# FCC TEST REPORT (15.407)

| | |
|---|---|
| **REPORT NO.:** | RF130702E05-1 |
| **MODEL NO.:** | E2500 |
| **FCC ID:** | Q87-E2500V2 |
| **RECEIVED:** | Oct. 26, 2012 |
| **TESTED:** | Oct. 26, 2012 and July 10 to 17, 2013 |
| **ISSUED:** | Aug. 09, 2013 |

| | |
|---|---|
| **APPLICANT:** | Linksys LLC |
| **ADDRESS:** | 131 Theory Drive, Irvine, CA 92617, USA |

| | |
|---|---|
| **ISSUED BY:** | Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory |
| **LAB ADDRESS :** | No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C. |
| **TEST LOCATION (1):** | No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C. |
| **TEST LOCATION (2):** | No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, 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.

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# RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|---|---|---|
| RF130702E05-1 | Original release | Aug. 09, 2013 |

# 1. CERTIFICATION

| | |
|---|---|
| **PRODUCT:** | Linksys E2500 Dual-Band Wireless-N Router |
| **BRAND NAME:** | Linksys |
| **MODEL NO.:** | E2500 |
| **VERSION:** | 3 |
| **TEST SAMPLE:** | ENGINEERING SAMPLE |
| **APPLICANT:** | Linksys LLC |
| **TESTED:** | Oct. 26, 2012 and July 10 to 17, 2013 |
| **STANDARDS:** | **FCC Part 15, Subpart E (Section 15.407)**<br>ANSI C63.10-2009 |

The above equipment (Model: E2500) 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** : _____, **DATE:** *Aug. 09, 2013*
( Lori Chung, Specialist )

**APPROVED BY** : _____, **DATE:** *Aug. 09, 2013*
( May Chen, Manager )

## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

For 5GHz, 5180~5240MHz

| 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 -2.06dB at 0.52500MHz |
| 15.407(b/1/2/3)(b)(6) | Spurious Emissions | PASS | Meet the requirement of limit. Minimum passing margin is -1.0dB at 5150.00MHz |
| 15.407(a/1/2) | 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. |

**NOTE:** The EUT was operating in 2.400 ~ 2.4835GHz, 5.15~5.25GHz and 5.725~5.850GHz frequencies band. This report was recorded the RF parameters including 5.15~5.25GHz. For the 2.400 ~ 2.4835GHz and 5.725~5.850GHz RF parameters was recorded in another test report.

## 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:

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

| Measurement | Value |
|---|---|
| Conducted emissions | 2.98 dB |
| Radiated emissions (30MHz-1GHz) | 5.63 dB |
| Radiated emissions (1GHz -6GHz) | 3.84 dB |
| Radiated emissions (6GHz -18GHz) | 4.09 dB |
| Radiated emissions (18GHz -40GHz) | 4.24 dB |

# 3. GENERAL INFORMATION

## 3.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| **PRODUCT** | Linksys E2500 Dual-Band Wireless-N Router |
| **MODEL NO.** | E2500 |
| **POWER SUPPLY** | DC 12V from power adapter |
| **MODULATION TYPE** | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM |
| **MODULATION TECHNOLOGY** | DSSS, OFDM |
| **TRANSFER RATE** | 802.11b: up to 11Mbps<br>802.11g/a: up to 54Mbps<br>802.11n: up to 270Mbps |
| **OPERATING FREQUENCY** | **For 15.407**<br>5.18 ~ 5.24GHz |
| | **For 15.247**<br>2.4GHz: 2.412 ~ 2.462GHz<br>5GHz: 5.745 ~ 5.825GHz |
| **NUMBER OF CHANNEL** | **For 15.407**<br>4 for 802.11a, 802.11n (HT20)<br>2 for 802.11n (HT40) |
| | **For 15.247 (2.4GHz)**<br>11 for 802.11b, 802.11g, 802.11n (HT20)<br>7 for 802.11n (HT40)<br>**For 15.247 (5GHz)**<br>5 for 802.11a, 802.11n (HT20)<br>2 for 802.11n (HT40) |
| **MAXIMUM OUTPUT POWER** | **For 15.407**<br>802.11a: 29.854mW<br>802.11n (HT20): 30.161mW<br>802.11n (HT40): 23.164mW<br>**For 15.247 (2.4GHz)**<br>802.11b: 120.781mW<br>802.11g: 348.337mW<br>802.11n (HT20): 570.997mW<br>802.11n (HT40): 440.233mW<br>**For 15.247 (5GHz)**<br>802.11a: 215.774mW<br>802.11n (HT20): 453.458mW<br>802.11n (HT40): 444.228mW |

| | |
|---|---|
| **ANTENNA TYPE** | Please see NOTE |
| **DATA CABLE** | RJ-45 cable (unshielded, 1.8m) |
| **I/O PORTS** | Refer to user's manual |
| **ASSOCIATED DEVICES** | Adapter x 1 |

