status of EUT	Engineering Sample
Driver version	v7.2.8.6
Power Supply Rating	12Vdc (Adapter)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	OFDM
Transfer Rate	802.11a: 54/ 48/ 36/ 24/ 18/ 12/ 9/ 6Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps
Operating Frequency	5745 ~ 5825MHz
Number of Channel	802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1
Output Power	961.541mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter
Data Cable Supplied	NA

Note:

- This report is prepared for FCC class II permissive change.
- This report is issued as a supplementary report to the original BV ADT report no.: RF141229E04D-1. The difference between them is below information:
 - ◆ Upgrade the standard to section 15.407 under new rule (16-24) for U-NII-3 band.
- The following models are electrically identical, different model names are for marketing purpose.

Brand	Model No.	Note
Linksys	WRT1200AC	For marketing requirement
	WRT1200AC V2	

From the above models, model: **WRT1200AC** was selected as representative model for the test and its data was recorded in this report.

- According to above conditions, all test items of U-NII-3 band test item need to be performed, except for AC power conducted emission test item. And all data was verified to meet the requirements.
- 2.4GHz and 5GHz technology can transmit at same time.

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

Brand	Model No.	Spec.
CWT	2ABL030F US	Input: 100-240V, 1.0A, 50/60Hz Output: 12V, 2.5A DC output cable: 1.8m, unshielded

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

Transmitter Circuit	Brand	Gain (dBi)	Cable Loss (dB)	Net Gain (dBi)	Frequency Range (GHz to GHz)	Antenna Type	Connector Type
Chain (0)	LINKSYS	3.8	1.9	1.9	5.725 ~ 5.85	DIPOLE	R-SMA
Chain (1)	LINKSYS	3.8	2.1	1.7	5.725 ~ 5.85	DIPOLE	R-SMA

8. The EUT has two different Transformer types could be chosen and please refer the below table:

Type 1 (Vendor: MINGTEK)		
Vendor P/N	Vendor	Location
HN1878CG	MINGTEK	T1
HN3678CG	MINGTEK	T2, T3
Type 2 (Vendor: BOTHHAND)		
Vendor P/N	Vendor	Location
LG1P109N LF	BOTHHAND	T1
LG2P109N LF	BOTHHAND	T2, T3

Note: In original report, **Type 2 (Vendor: BOTHHAND)**, the worse case one for radiated emission, was chosen for final test.

9. The EUT incorporates a MIMO function.

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

*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 5745 ~ 5825MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

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

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

Note:

- In original report, the EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on Y-plane (for below 1GHz) and X-plane (for above 1GHz).
- "-" means no effect.

Radiated Emission Test (Above 1GHz):

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

EUT CONFIGURE MODE	MODE	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
-	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

Radiated Emission Test (Below 1GHz):

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

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

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.

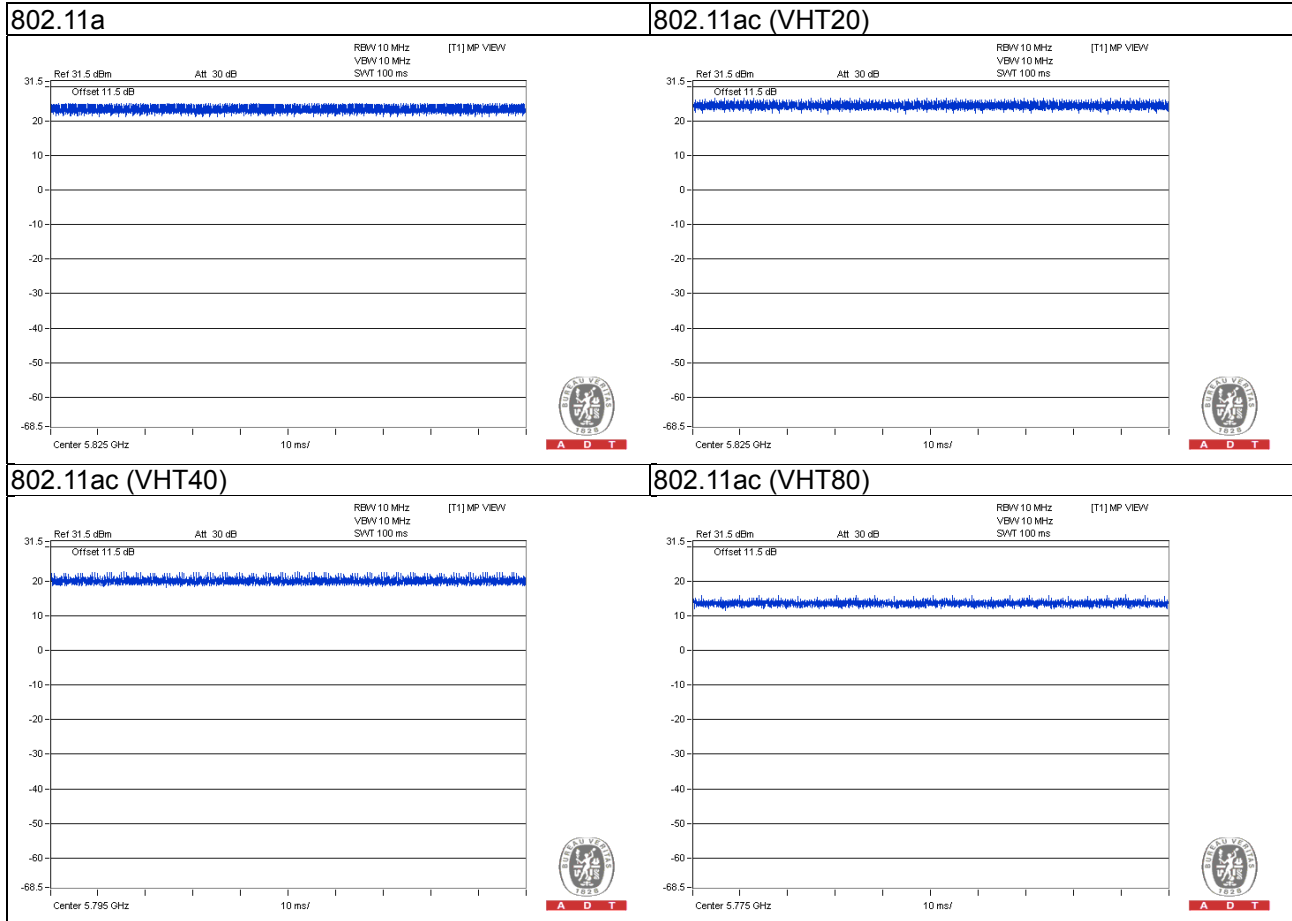
EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
-	802.11ac (VHT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5
-	802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
-	802.11ac (VHT80)		155	155	OFDM	BPSK	29.3

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	25deg. C, 72%RH	120Vac, 60Hz	Andy Ho
RE $<$ 1G	23deg. C, 70%RH	120Vac, 60Hz	Weiwei Lo
APCM	19deg. C, 63%RH	120Vac, 60Hz	Anderson Chen

