FCC Test Report

Report No.:	RF191209C26-1 R1
FCC ID:	2AKCZ-0F8
Test Model:	APL62-0F8
Received Date:	Dec. 09, 2019
Test Date:	Jan. 07 ~ Apr. 20, 2020 Dec. 27, 2021
Issued Date:	Feb. 16, 2023
Applicant:	SonicWall Inc.
Address:	1033 McCarthy Blvd., Milpitas, CA 95035, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RF191209C26-1	Original release.	Apr. 22, 2020
RF191209C26-1 R1	Update Beamforming mode power	Feb. 16, 2023

1 Certificate of Conformity

Product:	Wireless Network Security Appliance
Brand:	SONICWALL
Test Model:	APL62-0F8
Sample Status:	Engineering sample
Applicant:	SonicWall Inc.
Test Date:	Jan. 07 ~ Apr. 20, 2020 Dec. 27, 2021
Standards:	47 CFR FCC Part 15, Subpart E (Section 15.407) ANSI C63.10:2013

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

Prepared by : Polly Chien , **Date:** Feb. 16, 2023

Polly Chien / Specialist

Approved by : Jeremy Lin , **Date:** Feb. 16, 2023

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
FCC Clause	Test Item	Result	Remarks
15.407(b)(9)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -11.72dB at 12.97400MHz.
15.407(b) (1/2/3/4(i/ii)/9)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.0dB at 5642.400MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	-	Reference only.
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 RP-SMA not a standard connector.

Note:
1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOBE test plots were recorded in Annex A.
3. For U-NII-1 band compliance with rule 15.407(b) of the band-edge items, the test plots were recorded in Annex B. Test Procedures refer to report 4.1.3.

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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless Network Security Appliance
Brand	SONICWALL
Test Model	APL62-0F8
Sample Status	Engineering sample
Power Supply Rating	12Vdc from Adapter
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps
Operating Frequency	5180~5240MHz, 5745~5825MHz
Number of Channel	5180~5240MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5745~5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1
Output Power	CDD Mode: 5180 ~ 5240MHz: 313.327mW 5745 ~ 5825MHz: 274.194mW Beamforming Mode: 5180 ~ 5240MHz: 278.408mW 5745 ~ 5825MHz: 232.887mW
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	Adapter
Data Cable Supplied	0.91m AC power non-shielded cable without core 1.15m non-shielded console cable without core 0.95m shielded USB cable without core 0.95m non-shielded RJ45 cable without core

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function	Beamforming Mode
802.11a	2TX	Not Support
802.11n (HT20)	2TX	Support
802.11n (HT40)	2TX	Support
802.11ac (VHT20)	2TX	Support
802.11ac (VHT40)	2TX	Support
802.11ac (VHT80)	2TX	Support

* 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)

* For 802.11n and 802.11ac, CDD mode and Beamforming mode are presented in power output test item. For other test items, CDD mode is the worst case for final tests after pretesting.

2. The EUT consumes power from the following adapters.

Adapter 1	
Brand	Sunny COMPUTER TECHNOLOGY CO., LTD.
Model	SYS1548-6012-T3
Input Power	100-240Vac, 50-60Hz, 1.5A MAX
Output Power	12Vdc, 5.0A, 60W MAX
Power Line	1.85m DC power cable with 1 core attached on adapter

Adapter 2	
Brand	BILLION
Model	BA070-120500MAX
Input Power	100-240Vac, 50/60Hz, 1.5A
Output Power	12Vdc, 5.0A
Power Line	1.47m power cable with 1 core attached on adapter

* After the pretesting, the adapter 1 was chosen for final tests.

3. The EUT uses following antennas.

Ant. Type	Dipole					
Ant. Connector	RP-SMA					
Frequency (MHz)	2400	2450	2500	5150	5550	5850
Peak Gain (dBi)	3.19	3.10	3.05	5.85	5.73	5.03

* The max. gain was chosen for final tests.

4. The power settings are list as below.

CDD Mode:	802.11a	802.11n (HT20)		802.11n (HT40)		802.11ac (VHT80)
CH 36	41	41	CH 38	36	CH 42	34
CH 40	46	46	CH 46	44	CH 155	39
CH 48	49	49	CH 151	45		
CH 149	48	49	CH 159	46		
CH 157	48	49				
CH 165	48	49				

Beamforming Mode:	802.11n (HT20)		802.11n (HT40)		802.11ac (VHT80)
CH 36	39	CH 38	34	CH 42	30
CH 40	45	CH 46	42	CH 155	35
CH 48	45	CH 151	40		
CH 149	44	CH 159	43		
CH 157	41				
CH 165	38				

5. WLAN 2.4GHz & WLAN 5GHz technology cannot transmit at same time.
6. Spurious emission of the simultaneous operation (2.4GHz and 5GHz) has been evaluated and no non-compliance was found.

3.2 Description of Test Modes

5180~5240MHz:

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

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

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

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

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	Power
-	√	√	√	√	-

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

PLC: Power Line Conducted Emission APCM: Antenna Port Conducted Measurement

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane.**
2. Radiated emission test (below 1GHz) and power line conducted emission test items chosen the worst maximum power.

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	6.0
	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	6.5
	802.11n (HT40)		38 to 46	38, 46	OFDM	13.5
	802.11ac (VHT80)		42	42	OFDM	58.5
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	6.0
	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	6.5
	802.11n (HT40)		151 to 159	151, 159	OFDM	13.5
	802.11ac (VHT80)		155	155	OFDM	58.5

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11a	5180-5240	36 to 48	48	OFDM	6.0
	802.11a	5745-5825	149 to 165		OFDM	6.0

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11a	5180-5240	36 to 48	48	OFDM	6.0
	802.11a	5745-5825	149 to 165		OFDM	6.0

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	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	6.0
	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	6.5
	802.11n (HT40)		38 to 46	38, 46	OFDM	13.5
	802.11ac (VHT80)		42	42	OFDM	58.5
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	6.0
	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	6.5
	802.11n (HT40)		151 to 159	151, 159	OFDM	13.5
	802.11ac (VHT80)		155	155	OFDM	58.5

Test Condition:

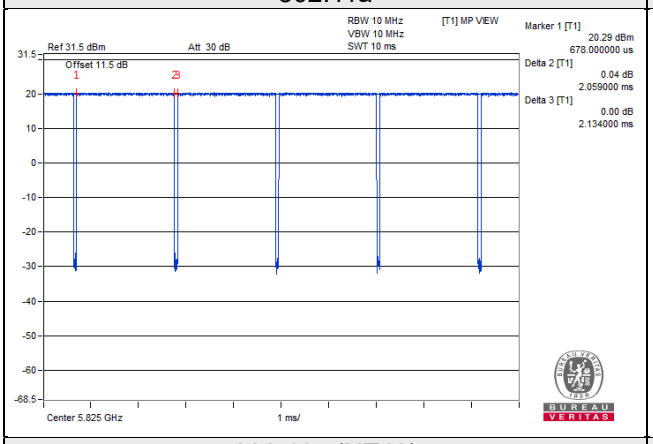
Applicable to	Environmental Conditions	Input Power	Tested by
RE≥1G	22 deg. C, 68% RH	120Vac, 60Hz	Greg Lin, Han Wu
RE<1G	22 deg. C, 68% RH	120Vac, 60Hz	Greg Lin
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Jones Chang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Jisyong Wang

3.3 Duty Cycle of Test Signal

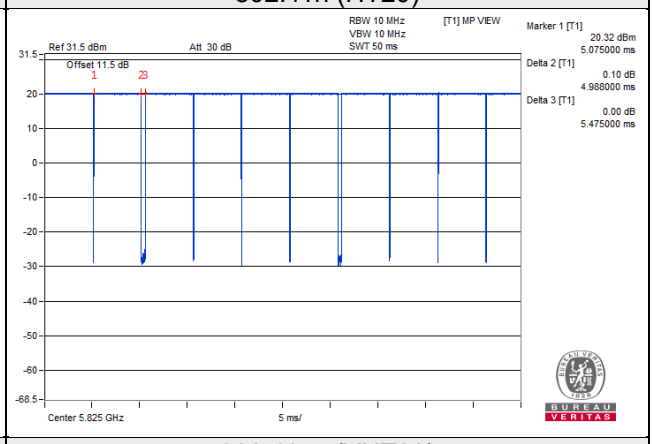
Duty cycle of test signal is < 98%, duty factor is required.

802.11a: Duty cycle = 2.059/2.134 = 0.965, Duty factor = 10 * log(1/0.965) = 0.16
802.11n (HT20): Duty cycle = 4.988/5.475 = 0.911, Duty factor = 10 * log(1/0.911) = 0.40
802.11n (HT40): Duty cycle = 2.425/2.525 = 0.960, Duty factor = 10 * log(1/0.960) = 0.18
802.11ac (VHT80): Duty cycle = 3.345/3.835 = 0.872, Duty factor = 10 * log(1/0.872) = 0.59

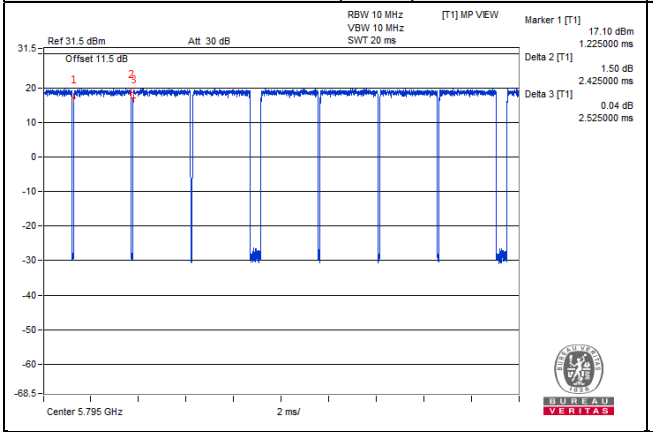
802.11a



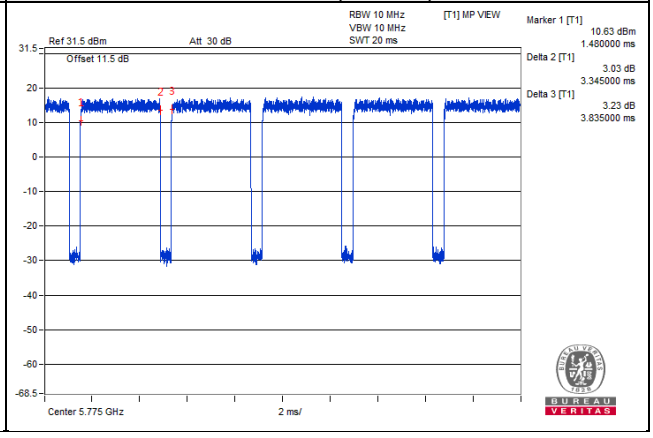
802.11n (HT20)



802.11n (HT40)



802.11ac (VHT80)



3.4 Description of Support Units

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

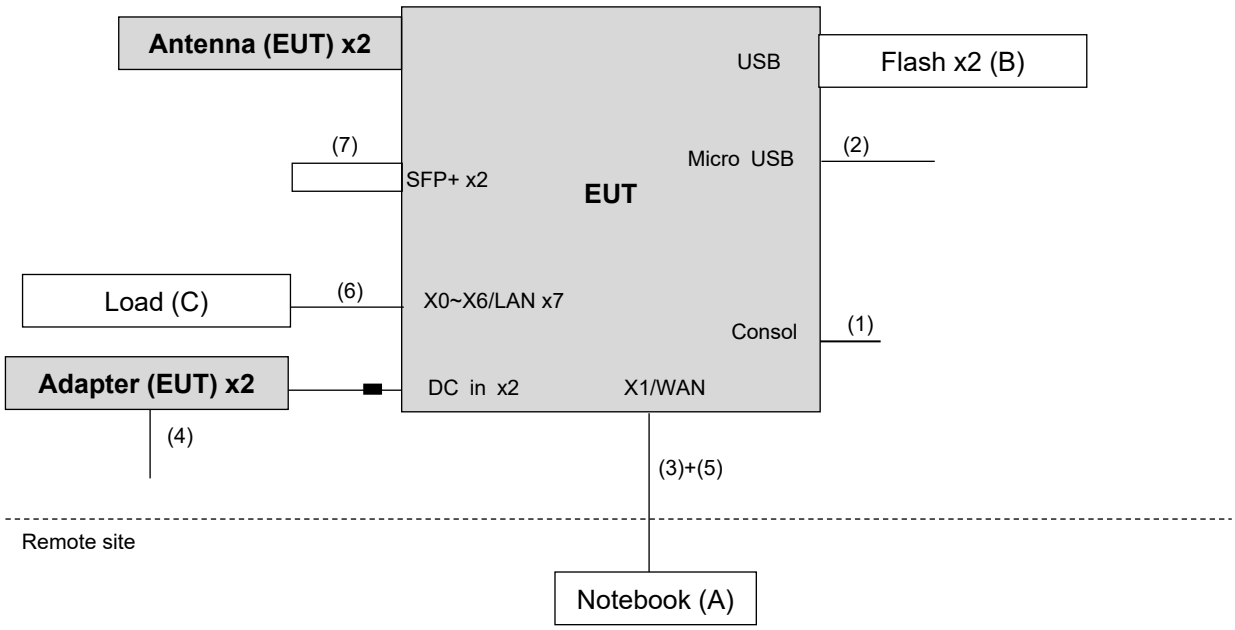
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	Flash	HP	v250W	09	NA	-
	Flash	HP	v250W	03	NA	-
C.	Load	NA	NA	NA	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Console cable	1	1.15	N	0	Accessory of EUT
2.	USB cable	1	0.95	Y	0	Accessory of EUT
3.	LAN cable	1	0.95	N	0	Accessory of EUT RJ45, Cat5e
4.	Power cord	2	0.91	N	0	Accessory of EUT
5.	LAN cable	1	7	N	0	RJ45, Cat5e
6.	LAN cable	7	1.5	N	0	RJ45, Cat5e
7.	Fiber cable	1	3	N	0	Provided by client

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

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

Test standard:
FCC Part 15, Subpart E (15.407)
ANSI C63.10:2013

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

References Test Guidance:
KDB 789033 D02 General UNII Test Procedure New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

<table>
<tr><td colspan="3">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK: 74 (dBμV/m)</td><td>AV: 54 (dBμV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK: -27 (dBm/MHz)</td><td rowspan="3">PK: 68.2(dBμV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK: -27 (dBm/MHz) *1
PK: 10 (dBm/MHz) *2
PK: 15.6 (dBm/MHz) *3
PK: 27 (dBm/MHz) *4</td><td>PK: 68.2(dBμV/m) *1
PK: 105.2 (dBμV/m) *2
PK: 110.8(dBμV/m) *3
PK: 122.2 (dBμV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*1 beyond 75 MHz or more above of the band edge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.
*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
</table>

