

# FCC TEST REPORT (15.407)

**REPORT NO.:** RF121129C07-1  
**MODEL NO.:** CAP-2100AG  
(Refer to item 3.1 for more details)  
**FCC ID:** U2M-CAP2100AG  
**RECEIVED:** Nov. 14, 2012  
**TESTED:** Dec. 03 ~ Dec. 06, 2012  
**ISSUED:** Dec. 10, 2012

**APPLICANT:** Senao Networks, Inc.

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

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**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei  
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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF121129C07-1	Original release	Dec. 10, 2012



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## 1. CERTIFICATION

**PRODUCT:** Wireless 802.11abgn Access Point

**MODEL:** CAP-2100AG (Refer to item 3.1 for more details)

**BRAND:** Senao Networks (Refer to item 3.1 for more details)

**APPLICANT:** Senao Networks, Inc.

**TESTED:** Dec. 03 ~ Dec. 06, 2012

**TEST SAMPLE:** ENGINEERING SAMPLE

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

ANSI C63.10-2009

The above equipment (model: CAP-2100AG) 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 :** Dec. 10, 2012  
Celine Chou / Specialist

**APPROVED BY :** Ken Liu , **DATE :** Dec. 10, 2012  
Ken Liu / 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)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -3.75dB at 0.38047MHz.
15.407(b/1/2/3)(b)(6)	Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -1.3dB at 5150.00MHz.
15.407(a/1/2)	Max Average Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(6)	Peak Power Excursion	PASS	Meet the requirement of limit.
15.407(a/1/2)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is UFL not a standard connector.

### 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	3.19 dB
	200MHz ~1000MHz	3.21 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 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>	Wireless 802.11abgn Access Point
<b>MODEL NO.</b>	CAP-2100AG (Refer to Note for more details)
<b>NOMINAL VOLTAGE</b>	12Vdc (adapter) 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 300.0Mbps
<b>OPERATING FREQUENCY</b>	5180.0 ~ 5240.0MHz
<b>NUMBER OF CHANNEL</b>	4 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
<b>OUTPUT POWER</b>	47.735mW
<b>ANTENNA TYPE</b>	<b>5.0GHz:</b> embedded antenna with 4dBi gain
<b>ANTENNA CONNECTOR</b>	UFL
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	Refer to user's manual
<b>ACCESSORY DEVICES</b>	Adapter

**NOTE:**

- The following models are electrically identical, different model names and brand names are for marketing purpose.

<b>BRAND</b>	<b>MODEL</b>
Senao Networks	CAP-2100AG
WatchGuard	AP100

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

<b>MODULATION MODE</b>	<b>TX FUNCTION</b>
<b>802.11b</b>	2TX
<b>802.11g</b>	2TX
<b>802.11a</b>	2TX
<b>802.11n (20MHz)</b>	2TX
<b>802.11n (40MHz)</b>	2TX

3. The EUT consumes power from the following adapter.

<b>BRAND:</b>	Powertron
<b>MODEL:</b>	PA1015-2I/PA1015-2I120125
<b>INPUT:</b>	100-240Vac, 50-60Hz, 0.4A
<b>OUTPUT:</b>	12Vdc, 1.25A, 15W
<b>POWER LINE:</b>	1.5m non-shielded, w/o core

4. 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

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

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz

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

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190MHz	46	5230MHz



### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
A	√	√	√	√	Power from adapter
B	-	√	√	-	Power from PoE

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

**NOTE 2**: “-” means no effect.

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

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
A	802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
A	802.11n (40MHz)	38 to 46	38, 46	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	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A, B	802.11n (40MHz)	38 to 46	46	OFDM	BPSK	15.0

#### **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	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A, B	802.11n (40MHz)	38 to 46	46	OFDM	BPSK	15.0

### **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.

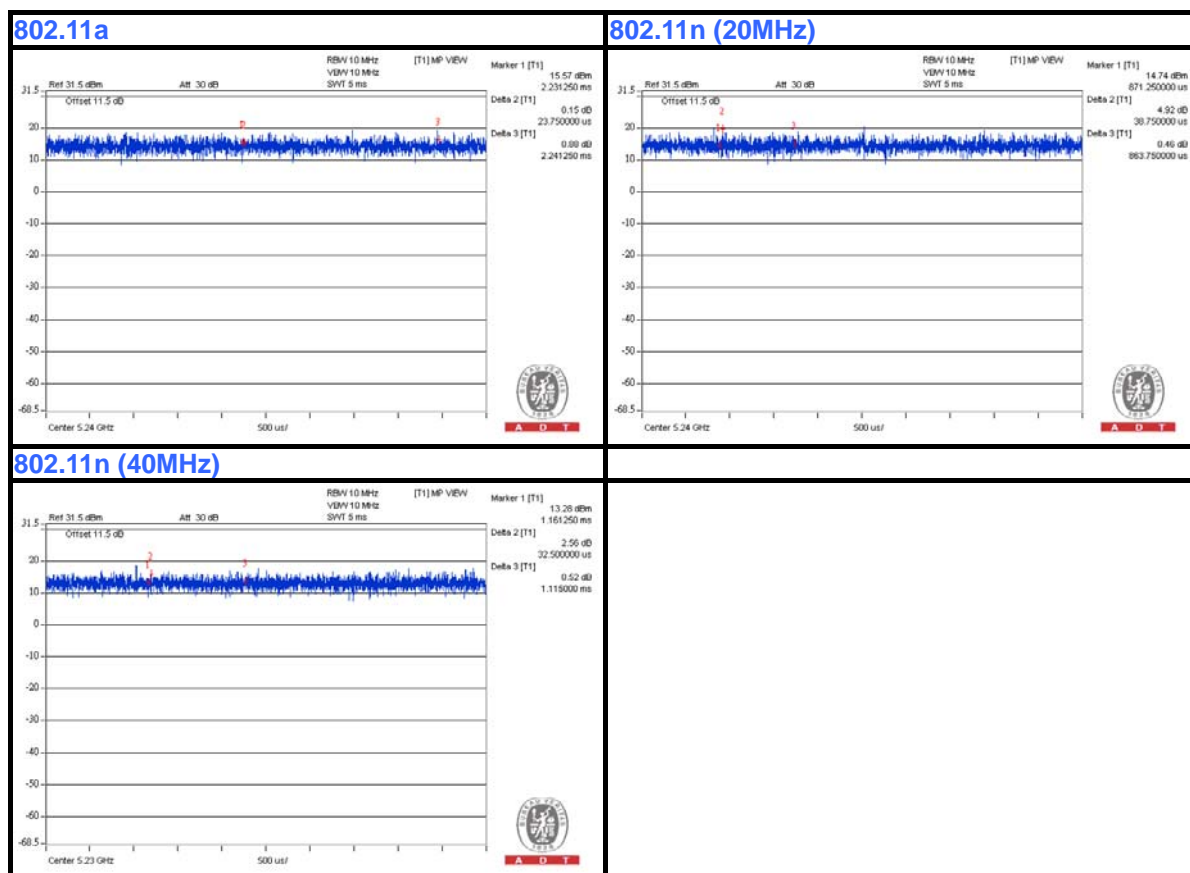
EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
A	802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
A	802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0

### **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Chris Lin
RE<1G	25deg. C, 65%RH	120Vac, 60Hz 48Vdc	Chris Lin
PLC	25deg. C, 60%RH	120Vac, 60Hz 48Vdc	Antony Lee
APCM	25deg. C, 60%RH	120Vac, 60Hz	Frank Liu

### 3.3 DUTY CYCLE OF TEST SIGNAL

Duty cycle of test signal is > 98 %, duty factor is not required.