3.3 Duty Cycle of Test Signal

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



3.4 Description of Support Units

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

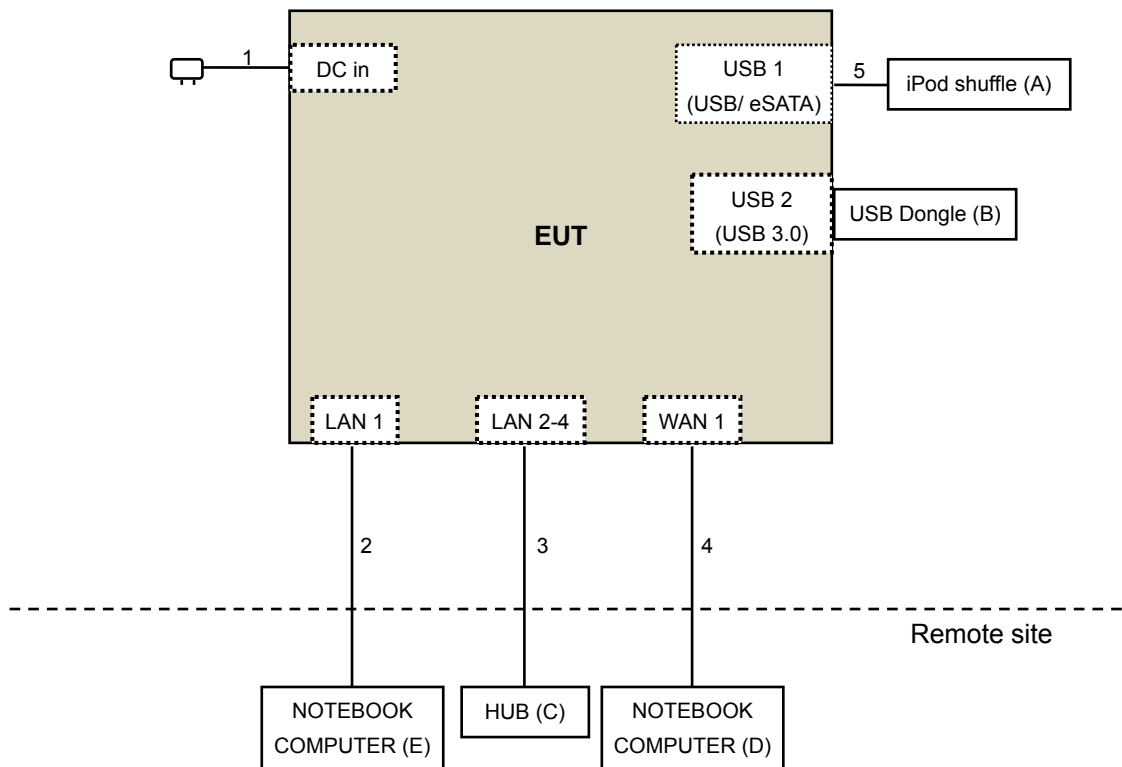
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	iPod shuffle	Apple	MC749TA/A	CC4DMFKUDFDM	NA	Provided by Lab
B.	USB Dongle	Transcend	TS16GJF750K	NA	NA	Provided by Lab
C.	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC Approved	Provided by Lab
D.	Notebook Computer	DELL	PP32LA	GSLB32S	FCC DoC Approved	Provided by Lab
E.	Notebook Computer	DELL	E6440	F9LYQ32	FCC DoC Approved	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items C-E acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC	1	1.8	No	0	Supplied by Client
2.	RJ-45	1	10	No	0	Provided by Lab
3.	RJ-45	3	10	No	0	Provided by Lab
4.	RJ-45	1	10	No	0	Provided by Lab
5.	USB	1	0.1	Yes	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart E (15.407)

KDB 789033 D02 General UNII Test Procedures New Rules v01r02

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

APPLICABLE TO	LIMIT	
789033 D02 General UNII Test Procedures New Rules v01r02	FIELD STRENGTH AT 3m	
	PK:74 (dBµV/m)	AV:54 (dBµV/m)
APPLICABLE TO	EIRP LIMIT	EQUIVALENT FIELD STRENGTH AT 3m
15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)(i)	PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4}	PK: 68.2(dBµV/m) ^{*1} PK:105.2 (dBµV/m) ^{*2} PK: 110.8(dBµV/m) ^{*3} PK:122.2 (dBµV/m) ^{*4}
15.407(b)(4)(ii)	FIELD STRENGTH at 3m / § 15.247(d),	
	PK:74 (dBµV/m)	AV:54 (dBµV/m)
^{*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.		

NOTE: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000 \sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

4.1.2 Test Instruments

For below 1GHz:

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Agilent	N9038A	MY51210202	Dec. 16, 2015	Dec. 15, 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-1000VH2B	AMP-ZFL-04	Nov. 11, 2015	Nov. 10, 2016
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Jan. 07, 2016	Jan. 06, 2017
RF Cable	8D-FB	CHHCAB-001-1 CHHCAB-001-2	Oct. 04, 2015	Oct. 03, 2016
	RF-141	CHHCAB-004	Oct. 04, 2015	Oct. 03, 2016
Software	ADT_Radiated_V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

- 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 loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. The test was performed in 966 Chamber No. H.
 4. The FCC Site Registration No. is 797305.
 5. The CANADA Site Registration No. is IC 7450H-3.
 6. Loop antenna was used for all emissions below 30 MHz.
 7. Tested Date: Mar. 28, 2016

For above 1GHz:

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Agilent	N9038A	MY51210105	July 24, 2015	July 23, 2016
Horn_Antenna AISI	AIH.8018	0000320091110	Jan. 19, 2016	Jan. 18, 2017
Pre-Amplifier Agilent	8449B	3008A02578	Jun. 23, 2015	Jun. 22, 2016
RF Cable	NA	131205 131216 131217 SNMY23684/4	Jan. 15, 2016	Jan. 14, 2017
Spectrum Analyzer Agilent	E4446A	MY48250254	Nov. 25, 2015	Nov. 24, 2016
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Dec. 11, 2015	Dec. 10, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Jan. 18, 2016	Jan. 17, 2017
RF Cable	SUCOFLEX 102	36442/2 36434/2	Dec. 10, 2015	Dec. 09, 2016
Software	ADT_Radiated_V8.7.0 7	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA
Boresight Antenna Fixture	NA	NA	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	FSP 40	100036	Jan. 27, 2016	Jan. 26, 2017

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in 966 Chamber No. G.
 3. The FCC Site Registration No. is 966073.
 4. The VCCI Site Registration No. is G-137.
 5. The CANADA Site Registration No. is IC 7450H-2.
 6. Tested Date: Apr. 28 ~ May 10, 2016

4.1.3 Test Procedures

- 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:

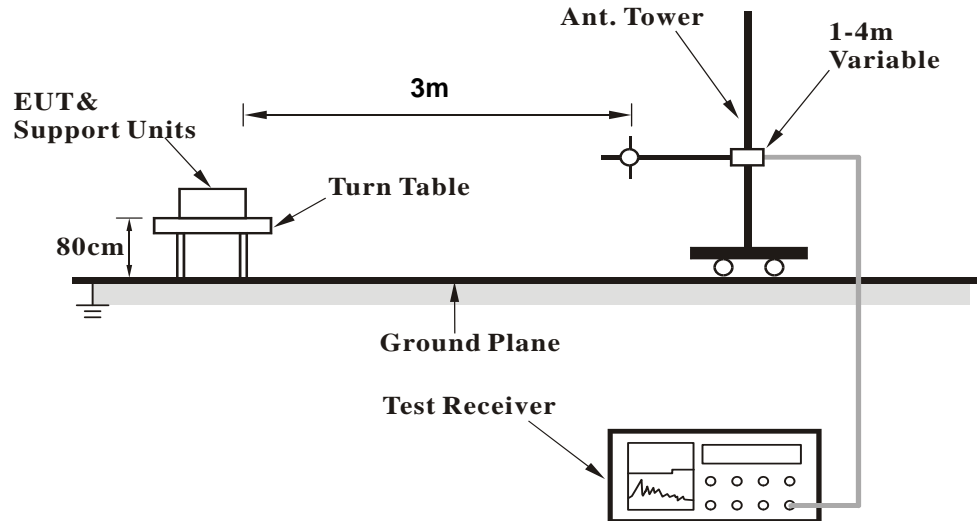
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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 ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) 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

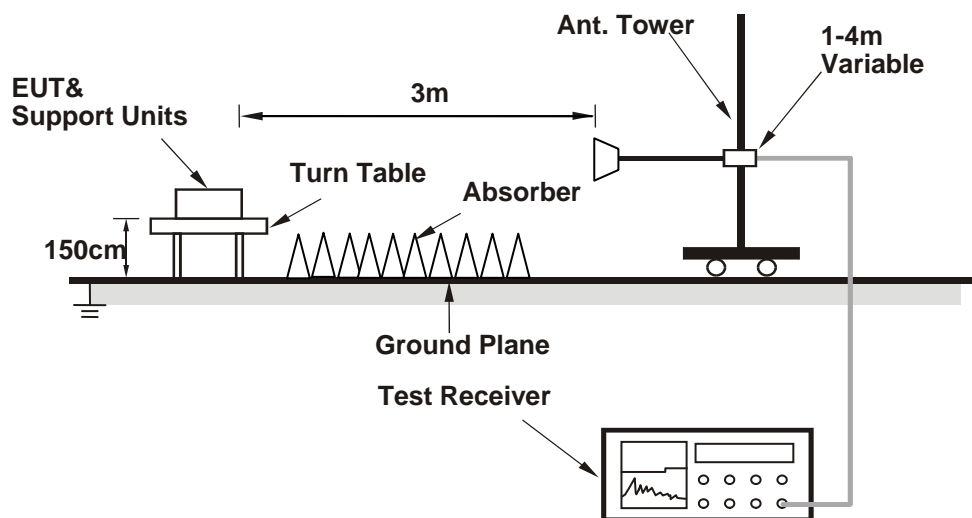
No deviation.

