FCC Test Report

Report No.: RF191023C07-1

FCC ID: BABTN0002A

Test Model: TN0002A

Received Date: Oct. 23, 2019

Test Date: Dec. 16, 2019 ~ Dec. 24, 2019

Issued Date: Jan. 06, 2020

Applicant: DENSO TEN Limited

Address: 2-28, GOSHO-DORI 1-CHOME, HYOGO-KU, KOBE 652-8510 JAPAN

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

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FCC Registration / Designation Number: 788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RF191023C07-1	Original Release	Jan. 06, 2020

1 Certificate of Conformity

Product: Car Audio

Brand: ISUZU

Test Model: TN0002A

Sample Status: Engineering Sample

Applicant: DENSO TEN Limited

Test Date: Dec. 16, 2019 ~ Dec. 24, 2019

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 : _____ , **Date:** Jan. 06, 2020

Shelly Hsueh / Specialist

Approved by : _____ , **Date:** Jan. 06, 2020

Dylan Chiou / 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 -25.44 dB at 0.15225 MHz.
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 -4.8 dB at 10360 MHz.
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)	6 dB 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	No antenna connector is used.

Note:

1. For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOBE test plots were recorded in Annex A.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Car Audio
Brand	ISUZU
Test Model	TN0002A
Status of EUT	Engineering Sample
Power Supply Rating	12Vdc (from car battery)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54.0 Mbps 802.11n: 65.0 Mbps 802.11ac: 86.7 Mbps
Operating Frequency	5180 ~ 5240 MHz, 5745 ~ 5825 MHz
Number of Channel	5180 ~ 5240 MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 5745 ~ 5825 MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
Output Power	14.06 mW for 5180 ~ 5240 MHz 9.638 mW for 5745 ~ 5825 MHz
Antenna Type	Inverted F antenna with 4.48 dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitters and one receivers.

Modulation Mode	Tx Function
802.11a	1TX
802.11n (HT20)	1TX
802.11ac (VHT20)	1TX

2. WLAN 2.4GHz & WLAN 5GHz & BT technology cannot transmit at same time.
3. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

For 5180 ~ 5240 MHz

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

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

For 5745 ~ 5825 MHz:

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

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	X-plane

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

Note:
1. The EUT had been pre-tested on 802.11n (HT20) and 802.11ac (VHT20). The worst case was found on 802.11n (HT20).
2.“-” means no effect.

Radiated Emission Test (Above 1 GHz):

☒ 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	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
-		802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
-	5745-5825	802.11a	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-		802.11n (HT20)	149 to 165	149, 157, 165	OFDM	BPSK	6.5

Radiated Emission Test (Below 1 GHz):

☒ 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	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11n (HT20)	36 to 48	36	OFDM	BPSK	6.5

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	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11n (HT20)	36 to 48	36	OFDM	BPSK	6.5

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

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

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

EUT Configure Mode	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
-		802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
-	5745-5825	802.11a	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-		802.11n (HT20)	149 to 165	149, 157, 165	OFDM	BPSK	6.5

RF Output Power:

☒ 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	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11ac (VHT20)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	5745-5825	802.11ac (VHT20)	149 to 165	149, 157, 165	OFDM	BPSK	7.2

Occupied Channel Bandwidth Measurement:

☒ 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	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	5180-5240	802.11ac (VHT20)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	5745-5825	802.11ac (VHT20)	149 to 165	149, 157, 165	OFDM	BPSK	7.2

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	12 Vdc	Han Wu
RE<1G	25 deg. C, 65 % RH	12 Vdc	Han Wu
PLC	25 deg. C, 65 % RH	12 Vdc	Jones Chang
APCM	25 deg. C, 65 % RH	12 Vdc	Jiayong Wang

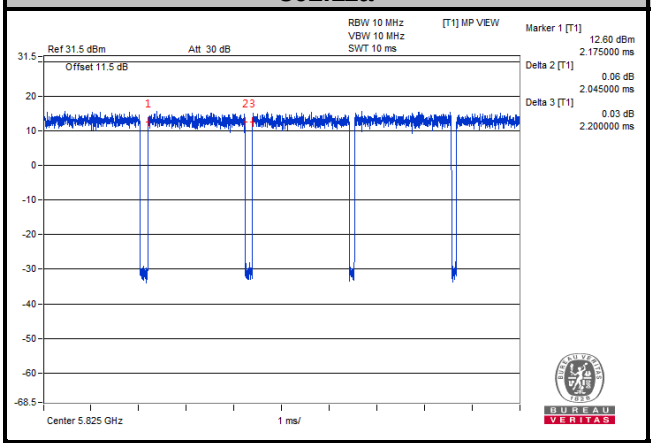
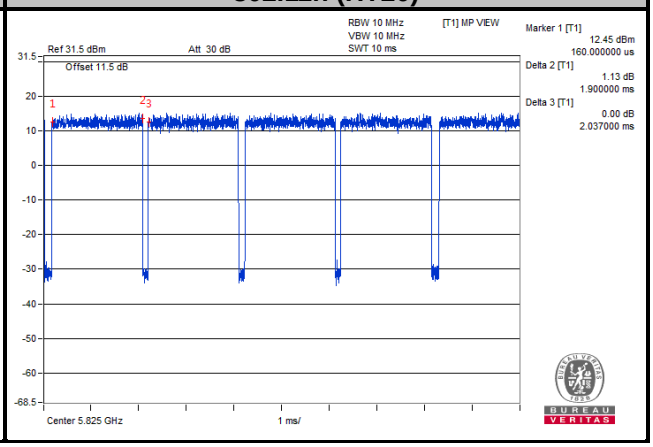
3.3 Duty Cycle of Test Signal

MODULATION TYPE: BPSK

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

802.11a: Duty cycle = 2.045/2.2 = 0.93, Duty factor = 10 * log(1/0.93) = 0.32

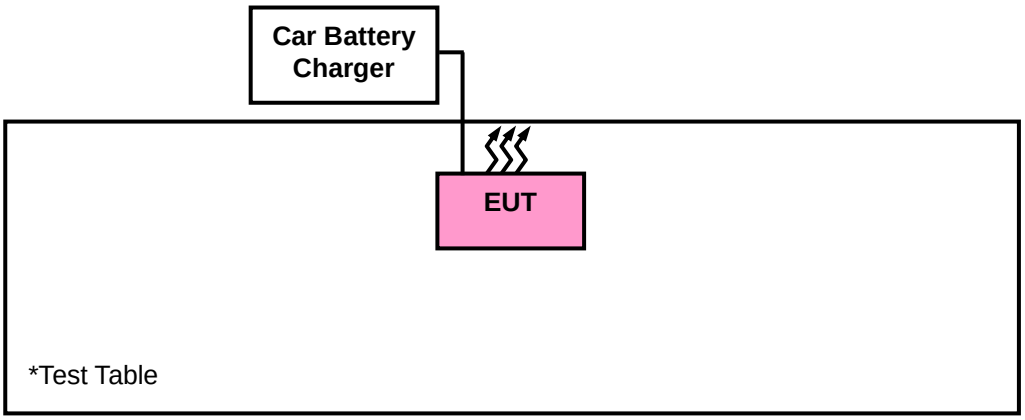
802.11n (HT20): Duty cycle = 1.9/2.037 = 0.933, Duty factor = 10 * log(1/0.933) = 0.30

802.11a	802.11n (HT20)
	

3.4 Description of Support Units

The EUT has been tested as an independent unit.

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 Procedures New Rules 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 1000 MHz, 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 20 dB under any condition of modulation.

4.1.2 Limits of Unwanted Emission Out of the Restricted Bands

Applicable To			Limit	
789033 D02 General UNII Test Procedures New Rules v02r01			Field Strength at 3 m	
			PK: 74 (dBμV/m)	AV: 54 (dBμV/m)
Frequency Band	**Applicable To**		**EIRP Limit**	**Equivalent Field Strength at 3 m**
5150~5250 MHz	15.407(b)(1)		PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
5250~5350 MHz	15.407(b)(2)			
5470~5725 MHz	15.407(b)(3)			
5725~5850 MHz	☒	15.407(b)(4)(i)	PK:-27 (dBm/MHz) *1 PK:10 (dBm/MHz) *2 PK:15.6 (dBm/MHz) *3 PK:27 (dBm/MHz) *4	PK: 68.2 (dBμV/m) *1 PK:105.2 (dBμV/m) *2 PK: 110.8 (dBμV/m) *3 PK:122.2 (dBμV/m) *4
	☐	15.407(b)(4)(ii)	Emission limits in section 15.247(d)	

*1 beyond 75 MHz or more above of the band edge.

