# FCC TEST REPORT (15.407)

| | |
|---|---|
| **REPORT NO.:** | RF130715C28-2 |
| **MODEL NO.:** | WAP-7410 |
| **FCC ID:** | 2AATB-000001 |
| **RECEIVED:** | Jul. 15, 2013 |
| **TESTED:** | Jul. 23, 2013 ~ Aug. 02, 2013 |
| **ISSUED:** | Aug. 12, 2013 |

**APPLICANT:** TATUNG TECHNOLOGY INC

**ADDRESS:** 22, CHUNGSHAN N.RD., 3RD SEC.,TAIPEI, TAIWAN, 10435

| | |
|---|---|
| **ISSUED BY:** | Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch |
| **LAB ADDRESS:** | No. 47, 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.

# TABLE OF CONTENTS

# RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|---|---|---|
| RF130715C28-2 | Original release | Aug. 12, 2013 |

# 1. CERTIFICATION

| | |
|---|---|
| **PRODUCT:** | Video Bridge |
| **MODEL NO.:** | WAP-7410 |
| **BRAND:** | TATUNG TECHNOLOGY INC |
| **APPLICANT:** | TATUNG TECHNOLOGY INC |
| **TESTED:** | Jul. 23, 2013 ~ Aug. 02, 2013 |
| **TEST SAMPLE:** | Production Unit |
| **STANDARDS:** | **FCC Part 15, Subpart E (Section 15.407)** |
| | ANSI C63.10-2009 |

The above equipment (model: WAP-7410) 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** : Vera Huang **, DATE :** Aug. 12, 2013

Vera Huang / Specialist

**APPROVED BY** : Sam chen **, DATE :** Aug. 12, 2013

Sam Chen / Assistant 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 -9.72dB at 0.17734MHz. |
| 15.407(b/1/2/3)(b)(6) | Spurious Emissions | PASS | Meet the requirement of limit. Minimum passing margin is -1.14dB at 5378MHz. |
| 15.407(a/1/2) | Peak 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 | No antenna connector is used. |

## 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 | 2.93 dB |
| | 200MHz ~1000MHz | 2.95 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

| | |
|---|---|
| **EUT** | Video Bridge |
| **MODEL NO.** | WAP-7410 |
| **POWER SUPPLY** | 9Vdc (adapter) |
| **MODULATION TYPE** | 64QAM, 16QAM, QPSK, BPSK |
| **MODULATION TECHNOLOGY** | OFDM |
| **TRANSFER RATE** | 802.11n: up to MCS7 |
| **OPERATING FREQUENCY** | 5270 ~ 5310MHz, 5510 ~ 5670MHz |
| **NUMBER OF CHANNEL** | 5270 ~ 5310MHz: 2 for 802.11n (40MHz)<br>5510 ~ 5670MHz: 3 for 802.11n (40MHz) |
| **OUTPUT POWER** | 139.637mW |
| **ANTENNA TYPE** | PCB antenna with 2.99dBi gain (5270 ~ 5310MHz)<br>PCB antenna with 3.88dBi gain (5510 ~ 5670MHz) |
| **ANTENNA CONNECTOR** | NA |
| **DATA CABLE** | Refer to Note as below |
| **I/O PORTS** | Refer to user's manual |
| **ACCESSORY DEVICES** | Refer to Note as below |

**NOTE:**

1. The EUT has following accessories.

| ITEM | BRAND | MODEL | DESCRIPTION |
|---|---|---|---|
| AC Adapter | DVE | DSA-9PFB-09<br>FUS 090100 | I/P: 100-240Vac, 50-60Hz, 0.3A<br>O/P: 9Vdc, 1A |

2. The EUT incorporates a MIMO function. Physically, the EUT provides 4 completed transmitters and 4 receivers.

| MODULATION MODE | TX FUNCTION |
|---|---|
| **802.11n (40MHz)** | 4TX |

3. 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

### FOR 5270 ~ 5310MHz

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

| CHANNEL | FREQUENCY | CHANNEL | FREQUENCY |
|---|---|---|---|
| 54 | 5270 MHz | 62 | 5310 MHz |

### FOR 5510 ~ 5670MHz

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

| CHANNEL | FREQUENCY | CHANNEL | FREQUENCY |
|---|---|---|---|
| 102 | 5510MHz | 134 | 5670MHz |
| 110 | 5550MHz | | |

## 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

| EUT CONFIGURE MODE | APPLICABLE TO | | | | DESCRIPTION |
|---|---|---|---|---|---|
| | RE≥1G | RE<1G | PLC | APCM | |
| - | √ | √ | √ | √ | - |

Where **RE≥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 **Z-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.

| MODE | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| 802.11n (40MHz) | 5270-5310 | 54 to 62 | 54, 62 | OFDM | BPSK | 13.5 |
| 802.11n (40MHz) | 5510-5670 | 102 to 134 | 102, 110, 134 | OFDM | BPSK | 13.5 |

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

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

| MODE | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| 802.11n (40MHz) | 5270-5310 | 54 to 62 | 54 | OFDM | BPSK | 13.5 |
| 802.11n (40MHz) | 5510-5670 | 102 to 134 | 134 | OFDM | BPSK | 13.5 |

**POWER LINE CONDUCTED EMISSION TEST:**

The EUT was tested with the following mode.

| TEST CONDITION |
|---|
| WLAN (5G) Link + Adapter |

**BANDEDGE MEASUREMENT:**

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

| MODE | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| 802.11n (40MHz) | 5270-5310 | 54 to 62 | 54, 62 | OFDM | BPSK | 13.5 |
| 802.11n (40MHz) | 5510-5670 | 102 to 134 | 102, 110, 134 | OFDM | BPSK | 13.5 |

**ANTENNA PORT CONDUCTED MEASUREMENT:**

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

| MODE | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| 802.11n (40MHz) | 5270-5310 | 54 to 62 | 54, 62 | OFDM | BPSK | 13.5 |
| 802.11n (40MHz) | 5510-5670 | 102 to 134 | 102, 110, 134 | OFDM | BPSK | 13.5 |

**TEST CONDITION:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---|---|---|---|
| RE≥1G | 25deg. C, 65%RH | 120Vac, 60Hz | Anson Lin |
| RE<1G | 25deg. C, 65%RH | 120Vac, 60Hz | Anson Lin |
| PLC | 25deg. C, 65%RH | 120Vac, 60Hz | Johnson Liao |
| APCM | 25deg. C, 65%RH | 120Vac, 60Hz | Howard Kao |