4.1.5 Test Set Up

<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 Conditions

1. Connect the EUT with the support units D-E (Notebook Computer) which is placed in remote site.
2. The communication partner run test program "DutApiMimoApApp.exe" 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)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5673.02	59.39 PK	85.28	-25.89	1.08 H	64	51.88	7.51
2	*5745.00	109.70 PK			1.08 H	64	101.99	7.71
3	*5745.00	100.50 AV			1.08 H	64	92.79	7.71
4	#5901.02	59.36 PK	85.91	-26.55	1.08 H	64	51.76	7.60
5	11490.00	57.60 PK	74.00	-16.40	1.18 H	321	44.46	13.14
6	11490.00	45.00 AV	54.00	-9.00	1.18 H	321	31.86	13.14
7	#17235.00	58.20 PK	74.00	-15.80	1.19 H	77	35.16	23.04
8	#17235.00	46.30 AV	54.00	-7.70	1.19 H	77	23.26	23.04
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	#5654.98	60.42 PK	71.90	-11.48	2.19 V	20	53.00	7.42
2	*5745.00	120.70 PK			2.19 V	20	112.99	7.71
3	*5745.00	111.30 AV			2.19 V	20	103.59	7.71
4	#5923.35	60.37 PK	69.42	-9.05	2.19 V	20	52.55	7.82
5	11490.00	57.20 PK	74.00	-16.80	1.14 V	309	44.06	13.14
6	11490.00	45.60 AV	54.00	-8.40	1.14 V	309	32.46	13.14
7	#17235.00	61.50 PK	74.00	-12.50	1.03 V	117	38.46	23.04
8	#17235.00	49.40 AV	54.00	-4.60	1.03 V	117	26.36	23.04

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)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	111.30 PK			1.10 H	52	103.53	7.77
2	*5785.00	102.30 AV			1.10 H	52	94.53	7.77
3	11570.00	57.70 PK	74.00	-16.30	1.20 H	335	44.52	13.18
4	11570.00	45.00 AV	54.00	-9.00	1.20 H	335	31.82	13.18
5	#17355.00	58.70 PK	74.00	-15.30	1.13 H	93	35.56	23.14
6	#17355.00	46.60 AV	54.00	-7.40	1.13 H	93	23.46	23.14
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	122.30 PK			2.33 V	360	114.53	7.77
2	*5785.00	113.10 AV			2.33 V	360	105.33	7.77
3	11570.00	56.90 PK	74.00	-17.10	1.17 V	316	43.72	13.18
4	11570.00	45.60 AV	54.00	-8.40	1.17 V	316	32.42	13.18
5	#17355.00	61.10 PK	74.00	-12.90	1.00 V	116	37.96	23.14
6	#17355.00	49.20 AV	54.00	-4.80	1.00 V	116	26.06	23.14

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)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5657.82	58.07 PK	74.01	-15.94	1.04 H	66	50.62	7.45
2	*5825.00	110.30 PK			1.04 H	66	102.57	7.73
3	*5825.00	101.30 AV			1.04 H	66	93.57	7.73
4	#5913.85	58.29 PK	76.42	-18.13	1.04 H	66	50.57	7.72
5	11650.00	57.40 PK	74.00	-16.60	1.24 H	336	44.16	13.24
6	11650.00	44.70 AV	54.00	-9.30	1.24 H	336	31.46	13.24
7	#17475.00	59.20 PK	74.00	-14.80	1.10 H	109	36.06	23.14
8	#17475.00	46.80 AV	54.00	-7.20	1.10 H	109	23.66	23.14

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	#5667.80	64.00 PK	81.41	-17.41	2.33 V	1	56.50	7.50
2	*5825.00	121.30 PK			2.33 V	1	113.57	7.73
3	*5825.00	112.10 AV			2.33 V	1	104.37	7.73
4	#5908.15	62.77 PK	80.63	-17.86	2.33 V	1	55.11	7.66
5	11650.00	57.10 PK	74.00	-16.90	1.11 V	319	43.86	13.24
6	11650.00	45.50 AV	54.00	-8.50	1.11 V	319	32.26	13.24
7	#17475.00	61.10 PK	74.00	-12.90	1.03 V	123	37.96	23.14
8	#17475.00	49.40 AV	54.00	-4.60	1.03 V	123	26.26	23.14

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	#5683.00	66.27 PK	92.66	-26.39	1.01 H	72	58.71	7.56
2	*5745.00	111.20 PK			1.01 H	72	103.49	7.71
3	*5745.00	102.40 AV			1.01 H	72	94.69	7.71
4	#5901.02	59.48 PK	85.91	-26.43	1.01 H	72	51.88	7.60
5	11490.00	57.70 PK	74.00	-16.30	1.20 H	351	44.56	13.14
6	11490.00	44.70 AV	54.00	-9.30	1.20 H	351	31.56	13.14
7	#17235.00	58.70 PK	74.00	-15.30	1.15 H	94	35.66	23.04
8	#17235.00	46.40 AV	54.00	-7.60	1.15 H	94	23.36	23.04

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	#5663.05	68.69 PK	77.89	-9.20	2.06 V	2	61.22	7.47
2	*5745.00	122.20 PK			2.06 V	2	114.49	7.71
3	*5745.00	113.20 AV			2.06 V	2	105.49	7.71
4	#5912.90	63.28 PK	77.13	-13.85	2.06 V	2	55.57	7.71
5	11490.00	57.00 PK	74.00	-17.00	1.11 V	319	43.86	13.14
6	11490.00	45.50 AV	54.00	-8.50	1.11 V	319	32.36	13.14
7	#17235.00	60.90 PK	74.00	-13.10	1.06 V	110	37.86	23.04
8	#17235.00	49.10 AV	54.00	-4.90	1.06 V	110	26.06	23.04

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)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	111.10 PK			1.06 H	78	103.33	7.77
2	*5785.00	102.20 AV			1.06 H	78	94.43	7.77
3	11570.00	57.70 PK	74.00	-16.30	1.18 H	360	44.52	13.18
4	11570.00	45.00 AV	54.00	-9.00	1.18 H	360	31.82	13.18
5	#17355.00	59.30 PK	74.00	-14.70	1.19 H	103	36.16	23.14
6	#17355.00	46.90 AV	54.00	-7.10	1.19 H	103	23.76	23.14

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	122.10 PK			2.26 V	360	114.33	7.77
2	*5785.00	113.00 AV			2.26 V	360	105.23	7.77
3	11570.00	57.00 PK	74.00	-17.00	1.15 V	332	43.82	13.18
4	11570.00	45.50 AV	54.00	-8.50	1.15 V	332	32.32	13.18
5	#17355.00	61.00 PK	74.00	-13.00	1.11 V	112	37.86	23.14
6	#17355.00	49.10 AV	54.00	-4.90	1.11 V	112	25.96	23.14

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.

