Partial FCC Test Report

(Spot Check)

Report No.:	RF200428C03E-1
FCC ID:	PZWBHTM80QW
Test Model:	BHT-M80-QW
Received Date:	Aug. 25, 2020
Test Date:	Sep. 05 ~ Oct. 24, 2020
Issued Date:	Oct. 27, 2020
Applicant:	DENSO WAVE INCORPORATED
Address:	1 Yoshiike Kusagi Agui-cho,Chita-gun Aichi 470-2297, Japan
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
RF200428C03E-1	Original release	Oct. 27, 2020

1 Certificate of Conformity

Product:	2D Code Handy Terminal
Brand:	DENSO
Test Model:	BHT-M80-QW
Sample Status:	Engineering sample
Applicant:	DENSO WAVE INCORPORATED
Test Date:	Sep. 05 ~ Oct. 24, 2020
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:** Oct. 27, 2020

Polly Chien / Specialist

Approved by : Bruce Chen , **Date:** Oct. 27, 2020

Bruce Chen / Senior 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)(6)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -14.45dB at 0.39633MHz.
15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.5dB at 5460.00MHz.
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	N/A	Refer to note 1
15.407(g)	Frequency Stability	N/A	Refer to note 1
15.203	Antenna Requirement	Pass	Antenna connector is spring not a standard connector.

Note:
1. This report is a partial report. Therefore, only Output Power, Power Spectral Density, AC Power Conducted Emission and Radiated Emissions were verified and recorded in this report. Other testing data please refer to the original BV CPS report no.: RF200428C03-4.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
3. For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOBE test plots were recorded in Annex A.
4. For U-NII-1, U-NII-2A and U-NII-2C 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	3.59 dB
	200MHz ~1000MHz	3.60 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	2D Code Handy Terminal
Brand	DENSO
Test Model	BHT-M80-QW
Sample Status	Engineering sample
Power Supply Rating	3.85Vdc (Battery) 5.0Vdc / 9.0Vdc / 12.0Vdc (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 866.7Mbps
Operating Frequency	5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5720MHz, 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 5260 ~ 5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5500 ~ 5720MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 12 802.11n (HT40), 802.11ac (VHT40): 6 802.11ac (VHT80): 3 5745 ~ 5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1
Output Power	5180 ~ 5240MHz: 233.106mW 5260 ~ 5320MHz: 194.406mW 5500 ~ 5720MHz: 198.561mW 5745 ~ 5825MHz: 88.113mW
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	Refer to note
Cable Supplied	Refer to note

Note:

1. This report is a supplementary report to the original BV CPS report no.: RF200428C03-4. Exhibit prepared for FCC Spot Check Verification report, the format, test items and amount of spot-check test data are decided by applicant's engineering judgment, for more details please refer to declaration letter exhibit. Therefore, only Output Power, Power Spectral Density, AC Power Conducted Emission and Radiated Emissions were verified and recorded in this report. AC Power Conducted Emission and Radiated Emission tests according to original report radiated emission worst channel.
2. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function
802.11a	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX
802.11ac (VHT20)	2TX
802.11ac (VHT40)	2TX
802.11ac (VHT80)	2TX

* The bandwidth and modulation are similar for HT20/HT40 on 802.11n mode and VHT20/VHT40 on 802.11ac mode. Therefore the investigated worst case is the representative mode in test report. (Final test mode refer section 3.2.1)

3. The EUT contains following accessory devices.

Battery 1	
Brand	DENSO
Model	BT1
Rating	3.85Vdc, 4020mAh, 15.47Wh

Battery 2	
Brand	DENSO
Model	BT1S
Rating	3.85Vdc, 2900mAh, 11.16Wh

Adapter	
Brand	CHANNEL WELL TECHNOLOGY
Model	2ACP0183C
Input Power	100-240Vac~0.5A , 50/60Hz
Output Power	5.0Vdc / 3.0A, 15.0W 9.0Vdc / 2.0A, 18.0W 12.0Vdc / 1.5A, 18.0W
Data Cable	1.45 m shielded USB cable without core

Cradle 1: QC3.0 charge single Cradle (Option)	
Brand	DENSO
Model	CU-M80UQ
Adapter	
Brand	CHANNEL WELL TECHNOLOGY
Model	2ACP0183C
Input Power	100-240Vac, 50/60Hz, 0.5A
Output Power	5.0Vdc / 3.0A, 15.0W 9.0Vdc / 2.0A, 18.0W 12.0Vdc / 1.5A, 18.0W
Data Cable	1.45 m shielded USB cable without core

Cradle 2: USB Cradle with spare battery charge (Option)	
Brand	DENSO
Model	CU-M80U
Adapter	
Brand	Sunny
Model	SYS1548-5012-T3
Input Power	100-240Vac, 1.5A MAX, 50-60Hz
Output Power	+12.0Vdc, 4.16A
Power cable	DC: 1.16m cable with one core AC: 1.71m non-shielded cable without core
Data Cable	1.45 m shielded USB cable without core

4. The EUT uses the following antennas.

Ant. Type	PIFA												
Ant. Connector	Spring												
Ant. 1 (WLAN)													
Frequency (MHz)	2412	2442	2484	5170	5180	5220	5320	5420	5520	5620	5720	5825	5835
Peak Gain (dBi)	0.81	1.36	1.05	3.34	2.97	2.96	2.78	2.88	3.28	3.24	3.45	3.18	3.39
Ant. 1 (BT)													
Frequency (MHz)	2402			2412			2442			2480			
Peak Gain (dBi)	-0.11			0.81			1.36			1.36			
Ant. 2 (WLAN)													
Frequency (MHz)	2412	2442	2484	5170	5180	5220	5320	5420	5520	5620	5720	5825	5835
Peak Gain (dBi)	1.33	1.47	0.29	3.80	3.78	3.65	3.51	2.98	2.99	3.09	3.49	3.53	3.44

* The max. gain was chosen for final tests.
* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

For 5180 ~ 5240MHz:

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

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

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

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

For 5260 ~ 5320MHz:

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

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

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

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
58	5290MHz

For 5500 ~ 5720MHz:

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

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	144	5720 MHz

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

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channels are provided for 802.11ac (VHT80):

Channel	Frequency	Channel	Frequency
106	5530 MHz	122	5610 MHz
138	5690 MHz		

For 5745 ~ 5825MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	√	√	EUT with adapter
B	-	√	√	-	EUT with Cradle 1
C	-	√	√	-	EUT with Cradle 2

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

1. Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane** for mode A.
2. "-"means no effect.

Radiated Emission Test (Above 1GHz):

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

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

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
A	802.11a	5180-5240	36 to 48	36	OFDM	6.0
A	802.11ac (VHT80)	5260-5320	58	58	OFDM	29.3
A	802.11ac (VHT80)	5500-5720	106 to 138	106	OFDM	29.3
A	802.11ac (VHT80)	5745-5825	155	155	OFDM	29.3

Radiated Emission Test (Below 1GHz):

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

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

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
A, B, C	802.11a	36 to 48	36, 40, 48	36	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)
A, B, C	802.11a	36 to 48	36, 40, 48	36	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)
A	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	29.3
A	802.11a	5260-5320	52 to 64	52, 60, 64	OFDM	6.0
	802.11n (HT20)		52 to 64	52, 60, 64	OFDM	6.5
	802.11n (HT40)		54 to 62	54, 62	OFDM	13.5
	802.11ac (VHT80)		58	58	OFDM	29.3
A	802.11a	5500-5720	100 to 144	100, 116, 140, 144	OFDM	6.0
	802.11n (HT20)		100 to 144	100, 116, 140, 144	OFDM	6.5
	802.11n (HT40)		102 to 142	102, 110, 134, 142	OFDM	13.5
	802.11ac (VHT80)		106 to 138	106, 122, 138	OFDM	29.3
A	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	29.3

Test Condition:

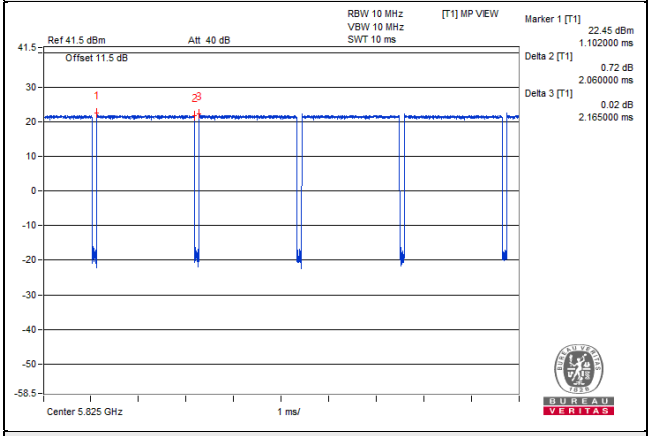
Applicable to	Environmental Conditions	Input Power	Tested by
RE≥1G	22 deg. C, 66% RH	120Vac, 60Hz	Greg Lin
RE<1G	22 deg. C, 66% RH 25 deg. C, 70% RH	120Vac, 60Hz	Greg Lin, Noah Chang
PLC	25 deg. C, 75% RH 26 deg. C, 69% RH	120Vac, 60Hz	Greg Lin, Willy Cheng
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Ivan Tseng

3.3 Duty Cycle of Test Signal

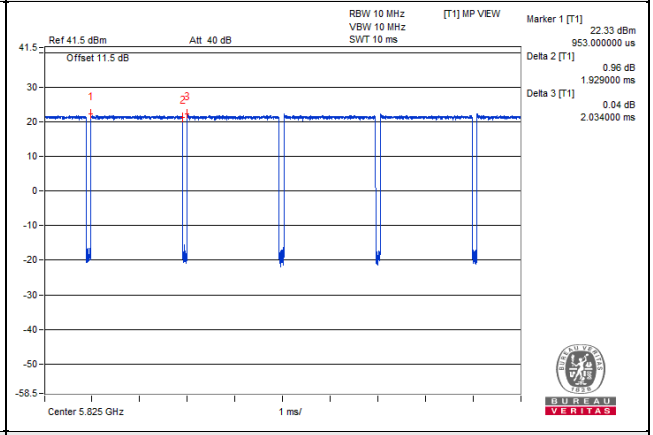
Duty cycle of test signal is < 98%, duty factor is required.

802.11a: Duty cycle = 2.060/2.165 = 0.952, Duty factor = 10 * log (1/0.952) = 0.22
802.11n (HT20): Duty cycle = 1.929/2.034 = 0.948, Duty factor = 10 * log (1/0.948) = 0.23
802.11n (HT40): Duty cycle = 0.945/1.052 = 0.898, Duty factor = 10 * log (1/0.898) = 0.47
802.11ac (VHT80): Duty cycle = 0.464/0.570 = 0.814, Duty factor = 10 * log (1/0.814) = 0.89

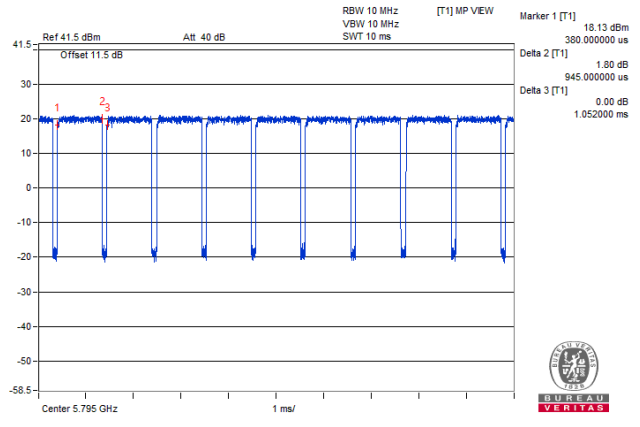
802.11a



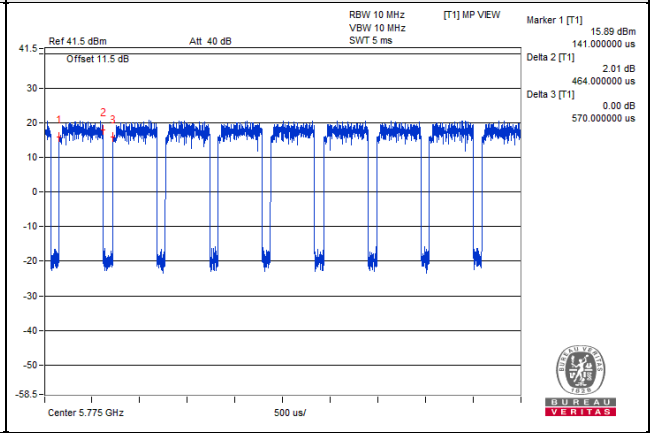
802.11n (HT20)



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.