**NOTE:**

1. There are 2.4GHz and 5GHz WLAN technology used for the EUT.

2. The EUT must be supplied with a power adapter as following table:

| No | Brand | Model No. | Plug | Spec. |
|---|---|---|---|---|
| 1 | DVE | DSA-12G-12 FUS | US | Input: 100-240V, 0.5A, 50/60Hz<br>Output: 12V, 1A<br>DC power cable: 1.5m, unshielded |
| 2 | HK | HK-AO-120A100-US | US | |
| 3 | HK | HK-AF-120A100-CP | Universal | Input: 100-240V, 0.35A, 50/60Hz<br>Output: 12V, 1A<br>DC power cable: 1.5m, unshielded |
| For radiated emissions test, the EUT was pre-tested with above adapters 1~3, the worst case was found in adapter 3. Therefore only the test data of the adapter was recorded in this report. | | | | |

3. The antennas provided to the EUT, please refer to the following table:

| 2.4GHz | | | |
|---|---|---|---|
| Transmitter Circuit | Antenna Type | Antenna Gain (dBi) | Connector |
| Chain (0) | PIFA | 2.5 | NA |
| Chain (1) | PIFA | 4 | NA |
| 5GHz | | | |
| Transmitter Circuit | Antenna Type | Antenna Gain (dBi) | Connector |
| Chain (0) | PIFA | 4 | NA |
| Chain (1) | PIFA | 5 | NA |

4. The EUT incorporates a MIMO function without beam forming.

| MODULATION MODE | TX/RX FUNCTION |
|---|---|
| **802.11a** | 1TX/2RX(diversity) |
| **802.11b** | 1TX/2RX(diversity) |
| **802.11g** | 1TX/2RX(diversity) |
| **802.11n (HT20)** | 2TX/2RX |
| **802.11n (HT40)** | 2TX/2RX |

5. Spurious emission of the simultaneous operation (2.4GHz & 5GHz) has been evaluated and no non-compliance was found.

6. When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 15.

7. The above EUT information was 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

**Operated in 5180 ~ 5240MHz band:**

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

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

2 channels are provided for 802.11n (HT40):

| CHANNEL | FREQUENCY |
|---|---|
| 38 | 5190 MHz |
| 46 | 5230 MHz |

## 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

| EUT CONFIGURE MODE | APPLICABLE TO | | | | DESCRIPTION |
|---|---|---|---|---|---|
| | PLC | RE < 1G | RE ≥ 1G | APCM | |
| 1 | √ | - | - | - | Adapter 1 |
| 2 | √ | - | - | - | Adapter 2 |
| 3 | √ | √ | √ | √ | Adapter 3 |

Where **PLC:** Power Line Conducted Emission **RE < 1G:** Radiated Emission below 1GHz

**RE ≥ 1G:** Radiated Emission above 1GHz **APCM:** Antenna Port Conducted Measurement

**NOTE:** "-"means no effect.

**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.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (MBPS) |
|---|---|---|---|---|---|
| 802.11n (HT20) | 36 to 48 | 48 | OFDM | BPSK | 6.5 |

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

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

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

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|
| 802.11n (HT20) | 36 to 48 | 48 | OFDM | BPSK | 6.5 |

## RADIATED EMISSION TEST (ABOVE 1 GHz):

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

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

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|
| 802.11a | 36 to 48 | 36, 40, 48 | OFDM | BPSK | 6 |
| 802.11n (HT20) | 36 to 48 | 36, 40, 48 | OFDM | BPSK | 6.5 |
| 802.11n (HT40) | 36 to 48 | 38, 46 | OFDM | BPSK | 13.5 |

## ANTENNA PORT CONDUCTED 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 | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|
| 802.11a | 36 to 48 | 36, 40, 48 | OFDM | BPSK | 6 |
| 802.11n (HT20) | 36 to 48 | 36, 40, 48 | OFDM | BPSK | 6.5 |
| 802.11n (HT40) | 36 to 48 | 38, 46 | OFDM | BPSK | 13.5 |

## TEST CONDITION:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---|---|---|---|
| PLC | 26deg. C, 66%RH | 120Vac, 60Hz | Jyunchun Lin |
| RE<1G | 23deg. C, 75%RH | 120Vac, 60Hz | Chilin Lee |
| RE≥1G | 22deg. C, 68%RH | 120Vac, 60Hz | Rank Liu |
| APCM | 25deg. C, 60%RH | 120Vac, 60Hz | Robert Cheng |

## 3.3 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 r03**

**662911 D01 Multiple Transmitter Output v01 r02**

**ANSI C63.10-2009**

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

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

## 3.4 DUTY CYCLE OF TEST SIGNAL

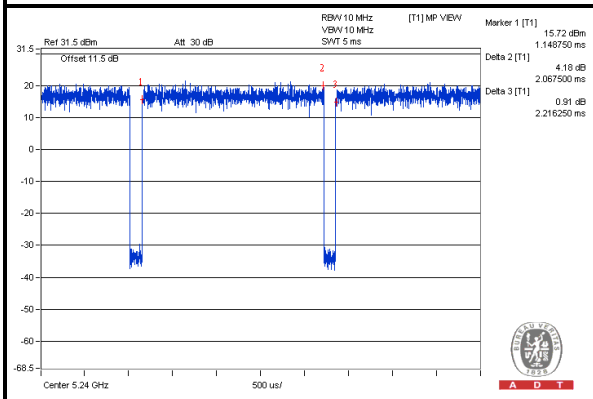
Duty cycle of test signal is < 98%, duty factor shall be considered.