*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.

*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.

*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Note:

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

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

4.1.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 15, 2019	Apr. 14, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jun. 12, 2019	Jun. 11, 2020
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. 01, 2019	Jun. 30, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jul. 11, 2019	Jul. 10, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 19, 2019	Feb. 18, 2020
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 19, 2019	Jan. 18, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Jul. 11, 2019	Jul. 10, 2020
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 30, 2019	Jul. 29, 2020
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
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Sep. 05, 2019	Sep. 04, 2020
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 15, 2019	Jul. 14, 2020
DC power supply Keysight	U8002A	MY56330015	NA	NA
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	Jan. 11, 2019	Jan. 10, 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 9.

4.1.4 Test Procedures

For Radiated Emission below 30 MHz

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 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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:

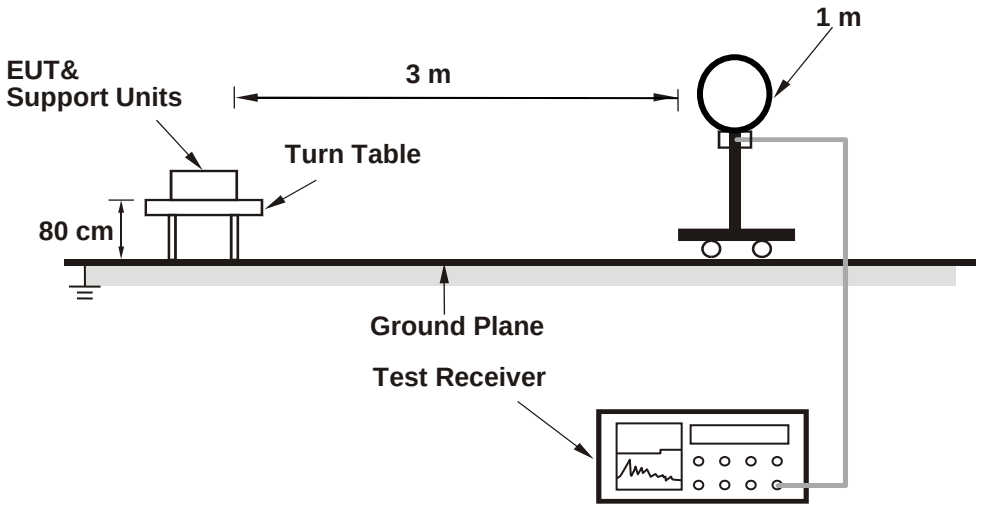
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz. (11a: RBW = 1 MHz, VBW = 1 kHz ; 11n (HT20): RBW = 1 MHz, VBW = 1 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.5 Deviation from Test Standard

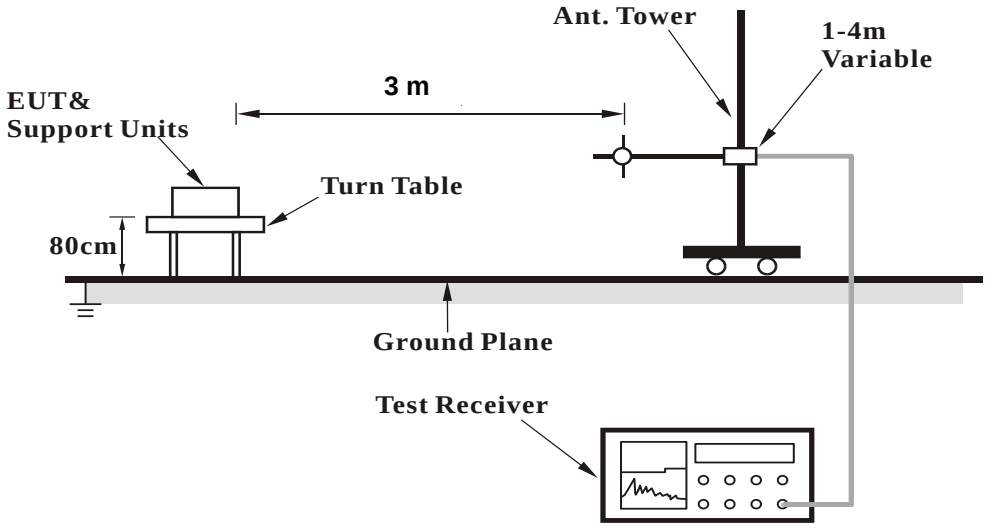
No deviation.

4.1.6 Test Setup

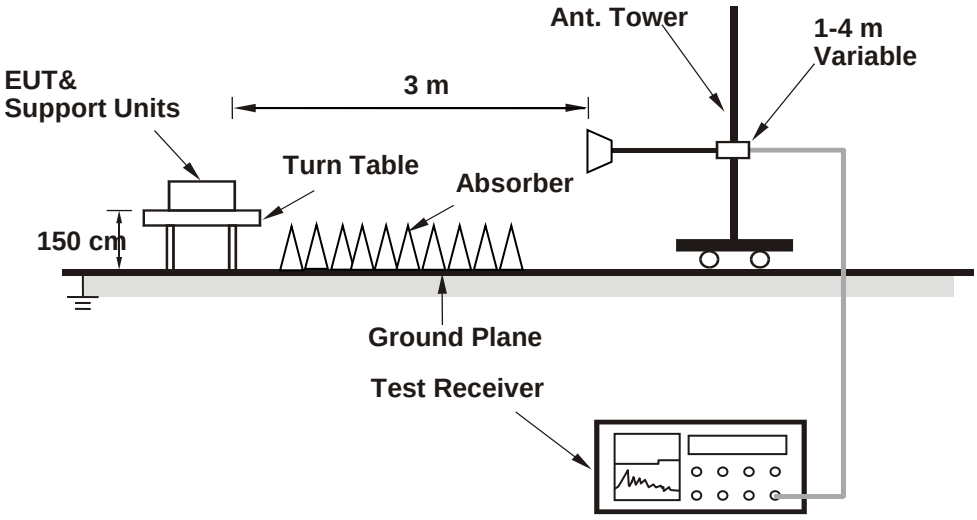
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.7 EUT Operating Conditions

a. Placed the EUT on a testing table.

b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.8 Test Results

Above 1 GHz Data：

802.11a

EUT Test Condition		Measurement Detail	
Channel	Channel 36	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
5150.00	56.7 PK	74.0	-17.3	2.48 H	220	52.8	3.9
5150.00	42.1 AV	54.0	-11.9	2.48 H	220	38.2	3.9
*5180.00	99.7 PK			2.49 H	222	61.4	38.3
*5180.00	89.1 AV			2.49 H	222	50.8	38.3
#10360.00	63.1 PK	68.2	-5.1	2.26 H	128	46.5	16.6
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
5150.00	62.2 PK	74.0	-11.8	3.09 V	131	58.3	3.9
5150.00	43.5 AV	54.0	-10.5	3.09 V	131	39.6	3.9
*5180.00	104.3 PK			3.10 V	132	66.0	38.3
*5180.00	93.8 AV			3.10 V	132	55.5	38.3
#10360.00	58.7 PK	68.2	-9.5	2.44 V	150	42.1	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. 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.

EUT Test Condition		Measurement Detail	
Channel	Channel 40	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5200.00	103.1 PK			2.48 H	222	65.0	38.1
*5200.00	92.3 AV			2.48 H	222	54.2	38.1
#10400.00	62.8 PK	68.2	-5.4	2.20 H	137	46.1	16.7
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5200.00	107.5 PK			3.10 V	132	69.4	38.1
*5200.00	96.9 AV			3.10 V	132	58.8	38.1
#10400.00	58.5 PK	68.2	-9.7	2.48 V	142	41.8	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. 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.