## 3.3 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.

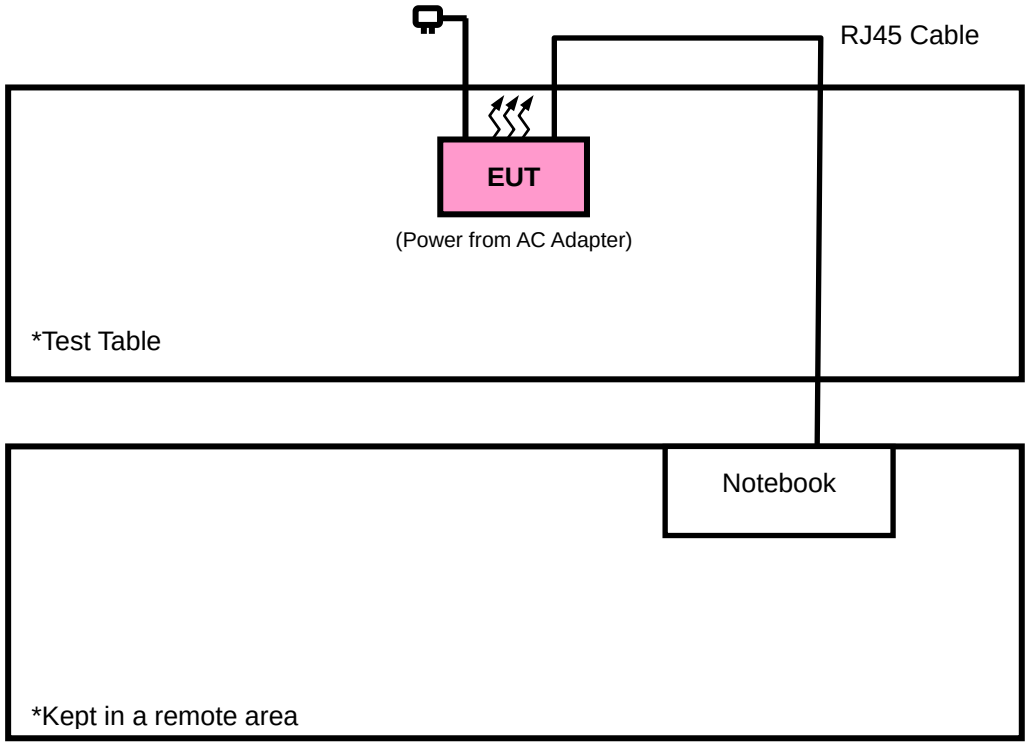
| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|---|---|---|---|---|---|
| 1 | NOTEBOOK | DELL | D531 | CN-0XM006-48643 -81U-2973 | QDS-BRCM1020 |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|---|---|
| 1 | NA |

**NOTE:**

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

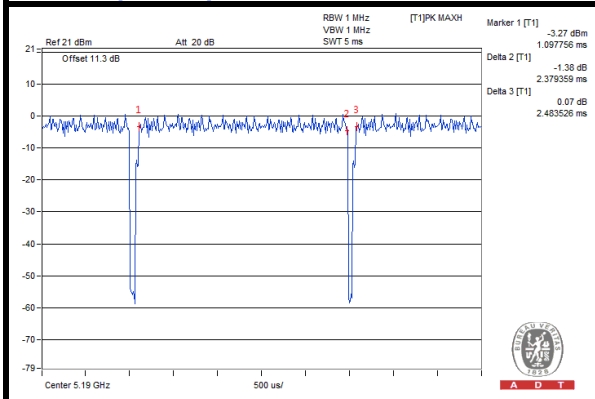
### 3.3.1 CONFIGURATION OF SYSTEM UNDER TEST



## 3.4 DUTY CYCLE OF TEST SIGNAL

If duty cycle is < 98%, duty factor shall be considered.

**802.11n (40MHz):** Duty cycle = 2.379/2.484 = 0.958, Duty factor = 10 * log(1/0.958) = 0.19

| 802.11n (40MHz) | |
|---|---|
|  | |



## 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)**

ANSI C63.10-2009

KDB 789033 D01 General UNII Test Procedures v01r02

662911 D01 Multiple Transmitter Output v01 r02

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

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

$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/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 | ESCI | 100424 | Aug. 21, 2012 | Aug. 20, 2013 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSU43 | 101261 | Dec. 17, 2012 | Dec. 16, 2013 |
| BILOG Antenna SCHWARZBECK | VULB9168 | 9168-472 | Mar. 25, 2013 | Mar. 24, 2014 |
| HORN Antenna SCHWARZBECK | BBHA 9120 D | 9120D-969 | Jan. 07, 2013 | Jan. 06, 2014 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | 9170-480 | Dec. 25, 2012 | Dec. 24, 2013 |
| Loop Antenna | HFH2-Z2 | 100070 | Jan. 31, 2012 | Jan. 30, 2014 |
| Preamplifier EMCI | EMC 012645 | 980115 | Dec. 28, 2012 | Dec. 27, 2013 |
| Preamplifier EMCI | EMC 184045 | 980116 | Dec. 28, 2012 | Dec. 27, 2013 |
| Preamplifier EMCI | EMC 330H | 980112 | Dec. 28, 2012 | Dec. 27, 2013 |
| RF signal cable HUBER+SUHNNER | SUCOFLEX 104 | 309219/4 | Oct. 19, 2012 | Oct. 18, 2013 |
| RF signal cable HUBER+SUHNNER | SUCOFLEX 104 | 250130/4 | Oct. 19, 2012 | Oct. 18, 2013 |
| RF signal cable Worken | RG-213 | NA | Dec. 29, 2012 | Dec. 28, 2013 |
| Software | E3 6.120103 | NA | NA | NA |
| Antenna Tower MF | MFA-440H | NA | NA | NA |
| Turn Table MF | MFT-201SS | NA | NA | NA |
| Antenna Tower &Turn Table Controller MF | MF-7802 | 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 calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in HwaYa Chamber 10.
4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
5. The FCC Site Registration No. is 690701.
6. The IC Site Registration No. is IC 7450F-10.

### 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 camber. 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.

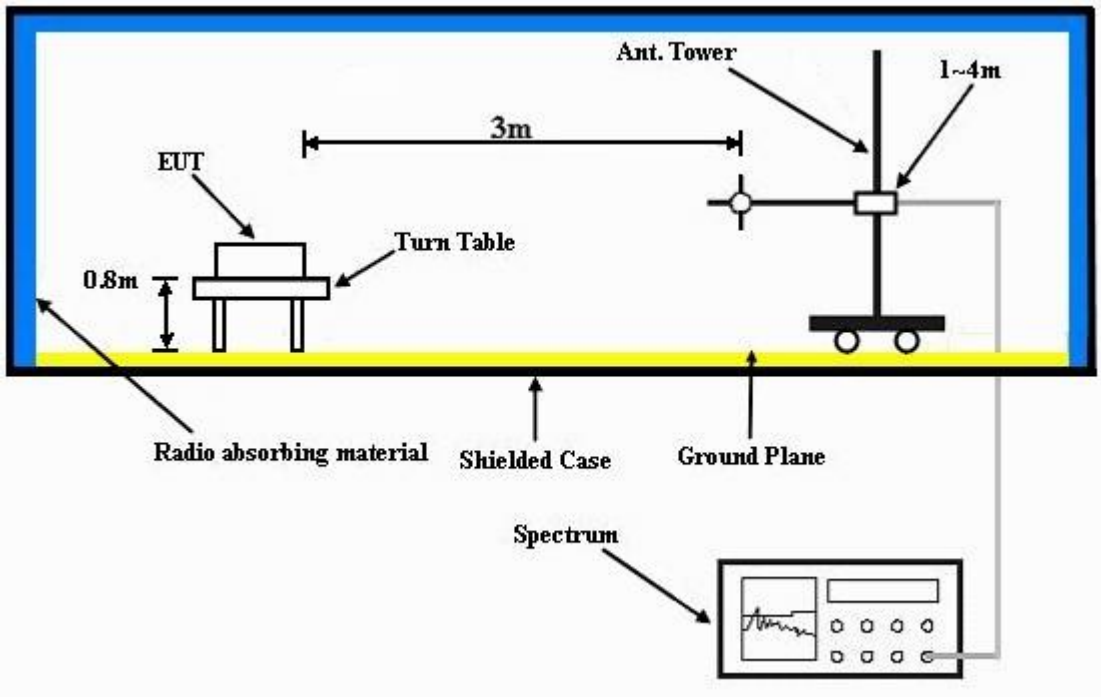
**NOTE:**

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

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

## 4.1.8 TEST RESULTS

**ABOVE 1GHz DATA:**

**802.11n (40MHz)**

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| **CHANNEL** | Channel 54 | **FREQUENCY RANGE** | 1GHz ~ 40GHz |
| **INPUT POWER (SYSTEM)** | 120Vac, 60 Hz | **DETECTOR FUNCTION** | Peak (PK)<br>Average (AV) |
| **ENVIRONMENTAL CONDITIONS** | 25deg. C, 65%RH | **TESTED BY** | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **FREQ. (MHz)** | **EMISSION LEVEL (dBuV/m)** | **READ LEVEL (dBuV)** | **LIMIT (dBuV/m)** | **MARGIN (dB)** | **ANTENNA FACTOR (dB/m)** | **CABLE LOSS (dB)** | **PREAMP FACTOR (dB)** | **ANTENNA HEIGHT (cm)** | **TABLE ANGLE (Degree)** | **REMARK** |
| 5150 | 48.67 | 12.06 | 54 | -5.33 | 31.32 | 5.29 | 0 | 112 | 66 | Average |
| 5150 | 57.99 | 21.38 | 74 | -16.01 | 31.32 | 5.29 | 0 | 112 | 66 | Peak |
| 5270 | 104.19 | 67.43 | | | 31.41 | 5.35 | 0 | 112 | 66 | Average |
| 5270 | 110.51 | 73.75 | | | 31.41 | 5.35 | 0 | 112 | 66 | Peak |
| 5350 | 48.66 | 11.79 | 54 | -5.34 | 31.48 | 5.39 | 0 | 112 | 66 | Average |
| 5350 | 60.84 | 23.97 | 74 | -13.16 | 31.48 | 5.39 | 0 | 112 | 66 | Peak |
| **ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M** | | | | | | | | | | |
| **FREQ. (MHz)** | **EMISSION LEVEL (dBuV/m)** | **READ LEVEL (dBuV)** | **LIMIT (dBuV/m)** | **MARGIN (dB)** | **ANTENNA FACTOR (dB/m)** | **CABLE LOSS (dB)** | **PREAMP FACTOR (dB)** | **ANTENNA HEIGHT (cm)** | **TABLE ANGLE (Degree)** | **REMARK** |
| 5114 | 47.03 | 10.46 | 54 | -6.97 | 31.29 | 5.28 | 0 | 101 | 155 | Average |
| 5114 | 57.03 | 20.46 | 74 | -16.97 | 31.29 | 5.28 | 0 | 101 | 155 | Peak |
| 5270 | 106.15 | 69.39 | | | 31.41 | 5.35 | 0 | 101 | 155 | Average |
| 5270 | 111.08 | 74.32 | | | 31.41 | 5.35 | 0 | 101 | 155 | Peak |
| 5378 | 52.86 | 15.95 | 54 | -1.14 | 31.51 | 5.4 | 0 | 101 | 155 | Average |
| 5378 | 60.53 | 23.62 | 74 | -13.47 | 31.51 | 5.4 | 0 | 101 | 155 | Peak |

**REMARKS:** 5270MHz: Fundamental frequency.

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| CHANNEL | Channel 62 | FREQUENCY RANGE | 1GHz ~ 40GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5012 | 45.99 | 46.79 | 54 | -8.01 | 31.21 | 5.22 | 37.23 | 113 | 56 | Average |
| 5012 | 57.06 | 57.86 | 74 | -16.94 | 31.21 | 5.22 | 37.23 | 113 | 56 | Peak |
| 5310 | 99.52 | 99.89 | | | 31.45 | 5.37 | 37.19 | 113 | 56 | Average |
| 5310 | 108.12 | 108.49 | | | 31.45 | 5.37 | 37.19 | 113 | 56 | Peak |
| 5352 | 51.39 | 51.7 | 54 | -2.61 | 31.48 | 5.39 | 37.18 | 113 | 56 | Average |
| 5352 | 63.5 | 63.81 | 74 | -10.5 | 31.48 | 5.39 | 37.18 | 113 | 56 | Peak |
| **ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M** | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5032 | 45.75 | 46.52 | 54 | -8.25 | 31.23 | 5.24 | 37.24 | 101 | 156 | Average |
| 5032 | 57.05 | 57.82 | 74 | -16.95 | 31.23 | 5.24 | 37.24 | 101 | 156 | Peak |
| 5310 | 101.03 | 101.4 | | | 31.45 | 5.37 | 37.19 | 101 | 156 | Average |
| 5310 | 109.34 | 109.71 | | | 31.45 | 5.37 | 37.19 | 101 | 156 | Peak |
| 5350 | 51.97 | 52.28 | 54 | -2.03 | 31.48 | 5.39 | 37.18 | 101 | 156 | Average |
| 5350 | 66.19 | 66.5 | 74 | -7.81 | 31.48 | 5.39 | 37.18 | 101 | 156 | Peak |

**REMARKS:** 5310MHz: Fundamental frequency.

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| CHANNEL | Channel 102 | FREQUENCY RANGE | 1GHz ~ 40GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5460 | 47.09 | 47.17 | 54 | -6.91 | 31.56 | 5.44 | 37.08 | 100 | 340 | Average |
| 5460 | 62.66 | 62.74 | 74 | -11.34 | 31.56 | 5.44 | 37.08 | 100 | 340 | Peak |
| 5470 | 66.11 | 66.17 | 68.3 | -2.19 | 31.57 | 5.45 | 37.08 | 100 | 340 | Peak |
| 5510 | 98.85 | 98.85 | | | 31.6 | 5.46 | 37.06 | 100 | 340 | Average |
| 5510 | 107.98 | 107.98 | | | 31.6 | 5.46 | 37.06 | 100 | 340 | Peak |
| 5725 | 56.49 | 56.37 | 68.3 | -11.81 | 31.96 | 5.59 | 37.43 | 100 | 340 | Peak |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5460 | 47.97 | 48.05 | 54 | -6.03 | 31.56 | 5.44 | 37.08 | 100 | 179 | Average |
| 5460 | 66.44 | 66.52 | 74 | -7.56 | 31.56 | 5.44 | 37.08 | 100 | 179 | Peak |
| 5470 | 66.85 | 66.91 | 68.3 | -1.45 | 31.57 | 5.45 | 37.08 | 100 | 179 | Peak |
| 5510 | 99.87 | 99.87 | | | 31.6 | 5.46 | 37.06 | 100 | 179 | Average |
| 5510 | 109.32 | 109.32 | | | 31.6 | 5.46 | 37.06 | 100 | 179 | Peak |
| 5725 | 56.29 | 56.17 | 68.3 | -12.01 | 31.96 | 5.59 | 37.43 | 100 | 179 | Peak |

**REMARKS:**

1. 5510MHz: Fundamental frequency.
2. 5470MHz & 5725MHz: Out of restricted band

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| CHANNEL | Channel 110 | FREQUENCY RANGE | 1GHz ~ 40GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5442 | 48.71 | 48.85 | 54 | -5.29 | 31.55 | 5.44 | 37.13 | 100 | 352 | Average |
| 5442 | 60.93 | 61.07 | 74 | -13.07 | 31.55 | 5.44 | 37.13 | 100 | 352 | Peak |
| 5470 | 60.34 | 60.4 | 68.3 | -7.96 | 31.57 | 5.45 | 37.08 | 100 | 352 | Peak |
| 5550 | 103.54 | 103.46 | | | 31.68 | 5.49 | 37.09 | 100 | 352 | Average |
| 5550 | 110.92 | 110.84 | | | 31.68 | 5.49 | 37.09 | 100 | 352 | Peak |
| 5725 | 56.69 | 56.57 | 68.3 | -11.61 | 31.96 | 5.59 | 37.43 | 100 | 352 | Peak |
| **ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M** | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5442 | 49.52 | 49.66 | 54 | -4.48 | 31.55 | 5.44 | 37.13 | 100 | 178 | Average |
| 5442 | 61.87 | 62.01 | 74 | -12.13 | 31.55 | 5.44 | 37.13 | 100 | 178 | Peak |
| 5470 | 61.26 | 61.32 | 68.3 | -7.04 | 31.57 | 5.45 | 37.08 | 100 | 178 | Peak |
| 5550 | 104.69 | 104.61 | | | 31.68 | 5.49 | 37.09 | 100 | 178 | Average |
| 5550 | 111.85 | 111.77 | | | 31.68 | 5.49 | 37.09 | 100 | 178 | Peak |
| 5725 | 56.59 | 56.47 | 68.3 | -11.71 | 31.96 | 5.59 | 37.43 | 100 | 178 | Peak |

**REMARKS:**

1. 5550MHz: Fundamental frequency.
2. 5470MHz & 5725MHz: Out of restricted band

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| CHANNEL | Channel 134 | FREQUENCY RANGE | 1GHz ~ 40GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5452 | 47.48 | 47.56 | 54 | -6.52 | 31.56 | 5.44 | 37.08 | 100 | 322 | Average |
| 5452 | 58.51 | 58.59 | 74 | -15.49 | 31.56 | 5.44 | 37.08 | 100 | 322 | Peak |
| 5470 | 57.67 | 57.73 | 68.3 | -10.63 | 31.57 | 5.45 | 37.08 | 100 | 322 | Peak |
| 5670 | 103.12 | 103.02 | | | 31.88 | 5.56 | 37.34 | 100 | 322 | Average |
| 5670 | 111.04 | 110.94 | | | 31.88 | 5.56 | 37.34 | 100 | 322 | Peak |
| 5725 | 61.35 | 61.23 | 68.3 | -6.95 | 31.96 | 5.59 | 37.43 | 100 | 322 | Peak |
| **ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M** | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 5458 | 48.8 | 48.88 | 54 | -5.2 | 31.56 | 5.44 | 37.08 | 106 | 169 | Average |
| 5458 | 57.59 | 57.67 | 74 | -16.41 | 31.56 | 5.44 | 37.08 | 106 | 169 | Peak |
| 5470 | 58.55 | 58.61 | 68.3 | -9.75 | 31.57 | 5.45 | 37.08 | 106 | 169 | Peak |
| 5670 | 104.41 | 104.31 | | | 31.88 | 5.56 | 37.34 | 106 | 169 | Average |
| 5670 | 111.81 | 111.71 | | | 31.88 | 5.56 | 37.34 | 106 | 169 | Peak |
| 5725 | 63.37 | 63.25 | 68.3 | -4.93 | 31.96 | 5.59 | 37.43 | 106 | 169 | Peak |