**802.11a**: Duty cycle = 2.067ms/2.216ms = 0.933, Duty factor = 10 * log( 1/0.933) = 0.30

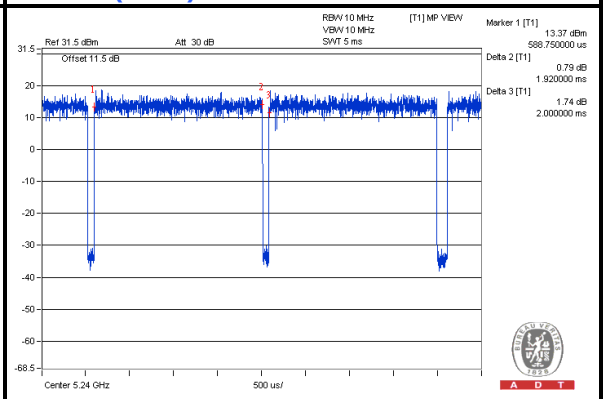
**802.11n (HT20):** Duty cycle = 1.92ms/2ms = 0.960, Duty factor = 10 * log( 1/0.960) = 0.18

**802.11n (HT40):** Duty cycle = 0.934ms/1.079ms = 0.866, Duty factor = 10 * log( 1/0.866) = 0.63

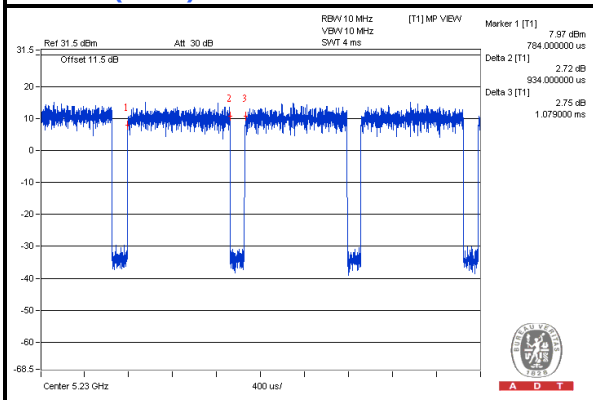
**802.11a**




**802.11n (HT20)**




**802.11n (HT40)**



## 3.5 DESCRIPTION OF SUPPORT UNITS

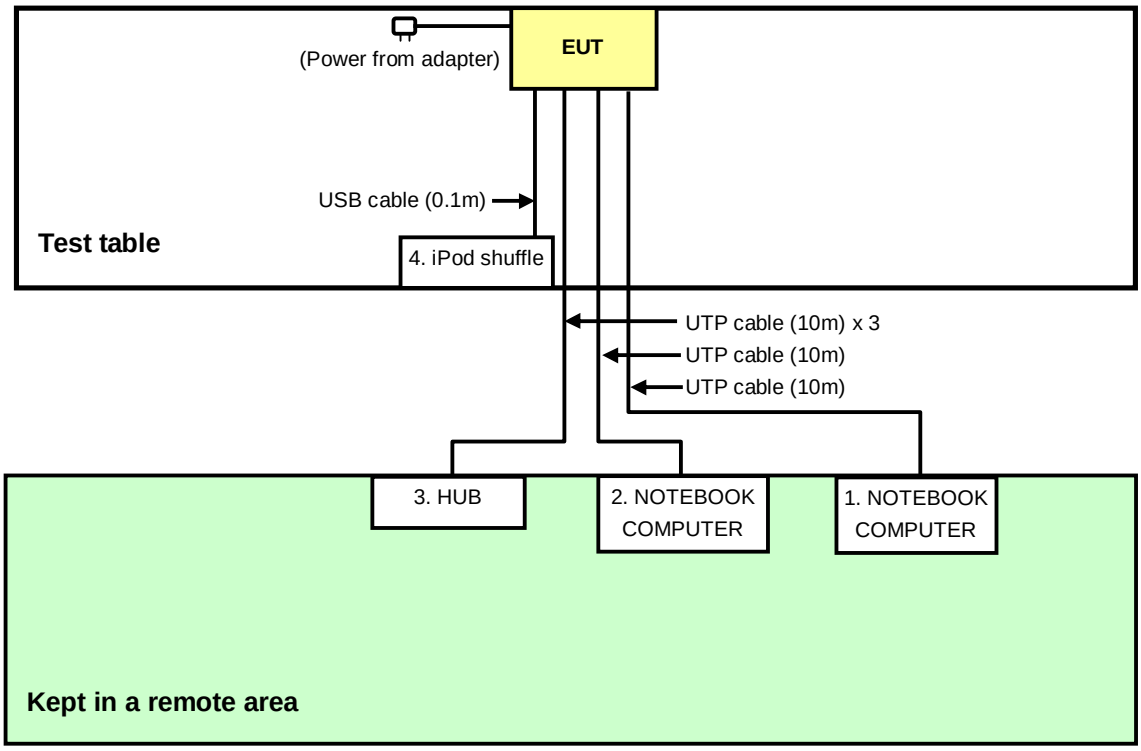
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|---|---|---|---|---|---|
| 1 | NOTEBOOK COMPUTER | DELL | PP32LA | FSLB32S | FCC DoC |
| 2 | NOTEBOOK COMPUTER | DELL | PP32LA | GSLB32S | FCC DoC |
| 3 | HUB | ZyXEL | ES-116P | S060H02000215 | FCC DoC |
| 4 | iPod shuffle | Apple | MC749TA/A | CC4DMFJUDFDM | NA |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|---|---|
| 1 | UTP cable, 10m |
| 2 | UTP cable, 10m |
| 3 | UTP cable, 10m |
| 4 | USB cable, 0.1m |