EUT Test Condition		Measurement Detail	
Channel	Channel 48	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5240.00	100.4 PK			2.41 H	222	62.3	38.1
*5240.00	90.0 AV			2.41 H	222	51.9	38.1
5350.00	52.4 PK	74.0	-21.6	2.44 H	223	48.6	3.8
5350.00	41.2 AV	54.0	-12.8	2.44 H	223	37.4	3.8
#10480.00	62.5 PK	68.2	-5.7	2.20 H	123	46.0	16.5
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5240.00	104.9 PK			2.83 V	135	66.8	38.1
*5240.00	94.6 AV			2.83 V	135	56.5	38.1
5350.00	52.1 PK	74.0	-21.9	2.81 V	138	48.3	3.8
5350.00	41.0 AV	54.0	-13.0	2.81 V	138	37.2	3.8
#10480.00	58.4 PK	68.2	-9.8	2.40 V	144	41.9	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. 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.

EUT Test Condition		Measurement Detail	
Channel	Channel 149	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5745.00	94.8 PK			2.10 H	236	55.9	38.9
*5745.00	84.8 AV			2.10 H	236	45.9	38.9
11490.00	56.9 PK	74.0	-17.1	2.21 H	171	40.0	16.9
11490.00	44.5 AV	54.0	-9.5	2.21 H	171	27.6	16.9
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5745.00	101.2 PK			3.50 V	352	62.3	38.9
*5745.00	90.5 AV			3.50 V	352	51.6	38.9
11490.00	57.1 PK	74.0	-16.9	3.46 V	151	40.2	16.9
11490.00	44.2 AV	54.0	-9.8	3.46 V	151	27.3	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 157	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5785.00	96.0 PK			3.34 H	233	57.0	39.0
*5785.00	85.6 AV			3.34 H	233	46.6	39.0
11570.00	56.8 PK	74.0	-17.2	2.31 H	165	40.1	16.7
11570.00	44.2 AV	54.0	-9.8	2.31 H	165	27.5	16.7
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5785.00	101.8 PK			3.68 V	355	62.8	39.0
*5785.00	91.4 AV			3.68 V	355	52.4	39.0
11570.00	57.7 PK	74.0	-16.3	3.47 V	146	41.0	16.7
11570.00	44.1 AV	54.0	-9.9	3.47 V	146	27.4	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 165	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5825.00	96.2 PK			3.32 H	238	57.1	39.1
*5825.00	85.3 AV			3.32 H	238	46.2	39.1
11650.00	56.5 PK	74.0	-17.5	2.28 H	169	40.0	16.5
11650.00	44.1 AV	54.0	-9.9	2.28 H	169	27.6	16.5
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5825.00	102.1 PK			3.45 V	354	63.0	39.1
*5825.00	91.0 AV			3.45 V	354	51.9	39.1
11650.00	57.3 PK	74.0	-16.7	3.41 V	155	40.8	16.5
11650.00	44.3 AV	54.0	-9.7	3.41 V	155	27.8	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

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EUT Test Condition		Measurement Detail	
Channel	Channel 36	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

a. Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
5150.00	52.1 PK	74.0	-21.9	2.57 H	223	48.2	3.9
5150.00	41.0 AV	54.0	-13.0	2.57 H	223	37.1	3.9
*5180.00	98.9 PK			2.46 H	225	60.6	38.3
*5180.00	88.8 AV			2.46 H	225	50.5	38.3
#10360.00	**63.4 PK**	**68.2**	**-4.8**	**2.34 H**	**126**	**46.8**	**16.6**
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
5150.00	54.1 PK	74.0	-19.9	2.62 V	139	50.2	3.9
5150.00	41.0 AV	54.0	-13.0	2.62 V	139	37.1	3.9
*5180.00	103.5 PK			2.63 V	140	65.2	38.3
*5180.00	93.5 AV			2.63 V	140	55.2	38.3
#10360.00	58.2 PK	68.2	-10.0	2.40 V	153	41.6	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. 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.

EUT Test Condition		Measurement Detail	
Channel	Channel 40	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5200.00	99.0 PK			2.42 H	226	60.9	38.1
*5200.00	88.6 AV			2.42 H	226	50.5	38.1
#10400.00	62.9 PK	68.2	-5.3	2.19 H	128	46.2	16.7
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5200.00	103.4 PK			2.56 V	137	65.3	38.1
*5200.00	93.3 AV			2.56 V	137	55.2	38.1
#10400.00	58.5 PK	68.2	-9.7	2.39 V	145	41.8	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. 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.

EUT Test Condition		Measurement Detail	
Channel	Channel 48	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5240.00	100.7 PK			2.54 H	224	62.6	38.1
*5240.00	90.1 AV			2.54 H	224	52.0	38.1
5350.00	59.1 PK	74.0	-14.9	2.54 H	224	55.3	3.8
5350.00	47.4 AV	54.0	-6.6	2.54 H	224	43.6	3.8
#10480.00	62.8 PK	68.2	-5.4	2.20 H	132	46.3	16.5
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5240.00	105.2 PK			2.42 V	136	67.1	38.1
*5240.00	94.5 AV			2.42 V	136	56.4	38.1
5350.00	52.7 PK	74.0	-21.3	2.40 V	135	48.9	3.8
5350.00	41.2 AV	54.0	-12.8	2.40 V	135	37.4	3.8
#10480.00	59.1 PK	68.2	-9.1	2.54 V	143	42.6	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. 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.

EUT Test Condition		Measurement Detail	
Channel	Channel 149	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5745.00	95.1 PK			3.39 H	237	56.2	38.9
*5745.00	84.4 AV			3.39 H	237	45.5	38.9
11490.00	56.9 PK	74.0	-17.1	2.13 H	166	40.0	16.9
11490.00	44.6 AV	54.0	-9.4	2.13 H	166	27.7	16.9
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5745.00	100.6 PK			3.53 V	357	61.7	38.9
*5745.00	90.2 AV			3.53 V	357	51.3	38.9
11490.00	57.9 PK	74.0	-16.1	3.45 V	152	41.0	16.9
11490.00	44.5 AV	54.0	-9.5	3.45 V	152	27.6	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 157	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5785.00	95.3 PK			3.46 H	235	56.3	39.0
*5785.00	84.9 AV			3.46 H	235	45.9	39.0
11570.00	57.0 PK	74.0	-17.0	2.24 H	163	40.3	16.7
11570.00	44.3 AV	54.0	-9.7	2.24 H	163	27.6	16.7
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5785.00	100.8 PK			3.33 V	355	61.8	39.0
*5785.00	90.6 AV			3.33 V	355	51.6	39.0
11570.00	56.7 PK	74.0	-17.3	3.56 V	153	40.0	16.7
11570.00	44.2 AV	54.0	-9.8	3.56 V	153	27.5	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 165	**Frequency Range**	1 GHz ~ 40 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5825.00	95.3 PK			3.40 H	240	56.2	39.1
*5825.00	84.5 AV			3.40 H	240	45.4	39.1
11650.00	56.8 PK	74.0	-17.2	2.17 H	180	40.3	16.5
11650.00	43.9 AV	54.0	-10.1	2.17 H	180	27.4	16.5
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
*5825.00	100.8 PK			3.44 V	356	61.7	39.1
*5825.00	90.2 AV			3.44 V	356	51.1	39.1
11650.00	57.1 PK	74.0	-16.9	3.39 V	149	40.6	16.5
11650.00	43.9 AV	54.0	-10.1	3.39 V	149	27.4	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

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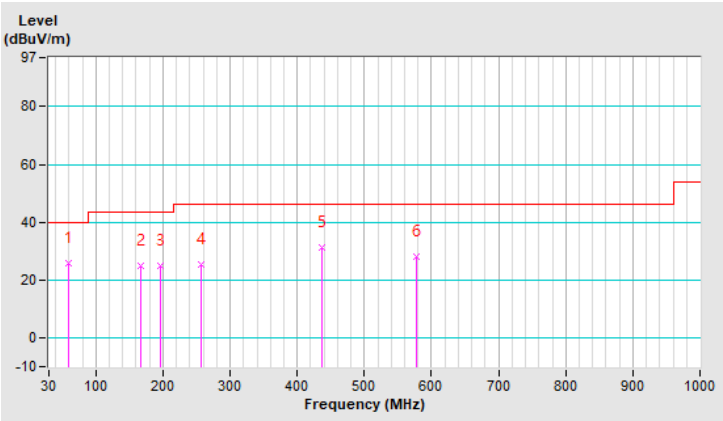
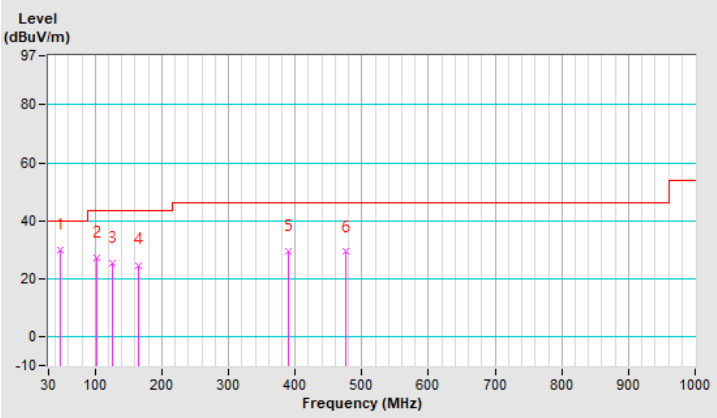
EUT Test Condition		Measurement Detail	
Channel	Channel 36	**Frequency Range**	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Han Wu

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
59.10	25.8 QP	40.0	-14.2	1.00 H	248	35.8	-10.0
167.74	24.7 QP	43.5	-18.8	1.00 H	243	34.0	-9.3
196.84	24.7 QP	43.5	-18.8	1.00 H	210	36.8	-12.1
256.01	25.5 QP	46.0	-20.5	1.00 H	240	35.4	-9.9
436.43	31.4 QP	46.0	-14.6	1.00 H	190	36.1	-4.7
578.05	28.3 QP	46.0	-17.7	1.00 H	8	30.6	-2.3
Antenna Polarity & Test Distance: Vertical at 3 m							
Frequency (MHz)	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Read Level (dBuV)**	**Factor (dB/m)**
48.43	**30.1 QP**	**40.0**	**-9.9**	**1.00 V**	**93**	**39.8**	**-9.7**
101.78	27.2 QP	43.5	-16.3	1.00 V	205	40.8	-13.6
126.03	25.2 QP	43.5	-18.3	1.00 V	149	36.1	-10.9
165.80	24.7 QP	43.5	-18.8	1.00 V	11	33.9	-9.2
389.87	29.5 QP	46.0	-16.5	1.00 V	114	35.5	-6.0
476.20	29.2 QP	46.0	-16.8	1.00 V	22	33.4	-4.2

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.

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 0.50 MHz.

4.2.2 Test Instruments

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 (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN/AMN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ENV216	101196	Apr. 16, 2019	Apr. 15, 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

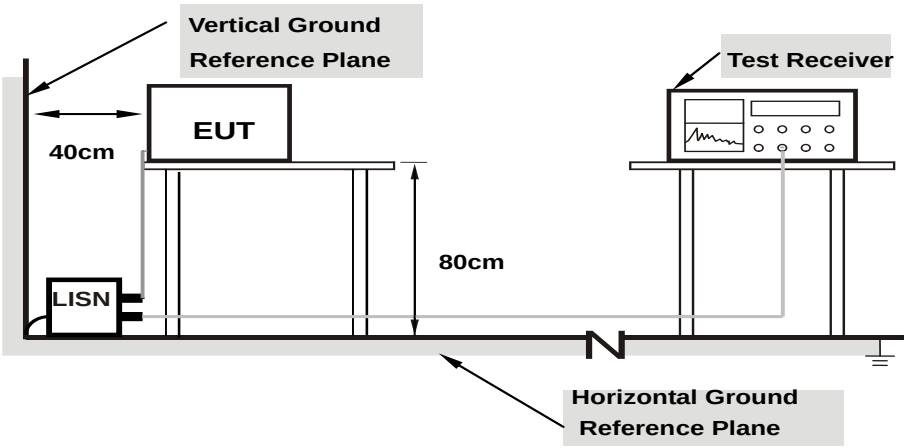
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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 150 kHz to 30 MHz was searched. Emission levels under (Limit -20 dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.2.6 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

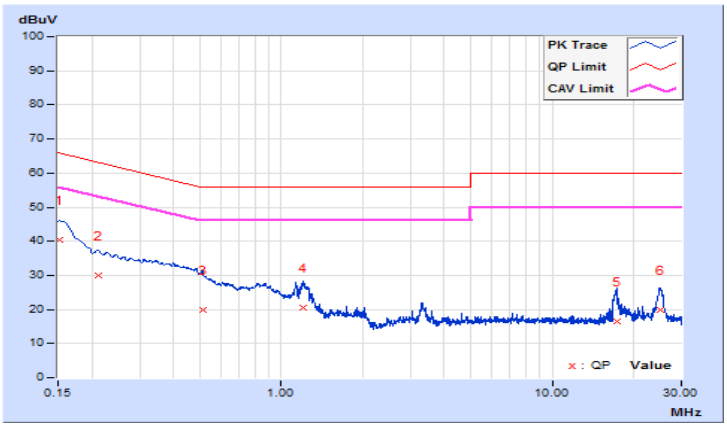
4.2.7 Test Results

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	0.15225	10.15	30.17	6.91	40.32	17.06	65.88	55.88	-25.56	-38.82
2	0.21011	10.17	19.95	0.39	30.12	10.56	63.20	53.20	-33.08	-42.64
3	0.51225	10.21	9.62	4.95	19.83	15.16	56.00	46.00	-36.17	-30.84
4	1.20975	10.27	10.41	2.18	20.68	12.45	56.00	46.00	-35.32	-33.55
5	17.26575	10.57	5.87	0.44	16.44	11.01	60.00	50.00	-43.56	-38.99
6	25.00800	10.48	9.46	0.56	19.94	11.04	60.00	50.00	-40.06	-38.96

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.

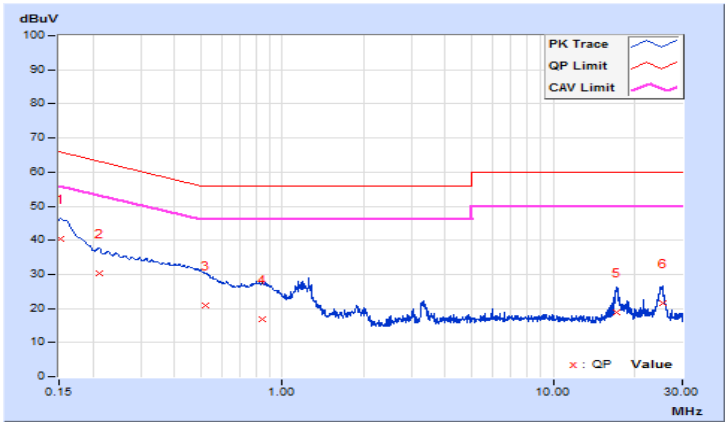


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	0.15225	10.12	30.32	7.11	40.44	17.23	65.88	55.88	-25.44	-38.65
2	0.21011	10.13	20.15	0.52	30.28	10.65	63.20	53.20	-32.92	-42.55
3	0.51834	10.19	10.68	5.02	20.87	15.21	56.00	46.00	-35.13	-30.79
4	0.84257	10.22	6.48	1.21	16.70	11.43	56.00	46.00	-39.30	-34.57
5	17.08350	10.73	7.98	2.90	18.71	13.63	60.00	50.00	-41.29	-36.37
6	25.31175	10.65	10.76	2.56	21.41	13.21	60.00	50.00	-38.59	-36.79

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 ≦ 125 mW (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	250 mW (24 dBm)
U-NII-2A			250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-2C			250 mW (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 $N_{ANT} \leq 4$;