### 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	E5420	33MLMQ1	FCC DoC Approved
2	POE	EnGenius	EPE-48GR	NA	NA
3	Adapter	Powertron	PA1030-4HC	NA	NA

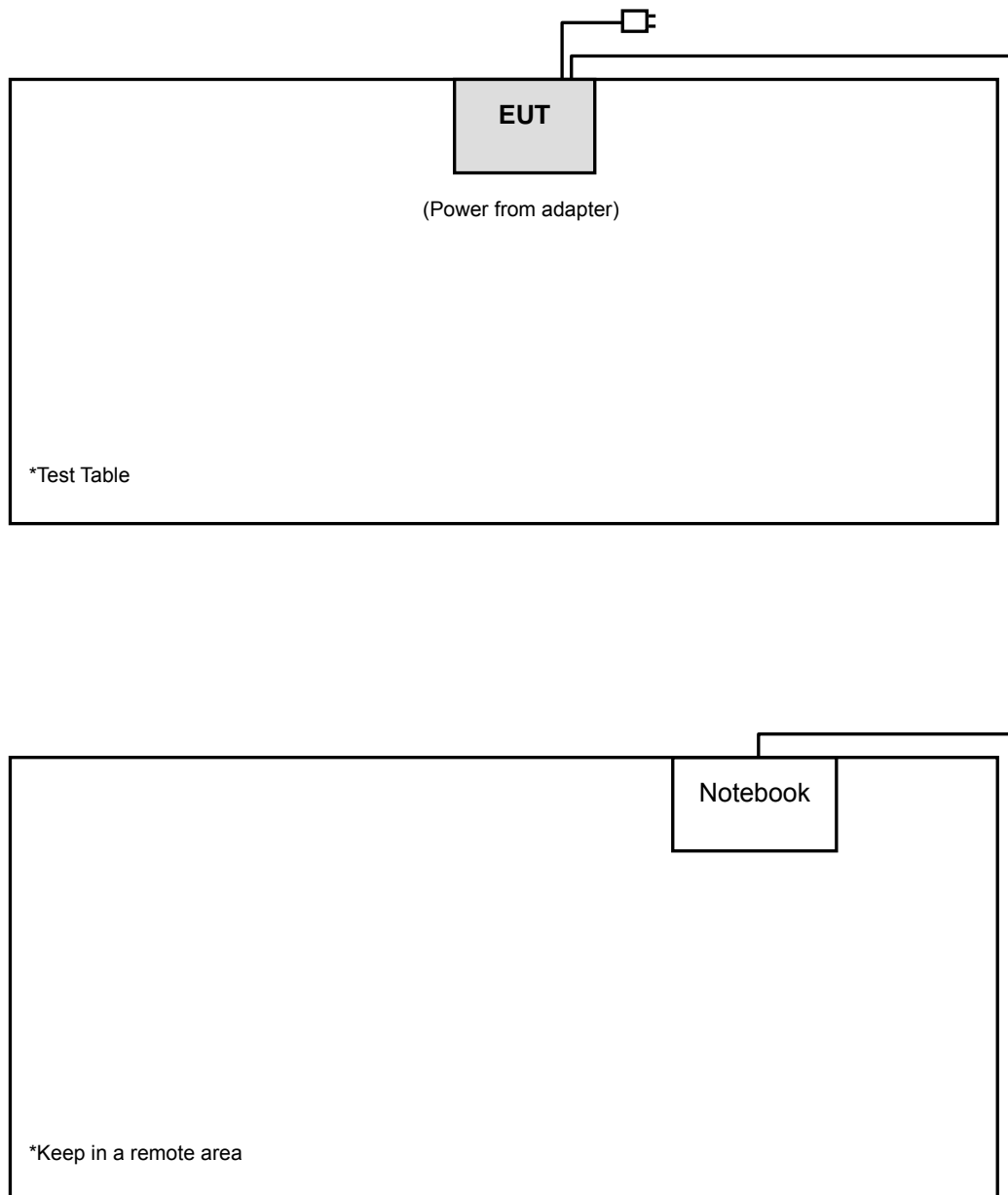
NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	3m RJ45 UTP cable
2	3m RJ45 UTP cable
3	1.5m non-shielded w/o core

**NOTE:**

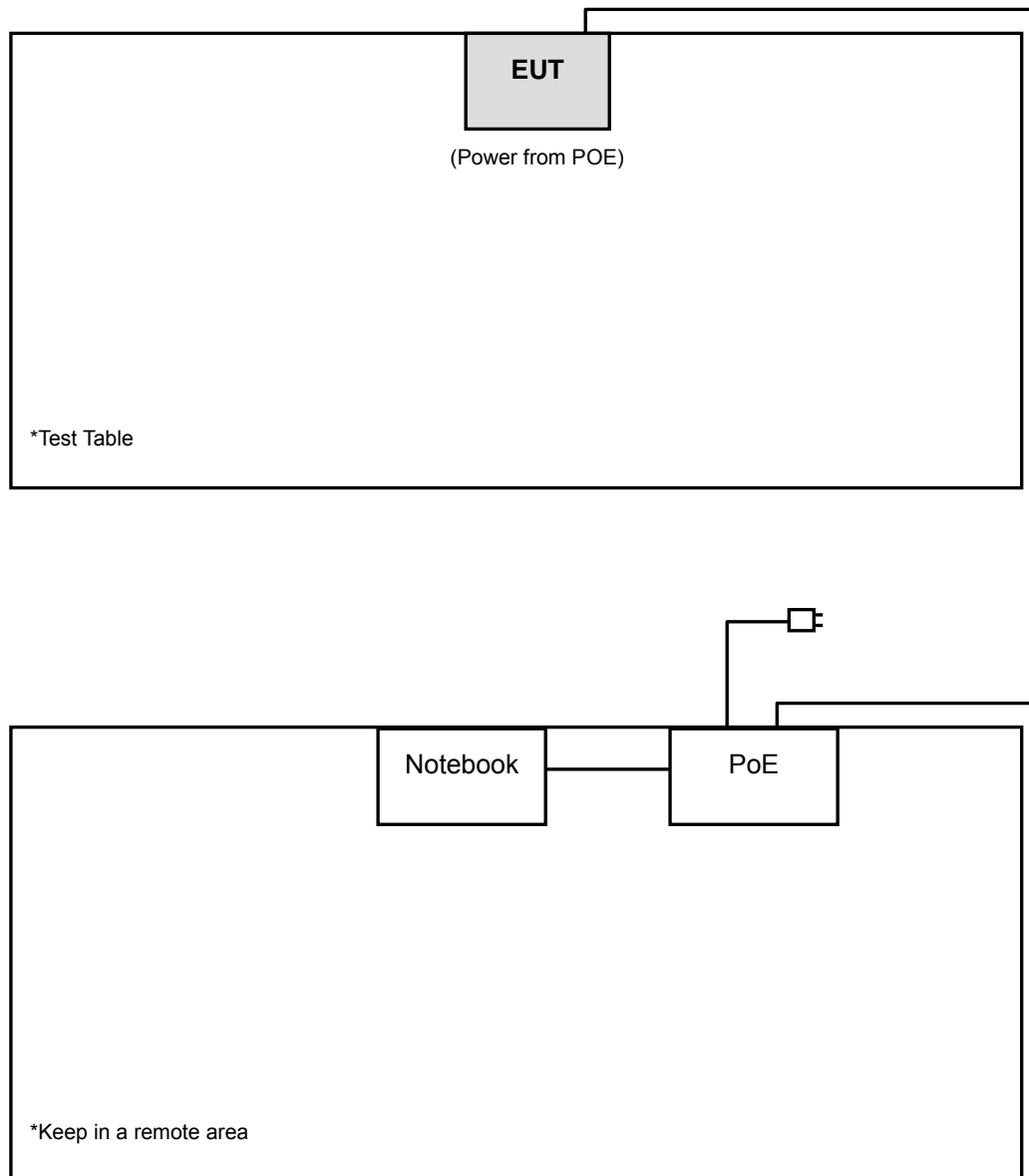
1. All power cords of the above support units are non-shielded (1.8 m).
2. Item 1, 2 acted as a communication partner to transfer data.
3. Item 2, 3 was provided by client.

### 3.4.1 CONFIGURATION OF SYSTEM UNDER TEST

#### TEST MODE A



## TEST MODE B



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

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

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

**789033 D01 General UNII Test Procedures v01 r02**

**662911 D01 Multiple Transmitter Output v01 r02**

**ANSI C63.10-2009**

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

## 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	
√	FIELD STRENGTH AT 3m (dBuV/m)	
	PK	AV
	74	54
	EIRP LIMIT (dBm)	EQUIVALENT FIELD STRENGTH AT 3m (dBuV/m)
	PK	PK
	-27	68.3

**NOTE:** 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	100212	Aug. 06, 2012	Aug. 05, 2013
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Feb. 03, 2012	Feb. 02, 2013
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Apr. 06, 2012	Apr. 05, 2013
HORN Antenna SCHWARZBECK	9120D	209	Sep. 03, 2012	Sep. 02, 2013
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 11, 2012	Jul. 10, 2013
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier Agilent	8447D	2944A10633	Oct. 25, 2012	Oct. 24, 2013
Preamplifier Agilent	8449B	3008A01964	Oct. 25, 2012	Oct. 24, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250723/4	Aug. 28, 2012	Aug. 27, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6+309224/ 4	Aug. 28, 2012	Aug. 27, 2013
Software ADT.	ADT_Radiated_ V7.6.15.9.2	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 ADT.	TT100	TT93021703	NA	NA
Turn Table Controller ADT.	SC100	SC93021703	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 25, 2012	Oct. 24, 2013
High Speed Peak Power Meter	ML2495A	0842014	Apr. 28, 2012	Apr. 27, 2013
Power Sensor	MA2411B	0738404	Apr. 28, 2012	Apr. 27, 2013

- 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.

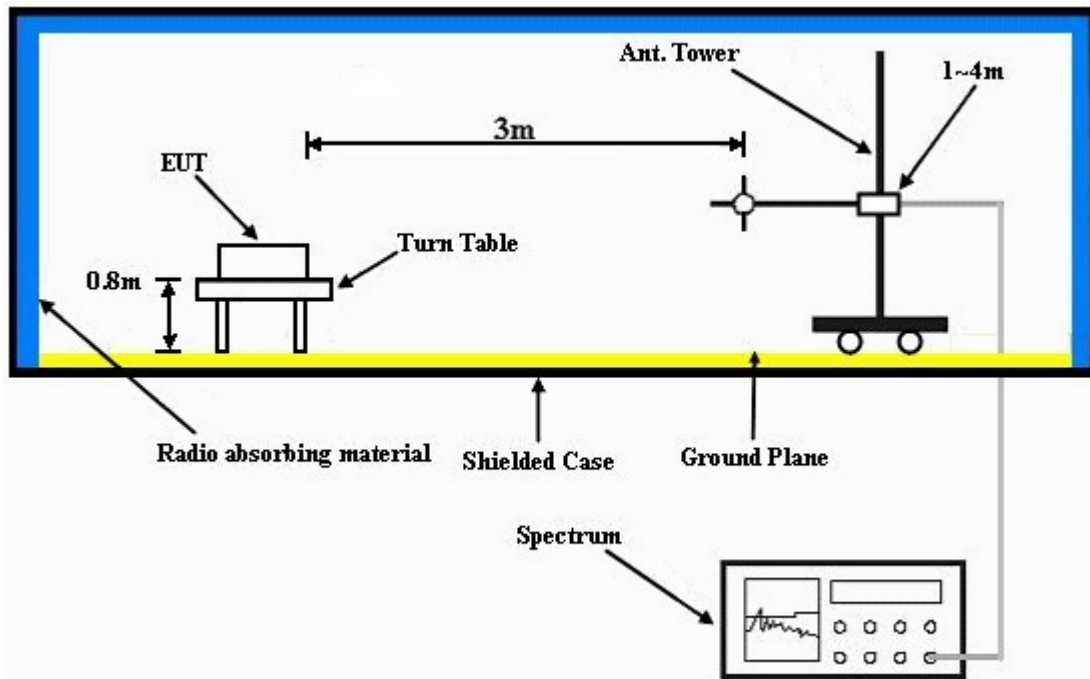
**NOTE:**

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



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

#### 4.1.7 EUT OPERATING CONDITION

- Placed the EUT on the testing table.
- Prepared notebook to act as communication partner and placed it outside of testing area.
- 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.
- The communication partner sent data to EUT by command "PING".

## 4.1.8 TEST RESULTS

### 802.11a

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 36	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	56.2 PK	74.0	-17.8	1.62 H	360	18.50	37.70
2	5150.00	43.1 AV	54.0	-10.9	1.62 H	360	5.40	37.70
3	*5180.00	105.0 PK			1.30 H	6	67.30	37.70
4	*5180.00	95.1 AV			1.30 H	6	57.40	37.70
5	#10360.00	57.9 PK	74.0	-16.1	1.41 H	278	9.10	48.80
6	#10360.00	45.2 AV	54.0	-8.8	1.41 H	278	-3.60	48.80
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	5133.00	57.9 PK	74.0	-16.1	1.90 V	338	20.20	37.70
2	5133.00	46.5 AV	54.0	-7.5	1.90 V	338	8.80	37.70
3	5150.00	56.0 PK	74.0	-18.0	1.00 V	7	18.30	37.70
4	5150.00	43.6 AV	54.0	-10.4	1.00 V	7	5.90	37.70
5	*5180.00	106.7 PK			1.37 V	339	69.00	37.70
6	*5180.00	96.7 AV			1.37 V	339	59.00	37.70
7	#10360.00	56.8 PK	74.0	-17.2	1.16 V	230	8.00	48.80
8	#10360.00	44.1 AV	54.0	-9.9	1.16 V	230	-4.70	48.80

#### 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).
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.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 40	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

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	*5200.00	104.7 PK			1.76 H	360	66.90	37.80
2	*5200.00	94.8 AV			1.76 H	360	57.00	37.80
3	#10400.00	59.6 PK	74.0	-14.4	1.19 H	315	10.70	48.90
4	#10400.00	46.8 AV	54.0	-7.2	1.19 H	315	-2.10	48.90
5	15600.00	61.5 PK	74.0	-12.5	1.48 H	240	12.80	48.70
6	15600.00	50.0 AV	54.0	-4.0	1.48 H	240	1.30	48.70
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	*5200.00	107.1 PK			1.11 V	341	69.30	37.80
2	*5200.00	97.4 AV			1.11 V	341	59.60	37.80
3	#10400.00	58.0 PK	74.0	-16.0	1.38 V	280	9.10	48.90
4	#10400.00	45.1 AV	54.0	-8.9	1.38 V	280	-3.80	48.90
5	15600.00	60.8 PK	74.0	-13.2	1.22 V	50	12.10	48.70
6	15600.00	48.0 AV	54.0	-6.0	1.22 V	50	-0.70	48.70

**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).
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.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 48	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	105.0 PK			1.27 H	360	67.20	37.80
2	*5240.00	95.1 AV			1.27 H	360	57.30	37.80
3	5350.00	56.9 PK	74.0	-17.1	1.66 H	54	18.90	38.00
4	5350.00	43.5 AV	54.0	-10.5	1.66 H	54	5.50	38.00
5	#10480.00	59.2 PK	74.0	-14.8	1.54 H	58	10.00	49.20
6	#10480.00	46.9 AV	54.0	-7.1	1.54 H	58	-2.30	49.20
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	107.0 PK			1.21 V	340	69.20	37.80
2	*5240.00	97.1 AV			1.21 V	340	59.30	37.80
3	5350.00	57.8 PK	74.0	-16.2	1.81 V	74	19.80	38.00
4	5350.00	43.7 AV	54.0	-10.3	1.81 V	74	5.70	38.00
5	#10480.00	57.6 PK	74.0	-16.4	1.31 V	136	8.40	49.20
6	#10480.00	45.4 AV	54.0	-8.6	1.31 V	136	-3.80	49.20

**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).
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)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 36	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	55.7 PK	74.0	-18.3	1.49 H	40	18.00	37.70
2	5150.00	42.9 AV	54.0	-11.1	1.49 H	40	5.20	37.70
3	*5180.00	105.2 PK			1.28 H	360	67.50	37.70
4	*5180.00	94.9 AV			1.28 H	360	57.20	37.70
5	#10360.00	57.7 PK	74.0	-16.3	1.32 H	325	8.90	48.80
6	#10360.00	46.6 AV	54.0	-7.4	1.32 H	325	-2.20	48.80
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	5150.00	56.2 PK	74.0	-17.8	1.00 V	0	18.50	37.70
2	5150.00	43.3 AV	54.0	-10.7	1.00 V	0	5.60	37.70
3	*5180.00	109.0 PK			1.50 V	335	71.30	37.70
4	*5180.00	98.2 AV			1.50 V	335	60.50	37.70
5	#10360.00	57.5 PK	74.0	-16.5	1.36 V	92	8.70	48.80
6	#10360.00	44.3 AV	54.0	-9.7	1.36 V	92	-4.50	48.80

## 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).
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.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 40	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

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	*5200.00	102.9 PK			1.00 H	126	65.10	37.80
2	*5200.00	93.4 AV			1.00 H	126	55.60	37.80
3	#10400.00	59.4 PK	74.0	-14.6	1.33 H	68	10.50	48.90
4	#10400.00	46.7 AV	54.0	-7.3	1.33 H	68	-2.20	48.90
5	15600.00	62.6 PK	74.0	-11.4	1.48 H	130	13.90	48.70
6	15600.00	48.9 AV	54.0	-5.1	1.48 H	130	0.20	48.70
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	*5200.00	103.3 PK			1.00 V	174	65.50	37.80
2	*5200.00	96.6 AV			1.00 V	174	58.80	37.80
3	#10400.00	57.3 PK	74.0	-16.7	1.21 V	228	8.40	48.90
4	#10400.00	44.4 AV	54.0	-9.6	1.21 V	228	-4.50	48.90
5	15600.00	60.2 PK	74.0	-13.8	1.35 V	48	11.50	48.70
6	15600.00	47.3 AV	54.0	-6.7	1.35 V	48	-1.40	48.70

**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).
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.





A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 48	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	105.8 PK			1.29 H	6	68.00	37.80
2	*5240.00	96.0 AV			1.29 H	6	58.20	37.80
3	5350.00	57.6 PK	74.0	-16.4	1.35 H	354	19.60	38.00
4	5350.00	43.1 AV	54.0	-10.9	1.35 H	354	5.10	38.00
5	#10480.00	60.2 PK	74.0	-13.8	1.32 H	69	11.00	49.20
6	#10480.00	46.9 AV	54.0	-7.1	1.32 H	69	-2.30	49.20
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	108.4 PK			1.22 V	337	70.60	37.80
2	*5240.00	97.9 AV			1.22 V	337	60.10	37.80
3	5350.00	58.4 PK	74.0	-15.6	1.44 V	242	20.40	38.00
4	5350.00	44.0 AV	54.0	-10.0	1.44 V	242	6.00	38.00
5	#10480.00	57.5 PK	74.0	-16.5	1.40 V	84	8.30	49.20
6	#10480.00	44.7 AV	54.0	-9.3	1.40 V	84	-4.50	49.20

**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).
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)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 38	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	69.2 PK	74.0	-4.8	1.63 H	29	31.50	37.70
2	5150.00	51.3 AV	54.0	-2.7	1.63 H	29	13.60	37.70
3	*5190.00	102.1 PK			1.44 H	5	64.40	37.70
4	*5190.00	92.4 AV			1.44 H	5	54.70	37.70
5	#10380.00	59.1 PK	74.0	-14.9	1.26 H	58	10.20	48.90
6	#10380.00	46.2 AV	54.0	-7.8	1.26 H	58	-2.70	48.90
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	5150.00	70.9 PK	74.0	-3.1	1.00 V	162	33.20	37.70
2	5150.00	52.7 AV	54.0	-1.3	1.00 V	162	15.00	37.70
3	*5190.00	106.9 PK			1.61 V	79	69.20	37.70
4	*5190.00	96.5 AV			1.61 V	79	58.80	37.70
5	#10380.00	58.2 PK	74.0	-15.8	1.30 V	312	9.30	48.90
6	#10380.00	44.8 AV	54.0	-9.2	1.30 V	312	-4.10	48.90

## 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).
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.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 46	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

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	*5230.00	103.4 PK			1.95 H	5	65.60	37.80
2	*5230.00	93.3 AV			1.95 H	5	55.50	37.80
3	5350.00	56.7 PK	74.0	-17.3	1.56 H	213	18.70	38.00
4	5350.00	43.3 AV	54.0	-10.7	1.56 H	213	5.30	38.00
5	#10460.00	59.1 PK	74.0	-14.9	1.25 H	40	10.00	49.10
6	#10460.00	46.6 AV	54.0	-7.4	1.25 H	40	-2.50	49.10
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	*5230.00	105.6 PK			1.35 V	336	67.80	37.80
2	*5230.00	95.6 AV			1.35 V	336	57.80	37.80
3	5350.00	57.6 PK	74.0	-16.4	1.44 V	245	19.60	38.00
4	5350.00	44.1 AV	54.0	-9.9	1.44 V	245	6.10	38.00
5	#10460.00	57.4 PK	74.0	-16.6	1.32 V	126	8.30	49.10
6	#10460.00	44.5 AV	54.0	-9.5	1.32 V	126	-4.60	49.10

**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).
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 : 802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 46	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin
TEST MODE	A		

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	31.5 QP	40.0	-8.5	2.00 H	12	17.90	13.60
2	218.50	43.9 QP	46.0	-2.1	1.25 H	246	32.20	11.70
3	374.04	40.5 QP	46.0	-5.5	1.00 H	111	23.60	16.90
4	500.42	39.9 QP	46.0	-6.1	1.50 H	133	19.90	20.00
5	624.85	42.8 QP	46.0	-3.2	1.25 H	142	20.50	22.30
6	875.67	38.6 QP	46.0	-7.4	1.00 H	137	12.10	26.50
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	53.23	37.7 QP	40.0	-2.3	1.00 V	16	23.90	13.80
2	218.50	32.7 QP	46.0	-13.3	1.50 V	282	21.00	11.70
3	374.04	39.2 QP	46.0	-6.8	1.00 V	145	22.30	16.90
4	500.42	34.6 QP	46.0	-11.4	2.00 V	141	14.60	20.00
5	624.85	40.5 QP	46.0	-5.5	1.00 V	246	18.20	22.30
6	875.67	37.6 QP	46.0	-8.4	1.25 V	221	11.10	26.50

## 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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 46	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	48Vdc	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin
TEST MODE	B		

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	125.17	30.3 QP	43.5	-13.2	1.50 H	272	18.00	12.30
2	218.50	35.7 QP	46.0	-10.3	1.50 H	242	24.00	11.70
3	374.04	37.4 QP	46.0	-8.6	1.00 H	102	20.50	16.90
4	624.85	36.3 QP	46.0	-9.7	1.25 H	195	14.00	22.30
5	675.40	32.6 QP	46.0	-13.4	1.25 H	147	9.80	22.80
6	875.67	38.3 QP	46.0	-7.7	1.50 H	105	11.80	26.50
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	57.12	36.5 QP	40.0	-3.5	1.00 V	333	22.90	13.60
2	249.60	31.3 QP	46.0	-14.7	1.50 V	178	18.30	13.00
3	374.04	34.3 QP	46.0	-11.7	1.00 V	133	17.40	16.90
4	500.42	30.0 QP	46.0	-16.0	1.00 V	163	10.00	20.00
5	624.85	33.6 QP	46.0	-12.4	1.25 V	165	11.30	22.30
6	875.67	37.0 QP	46.0	-9.0	1.25 V	219	10.50	26.50

**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).
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	ESCS30	100288	Nov. 09, 2012	Nov. 08, 2013
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 29, 2011	Dec. 28, 2012
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2011	Dec. 29, 2012
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 06, 2012	Jul. 05, 2013
Software ADT	BV ADT_Cond_ 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 2.
3. The VCCI Site Registration No. is C-2047.

### 4.2.3 TEST PROCEDURES

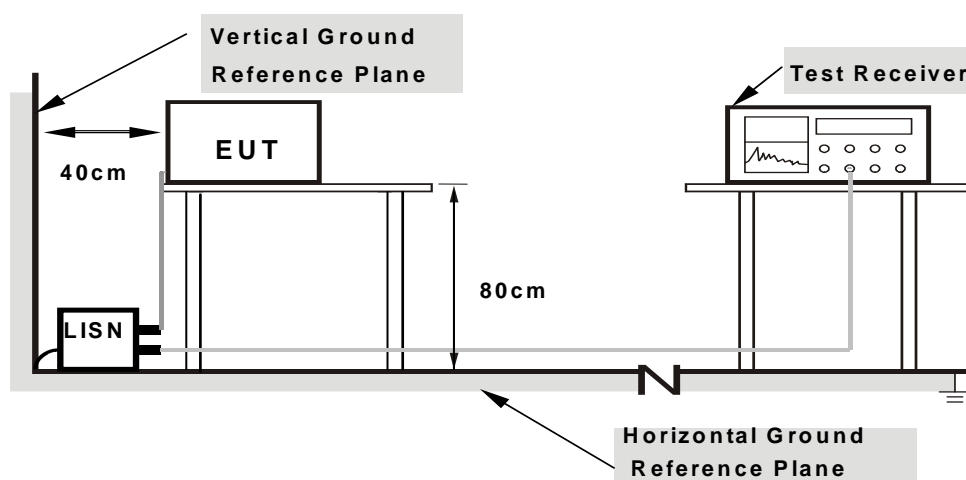
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

Same as 4.1.6.

## 4.2.7 TEST RESULTS

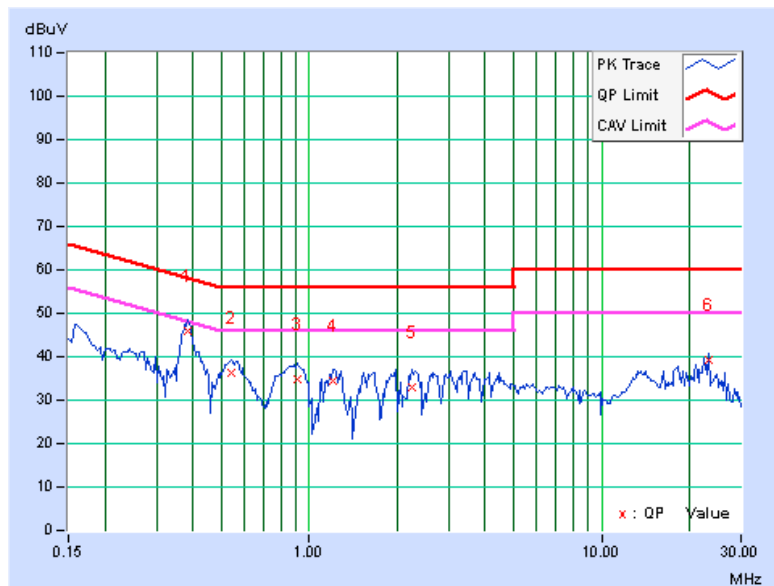
### CONDUCTED WORST-CASE DATA : 802.11n (40MHz)

PHASE	Line 1	6dB BANDWIDTH	9kHz
TEST MODE	A		

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	0.38438	0.18	45.58	35.93	45.76	36.11	58.18	48.18	-12.42	-12.07
2	0.54453	0.19	36.07	25.49	36.26	25.68	56.00	46.00	-19.74	-20.32
3	0.91172	0.21	34.70	23.04	34.91	23.25	56.00	46.00	-21.09	-22.75
4	1.21094	0.23	34.16	22.37	34.39	22.60	56.00	46.00	-21.61	-23.40
5	2.25781	0.31	32.82	22.21	33.13	22.52	56.00	46.00	-22.87	-23.48
6	23.12891	0.69	38.50	35.50	39.19	36.19	60.00	50.00	-20.81	-13.81

#### 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.



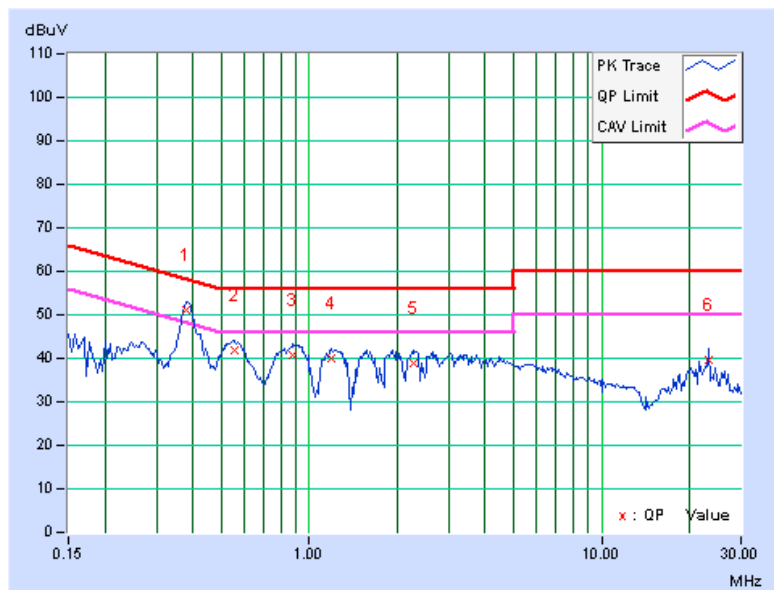


PHASE	Line 2	6dB BANDWIDTH	9kHz
TEST MODE	A		

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.38047	0.18	50.97	44.34	51.15	44.52	58.27	48.27	-7.12	-3.75
2	0.55625	0.19	41.57	34.88	41.76	35.07	56.00	46.00	-14.24	-10.93
3	0.88047	0.21	40.52	33.78	40.73	33.99	56.00	46.00	-15.27	-12.01
4	1.19531	0.24	39.74	33.12	39.98	33.36	56.00	46.00	-16.02	-12.64
5	2.26172	0.31	38.71	32.02	39.02	32.33	56.00	46.00	-16.98	-13.67
6	23.12891	0.76	38.96	35.59	39.72	36.35	60.00	50.00	-20.28	-13.65