**NOTE:** All power cords of the above support units are non shielded (1.8m).

## 3.6 CONFIGURATION OF SYSTEM UNDER TEST



# 4. TEST TYPES AND RESULTS

## 4.1 CONDUCTED EMISSION MEASUREMENT

### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5<br>0.5-5<br>5-30 | 66 to 56<br>56<br>60 | 56 to 46<br>46<br>50 |

**NOTE**: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 4.1.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver<br>ROHDE & SCHWARZ | ESCS 30 | 100375 | Mar. 08, 2013 | Mar. 07, 2014 |
| Line-Impedance Stabilization Network (for EUT)<br>SCHWARZBECK | NSLK8127 | 8127-522 | Sep. 06, 2012 | Sep. 05, 2013 |
| Line-Impedance Stabilization Network (for Peripheral) | ENV216 | 100072 | June 07, 2013 | June 06, 2014 |
| RF Cable (JYEBAO) | 5DFB | COCCAB-001 | Mar. 11, 2013 | Mar. 10, 2014 |
| 50 ohms Terminator | 50 | EMC-3 | Sep. 25, 2012 | Sep. 24, 2013 |
| Software<br>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 Shielded Room No. C.
3 The VCCI Con C Registration No. is C-3611.
4 Tested Date: July 11, 2013

### 4.1.3 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.

b. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

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

d. The frequency range from 150kHz to 30MHz was searched. Emission level under (Limit – 20dB) was not recorded.

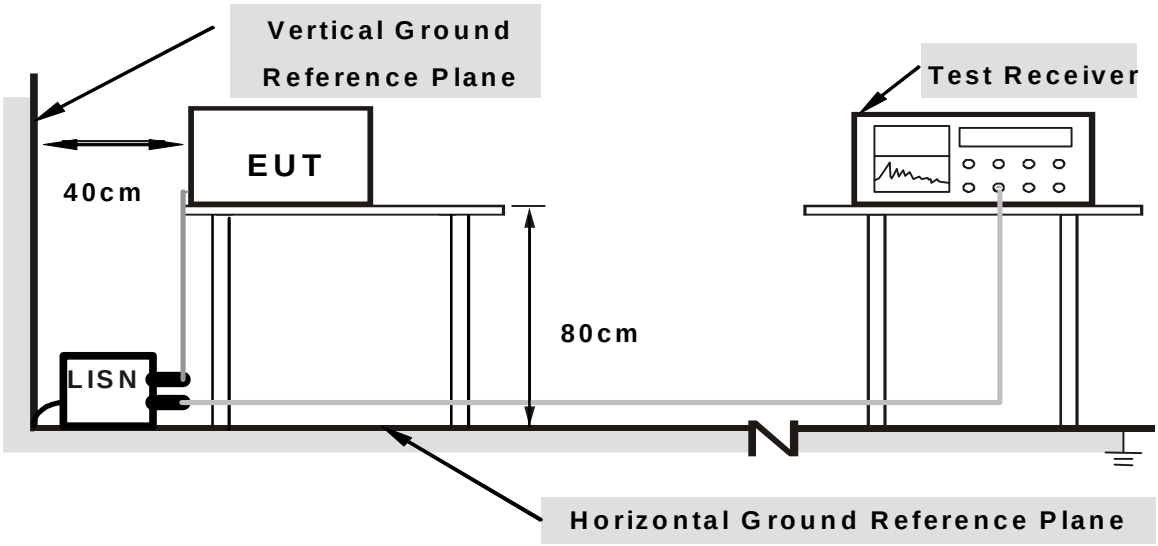
**NOTE:**

1. The resolution bandwidth of test receiver is 9kHz for Quasi-peak detection (QP) & Average detection (AV).

### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP




**Note: 1.Support units were connected to second LISN.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.1.6 EUT OPERATING CONDITIONS