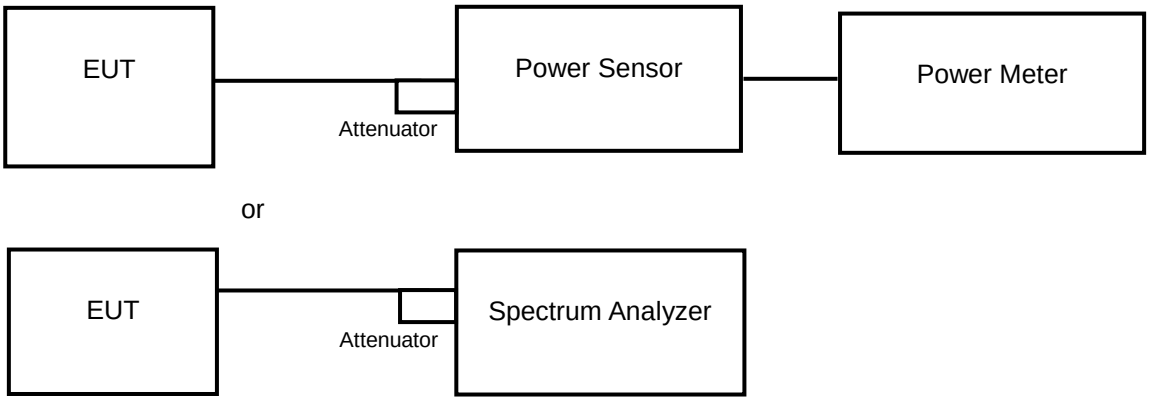
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20 MHz channel widths with $N_{ANT} \geq 5$.

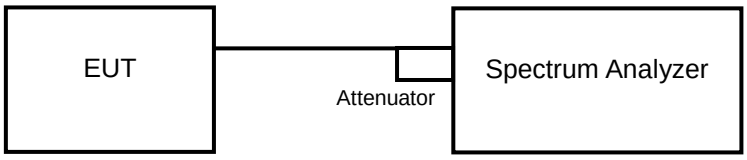
For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.3.2 Test Setup

<Power Output Measurement>



<26 dB Bandwidth>



4.3.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.3.4 Test Procedure

Average Power Measurement

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

26 dB Bandwidth

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 %.

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 Results

Power Output:

802.11a

Channel	Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass / Fail
36	5180	12.106	10.83	24	Pass
40	5200	12.503	10.97	24	Pass
48	5240	14.06	11.48	24	Pass
149	5745	9.311	9.69	30	Pass
157	5785	9.141	9.61	30	Pass
165	5825	9.638	9.84	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass / Fail
36	5180	11.092	10.45	24	Pass
40	5200	11.776	10.71	24	Pass
48	5240	13.274	11.23	24	Pass
149	5745	8.241	9.16	30	Pass
157	5785	8.356	9.22	30	Pass
165	5825	9.226	9.65	30	Pass

802.11ac (VHT20)

Channel	Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass / Fail
36	5180	10.28	10.12	24	Pass
40	5200	11.298	10.53	24	Pass
48	5240	12.618	11.01	24	Pass
149	5745	8.204	9.14	30	Pass
157	5785	8.279	9.18	30	Pass
165	5825	9.141	9.61	30	Pass

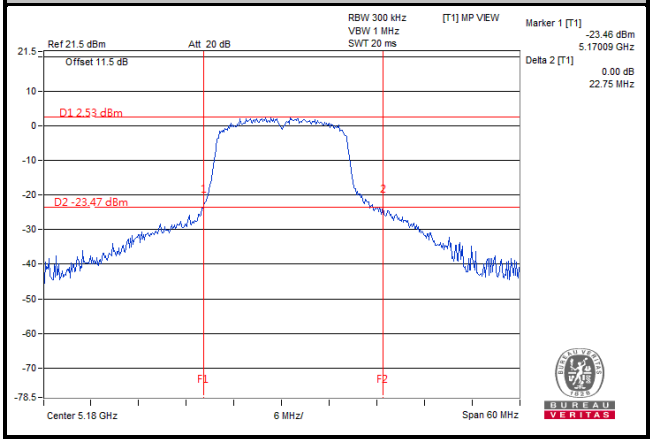
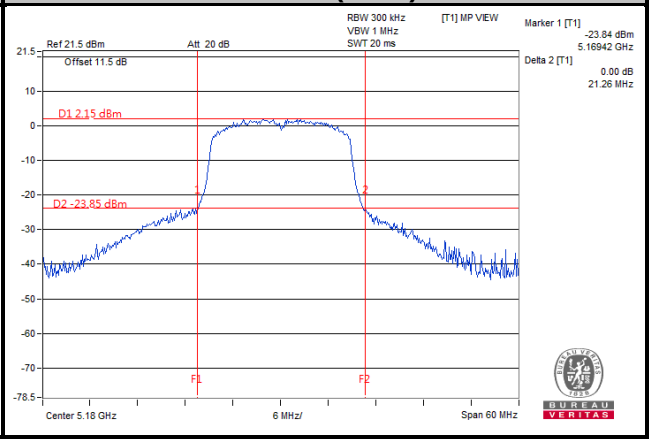
26 dB Bandwidth:

802.11a

Channel	Frequency (MHz)	26 dBc Bandwidth (MHz)
36	5180	22.75
40	5200	21.93
48	5240	21.40

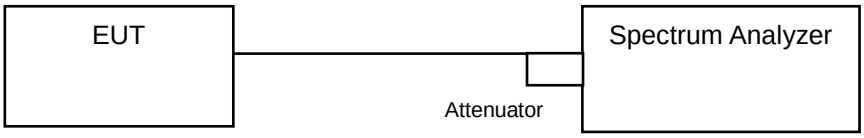
802.11n (HT20)

Channel	Frequency (MHz)	26 dBc Bandwidth (MHz)
36	5180	21.26
40	5200	20.64
48	5240	20.92

Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	

4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.3 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 SAMPLE. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.4 Test Results

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	16.44
40	5200	16.44
48	5240	16.44
149	5745	16.44
157	5785	16.44
165	5825	16.44

802.11n (HT20)

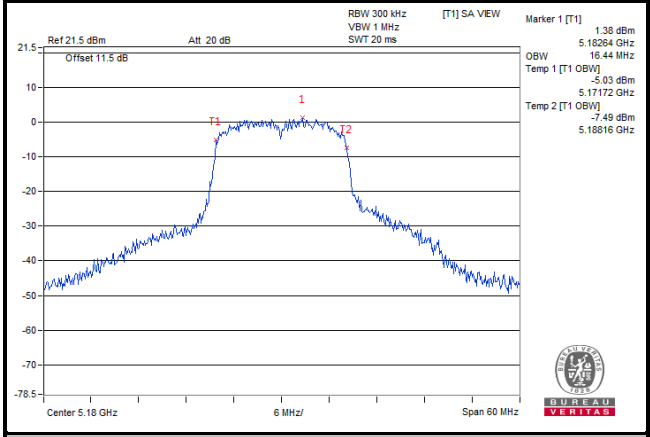
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	17.52
40	5200	17.64
48	5240	17.64
149	5745	17.52
157	5785	17.64
165	5825	17.52

802.11ac (VHT20)

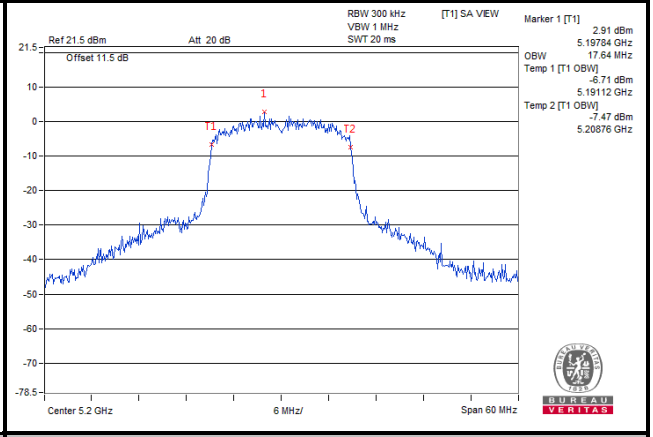
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	17.52
40	5200	17.62
48	5240	17.57
149	5745	17.52
157	5785	17.52
165	5825	17.52

Spectrum Plot of Worst Value

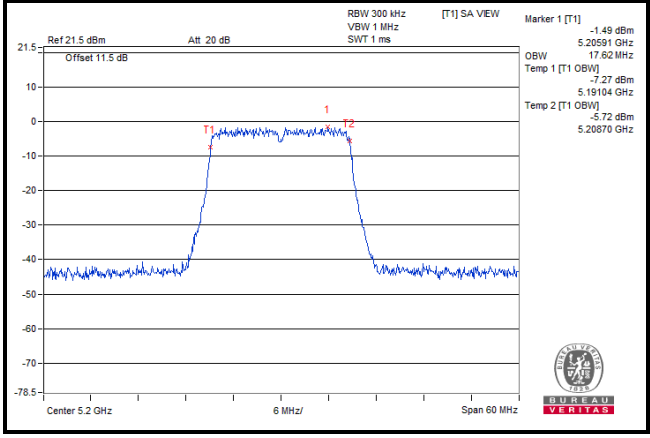
802.11a



802.11n (HT20)



802.11ac (VHT20)

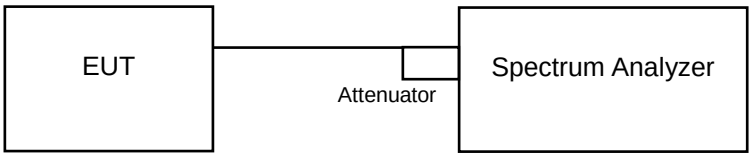


4.5 Peak Power Spectral Density Measurement

4.5.1 Limits of Peak Power Spectral Density Measurement

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.5.4 Test Procedures

For U-NII-1:

Using method SA-2

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

1. Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS
2. Sweep time = auto, trigger set to “free run”.
3. Trace average at least 100 traces in power averaging mode.
4. Record the max value and add 10 log (1/duty cycle)

※For U-NII-3:

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

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

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

4.5.7 Test Results

For U-NII-1

802.11a

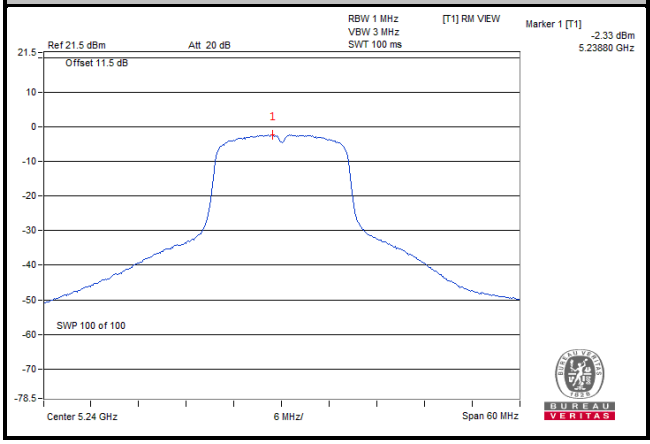
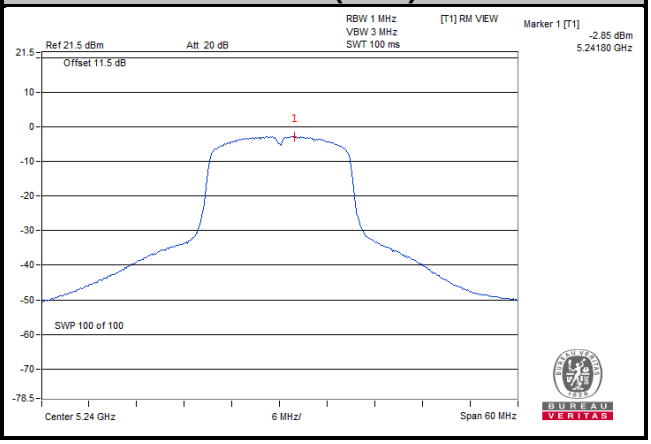
Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/MHz)	Duty Factor (dB)	PSD with Duty Factor (dBm/MHz)	Maximum Limit (dBm/MHz)	Pass / Fail
36	5180	-2.91	0.32	0.5117	11	Pass
40	5200	-3.08	0.32	0.492	11	Pass
48	5240	-2.33	0.32	0.5848	11	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/MHz)	Duty Factor (dB)	PSD with Duty Factor (dBm/MHz)	Maximum Limit (dBm/MHz)	Pass / Fail
36	5180	-3.40	0.30	0.4571	11	Pass
40	5200	-3.25	0.30	0.4732	11	Pass
48	5240	-2.85	0.30	0.5188	11	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value	
802.11a	**802.11n (HT20)**
	

For U-NII-3 Band

802.11a

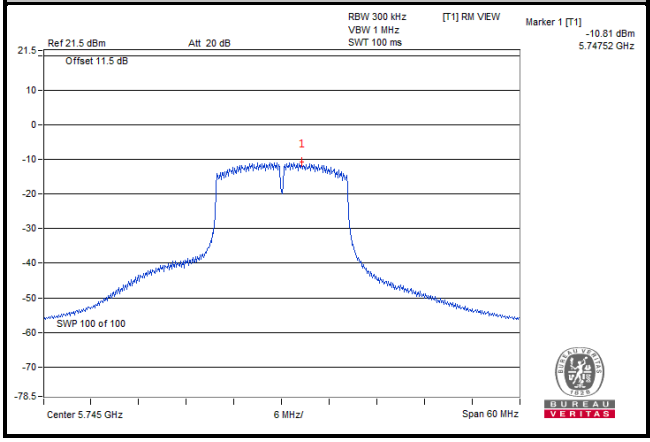
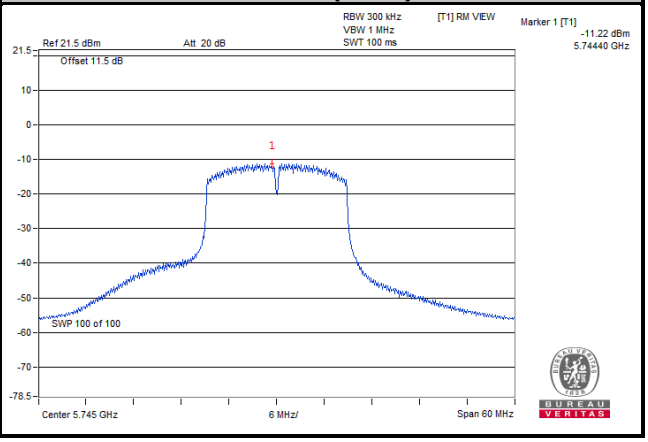
Channel	Frequency (MHz)	PSD w/o Duty Factor		Duty Factor (dB)	PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		(dBm/300 kHz)	(dBm/500 kHz)				
149	5745	-10.81	-8.59	0.32	-8.27	30	Pass
157	5785	-10.92	-8.70	0.32	-8.38	30	Pass
165	5825	-10.86	-8.64	0.32	-8.32	30	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Channel	Frequency (MHz)	PSD w/o Duty Factor		Duty Factor (dB)	PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		(dBm/300 kHz)	(dBm/500 kHz)				
149	5745	-11.22	-9.00	0.30	-8.70	30	Pass
157	5785	-11.48	-9.26	0.30	-8.96	30	Pass
165	5825	-11.49	-9.27	0.30	-8.97	30	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

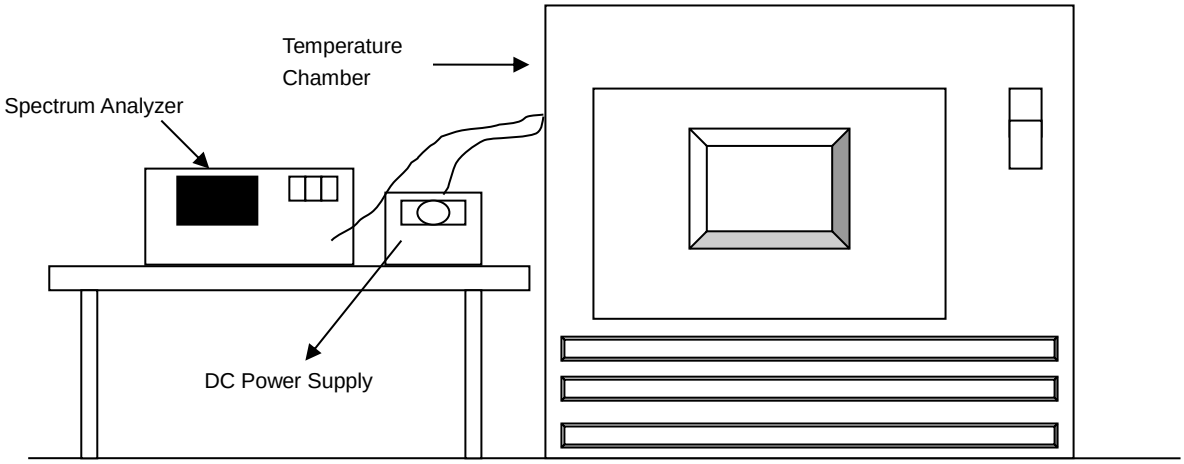
Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	

4.6 Frequency Stability

4.6.1 Limit 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

Refer to section 4.1.3 to get information of above instrument.

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: 5180 MHz									
Temp. (℃)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
65	24	5180.0181	PASS	5180.015	PASS	5180.0163	PASS	5180.0146	PASS
60	24	5180.0191	PASS	5180.0184	PASS	5180.0215	PASS	5180.019	PASS
50	24	5180.0194	PASS	5180.0225	PASS	5180.0197	PASS	5180.0194	PASS
40	24	5180.0124	PASS	5180.0127	PASS	5180.0114	PASS	5180.0133	PASS
30	24	5180.0153	PASS	5180.0112	PASS	5180.0134	PASS	5180.0149	PASS
20	24	5179.9864	PASS	5179.9841	PASS	5179.9869	PASS	5179.9853	PASS
10	24	5180.0124	PASS	5180.0143	PASS	5180.0117	PASS	5180.0159	PASS
0	24	5180.0235	PASS	5180.024	PASS	5180.0257	PASS	5180.0238	PASS
-10	24	5179.9987	PASS	5179.9957	PASS	5179.9984	PASS	5179.997	PASS
-20	24	5179.9839	PASS	5179.9856	PASS	5179.9826	PASS	5179.9844	PASS
-30	24	5180.0195	PASS	5180.0192	PASS	5180.0151	PASS	5180.0176	PASS

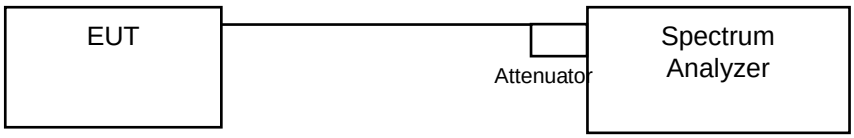
Frequency Stability Versus Voltage									
Operating Frequency: 5180 MHz									
Temp. (℃)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
20	27.6	5179.9855	PASS	5179.984	PASS	5179.9873	PASS	5179.9853	PASS
	24	5179.9864	PASS	5179.9841	PASS	5179.9869	PASS	5179.9853	PASS
	20.4	5179.9873	PASS	5179.9847	PASS	5179.986	PASS	5179.9854	PASS

4.7 6 dB Bandwidth Measurement

4.7.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set resolution bandwidth (RBW) = 100 kHz
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

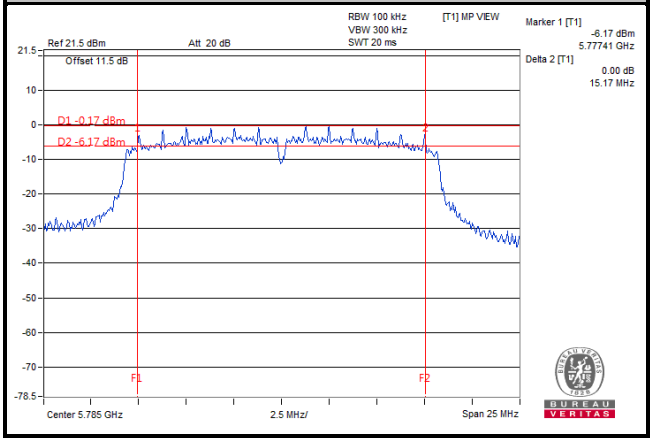
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	15.21	0.5	Pass
157	5785	15.17	0.5	Pass
165	5825	15.36	0.5	Pass

802.11n (HT20)

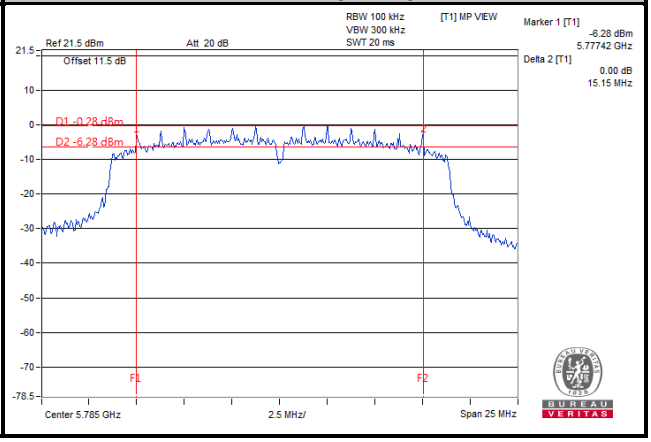
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	15.19	0.5	Pass
157	5785	15.15	0.5	Pass
165	5825	15.20	0.5	Pass

Spectrum Plot of Worst Value

802.11a



802.11n (HT20)

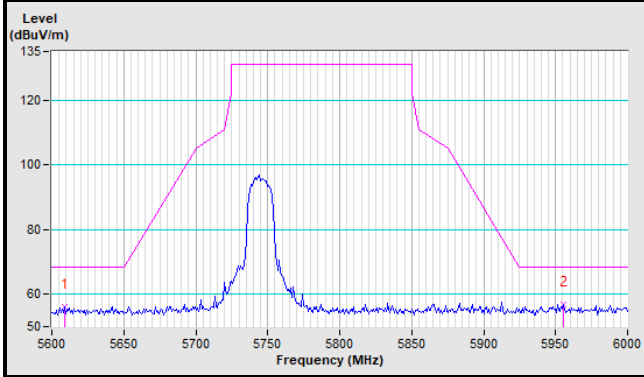
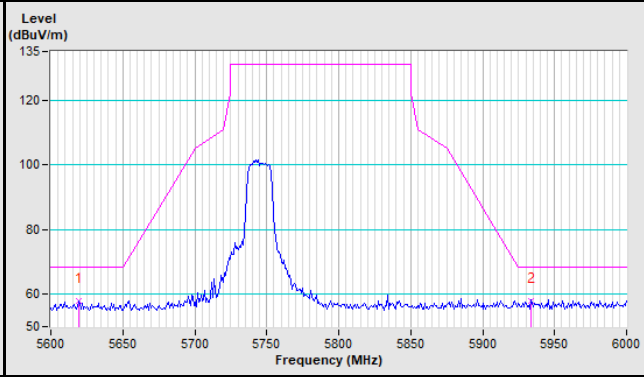