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

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	May 30, 2019	May 29, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Nov. 11, 2019	Nov. 10, 2020
HORN Antenna SCHWARZBECK	9120D	209	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 24, 2019	Nov. 23, 2020
Loop Antenna TESEQ	HLA 6121	45745	Jul. 01, 2019	Jun. 30, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Aug. 20, 2019	Aug. 19, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02465	Mar. 27, 2019	Mar. 26, 2020
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH3-01	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM-SM-8000	Cable-CH3-03 (309224+170907)	Aug. 20, 2019	Aug. 19, 2020
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 15, 2019	Jul. 14, 2020
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Sep. 05, 2019	Sep. 04, 2020

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.
3. Tested date: Jan. 07 ~ Apr. 20, 2020

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESR3	102579	Jul. 05, 2021	Jul. 04, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 12, 2021	Apr. 11, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Oct. 29, 2021	Oct. 28, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Oct. 26, 2021	Oct. 25, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Jul. 24, 2021	Jul. 23, 2022
Preamplifier Agilent (Above 1GHz)	8449B	3008A02465	Mar. 22, 2021	Mar. 21, 2022
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH3-01	Jul. 23, 2021	Jul. 22, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Jul. 23, 2021	Jul. 22, 2022
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM-SM-8000	Cable-CH3-03 (309224+170907)	Jul. 23, 2021	Jul. 22, 2022
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 12, 2021	Jul. 11, 2022

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.
3. Tested date: Dec. 27, 2021

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

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

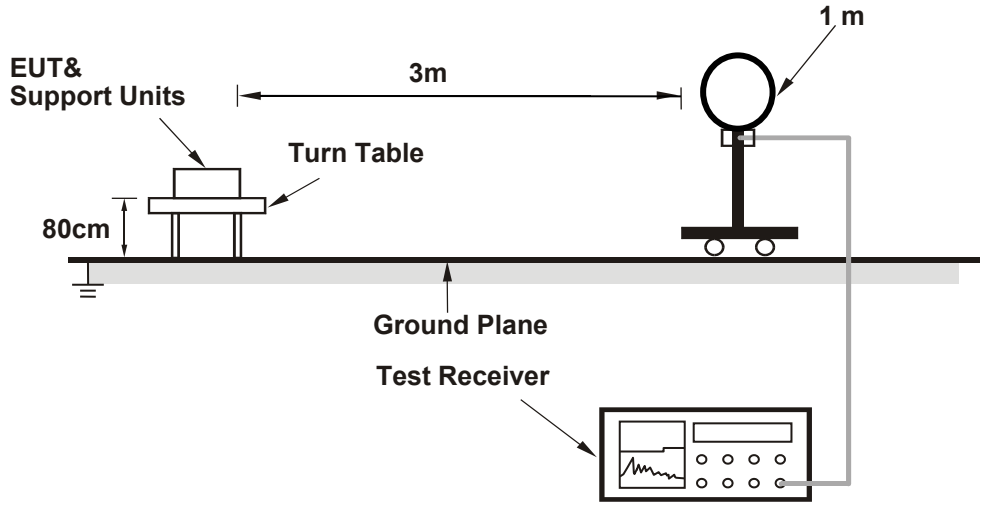
   (802.11a: RBW = 1MHz, VBW = 1kHz; 802.11n (HT20): RBW = 1MHz, VBW = 1kHz; 802.11n (HT40): RBW = 1MHz, VBW = 1kHz; 802.11ac (VHT80): RBW = 1MHz, VBW = 1kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

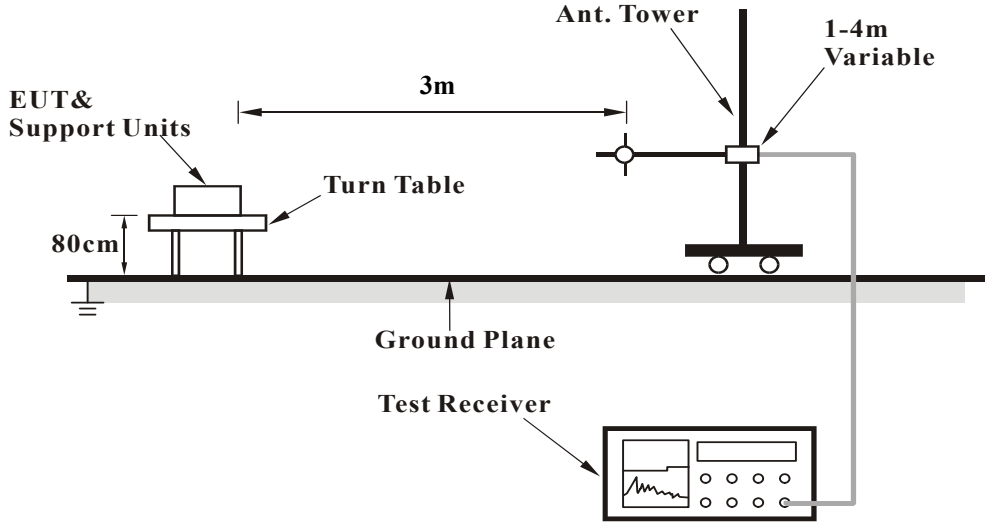
No deviation.

4.1.5 Test Setup

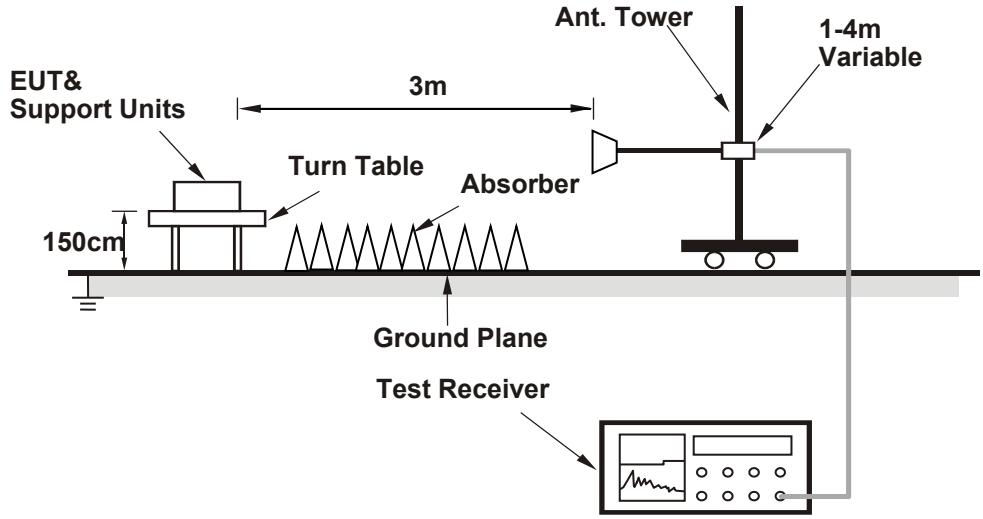
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Prepared a notebook to act as a communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and ran a test program (CMD) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz data:

802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	67.4 PK	74.0	-6.6	3.00 H	2	63.5	3.9
2	5150.00	52.7 AV	54.0	-1.3	3.00 H	2	48.8	3.9
3	*5180.00	116.6 PK			3.58 H	354	78.3	38.3
4	*5180.00	106.4 AV			3.58 H	354	68.1	38.3
5	#10360.00	57.2 PK	68.2	-11.0	1.56 H	111	40.6	16.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	58.0 PK	74.0	-16.0	3.14 V	253	54.1	3.9
2	5150.00	44.6 AV	54.0	-9.4	3.14 V	253	40.7	3.9
3	*5180.00	108.2 PK			2.98 V	270	69.9	38.3
4	*5180.00	97.4 AV			2.98 V	270	59.1	38.3
5	#10360.00	56.9 PK	68.2	-11.3	2.86 V	303	40.3	16.6

Remarks:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	67.5 PK	74.0	-6.5	3.45 H	3	63.6	3.9
2	5150.00	52.5 AV	54.0	-1.5	3.45 H	3	48.6	3.9
3	*5200.00	119.8 PK			3.55 H	358	81.7	38.1
4	*5200.00	109.1 AV			3.55 H	358	71.0	38.1
5	#10400.00	57.5 PK	68.2	-10.7	1.79 H	116	40.8	16.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	55.2 PK	74.0	-18.8	2.97 V	264	51.3	3.9
2	5150.00	44.3 AV	54.0	-9.7	2.97 V	264	40.4	3.9
3	*5200.00	110.9 PK			3.03 V	274	72.8	38.1
4	*5200.00	100.3 AV			3.03 V	274	62.2	38.1
5	#10400.00	57.2 PK	68.2	-11.0	2.84 V	305	40.5	16.7

Remarks:

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

CHANNEL	TX Channel 48	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	*5240.00	120.8 PK			3.50 H	357	82.7	38.1
2	*5240.00	110.3 AV			3.50 H	357	72.2	38.1
3	5350.00	54.7 PK	74.0	-19.3	3.43 H	7	50.9	3.8
4	5350.00	44.2 AV	54.0	-9.8	3.43 H	7	40.4	3.8
5	#10480.00	57.8 PK	68.2	-10.4	1.87 H	105	41.3	16.5
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	*5240.00	111.9 PK			2.94 V	273	73.8	38.1
2	*5240.00	101.4 AV			2.94 V	273	63.3	38.1
3	5350.00	54.0 PK	74.0	-20.0	2.87 V	262	50.2	3.8
4	5350.00	43.4 AV	54.0	-10.6	2.87 V	262	39.6	3.8
5	#10480.00	57.4 PK	68.2	-10.8	1.79 V	308	40.9	16.5

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 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	#5650.00	65.8 PK	68.2	-2.4	3.92 H	4	61.5	4.3
2	*5745.00	118.0 PK			3.92 H	4	79.1	38.9
3	*5745.00	107.5 AV			3.92 H	4	68.6	38.9
4	#5932.00	55.7 PK	68.2	-12.5	3.92 H	4	50.7	5.0
5	11490.00	58.0 PK	74.0	-16.0	1.51 H	124	41.1	16.9
6	11490.00	44.2 AV	54.0	-9.8	1.51 H	124	27.3	16.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5650.00	58.7 PK	68.2	-9.5	2.97 V	273	54.4	4.3
2	*5745.00	109.0 PK			2.97 V	273	70.1	38.9
3	*5745.00	98.5 AV			2.97 V	273	59.6	38.9
4	#5992.80	54.8 PK	68.2	-13.4	2.97 V	273	49.8	5.0
5	11490.00	58.2 PK	74.0	-15.8	2.86 V	311	41.3	16.9
6	11490.00	43.9 AV	54.0	-10.1	2.86 V	311	27.0	16.9

Remarks:

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

CHANNEL	TX Channel 157	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5648.80	57.8 PK	68.2	-10.4	3.91 H	1	53.5	4.3
2	*5785.00	118.7 PK			3.91 H	1	79.7	39.0
3	*5785.00	107.1 AV			3.91 H	1	68.1	39.0
4	#5957.60	55.7 PK	68.2	-12.5	3.91 H	1	50.7	5.0
5	11570.00	58.1 PK	74.0	-15.9	1.47 H	132	41.4	16.7
6	11570.00	43.6 AV	54.0	-10.4	1.47 H	132	26.9	16.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5602.40	55.1 PK	68.2	-13.1	2.92 V	271	50.9	4.2
2	*5785.00	109.7 PK			2.92 V	271	70.7	39.0
3	*5785.00	98.1 AV			2.92 V	271	59.1	39.0
4	#5932.00	55.6 PK	68.2	-12.6	2.92 V	271	50.6	5.0
5	11570.00	57.3 PK	74.0	-16.7	2.75 V	297	40.6	16.7
6	11570.00	44.0 AV	54.0	-10.0	2.75 V	297	27.3	16.7

Remarks:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5602.40	53.7 PK	68.2	-14.5	3.62 H	352	49.5	4.2
2	*5825.00	118.6 PK			3.62 H	352	79.5	39.1
3	*5825.00	107.2 AV			3.62 H	352	68.1	39.1
4	#5926.40	58.9 PK	68.2	-9.3	3.62 H	352	53.9	5.0
5	11650.00	57.4 PK	74.0	-16.6	1.54 H	127	40.9	16.5
6	11650.00	43.4 AV	54.0	-10.6	1.54 H	127	26.9	16.5
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	#5631.20	53.6 PK	68.2	-14.6	2.88 V	272	49.3	4.3
2	*5825.00	109.2 PK			2.88 V	272	70.1	39.1
3	*5825.00	98.0 AV			2.88 V	272	58.9	39.1
4	#5944.80	55.3 PK	68.2	-12.9	2.88 V	272	50.3	5.0
5	11650.00	57.8 PK	74.0	-16.2	2.87 V	301	41.3	16.5
6	11650.00	43.6 AV	54.0	-10.4	2.87 V	301	27.1	16.5

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.