**REMARKS:**

1. 5670MHz: Fundamental frequency.
2. 5470MHz & 5725MHz: Out of restricted band

## BELOW 1GHz WORST-CASE DATA：802.11n (40MHz)

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| CHANNEL | Channel 54 | FREQUENCY RANGE | 30MHz ~ 1GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK)<br>Quasi-Peak (QP) |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 56.73 | 32.95 | 51.24 | 40 | -7.05 | 12.25 | 0.81 | 31.35 | 100 | 152 | Peak |
| 125.04 | 33.62 | 52.95 | 43.5 | -9.88 | 11.35 | 1.21 | 31.89 | 100 | 288 | Peak |
| 200.1 | 26.04 | 46.86 | 43.5 | -17.46 | 9.36 | 1.59 | 31.77 | 100 | 317 | Peak |
| 320.3 | 28.29 | 44.63 | 46 | -17.71 | 13.43 | 2.12 | 31.89 | 100 | 154 | Peak |
| 519.8 | 29.24 | 40.19 | 46 | -16.76 | 17.77 | 2.85 | 31.57 | 100 | 60 | Peak |
| 759.9 | 28.42 | 34.6 | 46 | -17.58 | 21.66 | 3.6 | 31.44 | 100 | 199 | Peak |
| ANTENNA POLARITY & test distance: VERTICAL at 3 m | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 57 | 28.16 | 46.45 | 40 | -11.84 | 12.25 | 0.81 | 31.35 | 105 | 138 | QP |
| 75.09 | 29.44 | 50.62 | 40 | -10.56 | 9.57 | 0.93 | 31.68 | 115 | 241 | QP |
| 274.89 | 21.13 | 38.93 | 46 | -24.87 | 12.2 | 1.93 | 31.93 | 103 | 75 | Peak |
| 320.3 | 27.05 | 43.39 | 46 | -18.95 | 13.43 | 2.12 | 31.89 | 100 | 148 | Peak |
| 519.8 | 30.63 | 41.58 | 46 | -15.37 | 17.77 | 2.85 | 31.57 | 100 | 302 | Peak |
| 799.8 | 28.16 | 33.67 | 46 | -17.84 | 22.23 | 3.69 | 31.43 | 100 | 255 | Peak |

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|---|---|---|---|
| CHANNEL | Channel 134 | FREQUENCY RANGE | 30MHz ~ 1GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK)<br>Quasi-Peak (QP) |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Anson Lin |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 56.73 | 32.95 | 51.24 | 40 | -7.05 | 12.25 | 0.81 | 31.35 | 104 | 169 | Peak |
| 125.04 | 33.7 | 53.03 | 43.5 | -9.8 | 11.35 | 1.21 | 31.89 | 103 | 137 | Peak |
| 200.1 | 26.38 | 47.2 | 43.5 | -17.12 | 9.36 | 1.59 | 31.77 | 100 | 220 | Peak |
| 320.3 | 28.5 | 44.84 | 46 | -17.5 | 13.43 | 2.12 | 31.89 | 100 | 179 | Peak |
| 500.2 | 29.55 | 41.06 | 46 | -16.45 | 17.33 | 2.78 | 31.62 | 100 | 326 | Peak |
| 759.9 | 28.11 | 34.29 | 46 | -17.89 | 21.66 | 3.6 | 31.44 | 100 | 108 | Peak |
| ANTENNA POLARITY & test distance: VERTICAL at 3 m | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB/m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 56.73 | 29.06 | 47.35 | 40 | -10.94 | 12.25 | 0.81 | 31.35 | 108 | 32 | QP |
| 75.09 | 30.04 | 51.22 | 40 | -9.96 | 9.57 | 0.93 | 31.68 | 103 | 289 | QP |
| 200.1 | 19.97 | 40.79 | 43.5 | -23.53 | 9.36 | 1.59 | 31.77 | 100 | 277 | Peak |
| 320.3 | 27.24 | 43.58 | 46 | -18.76 | 13.43 | 2.12 | 31.89 | 100 | 108 | Peak |
| 575.1 | 31.6 | 41.65 | 46 | -14.4 | 19.03 | 3.02 | 32.1 | 100 | 163 | Peak |
| 811 | 28.22 | 33.6 | 46 | -17.78 | 22.37 | 3.72 | 31.47 | 100 | 72 | Peak |

## 4.2 CONDUCTED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dBμV) | |
|---|---|---|
| | 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. 28, 2012 | Dec. 27, 2013 |
| LISN ROHDE & SCHWARZ (EUT) | ESH2-Z5 | 100100 | Dec. 21, 2012 | Dec. 20, 2013 |
| LISN ROHDE & SCHWARZ (Peripheral) | ESH3-Z5 | 100312 | Jul. 02, 2013 | Jul. 01, 2014 |
| 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

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

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

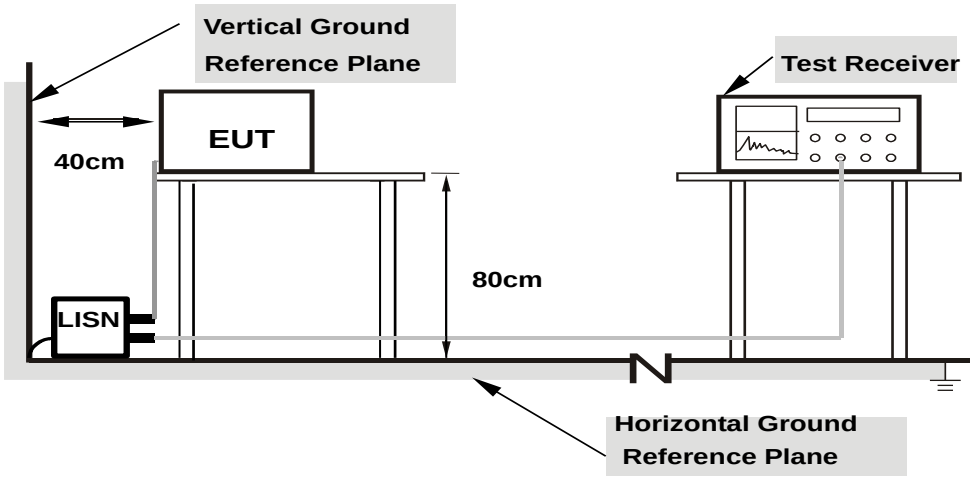
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**NOTE:** 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

