

FCC Test Report

Report No.: RF150430E02C-1

FCC ID: PY315200309

Test Model: R8500

Received Date: Oct. 01, 2015

Test Date: Oct. 23, 2015

Issued Date: Dec. 07, 2015

Applicant: NETGEAR, Inc.

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

Issue No.	Description	Date Issued
RF150430E02C-1	Original release.	Dec. 07, 2015

1 Certificate of Conformity

Product: Nighthawk X8 Tri Band WiFi Router

Brand: NETGEAR

Test Model: R8500

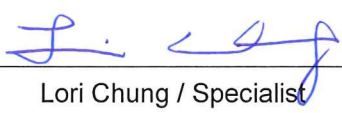
Sample Status: ENGINEERING SAMPLE

Applicant: NETGEAR, Inc.

Test Date: Oct. 23, 2015

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. This report contains Radiated Emissions & Band Edge Measurement (above 1GHz) test data that were produced under subcontract by Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories.

Prepared by : , **Date:** Dec. 07, 2015
Lori Chung / Specialist

Approved by : , **Date:** Dec. 07, 2015
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) (1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.2dB at 5860.10MHz
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 i-pex(MHF) not a standard connector.

Note: This report is prepared for FCC Class II change. (Upgrade the standard to section 15.407 under new rule for U-NII-3 band.)

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	Expended Uncertainty (k=2) ($\pm$)
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.43 dB
Radiated Emissions above 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~ 1000MHz	3.60 dB
	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Nighthawk X8 Tri Band WiFi Router
Brand	NETGEAR
Test Model	R8500
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	19Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11g/a: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1733.3Mbps
Operating Frequency	For 15.407 5.18 ~ 5.24GHz, 5.745 ~ 5.825GHz
	For 15.247 2.412 ~ 2.462GHz
Number of Channel	For 15.407 9 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 4 for 802.11n (HT40), 802.11ac (VHT40) 2 for 802.11ac (VHT80)
	For 15.247 11 for 802.11b, 802.11g, 802.11n (HT20), VHT20 7 for 802.11n (HT40), VHT40
Output Power	For 15.407 (U-NII-3 band) CDD Mode: 802.11a: 945.72mW 802.11ac (VHT20): 944.14mW 802.11ac (VHT40): 489.721mW 802.11ac (VHT80): 260.942mW Beamforming Mode: 802.11ac (VHT20): 378.925mW 802.11ac (VHT40): 395.406mW 802.11ac (VHT80): 209.383mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	Ethernet cable (shielded, 1.5m)

Note:

1. This report is prepared for FCC Class II change. The difference compared with the original report design is as the following:
 - ◆ Upgrade the standard to section 15.407 under new rule for U-NII-3 band.
2. 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.
3. The EUT's appearance has two different colors (black and Gray), and gray was selected as representative color for the test and its data was recorded in this report.
4. The EUT must be supplied with a power adapter as following table:

No	Brand Name	Model No.	P/N	Spec.
1	NETGEAR	AD2003F10	332-10631-01	Input: 100-120Vac, 50/60Hz, 1.5A Output: 19Vdc, 3.16A DC output cable: 1.8m, unshielded
2	NETGEAR	2ABS060K 1 NA	332-10788-01	Input: 100-120Vac, 50/60Hz, 1.0A Output: 19Vdc, 3.16A DC output cable: 1.8m, unshielded

From the above adapters, the worst radiated emission was found in Adapter 1. Therefore only the test data of the modes were recorded in this report.

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

Antenna No.	Ant. Gain(dBi)	Frequency range (GHz to GHz)	Antenna Type	Connector Type
Internal (1)	3.99	5.15~5.25	Dipole	i-pex(MHF)
	3.71	5.25~5.35	Dipole	i-pex(MHF)
	3.71	5.47~5.725	Dipole	i-pex(MHF)
	3.98	5.725~5.85	Dipole	i-pex(MHF)
Internal (2)	3.99	5.15~5.25	Dipole	i-pex(MHF)
	3.71	5.25~5.35	Dipole	i-pex(MHF)
	3.71	5.47~5.725	Dipole	i-pex(MHF)
	3.98	5.725~5.85	Dipole	i-pex(MHF)
Internal (3)	3.99	5.15~5.25	Dipole	i-pex(MHF)
	3.71	5.25~5.35	Dipole	i-pex(MHF)
	3.71	5.47~5.725	Dipole	i-pex(MHF)
	3.98	5.725~5.85	Dipole	i-pex(MHF)
Internal (4)	3.99	5.15~5.25	Dipole	i-pex(MHF)
	3.71	5.25~5.35	Dipole	i-pex(MHF)
	3.71	5.47~5.725	Dipole	i-pex(MHF)
	3.98	5.725~5.85	Dipole	i-pex(MHF)
External (1)	0.67	2.4~2.4835	Dipole	i-pex(MHF)
	-0.84	5.15~5.25	Dipole	i-pex(MHF)
	-1.38	5.25~5.35	Dipole	i-pex(MHF)
	-1.6	5.47~5.725	Dipole	i-pex(MHF)
	-1.79	5.725~5.85	Dipole	i-pex(MHF)
External (2)	0.67	2.4~2.4835	Dipole	i-pex(MHF)
	-0.84	5.15~5.25	Dipole	i-pex(MHF)
	-1.38	5.25~5.35	Dipole	i-pex(MHF)
	-1.6	5.47~5.725	Dipole	i-pex(MHF)
	-1.79	5.725~5.85	Dipole	i-pex(MHF)
External (3)	0.67	2.4~2.4835	Dipole	i-pex(MHF)
	-0.84	5.15~5.25	Dipole	i-pex(MHF)
	-1.38	5.25~5.35	Dipole	i-pex(MHF)
	-1.6	5.47~5.725	Dipole	i-pex(MHF)
	-1.79	5.725~5.85	Dipole	i-pex(MHF)
External (4)	0.67	2.4~2.4835	Dipole	i-pex(MHF)
	-0.84	5.15~5.25	Dipole	i-pex(MHF)
	-1.38	5.25~5.35	Dipole	i-pex(MHF)
	-1.6	5.47~5.725	Dipole	i-pex(MHF)
	-1.79	5.725~5.85	Dipole	i-pex(MHF)

6. The coexistence mode:

Technology		
WLAN(2.4GHz) - External Antenna	WLAN(5GHz <5150~5250MHz>) - External Antenna	WLAN(5GHz <5725~5850MHz>) - Internal Antenna
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

7. The EUT incorporates a MIMO function with beamforming.(Except for 802.11a/b/g)

For 2.4GHz Band

MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	4TX	4RX
802.11g	1 ~ 11Mbps	4TX	4RX
802.11n (HT20)	MCS 0~7	4TX	4RX
	MCS 8~15	4TX	4RX
	MCS 16~23	4TX	4RX
	MCS 24~31	4TX	4RX
802.11n (HT40)	MCS 0~7	4TX	4RX
	MCS 8~15	4TX	4RX
	MCS 16~23	4TX	4RX
	MCS 24~31	4TX	4RX
VHT20	MCS0~8 Nss=1	4TX	4RX
	MCS0~8 Nss=2	4TX	4RX
	MCS0~9 Nss=3	4TX	4RX
	MCS0~8 Nss=4	4TX	4RX
VHT40	MCS0~9 Nss=1	4TX	4RX
	MCS0~9 Nss=2	4TX	4RX
	MCS0~9 Nss=3	4TX	4RX
	MCS0~9 Nss=4	4TX	4RX

For 5GHz Band

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

Note: 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. 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≥1G	RE<1G	PLC	APCM	
-	√	√	-	√	-

Where **RE≥1G**: Radiated Emission above 1GHz

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

NOTE:

1. "-" 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.