802.11n (HT20)

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	66.3 PK	74.0	-7.7	3.64 H	3	62.4	3.9
2	5150.00	52.3 AV	54.0	-1.7	3.64 H	3	48.4	3.9
3	*5180.00	116.2 PK			3.59 H	357	77.9	38.3
4	*5180.00	105.3 AV			3.59 H	357	67.0	38.3
5	#10360.00	57.1 PK	68.2	-11.1	1.84 H	115	40.5	16.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	54.7 PK	74.0	-19.3	2.86 V	257	50.8	3.9
2	5150.00	44.4 AV	54.0	-9.6	2.86 V	257	40.5	3.9
3	*5180.00	107.2 PK			2.93 V	263	68.9	38.3
4	*5180.00	96.5 AV			2.93 V	263	58.2	38.3
5	#10360.00	57.0 PK	68.2	-11.2	2.83 V	307	40.4	16.6

Remarks:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	66.2 PK	74.0	-7.8	3.85 H	356	62.3	3.9
2	5150.00	52.4 AV	54.0	-1.6	3.85 H	356	48.5	3.9
3	*5200.00	118.2 PK			3.97 H	355	80.1	38.1
4	*5200.00	107.9 AV			3.97 H	355	69.8	38.1
5	#10400.00	57.4 PK	68.2	-10.8	1.83 H	117	40.7	16.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	55.1 PK	74.0	-18.9	2.83 V	257	51.2	3.9
2	5150.00	44.4 AV	54.0	-9.6	2.83 V	257	40.5	3.9
3	*5200.00	109.3 PK			2.93 V	262	71.2	38.1
4	*5200.00	98.9 AV			2.93 V	262	60.8	38.1
5	#10400.00	57.4 PK	68.2	-10.8	2.85 V	296	40.7	16.7

Remarks:

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

CHANNEL	TX Channel 48	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	*5240.00	121.2 PK			3.35 H	1	83.1	38.1
2	*5240.00	109.5 AV			3.35 H	1	71.4	38.1
3	5350.00	55.4 PK	74.0	-18.6	3.43 H	352	51.6	3.8
4	5350.00	44.2 AV	54.0	-9.8	3.43 H	352	40.4	3.8
5	#10480.00	57.7 PK	68.2	-10.5	1.56 H	107	41.2	16.5
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	*5240.00	111.3 PK			2.93 V	272	73.2	38.1
2	*5240.00	100.6 AV			2.93 V	272	62.5	38.1
3	5350.00	54.1 PK	74.0	-19.9	2.84 V	269	50.3	3.8
4	5350.00	43.5 AV	54.0	-10.5	2.84 V	269	39.7	3.8
5	#10480.00	57.5 PK	68.2	-10.7	2.87 V	312	41.0	16.5

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 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	#5644.80	67.1 PK	68.2	-1.1	3.74 H	357	62.8	4.3
2	*5745.00	119.2 PK			3.74 H	357	80.3	38.9
3	*5745.00	107.6 AV			3.74 H	357	68.7	38.9
4	#5952.00	55.4 PK	68.2	-12.8	3.74 H	357	50.4	5.0
5	11490.00	57.6 PK	74.0	-16.4	1.56 H	126	40.7	16.9
6	11490.00	44.1 AV	54.0	-9.9	1.56 H	126	27.2	16.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5642.40	58.6 PK	68.2	-9.6	2.94 V	267	54.3	4.3
2	*5745.00	109.8 PK			2.94 V	267	70.9	38.9
3	*5745.00	98.4 AV			2.94 V	267	59.5	38.9
4	#5953.60	55.4 PK	68.2	-12.8	2.94 V	267	50.4	5.0
5	11490.00	57.5 PK	74.0	-16.5	2.74 V	299	40.6	16.9
6	11490.00	44.1 AV	54.0	-9.9	2.74 V	299	27.2	16.9

Remarks:

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

CHANNEL	TX Channel 157	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5640.80	59.5 PK	68.2	-8.7	2.73 H	5	55.2	4.3
2	*5785.00	118.5 PK			2.73 H	5	79.5	39.0
3	*5785.00	106.7 AV			2.73 H	5	67.7	39.0
4	#5956.00	55.2 PK	68.2	-13.0	2.73 H	5	50.2	5.0
5	11570.00	57.2 PK	74.0	-16.8	1.51 H	125	40.5	16.7
6	11570.00	43.9 AV	54.0	-10.1	1.51 H	125	27.2	16.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5639.20	55.6 PK	68.2	-12.6	3.08 V	275	51.3	4.3
2	*5785.00	109.7 PK			3.08 V	275	70.7	39.0
3	*5785.00	97.8 AV			3.08 V	275	58.8	39.0
4	#5976.00	55.1 PK	68.2	-13.1	3.08 V	275	50.1	5.0
5	11570.00	57.8 PK	74.0	-16.2	2.85 V	303	41.1	16.7
6	11570.00	43.9 AV	54.0	-10.1	2.85 V	303	27.2	16.7

Remarks:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5616.00	54.6 PK	68.2	-13.6	3.69 H	1	50.3	4.3
2	*5825.00	116.1 PK			3.69 H	1	77.0	39.1
3	*5825.00	105.2 AV			3.69 H	1	66.1	39.1
4	#5931.20	61.6 PK	68.2	-6.6	3.69 H	1	56.6	5.0
5	11650.00	57.8 PK	74.0	-16.2	1.60 H	129	41.3	16.5
6	11650.00	43.4 AV	54.0	-10.6	1.60 H	129	26.9	16.5
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	#5615.20	54.7 PK	68.2	-13.5	3.00 V	268	50.4	4.3
2	*5825.00	106.7 PK			3.00 V	268	67.6	39.1
3	*5825.00	96.0 AV			3.00 V	268	56.9	39.1
4	#5936.00	55.8 PK	68.2	-12.4	3.00 V	268	50.8	5.0
5	11650.00	57.9 PK	74.0	-16.1	2.88 V	311	41.4	16.5
6	11650.00	43.4 AV	54.0	-10.6	2.88 V	311	26.9	16.5

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.

802.11n (HT40)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	66.5 PK	74.0	-7.5	3.67 H	5	62.6	3.9
2	5150.00	52.7 AV	54.0	-1.3	3.67 H	5	48.8	3.9
3	*5190.00	111.3 PK			3.62 H	356	73.1	38.2
4	*5190.00	100.7 AV			3.62 H	356	62.5	38.2
5	#10380.00	57.1 PK	68.2	-11.1	1.63 H	124	40.4	16.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	55.2 PK	74.0	-18.8	2.76 V	265	51.3	3.9
2	5150.00	44.6 AV	54.0	-9.4	2.76 V	265	40.7	3.9
3	*5190.00	102.4 PK			2.85 V	272	64.2	38.2
4	*5190.00	91.8 AV			2.85 V	272	53.6	38.2
5	#10380.00	57.1 PK	68.2	-11.1	2.92 V	311	40.4	16.7

Remarks:

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

CHANNEL	TX Channel 46	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	64.7 PK	74.0	-9.3	3.47 H	4	60.8	3.9
2	5150.00	52.6 AV	54.0	-1.4	3.47 H	4	48.7	3.9
3	*5230.00	116.4 PK			3.51 H	355	78.3	38.1
4	*5230.00	105.6 AV			3.51 H	355	67.5	38.1
5	5350.00	54.5 PK	74.0	-19.5	3.53 H	358	50.7	3.8
6	5350.00	44.1 AV	54.0	-9.9	3.53 H	358	40.3	3.8
7	#10460.00	57.3 PK	68.2	-10.9	1.57 H	103	40.8	16.5
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	56.2 PK	74.0	-17.8	2.81 V	266	52.3	3.9
2	5150.00	44.7 AV	54.0	-9.3	2.81 V	266	40.8	3.9
3	*5230.00	107.4 PK			2.93 V	276	69.3	38.1
4	*5230.00	96.8 AV			2.93 V	276	58.7	38.1
5	5350.00	54.0 PK	74.0	-20.0	2.76 V	257	50.2	3.8
6	5350.00	43.6 AV	54.0	-10.4	2.76 V	257	39.8	3.8
7	#10460.00	57.2 PK	68.2	-11.0	2.93 V	314	40.7	16.5

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 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	#5645.60	66.9 PK	68.2	-1.3	3.78 H	7	62.6	4.3
2	*5755.00	114.8 PK			3.78 H	7	75.9	38.9
3	*5755.00	104.2 AV			3.78 H	7	65.3	38.9
4	#5957.60	56.2 PK	68.2	-12.0	3.78 H	7	51.2	5.0
5	11510.00	57.9 PK	74.0	-16.1	1.63 H	131	41.0	16.9
6	11510.00	44.2 AV	54.0	-9.8	1.63 H	131	27.3	16.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5650.00	58.9 PK	68.2	-9.3	2.90 V	267	54.6	4.3
2	*5755.00	105.8 PK			2.90 V	267	66.9	38.9
3	*5755.00	95.2 AV			2.90 V	267	56.3	38.9
4	#5985.60	55.7 PK	68.2	-12.5	2.90 V	267	50.7	5.0
5	11510.00	57.8 PK	74.0	-16.2	2.79 V	311	40.9	16.9
6	11510.00	44.1 AV	54.0	-9.9	2.79 V	311	27.2	16.9

Remarks:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	**#5642.40**	**67.2 PK**	**68.2**	**-1.0**	**3.75 H**	**4**	**62.9**	**4.3**
2	*5795.00	113.5 PK			3.75 H	4	74.5	39.0
3	*5795.00	103.1 AV			3.75 H	4	64.1	39.0
4	#5932.80	62.0 PK	68.2	-6.2	3.75 H	4	57.0	5.0
5	11590.00	58.0 PK	74.0	-16.0	1.58 H	124	41.5	16.5
6	11590.00	43.6 AV	54.0	-10.4	1.58 H	124	27.1	16.5
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	#5644.00	58.2 PK	68.2	-10.0	3.00 V	273	53.9	4.3
2	*5795.00	104.7 PK			3.00 V	273	65.7	39.0
3	*5795.00	94.2 AV			3.00 V	273	55.2	39.0
4	#5932.80	59.4 PK	68.2	-8.8	3.00 V	273	54.4	5.0
5	11590.00	57.6 PK	74.0	-16.4	2.79 V	299	41.1	16.5
6	11590.00	43.6 AV	54.0	-10.4	2.79 V	299	27.1	16.5

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	66.2 PK	74.0	-7.8	3.46 H	3	62.3	3.9
2	5150.00	52.7 AV	54.0	-1.3	3.46 H	3	48.8	3.9
3	*5210.00	106.2 PK			3.62 H	355	68.1	38.1
4	*5210.00	95.4 AV			3.62 H	355	57.3	38.1
5	5350.00	54.2 PK	74.0	-19.8	3.53 H	357	50.4	3.8
6	5350.00	43.8 AV	54.0	-10.2	3.53 H	357	40.0	3.8
7	#10420.00	56.9 PK	68.2	-11.3	1.68 H	105	40.3	16.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	59.2 PK	74.0	-14.8	2.96 V	265	55.3	3.9
2	5150.00	45.0 AV	54.0	-9.0	2.96 V	265	41.1	3.9
3	*5210.00	97.5 PK			3.03 V	274	59.4	38.1
4	*5210.00	86.8 AV			3.03 V	274	48.7	38.1
5	5350.00	54.3 PK	74.0	-19.7	2.87 V	262	50.5	3.8
6	5350.00	42.5 AV	54.0	-11.5	2.87 V	262	38.7	3.8
7	#10420.00	56.8 PK	68.2	-11.4	2.93 V	315	40.2	16.6

Remarks:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5642.40	67.1 PK	68.2	-1.1	3.94 H	4	62.8	4.3
2	*5775.00	107.4 PK			3.94 H	4	68.4	39.0
3	*5775.00	97.3 AV			3.94 H	4	58.3	39.0
4	#5925.60	59.0 PK	68.2	-9.2	3.94 H	4	54.0	5.0
5	11550.00	58.1 PK	74.0	-15.9	1.50 H	124	41.4	16.7
6	11550.00	44.0 AV	54.0	-10.0	1.50 H	124	27.3	16.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5640.00	57.0 PK	68.2	-11.2	3.04 V	274	52.7	4.3
2	*5775.00	98.0 PK			3.04 V	274	59.0	39.0
3	*5775.00	88.1 AV			3.04 V	274	49.1	39.0
4	#5926.40	57.1 PK	68.2	-11.1	3.04 V	274	52.1	5.0
5	11550.00	57.8 PK	74.0	-16.2	2.74 V	297	41.1	16.7
6	11550.00	43.9 AV	54.0	-10.1	2.74 V	297	27.2	16.7

Remarks:

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

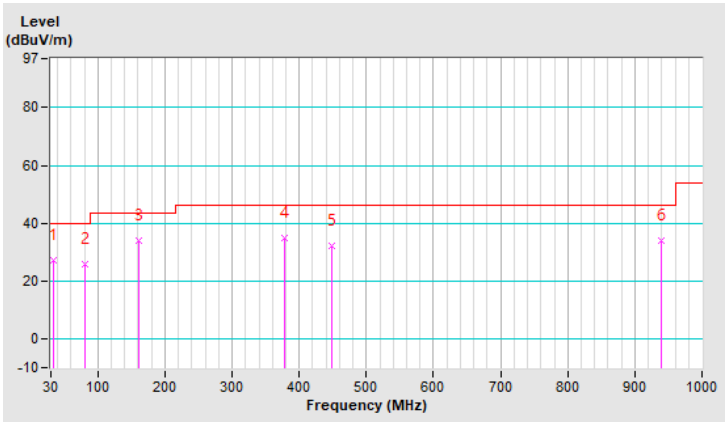
Below 1GHz Worst-Case Data: 802.11a

CHANNEL	TX Channel 48	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	34.85	27.2 QP	40.0	-12.8	1.25 H	219	38.3	-11.1
2	81.41	25.6 QP	40.0	-14.4	1.00 H	129	39.8	-14.2
3	161.92	34.1 QP	43.5	-9.4	1.50 H	183	43.2	-9.1
4	377.26	34.8 QP	46.0	-11.2	1.00 H	217	40.9	-6.1
5	448.07	32.1 QP	46.0	-13.9	1.25 H	76	36.5	-4.4
6	939.86	33.8 QP	46.0	-12.2	1.50 H	160	29.5	4.3

Remarks:

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

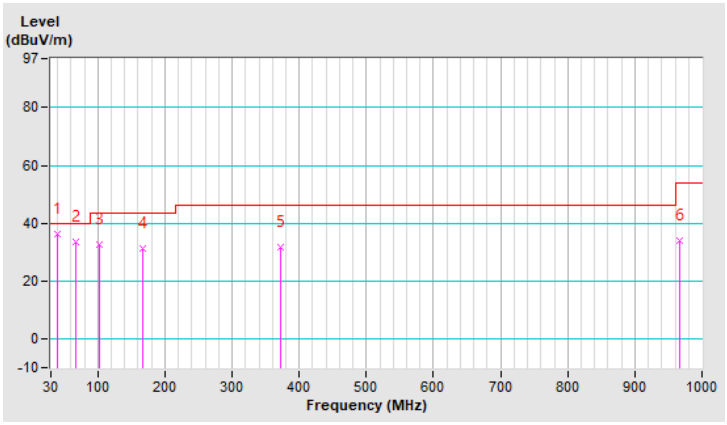


CHANNEL	TX Channel 48	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	40.67	36.3 QP	40.0	-3.7	1.00 V	63	46.6	-10.3
2	66.86	33.7 QP	40.0	-6.3	1.25 V	123	44.6	-10.9
3	101.78	32.5 QP	43.5	-11.0	1.00 V	150	46.1	-13.6
4	167.74	31.4 QP	43.5	-12.1	1.25 V	295	40.7	-9.3
5	372.41	31.8 QP	46.0	-14.2	1.00 V	314	38.0	-6.2
6	967.02	34.0 QP	54.0	-20.0	1.50 V	328	29.1	4.9

Remarks:

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



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Tested date: Feb. 12, 2020

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 21, 2019	Feb. 20, 2020
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_Cond_ V7.3.7.4	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 HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

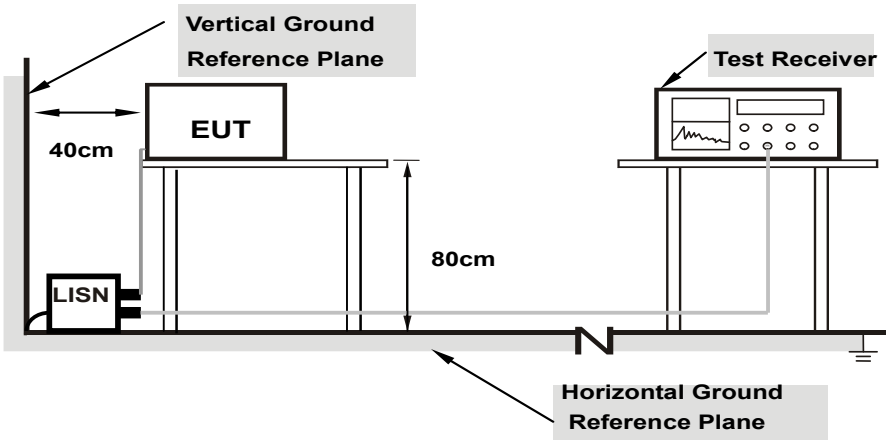
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

4.2.7 Test Results

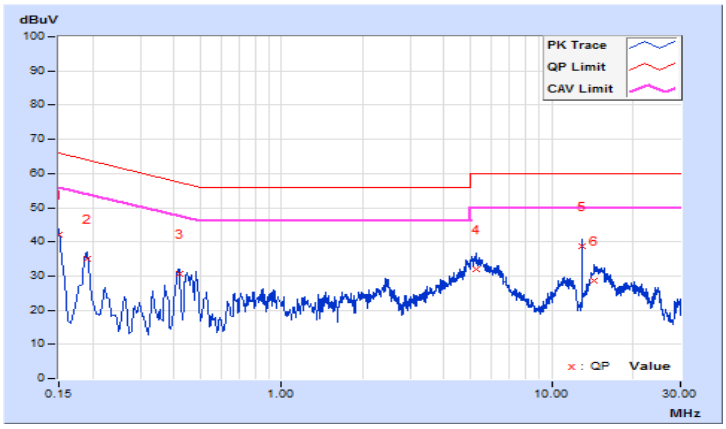
Worst-case data: 802.11a

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.15	32.07	23.66	42.22	33.81	66.00	56.00	-23.78	-22.19
2	0.19000	10.16	24.89	15.12	35.05	25.28	64.04	54.04	-28.99	-28.76
3	0.41799	10.17	20.60	12.69	30.77	22.86	57.49	47.49	-26.72	-24.63
4	5.26200	10.49	21.54	16.09	32.03	26.58	60.00	50.00	-27.97	-23.42
5	12.97000	10.59	28.21	26.96	38.80	37.55	60.00	50.00	-21.20	-12.45
6	14.41000	10.61	18.05	12.69	28.66	23.30	60.00	50.00	-31.34	-26.70

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

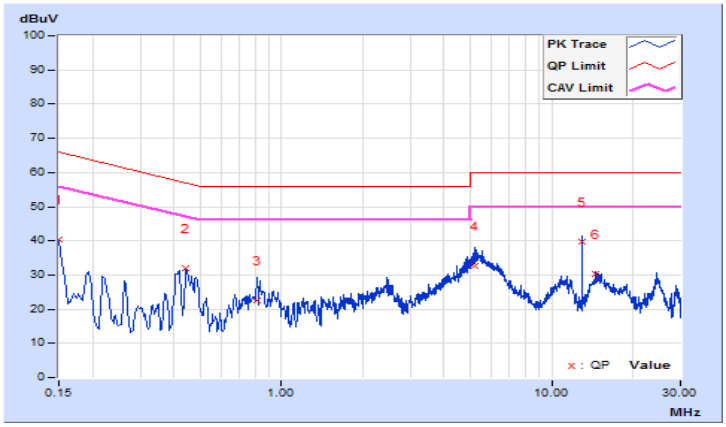


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.13	30.43	23.81	40.56	33.94	66.00	56.00	-25.44	-22.06
2	0.44200	10.18	21.65	12.82	31.83	23.00	57.02	47.02	-25.19	-24.02
3	0.81400	10.23	12.44	6.42	22.67	16.65	56.00	46.00	-33.33	-29.35
4	5.20177	10.47	22.31	16.43	32.78	26.90	60.00	50.00	-27.22	-23.10
5	**12.97400**	**10.62**	**29.04**	**27.66**	**39.66**	**38.28**	**60.00**	**50.00**	**-20.34**	**-11.72**
6	14.59400	10.67	19.80	16.43	30.47	27.10	60.00	50.00	-29.53	-22.90

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



4.3 Transmit Power Measurement

4.3.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		Limit
U-NII-1	-	Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p ≦ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
	-	Fixed point-to-point Access Point	1 Watt (30 dBm)
	√	Indoor Access Point	1 Watt (30 dBm)
	-	Mobile and Portable client device	250mW (24 dBm)
U-NII-2A	-		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	-		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	√		1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

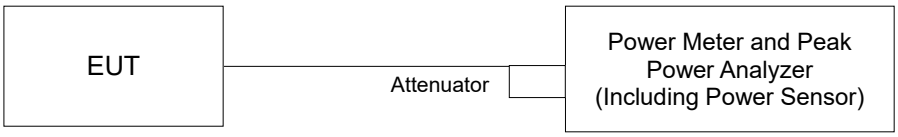
Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

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

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

4.3.2 Test Setup

For Power Output



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

For Average Power Measurement

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

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

Power Output:

CDD Mode

802.11a

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	17.75	18.76	134.728	21.29	30.00	Pass
40	5200	20.44	21.39	248.383	23.95	30.00	Pass
48	5240	22.23	21.65	**313.327**	24.96	30.00	Pass
149	5745	21.01	21.59	270.395	24.32	30.00	Pass
157	5785	20.89	21.35	259.202	24.14	30.00	Pass
165	5825	21.11	21.35	265.580	24.24	30.00	Pass

802.11n (HT20)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	17.11	18.53	122.689	20.89	30.00	Pass
40	5200	20.04	21.08	229.158	23.60	30.00	Pass
48	5240	22.20	21.61	310.836	24.93	30.00	Pass
149	5745	20.93	21.77	**274.194**	24.38	30.00	Pass
157	5785	20.89	21.50	263.998	24.22	30.00	Pass
165	5825	21.01	21.25	259.535	24.14	30.00	Pass

802.11n (HT40)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
38	5190	16.24	16.73	89.171	19.50	30.00	Pass
46	5230	20.32	21.03	234.412	23.70	30.00	Pass
151	5755	20.17	21.23	236.731	23.74	30.00	Pass
159	5795	20.71	21.09	246.290	23.91	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				
42	5210	15.25	15.92	72.581	18.61	30.00	Pass
155	5775	17.64	18.45	128.060	21.07	30.00	Pass

Beamforming Mode

802.11n (HT20)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	18.02	18.43	133.050	21.24	27.14	Pass
40	5200	21.55	21.32	**278.408**	24.45	27.14	Pass
48	5240	18.86	19.45	165.018	22.18	27.14	Pass
149	5745	20.56	20.76	**232.887**	23.67	27.14	Pass
157	5785	18.89	19.12	159.104	22.02	27.14	Pass
165	5825	17.84	17.65	119.024	20.76	27.14	Pass

Note: Beamforming Gain = 5.85 + 10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 30-(8.86-6) = 27.14dBm.

802.11n (HT40)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
38	5190	16.82	16.53	93.062	19.69	27.14	Pass
46	5230	20.62	20.14	218.621	23.40	27.14	Pass
151	5755	19.89	21.05	224.849	23.52	27.14	Pass
159	5795	20.95	21.74	273.731	24.37	27.14	Pass

Note: Beamforming Gain = 5.85 + 10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 30-(8.86-6) = 27.14dBm.

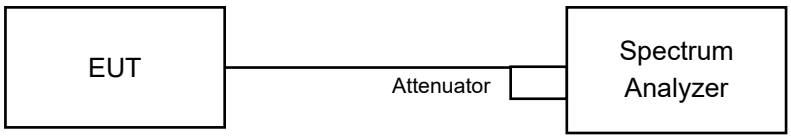
802.11ac (VHT80)

Chan.	Freq. (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
42	5210	14.69	14.73	59.161	17.72	27.14	Pass
155	5775	16.42	17.24	96.819	19.86	27.14	Pass

Note: Beamforming Gain = 5.85 + 10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 30-(8.86-6) = 27.14dBm.

4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.3 Test Procedure

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

4.4.4 Test Result

802.11a

Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
36	5180	16.44	16.56
40	5200	17.28	21.48
48	5240	16.78	17.31
149	5745	23.40	23.64
157	5785	44.88	40.32
165	5825	43.74	36.48

802.11n (HT20)

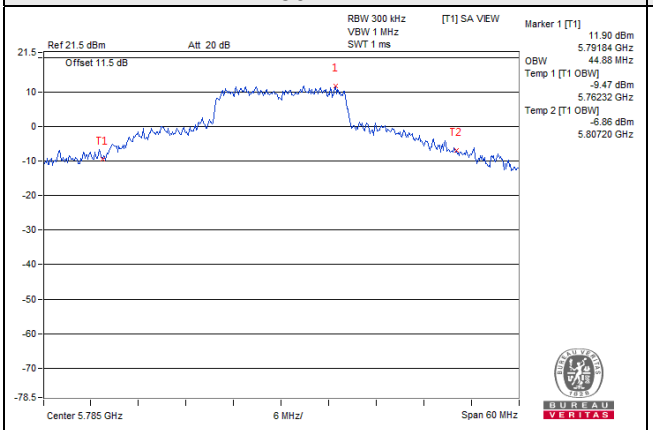
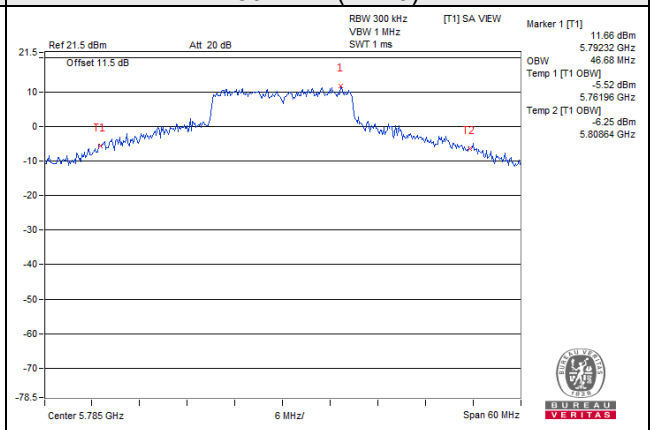
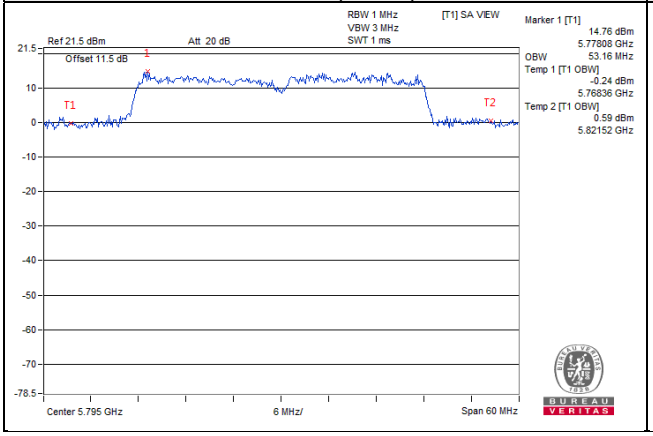
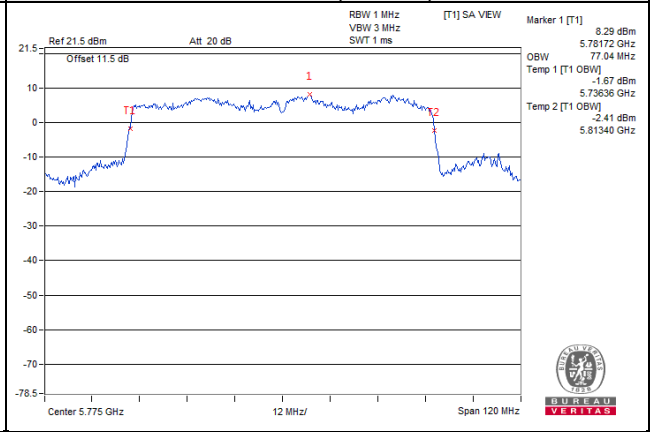
Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
36	5180	17.64	17.64
40	5200	18.24	21.12
48	5240	18.26	18.26
149	5745	26.76	25.68
157	5785	46.68	45.48
165	5825	45.84	38.04

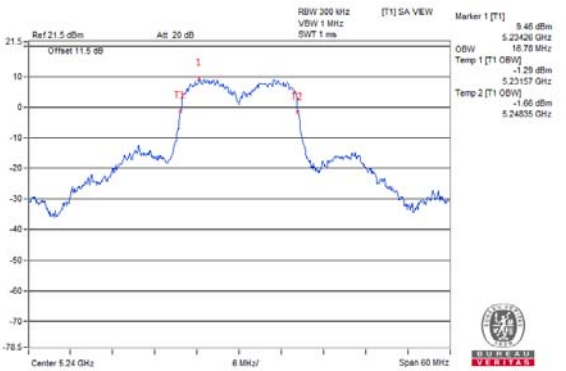
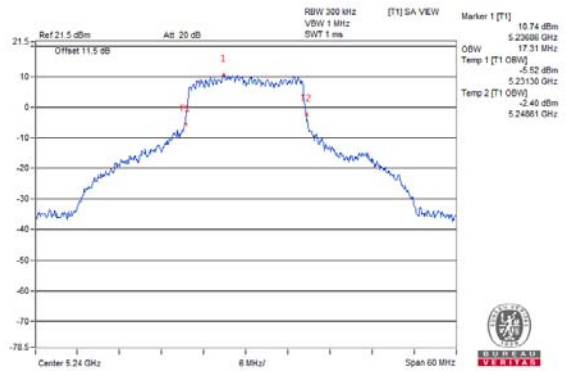
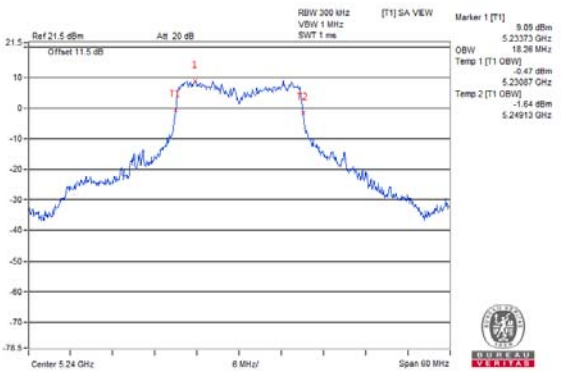
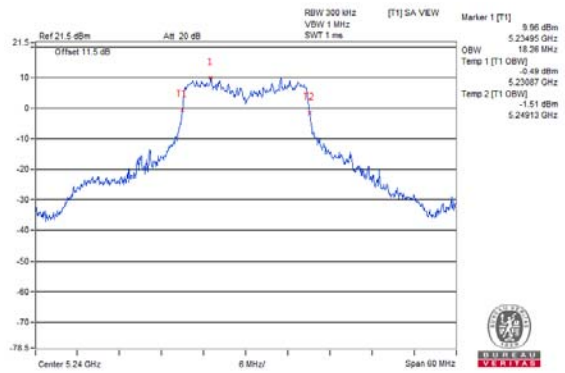
802.11n (HT40)

Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
38	5190	38.28	36.48
46	5230	36.36	37.56
151	5755	50.64	50.52
159	5795	53.16	49.92

802.11ac (VHT80)

Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
42	5210	75.60	76.08
155	5775	77.04	75.60

Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

Spectrum Plot of Worst Value	
802.11a / Chain 0 / Ch 48	802.11a / Chain 1 / Ch 48
	
802.11n (HT20) / Chain 0 / Ch 48	802.11n (HT20) / Chain 1 / Ch 48
	
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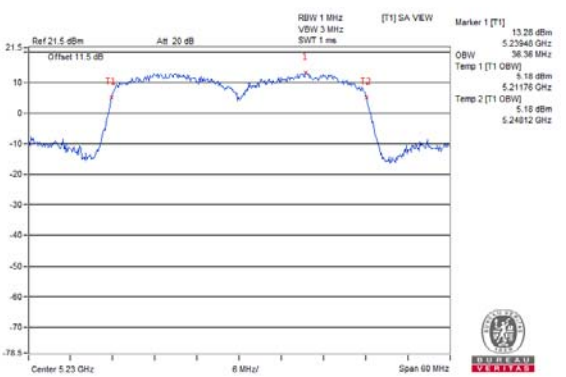
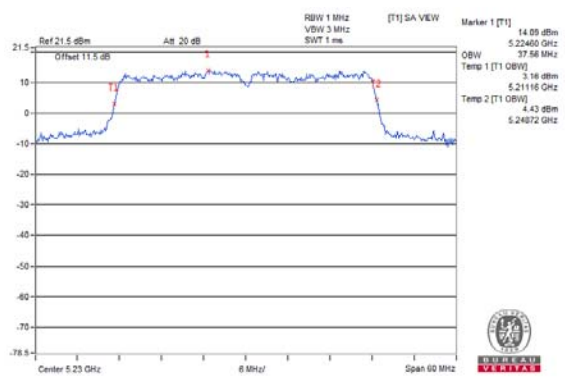
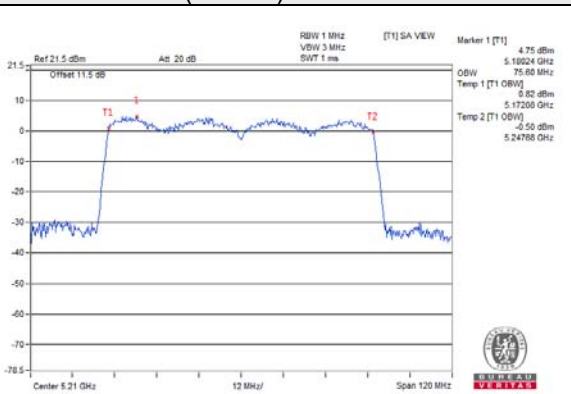
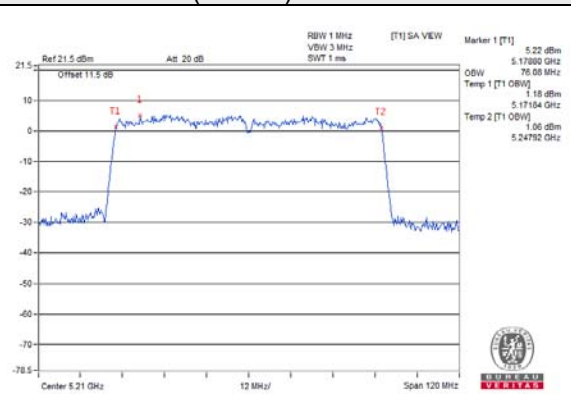
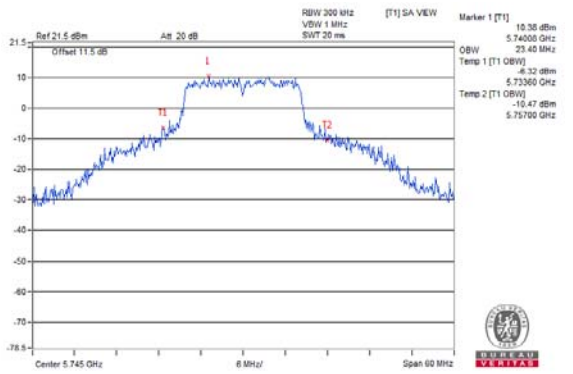
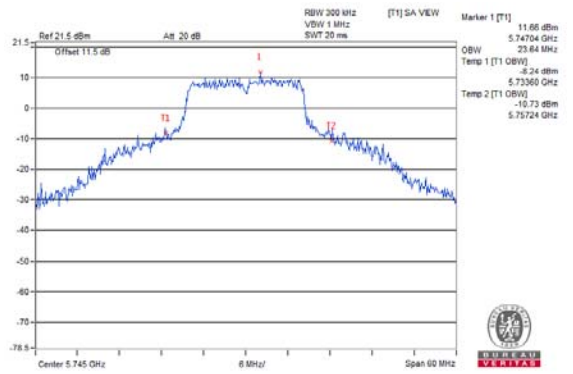
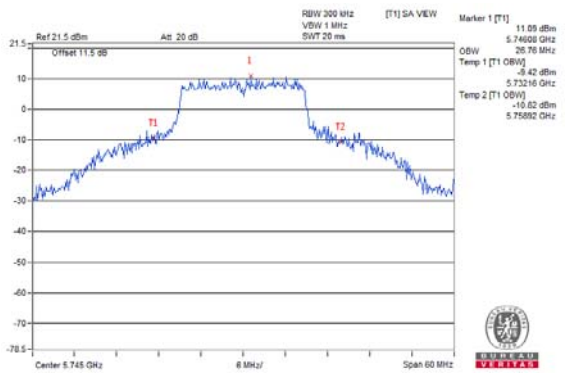
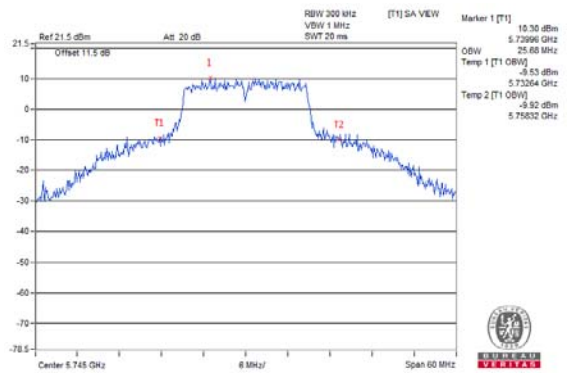
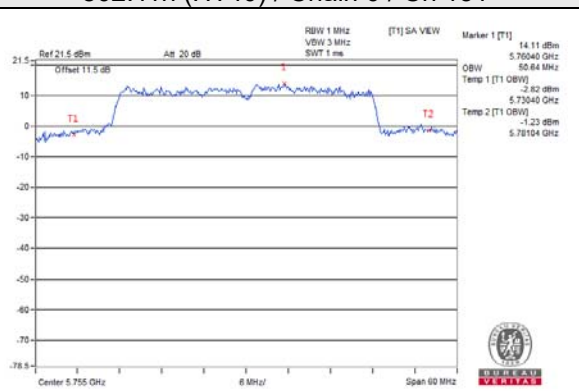
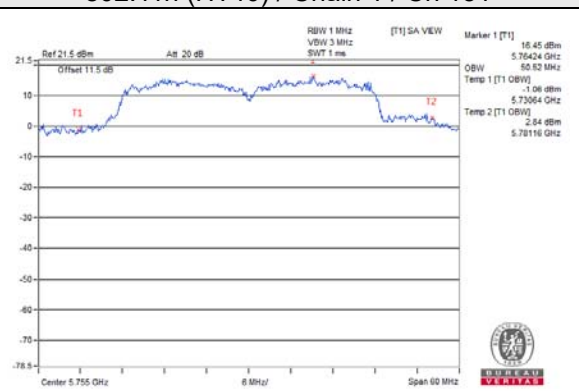
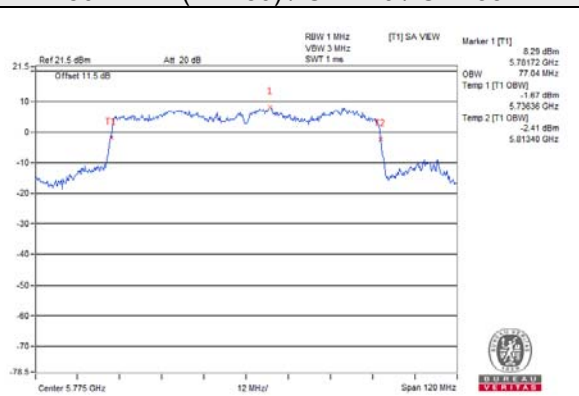
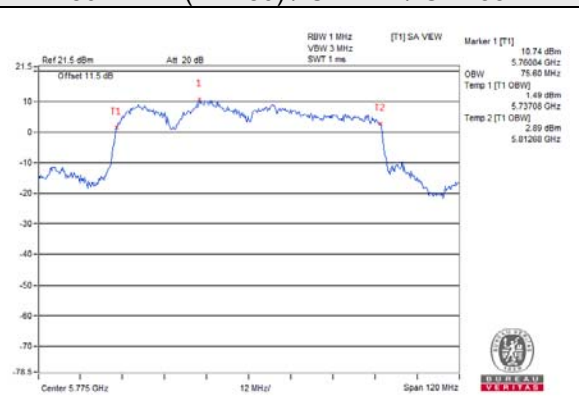
	
802.11ac (VHT80) / Chain 0 / Ch 42	802.11ac (VHT80) / Chain 1 / Ch 42
	

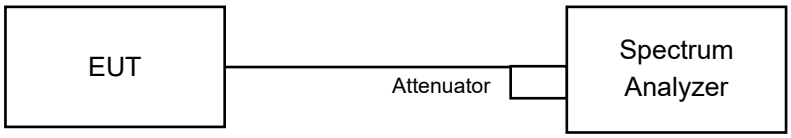
Spectrum Plot of Worst Value	
802.11a / Chain 0 / Ch 149	802.11a / Chain 1 / Ch 149
	
802.11n (HT20) / Chain 0 / Ch 149	802.11n (HT20) / Chain 1 / Ch 149
	
802.11n (HT40) / Chain 0 / Ch 151	802.11n (HT40) / Chain 1 / Ch 151
	
802.11ac (VHT80) / Chain 0 / Ch 155	802.11ac (VHT80) / Chain 1 / Ch 155
	

4.5 Peak Power Spectral Density Measurement

4.5.1 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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedures

For U-NII-1 band:

Duty cycle of test signal is < 98%

Using method SA-2

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.

b. Set RBW = 1MHz, Set VBW ≥ 3 MHz, Detector = RMS

c. Set Channel power measure = 1MHz

d. Sweep time = auto, trigger set to “free run”.

e. Trace average at least 100 traces in power averaging mode.

f. Record the max value and add 10 log (1/duty cycle)

For U-NII-3 band:

Duty cycle of test signal is < 98%

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.

b. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS

c. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.

d. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz / 300 kHz)

e. Sweep time = auto, trigger set to “free run”.

f. Trace average at least 100 traces in power averaging mode.

g. Record the max value and add 10 log (1/duty cycle)

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

Same as 4.3.6.

4.5.7 Test Results

For U-NII-1 Band

802.11a

Chan.	Freq. (MHz)	PSD w/o Duty Factor (dBm/MHz)		Duty Factor (dB)	Total PSD with Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1				
36	5180	2.67	4.42	0.16	6.80	14.14	Pass
40	5200	5.55	6.96	0.16	9.48	14.14	Pass
48	5240	7.90	8.34	0.16	11.30	14.14	Pass

Note:
1. Method E) 2) a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 5.85dBi+10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 17-(8.86-6) = 14.14dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Chan.	Freq. (MHz)	PSD w/o Duty Factor (dBm/MHz)		Duty Factor (dB)	Total PSD with Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1				
36	5180	2.23	4.06	0.40	4.46	14.14	Pass
40	5200	5.11	6.20	0.40	9.10	14.14	Pass
48	5240	7.51	7.76	0.40	11.05	14.14	Pass

Note:
1. Method E) 2) a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 5.85dBi+10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 17-(8.86-6) = 14.14dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

Chan.	Freq. (MHz)	PSD w/o Duty Factor (dBm/MHz)		Duty Factor (dB)	Total PSD with Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1				
38	5190	-0.75	0.18	0.18	2.93	14.14	Pass
46	5230	1.39	2.89	0.18	5.39	14.14	Pass

Note:
1. Method E) 2) a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 5.85dBi+10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 17-(8.86-6) = 14.14dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

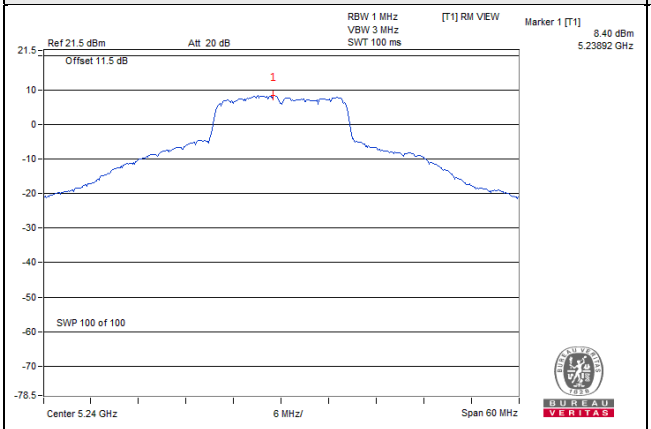
802.11ac (VHT80)

Chan.	Freq. (MHz)	PSD w/o Duty Factor (dBm/MHz)		Duty Factor (dB)	Total PSD with Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1				
42	5210	-5.71	-7.32	0.59	-2.84	14.14	Pass

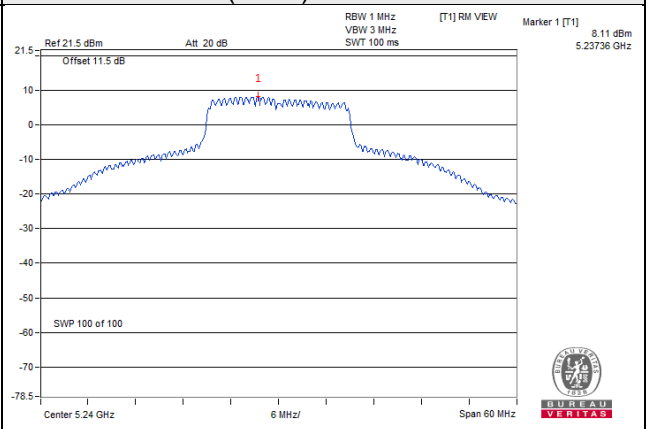
Note:
1. Method E) 2) a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 5.85dBi+10log(2) = 8.86dBi > 6dBi, so the limit shall be reduced to 17-(8.86-6) = 14.14dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

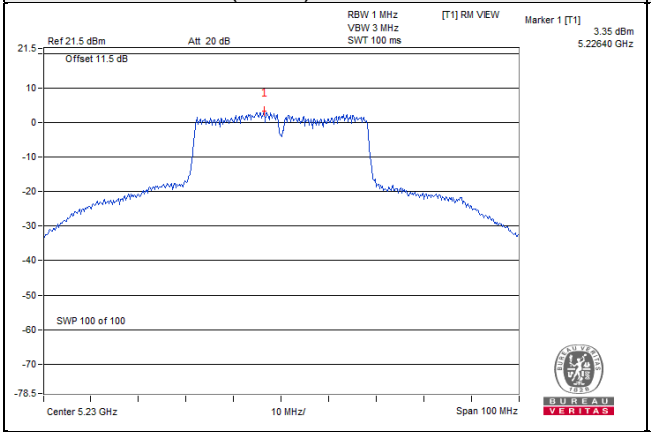
802.11a / Chain 1 / CH 48



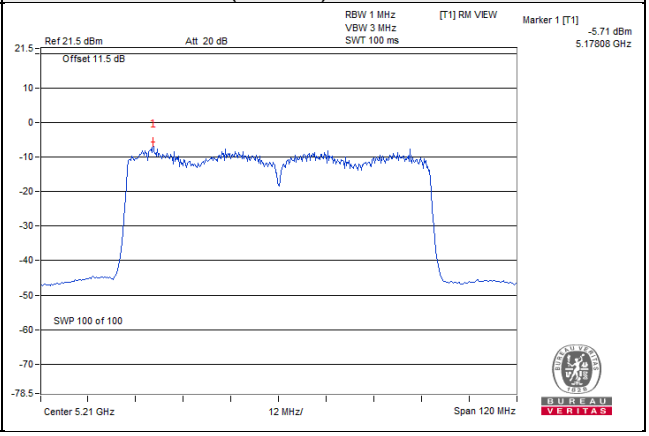
802.11n (HT20) / Chain 1 / CH 48



802.11n (HT40) / Chain 1 / CH 46



802.11ac (VHT80) / Chain 0/ CH 42



For U-NII-3 Band

802.11a

TX chain	Chan.	Freq. (MHz)	PSD W/O Duty Factor		10 log (N=2) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass / Fail
			(dBm/300kHz)	(dBm/500kHz)					
0	149	5745	-1.45	0.77	3.01	0.16	3.94	27.14	Pass
	157	5785	-1.47	0.75	3.01	0.16	3.92	27.14	Pass
	165	5825	-1.21	1.01	3.01	0.16	4.18	27.14	Pass
1	149	5745	0.51	2.73	3.01	0.16	5.90	27.14	Pass
	157	5785	0.28	2.50	3.01	0.16	5.67	27.14	Pass
	165	5825	0.29	2.51	3.01	0.16	5.68	27.14	Pass

Note:
1. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density, Measure and add 10 log (N_{ANT}) dB.
2. Directional gain = 5.85dBi + 10log(2) = 8.86dBi > 6dBi, so the power density limit shall be reduced to 30 - (8.86 - 6) = 27.14dBi.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

TX chain	Chan.	Freq. (MHz)	PSD W/O Duty Factor		10 log (N=2) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass / Fail
			(dBm/300kHz)	(dBm/500kHz)					
0	149	5745	-2.18	0.04	3.01	0.40	3.45	27.14	Pass
	157	5785	-2.14	0.08	3.01	0.40	3.49	27.14	Pass
	165	5825	-2.32	-0.10	3.01	0.40	3.31	27.14	Pass
1	149	5745	0.14	2.36	3.01	0.40	5.77	27.14	Pass
	157	5785	-0.07	2.15	3.01	0.40	5.56	27.14	Pass
	165	5825	0.16	2.38	3.01	0.40	5.79	27.14	Pass

Note:
1. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density, Measure and add 10 log (N_{ANT}) dB.
2. Directional gain = 5.85dBi + 10log(2) = 8.86dBi > 6dBi, so the power density limit shall be reduced to 30 - (8.86 - 6) = 27.14dBi.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

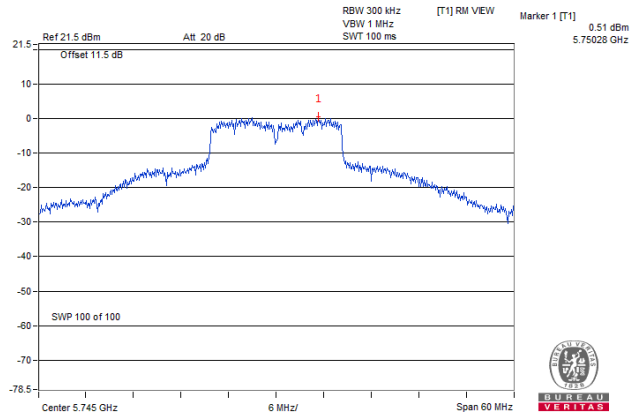
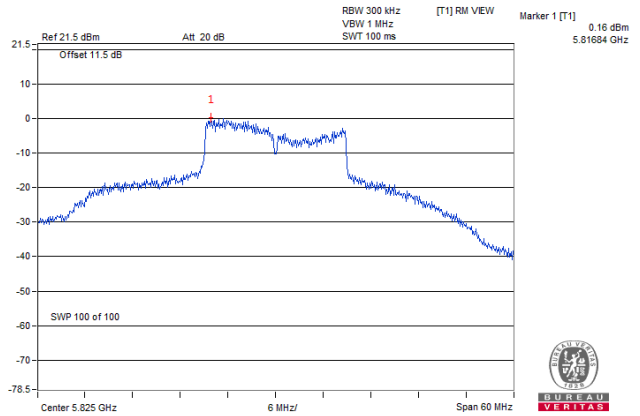
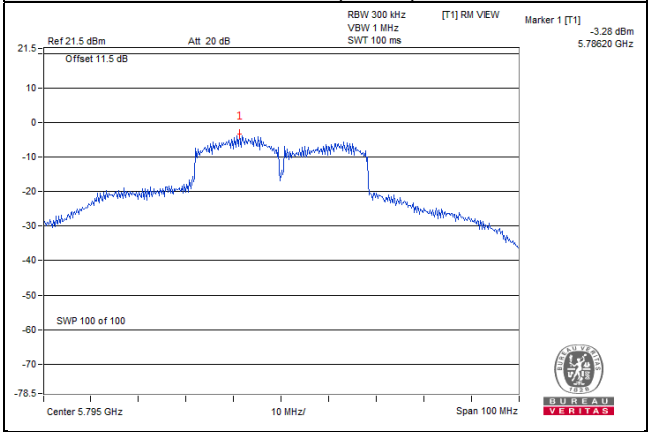
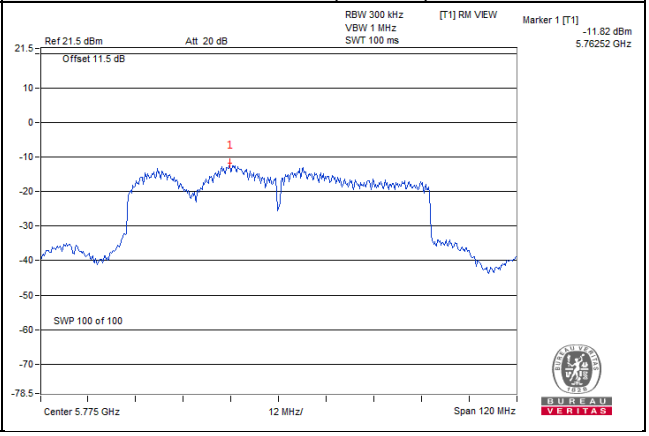
TX chain	Chan.	Freq. (MHz)	PSD W/O Duty Factor		10 log (N=2) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass / Fail
			(dBm/300kHz)	(dBm/500kHz)					
0	151	5755	-6.14	-3.92	3.01	0.18	-0.73	27.14	Pass
	159	5795	-6.00	-3.78	3.01	0.18	-0.59	27.14	Pass
1	151	5755	-5.06	-2.84	3.01	0.18	0.35	27.14	Pass
	159	5795	-3.28	-1.06	3.01	0.18	2.13	27.14	Pass

Note:
1. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density, Measure and add 10 log (N_{ANT}) dB.
2. Directional gain = 5.85dBi + 10log(2) = 8.86dBi > 6dBi, so the power density limit shall be reduced to 30 - (8.86 - 6) = 27.14dBi.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (VHT80)

TX chain	Chan.	Freq. (MHz)	PSD W/O Duty Factor		10 log (N=2) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass / Fail
			(dBm/300kHz)	(dBm/500kHz)					
0	155	5775	-13.45	-11.23	3.01	0.59	-7.63	27.14	Pass
1	155	5775	-11.82	-9.60	3.01	0.59	-6.00	27.14	Pass

Note:
1. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density, Measure and add 10 log (N_{ANT}) dB.
2. Directional gain = 5.85dBi + 10log(2) = 8.86dBi > 6dBi, so the power density limit shall be reduced to 30 - (8.86 - 6) = 27.14dBi.
3. Refer to section 3.3 for duty cycle spectrum plot.

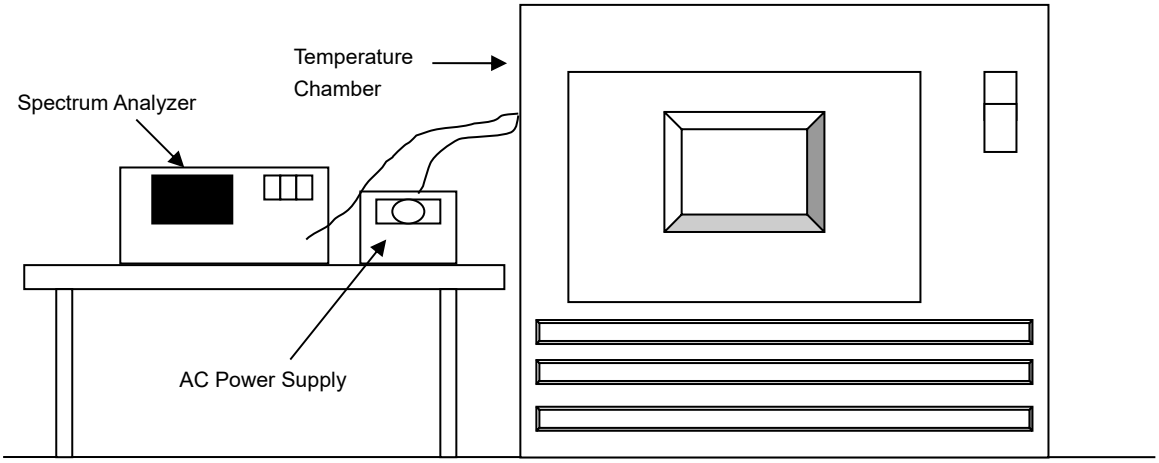
Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

4.6 Frequency Stability

4.6.1 Limits of Frequency Stability Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 23, 2019	Sep. 22, 2020
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 03, 2019	Jun. 02, 2020
Digital Multimeter Fluke	87-III	70360742	Jun. 27, 2019	Jun. 26, 2020
AC Power Supply Extech	6905S	1991553	NA	NA
True RMS Clamp Meter / Fluke	325	31130711WS	May 21, 2019	May 20, 2020

4.6.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.

b. Turn the EUT on and couple its output to a spectrum analyzer.

c. Turn the EUT off and set the chamber to the highest temperature specified.

d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.

e. Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.

f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

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

4.6.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5180MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
40	120	5179.9916	PASS	5179.9885	PASS	5179.9918	PASS	5179.9931	PASS
30	120	5180.0107	PASS	5180.0129	PASS	5180.0131	PASS	5180.0128	PASS
20	120	5180.0097	PASS	5180.0106	PASS	5180.0092	PASS	5180.0102	PASS
10	120	5179.9930	PASS	5179.9916	PASS	5179.9929	PASS	5179.9895	PASS
0	120	5179.9999	PASS	5179.9968	PASS	5179.9979	PASS	5179.9972	PASS

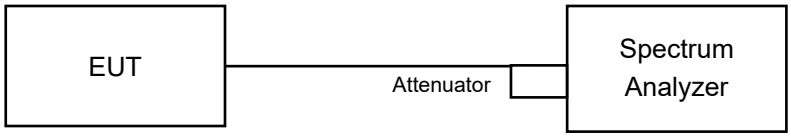
Frequency Stability Versus Voltage									
Operating Frequency: 5180MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
20	138	5180.0094	PASS	5180.0116	PASS	5180.0084	PASS	5180.0101	PASS
	120	5180.0097	PASS	5180.0106	PASS	5180.0092	PASS	5180.0102	PASS
	102	5180.0097	PASS	5180.0102	PASS	5180.0088	PASS	5180.0106	PASS

4.7 6dB Bandwidth Measurement

4.7.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

Measurement Procedure REF

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

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

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

4.7.7 Test Results

802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
149	5745	16.36	15.77	0.5	Pass
157	5785	16.36	15.76	0.5	Pass
165	5825	16.35	15.71	0.5	Pass

802.11n (HT20)