CHANNEL	TX Channel 165	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5672.07	59.17 PK	84.57	-25.40	1.07 H	83	51.66	7.51
2	*5825.00	110.80 PK			1.07 H	83	103.07	7.73
3	*5825.00	101.50 AV			1.07 H	83	93.77	7.73
4	#5902.45	59.92 PK	84.85	-24.93	1.07 H	83	52.30	7.62
5	11650.00	57.30 PK	74.00	-16.70	1.15 H	357	44.06	13.24
6	11650.00	44.70 AV	54.00	-9.30	1.15 H	357	31.46	13.24
7	#17475.00	59.70 PK	74.00	-14.30	1.13 H	108	36.56	23.14
8	#17475.00	47.20 AV	54.00	-6.80	1.13 H	108	24.06	23.14

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	#5655.93	61.39 PK	72.61	-11.22	2.23 V	18	53.95	7.44
2	*5825.00	121.80 PK			2.23 V	18	114.07	7.73
3	*5825.00	112.30 AV			2.23 V	18	104.57	7.73
4	#5918.12	65.63 PK	73.27	-7.64	2.23 V	18	57.87	7.76
5	11650.00	57.00 PK	74.00	-17.00	1.16 V	348	43.76	13.24
6	11650.00	45.50 AV	54.00	-8.50	1.16 V	348	32.26	13.24
7	#17475.00	60.90 PK	74.00	-13.10	1.06 V	97	37.76	23.14
8	#17475.00	49.20 AV	54.00	-4.80	1.06 V	97	26.06	23.14

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	#5688.23	67.08 PK	96.52	-29.44	1.08 H	77	59.49	7.59
2	*5755.00	108.00 PK			1.08 H	77	100.27	7.73
3	*5755.00	98.80 AV			1.08 H	77	91.07	7.73
4	#5920.50	58.09 PK	71.52	-13.43	1.08 H	77	50.31	7.78
5	11510.00	57.50 PK	74.00	-16.50	1.14 H	351	44.38	13.12
6	11510.00	45.10 AV	54.00	-8.90	1.14 H	351	31.98	13.12
7	#17265.00	59.00 PK	74.00	-15.00	1.13 H	106	35.90	23.10
8	#17265.00	46.80 AV	54.00	-7.20	1.13 H	106	23.70	23.10

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	#5654.02	70.26 PK	71.19	-0.93	2.06 V	300	62.84	7.42
2	*5755.00	119.00 PK			2.06 V	300	111.27	7.73
3	*5755.00	109.60 AV			2.06 V	300	101.87	7.73
4	#5924.77	63.67 PK	68.37	-4.70	2.06 V	300	55.84	7.83
5	11510.00	56.50 PK	74.00	-17.50	1.18 V	360	43.38	13.12
6	11510.00	45.20 AV	54.00	-8.80	1.18 V	360	32.08	13.12
7	#17265.00	61.10 PK	74.00	-12.90	1.09 V	106	38.00	23.10
8	#17265.00	49.20 AV	54.00	-4.80	1.09 V	106	26.10	23.10

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 159	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5672.07	58.59 PK	84.57	-25.98	1.04 H	74	51.08	7.51
2	*5795.00	108.60 PK			1.04 H	74	100.81	7.79
3	*5795.00	99.10 AV			1.04 H	74	91.31	7.79
4	#5911.00	59.41 PK	78.53	-19.12	1.04 H	74	51.71	7.70
5	11590.00	57.30 PK	74.00	-16.70	1.11 H	346	44.10	13.20
6	11590.00	45.20 AV	54.00	-8.80	1.11 H	346	32.00	13.20
7	#17385.00	59.10 PK	74.00	-14.90	1.13 H	118	36.00	23.10
8	#17385.00	46.90 AV	54.00	-7.10	1.13 H	118	23.80	23.10

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	#5654.02	64.16 PK	71.19	-7.03	2.14 V	300	56.74	7.42
2	*5795.00	119.60 PK			2.14 V	300	111.81	7.79
3	*5795.00	109.90 AV			2.14 V	300	102.11	7.79
4	#5924.30	68.46 PK	68.72	-0.26	2.14 V	300	60.63	7.83
5	11590.00	56.70 PK	74.00	-17.30	1.12 V	356	43.50	13.20
6	11590.00	45.40 AV	54.00	-8.60	1.12 V	356	32.20	13.20
7	#17385.00	61.20 PK	74.00	-12.80	1.04 V	111	38.10	23.10
8	#17385.00	49.20 AV	54.00	-4.80	1.04 V	111	26.10	23.10

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.

802.11ac (VHT80)

CHANNEL	TX Channel 155	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5664.48	60.89 PK	78.95	-18.06	1.47 H	326	53.41	7.48
2	*5775.00	98.40 PK			1.47 H	326	90.65	7.75
3	*5775.00	88.90 AV			1.47 H	326	81.15	7.75
4	#5920.50	58.83 PK	71.52	-12.69	1.47 H	326	51.05	7.78
5	11550.00	57.60 PK	74.00	-16.40	1.12 H	341	44.44	13.16
6	11550.00	45.40 AV	54.00	-8.60	1.12 H	341	32.24	13.16
7	#17325.00	59.50 PK	74.00	-14.50	1.11 H	133	36.34	23.16
8	#17325.00	47.30 AV	54.00	-6.70	1.11 H	133	24.14	23.16

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	#5654.02	69.18 PK	71.19	-2.01	2.37 V	1	61.76	7.42
2	*5775.00	111.30 PK			2.37 V	1	103.55	7.75
3	*5775.00	100.90 AV			2.37 V	1	93.15	7.75
4	#5922.87	66.40 PK	69.77	-3.37	2.37 V	1	58.59	7.81
5	11550.00	57.00 PK	74.00	-17.00	1.12 V	360	43.84	13.16
6	11550.00	45.90 AV	54.00	-8.10	1.12 V	360	32.74	13.16
7	#17325.00	61.40 PK	74.00	-12.60	1.01 V	101	38.24	23.16
8	#17325.00	49.50 AV	54.00	-4.50	1.01 V	101	26.34	23.16

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

802.11a

CHANNEL	TX Channel 157	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	100.01	27.84 QP	43.50	-15.66	1.00 H	1	40.28	-12.44
2	135.66	26.69 QP	43.50	-16.81	1.50 H	360	35.46	-8.77
3	200.02	29.92 QP	43.50	-13.58	1.00 H	349	40.69	-10.77
4	375.00	31.50 QP	46.00	-14.50	1.00 H	57	36.17	-4.67
5	437.50	34.37 QP	46.00	-11.63	1.00 H	76	37.14	-2.77
6	562.51	36.06 QP	46.00	-9.94	1.50 H	360	36.57	-0.51
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	41.37	33.03 QP	40.00	-6.97	1.00 V	264	41.90	-8.87
2	199.99	29.31 QP	43.50	-14.19	1.00 V	348	40.08	-10.77
3	250.00	33.11 QP	46.00	-12.89	2.00 V	231	41.93	-8.82
4	375.00	31.45 QP	46.00	-14.55	1.00 V	63	36.12	-4.67
5	437.50	33.63 QP	46.00	-12.37	1.00 V	330	36.40	-2.77
6	600.02	33.80 QP	46.00	-12.20	1.00 V	331	33.09	0.71

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 Measurement

4.2.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p \leq 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,

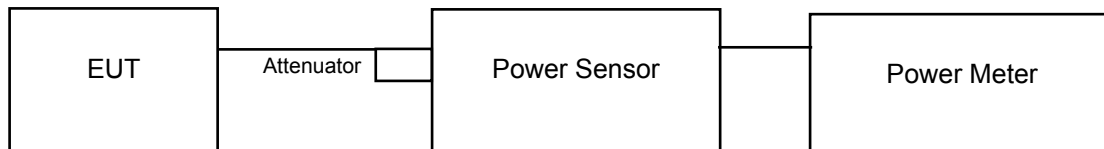
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

For Average Power Measurement

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

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

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

4.2.7 Test Result

Power Output:

802.11a

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
149	5745	26.62	26.61	917.340	29.63	30.00	Pass
157	5785	26.62	27.01	961.541	29.83	30.00	Pass
165	5825	26.48	27.00	945.818	29.76	30.00	Pass

802.11ac (VHT20)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
149	5745	26.74	26.67	936.578	29.72	30.00	Pass
157	5785	26.77	26.79	952.864	29.79	30.00	Pass
165	5825	26.71	26.52	917.558	29.63	30.00	Pass

802.11ac (VHT40)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
151	5755	26.23	26.12	829.020	29.19	30.00	Pass
159	5795	26.88	26.49	933.184	29.70	30.00	Pass

802.11ac (VHT80)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
155	5775	23.22	23.08	413.13	26.16	30.00	Pass

Occupied Bandwidth:

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
149	5745	16.92	17.52
157	5785	18.12	22.56
165	5825	18.84	20.88

802.11ac (VHT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
149	5745	19.92	24.00
157	5785	21.12	22.80
165	5825	18.84	21.24

802.11ac (VHT40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
151	5755	37.40	38.80
159	5795	38.20	42.00

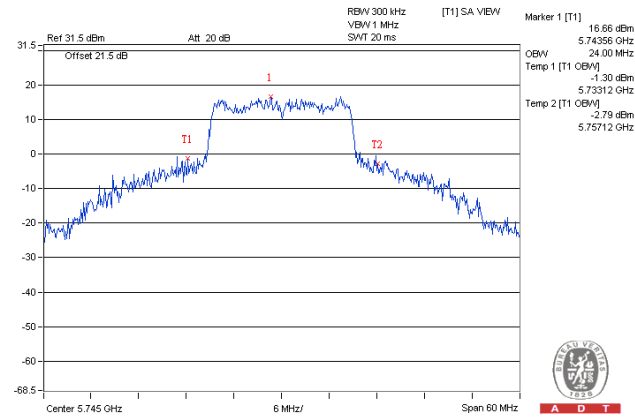
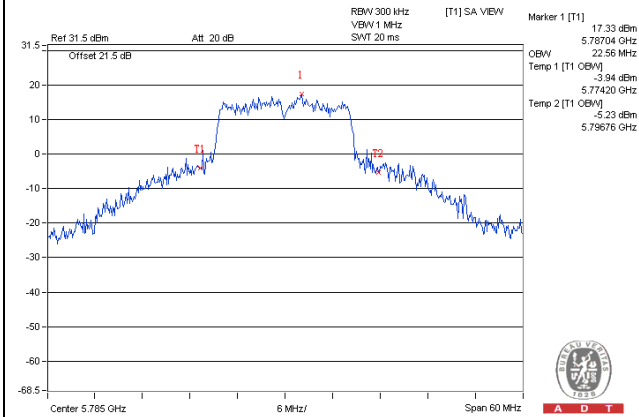
802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
155	5775	76.32	76.08

Spectrum Plot of Worst Value

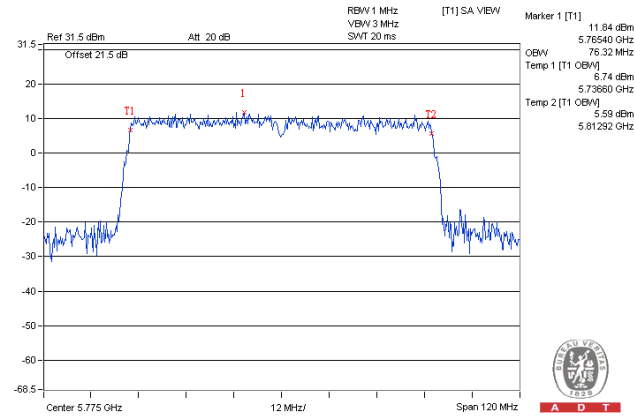
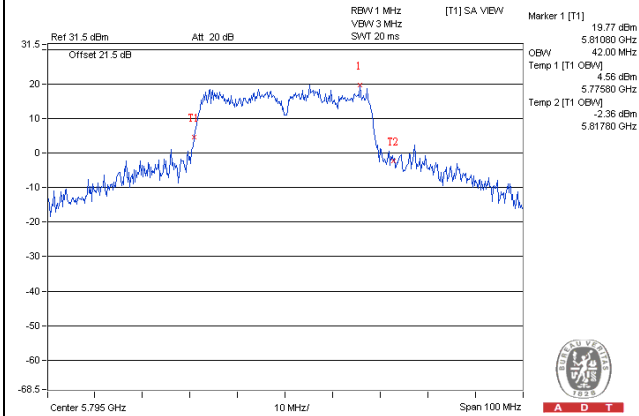
802.11a

802.11ac (VHT20)



802.11ac (VHT40)

802.11ac (VHT80)

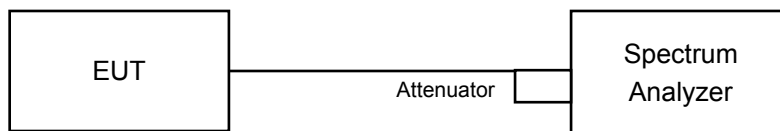


4.3 Peak Power Spectral Density Measurement

4.3.1 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

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz, Set VBW \geq 1 MHz, Detector = RMS
- Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
- 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 $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$
- Sweep time = auto, trigger set to "free run".
- Trace average at least 100 traces in power averaging mode.
- Record the max value

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.2.6.

4.3.7 Test Results

802.11a

TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	149	5745	3.47	5.69	3.01	8.70	30.00	Pass
	157	5785	4.78	7.00	3.01	10.01	30.00	Pass
	165	5825	4.98	7.20	3.01	10.21	30.00	Pass
1	149	5745	4.20	6.42	3.01	9.43	30.00	Pass
	157	5785	5.28	7.50	3.01	10.51	30.00	Pass
	165	5825	5.19	7.41	3.01	10.42	30.00	Pass

Note:

- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20}) / 2] = 4.81\text{dBi} < 6\text{dBi}$, so the power density limit no need to reduced.

802.11ac (VHT20)

TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	149	5745	4.54	6.76	3.01	9.77	30.00	Pass
	157	5785	4.82	7.04	3.01	10.05	30.00	Pass
	165	5825	4.41	6.63	3.01	9.64	30.00	Pass
1	149	5745	5.13	7.35	3.01	10.36	30.00	Pass
	157	5785	4.82	7.04	3.01	10.05	30.00	Pass
	165	5825	4.78	7.00	3.01	10.01	30.00	Pass

Note:

- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20}) / 2] = 4.81\text{dBi} < 6\text{dBi}$, so the power density limit no need to reduced.

802.11ac (VHT40)

TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	151	5755	0.95	3.17	3.01	6.18	30.00	Pass
	159	5795	1.01	3.23	3.01	6.24	30.00	Pass
1	151	5755	1.21	3.43	3.01	6.44	30.00	Pass
	159	5795	1.40	3.62	3.01	6.63	30.00	Pass

Note:

1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})/2] = 4.81\text{dBi} < 6\text{dBi}$, so the power density limit no need to reduced.

802.11ac (VHT80)

TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	155	5755	-6.41	-4.19	3.01	-1.18	30.00	Pass
1	155	5755	-5.74	-3.52	3.01	-0.51	30.00	Pass

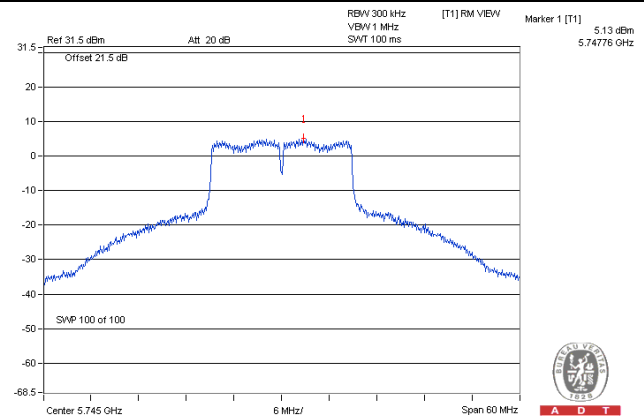
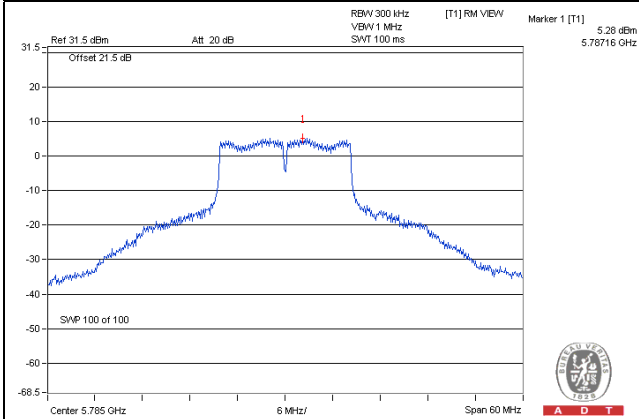
Note:

1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})/2] = 4.81\text{dBi} < 6\text{dBi}$, so the power density limit no need to reduced.