1. Turn on the power of EUT.
2. The communication partner run test program “telnet WI Comman” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

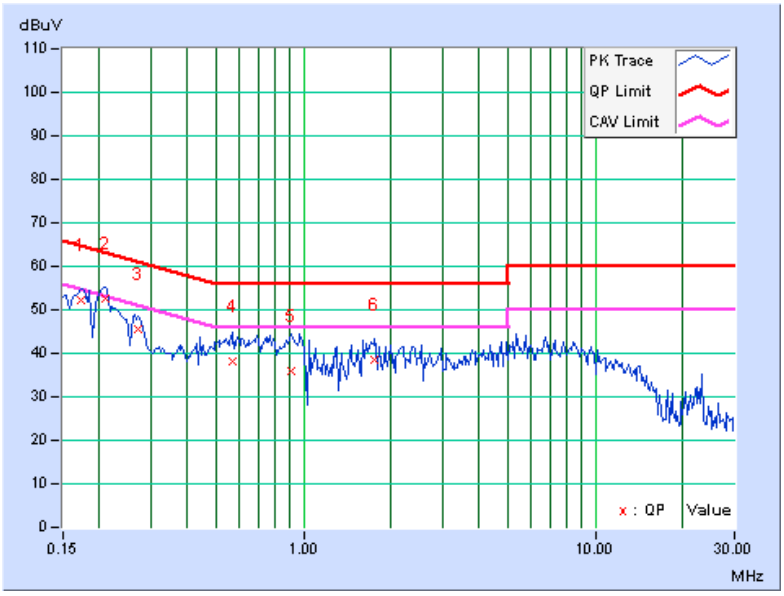
## 4.1.7 TEST RESULTS (MODE 1)

| PHASE | Line (L) | DETECTOR FUNCTION & BANDWIDTH | Quasi-Peak (QP) / Average (AV), 9kHz |
|---|---|---|---|

| | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.17344 | 0.14 | 52.26 | 47.76 | 52.40 | 47.90 | 64.79 | 54.79 | -12.39 | -6.89 |
| 2 | 0.20859 | 0.15 | 52.42 | 48.63 | 52.57 | 48.78 | 63.26 | 53.26 | -10.69 | -4.48 |
| 3 | 0.27241 | 0.17 | 45.55 | 37.56 | 45.72 | 37.73 | 61.04 | 51.04 | -15.33 | -13.32 |
| 4 | 0.57188 | 0.21 | 38.09 | 22.59 | 38.30 | 22.80 | 56.00 | 46.00 | -17.70 | -23.20 |
| 5 | 0.90391 | 0.24 | 35.67 | 26.35 | 35.91 | 26.59 | 56.00 | 46.00 | -20.09 | -19.41 |
| 6 | 1.74219 | 0.32 | 38.04 | 28.28 | 38.36 | 28.60 | 56.00 | 46.00 | -17.64 | -17.40 |

**REMARKS:**

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

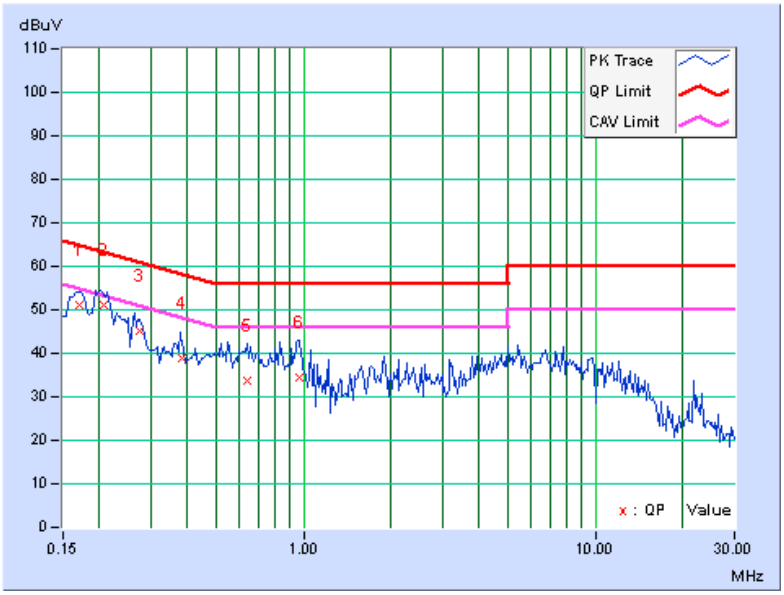


| PHASE | Neutral (N) | DETECTOR FUNCTION & BANDWIDTH | Quasi-Peak (QP) / Average (AV), 9kHz |
|---|---|---|---|

| | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.16953 | 0.12 | 50.98 | 41.87 | 51.10 | 41.99 | 64.98 | 54.98 | -13.89 | -13.00 |
| 2 | 0.20703 | 0.13 | 51.02 | 46.23 | 51.15 | 46.36 | 63.32 | 53.32 | -12.17 | -6.96 |
| 3 | 0.27378 | 0.15 | 45.11 | 35.69 | 45.26 | 35.84 | 61.00 | 51.00 | -15.74 | -15.16 |
| 4 | 0.38231 | 0.18 | 38.87 | 31.14 | 39.05 | 31.32 | 58.23 | 48.23 | -19.17 | -16.90 |
| 5 | 0.63828 | 0.20 | 33.58 | 20.94 | 33.78 | 21.14 | 56.00 | 46.00 | -22.22 | -24.86 |
| 6 | 0.97031 | 0.22 | 34.38 | 25.29 | 34.60 | 25.51 | 56.00 | 46.00 | -21.40 | -20.49 |

**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



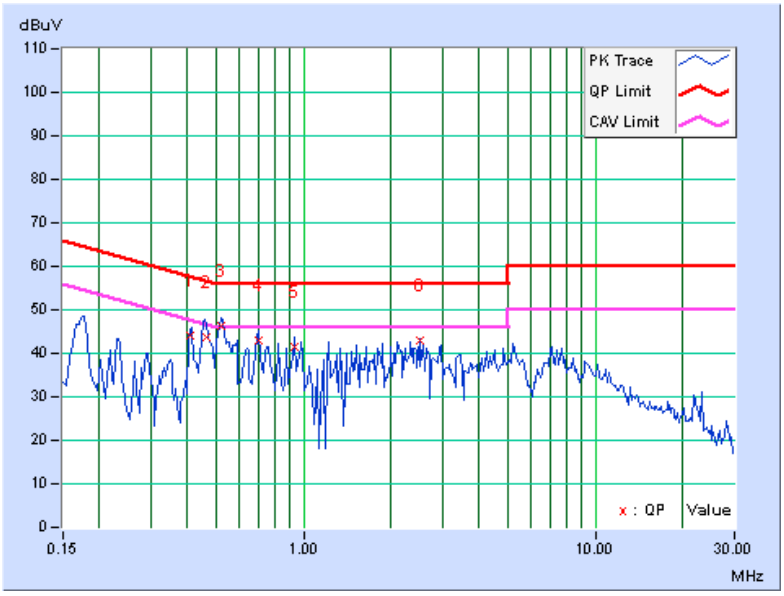
## 4.1.8 TEST RESULTS (MODE 2)

| PHASE | Line (L) | DETECTOR FUNCTION & BANDWIDTH | Quasi-Peak (QP) / Average (AV), 9kHz |
|---|---|---|---|

| | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.41047 | 0.20 | 43.97 | 41.63 | 44.17 | 41.83 | 57.64 | 47.64 | -13.47 | -5.81 |
| 2 | 0.46641 | 0.21 | 43.59 | 40.77 | 43.80 | 40.98 | 56.58 | 46.58 | -12.78 | -5.60 |
| 3 | 0.52500 | 0.21 | 45.98 | 43.72 | 46.19 | 43.93 | 56.00 | 46.00 | -9.81 | -2.07 |
| 4 | 0.70078 | 0.23 | 42.78 | 40.48 | 43.01 | 40.71 | 56.00 | 46.00 | -12.99 | -5.29 |
| 5 | 0.93450 | 0.24 | 41.23 | 38.63 | 41.47 | 38.87 | 56.00 | 46.00 | -14.53 | -7.13 |
| 6 | 2.51344 | 0.37 | 42.43 | 35.51 | 42.80 | 35.88 | 56.00 | 46.00 | -13.20 | -10.12 |

**REMARKS:**

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

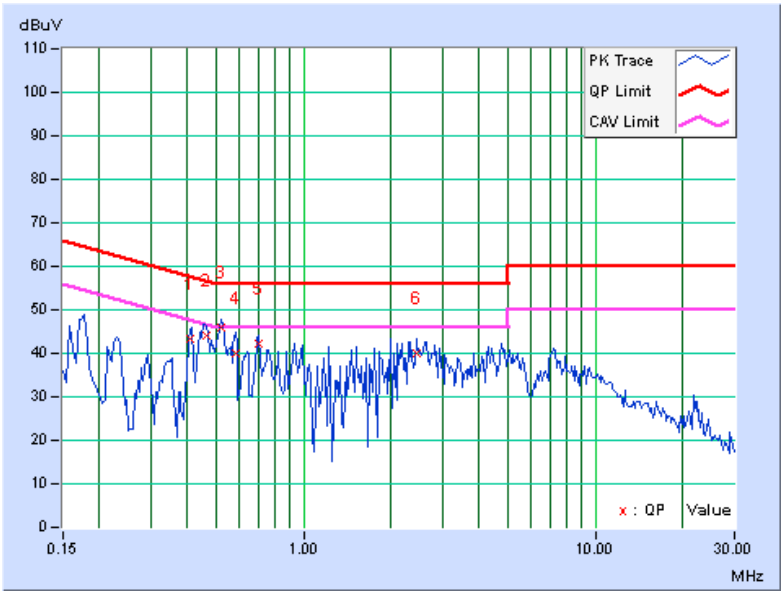


| PHASE | Neutral (N) | DETECTOR FUNCTION & BANDWIDTH | Quasi-Peak (QP) / Average (AV), 9kHz |
|---|---|---|---|

| | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.40781 | 0.19 | 43.15 | 41.29 | 43.34 | 41.48 | 57.69 | 47.69 | -14.35 | -6.21 |
| 2 | 0.46497 | 0.19 | 43.96 | 40.62 | 44.15 | 40.81 | 56.60 | 46.60 | -12.45 | -5.79 |
| **3** | **0.52500** | **0.20** | **45.78** | **43.74** | **45.98** | **43.94** | **56.00** | **46.00** | **-10.02** | **-2.06** |
| 4 | 0.58359 | 0.20 | 39.94 | 36.98 | 40.14 | 37.18 | 56.00 | 46.00 | -15.86 | -8.82 |
| 5 | 0.70078 | 0.21 | 42.05 | 39.51 | 42.26 | 39.72 | 56.00 | 46.00 | -13.74 | -6.28 |
| 6 | 2.45313 | 0.33 | 39.73 | 31.64 | 40.06 | 31.97 | 56.00 | 46.00 | -15.94 | -14.03 |

**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



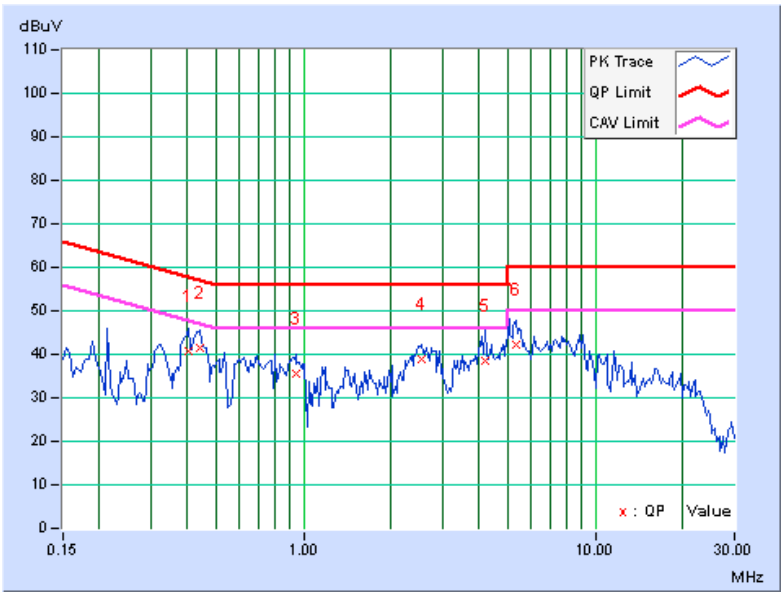
## 4.1.9 TEST RESULTS (MODE 3)

| PHASE | Line (L) | DETECTOR FUNCTION & BANDWIDTH | Quasi-Peak (QP) / Average (AV), 9kHz |
|---|---|---|---|

| | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.40391 | 0.20 | 40.67 | 34.53 | 40.87 | 34.73 | 57.77 | 47.77 | -16.90 | -13.04 |
| 2 | 0.44297 | 0.20 | 41.44 | 33.78 | 41.64 | 33.98 | 57.01 | 47.01 | -15.36 | -13.02 |
| 3 | 0.94297 | 0.25 | 35.21 | 26.16 | 35.46 | 26.41 | 56.00 | 46.00 | -20.54 | -19.59 |
| 4 | 2.53516 | 0.37 | 38.35 | 31.67 | 38.72 | 32.04 | 56.00 | 46.00 | -17.28 | -13.96 |
| 5 | 4.19922 | 0.48 | 38.00 | 30.76 | 38.48 | 31.24 | 56.00 | 46.00 | -17.52 | -14.76 |
| 6 | 5.35938 | 0.57 | 41.76 | 34.88 | 42.33 | 35.45 | 60.00 | 50.00 | -17.67 | -14.55 |