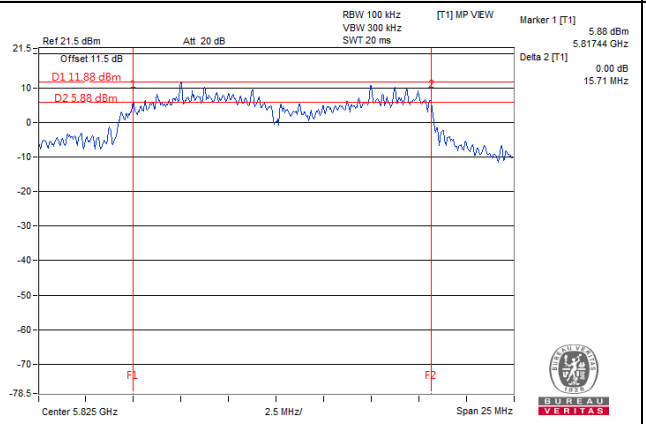
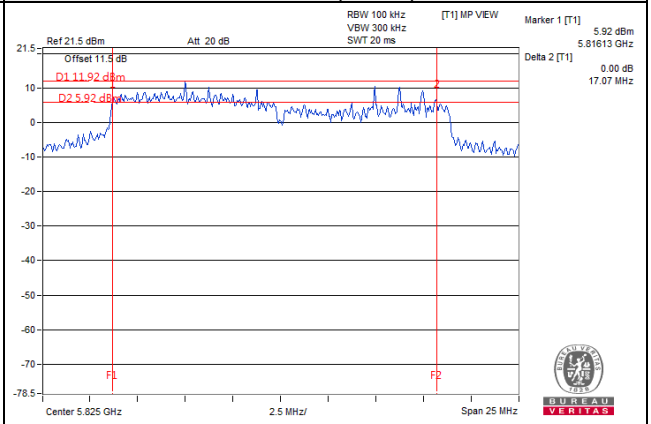
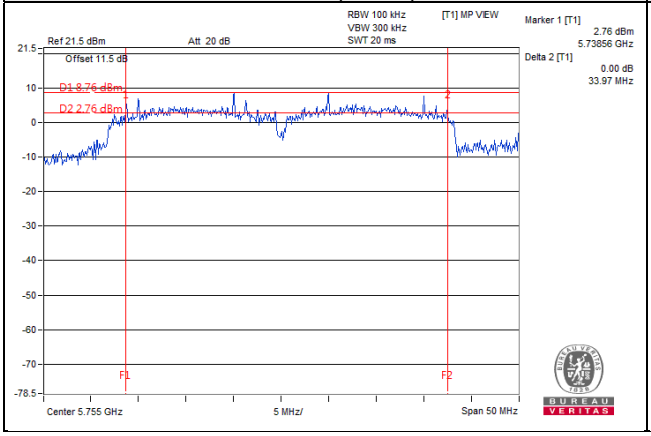
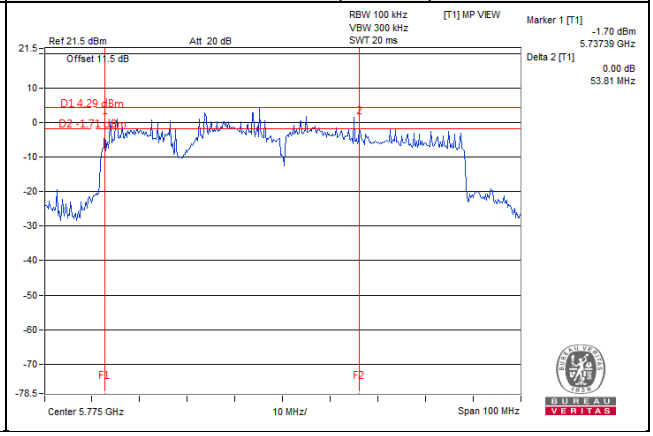
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
149	5745	17.66	17.64	0.5	Pass
157	5785	17.67	17.65	0.5	Pass
165	5825	17.68	17.07	0.5	Pass

802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
151	5755	35.85	33.97	0.5	Pass
159	5795	35.79	35.47	0.5	Pass

802.11ac (VHT80)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
155	5775	75.64	53.81	0.5	Pass

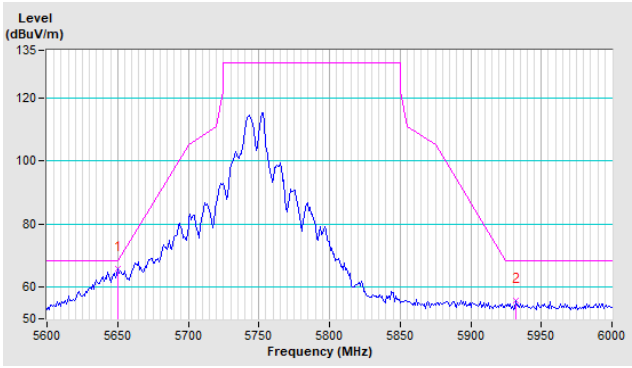
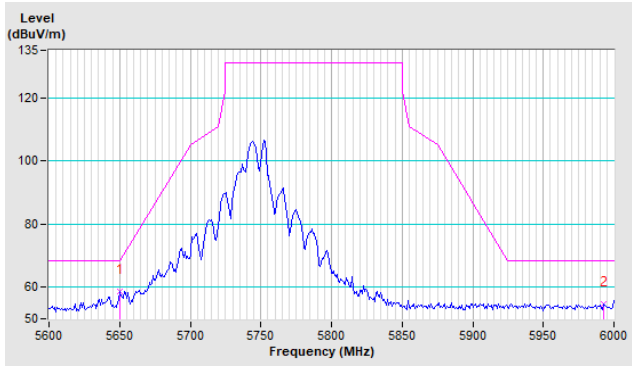
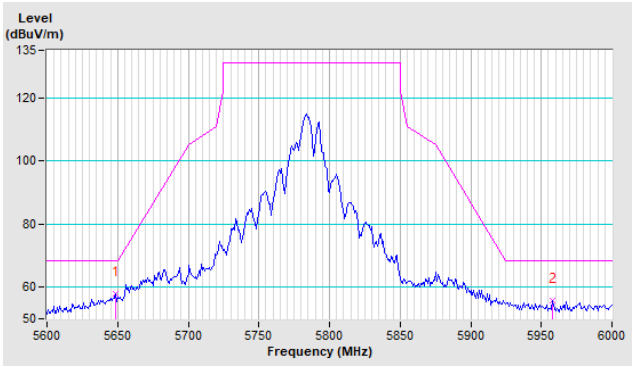
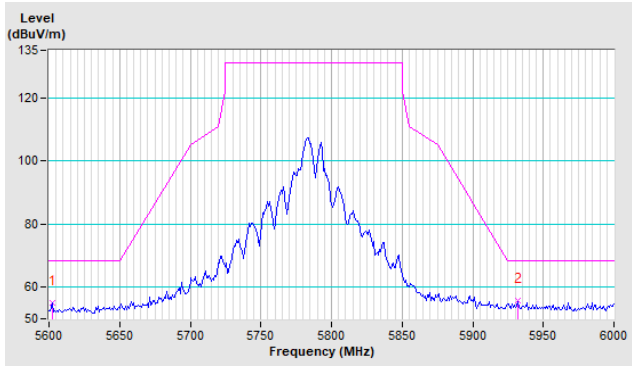
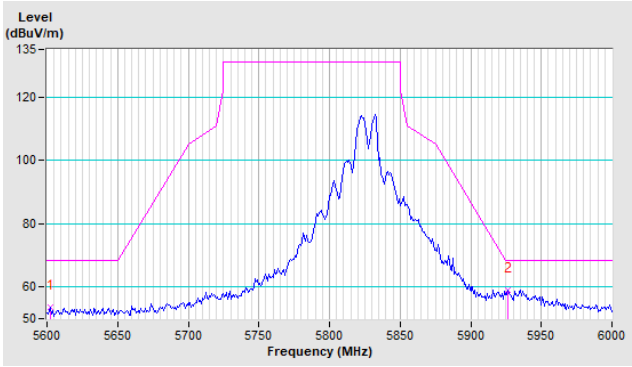
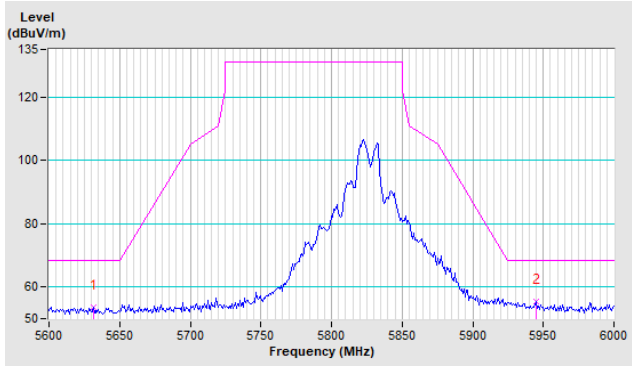
Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

5 Pictures of Test Arrangements

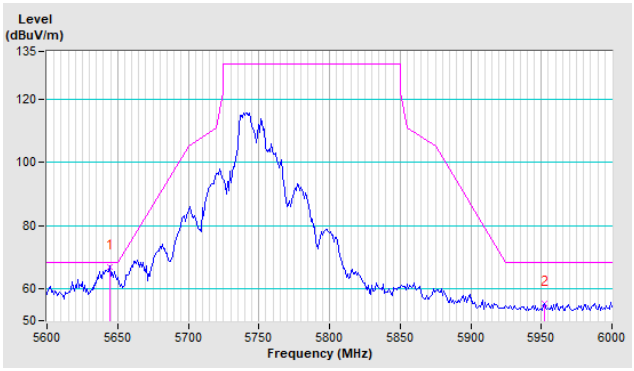
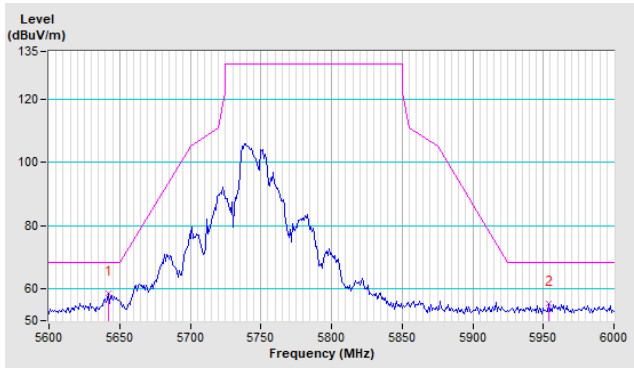
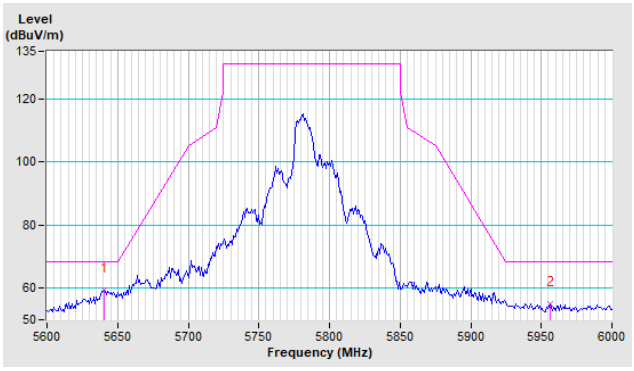
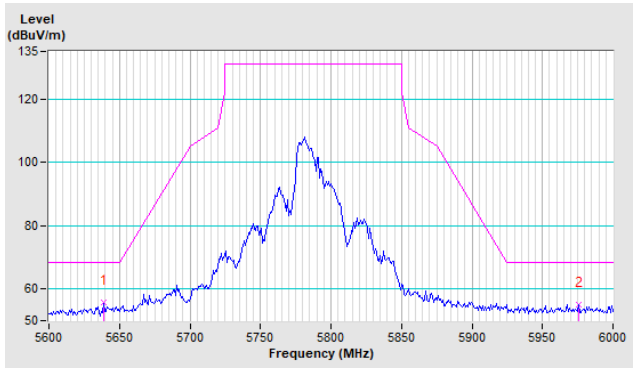
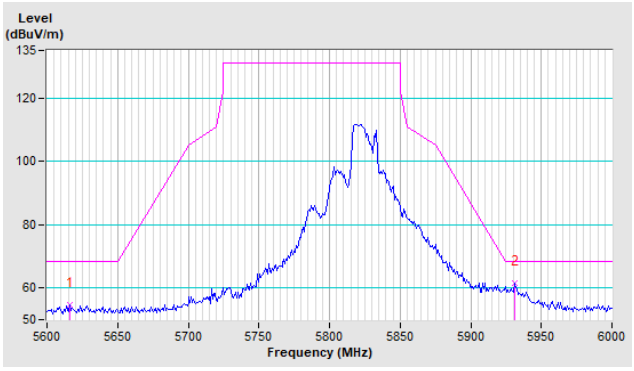
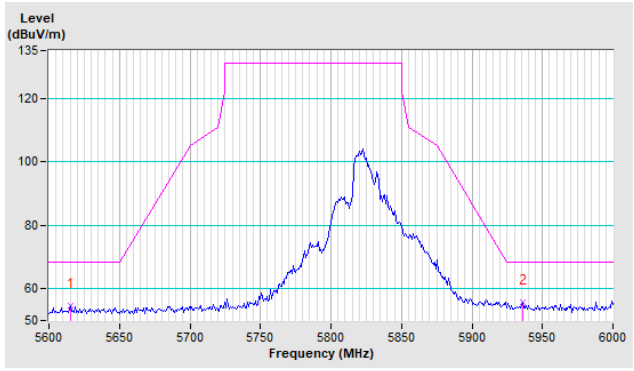
Please refer to the attached file (Test Setup Photo).

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

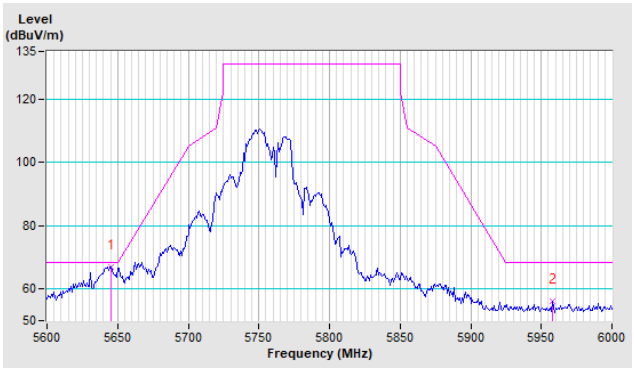
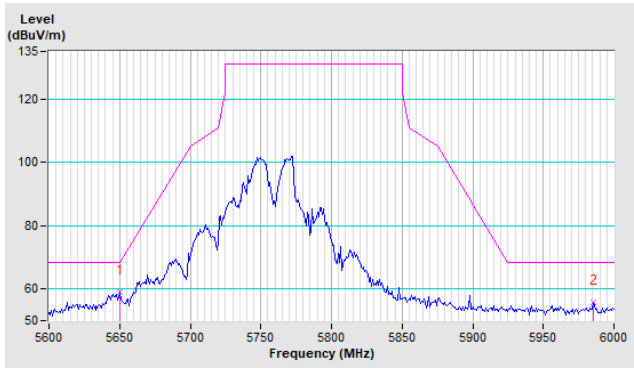
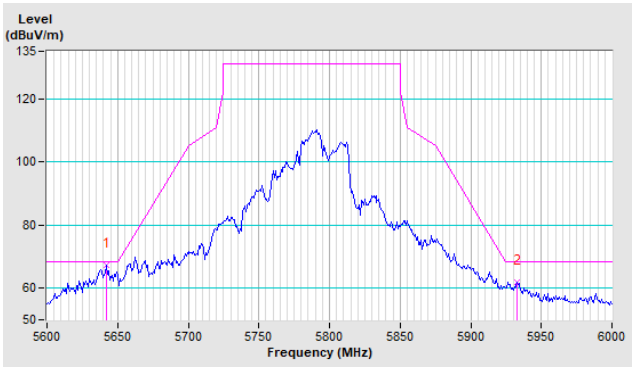
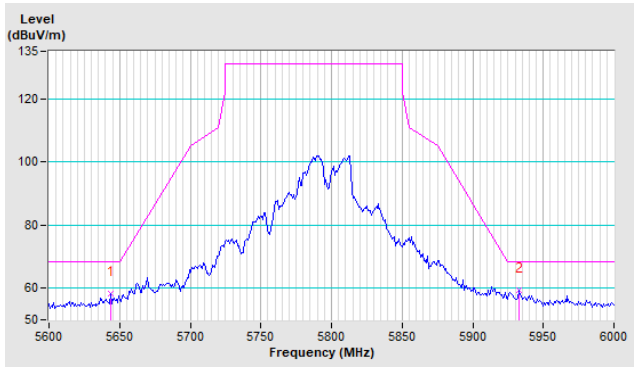
802.11a