#### 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.

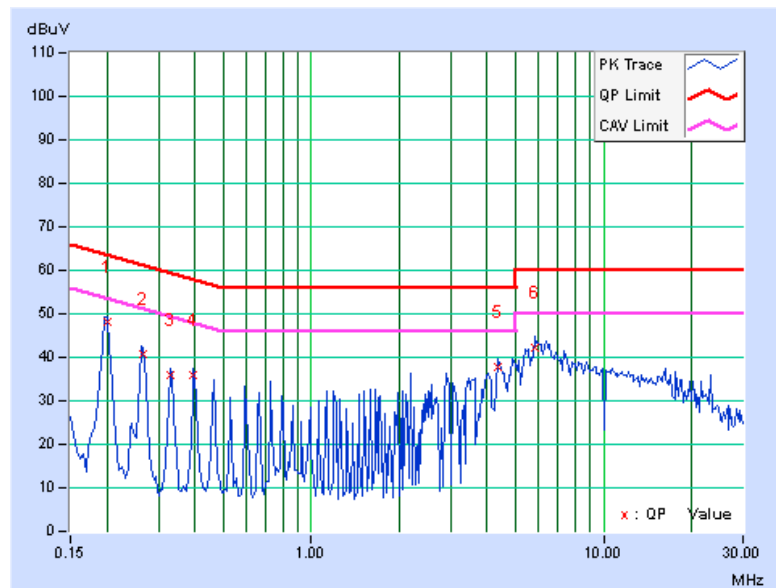


PHASE	Line 1	6dB BANDWIDTH	9kHz
TEST MODE	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]	(dB)	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	(dB)	(dB)
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20078	0.18	47.84	37.25	48.02	37.43	63.58	53.58	-15.56	-16.15
2	0.26719	0.18	40.74	30.70	40.92	30.88	61.20	51.20	-20.28	-20.32
3	0.32969	0.18	35.75	29.74	35.93	29.92	59.46	49.46	-23.53	-19.54
4	0.39609	0.18	35.67	33.93	35.85	34.11	57.93	47.93	-22.08	-13.82
5	4.37109	0.38	37.40	34.06	37.78	34.44	56.00	46.00	-18.22	-11.56
6	5.83203	0.41	41.66	39.48	42.07	39.89	60.00	50.00	-17.93	-10.11

#### 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.

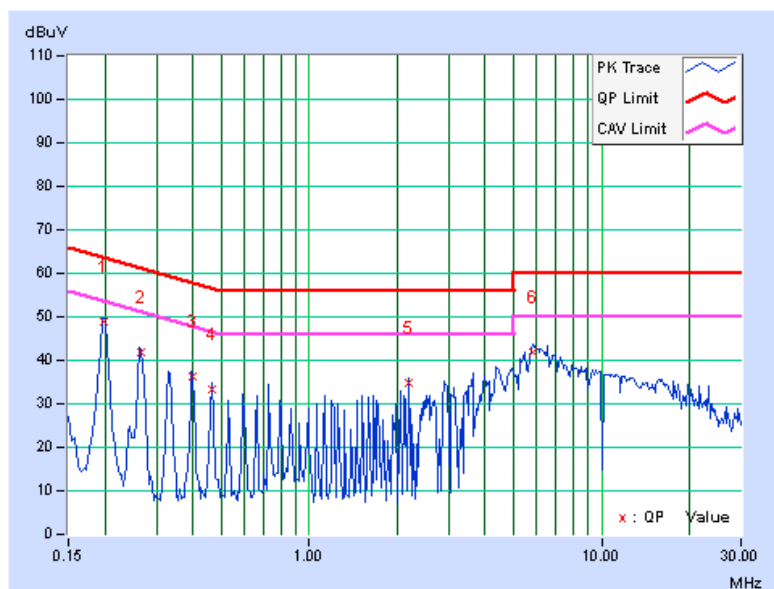


PHASE	Line 2	6dB BANDWIDTH	9kHz
TEST MODE	B		

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	0.19942	0.15	48.72	38.00	48.87	38.15	63.63	53.63	-14.76	-15.48
2	0.26583	0.16	41.71	31.53	41.87	31.69	61.25	51.25	-19.38	-19.56
3	0.39737	0.18	36.17	34.30	36.35	34.48	57.91	47.91	-21.56	-13.43
4	0.46250	0.18	33.13	32.18	33.31	32.36	56.65	46.65	-23.33	-14.28
5	2.18750	0.31	34.67	31.69	34.98	32.00	56.00	46.00	-21.02	-14.00
6	5.83203	0.46	41.31	39.26	41.77	39.72	60.00	50.00	-18.23	-10.28

# 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 PEAK TRANSMIT POWER MEASUREMENT

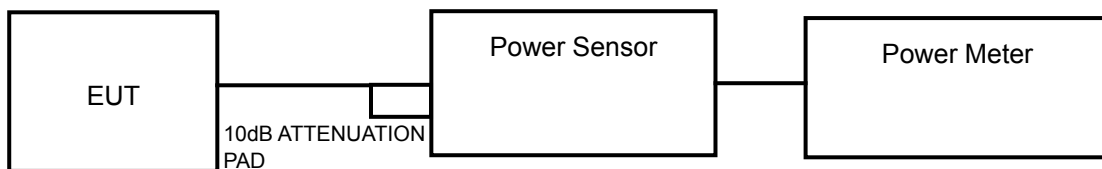
#### 4.3.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	The lesser of 50mW (17dBm) or 4dBm + 10logB

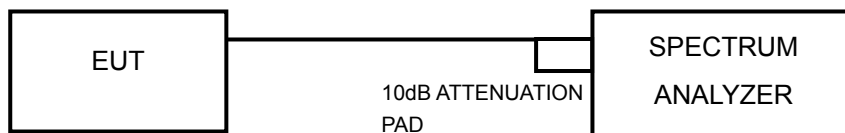
**NOTE:** Where B is the 26dB emission bandwidth in MHz.

#### 4.3.2 TEST SETUP

##### FOR POWER OUTPUT MEASUREMENT



##### FOR 26dB BANDWIDTH



#### 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.

##### FOR 26dB BANDWIDTH

- 1) Set RBW = approximately 1% of the emission bandwidth.
- 2) Set the VBW > RBW.
- 3) Detector = Peak.
- 4) Trace mode = max hold.
- 5) 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 specific channel frequencies individually.

#### 4.3.7 TEST RESULTS

##### POWER OUTPUT

###### 802.11a

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	10.95	12.20	29.041	14.63	17	PASS
40	5200	11.00	12.20	29.185	14.65	17	PASS
48	5240	11.00	11.90	28.077	14.48	17	PASS

###### 802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	11.00	11.80	27.725	14.43	17	PASS
40	5200	11.00	12.30	29.571	14.71	17	PASS
48	5240	11.00	11.80	27.725	14.43	17	PASS

###### 802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
38	5190	13.14	14.30	47.521	16.77	17	PASS
46	5230	13.61	13.94	47.735	<b>16.79</b>	17	PASS

## 26dB BANDWIDTH

### 802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		PASS / FAIL
		CHAIN 0	CHAIN 1	
36	5180	23.72	23.76	PASS
40	5200	23.99	23.55	PASS
48	5240	23.83	23.07	PASS

### 802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		PASS / FAIL
		CHAIN 0	CHAIN 1	
36	5180	24.35	23.67	PASS
40	5200	24.45	23.94	PASS
48	5240	24.72	24.09	PASS

### 802.11n (40MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		PASS / FAIL
		CHAIN 0	CHAIN 1	
38	5190	50.94	51.81	PASS
46	5230	52.01	50.86	PASS

## 4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT

### 4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	4dBm

### 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 = 30 KHz, Set VBW  $\geq$  1 MHz, 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

### 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

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)		TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	-0.64	0.41	2.93	2.99	PASS
40	5200	-0.77	0.44	2.89	2.99	PASS
48	5240	-0.65	0.42	2.93	2.99	PASS

- NOTE:** 1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain =  $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $4 - (7.01-6) = 2.99\text{dBm}$ .

##### 802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)		TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	-1.36	0.33	2.58	2.99	PASS
40	5200	-0.90	0.51	2.87	2.99	PASS
48	5240	-1.09	0.43	2.75	2.99	PASS

- NOTE:** 1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain =  $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $4 - (7.01-6) = 2.99\text{dBm}$ .

##### 802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)		TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
38	5190	-1.43	0.35	2.56	2.99	PASS
46	5230	-1.18	0.45	2.72	2.99	PASS

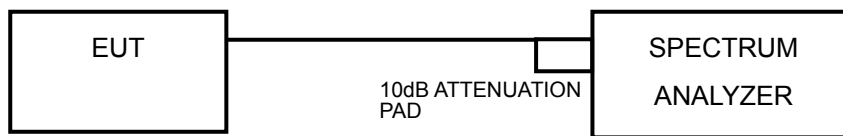
- NOTE:** 1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain =  $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $4 - (7.01-6) = 2.99\text{dBm}$ .

## 4.5 PEAK POWER EXCURSION MEASUREMENT

### 4.5.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

Shall not exceed 13 dB

### 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

- 1) Set RBW = 1 MHz, VBW  $\geq$  3 MHz, Detector = peak.
- 2) Trace mode = max-hold. Allow the sweeps to continue until the trace stabilizes.
- 3) Use the peak search function to find the peak of the spectrum.
- 4) Measure the PPSD.
- 5) Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

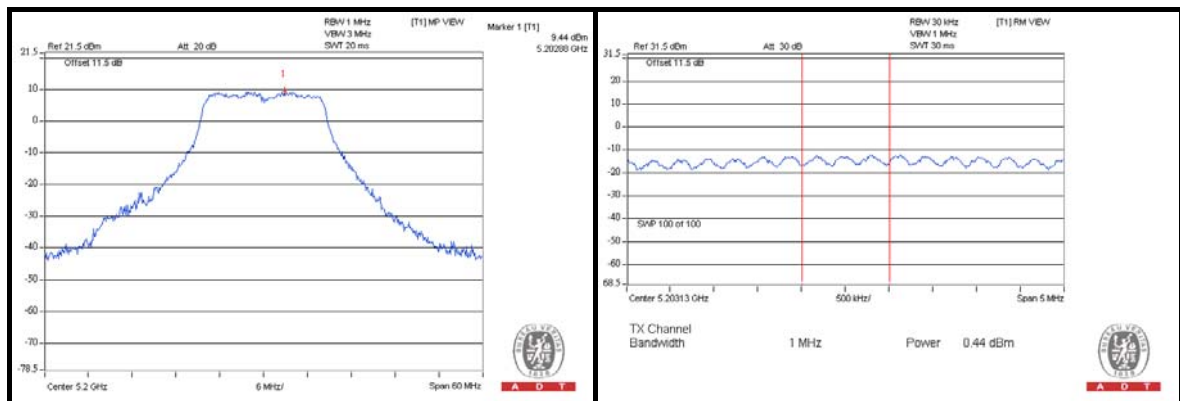
### 4.5.6 EUT OPERATING CONDITIONS

Same as 4.2.6

## 4.5.7 TEST RESULTS

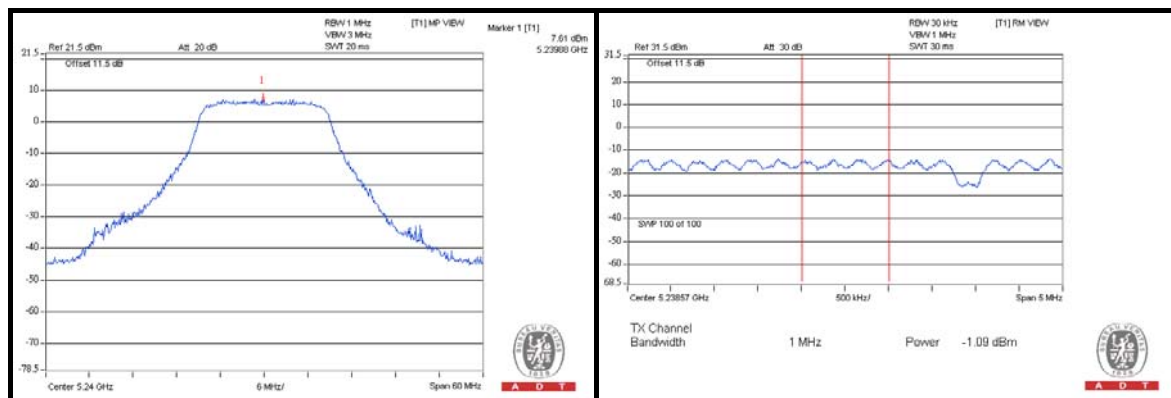
### 802.11a

TX chain	CHAN.	CHANNEL FREQUENCY (MHz)	PEAK VALUE (dBm)	PPSD (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
0	36	5180	7.50	-0.64	8.14	13	PASS
	40	5200	7.16	-0.77	7.93	13	PASS
	48	5240	8.25	-0.65	8.90	13	PASS
1	36	5180	9.34	0.41	8.93	13	PASS
	40	5200	9.44	0.44	9.00	13	PASS
	48	5240	9.30	0.42	8.88	13	PASS



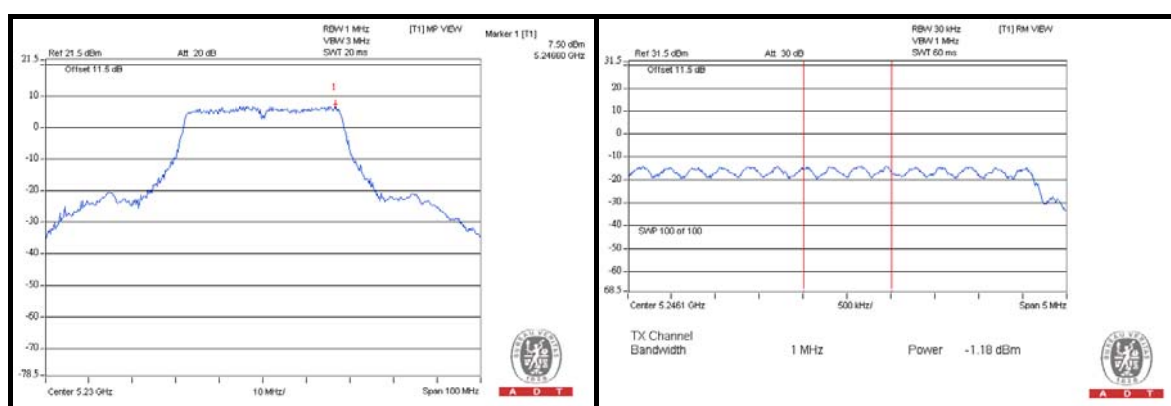
# 802.11n (20MHz)

TX chain	CHAN.	CHANNEL FREQUENCY (MHz)	PEAK VALUE (dBm)	PPSD (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
0	36	5180	7.17	-1.36	8.53	13	PASS
	40	5200	7.60	-0.90	8.50	13	PASS
	48	5240	7.61	-1.09	8.70	13	PASS
1	36	5180	8.39	0.33	8.06	13	PASS
	40	5200	8.62	0.51	8.11	13	PASS
	48	5240	7.86	0.43	7.43	13	PASS



# 802.11n (40MHz)

TX chain	CHAN.	CHANNEL FREQUENCY (MHz)	PEAK VALUE (dBm)	PPSD (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
0	38	5190	6.64	-1.43	8.07	13	PASS
	46	5230	7.50	-1.18	8.68	13	PASS
1	38	5190	8.42	0.35	8.07	13	PASS
	46	5230	8.66	0.45	8.21	13	PASS

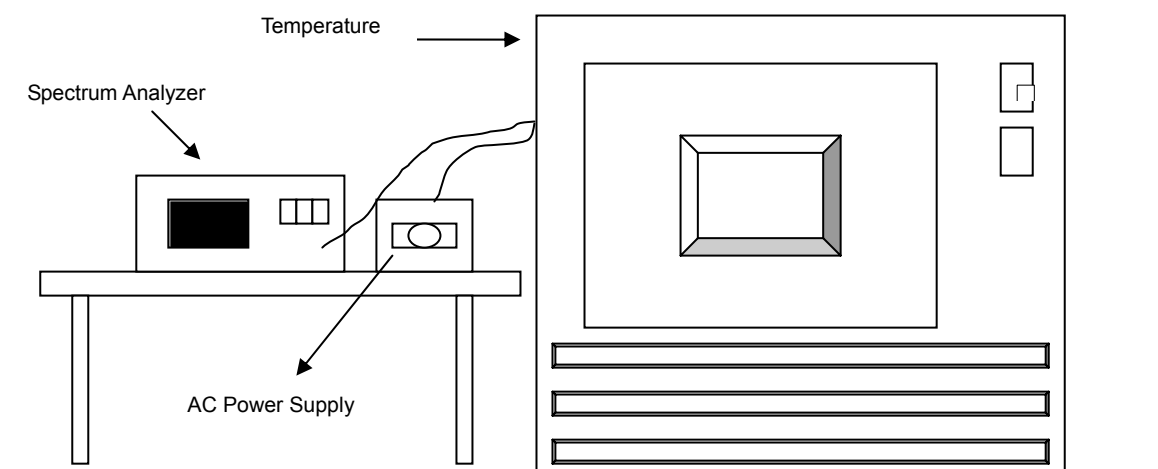


## 4.6 FREQUENCY STABILITY

### 4.6.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

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

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

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 AC 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.

#### 4.6.5 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

##### 802.11a

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5180MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
50	120	5179.9766	-0.00045	5179.9829	-0.00033	5179.9774	-0.00044	5179.9755	-0.00047
40	120	5180.0297	0.00057	5180.0275	0.00053	5180.0207	0.00040	5180.0247	0.00048
30	120	5179.983	-0.00033	5179.9852	-0.00029	5179.9889	-0.00021	5179.9884	-0.00022
20	120	5180.0116	0.00022	5180.0167	0.00032	5180.0145	0.00028	5180.0184	0.00036
10	120	5180.0173	0.00033	5180.016	0.00031	5180.0147	0.00028	5180.0145	0.00028
0	120	5179.9936	-0.00012	5179.9949	-0.00010	5179.9894	-0.00020	5179.9887	-0.00022
-10	120	5179.9847	-0.00030	5179.9817	-0.00035	5179.9813	-0.00036	5179.9788	-0.00041
-20	120	5179.9856	-0.00028	5179.9849	-0.00029	5179.9785	-0.00042	5179.9873	-0.00025

FREQUENCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5180MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	138	5180.012	0.00023	5180.0162	0.00031	5180.0153	0.00030	5180.0179	0.00035
	120	5180.0116	0.00022	5180.0167	0.00032	5180.0145	0.00028	5180.0184	0.00036
	102	5180.0129	0.00025	5180.0173	0.00033	5180.0149	0.00029	5180.0177	0.00034



## 802.11n (20MHz)

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5180MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
50	120	5180.0143	0.00028	5180.0142	0.00027	5180.0156	0.00030	5180.0189	0.00036
40	120	5180.0184	0.00036	5180.022	0.00042	5180.0264	0.00051	5180.0261	0.00050
30	120	5180.0211	0.00041	5180.0202	0.00039	5180.0143	0.00028	5180.0197	0.00038
20	120	5179.9968	-0.00006	5179.9924	-0.00015	5179.9962	-0.00007	5179.9926	-0.00014
10	120	5180.0097	0.00019	5180.0043	0.00008	5180.0036	0.00007	5180.0038	0.00007
0	120	5179.9888	-0.00022	5179.9926	-0.00014	5179.9926	-0.00014	5179.9857	-0.00028
-10	120	5179.9871	-0.00025	5179.9905	-0.00018	5179.9934	-0.00013	5179.9907	-0.00018
-20	120	5180.0013	0.00003	5179.9979	-0.00004	5179.9959	-0.00008	5180.0030	0.00006

FREQUENCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5180MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	138	5179.997	-0.00006	5179.9929	-0.00014	5179.9972	-0.00005	5179.9941	-0.00011
	120	5179.9968	-0.00006	5179.9924	-0.00015	5179.9962	-0.00007	5179.9926	-0.00014
	102	5179.9963	-0.00007	5179.9929	-0.00014	5179.9977	-0.00004	5179.9925	-0.00014

## 802.11n (40MHz)

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5190MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
50	120	5190.0175	0.00034	5190.0111	0.00021	5190.0171	0.00033	5190.0121	0.00023
40	120	5190.0147	0.00028	5190.0094	0.00018	5190.0161	0.00031	5190.0152	0.00029
30	120	5189.9836	-0.00032	5189.9859	-0.00027	5189.982	-0.00035	5189.9798	-0.00039
20	120	5190.0115	0.00022	5190.0044	0.00008	5190.0118	0.00023	5190.0084	0.00016
10	120	5190.0076	0.00015	5190.0136	0.00026	5190.0093	0.00018	5190.0079	0.00015
0	120	5189.9985	-0.00003	5189.9915	-0.00016	5189.9991	-0.00002	5189.9974	-0.00005
-10	120	5190.0113	0.00022	5190.0035	0.00007	5190.008	0.00015	5190.0046	0.00009
-20	120	5189.9876	-0.00024	5189.9804	-0.00038	5189.9804	-0.00038	5189.985	-0.00029

FREQUENCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5190MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	138	5190.0108	0.00021	5190.0056	0.00011	5190.0124	0.00024	5190.0082	0.00016
	120	5190.0115	0.00022	5190.0044	0.00008	5190.0118	0.00023	5190.0084	0.00016
	102	5190.0115	0.00022	5190.0052	0.00010	5190.0127	0.00024	5190.0066	0.00013

## 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:

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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---**