CDD 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)	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)
802.11a	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.

CDD MODE						
For Transmit Power / Power Spectral Density / 6dB Bandwidth Measurement						
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
Beamforming MODE						
For Transmit Power Measurement						
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	26deg. C, 71%RH	120Vac, 60Hz	Alan Wu
RE<1G	25deg. C, 69%RH	120Vac, 60Hz	Gary Cheng
APCM	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

3.3 Duty Cycle of Test Signal

If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

If duty cycle of test signal is $< 98\%$, duty factor shall be considered.

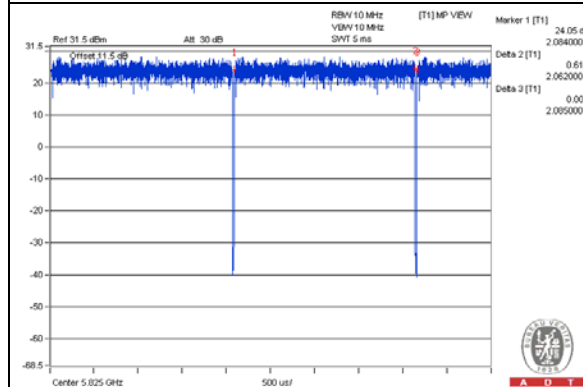
802.11a: Duty cycle = $2.062 \text{ ms} / 2.085 \text{ ms} = 0.989$

802.11ac (VHT20): Duty cycle = $1.916 \text{ ms} / 1.94 \text{ ms} = 0.988$

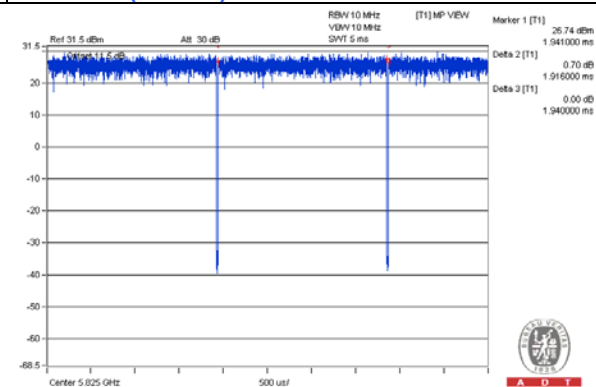
802.11ac (VHT40): Duty cycle = $0.944 \text{ ms} / 0.963 \text{ ms} = 0.98$

802.11ac (VHT80): Duty cycle = $0.458 \text{ ms} / 0.48 \text{ ms} = 0.954$, Duty factor = $10 * \log(1/0.954) = 0.20$

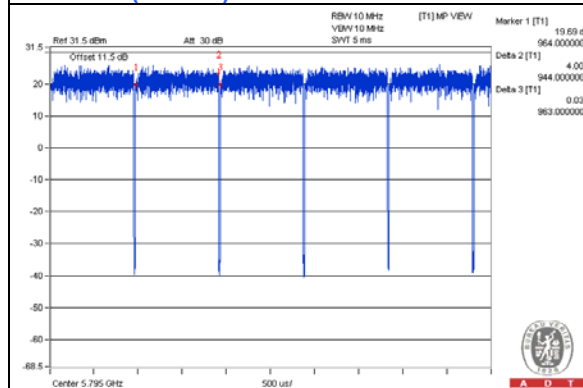
802.11a



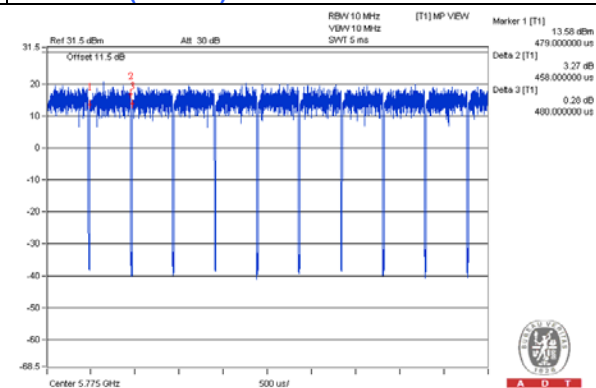
802.11ac (VHT20)



802.11ac (VHT40)



802.11ac (VHT80)



3.4 Description of Support Units

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

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	USB Flash Driver	Transcend	JetFlash 790	NA	NA	Provided by Lab
B	USB Flash Driver	Transcend	JetFlash 790	NA	NA	Provided by Lab
C	NOTEBOOK COMPUTER	DELL	PP32LA	HSLB32S	FCC DoC	Provided by Lab
D	NOTEBOOK COMPUTER	DELL	E5430	4YV4VY1	FCC DoC	Provided by Lab
E	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC	Provided by Lab
F	USB Flash Driver	Team	E902	NA	NA	Provided by Lab
G	External Flash Disk	WD	WDBACY5000A BL-01	WX51C12T6215	NA	Provided by Lab

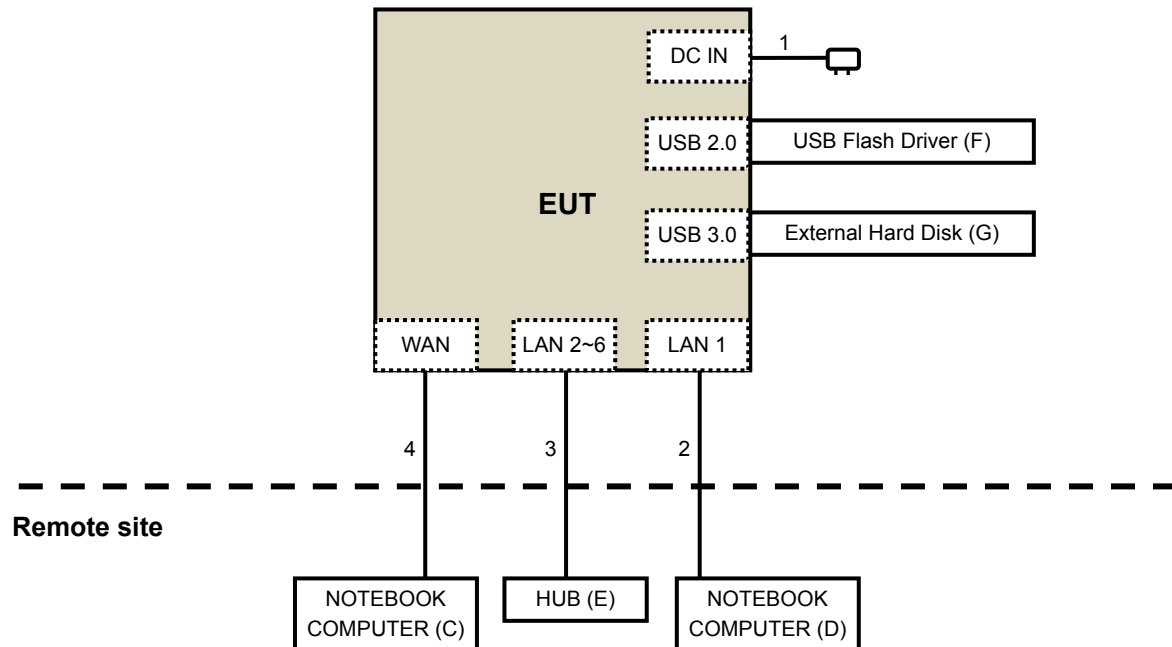
NOTE:

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

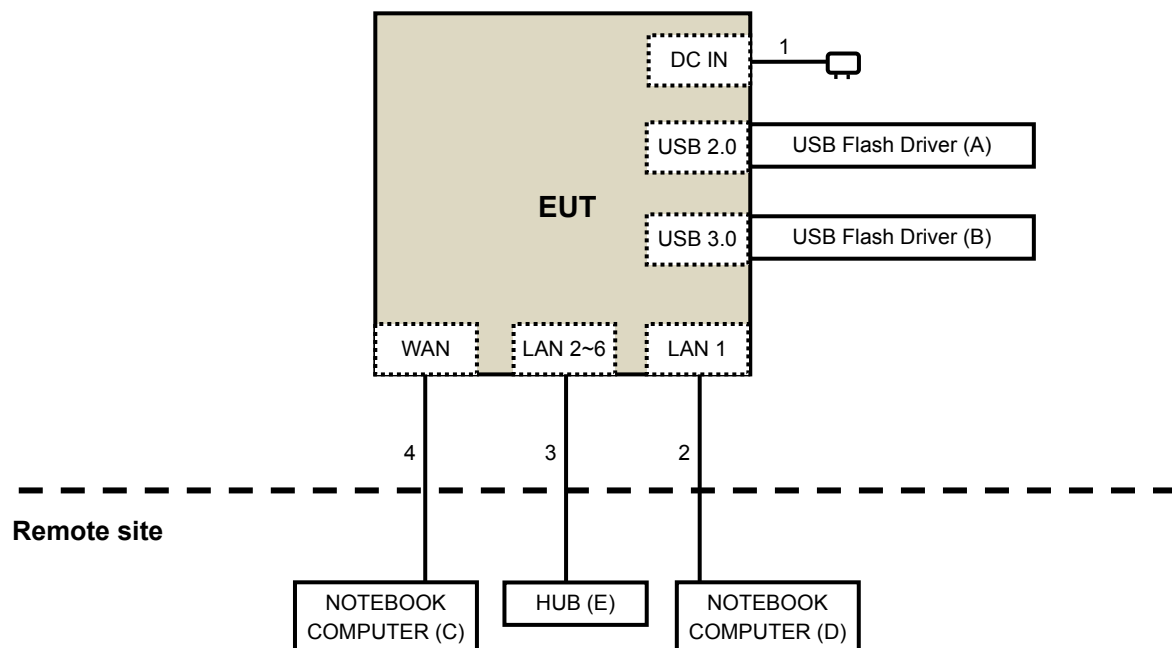
No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	DC	1	1.8	No	0	Supplied by Client
2	RJ45	1	10	No	0	Provided by Lab
3	RJ45	5	10	No	0	Provided by Lab
4	RJ45	1	10	No	0	Provided by Lab
5	USB	1	0.45	Yes	0	Provided by Lab

3.4.1 Configuration of System under Test

For other test items:



For Radiated emission above 1GHz 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)

789033 D02 General UNII Test Procedure New Rules v01

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:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 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 Procedure New Rules v01	FIELD STRENGTH AT 3m	
	PK:74 (dBuV/m)	AV:54 (dBuV/m)
APPLICABLE TO	EIRP LIMIT	EQUIVALENT FIELD STRENGTH AT 3m
15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBuV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)	PK:-27 (dBm/MHz) ^{*1} PK:-17 (dBm/MHz) ^{*2}	PK: 68.2(dBuV/m) ^{*1} PK:78.2 (dBuV/m) ^{*2}

NOTE: ^{*1} beyond 10MHz of the band edge ^{*2} within 10 MHz of band edge

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

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



A D T

4.1.2 Test Instruments

For above 1GHz

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 12, 2015	Oct. 11, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	July 08, 2015	July 07, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Feb. 06, 2015	Feb. 05, 2016
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8449B	3008A01960	Aug. 09, 2015	Aug. 08, 2016
Preamplifier Agilent	8447D	2944A10631	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-02(295012+309220)	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03(250724)	Aug. 09, 2015	Aug. 08, 2016
Software BV ADT	ADT_Radiated_V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100.	SC93021703	NA	NA
Power Meter Anritsu	ML2495A	1014008	Apr. 28, 2015	Apr. 27, 2016
Power Sensor Anritsu	MA2411B	0917122	Apr. 28, 2015	Apr. 27, 2016
Spectrum Analyzer R&S	FSP40	100060	May 08, 2015	May 07, 2016
Temperature & Humidity Chamber GIANTFORCE	GTH-150-40-SP-AR	MAA0812-008	Jan. 12, 2015	Jan. 11, 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 test was performed in HwaYa Chamber 4.
3. The FCC Site Registration No. is 460141.
4. The IC Site Registration No. is IC7450F-4.
5. Tested Date: Oct. 23, 2015

For below 1GHz

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 12, 2014	Dec. 11, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 09, 2015	Feb. 08, 2016
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 test was performed in 966 Chamber No. H.
3. The FCC Site Registration No. is 797305.
4. The CANADA Site Registration No. is IC 7450H-3.
5. Tested Date: Oct. 23, 2015

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:

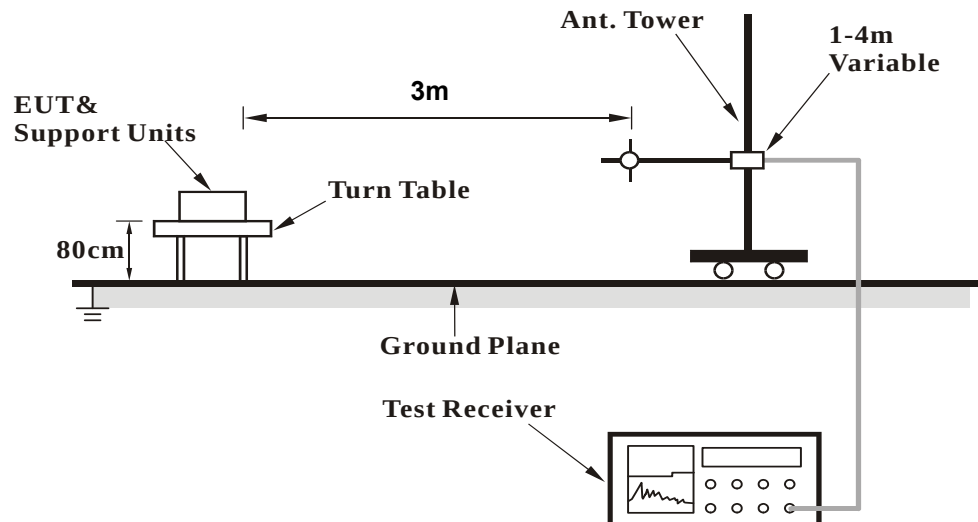
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

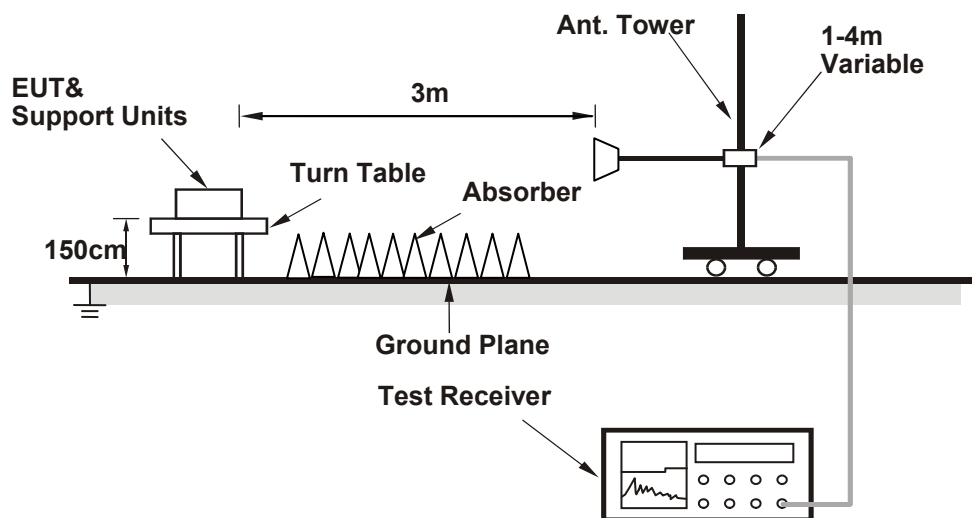
No deviation.

4.1.5 Test 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

1. Connect the EUT with the support units C-D (NOTEBOOK COMPUTER) which is placed on remote site.
2. Controlling software (Mtool.exe_2_0_2_7) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data (Subcontract Item)

CDD Mode

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	#5715.00	67.4 PK	74.0	-6.6	1.67 H	114	61.48	5.92
2	#5715.00	51.4 AV	54.0	-2.6	1.67 H	114	45.48	5.92
3	#5722.00	74.7 PK	78.2	-3.5	1.67 H	114	68.79	5.91
4	*5745.00	116.3 PK			1.67 H	114	110.41	5.89
5	*5745.00	106.2 AV			1.67 H	114	100.31	5.89
6	11490.00	60.4 PK	74.0	-13.6	1.21 H	206	48.01	12.39
7	11490.00	46.3 AV	54.0	-7.7	1.21 H	206	33.91	12.39
8	#17235.00	61.6 PK	74.0	-12.4	1.51 H	239	40.61	20.99
9	#17235.00	49.7 AV	54.0	-4.3	1.51 H	239	28.71	20.99
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	#5715.00	68.4 PK	74.0	-5.6	1.38 V	96	62.48	5.92
2	#5715.00	53.2 AV	54.0	-0.8	1.38 V	96	47.28	5.92
3	#5722.00	77.8 PK	78.2	-0.4	1.38 V	96	71.89	5.91
4	*5745.00	118.3 PK			1.38 V	96	112.41	5.89
5	*5745.00	108.5 AV			1.38 V	96	102.61	5.89
6	11490.00	62.4 PK	74.0	-11.6	1.11 V	255	50.01	12.39
7	11490.00	48.1 AV	54.0	-5.9	1.11 V	255	35.71	12.39
8	#17235.00	62.6 PK	74.0	-11.4	1.60 V	28	41.61	20.99
9	#17235.00	50.5 AV	54.0	-3.5	1.60 V	28	29.51	20.99

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	117.5 PK			1.54 H	117	111.65	5.85
2	*5785.00	108.1 AV			1.54 H	117	102.25	5.85
3	11570.00	59.7 PK	74.0	-14.3	1.19 H	200	47.38	12.32
4	11570.00	48.4 AV	54.0	-5.6	1.19 H	200	36.08	12.32
5	#17355.00	66.3 PK	74.0	-7.7	1.43 H	228	45.03	21.27
6	#17355.00	52.3 AV	54.0	-1.7	1.43 H	228	31.03	21.27
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	119.3 PK			1.81 V	81	113.45	5.85
2	*5785.00	110.5 AV			1.81 V	81	104.65	5.85
3	11570.00	62.4 PK	74.0	-11.6	1.09 V	39	50.08	12.32
4	11570.00	50.6 AV	54.0	-3.4	1.09 V	39	38.28	12.32
5	#17355.00	67.2 PK	74.0	-6.8	1.52 V	341	45.93	21.27
6	#17355.00	53.7 AV	54.0	-0.3	1.52 V	341	32.43	21.27

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	*5825.00	116.1 PK			1.56 H	144	110.32	5.78
2	*5825.00	106.2 AV			1.56 H	144	100.42	5.78
3	#5850.00	73.8 PK	78.2	-4.4	1.56 H	144	68.07	5.73
4	#5861.00	58.1 PK	74.0	-15.9	1.56 H	144	52.40	5.70
5	#5861.00	47.6 AV	54.0	-6.4	1.56 H	144	41.90	5.70
6	11650.00	60.3 PK	74.0	-13.7	1.17 H	201	47.94	12.36
7	11650.00	48.4 AV	54.0	-5.6	1.17 H	201	36.04	12.36
8	#17475.00	65.9 PK	74.0	-8.1	1.36 H	235	44.73	21.17
9	#17475.00	52.1 AV	54.0	-1.9	1.36 H	235	30.93	21.17
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	117.7 PK			1.57 V	94	111.92	5.78
2	*5825.00	108.4 AV			1.57 V	94	102.62	5.78
3	#5850.00	77.5 PK	78.2	-0.7	1.57 V	94	71.77	5.73
4	#5861.00	71.2 PK	74.0	-2.8	1.57 V	94	65.50	5.70
5	#5861.00	53.5 AV	54.0	-0.5	1.57 V	94	47.80	5.70
6	11650.00	61.4 PK	74.0	-12.6	1.15 V	234	49.04	12.36
7	11650.00	48.8 AV	54.0	-5.2	1.15 V	234	36.44	12.36
8	#17475.00	66.2 PK	74.0	-7.8	1.62 V	1	45.03	21.17
9	#17475.00	52.9 AV	54.0	-1.1	1.62 V	1	31.73	21.17

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)
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	#5715.00	66.8 PK	74.0	-7.2	1.54 H	125	60.88	5.92
2	#5715.00	52.0 AV	54.0	-2.0	1.54 H	125	46.08	5.92
3	#5722.00	75.1 PK	78.2	-3.1	1.54 H	125	69.19	5.91
4	*5745.00	114.1 PK			1.54 H	125	108.21	5.89
5	*5745.00	104.0 AV			1.54 H	125	98.11	5.89
6	11490.00	59.7 PK	74.0	-14.3	1.24 H	181	47.31	12.39
7	11490.00	46.0 AV	54.0	-8.0	1.24 H	181	33.61	12.39
8	#17235.00	61.3 PK	74.0	-12.7	1.46 H	224	40.31	20.99
9	#17235.00	49.8 AV	54.0	-4.2	1.46 H	224	28.81	20.99
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	#5715.00	68.0 PK	74.0	-6.0	1.66 V	97	62.08	5.92
2	#5715.00	53.4 AV	54.0	-0.6	1.66 V	97	47.48	5.92
3	#5722.00	77.9 PK	78.2	-0.3	1.66 V	97	71.99	5.91
4	*5745.00	116.3 PK			1.66 V	97	110.41	5.89
5	*5745.00	106.4 AV			1.66 V	97	100.51	5.89
6	11490.00	61.4 PK	74.0	-12.6	1.81 V	0	49.01	12.39
7	11490.00	49.2 AV	54.0	-4.8	1.81 V	0	36.81	12.39
8	#17235.00	64.1 PK	74.0	-9.9	1.42 V	310	43.11	20.99
9	#17235.00	50.6 AV	54.0	-3.4	1.42 V	310	29.61	20.99

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- " # ": 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	118.2 PK			1.65 H	130	112.35	5.85
2	*5785.00	108.0 AV			1.65 H	130	102.15	5.85
3	11570.00	60.8 PK	74.0	-13.2	1.14 H	221	48.48	12.32
4	11570.00	48.8 AV	54.0	-5.2	1.14 H	221	36.48	12.32
5	#17355.00	66.0 PK	74.0	-8.0	1.36 H	259	44.73	21.27
6	#17355.00	52.3 AV	54.0	-1.7	1.36 H	259	31.03	21.27
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	119.6 PK			1.39 V	96	113.75	5.85
2	*5785.00	110.1 AV			1.39 V	96	104.25	5.85
3	11570.00	63.0 PK	74.0	-11.0	1.26 V	32	50.68	12.32
4	11570.00	50.8 AV	54.0	-3.2	1.26 V	32	38.48	12.32
5	#17355.00	65.1 PK	74.0	-8.9	1.53 V	24	43.83	21.27
6	#17355.00	52.8 AV	54.0	-1.2	1.53 V	24	31.53	21.27

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	*5825.00	116.8 PK			1.56 H	123	111.02	5.78
2	*5825.00	106.7 AV			1.56 H	123	100.92	5.78
3	#5850.00	73.3 PK	78.2	-4.9	1.56 H	123	67.57	5.73
4	#5861.00	63.9 PK	74.0	-10.1	1.56 H	123	58.20	5.70
5	#5861.00	49.8 AV	54.0	-4.2	1.56 H	123	44.10	5.70
6	11650.00	60.2 PK	74.0	-13.8	1.21 H	214	47.84	12.36
7	11650.00	48.3 AV	54.0	-5.7	1.21 H	214	35.94	12.36
8	#17475.00	65.9 PK	74.0	-8.1	1.39 H	230	44.73	21.17
9	#17475.00	51.0 AV	54.0	-3.0	1.39 H	230	29.83	21.17

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	118.4 PK			1.64 V	99	112.62	5.78
2	*5825.00	108.8 AV			1.64 V	99	103.02	5.78
3	#5850.00	77.6 PK	78.2	-0.6	1.64 V	99	71.87	5.73
4	#5861.00	71.4 PK	74.0	-2.6	1.64 V	99	65.70	5.70
5	#5861.00	53.6 AV	54.0	-0.4	1.64 V	99	47.90	5.70
6	11650.00	61.0 PK	74.0	-13.0	1.21 V	31	48.64	12.36
7	11650.00	49.2 AV	54.0	-4.8	1.21 V	31	36.84	12.36
8	#17475.00	64.0 PK	74.0	-10.0	1.61 V	358	42.83	21.17
9	#17475.00	51.3 AV	54.0	-2.7	1.61 V	358	30.13	21.17

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)
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	#5714.90	65.4 PK	74.0	-8.6	1.62 H	125	59.48	5.92
2	#5714.90	51.2 AV	54.0	-2.8	1.62 H	125	45.28	5.92
3	#5725.00	73.7 PK	78.2	-4.5	1.62 H	125	67.79	5.91
4	*5755.00	108.3 PK			1.62 H	125	102.42	5.88
5	*5755.00	98.0 AV			1.62 H	125	92.12	5.88
6	11510.00	57.6 PK	74.0	-16.4	1.19 H	177	45.24	12.36
7	11510.00	44.6 AV	54.0	-9.4	1.19 H	177	32.24	12.36
8	#17265.00	60.5 PK	74.0	-13.5	1.46 H	229	39.71	20.79
9	#17265.00	48.3 AV	54.0	-5.7	1.46 H	229	27.51	20.79
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	#5714.90	72.8 PK	74.0	-1.2	1.45 V	95	66.88	5.92
2	#5714.90	53.6 AV	54.0	-0.4	1.45 V	95	47.68	5.92
3	#5725.00	77.4 PK	78.2	-0.8	1.45 V	95	71.49	5.91
4	*5755.00	111.0 PK			1.45 V	95	105.12	5.88
5	*5755.00	100.9 AV			1.45 V	95	95.02	5.88
6	11510.00	58.8 PK	74.0	-15.2	1.20 V	90	46.44	12.36
7	11510.00	45.5 AV	54.0	-8.5	1.20 V	90	33.14	12.36
8	#17265.00	61.1 PK	74.0	-12.9	1.65 V	16	40.31	20.79
9	#17265.00	49.2 AV	54.0	-4.8	1.65 V	16	28.41	20.79

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- " # ": 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	*5795.00	110.7 PK			1.65 H	114	104.86	5.84
2	*5795.00	100.6 AV			1.65 H	114	94.76	5.84
3	#5850.00	72.5 PK	78.2	-5.7	1.65 H	114	66.77	5.73
4	#5860.10	64.8 PK	74.0	-9.2	1.65 H	114	59.10	5.70
5	#5860.10	50.9 AV	54.0	-3.1	1.65 H	114	45.20	5.70
6	11590.00	58.5 PK	74.0	-15.5	1.12 H	175	46.18	12.32
7	11590.00	45.9 AV	54.0	-8.1	1.12 H	175	33.58	12.32
8	#17385.00	60.9 PK	74.0	-13.1	1.43 H	226	39.27	21.63
9	#17385.00	49.2 AV	54.0	-4.8	1.43 H	226	27.57	21.63

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	112.9 PK			1.26 V	96	107.06	5.84
2	*5795.00	102.7 AV			1.26 V	96	96.86	5.84
3	#5850.00	76.9 PK	78.2	-1.3	1.26 V	96	71.17	5.73
4	#5860.10	69.0 PK	74.0	-5.0	1.26 V	96	63.30	5.70
5	#5860.10	53.6 AV	54.0	-0.4	1.26 V	96	47.90	5.70
6	11590.00	61.1 PK	74.0	-12.9	1.08 V	238	48.78	12.32
7	11590.00	47.9 AV	54.0	-6.1	1.08 V	238	35.58	12.32
8	#17385.00	64.5 PK	74.0	-9.5	1.67 V	15	42.87	21.63
9	#17385.00	51.4 AV	54.0	-2.6	1.67 V	15	29.77	21.63

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	#5715.00	61.2 PK	74.0	-12.8	1.62 H	115	55.28	5.92
2	#5715.00	49.1 AV	54.0	-4.9	1.62 H	115	43.18	5.92
3	#5725.00	71.4 PK	78.2	-6.8	1.62 H	115	65.49	5.91
4	*5775.00	104.5 PK			1.62 H	115	98.64	5.86
5	*5775.00	95.6 AV			1.62 H	115	89.74	5.86
6	#5850.00	73.4 PK	78.2	-4.8	1.62 H	115	67.67	5.73
7	#5860.10	62.9 PK	74.0	-11.1	1.62 H	115	57.20	5.70
8	#5860.10	51.3 AV	54.0	-2.7	1.62 H	115	45.60	5.70
9	11550.00	57.9 PK	74.0	-16.1	1.06 H	173	45.56	12.34
10	11550.00	44.9 AV	54.0	-9.1	1.06 H	173	32.56	12.34
11	#17325.00	59.8 PK	74.0	-14.2	1.49 H	245	38.91	20.89
12	#17325.00	48.0 AV	54.0	-6.0	1.49 H	245	27.11	20.89
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	#5715.00	65.9 PK	74.0	-8.1	1.24 V	97	59.98	5.92
2	#5715.00	51.6 AV	54.0	-2.4	1.24 V	97	45.68	5.92
3	#5725.00	75.6 PK	78.2	-2.6	1.24 V	97	69.69	5.91
4	*5775.00	106.1 PK			1.24 V	97	100.24	5.86
5	*5775.00	97.0 AV			1.24 V	97	91.14	5.86
6	#5850.00	77.4 PK	78.2	-0.8	1.24 V	97	71.67	5.73
7	#5860.10	67.7 PK	74.0	-6.3	1.24 V	97	62.00	5.70
8	#5860.10	53.8 AV	54.0	-0.2	1.24 V	97	48.10	5.70
9	11550.00	58.8 PK	74.0	-15.2	1.22 V	227	46.46	12.34
10	11550.00	46.8 AV	54.0	-7.2	1.22 V	227	34.46	12.34
11	#17325.00	61.4 PK	74.0	-12.6	1.70 V	29	40.51	20.89
12	#17325.00	49.8 AV	54.0	-4.2	1.70 V	29	28.91	20.89

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

CDD Mode

802.11a

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	214.13	37.6 QP	43.5	-5.9	1.50 H	289	53.62	-16.05
2	325.35	42.5 QP	46.0	-3.5	1.00 H	138	53.47	-10.93
3	354.98	40.9 QP	46.0	-5.2	1.50 H	16	51.47	-10.62
4	371.12	40.2 QP	46.0	-5.8	1.50 H	306	50.51	-10.28
5	388.96	40.8 QP	46.0	-5.2	1.00 H	352	50.66	-9.87
6	625.02	41.5 QP	46.0	-4.5	1.50 H	263	45.82	-4.31
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	34.56	36.4 QP	40.0	-3.7	1.00 V	314	50.70	-14.35
2	62.67	36.4 QP	40.0	-3.6	1.00 V	259	50.78	-14.39
3	125.02	39.9 QP	43.5	-3.6	1.25 V	336	54.48	-14.62
4	335.61	42.5 QP	46.0	-3.5	1.50 V	149	53.29	-10.77
5	397.03	42.6 QP	46.0	-3.5	1.00 V	32	52.26	-9.71
6	500.05	42.5 QP	46.0	-3.5	1.50 V	308	49.68	-7.16

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

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,

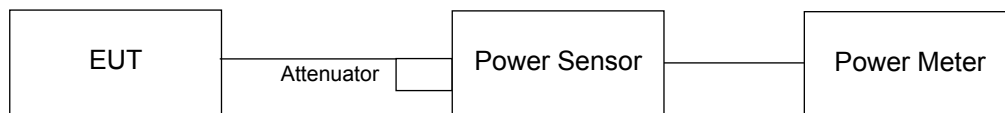
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

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

CDD Mode

POWER OUTPUT:

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
802.11a									
149	5745	21.66	20.81	21.86	21.95	577.196	27.61	30	Pass
157	5785	23.75	23.19	24.05	23.91	945.72	29.76	30	Pass
165	5825	20.98	20.50	21.96	21.19	526.074	27.21	30	Pass
802.11ac (VHT20)									
149	5745	19.51	18.67	19.69	19.77	350.905	25.45	30	Pass
157	5785	23.70	22.99	24.16	23.98	944.14	29.75	30	Pass
165	5825	20.95	20.09	21.98	21.30	519.202	27.15	30	Pass
802.11ac (VHT40)									
151	5755	19.10	18.13	19.13	19.37	314.639	24.98	30	Pass
159	5795	20.84	20.12	21.35	21.11	489.721	26.90	30	Pass
802.11ac (VHT80)									
155	5775	18.27	17.56	18.36	18.34	260.942	24.17	30	Pass

Beamforming Mode

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
802.11ac (VHT20)									
149	5745	19.51	18.67	19.69	19.77	350.905	25.45	26	Pass
157	5785	19.88	19.02	20.05	20.03	378.925	25.79	26	Pass
165	5825	19.59	18.72	20.46	19.88	373.912	25.73	26	Pass
802.11ac (VHT40)									
151	5755	18.08	17.11	17.90	18.46	247.479	23.94	26	Pass
159	5795	19.90	19.32	20.49	20.01	395.406	25.97	26	Pass
802.11ac (VHT80)									
155	5775	17.31	16.50	17.61	17.26	209.383	23.21	26	Pass

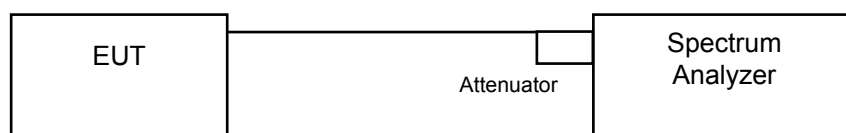
Note: 1. Directional gain = 3.98dBi + 10log(4) = 10dBi > 6dBi , so the power limit shall be reduced to 30-(10-6) = 26dBm.

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 Procedure

For AVG. power (duty cycle ≥ 98%)

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 $BWCF = 10\log(500\text{kHz}/300\text{kHz})$
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 AVG. power (duty cycle < 98%)

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 $BWCF = 10\log(500\text{kHz}/300\text{kHz})$
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 $10\log(1/\text{duty cycle})$

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Condition

Same as Item 4.2.6.

4.3.7 Test Results

CDD Mode

TX chain	Channel	Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	10 log (N=4) dB	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
802.11a								
0	149	5745	0.10	2.32	6.02	8.34	26	Pass
	157	5785	1.52	3.74	6.02	9.76	26	Pass
	165	5825	-1.12	1.10	6.02	7.12	26	Pass
1	149	5745	-0.79	1.43	6.02	7.45	26	Pass
	157	5785	1.02	3.24	6.02	9.26	26	Pass
	165	5825	-1.44	0.78	6.02	6.80	26	Pass
2	149	5745	-1.38	0.84	6.02	6.86	26	Pass
	157	5785	0.27	2.49	6.02	8.51	26	Pass
	165	5825	-2.44	-0.22	6.02	5.80	26	Pass
3	149	5745	-1.39	0.83	6.02	6.85	26	Pass
	157	5785	0.08	2.30	6.02	8.32	26	Pass
	165	5825	-2.21	0.01	6.02	6.03	26	Pass
802.11ac (VHT20)								
0	149	5745	-2.22	0.00	6.02	6.02	26	Pass
	157	5785	1.16	3.38	6.02	9.40	26	Pass
	165	5825	-1.12	1.10	6.02	7.12	26	Pass
1	149	5745	-2.53	-0.31	6.02	5.71	26	Pass
	157	5785	0.78	3.00	6.02	9.02	26	Pass
	165	5825	-1.53	0.69	6.02	6.71	26	Pass
2	149	5745	-3.34	-1.12	6.02	4.90	26	Pass
	157	5785	-0.22	2.00	6.02	8.02	26	Pass
	165	5825	-2.91	-0.69	6.02	5.33	26	Pass
3	149	5745	-3.22	-1.00	6.02	5.02	26	Pass
	157	5785	-0.02	2.20	6.02	8.22	26	Pass
	165	5825	-2.49	-0.27	6.02	5.75	26	Pass

Note: 1. Directional gain = $3.98\text{dBi} + 10\log(4) = 10\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30-(10-6) = 26\text{dBm}$.

TX chain	Channel	Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	10 log (N=4) dB	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
802.11ac (VHT40)								
0	151	5755	-5.62	-3.40	6.02	2.62	26	Pass
	159	5795	-4.50	-2.28	6.02	3.74	26	Pass
1	151	5755	-6.27	-4.05	6.02	1.97	26	Pass
	159	5795	-5.65	-3.43	6.02	2.59	26	Pass
2	151	5755	-6.95	-4.73	6.02	1.29	26	Pass
	159	5795	-6.25	-4.03	6.02	1.99	26	Pass
3	151	5755	-6.03	-3.81	6.02	2.21	26	Pass
	159	5795	-5.42	-3.20	6.02	2.82	26	Pass

Note: 1. Directional gain = $3.98\text{dBi} + 10\log(4) = 10\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30-(10-6) = 26\text{dBm}$.

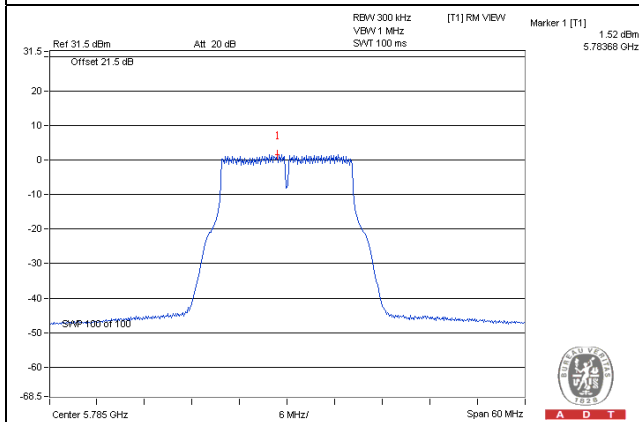
TX chain	Chan.	Chan. Freq. (MHz)	PSD W/O Duty Factor		10 log (N=4) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
			(dBm/300kHz)	(dBm/500kHz)					
802.11ac (VHT80)									
0	155	5775	-10.24	-8.02	6.02	0.20	-1.80	26	Pass
1	155	5775	-11.23	-9.01	6.02	0.20	-2.79	26	Pass
2	155	5775	-11.77	-9.55	6.02	0.20	-3.33	26	Pass
3	155	5775	-10.75	-8.53	6.02	0.20	-2.31	26	Pass

Note: 1. Directional gain = Directional gain = $3.98\text{dBi} + 10\log(4) = 10\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30-(10-6) = 26\text{dBm}$.

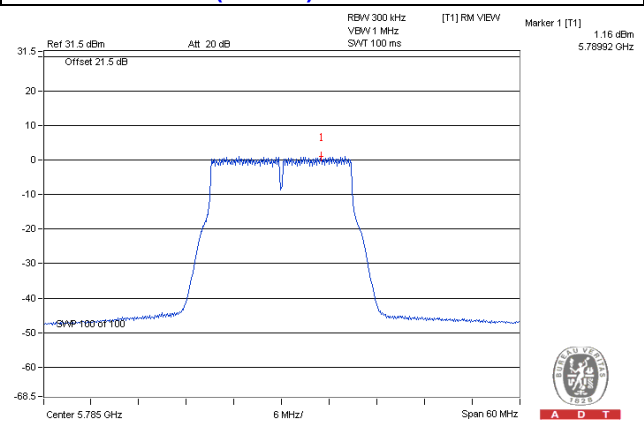
2. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

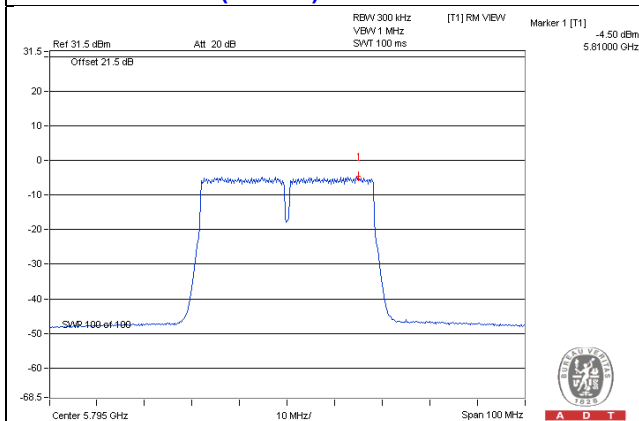
802.11a – Chain 0: CH 157



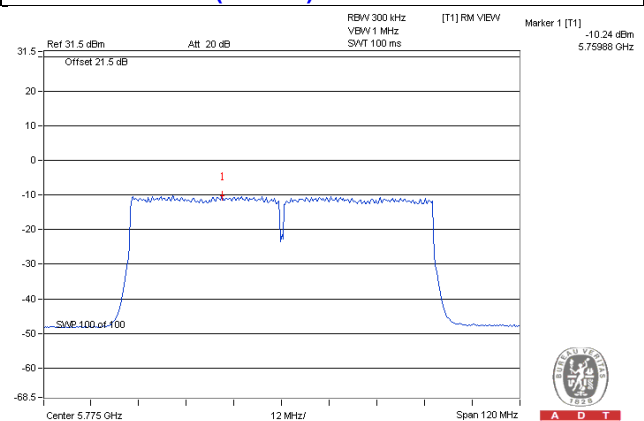
802.11ac (VHT20) – Chain 0: CH 157



802.11ac (VHT40) – Chain 0: CH 159



802.11ac (VHT80) – Chain 0: CH 155

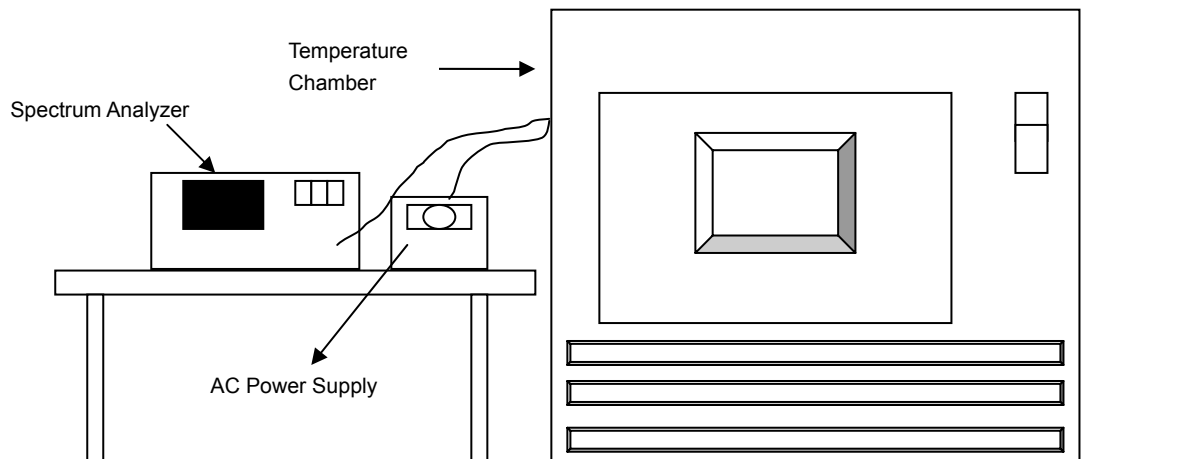


4.4 Frequency Stability Measurement

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)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
50	120	5744.9773	-0.00040	5744.9789	-0.00037	5744.9748	-0.00044	5744.9786	-0.00037
40	120	5744.9981	-0.00003	5744.998	-0.00003	5744.9942	-0.00010	5744.9959	-0.00007
30	120	5744.9746	-0.00044	5744.9773	-0.00040	5744.9732	-0.00047	5744.9758	-0.00042
20	120	5745.0285	0.00050	5745.029	0.00050	5745.0259	0.00045	5745.027	0.00047
10	120	5744.9823	-0.00031	5744.9812	-0.00033	5744.9823	-0.00031	5744.9799	-0.00035
0	120	5745.007	0.00012	5745.0055	0.00010	5745.0071	0.00012	5745.0059	0.00010
-10	120	5745.0055	0.00010	5745.0011	0.00002	5745.0025	0.00004	5745.0018	0.00003
-20	120	5744.9917	-0.00014	5744.9929	-0.00012	5744.9893	-0.00019	5744.9928	-0.00013
-30	120	5745.004	0.00007	5744.9998	0.00000	5745.004	0.00007	5744.999	-0.00002

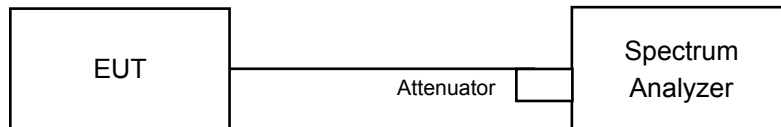
FREQUENCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5745MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
20	138	5745.0295	0.00051	5745.0281	0.00049	5745.0248	0.00043	5745.0279	0.00049
	120	5745.0285	0.00050	5745.029	0.00050	5745.0259	0.00045	5745.027	0.00047
	102	5745.0292	0.00051	5745.0283	0.00049	5745.0269	0.00047	5745.0276	0.00048

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

CDD Mode

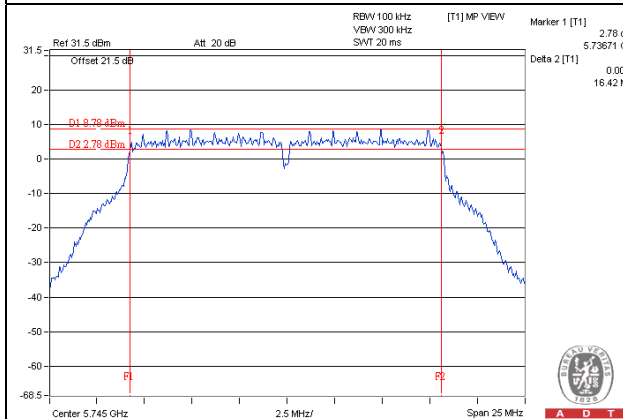
Channel	Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
802.11a							
149	5745	16.42	16.42	16.43	16.44	0.5	Pass
157	5785	16.43	16.44	16.45	16.46	0.5	Pass
165	5825	16.46	16.43	16.44	16.45	0.5	Pass
802.11ac (VHT20)							
149	5745	17.68	17.70	17.69	17.69	0.5	Pass
157	5785	17.69	17.69	17.67	17.73	0.5	Pass
165	5825	17.71	17.68	17.70	17.72	0.5	Pass
802.11ac (VHT40)							
151	5755	36.46	36.56	36.46	36.49	0.5	Pass
159	5795	36.45	36.53	36.49	36.52	0.5	Pass
802.11ac (VHT80)							
155	5775	76.52	76.61	76.56	76.55	0.5	Pass



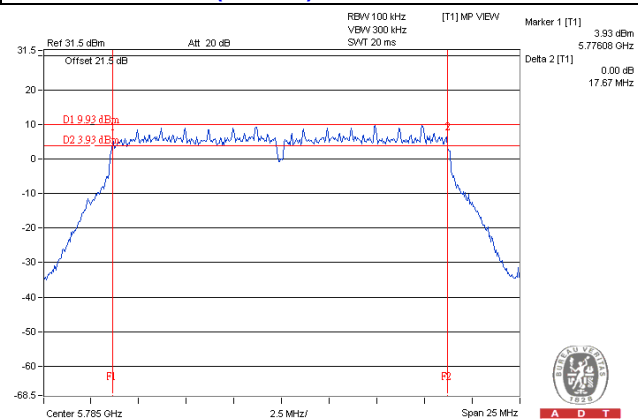
A D T

Spectrum Plot of Worst Value

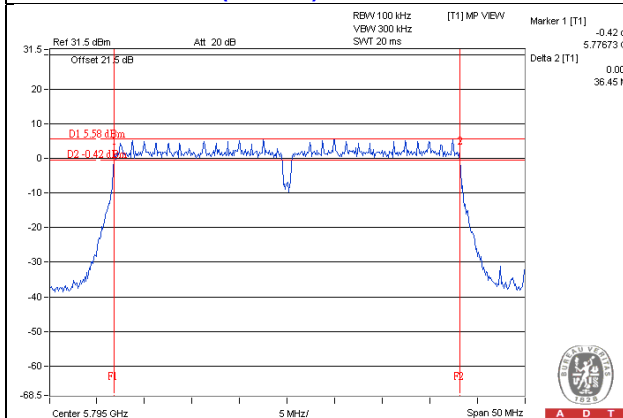
802.11a – Chain 1: CH 149



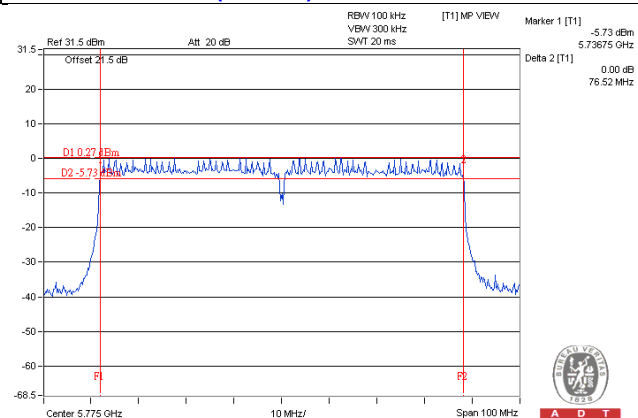
802.11ac (VHT20) – Chain 2: CH 157



802.11ac (VHT40) – Chain 0: CH 159



802.11ac (VHT80) – Chain 0: CH 155



5 Pictures of Test Arrangements

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

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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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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