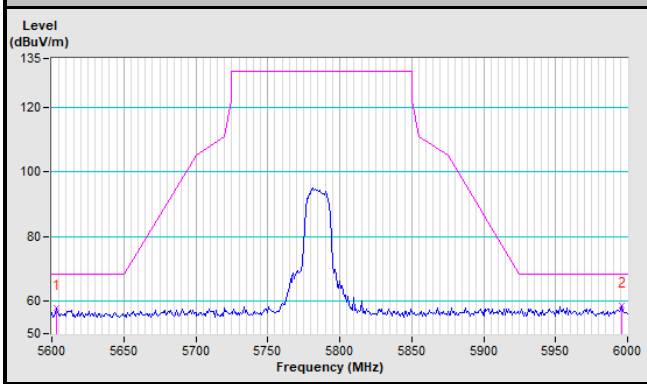
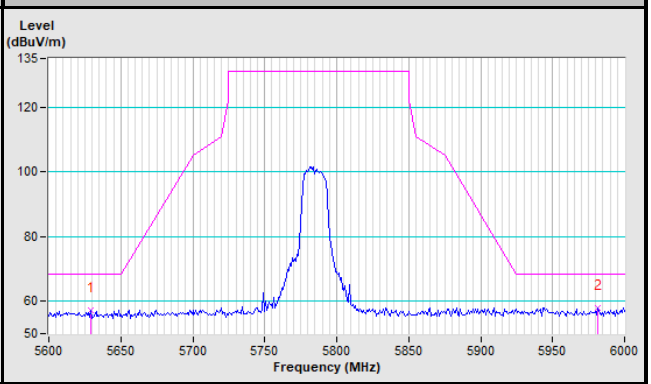
5 Pictures of Test Arrangements

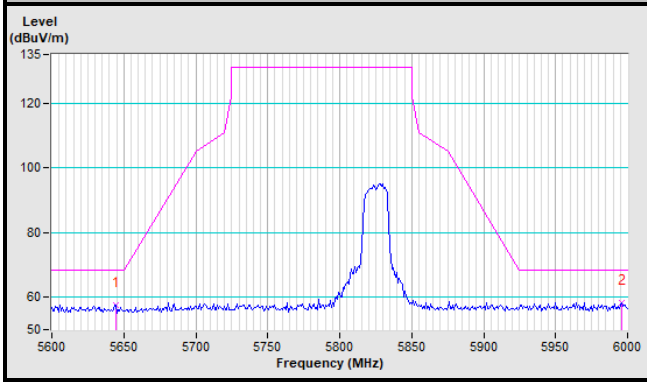
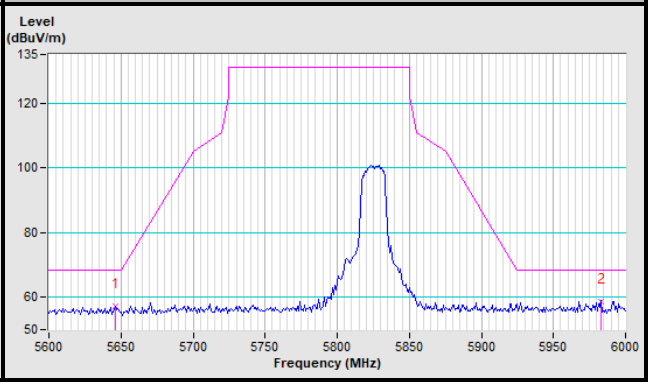
Please refer to the attached file (Test Setup Photo).

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

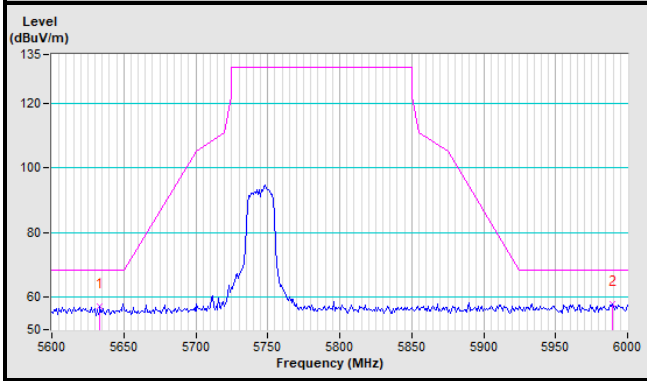
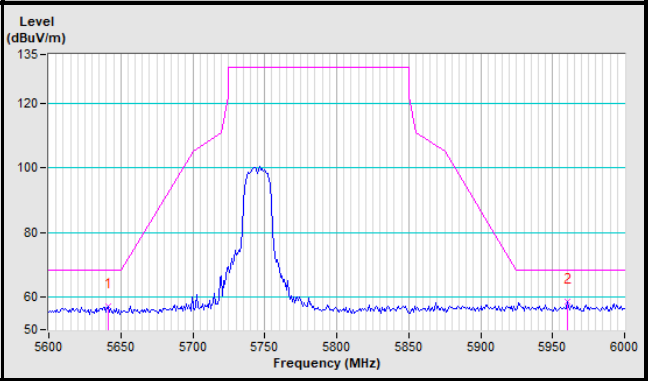
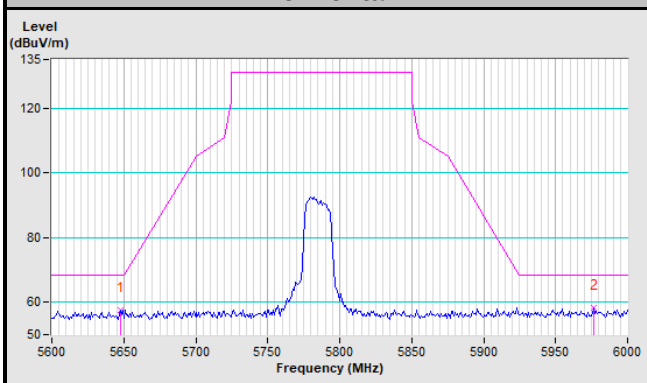
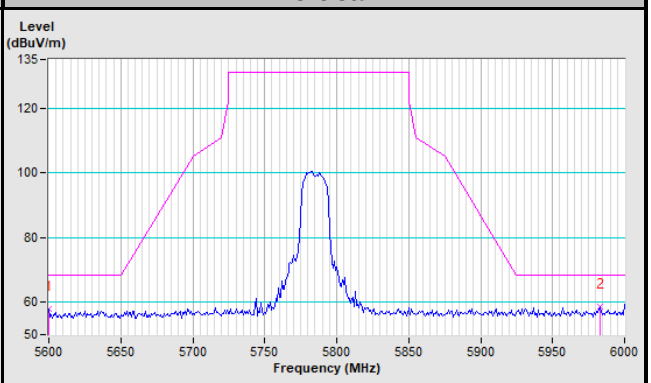
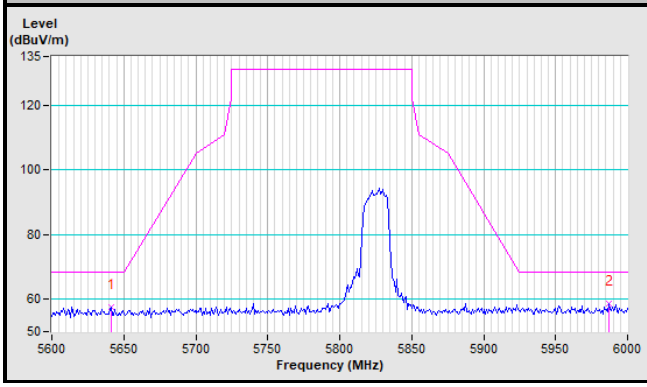
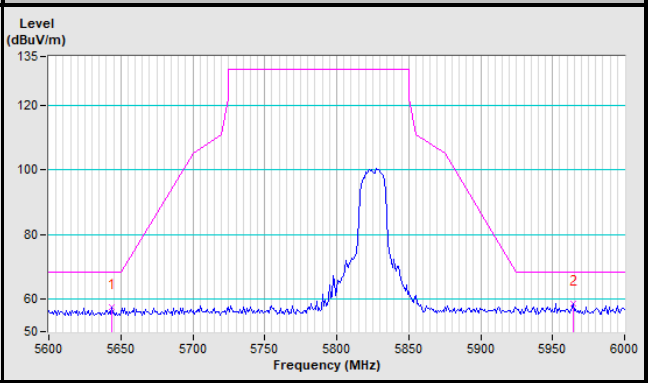
802.11a

Ch 149	
Horizontal	Vertical
	

Ch 157	
Horizontal	Vertical
	

Ch 165	
Horizontal	Vertical
	

802.11n (HT20)

Ch 149	
Horizontal	Vertical
	
Ch 157	
Horizontal	Vertical
	
Ch 165	
Horizontal	Vertical
	

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 according to ISO/IEC 17025.

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

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Web Site: www.bureauveritas-adt.com

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

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