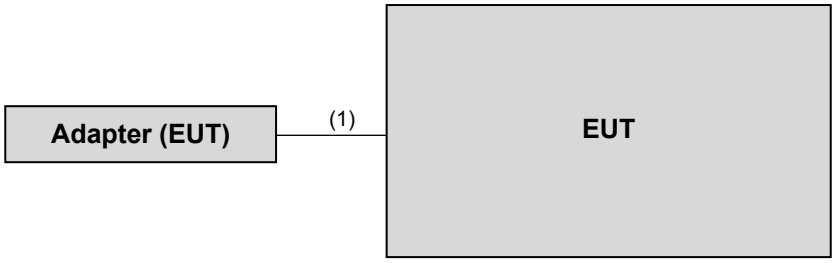
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Cradle 1	DENSO	CU-M80UQ	NA	NA	Provided by manufacturer
B.	Adapter	CHANNEL WELL TECHNOLOGY	2ACP0183C	NA	NA	Provided by manufacturer
C.	Cradle 2	DENSO	CU-M80U	NA	NA	Provided by manufacturer
D.	Adapter	Sunny	SYS1548-5012-T3	NA	NA	Provided by manufacturer

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1.45	Y	0	Accessory of EUT
2.	USB cable	1	1.45	Y	0	Provided by manufacturer
3.	USB cable	1	1.45	Y	0	Provided by manufacturer
4.	Power cable	1	1.16	-	1	Provided by manufacturer

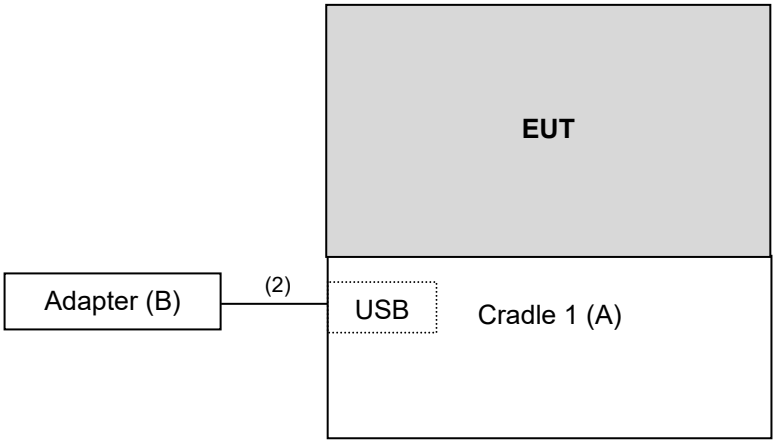
Note: The core(s) is(are) originally attached to the cable(s).

3.4.1 Configuration of System under Test

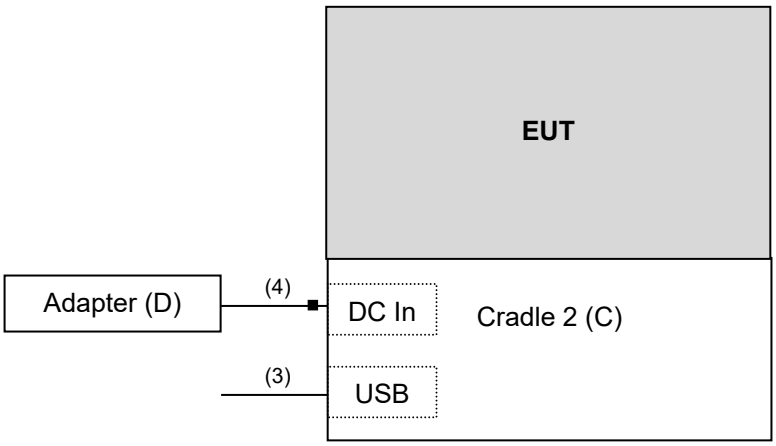
Mode A



Mode B



Mode C



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:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 16, 2020	Apr. 15, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jun. 12, 2020	Jun. 11, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100979	Mar. 18, 2020	Mar. 17, 2021
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 07, 2019	Nov. 06, 2020
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	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. 06, 2020	Jul. 05, 2021
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jun. 08, 2020	Jun. 07, 2021
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 18, 2020	Feb. 17, 2021
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 18, 2020	Jan. 17, 2021
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Jan. 18, 2020	Jan. 17, 2021
RF signal cable Woken	8D-FB	Cable-CH9-01	Jun. 08, 2020	Jun. 07, 2021
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 13, 2020	Jul. 12, 2021
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Sep. 04, 2020	Sep. 03, 2021

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 9.

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 detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

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

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

3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz. (802.11a: RBW = 1MHz, VBW = 1kHz; 802.11n (HT20): RBW = 1MHz, VBW = 1kHz; 802.11n (HT40): RBW = 1MHz, VBW = 3kHz; 802.11ac (VHT80): RBW = 1MHz, VBW = 3kHz)

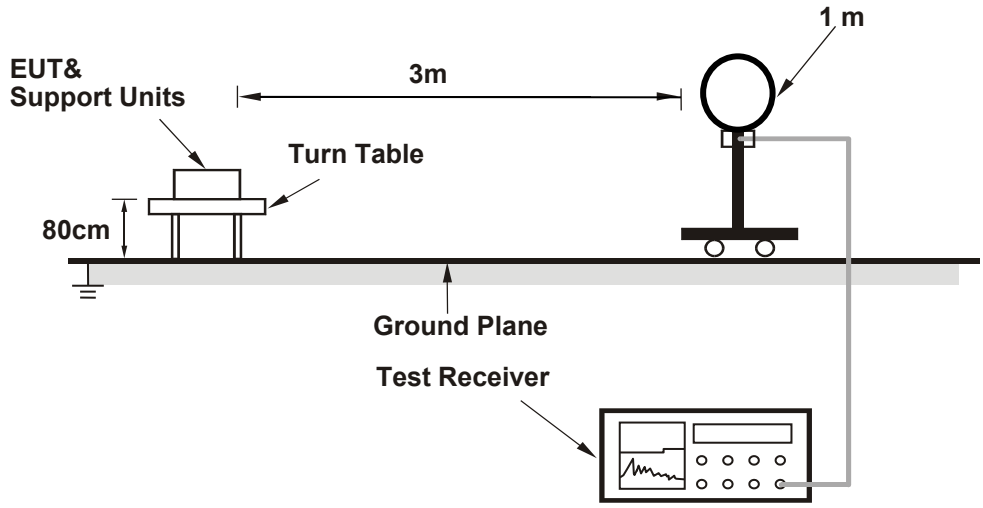
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

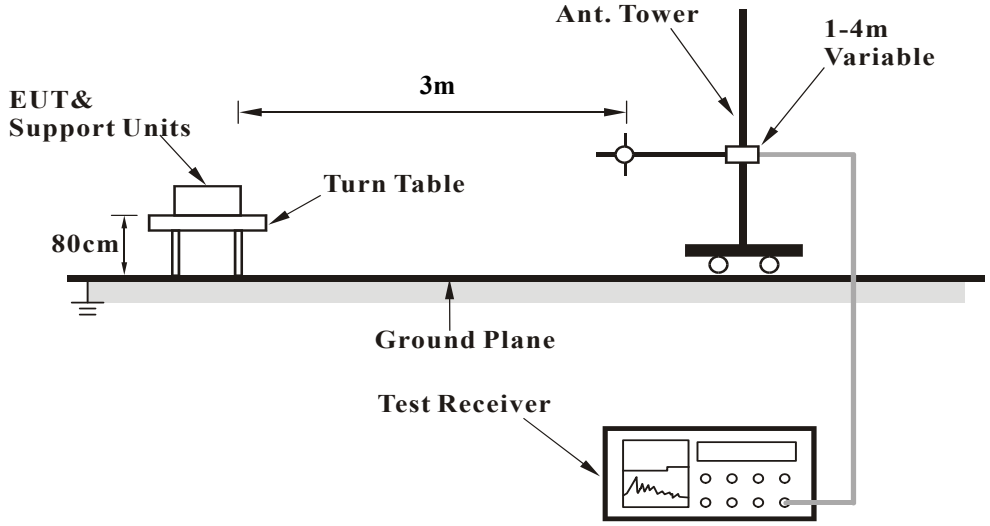
No deviation.

4.1.5 Test Setup

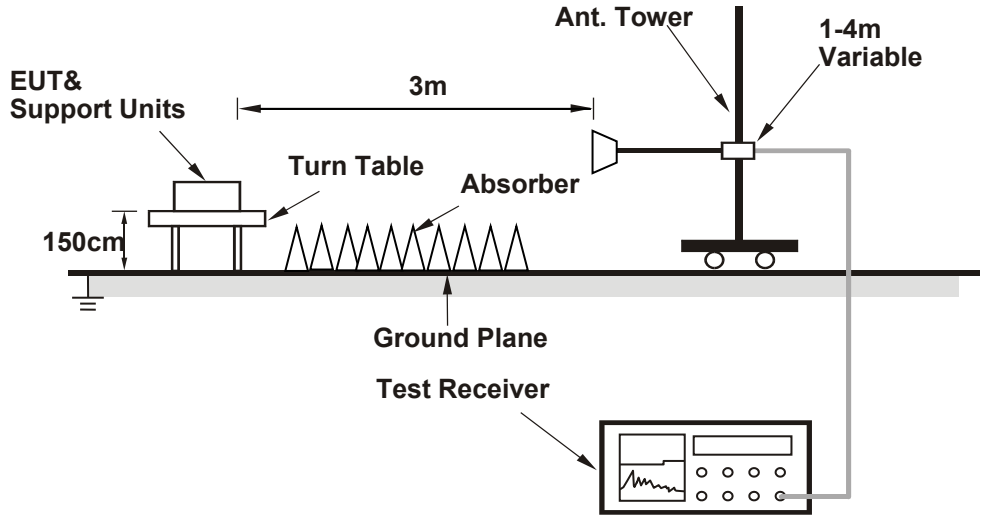
For Radiated emission below 30MHz



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. The EUT under transmission condition continuously at specific channel frequency.

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	59.6 PK	74.0	-14.4	1.32 H	65	57.5	2.1
2	5150.00	45.9 AV	54.0	-8.1	1.32 H	65	43.8	2.1
3	*5180.00	109.8 PK			1.32 H	65	73.5	36.3
4	*5180.00	100.3 AV			1.32 H	65	64.0	36.3
5	#10360.00	56.4 PK	68.2	-11.8	3.26 H	108	41.3	15.1
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	55.3 PK	74.0	-18.7	2.87 V	201	53.2	2.1
2	5150.00	42.6 AV	54.0	-11.4	2.87 V	201	40.5	2.1
3	*5180.00	108.6 PK			2.87 V	201	72.3	36.3
4	*5180.00	98.8 AV			2.87 V	201	62.5	36.3
5	#10360.00	56.0 PK	68.2	-12.2	2.38 V	306	40.9	15.1

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. Margin value = Emission Level – Limit value.
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11ac (VHT80)

CHANNEL	TX Channel 58	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5290.00	98.9 PK			1.20 H	67	62.8	36.1
2	*5290.00	89.3 AV			1.20 H	67	53.2	36.1
3	5350.00	65.8 PK	74.0	-8.2	1.20 H	58	63.8	2.0
4	5350.00	53.4 AV	54.0	-0.6	1.20 H	58	51.4	2.0
5	#10580.00	56.0 PK	68.2	-12.2	3.31 H	128	40.5	15.5
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	*5290.00	97.7 PK			2.84 V	203	61.6	36.1
2	*5290.00	87.9 AV			2.84 V	203	51.8	36.1
3	5350.00	64.4 PK	74.0	-9.6	2.84 V	203	62.4	2.0
4	5350.00	51.8 AV	54.0	-2.2	2.84 V	203	49.8	2.0
5	#10580.00	55.4 PK	68.2	-12.8	2.46 V	312	39.9	15.5

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. Margin value = Emission Level – Limit value.
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 106	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5460.00	66.4 PK	74.0	-7.6	1.19 H	72	63.7	2.7
2	**5460.00**	**53.5 AV**	**54.0**	**-0.5**	**1.19 H**	**72**	**50.8**	**2.7**
3	#5470.00	67.1 PK	68.2	-1.1	1.19 H	72	64.4	2.7
4	*5530.00	101.5 PK			1.19 H	72	64.6	36.9
5	*5530.00	91.2 AV			1.19 H	72	54.3	36.9
6	#5725.00	53.1 PK	68.2	-15.1	1.19 H	72	50.2	2.9
7	11060.00	57.2 PK	74.0	-16.8	3.23 H	118	40.8	16.4
8	11060.00	43.5 AV	54.0	-10.5	3.23 H	118	27.1	16.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5460.00	65.9 PK	74.0	-8.1	2.73 V	209	63.2	2.7
2	5460.00	52.8 AV	54.0	-1.2	2.73 V	209	50.1	2.7
3	#5470.00	66.5 PK	68.2	-1.7	2.73 V	209	63.8	2.7
4	*5530.00	99.8 PK			2.73 V	209	62.9	36.9
5	*5530.00	89.8 AV			2.73 V	209	52.9	36.9
6	#5725.00	53.1 PK	68.2	-15.1	2.73 V	209	50.2	2.9
7	11060.00	56.6 PK	74.0	-17.4	2.33 V	314	40.2	16.4
8	11060.00	43.2 AV	54.0	-10.8	2.33 V	314	26.8	16.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. Margin value = Emission Level – Limit value.
4. The other emission levels were very low against the limit.
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	#5639.20	60.0 PK	68.2	-8.2	1.29 H	77	57.4	2.6
2	*5775.00	105.0 PK			1.29 H	77	67.5	37.5
3	*5775.00	94.1 AV			1.29 H	77	56.6	37.5
4	#5937.60	56.2 PK	68.2	-12.0	1.29 H	77	52.9	3.3
5	11550.00	55.9 PK	74.0	-18.1	3.16 H	142	40.6	15.3
6	11550.00	41.9 AV	54.0	-12.1	3.16 H	142	26.6	15.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5641.60	59.5 PK	68.2	-8.7	2.95 V	207	56.8	2.7
2	*5775.00	103.7 PK			2.95 V	207	66.2	37.5
3	*5775.00	92.6 AV			2.95 V	207	55.1	37.5
4	#5927.20	54.8 PK	68.2	-13.4	2.95 V	207	51.5	3.3
5	11550.00	54.9 PK	74.0	-19.1	2.11 V	263	39.6	15.3
6	11550.00	41.5 AV	54.0	-12.5	2.11 V	263	26.2	15.3

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. Margin value = Emission Level – Limit value.
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz Worst-Case Data:

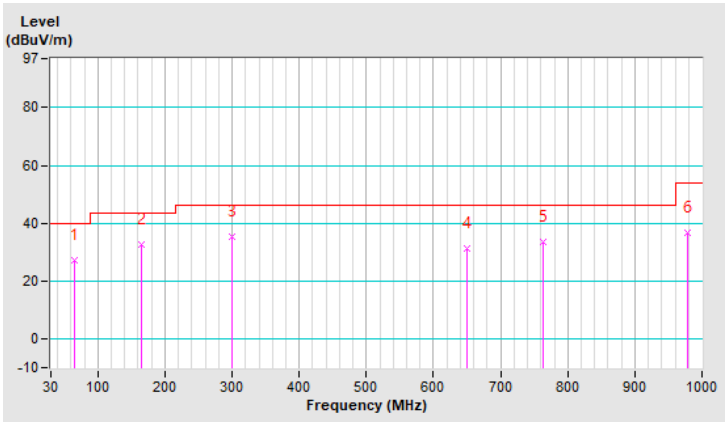
802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	64.92	27.2 QP	40.0	-12.8	1.25 H	217	37.6	-10.4
2	165.80	32.7 QP	43.5	-10.8	1.00 H	173	41.4	-8.7
3	299.66	35.4 QP	46.0	-10.6	1.25 H	145	42.5	-7.1
4	650.80	31.1 QP	46.0	-14.9	1.00 H	30	31.0	0.1
5	764.29	33.3 QP	46.0	-12.7	1.50 H	253	30.8	2.5
6	978.66	36.5 QP	54.0	-17.5	1.00 H	253	30.7	5.8

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 of frequency range 30MHz ~ 1000MHz.
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 20 dB below the permissible value to be report.

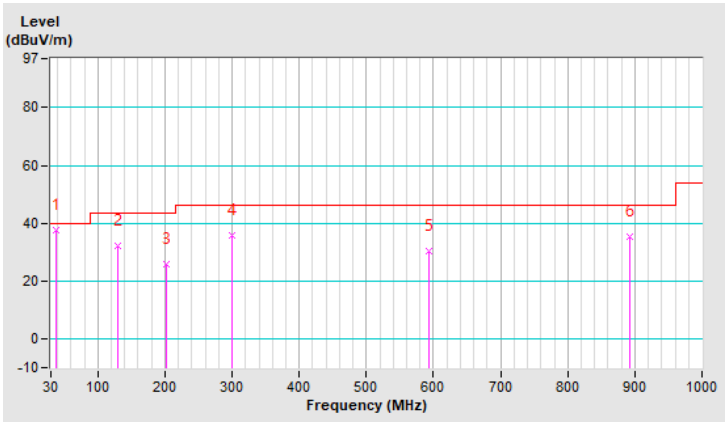


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	38.73	37.4 QP	40.0	-2.6	1.25 V	86	47.4	-10.0
2	129.91	32.1 QP	43.5	-11.4	1.00 V	306	42.2	-10.1
3	201.69	25.6 QP	43.5	-17.9	1.50 V	286	37.1	-11.5
4	299.66	35.9 QP	46.0	-10.1	1.50 V	16	43.0	-7.1
5	592.60	30.3 QP	46.0	-15.7	1.00 V	10	31.3	-1.0
6	893.30	35.4 QP	46.0	-10.6	1.00 V	242	31.1	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 of frequency range 30MHz ~ 1000MHz.
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 20 dB below the permissible value to be report.

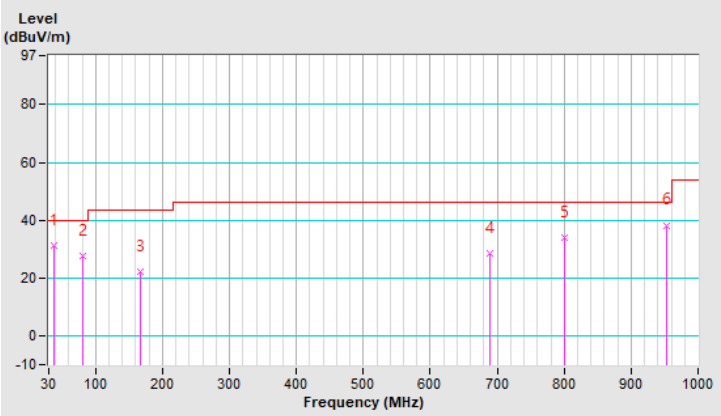


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	37.66	31.2 QP	40.0	-8.8	1.00 H	64	40.8	-9.6
2	80.35	27.8 QP	40.0	-12.2	1.00 H	112	41.0	-13.2
3	167.67	22.2 QP	43.5	-21.3	1.49 H	92	31.2	-9.0
4	689.64	28.4 QP	46.0	-17.6	1.99 H	307	27.7	0.7
5	800.24	33.8 QP	46.0	-12.2	1.49 H	204	29.9	3.9
6	953.53	38.3 QP	46.0	-7.7	1.99 H	13	30.9	7.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
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 20 dB below the permissible value to be report.

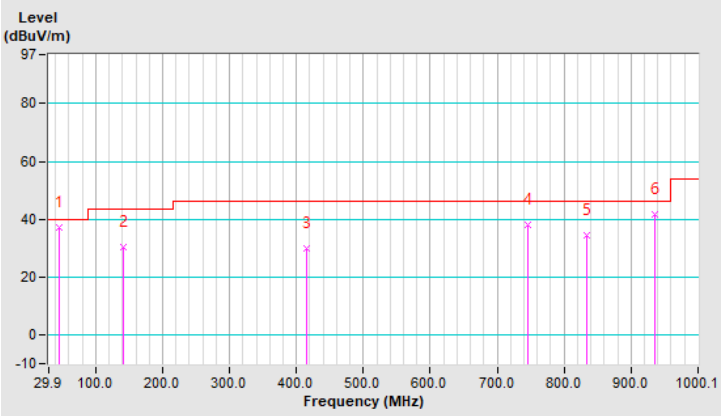


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	45.42	37.3 QP	40.0	-2.7	1.51 V	61	46.1	-8.8
2	140.50	30.2 QP	43.5	-13.3	1.01 V	59	39.4	-9.2
3	416.04	29.7 QP	46.0	-16.3	2.00 V	25	35.3	-5.6
4	745.91	37.9 QP	46.0	-8.1	1.51 V	285	35.3	2.6
5	833.23	34.4 QP	46.0	-11.6	1.01 V	62	29.7	4.7
6	935.51	41.7 QP	46.0	-4.3	1.01 V	115	34.7	7.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
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 20 dB below the permissible value to be report.

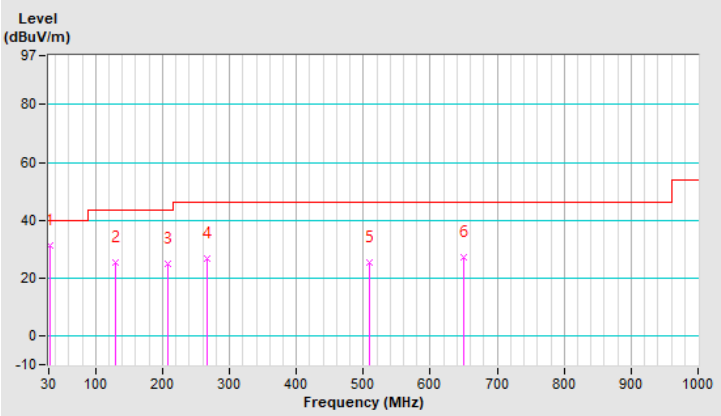


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	C

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	31.84	31.4 QP	40.0	-8.6	1.00 H	64	41.8	-10.4
2	128.86	25.3 QP	43.5	-18.2	1.99 H	244	35.6	-10.3
3	208.42	24.9 QP	43.5	-18.6	1.00 H	96	36.4	-11.5
4	266.63	26.9 QP	46.0	-19.1	1.00 H	106	35.6	-8.7
5	509.18	25.4 QP	46.0	-20.6	1.99 H	353	28.9	-3.5
6	650.83	27.3 QP	46.0	-18.7	1.00 H	180	27.4	-0.1

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 of frequency range 30MHz ~ 1000MHz.
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 20 dB below the permissible value to be report.

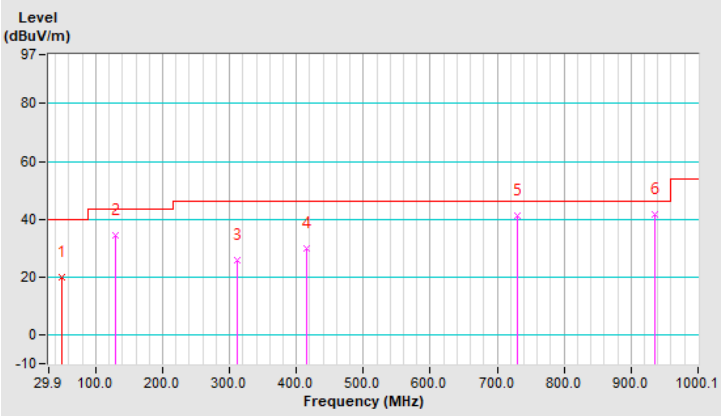


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	C

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	49.26	20.1 QP	40.0	-19.9	1.01 V	230	28.8	-8.7
2	128.86	34.5 QP	43.5	-9.0	1.01 V	59	44.8	-10.3
3	311.26	25.7 QP	46.0	-20.3	1.01 V	58	32.9	-7.2
4	416.04	29.7 QP	46.0	-16.3	2.00 V	25	35.3	-5.6
5	730.38	41.2 QP	46.0	-4.8	1.01 V	292	39.2	2.0
6	936.07	41.7 QP	46.0	-4.3	1.01 V	115	34.7	7.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
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 20 dB 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: Sep. 05 ~ Oct. 24, 2020

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 04, 2020	Sep. 03, 2021
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 20, 2020	Feb. 19, 2021
V-LISN ROHDE & SCHWARZ (Peripheral)	NNBL 8226-2	8226-142	Jul. 31, 2020	Jul. 30, 2021
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 (Conduction 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.

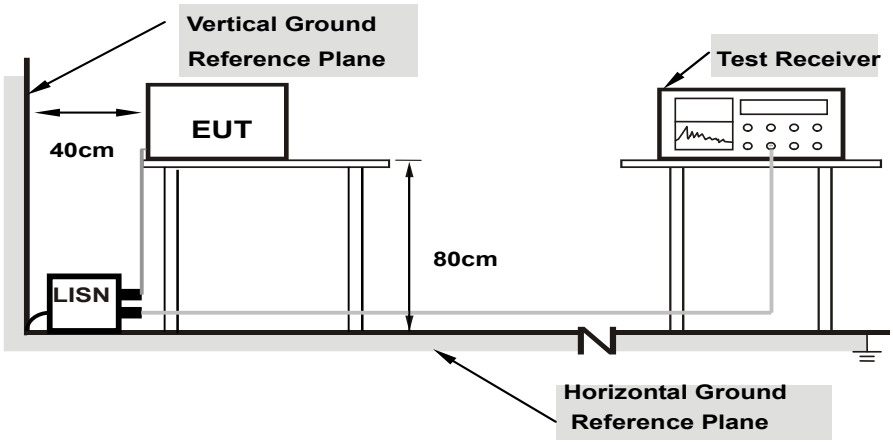
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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:

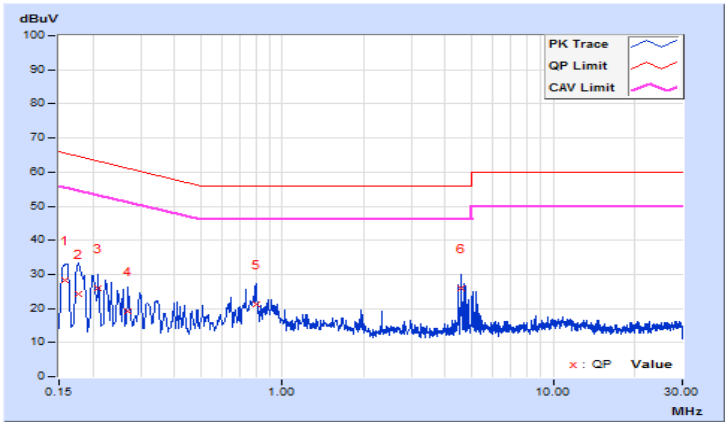
802.11a

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

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15770	9.65	18.56	8.17	28.21	17.82	65.58	55.58	-37.37	-37.76
2	0.17800	9.66	14.53	7.30	24.19	16.96	64.58	54.58	-40.39	-37.62
3	0.21000	9.66	16.39	9.85	26.05	19.51	63.21	53.21	-37.16	-33.70
4	0.27000	9.66	9.38	4.67	19.04	14.33	61.12	51.12	-42.08	-36.79
5	0.79800	9.67	11.51	1.04	21.18	10.71	56.00	46.00	-34.82	-35.29
6	4.57800	9.74	16.35	10.52	26.09	20.26	56.00	46.00	-29.91	-25.74

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.

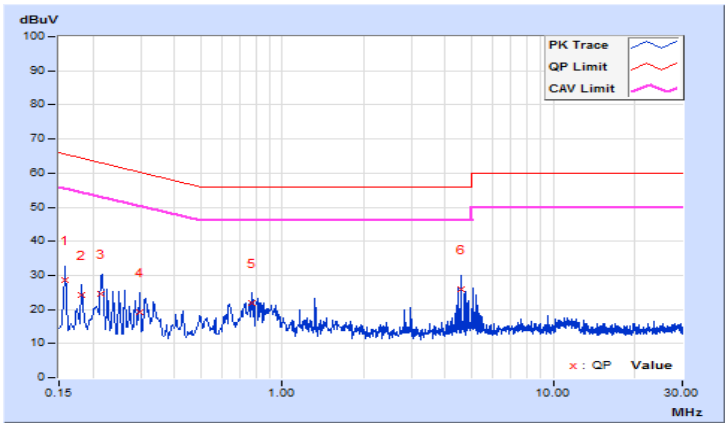


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15800	9.68	19.02	3.44	28.70	13.12	65.57	55.57	-36.87	-42.45
2	0.18200	9.68	14.47	3.71	24.15	13.39	64.39	54.39	-40.24	-41.00
3	0.21406	9.68	14.80	4.25	24.48	13.93	63.05	53.05	-38.57	-39.12
4	0.29800	9.68	9.45	1.38	19.13	11.06	60.30	50.30	-41.17	-39.24
5	0.77400	9.69	12.17	3.80	21.86	13.49	56.00	46.00	-34.14	-32.51
6	4.57800	9.78	16.12	1.36	25.90	11.14	56.00	46.00	-30.10	-34.86

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.

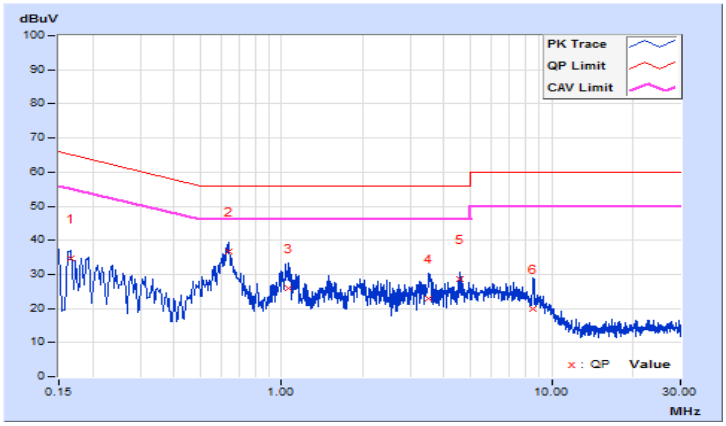


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16564	9.65	24.96	11.85	34.61	21.50	65.18	55.18	-30.57	-33.68
2	0.63856	9.66	27.04	20.22	36.70	29.88	56.00	46.00	-19.30	-16.12
3	1.05712	9.67	16.34	10.24	26.01	19.91	56.00	46.00	-29.99	-26.09
4	3.51260	9.73	13.31	5.89	23.04	15.62	56.00	46.00	-32.96	-30.38
5	4.55266	9.74	18.77	7.65	28.51	17.39	56.00	46.00	-27.49	-28.61
6	8.54477	9.78	10.05	3.28	19.83	13.06	60.00	50.00	-40.17	-36.94

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.

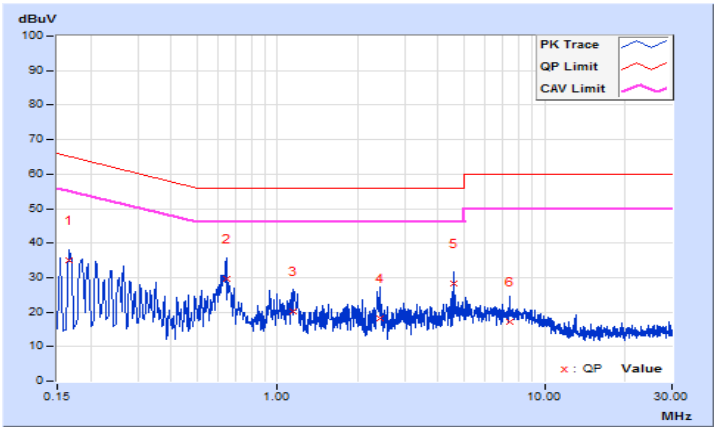


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16564	9.68	25.22	10.26	34.90	19.94	65.18	55.18	-30.28	-35.24
2	0.64266	9.68	20.10	11.96	29.78	21.64	56.00	46.00	-26.22	-24.36
3	1.13923	9.70	10.45	2.47	20.15	12.17	56.00	46.00	-35.85	-33.83
4	2.42953	9.74	8.54	0.50	18.28	10.24	56.00	46.00	-37.72	-35.76
5	4.55266	9.78	18.37	4.05	28.15	13.83	56.00	46.00	-27.85	-32.17
6	7.39132	9.80	7.28	0.18	17.08	9.98	60.00	50.00	-42.92	-40.02

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.

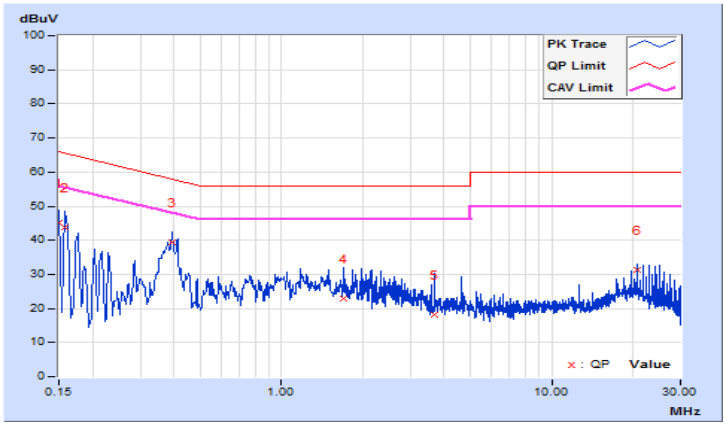


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	C		

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	9.58	35.63	17.70	45.21	27.28	66.00	56.00	-20.79	-28.72
2	0.15782	9.58	34.17	16.16	43.75	25.74	65.58	55.58	-21.83	-29.84
3	**0.39633**	**9.58**	**29.86**	**23.90**	**39.44**	**33.48**	**57.93**	**47.93**	**-18.49**	**-14.45**
4	1.70227	9.62	13.34	5.53	22.96	15.15	56.00	46.00	-33.04	-30.85
5	3.69246	9.66	8.66	2.70	18.32	12.36	56.00	46.00	-37.68	-33.64
6	20.75179	9.78	21.56	20.48	31.34	30.26	60.00	50.00	-28.66	-19.74

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.

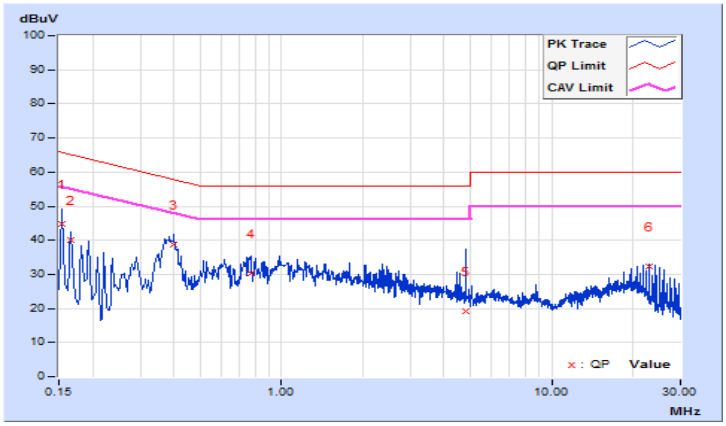


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	C		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.56	35.08	18.87	44.64	28.43	65.79	55.79	-21.15	-27.36
2	0.16564	9.56	30.46	14.52	40.02	24.08	65.18	55.18	-25.16	-31.10
3	0.40024	9.56	29.21	23.48	38.77	33.04	57.85	47.85	-19.08	-14.81
4	0.76778	9.57	20.88	13.94	30.45	23.51	56.00	46.00	-25.55	-22.49
5	4.79508	9.66	9.52	3.09	19.18	12.75	56.00	46.00	-36.82	-33.25
6	22.93748	9.83	22.36	21.90	32.19	31.73	60.00	50.00	-27.81	-18.27

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

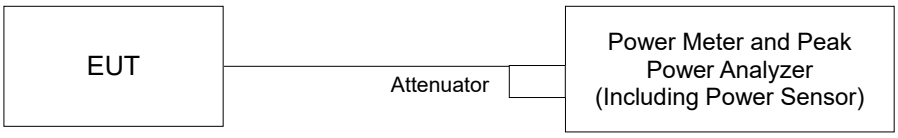
Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

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 $N_{ANT} \geq 5$.

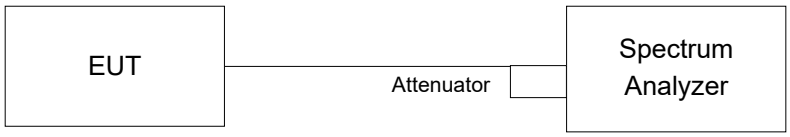
For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.3.2 Test Setup

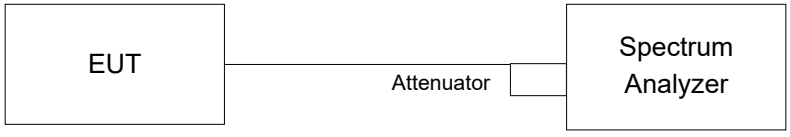
For Power Output



For Power Output (straddle channel)



For 26dB Bandwidth



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.

For 26dB Bandwidth and straddle channel measurement

a. Set RBW = approximately 1% of the emission bandwidth.

b. Set the VBW > RBW.

c. Detector = Peak.

d. Trace mode = max hold.

e. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

f. For channel aggregation (channel 138, 142, 144) measurement refer to KDB 789033 D02 Section III. CHANNEL AGGREGATION.

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:

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	19.24	19.72	177.702	22.50	24.00	Pass
40	5200	19.00	19.64	171.478	22.34	24.00	Pass
48	5240	19.02	19.50	168.925	22.28	24.00	Pass
52	5260	19.41	19.54	177.247	22.49	24.00	Pass
60	5300	19.26	19.32	169.840	22.30	24.00	Pass
64	5320	19.14	19.16	164.449	22.16	24.00	Pass
100	5500	19.06	19.29	165.456	22.19	24.00	Pass
116	5580	18.65	19.42	160.781	22.06	24.00	Pass
140	5700	18.62	19.22	156.338	21.94	24.00	Pass
144	5720 (For U-NII-2C)	17.24	17.93	120.918	20.82	24.00	Pass
144	5720 (For U-NII-3)	9.91	8.63	17.961	12.54	30.00	Pass
149	5745	16.10	16.22	82.617	19.17	30.00	Pass
157	5785	16.36	16.44	87.307	19.41	30.00	Pass
165	5825	16.09	16.45	84.801	19.28	30.00	Pass

Note:

For U-NII-2A, U-NII-2C Band:

Chain 0

1. 11dBm + 10log (25.07) = 24.99 > 24dBm
2. 11dBm + 10log (31.44) = 25.97 > 24dBm
3. 11dBm + 10log (31.18) = 25.93 > 24dBm
4. 11dBm + 10log (34.30) = 26.35 > 24dBm
5. 11dBm + 10log (34.49) = 26.37 > 24dBm
6. 11dBm + 10log (34.54) = 26.38 > 24dBm
7. 11dBm + 10log (5725.00 - 5703.18) = 24.38 > 24dBm

Chain 1

1. 11dBm + 10log (28.69) = 25.57 > 24dBm
2. 11dBm + 10log (31.60) = 25.99 > 24dBm
3. 11dBm + 10log (29.03) = 25.62 > 24dBm
4. 11dBm + 10log (31.15) = 25.93 > 24dBm
5. 11dBm + 10log (34.29) = 26.35 > 24dBm
6. 11dBm + 10log (34.47) = 26.37 > 24dBm
7. 11dBm + 10log (5725.00 - 5703.14) = 24.39 > 24dBm

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	19.55	19.90	187.881	22.74	24.00	Pass
40	5200	19.45	19.85	184.710	22.66	24.00	Pass
48	5240	19.21	19.82	179.308	22.54	24.00	Pass
52	5260	19.61	19.88	188.686	22.76	24.00	Pass
60	5300	19.58	19.79	186.062	22.70	24.00	Pass
64	5320	19.57	19.87	187.624	22.73	24.00	Pass
100	5500	19.51	19.56	179.695	22.55	24.00	Pass
116	5580	19.04	19.65	172.425	22.37	24.00	Pass
140	5700	19.24	19.06	164.484	22.16	24.00	Pass
144	5720 (For U-NII-2C)	16.53	17.64	108.664	20.36	24.00	Pass
144	5720 (For U-NII-3)	6.90	8.37	12.409	10.94	30.00	Pass
149	5745	16.18	16.14	82.610	19.17	30.00	Pass
157	5785	16.30	16.47	87.019	19.40	30.00	Pass
165	5825	16.02	16.44	84.050	19.25	30.00	Pass

Note:
For U-NII-2A, U-NII-2C Band:
Chain 0
1. 11dBm + 10log (35.63) = 26.51 > 24dBm
2. 11dBm + 10log (36.35) = 26.60 > 24dBm
3. 11dBm + 10log (38.23) = 26.82 > 24dBm
4. 11dBm + 10log (35.87) = 26.54 > 24dBm
5. 11dBm + 10log (34.86) = 26.42 > 24dBm
6. 11dBm + 10log (37.51) = 26.74 > 24dBm
7. 11dBm + 10log (5725.00 - 5701.20) = 24.76 > 24dBm

Chain 1
1. 11dBm + 10log (33.34) = 26.22 > 24dBm
2. 11dBm + 10log (35.68) = 26.52 > 24dBm
3. 11dBm + 10log (34.33) = 26.35 > 24dBm
4. 11dBm + 10log (36.78) = 26.65 > 24dBm
5. 11dBm + 10log (37.66) = 26.75 > 24dBm
6. 11dBm + 10log (41.95) = 27.22 > 24dBm
7. 11dBm + 10log (5725.00 - 5699.32) = 25.09 > 24dBm

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	19.00	19.43	167.133	22.23	24.00	Pass
46	5230	20.62	20.71	**233.106**	23.68	24.00	Pass
54	5270	19.75	20.00	**194.406**	22.89	24.00	Pass
62	5310	18.33	18.41	137.420	21.38	24.00	Pass
102	5510	18.67	18.83	150.004	21.76	24.00	Pass
110	5550	19.82	20.09	198.034	22.97	24.00	Pass
134	5670	19.22	19.56	173.925	22.40	24.00	Pass
142	5710 (For U-NII-2C)	18.39	19.30	171.590	22.34	24.00	Pass
142	5710 (For U-NII-3)	8.46	9.24	17.154	12.34	30.00	Pass
151	5755	16.28	16.45	86.619	19.38	30.00	Pass
159	5795	16.36	16.47	87.612	19.43	30.00	Pass

Note:
For U-NII-2A, U-NII-2C Band:
Chain 0
1. 11dBm + 10log (82.75) = 30.17 > 24dBm
2. 11dBm + 10log (43.18) = 27.35 > 24dBm
3. 11dBm + 10log (47.59) = 27.77 > 24dBm
4. 11dBm + 10log (90.82) = 30.58 > 24dBm
5. 11dBm + 10log (89.48) = 30.51 > 24dBm
6. 11dBm + 10log (5725.00 - 5663.54) = 28.88 > 24dBm

Chain 1
1. 11dBm + 10log (86.57) = 30.37 > 24dBm
2. 11dBm + 10log (48.47) = 27.85 > 24dBm
3. 11dBm + 10log (76.03) = 29.80 > 24dBm
4. 11dBm + 10log (98.06) = 30.91 > 24dBm
5. 11dBm + 10log (99.86) = 30.99 > 24dBm
6. 11dBm + 10log (5725.00 - 5660.00) = 29.12 > 24dBm

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	18.21	18.99	145.472	21.63	24.00	Pass
58	5290	17.67	17.82	118.973	20.75	24.00	Pass
106	5530	18.26	18.26	133.977	21.27	24.00	Pass
122	5610	17.82	17.82	121.068	20.83	24.00	Pass
138	5690 (For U-NII-2C)	19.10	19.05	**198.561**	22.98	24.00	Pass
138	5690 (For U-NII-3)	5.68	6.22	9.688	9.86	30.00	Pass
155	5775	16.41	16.47	**88.113**	19.45	30.00	Pass

Note:
For U-NII-2A, U-NII-2C Band:
Chain 0
1. 11dBm + 10log (84.55) = 30.27 > 24dBm
2. 11dBm + 10log (131.83) = 32.20 > 24dBm
3. 11dBm + 10log (144.34) = 32.59 > 24dBm
4. 11dBm + 10log (5725.00 - 5594.09) = 32.16 > 24dBm

Chain 1
1. 11dBm + 10log (99.36) = 30.97 > 24dBm
2. 11dBm + 10log (183.55) = 33.63 > 24dBm
3. 11dBm + 10log (143.67) = 32.57 > 24dBm
4. 11dBm + 10log (5725.00 - 5626.46) = 30.93 > 24dBm

26dB Bandwidth:

802.11a

Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)	
		Chain 0	Chain 1
52	5260	25.07	28.69
60	5300	31.44	31.60
64	5320	31.18	29.03
100	5500	34.30	31.15
116	5580	34.49	34.29
140	5700	34.54	34.47
144	5720 (For U-NII-2C)	21.82	21.86
144	5720 (For U-NII-3)	12.60	12.61

802.11n (HT20)

Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)	
		Chain 0	Chain 1
52	5260	35.63	33.34
60	5300	36.35	35.68
64	5320	38.23	34.33
100	5500	35.87	36.78
116	5580	34.86	37.66
140	5700	37.51	41.95
144	5720 (For U-NII-2C)	23.80	25.68
144	5720 (For U-NII-3)	15.19	16.99

802.11n (HT40)

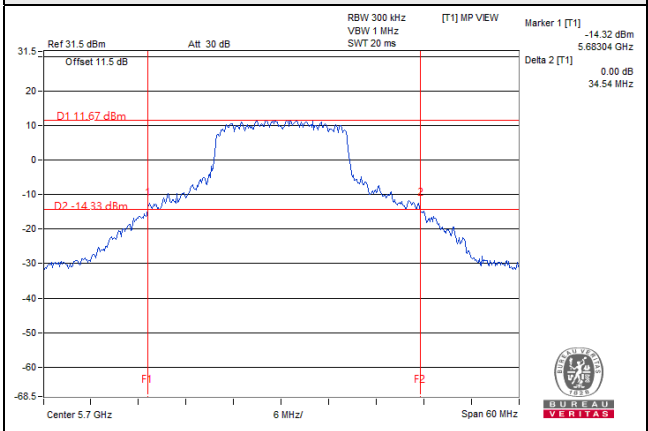
Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)	
		Chain 0	Chain 1
54	5270	82.75	86.57
62	5310	43.18	48.47
102	5510	47.59	76.03
110	5550	90.82	98.06
134	5670	89.48	99.86
142	5710 (For U-NII-2C)	61.46	65.00
142	5710 (For U-NII-3)	35.00	35.00

802.11ac (VHT80)

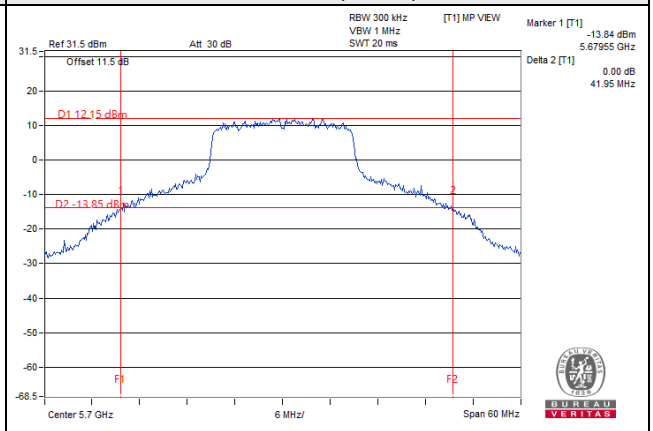
Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)	
		Chain 0	Chain 1
58	5290	84.55	99.36
106	5530	131.83	183.55
122	5610	144.34	143.67
138	5690 (For U-NII-2C)	130.91	98.54
138	5690 (For U-NII-3)	72.93	61.64

Spectrum Plot of Worst Value

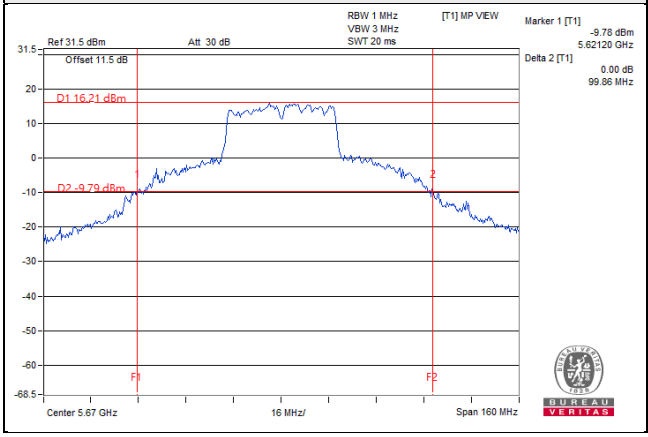
802.11a



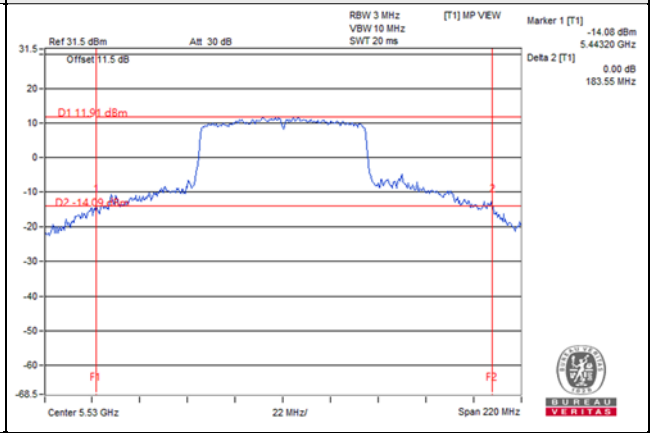
802.11n (HT20)



802.11n (HT40)



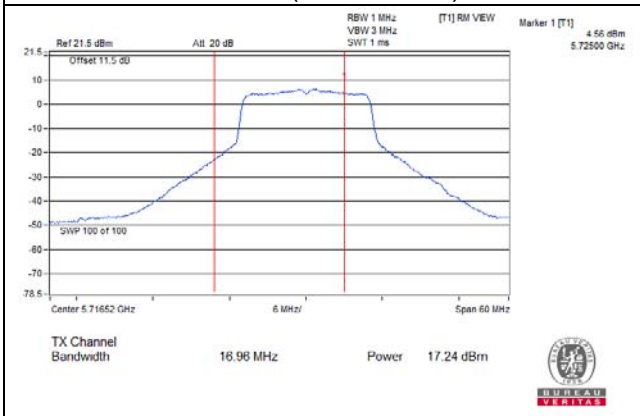
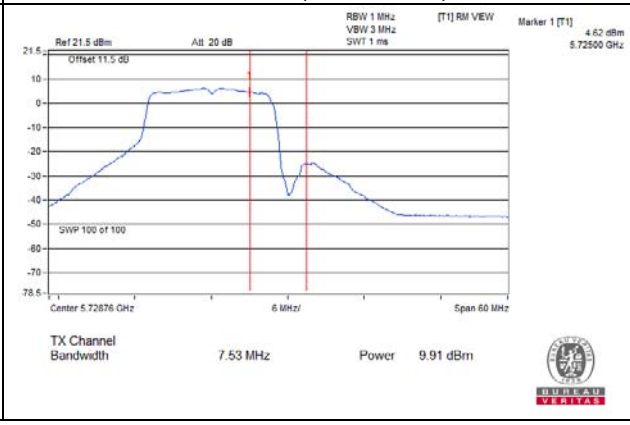
802.11ac (VHT80)



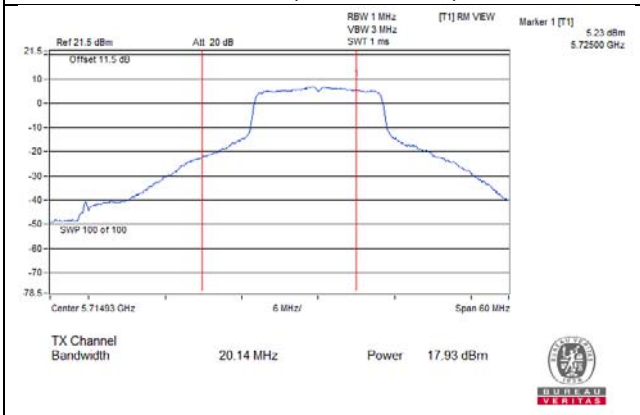
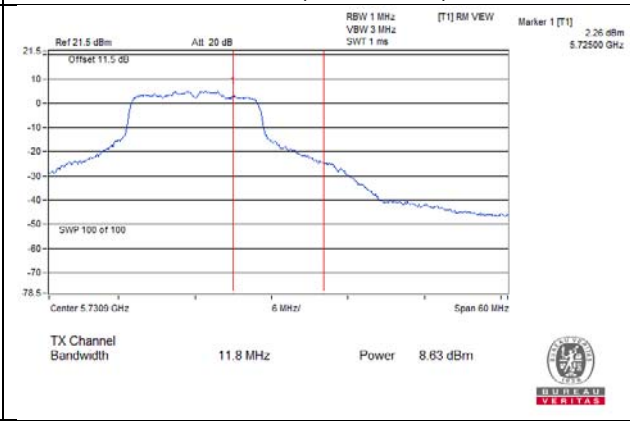
Straddle channel power plots:

802.11a

Chain 0

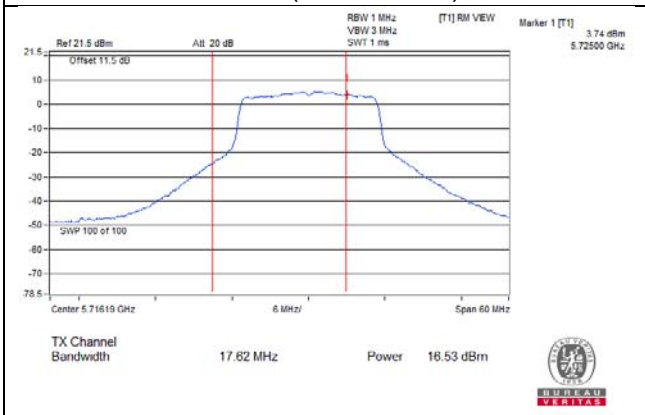
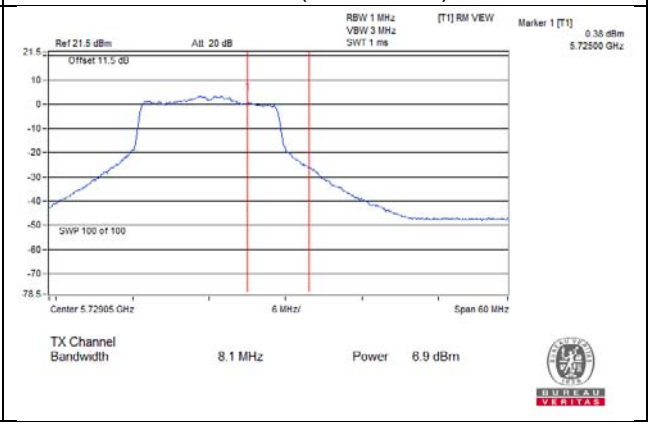
CH 144 (For U-NII-2C)	CH 144 (For U-NII-3)
	

Chain 1

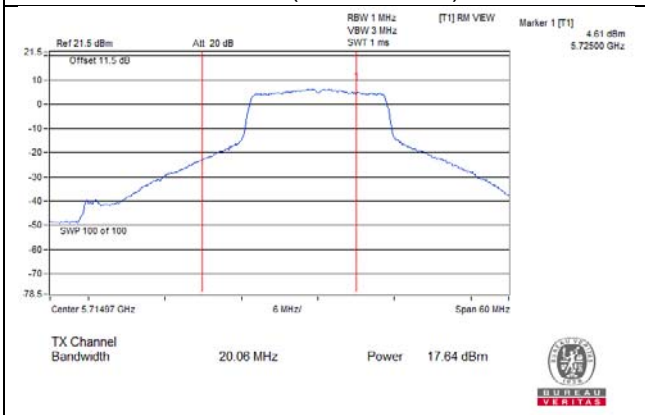
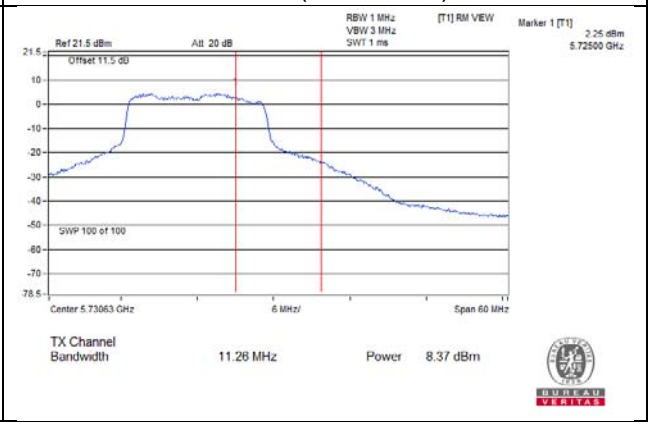
CH 144 (For U-NII-2C)	CH 144 (For U-NII-3)
	

802.11n (HT20)

Chain 0

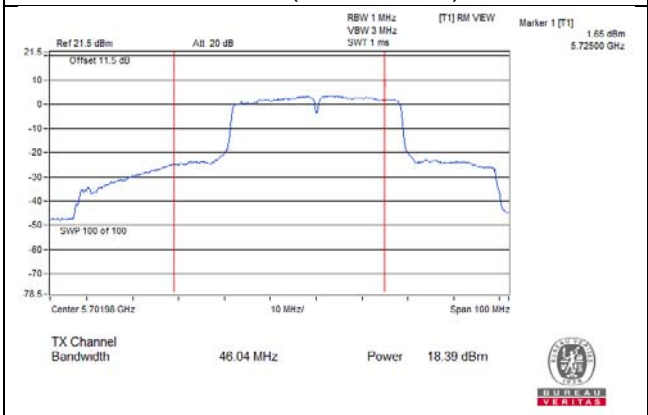
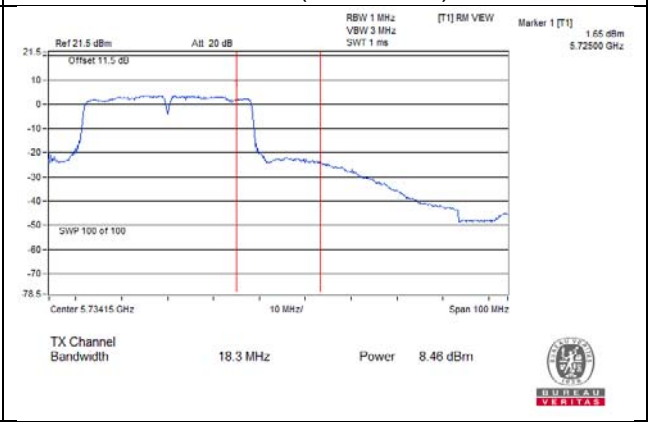
CH 144 (For U-NII-2C)	CH 144 (For U-NII-3)
	
TX Channel Bandwidth 17.62 MHz Power 16.53 dBm	TX Channel Bandwidth 8.1 MHz Power 6.9 dBm

Chain 1

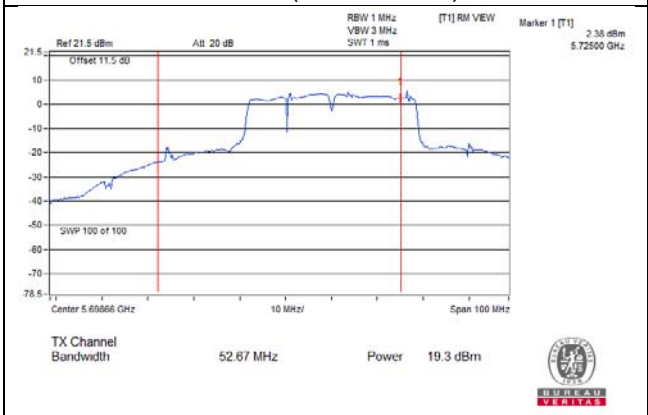
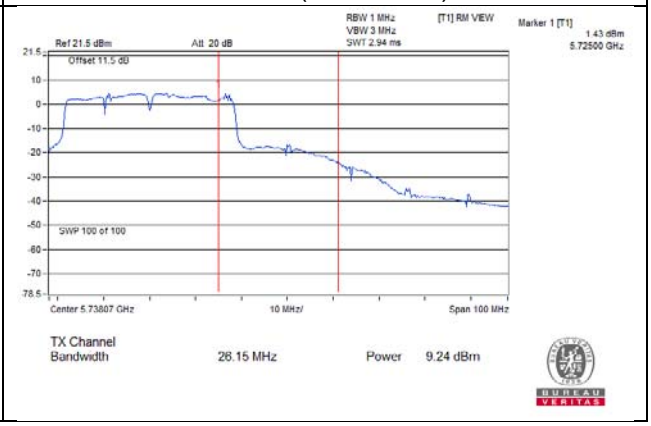
CH 144 (For U-NII-2C)	CH 144 (For U-NII-3)
	
TX Channel Bandwidth 20.06 MHz Power 17.64 dBm	TX Channel Bandwidth 11.26 MHz Power 8.37 dBm

802.11n (HT40)

Chain 0

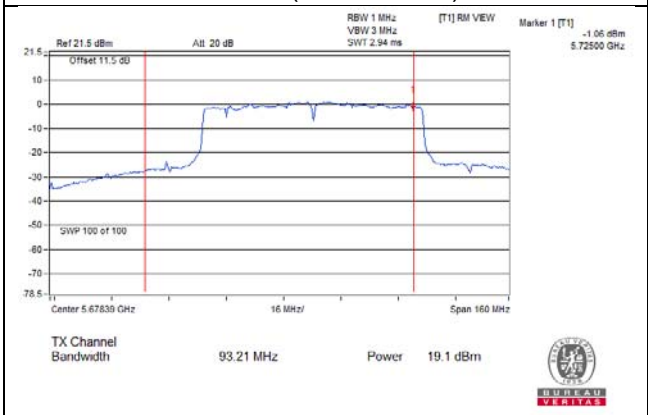
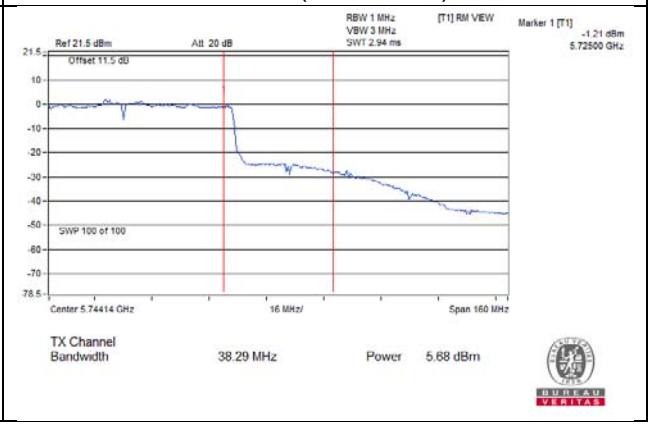
CH 142 (For U-NII-2C)	CH 142 (For U-NII-3)
	

Chain 1

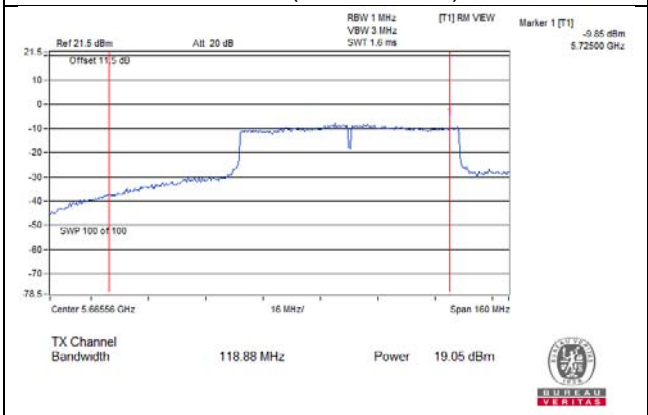
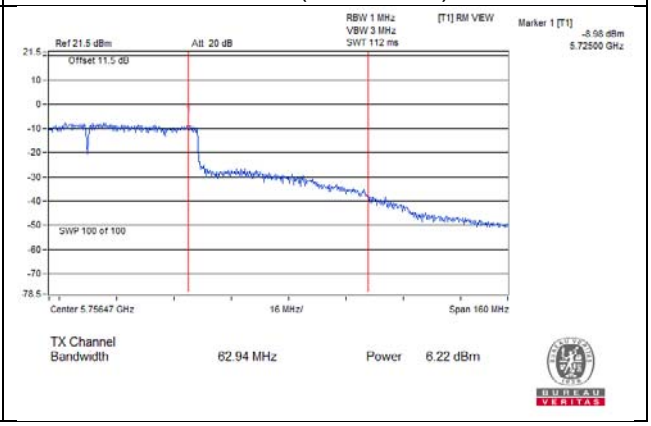
CH 142 (For U-NII-2C)	CH 142 (For U-NII-3)
	

802.11ac (VHT80)

Chain 0

CH 138 (For U-NII-2C)	CH 138 (For U-NII-3)
	
TX Channel Bandwidth 93.21 MHz Power 19.1 dBm	TX Channel Bandwidth 38.29 MHz Power 5.68 dBm

Chain 1

CH 138 (For U-NII-2C)	CH 138 (For U-NII-3)
	
TX Channel Bandwidth 118.88 MHz Power 19.05 dBm	TX Channel Bandwidth 62.94 MHz Power 6.22 dBm

EUT Maximum Conducted Power

802.11a

Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	177.247	22.49
5470~5725	165.456	22.19

802.11n (HT20)

Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	188.686	22.76
5470~5725	179.695	22.55

802.11n (HT40)

Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	194.406	22.89
5470~5725	198.034	22.97

802.11ac (VHT80)

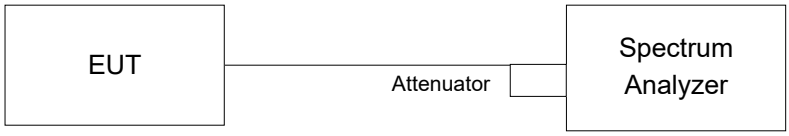
Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	118.973	20.75
5470~5725	198.561	22.98

4.4 Peak Power Spectral Density Measurement

4.4.1 Limits of Peak Power Spectral Density Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

For U-NII-1, U-NII-2A and U-NII-2C 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 (raising) 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)

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as 4.3.6.

4.4.7 Test Results

For U-NII-1, U-NII-2A and U-NII-2C 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	7.04	6.94	0.22	10.22	10.42	Pass
40	5200	7.11	7.22	0.22	10.39	10.42	Pass
48	5240	6.86	7.04	0.22	10.18	10.42	Pass
52	5260	7.30	7.42	0.22	10.59	10.84	Pass
60	5300	7.17	7.62	0.22	10.63	10.84	Pass
64	5320	7.34	7.37	0.22	10.58	10.84	Pass
100	5500	7.15	6.84	0.22	10.22	10.52	Pass
116	5580	6.53	6.92	0.22	9.96	10.52	Pass
140	5700	6.27	7.15	0.22	9.96	10.52	Pass
144	5720	6.07	6.88	0.22	9.72	10.52	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. 5180~5240MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.58dBi > 6dBi, so the limit shall be reduced to 11-(6.58-6) = 10.42dBm.
   5260~5320MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.16dBi > 6dBi, so the limit shall be reduced to 11-(6.16-6) = 10.84dBm.
   5500~5720MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.48dBi > 6dBi, so the limit shall be reduced to 11-(6.48-6) = 10.52dBm.
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	7.10	7.13	0.23	10.36	10.42	Pass
40	5200	7.05	7.18	0.23	10.36	10.42	Pass
48	5240	7.01	7.13	0.23	10.31	10.42	Pass
52	5260	6.82	7.17	0.23	10.24	10.84	Pass
60	5300	6.66	7.76	0.23	10.49	10.84	Pass
64	5320	6.53	7.78	0.23	10.44	10.84	Pass
100	5500	6.94	7.16	0.23	10.29	10.52	Pass
116	5580	6.52	7.17	0.23	10.10	10.52	Pass
140	5700	6.95	6.04	0.23	9.76	10.52	Pass
144	5720	5.32	6.35	0.23	9.11	10.52	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. 5180~5240MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.58dBi > 6dBi, so the limit shall be reduced to 11-(6.58-6) = 10.42dBm.
   5260~5320MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.16dBi > 6dBi, so the limit shall be reduced to 11-(6.16-6) = 10.84dBm.
   5500~5720MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.48dBi > 6dBi, so the limit shall be reduced to 11-(6.48-6) = 10.52dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

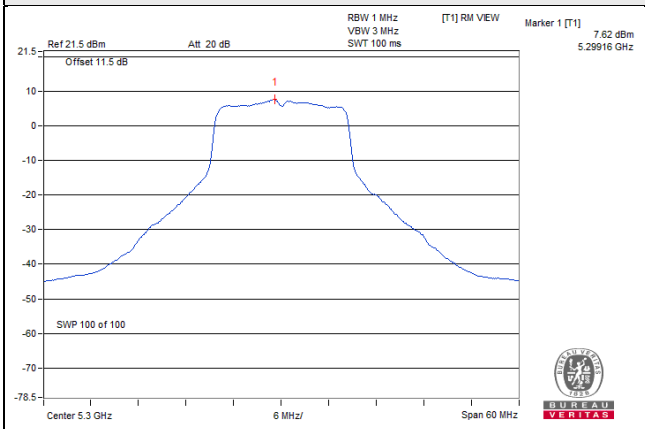
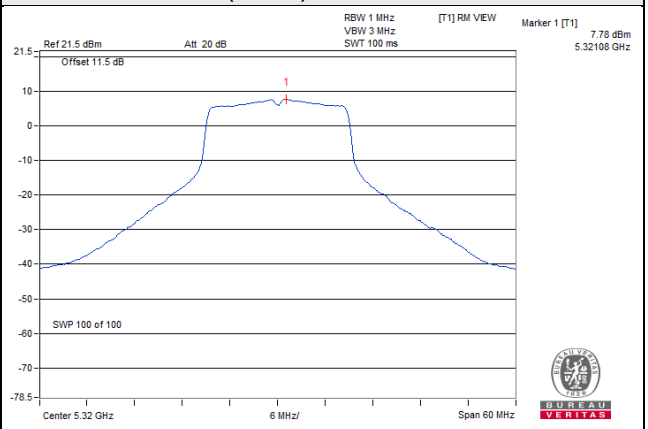
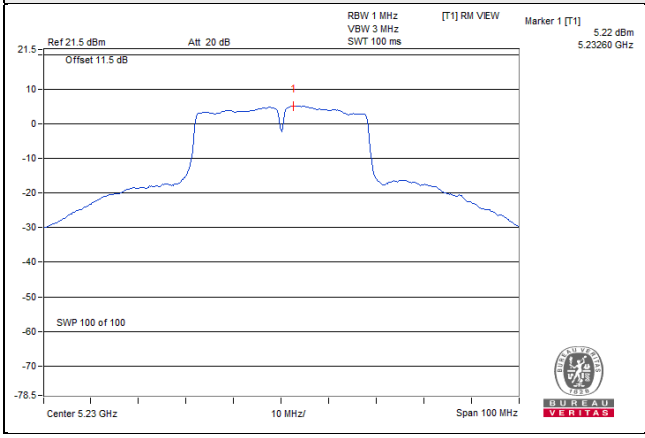
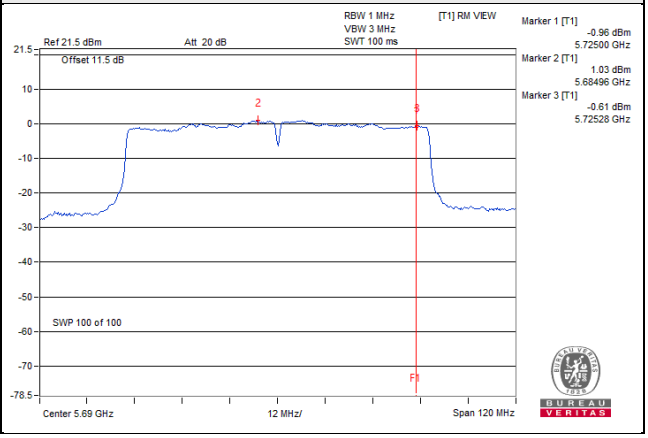
Chan.	Freq. (MHz)	PSD w/o Duty Factor (dBm/MHz)		Duty Factor (dB)	Total PSD with Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1				
38	5190	3.71	4.01	0.47	7.34	10.42	Pass
46	5230	5.22	5.15	0.47	8.66	10.42	Pass
54	5270	4.43	4.86	0.47	8.13	10.84	Pass
62	5310	2.57	3.09	0.47	6.31	10.84	Pass
102	5510	3.11	3.53	0.47	6.80	10.52	Pass
110	5550	4.39	4.34	0.47	7.84	10.52	Pass
134	5670	3.24	4.09	0.47	7.16	10.52	Pass
142	5710	3.50	3.79	0.47	7.12	10.52	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. 5180~5240MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.58dBi > 6dBi, so the limit shall be reduced to 11-(6.58-6) = 10.42dBm.
   5260~5320MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.16dBi > 6dBi, so the limit shall be reduced to 11-(6.16-6) = 10.84dBm.
   5500~5720MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.48dBi > 6dBi, so the limit shall be reduced to 11-(6.48-6) = 10.52dBm.
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	-0.19	-0.19	0.89	3.71	10.42	Pass
58	5290	-1.52	-0.75	0.89	2.79	10.84	Pass
106	5530	-0.35	-0.23	0.89	3.61	10.52	Pass
122	5610	-0.90	-0.60	0.89	3.16	10.52	Pass
138	5690	0.98	0.83	0.89	4.81	10.52	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. 5180~5240MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.58dBi > 6dBi, so the limit shall be reduced to 11-(6.58-6) = 10.42dBm.
   5260~5320MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.16dBi > 6dBi, so the limit shall be reduced to 11-(6.16-6) = 10.84dBm.
   5500~5720MHz: Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/2$]=6.48dBi > 6dBi, so the limit shall be reduced to 11-(6.48-6) = 10.52dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value	
802.11a / Chain 1 / CH 60	802.11n (HT20) / Chain 1 / CH 64
	
802.11n (HT40) / Chain 0 / CH 46	802.11ac (VHT80) / Chain 0 / 138
	

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	144	5720	-3.49	-1.27	3.01	0.22	1.96	29.53	Pass
	149	5745	1.98	4.20	3.01	0.22	7.43	29.53	Pass
	157	5785	1.53	3.75	3.01	0.22	6.98	29.53	Pass
	165	5825	1.09	3.31	3.01	0.22	6.54	29.53	Pass
1	144	5720	-2.87	-0.65	3.01	0.22	2.58	29.53	Pass
	149	5745	1.10	3.32	3.01	0.22	6.55	29.53	Pass
	157	5785	1.40	3.62	3.01	0.22	6.85	29.53	Pass
	165	5825	1.31	3.53	3.01	0.22	6.76	29.53	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 =10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/2$]= 6.47dBi > 6dBi, so the limit shall be reduced to 30-(6.47-6) = 29.53dBm.
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	144	5720	-4.01	-1.79	3.01	0.23	1.45	29.53	Pass
	149	5745	0.81	3.03	3.01	0.23	6.27	29.53	Pass
	157	5785	0.74	2.96	3.01	0.23	6.20	29.53	Pass
	165	5825	0.48	2.70	3.01	0.23	5.94	29.53	Pass
1	144	5720	-3.29	-1.07	3.01	0.23	2.17	29.53	Pass
	149	5745	0.97	3.19	3.01	0.23	6.43	29.53	Pass
	157	5785	0.93	3.15	3.01	0.23	6.39	29.53	Pass
	165	5825	0.77	2.99	3.01	0.23	6.23	29.53	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 =10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/2$]= 6.47dBi > 6dBi, so the limit shall be reduced to 30-(6.47-6) = 29.53dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

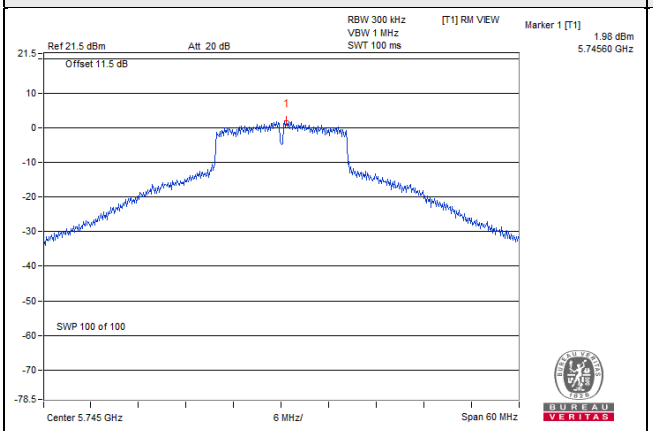
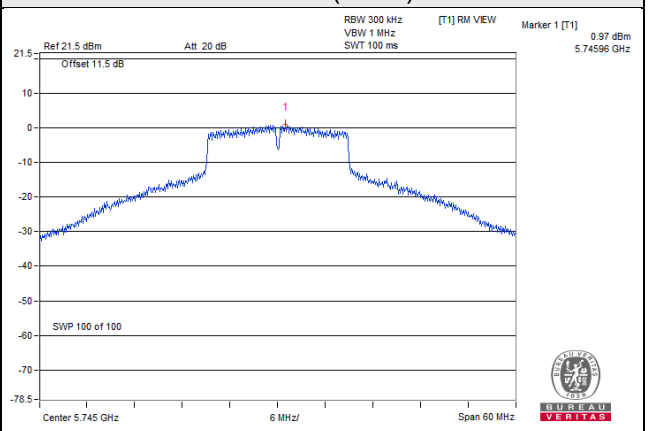
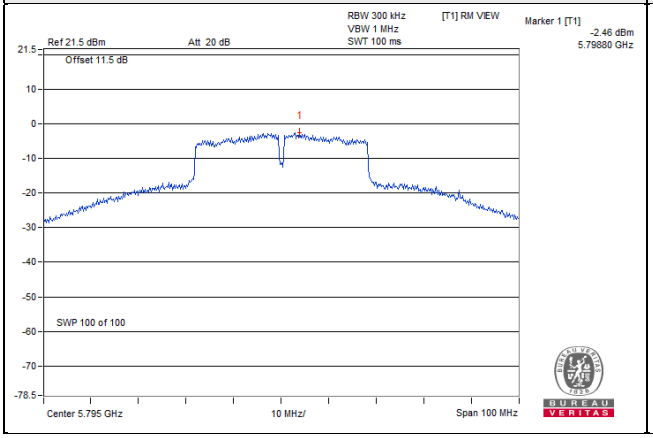
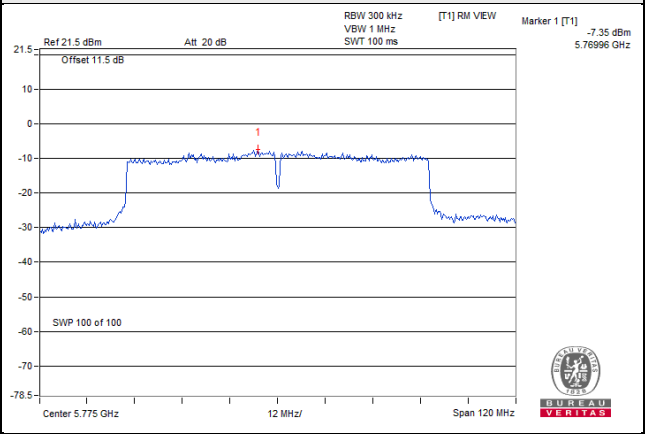
TX chain	Chan.	Freq. (MHz)	PSD W/O Duty Factor		10 log (N=2) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass / Fail
			(dBm/300kHz)	(dBm/500kHz)					
0	142	5710	-6.78	-4.56	3.01	0.47	-1.08	29.53	Pass
	151	5755	-2.63	-0.41	3.01	0.47	3.07	29.53	Pass
	159	5795	-2.46	-0.24	3.01	0.47	3.24	29.53	Pass
1	142	5710	-6.62	-4.40	3.01	0.47	-0.92	29.53	Pass
	151	5755	-2.54	-0.32	3.01	0.47	3.16	29.53	Pass
	159	5795	-2.58	-0.36	3.01	0.47	3.12	29.53	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 =10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20}$)^2/2]= 6.47dBi > 6dBi, so the limit shall be reduced to 30-(6.47-6) = 29.53dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (VHT80)

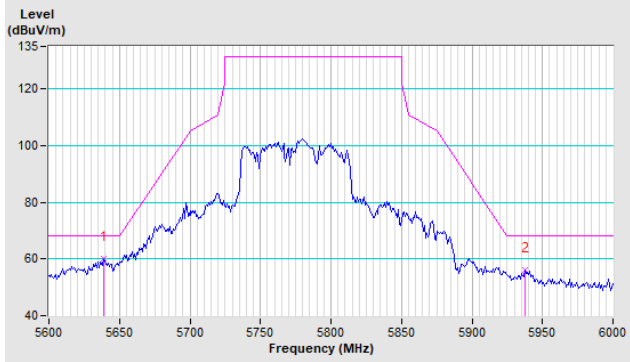
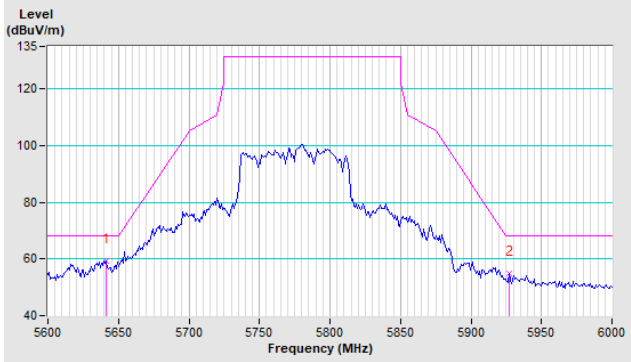
TX chain	Chan.	Freq. (MHz)	PSD W/O Duty Factor		10 log (N=2) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass / Fail
			(dBm/300kHz)	(dBm/500kHz)					
0	138	5690	-10.40	-8.18	3.01	0.89	-4.28	29.53	Pass
	155	5775	-7.36	-5.14	3.01	0.89	-1.24	29.53	Pass
1	138	5690	-9.22	-7.00	3.01	0.89	-3.10	29.53	Pass
	155	5775	-7.35	-5.13	3.01	0.89	-1.23	29.53	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 =10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20}$)^2/2]= 6.47dBi > 6dBi, so the limit shall be reduced to 30-(6.47-6) = 29.53dBm.
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)
	

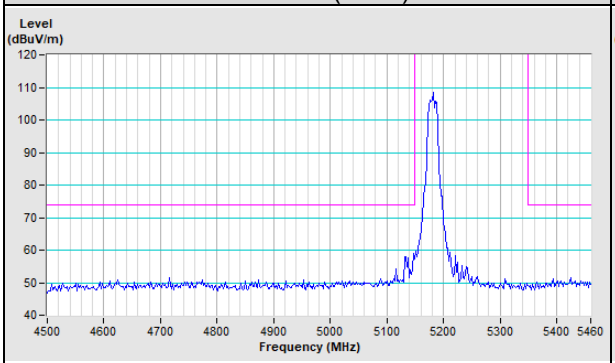
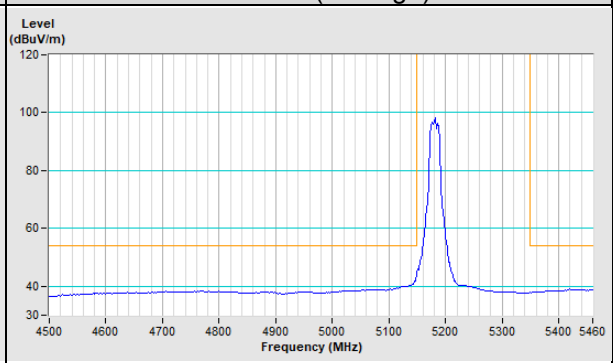
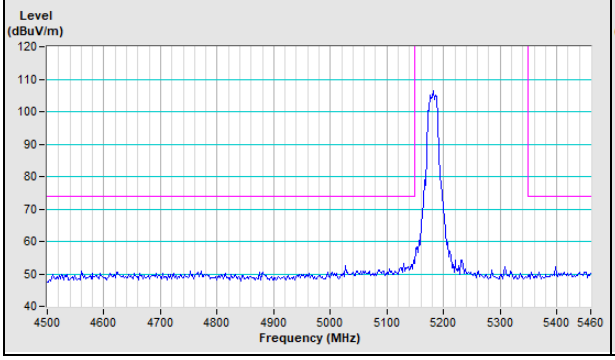
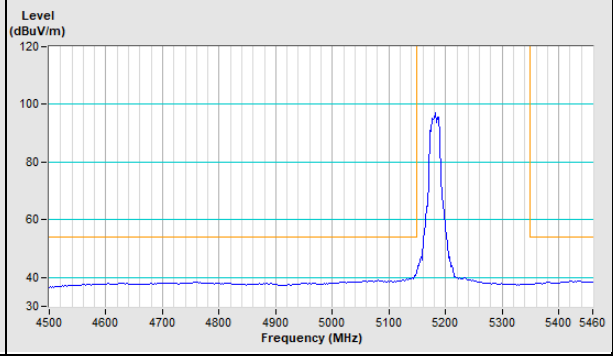
Annex A- Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

802.11ac (VHT80)

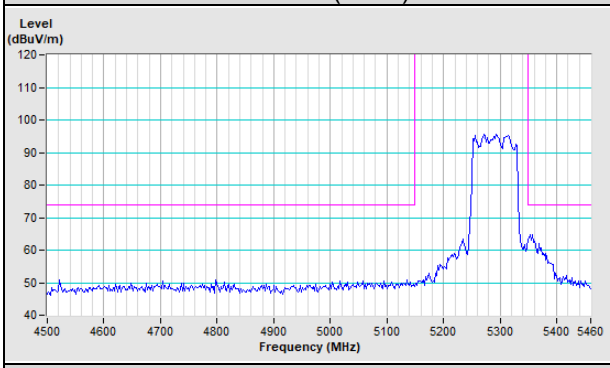
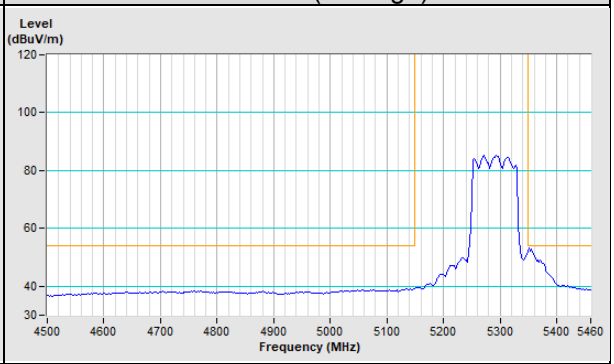
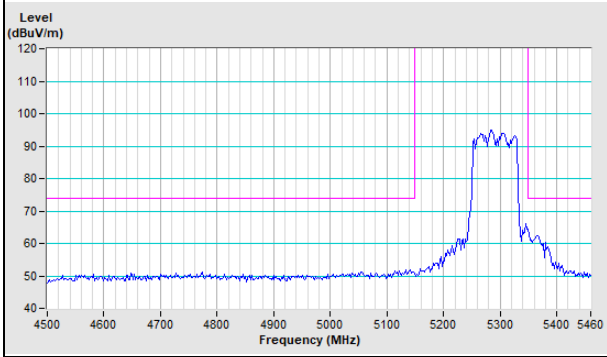
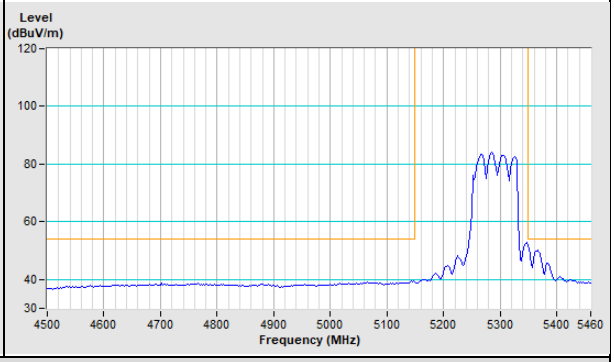
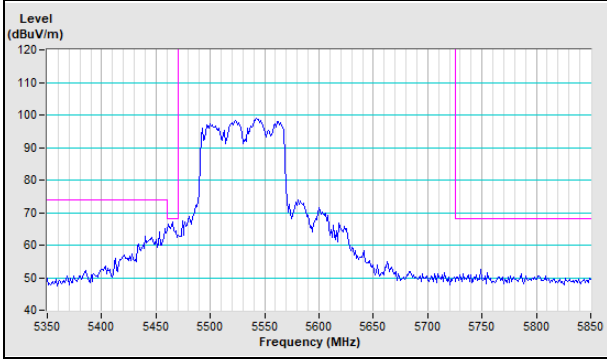
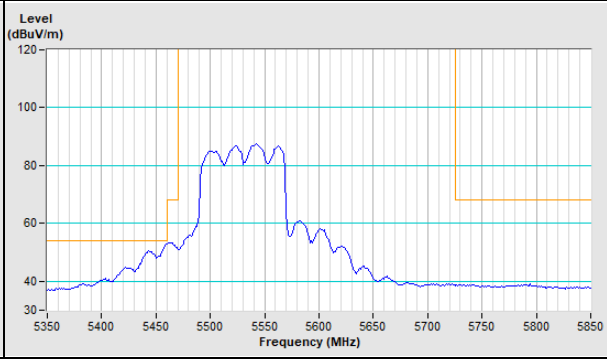
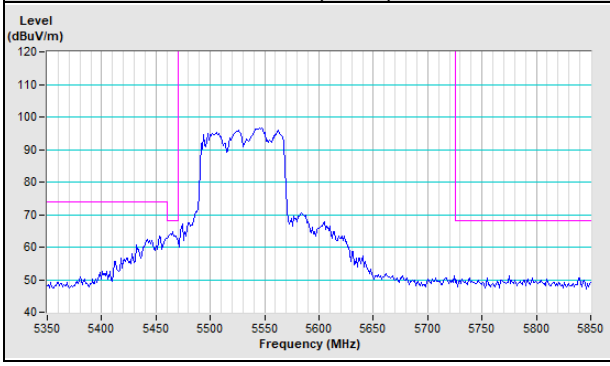
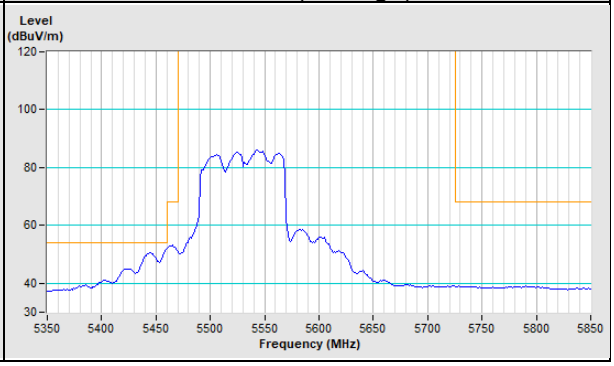
CH 155 5775 MHz	
Horizontal	Vertical
	

Annex B- Band Edge Measurement

802.11a

802.11a Channel 36	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

802.11ac (VHT80)

802.11ac (VHT80) Channel 58	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	
802.11ac (VHT80) Channel 106	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

5 Pictures of Test Arrangements

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

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.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety
Tel: 886-3-3183232
Fax: 886-3-3270892

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

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

--- END ---