Spectrum Plot of Worst Value

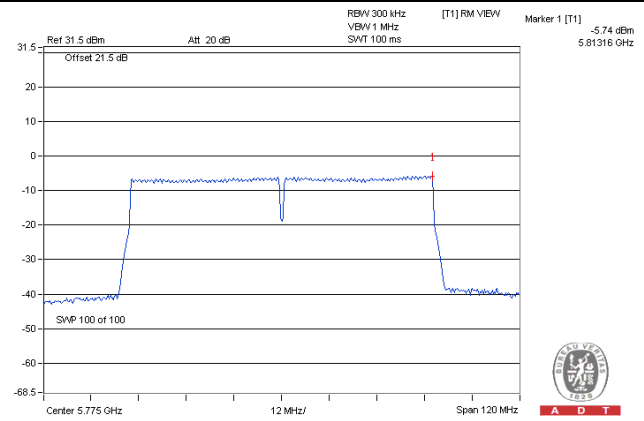
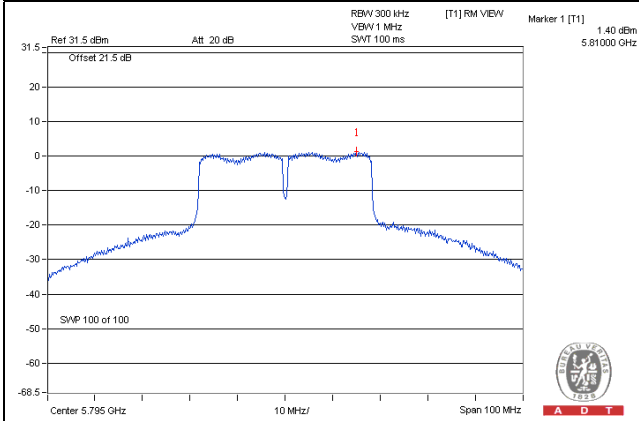
802.11a

802.11ac (VHT20)



802.11ac (VHT40)

802.11ac (VHT80)

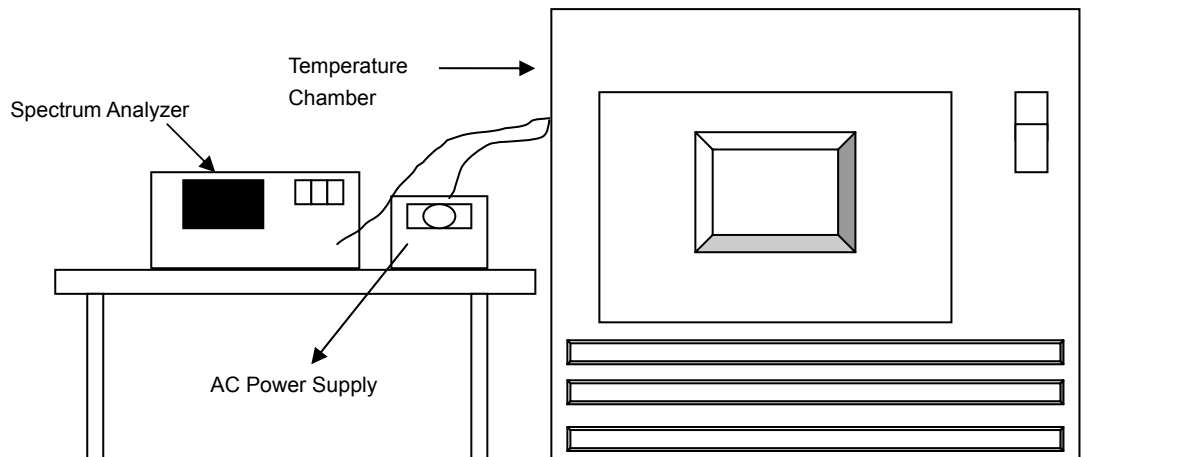


4.4 Frequency Stability

4.4.1 Limits of Frequency Stability Measurement

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

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

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- 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.
- Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- 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.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Condition

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

4.4.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5745MHz									
Temp. (°C)	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	5745.0101	Pass	5745.0064	Pass	5745.0063	Pass	5745.0098	Pass
40	120	5744.9724	Pass	5744.9742	Pass	5744.9730	Pass	5744.9751	Pass
30	120	5745.0193	Pass	5745.0201	Pass	5745.0176	Pass	5745.0154	Pass
20	120	5745.0163	Pass	5745.0126	Pass	5745.0146	Pass	5745.0159	Pass
10	120	5745.0250	Pass	5745.0240	Pass	5745.0245	Pass	5745.0226	Pass
0	120	5745.0057	Pass	5745.0059	Pass	5745.0061	Pass	5745.0085	Pass
-10	120	5745.0197	Pass	5745.0161	Pass	5745.0175	Pass	5745.0192	Pass
-20	120	5744.9779	Pass	5744.9763	Pass	5744.9757	Pass	5744.9789	Pass
-30	120	5744.9740	Pass	5744.9741	Pass	5744.9713	Pass	5744.9741	Pass

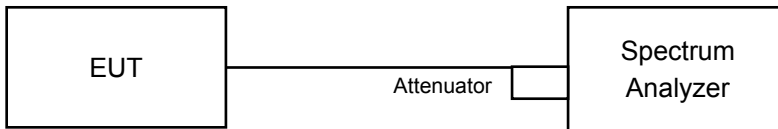
Frequency Stability Versus Voltage									
Operating Frequency: 5745MHz									
Temp. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Pass / Fail	Measured Frequency (MHz)	Pass / Fail	Measured Frequency (MHz)	Pass / Fail	Measured Frequency (MHz)	Pass / Fail
20	138	5745.0157	Pass	5745.0130	Pass	5745.0135	Pass	5745.0160	Pass
	120	5745.0163	Pass	5745.0126	Pass	5745.0146	Pass	5745.0159	Pass
	102	5745.0162	Pass	5745.0137	Pass	5745.0141	Pass	5745.0157	Pass

4.5 6dB Bandwidth Measurement

4.5.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

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

MEASUREMENT PROCEDURE REF

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- 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

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 Test Results

802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
149	5745	16.62	16.59	0.5	Pass
157	5785	16.57	16.54	0.5	Pass
165	5825	16.59	16.55	0.5	Pass

802.11ac (VHT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
149	5745	17.72	17.86	0.5	Pass
157	5785	17.76	17.81	0.5	Pass
165	5825	17.73	17.81	0.5	Pass

802.11ac (VHT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
151	5755	36.54	36.56	0.5	Pass
159	5795	36.57	36.54	0.5	Pass