**REMARKS:**

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

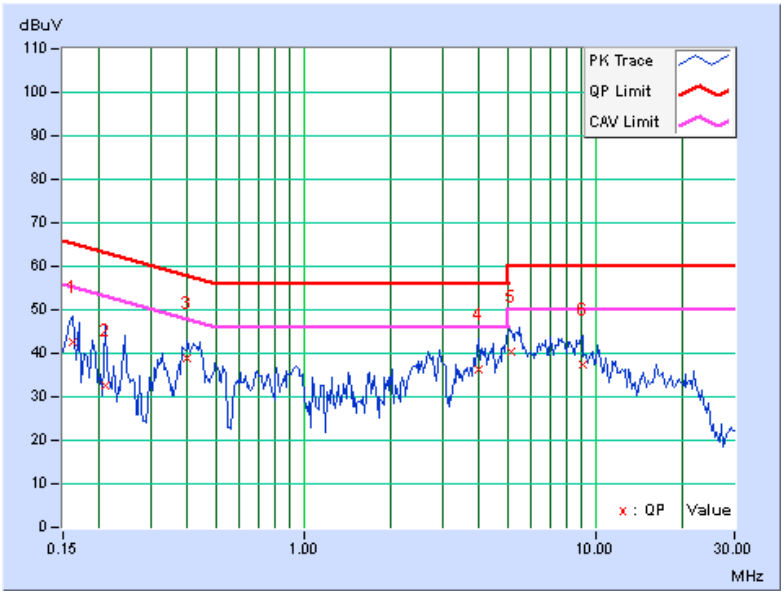


| PHASE | Neutral (N) | DETECTOR FUNCTION & BANDWIDTH | Quasi-Peak (QP) / Average (AV), 9kHz |
|---|---|---|---|

| | Freq. | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.16172 | 0.11 | 42.31 | 20.57 | 42.42 | 20.68 | 65.38 | 55.38 | -22.95 | -34.69 |
| 2 | 0.20859 | 0.13 | 32.62 | 19.04 | 32.75 | 19.17 | 63.26 | 53.26 | -30.51 | -34.09 |
| 3 | 0.40000 | 0.19 | 38.77 | 32.04 | 38.96 | 32.23 | 57.85 | 47.85 | -18.89 | -15.62 |
| 4 | 3.96484 | 0.43 | 35.70 | 28.45 | 36.13 | 28.88 | 56.00 | 46.00 | -19.87 | -17.12 |
| 5 | 5.12891 | 0.49 | 39.83 | 32.49 | 40.32 | 32.98 | 60.00 | 50.00 | -19.68 | -17.02 |
| 6 | 9.07422 | 0.69 | 36.90 | 30.51 | 37.59 | 31.20 | 60.00 | 50.00 | -22.41 | -18.80 |

**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



## 4.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT

### 4.2.1 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.

## 4.2.2 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:**

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

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

## 4.2.3 TEST INSTRUMENTS

**For below 1GHz test:**

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer Agilent | E4446A | MY48250253 | Sep. 03, 2012 | Sep. 02, 2013 |
| MXE EMI Receiver Agilent | N9038A | MY51210105 | Jan. 29, 2013 | Jan. 28, 2014 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2 B | AMP-ZFL-03 | Nov. 14, 2012 | Nov. 13, 2013 |
| Pre-Amplifier Agilent | 8449B | 3008A02578 | June 25, 2013 | June 24, 2014 |
| Pre-Amplifier SPACEK LABS | SLKKa-48-6 | 9K16 | Nov. 14, 2012 | Nov. 13, 2013 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-360 | Mar. 19, 2013 | Mar. 18, 2014 |
| Horn_Antenna AISI | AIH.8018 | 0000320091110 | Nov. 19, 2012 | Nov. 18, 2013 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | 9170-424 | Oct. 12, 2012 | Oct. 11, 2013 |
| RF Cable | NA | RF104-201 RF104-203 RF104-204 | Dec. 25, 2012 | Dec. 24, 2013 |
| RF Cable | NA | CHGCAB_001 | Oct. 06, 2012 | Oct. 05, 2013 |
| Software | ADT_Radiated _V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | 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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3 The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
5 The VCCI Site Registration No. is G-137.
6 The CANADA Site Registration No. is IC 7450H-2.
7 Tested Date: July 10, 2013

**For above 1GHz test:**

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer Agilent | E4446A | MY48250253 | Sep. 03, 2012 | Sep. 02, 2013 |
| Pre-Selector Agilent | N9039A | MY46520310 | Sep. 03, 2012 | Sep. 02, 2013 |
| Signal Generator Agilent | N5181A | MY49060347 | July 24, 2012 | July 23, 2013 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-04 | Nov. 15, 2011 | Nov. 14, 2012 |
| Pre-Amplifier Agilent | 8449B | 3008A02465 | Feb. 27, 2012 | Feb. 26, 2013 |
| SPACEK LABS | SLKKa-48-6 | 9K16 | Nov. 15, 2011 | Nov. 14, 2012 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-361 | Apr. 06, 2012 | Apr. 05, 2013 |
| Horn_Antenna AISI | AIH.8018 | 0000220091110 | Nov. 23, 2011 | Nov. 22, 2012 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | 9170-424 | Oct. 12, 2012 | Oct. 11, 2013 |
| RF Cable | NA | RF104-205<br>RF104-207<br>RF104-202 | