

# FCC TEST REPORT

## (15.407)

**REPORT NO.:** RF141219C47

**MODEL NO.:** APX-57200-D

**FCC ID:** Q5A-SMAC-5700

**RECEIVED:** Dec. 19, 2014

**TESTED:** Dec. 27, 2014 ~ Jan. 05, 2015

**ISSUED:** Jan. 07, 2015

**APPLICANT:** Sify Technologies Ltd.

**ADDRESS:** II floor, TIDEL Park, 4, Rajiv Gandhi Salai,  
Tharamani, Chennai – 600113

**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch

**LAB ADDRESS:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist.,  
New Taipei City, Taiwan, R.O.C.

**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei  
Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

This report should not be used by the client to claim  
product certification, approval, or endorsement by  
TAF or any government agencies.



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

## TABLE OF CONTENTS

RELEASE CONTROL RECORD .....	4
1. CERTIFICATION .....	5
2. SUMMARY OF TEST RESULTS .....	6
2.1 MEASUREMENT UNCERTAINTY .....	6
3. GENERAL INFORMATION .....	7
3.1 GENERAL DESCRIPTION OF EUT .....	7
3.2 DESCRIPTION OF TEST MODES .....	8
3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL .....	9
3.3 DUTY CYCLE OF TEST SIGNAL .....	11
3.4 DESCRIPTION OF SUPPORT UNITS .....	12
3.4.1 CONFIGURATION OF SYSTEM UNDER TEST .....	12
3.5 GENERAL DESCRIPTION OF APPLIED STANDARDS .....	13
4. TEST TYPES AND RESULTS .....	14
4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT .....	14
4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT .....	14
4.1.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS .....	14
4.1.3 TEST INSTRUMENTS .....	15
4.1.4 TEST PROCEDURES .....	16
4.1.5 DEVIATION FROM TEST STANDARD .....	16
4.1.6 TEST SETUP .....	17
4.1.7 EUT OPERATING CONDITION .....	18
4.1.8 TEST RESULTS .....	19
4.2 CONDUCTED EMISSION MEASUREMENT .....	28
4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT .....	28
4.2.2 TEST INSTRUMENTS .....	28
4.2.3 TEST PROCEDURES .....	29
4.2.4 DEVIATION FROM TEST STANDARD .....	29
4.2.5 TEST SETUP .....	29
4.2.6 EUT OPERATING CONDITIONS .....	29
4.2.7 TEST RESULTS .....	30
4.3 TRANSMIT POWER MEASUREMENT .....	32
4.3.1 LIMITS OF TRANSMIT POWER MEASUREMENT .....	32
4.3.2 TEST SETUP .....	32
4.3.3 TEST INSTRUMENTS .....	33
4.3.4 TEST PROCEDURE .....	33
4.3.5 DEVIATION FROM TEST STANDARD .....	33
4.3.6 EUT OPERATING CONDITIONS .....	33
4.3.7 TEST RESULTS .....	34
4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT .....	35
4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT .....	35
4.4.2 TEST SETUP .....	35
4.4.3 TEST INSTRUMENTS .....	35
4.4.4 TEST PROCEDURES .....	35
4.4.5 DEVIATION FROM TEST STANDARD .....	36
4.4.6 EUT OPERATING CONDITIONS .....	36
4.4.7 TEST RESULTS .....	37
4.5 FREQUENCY STABILITY .....	39
4.5.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT .....	39
4.5.2 TEST SETUP .....	39
4.5.3 TEST INSTRUMENTS .....	39



A D T

4.5.4	TEST PROCEDURE.....	40
4.5.5	DEVIATION FROM TEST STANDARD .....	40
4.5.6	EUT OPERATING CONDITION.....	40
4.5.7	TEST RESULTS .....	41
4.6	6DB BANDWIDTH MEASUREMENT .....	42
4.6.1	LIMITS OF 6DB BANDWIDTH MEASUREMENT .....	42
4.6.2	TEST SETUP .....	42
4.6.3	TEST INSTRUMENTS.....	42
4.6.4	TEST PROCEDURE.....	42
4.6.5	DEVIATION FROM TEST STANDARD .....	42
4.6.6	EUT OPERATING CONDITIONS .....	42
4.6.7	TEST RESULTS .....	43
5.	PHOTOGRAPHS OF THE TEST CONFIGURATION.....	45
6.	INFORMATION ON THE TESTING LABORATORIES .....	46
7.	APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB.....	47



## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF141219C47	Original release	Jan. 07, 2015

## 1. CERTIFICATION

**PRODUCT:** WIFI AP 802.11a/n 2x2 300Mbps

**MODEL:** APX-57200-D

**BRAND:** Sify

**APPLICANT:** Sify Technologies Ltd.

**TESTED:** Dec. 27, 2014 ~ Jan. 05, 2015

**TEST SAMPLE:** ENGINEERING SAMPLE

**STANDARDS:** FCC Part 15, Subpart E (Section 15.407)

The above equipment (model: APX-57200-D) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY :** Celine Chou , **DATE :** Jan. 07, 2015  
Celine Chou / Specialist

**APPROVED BY :** Ken Liu , **DATE :** Jan. 07, 2015  
Ken Liu / Senior Manager

## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART E (SECTION 15.407 UNDER NEW RULE)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.407(b)(6)	AC Power Conducted Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -16.17dB at 0.16564MHz.
15.407(b)(1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -1.0dB at 5456.00 and 5714.00MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(1/2/3)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(e)	6dB bandwidth	PASS	Meet the requirement of limit. (U-NII-3 Band only)
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is N Type. (The device is professionally installed)

### 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	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	WIFI AP 802.11a/n 2x2 300Mbps
<b>MODEL NO.</b>	APX-57200-D
<b>POWER SUPPLY</b>	48Vdc (POE)
<b>MODULATION TYPE</b>	64QAM, 16QAM, QPSK, BPSK
<b>MODULATION TECHNOLOGY</b>	OFDM
<b>TRANSFER RATE</b>	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300Mbps
<b>OPERATING FREQUENCY</b>	5745 ~ 5825MHz
<b>NUMBER OF CHANNEL</b>	5 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
<b>OUTPUT POWER</b>	166.341mW
<b>ANTENNA TYPE</b>	Dipole antenna with 6.03dBi gain
<b>ANTENNA CONNECTOR</b>	N Type (The device is professionally installed)
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	Refer to user's manual
<b>ACCESSORY DEVICES</b>	POE

**NOTE:**

- 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 (20MHz)	2TX
802.11n (40MHz)	2TX

- The EUT uses following POE.

<b>BRAND:</b>	Powertron
<b>MODEL:</b>	POE1024-480T3A050
<b>INPUT:</b>	100-240Vac, 50-60Hz, 1.0A
<b>OUTPUT:</b>	48Vdc, 0.5A

- The above EUT information is declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 DESCRIPTION OF TEST MODES

5 channels are provided for 802.11a, 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755MHz	159	5795MHz



### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

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

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

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

#### **RADIATED EMISSION TEST (ABOVE 1GHz):**

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

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

EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)		149 to 165	149, 157, 165	OFDM	BPSK	7.2
-	802.11n (40MHz)		151 to 159	151, 159	OFDM	BPSK	15.0

#### **RADIATED EMISSION TEST (BELOW 1GHz):**

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

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

EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5745-5825	149 to 165	149	OFDM	BPSK	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	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5745-5825	149 to 165	149	OFDM	BPSK	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	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)		149 to 165	149, 157, 165	OFDM	BPSK	7.2
-	802.11n (40MHz)		151 to 159	151, 159	OFDM	BPSK	15.0

#### **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
<b>RE<math>\geq</math>1G</b>	19deg. C, 65%RH	120Vac, 60Hz	Nick Hsu
<b>RE<math>&lt;</math>1G</b>	19deg. C, 65%RH	120Vac, 60Hz	Jones Chang
<b>PLC</b>	20deg. C, 70%RH	120Vac, 60Hz	Jones Chang
<b>APCM</b>	25deg. C, 60%RH	120Vac, 60Hz	Nick Hsu

### 3.3 DUTY CYCLE OF TEST SIGNAL

Duty cycle of test signal is < 98%, duty factor shall be considered.

**802.11a:** Duty cycle =  $1.352/1.405 = 0.962$ , Duty factor =  $10 * \log(1/0.962) = 0.17$

**802.11n (20MHz):** Duty cycle =  $1.258/1.318 = 0.954$ , Duty factor =  $10 * \log(1/0.954) = 0.20$

**802.11n (40MHz):** Duty cycle =  $0.622/0.664 = 0.937$ , Duty factor =  $10 * \log(1/0.937) = 0.28$



### 3.4 DESCRIPTION OF SUPPORT UNITS

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

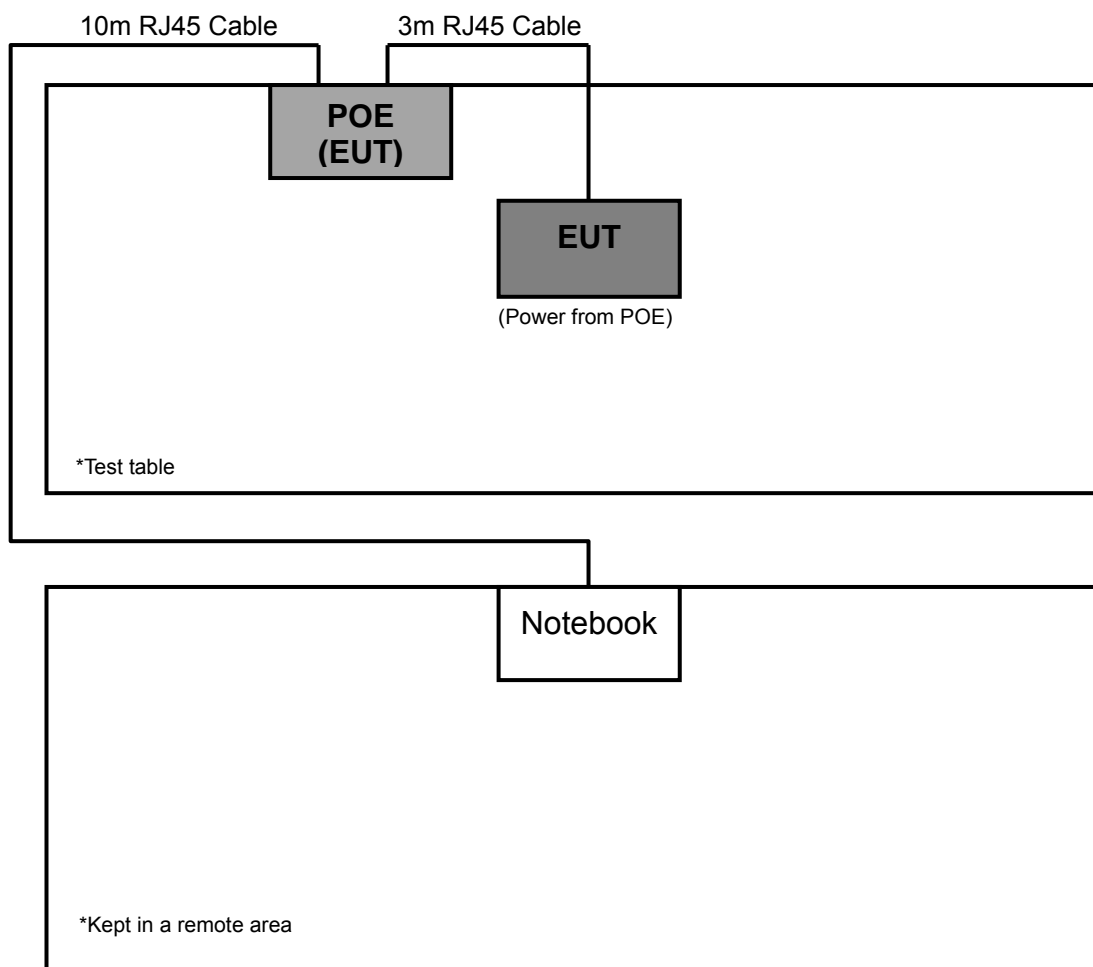
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK	DELL	E5410	1HC2XM1	FCC DoC Approved

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	3m RJ45 Cable

**NOTE:**

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

#### 3.4.1 CONFIGURATION OF SYSTEM UNDER TEST



### **3.5 GENERAL DESCRIPTION OF APPLIED STANDARDS**

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

**FCC Part 15, Subpart E (15.407)**

**789033 D02 General UNII Test Procedures New Rules v01**

**662911 D01 Multiple Transmitter Output v02r01**

**ANSI C63.10-2009**

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

**NOTE:** The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

## 4. TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

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

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

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

#### 4.1.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
789033 D02 General UNII Test Procedures New Rules v01	FIELD STRENGTH AT 3m	
	PK: 74 (dBuV/m)	AV: 54 (dBuV/m)
APPLICABLE TO	EIRP LIMIT	EQUIVALENT FIELD STRENGTH AT 3m
15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.2 (dBuV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)	PK: -27 (dBm/MHz) <sup>*1</sup> PK: -17 (dBm/MHz) <sup>*2</sup>	PK: 68.2 (dBuV/m) <sup>*1</sup> PK: 78.2 (dBuV/m) <sup>*2</sup>

**NOTE:** <sup>\*1</sup> beyond 10MHz of the band edge <sup>\*2</sup> within 10 MHz of band edge

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

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

#### 4.1.3 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Jan. 02, 2014	Jan. 01, 2015
			Jan. 02, 2015	Jan. 01, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Mar. 03, 2014	Mar. 02, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Feb. 26, 2014	Feb. 25, 2015
HORN Antenna SCHWARZBECK	9120D	209	Aug. 25, 2014	Aug. 24, 2015
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 17, 2014	Feb. 16, 2015
Preamplifier Agilent	8447D	2944A10738	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2014	Aug. 21, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	214378/4	Aug. 22, 2014	Aug. 21, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6 +309224/4	Aug. 22, 2014	Aug. 21, 2015
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller inn-co GmbH	CO2000	017303	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 18, 2014	Oct. 17, 2015
High Speed Peak Power Meter	ML2495A	0824011	Jul. 26, 2014	Jul. 25, 2015
Power Sensor	MA2411B	0738171	Jul. 26, 2014	Jul. 25, 2015
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 09, 2014	Jun. 08, 2015
Mini-Circuits Power Splitter	ZN2PD-9G	NA	Apr. 25, 2014	Apr. 24, 2015

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 988962.
5. The IC Site Registration No. is IC 7450F-3.

#### 4.1.4 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. 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 antenna is a broadband antenna, and its height 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

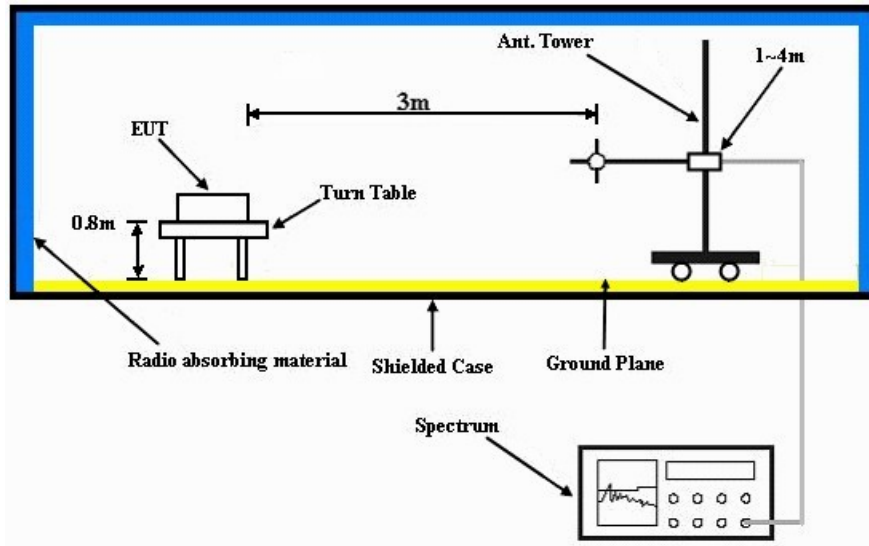
#### 4.1.5 DEVIATION FROM TEST STANDARD

No deviation.

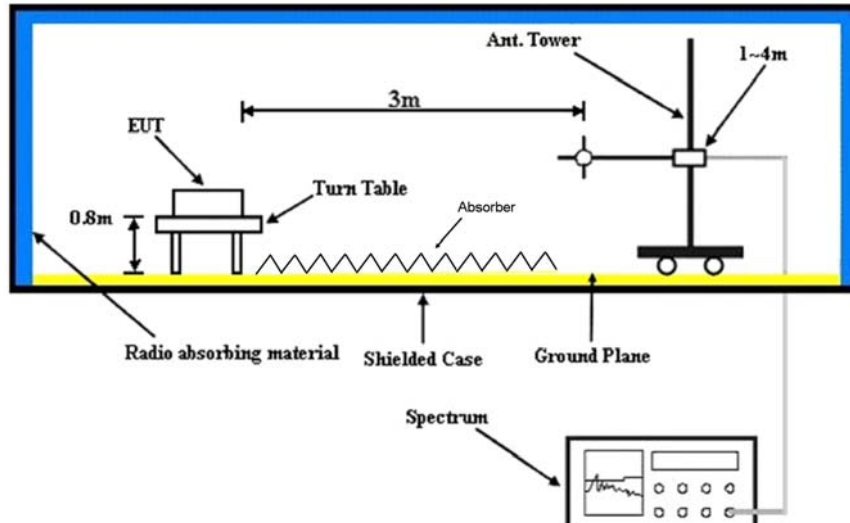


#### 4.1.6 TEST SETUP

##### Frequency range 30MHz~1GHz



##### Frequency range above 1GHz



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

#### 4.1.7 EUT OPERATING CONDITION

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

#### 4.1.8 TEST RESULTS

##### ABOVE 1GHz WORST-CASE DATA:

##### 802.11a

CHANNEL	TX Channel 149	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	63.9 PK	74.0	-10.1	1.00 H	170	57.20	6.70
2	5456.00	52.5 AV	54.0	-1.5	1.00 H	170	45.80	6.70
3	#5714.00	64.1 PK	74.0	-9.9	1.00 H	157	57.10	7.00
4	#5714.00	51.4 AV	54.0	-2.6	1.00 H	157	44.40	7.00
5	#5722.00	76.6 PK	78.2	-1.6	1.02 H	157	69.60	7.00
6	#5725.00	61.7 PK	78.2	-16.5	1.02 H	155	54.60	7.10
7	*5745.00	119.4 PK			1.13 H	156	78.80	40.60
8	*5745.00	109.6 AV			1.13 H	156	69.00	40.60
9	11490.00	59.2 PK	74.0	-14.8	1.14 H	76	40.40	18.80
10	11490.00	46.3 AV	54.0	-7.7	1.14 H	76	27.50	18.80
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	5456.00	58.0 PK	74.0	-16.0	1.25 V	55	51.30	6.70
2	5456.00	45.7 AV	54.0	-8.3	1.25 V	55	39.00	6.70
3	#5714.00	58.1 PK	74.0	-15.9	1.00 V	264	51.10	7.00
4	#5714.00	45.1 AV	54.0	-8.9	1.00 V	264	38.10	7.00
5	#5722.00	63.4 PK	78.2	-14.8	1.39 V	267	56.40	7.00
6	#5725.00	52.0 PK	78.2	-26.2	1.42 V	261	44.90	7.10
7	*5745.00	105.9 PK			1.22 V	88	65.30	40.60
8	*5745.00	96.0 AV			1.22 V	88	55.40	40.60
9	11490.00	59.9 PK	74.0	-14.1	1.00 V	292	41.10	18.80
10	11490.00	46.3 AV	54.0	-7.7	1.00 V	292	27.50	18.80

##### REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	64.0 PK	74.0	-10.0	1.00 H	172	57.30	6.70
2	5456.00	52.8 AV	54.0	-1.2	1.00 H	172	46.10	6.70
3	*5785.00	118.3 PK			1.11 H	157	77.60	40.70
4	*5785.00	108.9 AV			1.11 H	157	68.20	40.70
5	11570.00	59.4 PK	74.0	-14.6	1.17 H	124	40.50	18.90
6	11570.00	46.6 AV	54.0	-7.4	1.17 H	124	27.70	18.90
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	5456.00	57.7 PK	74.0	-16.3	1.14 V	269	51.00	6.70
2	5456.00	45.1 AV	54.0	-8.9	1.14 V	269	38.40	6.70
3	*5785.00	106.5 PK			1.21 V	92	65.80	40.70
4	*5785.00	97.0 AV			1.21 V	92	56.30	40.70
5	11570.00	59.0 PK	74.0	-15.0	1.00 V	116	40.10	18.90
6	11570.00	46.4 AV	54.0	-7.6	1.00 V	116	27.50	18.90

#### REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	63.6 PK	74.0	-10.4	1.00 H	170	56.90	6.70
2	5456.00	53.0 AV	54.0	-1.0	1.00 H	170	46.30	6.70
3	*5825.00	117.3 PK			1.11 H	156	76.60	40.70
4	*5825.00	107.2 AV			1.11 H	156	66.50	40.70
5	#5850.00	50.9 PK	78.2	-27.3	1.11 H	154	43.90	7.00
6	#5853.00	65.4 PK	78.2	-12.8	1.10 H	156	58.30	7.10
7	#5861.00	62.3 PK	74.0	-11.7	1.10 H	157	55.20	7.10
8	#5861.00	47.8 AV	54.0	-6.2	1.10 H	157	40.70	7.10
9	11650.00	60.3 PK	74.0	-13.7	1.18 H	75	40.90	19.40
10	11650.00	47.4 AV	54.0	-6.6	1.18 H	75	28.00	19.40
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	5456.00	57.6 PK	74.0	-16.4	1.03 V	91	50.90	6.70
2	5456.00	45.0 AV	54.0	-9.0	1.03 V	91	38.30	6.70
3	*5825.00	103.0 PK			1.00 V	272	62.30	40.70
4	*5825.00	92.8 AV			1.00 V	272	52.10	40.70
5	#5850.00	45.8 PK	78.2	-32.4	1.00 V	197	38.80	7.00
6	#5853.00	58.1 PK	78.2	-20.1	1.00 V	198	51.00	7.10
7	#5861.00	58.4 PK	74.0	-15.6	1.00 V	167	51.30	7.10
8	#5861.00	44.7 AV	54.0	-9.3	1.00 V	167	37.60	7.10
9	11650.00	60.0 PK	74.0	-14.0	1.00 V	53	40.60	19.40
10	11650.00	47.0 AV	54.0	-7.0	1.00 V	53	27.60	19.40

#### REMARKS:

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

# 802.11n (20MHz)

CHANNEL	TX Channel 149	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	63.4 PK	74.0	-10.6	1.00 H	171	56.70	6.70
2	5456.00	52.2 AV	54.0	-1.8	1.00 H	171	45.50	6.70
3	#5714.00	71.1 PK	74.0	-2.9	1.02 H	157	64.10	7.00
4	#5714.00	51.6 AV	54.0	-2.4	1.02 H	157	44.60	7.00
5	#5722.00	76.4 PK	78.2	-1.8	1.03 H	155	69.40	7.00
6	#5725.00	60.2 PK	78.2	-18.0	1.01 H	149	53.10	7.10
7	*5745.00	118.0 PK			1.13 H	158	77.40	40.60
8	*5745.00	108.0 AV			1.13 H	158	67.40	40.60
9	11490.00	59.2 PK	74.0	-14.8	1.21 H	94	40.40	18.80
10	11490.00	46.2 AV	54.0	-7.8	1.21 H	94	27.40	18.80
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	5456.00	57.9 PK	74.0	-16.1	1.00 V	181	51.20	6.70
2	5456.00	44.8 AV	54.0	-9.2	1.00 V	181	38.10	6.70
3	#5714.00	57.9 PK	74.0	-16.1	1.00 V	122	50.90	7.00
4	#5714.00	44.6 AV	54.0	-9.4	1.00 V	122	37.60	7.00
5	#5722.00	63.2 PK	78.2	-15.0	1.03 V	142	56.20	7.00
6	#5725.00	50.5 PK	78.2	-27.7	1.02 V	141	43.40	7.10
7	*5745.00	105.6 PK			1.22 V	88	65.00	40.60
8	*5745.00	95.5 AV			1.22 V	88	54.90	40.60
9	11490.00	59.1 PK	74.0	-14.9	1.00 V	136	40.30	18.80
10	11490.00	45.7 AV	54.0	-8.3	1.00 V	136	26.90	18.80

## REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	63.3 PK	74.0	-10.7	1.00 H	171	56.60	6.70
2	5456.00	52.9 AV	54.0	-1.1	1.00 H	171	46.20	6.70
3	*5785.00	117.9 PK			1.11 H	156	77.20	40.70
4	*5785.00	108.0 AV			1.11 H	156	67.30	40.70
5	11570.00	59.9 PK	74.0	-14.1	1.26 H	245	41.00	18.90
6	11570.00	47.1 AV	54.0	-6.9	1.26 H	245	28.20	18.90
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	5456.00	58.0 PK	74.0	-16.0	1.00 V	136	51.30	6.70
2	5456.00	45.1 AV	54.0	-8.9	1.00 V	136	38.40	6.70
3	*5785.00	106.9 PK			1.21 V	93	66.20	40.70
4	*5785.00	96.9 AV			1.21 V	93	56.20	40.70
5	11570.00	60.5 PK	74.0	-13.5	1.00 V	284	41.60	18.90
6	11570.00	46.6 AV	54.0	-7.4	1.00 V	284	27.70	18.90

#### REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	63.8 PK	74.0	-10.2	1.00 H	170	57.10	6.70
2	5456.00	52.9 AV	54.0	-1.1	1.00 H	170	46.20	6.70
3	*5825.00	116.8 PK			1.11 H	158	76.10	40.70
4	*5825.00	106.9 AV			1.11 H	158	66.20	40.70
5	#5850.00	52.6 PK	78.2	-25.6	1.10 H	157	45.60	7.00
6	#5853.00	65.8 PK	78.2	-12.4	1.10 H	156	58.70	7.10
7	#5861.00	62.0 PK	74.0	-12.0	1.10 H	157	54.90	7.10
8	#5861.00	47.5 AV	54.0	-6.5	1.10 H	157	40.40	7.10
9	11650.00	59.8 PK	74.0	-14.2	1.21 H	223	40.40	19.40
10	11650.00	47.3 AV	54.0	-6.7	1.21 H	223	27.90	19.40
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	5456.00	57.9 PK	74.0	-16.1	1.00 V	174	51.20	6.70
2	5456.00	44.9 AV	54.0	-9.1	1.00 V	174	38.20	6.70
3	*5825.00	104.7 PK			1.20 V	93	64.00	40.70
4	*5825.00	94.5 AV			1.20 V	93	53.80	40.70
5	#5850.00	57.5 PK	74.0	-16.5	1.19 V	157	50.50	7.00
6	#5850.00	45.1 AV	54.0	-8.9	1.19 V	157	38.10	7.00
7	#5853.00	58.3 PK	78.2	-19.9	1.05 V	235	51.20	7.10
8	#5861.00	58.0 PK	74.0	-16.0	1.05 V	204	50.90	7.10
9	#5861.00	44.9 AV	54.0	-9.1	1.05 V	204	37.80	7.10
10	11650.00	60.2 PK	74.0	-13.8	1.00 V	284	40.80	19.40
11	11650.00	47.1 AV	54.0	-6.9	1.00 V	284	27.70	19.40

#### REMARKS:

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



# 802.11n (40MHz)

CHANNEL	TX Channel 151	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5714.00	69.7 PK	74.0	-4.3	1.03 H	156	62.70	7.00
2	#5714.00	53.0 AV	54.0	-1.0	1.03 H	156	46.00	7.00
3	#5720.00	75.1 PK	78.2	-3.1	1.03 H	156	68.10	7.00
4	#5725.00	73.2 PK	78.2	-5.0	1.03 H	156	66.10	7.10
5	*5755.00	109.4 PK			1.03 H	155	68.70	40.70
6	*5755.00	99.1 AV			1.03 H	155	58.40	40.70
7	11510.00	60.3 PK	74.0	-13.7	1.14 H	279	41.50	18.80
8	11510.00	46.9 AV	54.0	-7.1	1.14 H	279	28.10	18.80
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5714.00	58.0 PK	74.0	-16.0	1.00 V	266	51.00	7.00
2	#5714.00	47.0 AV	54.0	-7.0	1.00 V	266	40.00	7.00
3	#5722.00	63.0 PK	78.2	-15.2	1.39 V	266	56.00	7.00
4	#5725.00	57.1 PK	78.2	-21.1	1.40 V	258	50.00	7.10
5	*5755.00	98.0 PK			1.22 V	90	57.30	40.70
6	*5755.00	87.1 AV			1.22 V	90	46.40	40.70
7	11510.00	60.8 PK	74.0	-13.2	1.01 V	19	42.00	18.80
8	11510.00	48.0 AV	54.0	-6.0	1.01 V	19	29.20	18.80

## REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5456.00	64.5 PK	74.0	-9.5	1.00 H	168	57.80	6.70
2	5456.00	52.3 AV	54.0	-1.7	1.00 H	168	45.60	6.70
3	*5795.00	115.6 PK			1.13 H	159	74.90	40.70
4	*5795.00	105.3 AV			1.13 H	159	64.60	40.70
5	#5850.00	63.8 PK	78.2	-14.4	1.13 H	156	56.80	7.00
6	#5858.00	65.5 PK	78.2	-12.7	1.13 H	156	58.40	7.10
7	#5861.00	60.7 PK	74.0	-13.3	1.13 H	156	53.60	7.10
8	#5861.00	50.0 AV	54.0	-4.0	1.13 H	156	42.90	7.10
9	11590.00	60.4 PK	74.0	-13.6	1.20 H	212	41.40	19.00
10	11590.00	47.9 AV	54.0	-6.1	1.20 H	212	28.90	19.00
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	5456.00	57.0 PK	74.0	-17.0	1.00 V	178	50.30	6.70
2	5456.00	46.7 AV	54.0	-7.3	1.00 V	178	40.00	6.70
3	*5795.00	103.2 PK			1.40 V	76	62.50	40.70
4	*5795.00	93.0 AV			1.40 V	76	52.30	40.70
5	#5850.00	59.1 PK	78.2	-19.1	1.19 V	160	52.10	7.00
6	#5853.00	60.0 PK	78.2	-18.2	1.19 V	160	52.90	7.10
7	#5861.00	57.6 PK	74.0	-16.4	1.00 V	211	50.50	7.10
8	#5861.00	46.1 AV	54.0	-7.9	1.00 V	211	39.00	7.10
9	11590.00	60.3 PK	74.0	-13.7	1.00 V	280	41.30	19.00
10	11590.00	47.2 AV	54.0	-6.8	1.00 V	280	28.20	19.00

#### REMARKS:

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

# BELOW 1GHz WORST-CASE DATA: 802.11a

CHANNEL	TX Channel 149	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	57.12	34.8 QP	40.0	-5.2	1.99 H	66	49.50	-14.70
2	109.62	35.5 QP	43.5	-8.0	1.49 H	49	52.90	-17.40
3	160.17	31.8 QP	43.5	-11.7	1.49 H	239	45.50	-13.70
4	294.32	29.3 QP	46.0	-16.7	1.00 H	100	41.80	-12.50
5	337.10	31.4 QP	46.0	-14.6	1.99 H	189	43.00	-11.60
6	675.40	27.7 QP	46.0	-18.3	1.00 H	5	32.60	-4.90
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	59.28	34.3 QP	40.0	-5.7	1.00 V	32	49.20	-14.90
2	113.50	35.2 QP	43.5	-8.3	1.00 V	296	52.10	-16.90
3	175.72	35.2 QP	43.5	-8.3	1.00 V	34	50.00	-14.80
4	249.60	33.7 QP	46.0	-12.3	1.00 V	175	48.00	-14.30
5	337.10	33.1 QP	46.0	-12.9	1.49 V	237	44.70	-11.60
6	836.78	41.6 QP	46.0	-4.4	1.99 V	357	43.40	-1.80

## REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

## 4.2 CONDUCTED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	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.  
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCI	100612	Sep. 30, 2014	Sep. 29, 2015
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 13, 2014	Feb. 12, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 21, 2014	Jul. 20, 2015
Software ADT	BV ADT_Conc_ V7.3.7.3	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-2040.

#### 4.2.3 TEST PROCEDURES

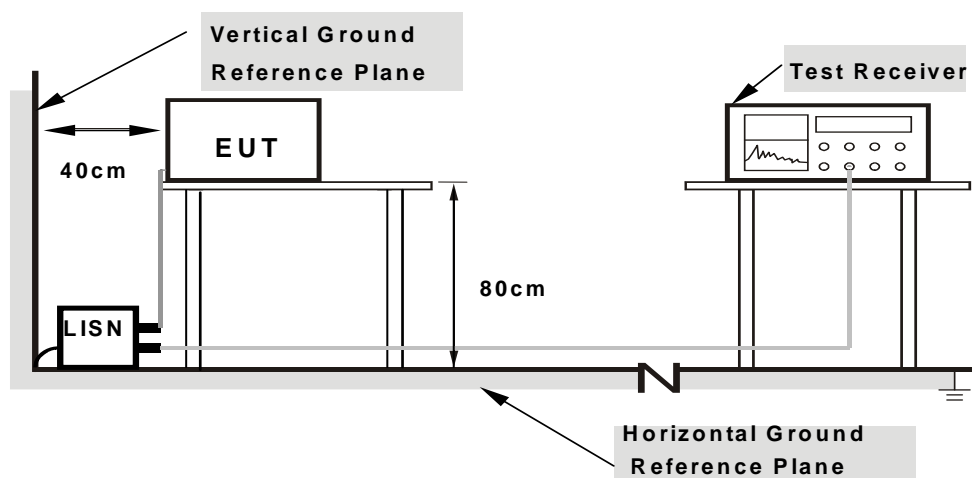
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were 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:**
- Support units were connected to second LISN.
  - 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

Same as 4.1.7.

## 4.2.7 TEST RESULTS

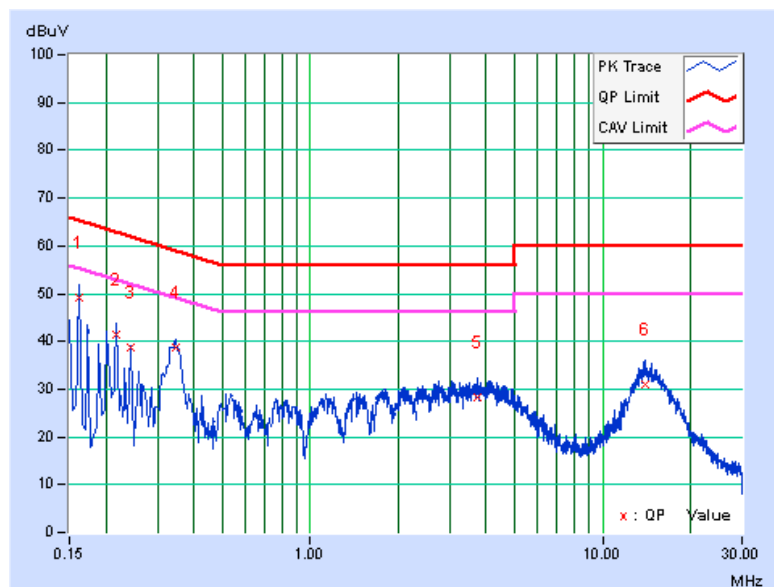
### CONDUCTED WORST-CASE DATA : 802.11a

PHASE	Line 1	6dB BANDWIDTH	9kHz
-------	--------	---------------	------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16173	0.11	48.93	30.00	49.04	30.11	65.37	55.37	-16.34	-25.27
2	0.21647	0.09	41.24	24.56	41.33	24.65	62.95	52.95	-21.62	-28.30
3	0.24384	0.09	38.59	24.29	38.68	24.38	61.96	51.96	-23.28	-27.58
4	0.34560	0.10	38.60	28.91	38.70	29.01	59.07	49.07	-20.36	-20.05
5	3.74720	0.26	28.01	19.03	28.27	19.29	56.00	46.00	-27.73	-26.71
6	14.00313	0.77	30.15	24.41	30.92	25.18	60.00	50.00	-29.08	-24.82

### 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

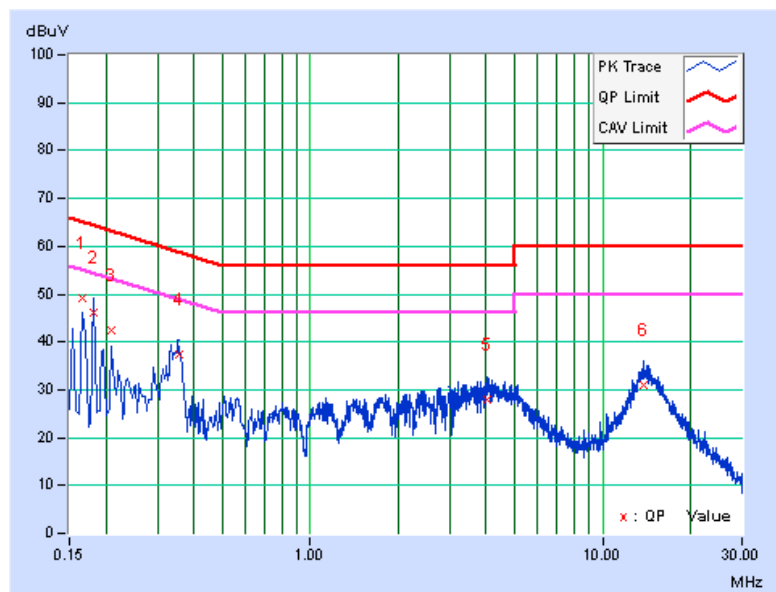


PHASE	Line 2	6dB BANDWIDTH	9kHz
-------	--------	---------------	------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16564	0.06	48.94	30.13	49.00	30.19	65.18	55.18	-16.17	-24.98
2	0.18128	0.08	46.19	27.07	46.27	27.15	64.43	54.43	-18.16	-27.28
3	0.20865	0.09	42.40	24.67	42.49	24.76	63.26	53.26	-20.77	-28.50
4	0.35389	0.15	37.15	27.93	37.30	28.08	58.87	48.87	-21.57	-20.79
5	4.02481	0.26	27.80	19.38	28.06	19.64	56.00	46.00	-27.94	-26.36
6	13.80763	0.72	30.41	25.21	31.13	25.93	60.00	50.00	-28.87	-24.07

#### 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 $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
		Indoor Access Point	1 Watt (30 dBm)
		Mobile and Portable client device	250mW (24 dBm)
U-NII-2A		---	250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C		---	250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	√	---	1 Watt (30 dBm)

\*B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 D01 Multiple Transmitter Output v02r01 Method of conducted output power measurement on IEEE 802.11 devices,

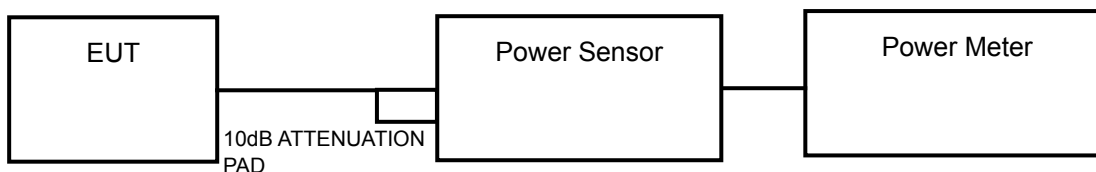
Array Gain = 0 dB (i.e., no array gain) for NANT  $\leq$  4;

Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq$  40 MHz for any NANT;

Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20-MHz channel widths with NANT  $\geq$  5.

For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

#### 4.3.2 TEST SETUP





#### 4.3.3 TEST INSTRUMENTS

Refer to section 4.1.3 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. Duty factor is not added to measured value.

#### 4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

#### 4.3.7 TEST RESULTS

##### POWER OUTPUT:

##### 802.11a

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
149	5745	19.48	18.90	166.341	22.21	29.97	PASS
157	5785	19.29	18.02	148.305	21.71	29.97	PASS
165	5825	18.00	16.49	107.662	20.32	29.97	PASS

**NOTE:** Gain = 6.03dBi, so the power limit shall be reduced to  $30-(6.03-6) = 29.97\text{dBm}$ .

##### 802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
149	5745	18.70	18.31	141.895	21.52	29.97	PASS
157	5785	19.31	18.11	150.024	21.76	29.97	PASS
165	5825	17.96	16.41	106.269	20.26	29.97	PASS

**NOTE:** Gain = 6.03dBi, so the power limit shall be reduced to  $30-(6.03-6) = 29.97\text{dBm}$ .

##### 802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
151	5755	12.86	12.55	37.309	15.72	29.97	PASS
159	5795	18.12	16.77	112.397	20.51	29.97	PASS

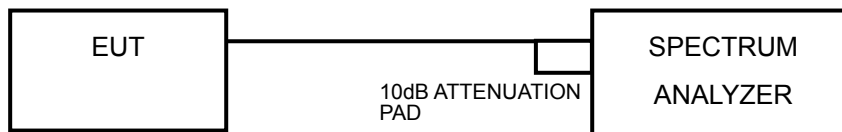
**NOTE:** Gain = 6.03dBi, so the power limit shall be reduced to  $30-(6.03-6) = 29.97\text{dBm}$ .

## 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/ 500 kHz

### 4.4.2 TEST SETUP



### 4.4.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

### 4.4.4 TEST PROCEDURES

- 1) Set span to encompass the entire emission bandwidth (EBW) of the signal.
- 2) Set RBW = 500 kHz, Set VBW ≥ 3 RBW, Detector = RMS
- 3) Sweep time = auto, trigger set to “free run”.
- 4) Trace average at least 100 traces in power averaging mode.
- 5) Record the max value.
- 6) Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where  $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$

#### 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

### 802.11a

TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Duty Factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	PASS /FAIL
0	149	5745	-3.87	-1.65	3.01	0.17	1.53	26.96	PASS
	157	5785	-4.24	-2.02	3.01	0.17	1.16	26.96	PASS
	165	5825	-5.39	-3.17	3.01	0.17	0.01	26.96	PASS
1	149	5745	-3.05	-0.83	3.01	0.17	2.35	26.96	PASS
	157	5785	-4.08	-1.86	3.01	0.17	1.32	26.96	PASS
	165	5825	-5.75	-3.53	3.01	0.17	-0.35	26.96	PASS

**NOTE:** 1. Directional gain =  $6.03\text{dBi} + 10\log(2) = 9.04\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $30-(9.04-6) = 26.96\text{dBm}$ .

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

### 802.11n (20MHz)

TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Duty Factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	PASS /FAIL
0	149	5745	-4.55	-2.33	3.01	0.20	0.88	26.96	PASS
	157	5785	-4.60	-2.38	3.01	0.20	0.83	26.96	PASS
	165	5825	-5.59	-3.37	3.01	0.20	-0.16	26.96	PASS
1	149	5745	-4.10	-1.88	3.01	0.20	1.33	26.96	PASS
	157	5785	-3.82	-1.60	3.01	0.20	1.61	26.96	PASS
	165	5825	-6.23	-4.01	3.01	0.20	-0.80	26.96	PASS

**NOTE:** 1. Directional gain =  $6.03\text{dBi} + 10\log(2) = 9.04\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $30-(9.04-6) = 26.96\text{dBm}$ .

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

### 802.11n (40MHz)

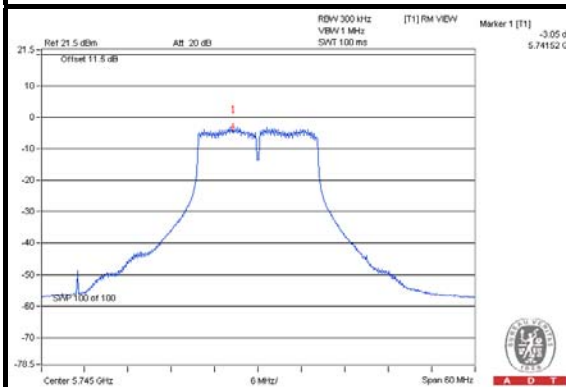
TX chain	Channel	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=2) dB	Duty Factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	PASS /FAIL
0	151	5755	-14.12	-11.90	3.01	0.28	-8.61	26.96	PASS
	159	5795	-9.10	-6.88	3.01	0.28	-3.59	26.96	PASS
1	151	5755	-12.69	-10.47	3.01	0.28	-7.18	26.96	PASS
	159	5795	-8.57	-6.35	3.01	0.28	-3.06	26.96	PASS

**NOTE:** 1. Directional gain =  $6.03\text{dBi} + 10\log(2) = 9.04\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $30-(9.04-6) = 26.96\text{dBm}$ .

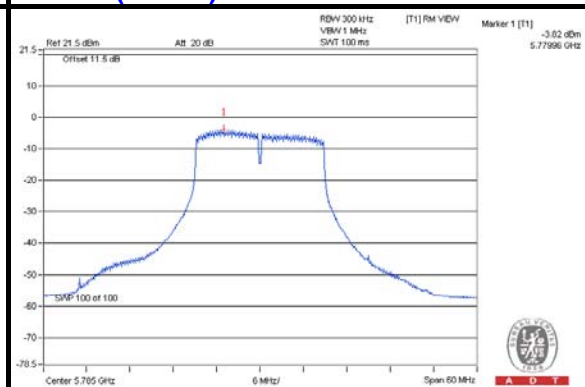
2. Refer to section 3.3 for duty cycle spectrum plot.

# SPECTRUM PLOT OF WORST VALUE

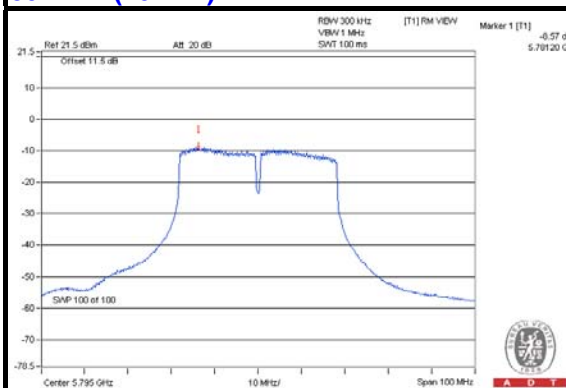
802.11a



802.11n (20MHz)



802.11n (40MHz)

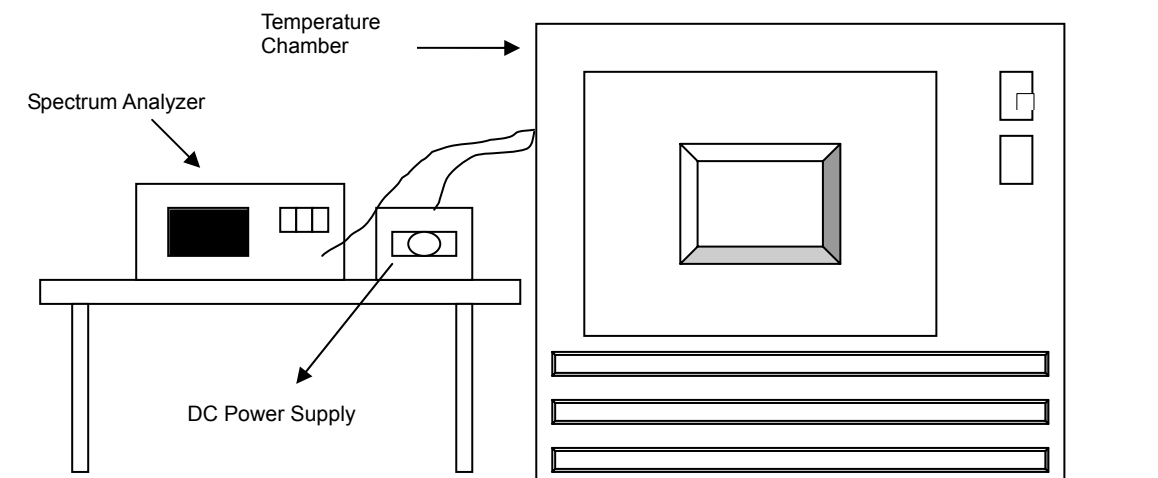


## 4.5 FREQUENCY STABILITY

### 4.5.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

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

### 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 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 2 and 3 with the temperature chamber set to the lowest temperature.
- 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.

#### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.5.6 EUT OPERATING CONDITION

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



#### 4.5.7 TEST RESULTS

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5825MHz									
TEMP. (°C)	POWER SUPPLY (Vdc)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
50	48	5824.9727	-0.00047	5824.9732	-0.00046	5824.9726	-0.00047	5824.9755	-0.00042
40	48	5825.0107	0.00018	5825.0136	0.00023	5825.0127	0.00022	5825.0089	0.00015
30	48	5825.0117	0.00020	5825.008	0.00014	5825.008	0.00014	5825.0075	0.00013
20	48	5825.0286	0.00049	5825.0266	0.00046	5825.027	0.00046	5825.0282	0.00048
10	48	5825.0141	0.00024	5825.0097	0.00017	5825.0095	0.00016	5825.0132	0.00023
0	48	5824.9721	-0.00048	5824.9749	-0.00043	5824.9709	-0.00050	5824.9752	-0.00043
-10	48	5825.0197	0.00034	5825.0166	0.00028	5825.017	0.00029	5825.0198	0.00034
-20	48	5825.0236	0.00041	5825.0232	0.00040	5825.0227	0.00039	5825.0265	0.00045
-30	48	5824.9973	-0.00005	5825.001	0.00002	5824.9997	-0.00001	5825.0014	0.00002

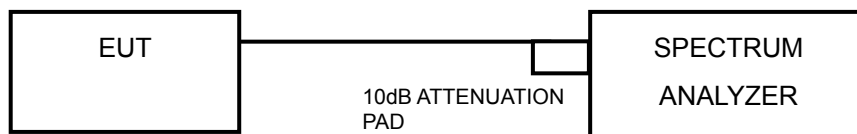
FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5825MHz									
TEMP. (°C)	POWER SUPPLY (Vdc)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
20	55.2	5825.0276	0.00047	5825.027	0.00046	5825.0272	0.00047	5825.0291	0.00050
	48	5825.0286	0.00049	5825.0266	0.00046	5825.027	0.00046	5825.0282	0.00048
	40.8	5825.0293	0.00050	5825.0271	0.00047	5825.0259	0.00044	5825.0283	0.00049

## 4.6 6dB BANDWIDTH MEASUREMENT

### 4.6.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 4.6.4 TEST PROCEDURE

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

### 4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.6.6 EUT OPERATING CONDITIONS

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

#### 4.6.7 TEST RESULTS

##### 802.11a

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
149	5745	16.40	16.44	0.5	PASS
157	5785	16.13	16.40	0.5	PASS
165	5825	16.40	16.39	0.5	PASS

##### 802.11n (20MHz)

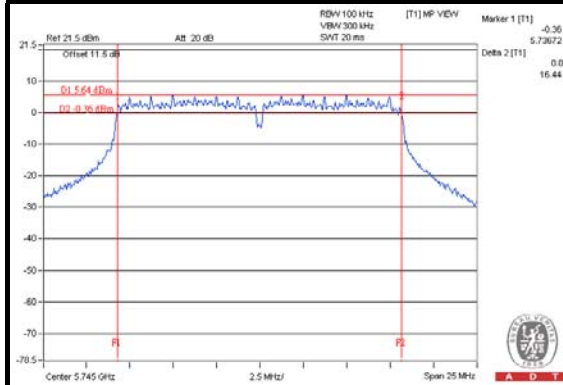
CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
149	5745	16.97	17.65	0.5	PASS
157	5785	17.10	17.33	0.5	PASS
165	5825	17.35	17.54	0.5	PASS

##### 802.11n (40MHz)

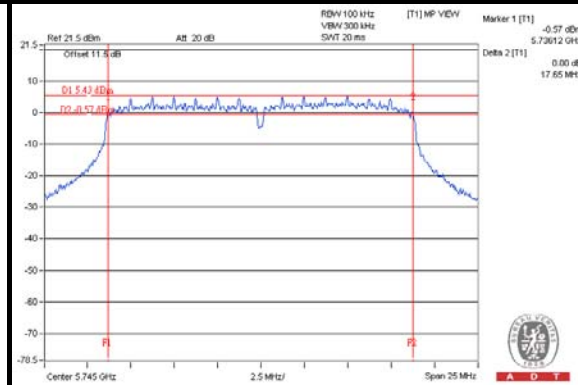
CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
151	5755	35.80	35.83	0.5	PASS
159	5795	36.07	35.83	0.5	PASS

## SPECTRUM PLOT OF WORST VALUE

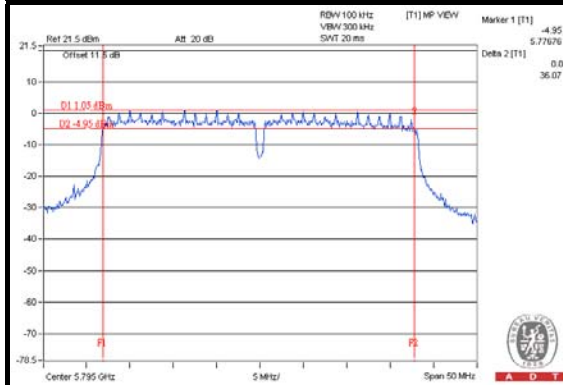
802.11a



802.11n (20MHz)



802.11n (40MHz)



## 5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

## 6. INFORMATION ON THE TESTING LABORATORIES

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

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

**Linko EMC/RF Lab:**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab:**

Tel: 886-3-5935343

Fax: 886-3-5935342

**Hwa Ya EMC/RF/Safety Lab:**

Tel: 886-3-3183232

Fax: 886-3-3270892

**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

## **7. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No modifications were made to the EUT by the lab during the test.

**---END---**