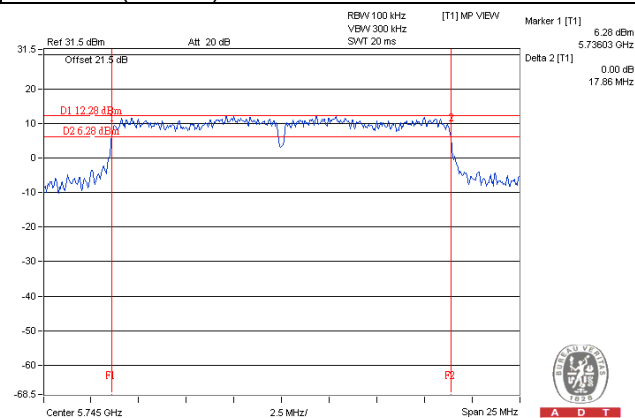
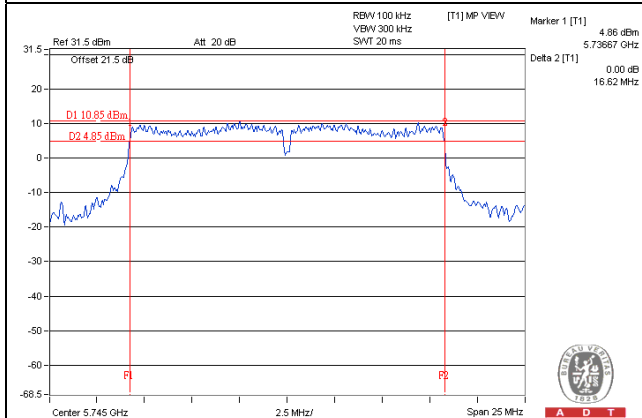
802.11ac (VHT80)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
155	5775	76.82	76.88	0.5	Pass

Spectrum Plot of Worst Value

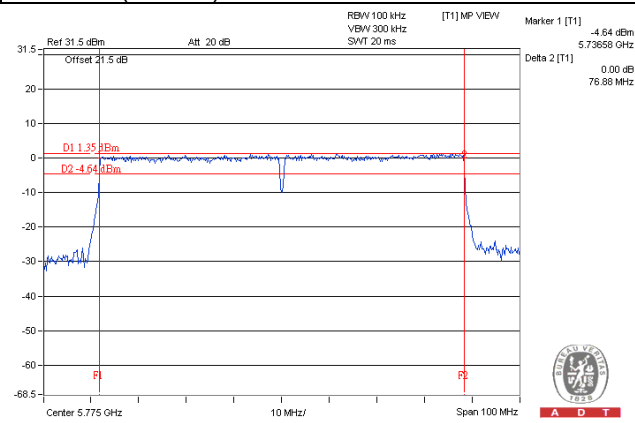
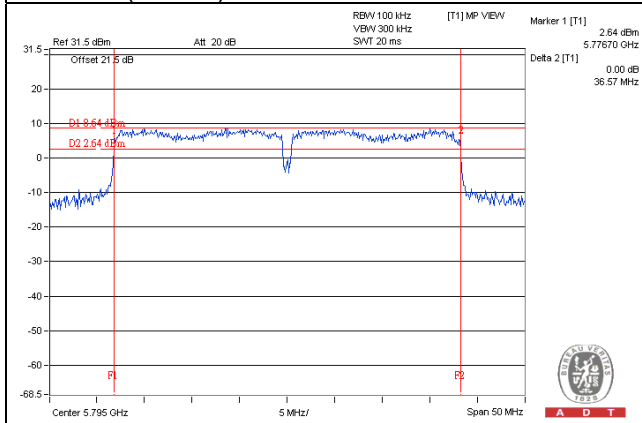
802.11a

802.11ac (VHT20)



802.11ac (VHT40)

802.11ac (VHT80)