CH149	
Horizontal	Vertical
	
CH157	
Horizontal	Vertical
	
CH165	
Horizontal	Vertical
	

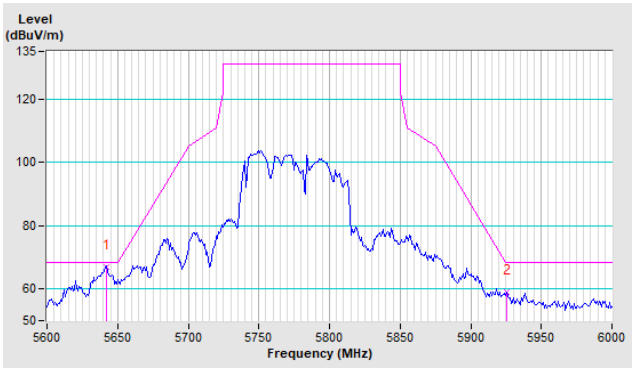
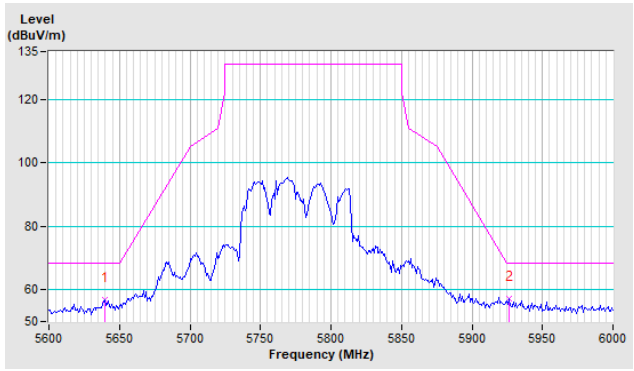
802.11n (HT20)

CH149	
Horizontal	Vertical
	
CH157	
Horizontal	Vertical
	
CH165	
Horizontal	Vertical
	

802.11n (HT40)

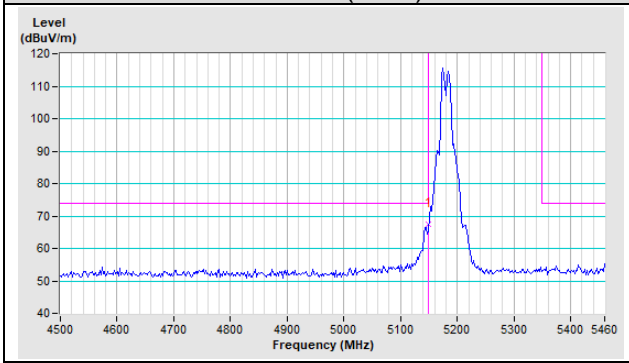
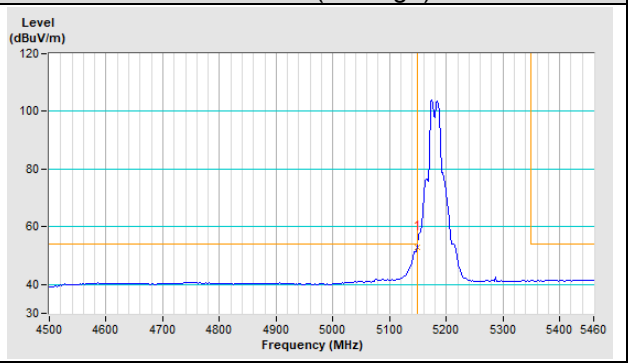
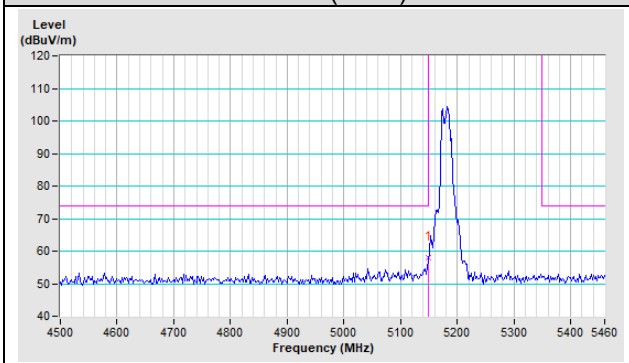
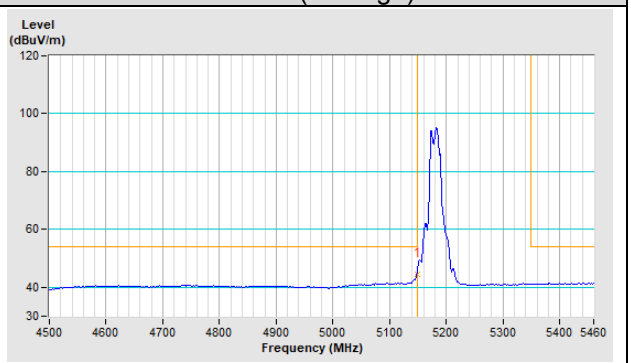
CH151	
Horizontal	Vertical
	
CH159	
Horizontal	Vertical
	

802.11ac (VHT80)

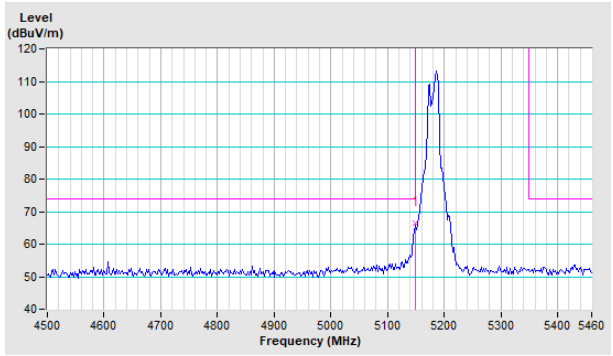
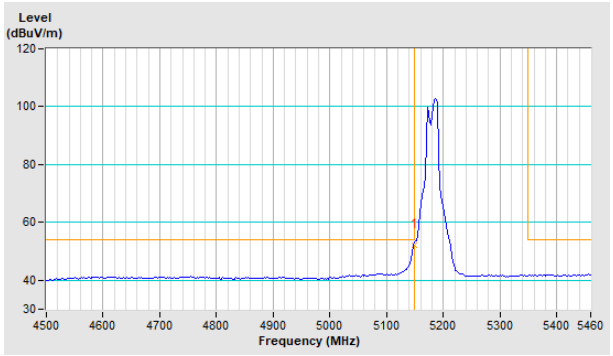
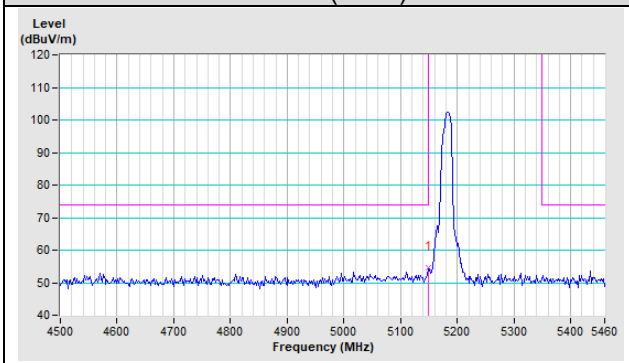
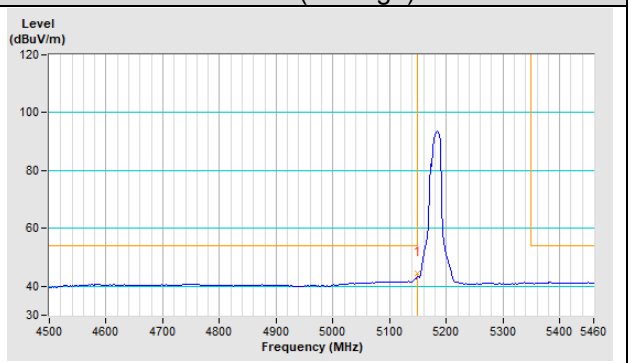
CH155	
Horizontal	Vertical
	

Annex B- Band Edge Measurement

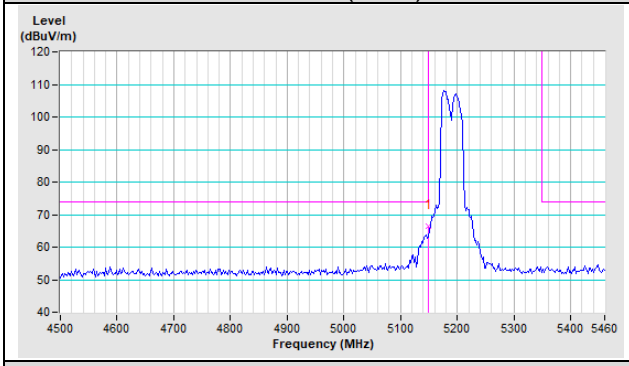
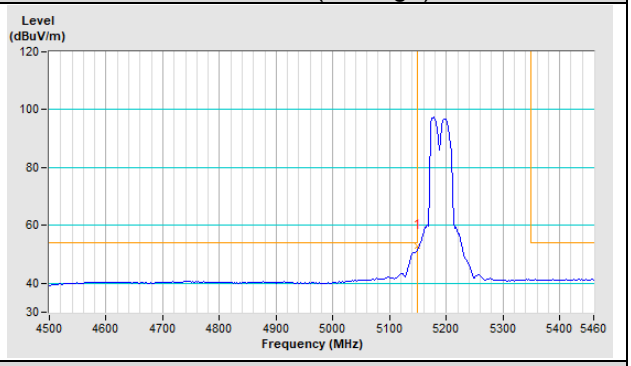
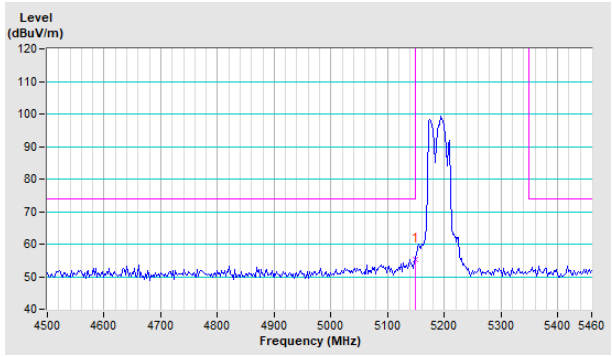
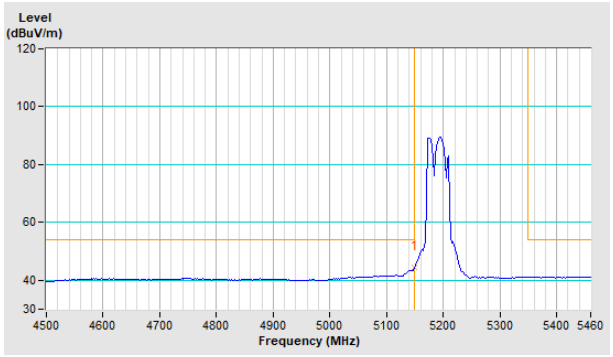
802.11a

Channel 36	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

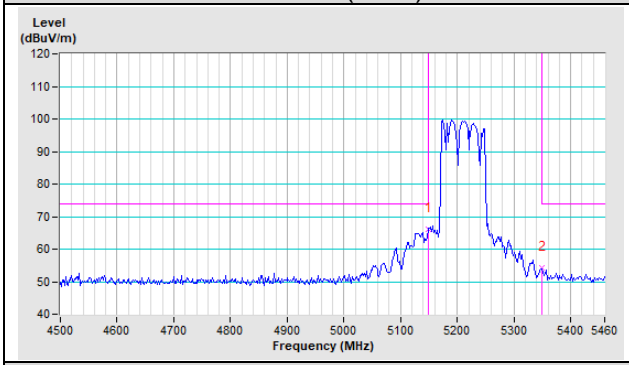
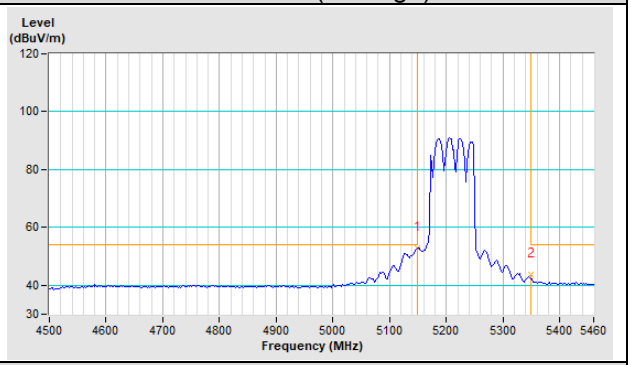
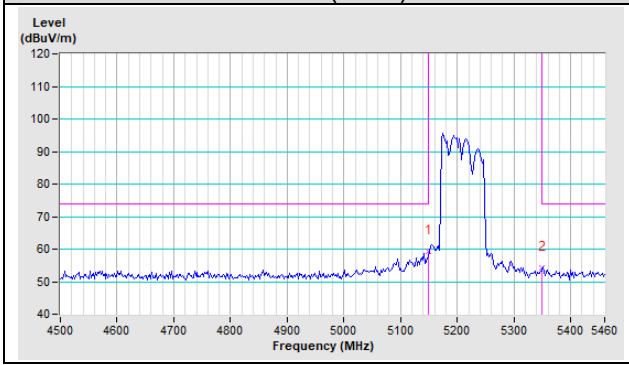
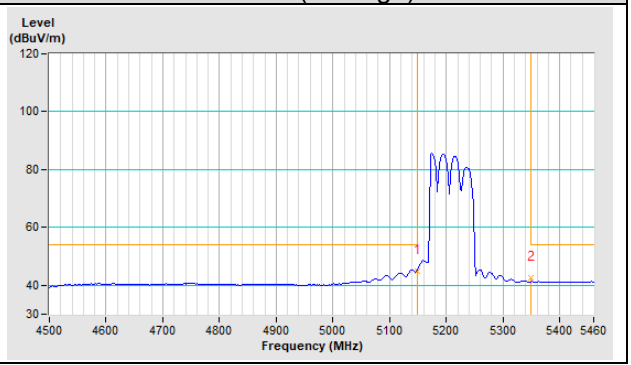
802.11n (HT20)

Channel 36	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

802.11n (HT40)

Channel 38	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

802.11ac (VHT80)

Channel 42	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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

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