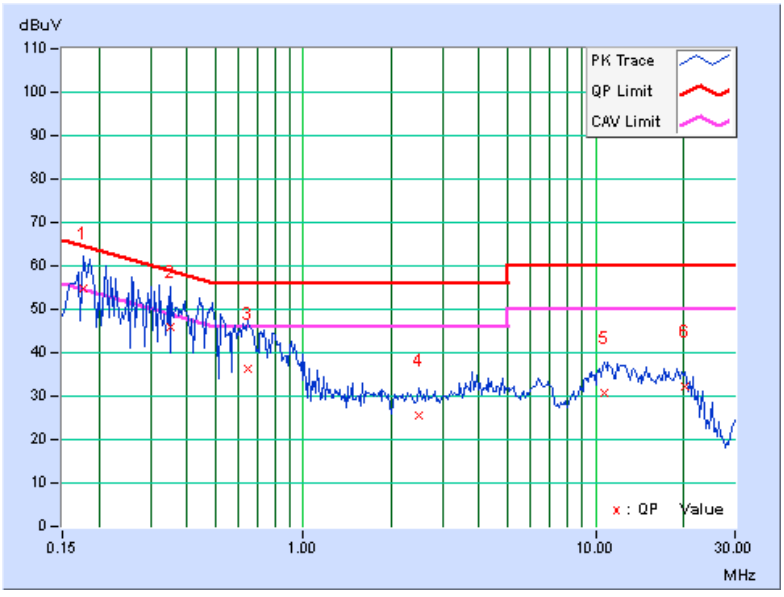
**CONDUCTED WORST-CASE DATA：802.11n (40MHz)**

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

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.17734 | 0.17 | 54.72 | 31.72 | 54.89 | 31.89 | 64.61 | 54.61 | -9.72 | -22.72 |
| 2 | 0.35313 | 0.20 | 45.77 | 31.01 | 45.97 | 31.21 | 58.89 | 48.89 | -12.92 | -17.68 |
| 3 | 0.64609 | 0.23 | 36.15 | 21.83 | 36.38 | 22.06 | 56.00 | 46.00 | -19.62 | -23.94 |
| 4 | 2.48828 | 0.30 | 25.30 | 17.84 | 25.60 | 18.14 | 56.00 | 46.00 | -30.40 | -27.86 |
| 5 | 10.69922 | 0.44 | 30.26 | 22.81 | 30.70 | 23.25 | 60.00 | 50.00 | -29.30 | -26.75 |
| 6 | 20.25781 | 0.64 | 31.53 | 25.57 | 32.17 | 26.21 | 60.00 | 50.00 | -27.83 | -23.79 |

**REMARKS:**

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

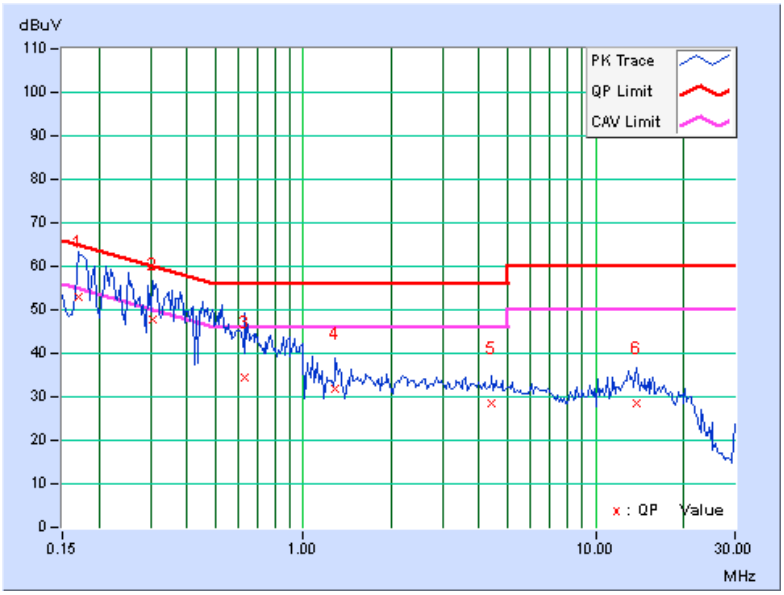


| PHASE | Line 2 | 6dB BANDWIDTH | 9kHz |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.16953 | 0.18 | 52.60 | 36.34 | 52.78 | 36.52 | 64.98 | 54.98 | -12.20 | -18.46 |
| 2 | 0.30625 | 0.22 | 47.61 | 30.06 | 47.83 | 30.28 | 60.07 | 50.07 | -12.24 | -19.79 |
| 3 | 0.63047 | 0.24 | 34.20 | 20.11 | 34.44 | 20.35 | 56.00 | 46.00 | -21.56 | -25.65 |
| 4 | 1.28516 | 0.24 | 31.59 | 25.83 | 31.83 | 26.07 | 56.00 | 46.00 | -24.17 | -19.93 |
| 5 | 4.41797 | 0.40 | 27.94 | 22.51 | 28.34 | 22.91 | 56.00 | 46.00 | -27.66 | -23.09 |
| 6 | 13.74609 | 0.57 | 27.95 | 20.32 | 28.52 | 20.89 | 60.00 | 50.00 | -31.48 | -29.11 |

**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



## 4.3 PEAK TRANSMIT POWER MEASUREMENT

### 4.3.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT

| FREQUENCY BAND | LIMIT |
|---|---|
| 5.250 ~ 5.350GHz | The lesser of 250mW (24dBm) or 11dBm + 10logB |
| 5.470 ~ 5.725GHz | The lesser of 250mW (24dBm) or 11dBm + 10logB |

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

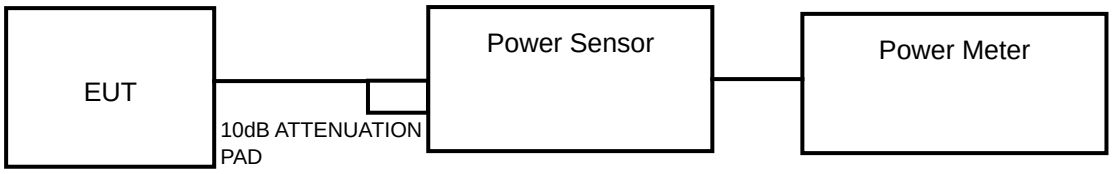
Per KDB 662911 D01 Multiple Transmitter Output v01r02 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 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 ≥ 5.

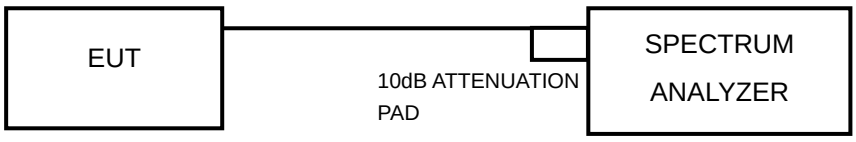
For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

### 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:

#### 802.11n (40MHz)

| CH. | CHAN. FREQ. (MHz) | AVERAGE POWER (dBm) | | | | TOTAL POWER (mW) | TOTAL POWER (dBm) | POWER LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | | | | |
| 54 | 5270 | 15.82 | 15.01 | 15.71 | 15.12 | 139.637 | 21.45 | 24 | PASS |
| 62 | 5310 | 11.15 | 10.85 | 11.69 | 11.39 | 53.703 | 17.30 | 24 | PASS |
| 102 | 5510 | 10.15 | 9.91 | 10.73 | 10.08 | 42.170 | 16.25 | 24 | PASS |
| 110 | 5550 | 14.75 | 14.66 | 15.42 | 14.72 | 123.595 | 20.92 | 24 | PASS |
| 134 | 5670 | 14.02 | 13.98 | 14.76 | 14.07 | 105.682 | 20.24 | 24 | PASS |

### 26dB BANDWIDTH:

#### 802.11n (40MHz)

| CH. | CHANNEL FREQUENCY (MHz) | 26dBc BANDWIDTH (MHz) | | | | PASS / FAIL |
|---|---|---|---|---|---|---|
| | | chain 0 | chain 1 | CHAIN 2 | CHAIN 3 | |
| 54 | 5270 | 52.92 | 50.27 | 52.80 | 48.40 | PASS |
| 62 | 5310 | 52.76 | 48.62 | 53.00 | 48.35 | PASS |
| 102 | 5510 | 53.19 | 50.75 | 57.90 | 48.67 | PASS |
| 110 | 5550 | 59.79 | 52.28 | 55.40 | 50.24 | PASS |
| 134 | 5670 | 58.07 | 50.41 | 54.81 | 50.01 | PASS |

## 4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT

### 4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

| FREQUENCY BAND | LIMIT |
|---|---|
| 5.250 ~ 5.350GHz | 11dBm |
| 5.470 ~ 5.725GHz | 11dBm |

### 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

Using method SA-2 alternative

1) Set span to encompass the entire emission bandwidth (EBW) of the signal.
2) Set RBW = 30 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3) Set Channel power measure = 1MHz
4) Sweep time = 30ms
5) Perform a single sweep.
6) Record the max value and add 10 log (1/duty cycle)

### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.4.6 EUT OPERATING CONDITIONS

Same as 4.3.6.

### 4.4.7 TEST RESULTS

**For 5270 ~ 5310 MHz**

**802.11n (40MHz)**

| CH. | CHAN. FREQ. (MHz) | PSD W/O DUTY FACTOR (dBm) | | | | DUTY FACTOR | PSD W/ DUTY FACTOR (dBm) | | | | TOTAL PSD WITH DUTY FACTOR (dBm) | MAX. LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | | | |
| 54 | 5270 | 1.22 | -0.11 | 0.44 | -0.12 | 0.19 | 1.41 | 0.08 | 0.63 | 0.07 | 6.60 | 7.99 | PASS |
| 62 | 5310 | 1.04 | -0.18 | 0.39 | -0.14 | 0.19 | 1.23 | 0.01 | 0.58 | 0.05 | 6.51 | 7.99 | 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 = 2.99dBi + 10log(4) = 9.01dBi > 6dBi , so the power density limit shall be reduced to 11-(9.01-6) = 7.99dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

## For 5510 ~ 5670 MHz

## 802.11n (40MHz)

| CH. | CHAN. FREQ. (MHz) | PSD W/O DUTY FACTOR (dBm) | | | | DUTY FACTOR | PSD W/ DUTY FACTOR (dBm) | | | | TOTAL PSD WITH DUTY FACTOR (dBm) | MAX. LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | | | |
| 102 | 5510 | 0.56 | -0.17 | 0.03 | -0.42 | 0.19 | 0.75 | 0.02 | 0.22 | -0.23 | 6.22 | 7.1 | PASS |
| 110 | 5550 | 0.53 | -0.19 | 0.35 | -0.45 | 0.19 | 0.72 | 0.00 | 0.54 | -0.26 | 6.28 | 7.1 | PASS |
| 134 | 5670 | 0.79 | -0.53 | 0.24 | -0.55 | 0.19 | 0.98 | -0.34 | 0.43 | -0.36 | 6.23 | 7.1 | 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 = 3.88dBi + 10log(4) = 9.9dBi > 6dBi , so the power density limit shall be reduced to 11-(9.9-6) = 7.1dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

## 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 ≥ 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

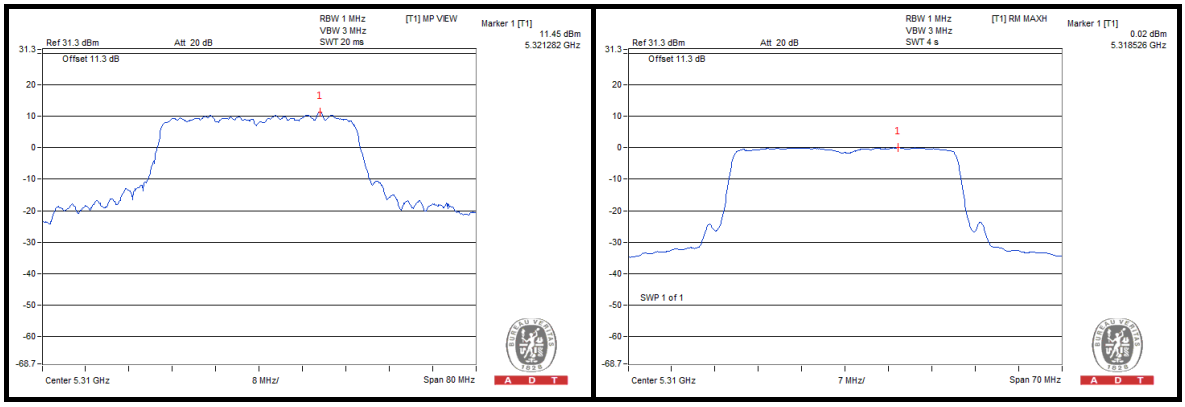
Same as 4.2.6

## 4.5.7 TEST RESULTS

**802.11n (40MHz)**

| Modulation Mode | Modulation type | Channel Frequency (MHz) | PEAK VALUE (dBm) | | | | PPSD WITHOUT DUTY FACTOR (dBm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 |
| HT 40 _MCS0 | BPSK | 5310 | 10.20 | 8.61 | 9.25 | 8.67 | 1.04 | -0.18 | 0.39 | -0.14 |
| | QPSK | | 9.72 | 8.69 | 9.13 | 9.20 | 0.43 | -0.20 | 0.56 | -0.25 |
| | 16QAM | | 10.04 | 9.34 | 9.94 | 8.89 | 0.60 | 0.07 | 0.34 | -0.27 |
| | 64QAM | | 10.98 | 10.48 | 11.45 | 9.55 | 0.53 | -0.24 | 0.02 | -0.45 |

| PPSD WITH DUTY FACTOR (dBm) | | | | PEAK Excursion (dB) | | | | LIMIT (dB) | PASS /FAIL |
|---|---|---|---|---|---|---|---|---|---|
| CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | CHAIN 0 | CHAIN 1 | CHAIN 2 | CHAIN 3 | | |
| 1.23 | 0.01 | 0.58 | 0.05 | 8.97 | 8.60 | 8.67 | 8.62 | 13 | PASS |
| 0.62 | -0.01 | 0.75 | -0.06 | 9.10 | 8.70 | 8.38 | 9.26 | 13 | PASS |
| 0.79 | 0.26 | 0.53 | -0.08 | 9.25 | 9.08 | 9.41 | 8.97 | 13 | PASS |
| 0.72 | -0.05 | 0.21 | -0.26 | 10.26 | 10.53 | 11.24 | 9.81 | 13 | PASS |

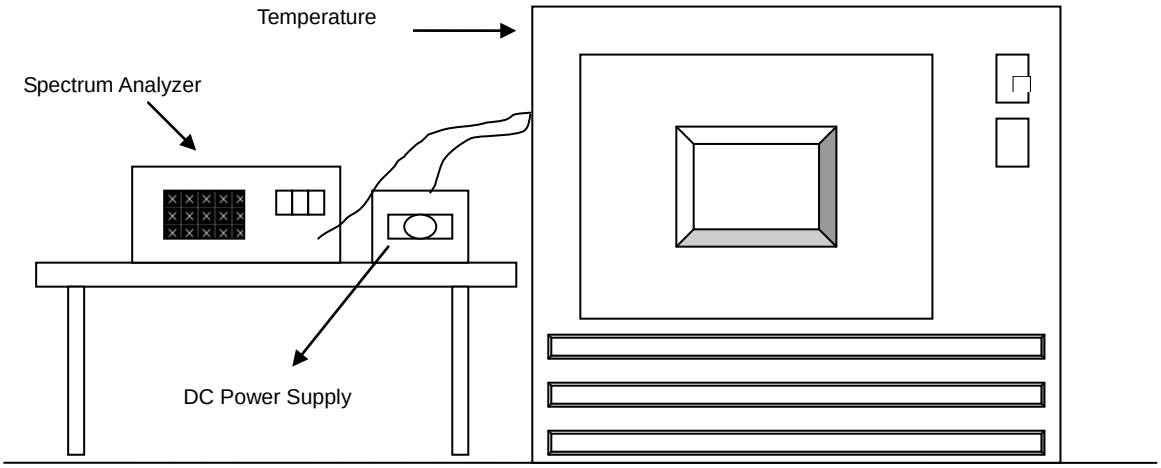


## 4.6 FREQUENCY STABILITY

### 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. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.

b. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.

c. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

### 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

| FREQUEMCY STABILITY VERSUS TEMP. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OPERATING FREQUENCY: 5310MHz | | | | | | | | | |
| TEMP. (℃) | POWER SUPPLY (Vdc) | 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 | 9.0 | 5310.067151 | 12.646 | 5310.067044 | 12.626 | 5310.067064 | 12.630 | 5310.067019 | 12.621 |
| 40 | 9.0 | 5310.068250 | 12.853 | 5310.068042 | 12.814 | 5310.068456 | 12.892 | 5310.067991 | 12.804 |
| 30 | 9.0 | 5310.069093 | 13.012 | 5310.069389 | 13.068 | 5310.069581 | 13.104 | 5310.069089 | 13.011 |
| 20 | 9.0 | 5310.072264 | 13.609 | 5310.072733 | 13.697 | 5310.072432 | 13.641 | 5310.072935 | 13.735 |
| 10 | 9.0 | 5310.071137 | 13.397 | 5310.070973 | 13.366 | 5310.071710 | 13.505 | 5310.071211 | 13.411 |
| 0 | 9.0 | 5310.070389 | 13.256 | 5310.070517 | 13.280 | 5310.070294 | 13.238 | 5310.070315 | 13.242 |
| -10 | 9.0 | 5310.068627 | 12.924 | 5310.068768 | 12.951 | 5310.068746 | 12.947 | 5310.068619 | 12.923 |
| -20 | 9.0 | 5310.068258 | 12.855 | 5310.068329 | 12.868 | 5310.068170 | 12.838 | 5310.068380 | 12.878 |
| -30 | 9.0 | 5310.067074 | 12.632 | 5310.066992 | 12.616 | 5310.066941 | 12.607 | 5310.066871 | 12.593 |

| FREQUEMCY STABILITY VERSUS VOLTAGE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OPERATING FREQUENCY: 5310MHz | | | | | | | | | |
| TEMP. (℃) | 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 | 8.5 | 5310.071621 | 13.488 | 5310.071859 | 13.533 | 5310.072019 | 13.563 | 5310.072193 | 13.596 |
| | 9.0 | 5310.072264 | 13.609 | 5310.072733 | 13.697 | 5310.072432 | 13.641 | 5310.072935 | 13.735 |
| | 9.5 | 5310.073400 | 13.823 | 5310.073202 | 13.786 | 5310.073151 | 13.776 | 5310.072787 | 13.708 |

# 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**:
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**Web Site:** www.bureauveritas-adt.com


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

# 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---**