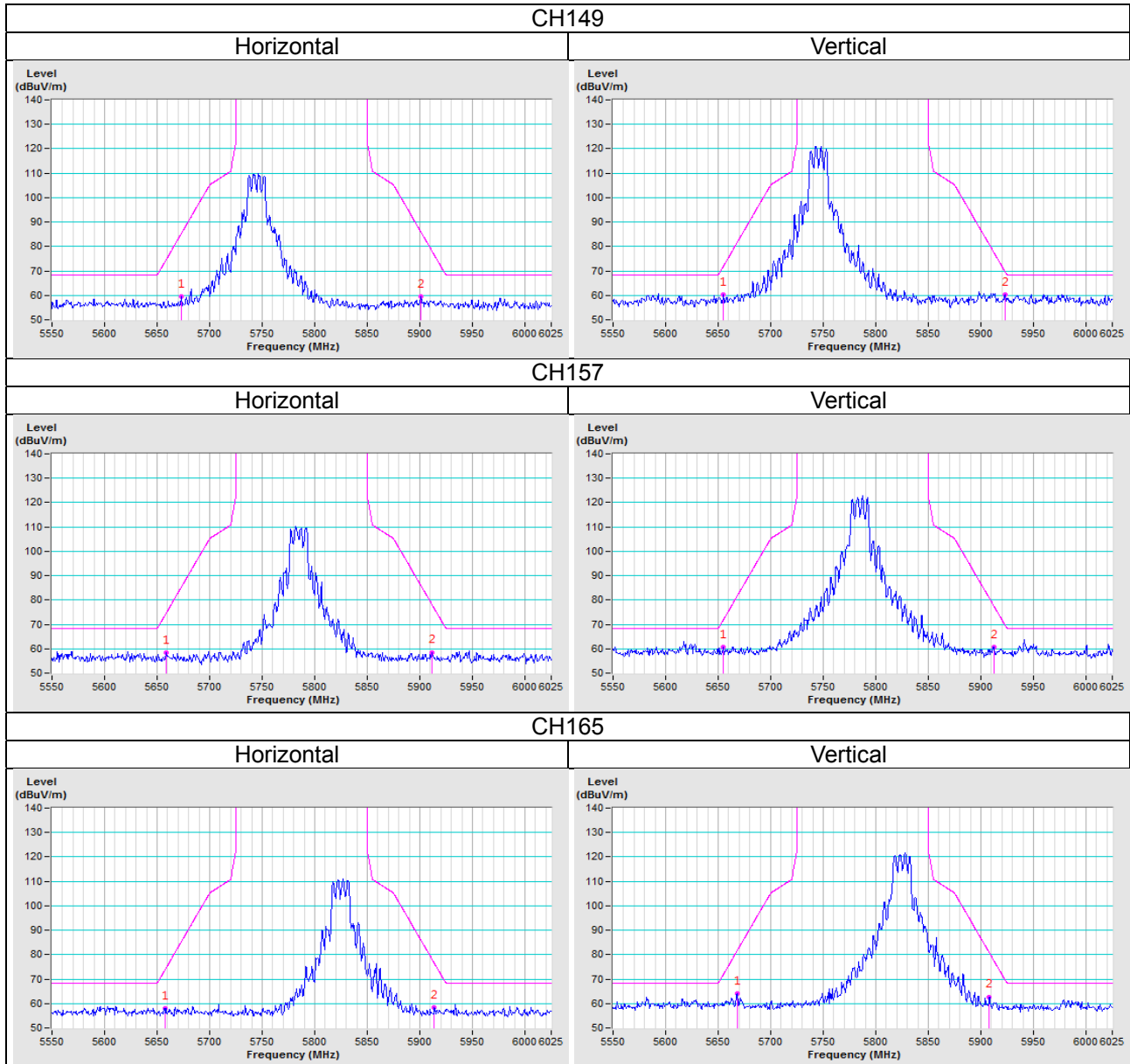


5 Pictures of Test Arrangements

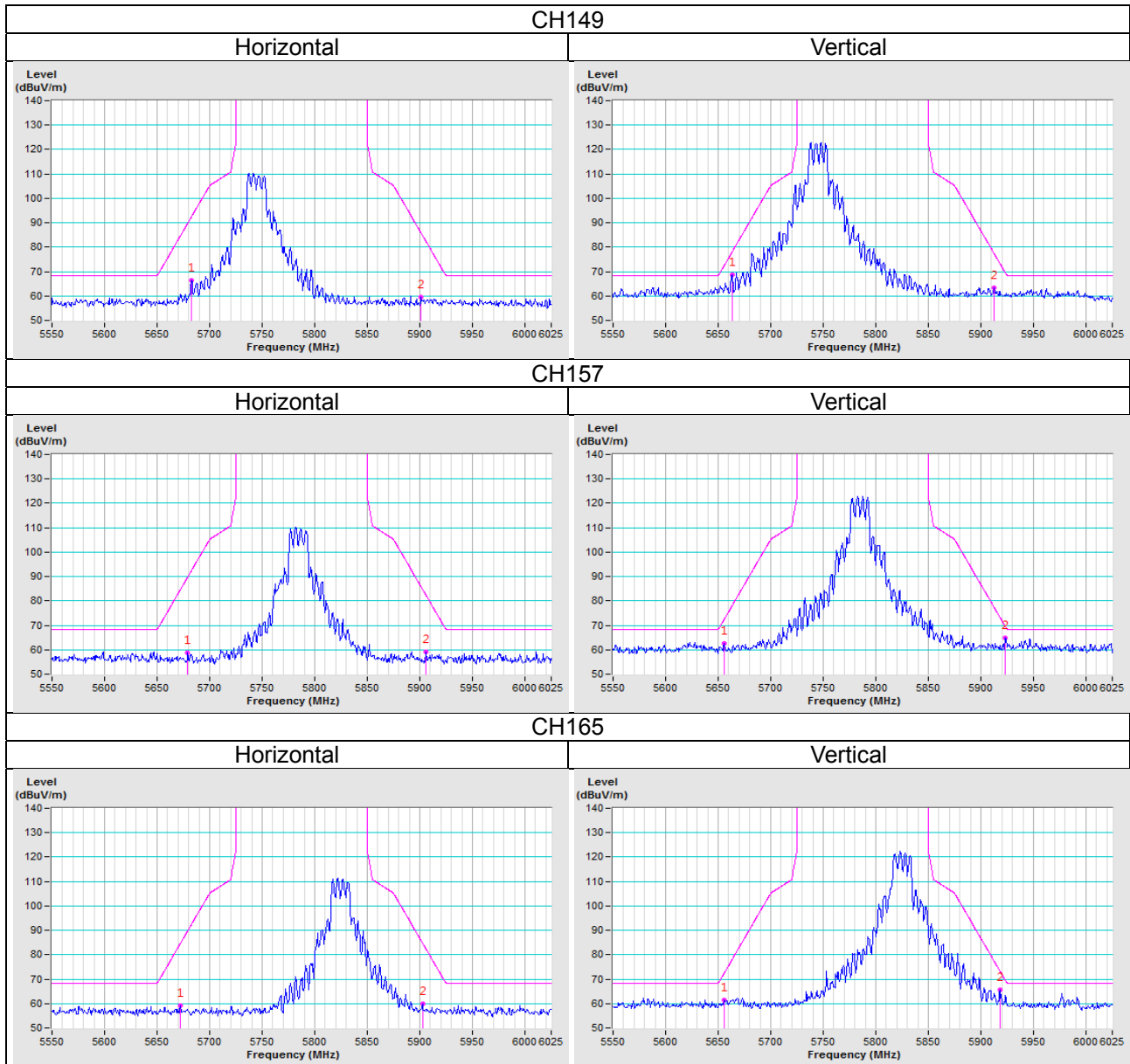
Please refer to the attached file (Test Setup Photo).

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

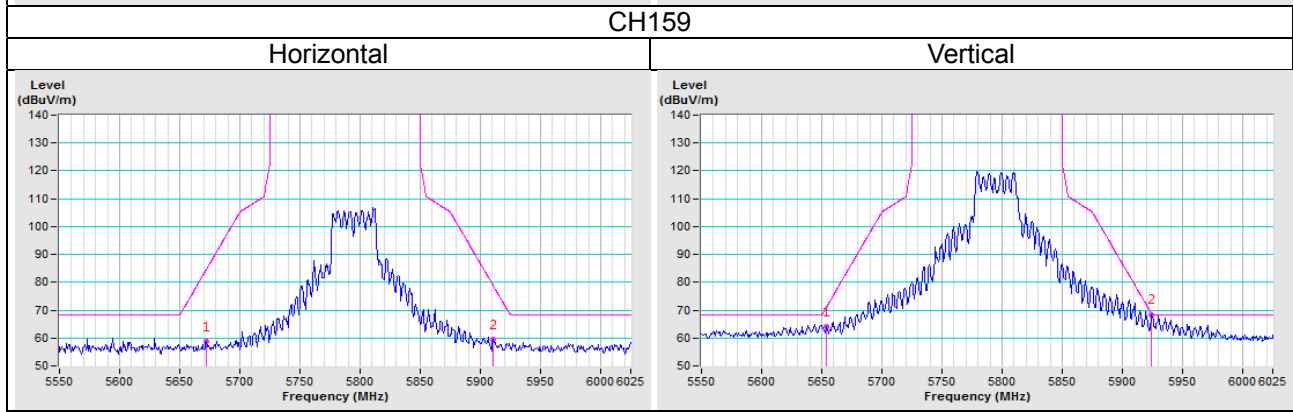
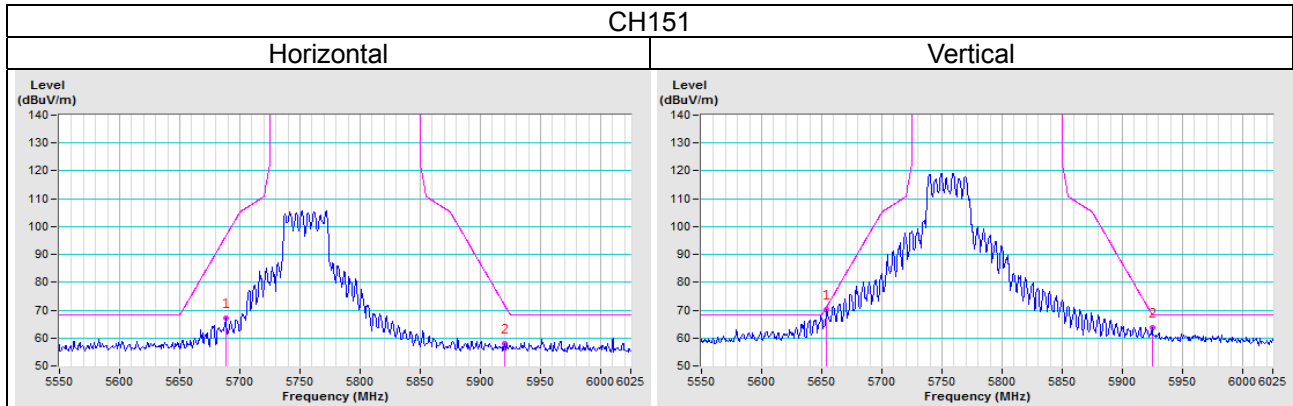
802.11a



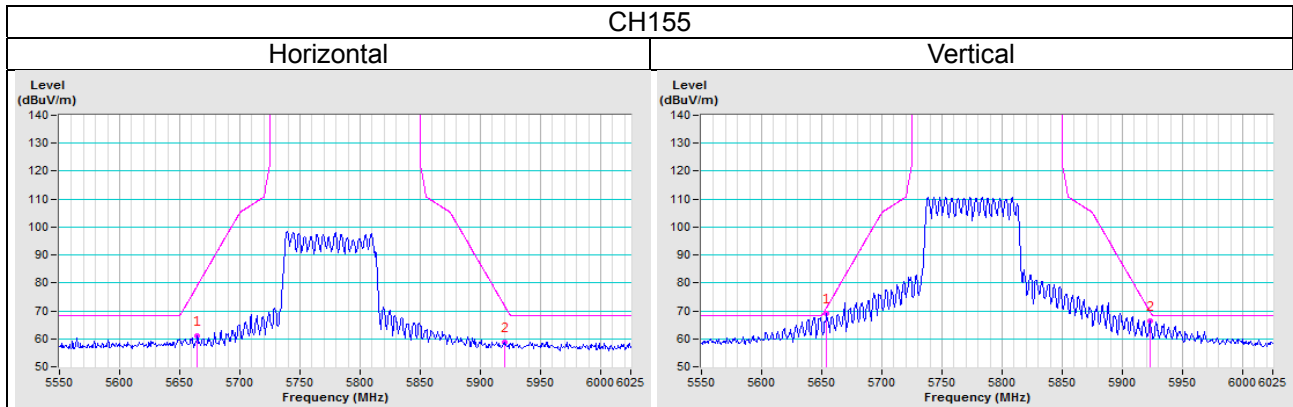
802.11ac (VHT20)



802.11ac (VHT40)



802.11ac (VHT80)



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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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

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Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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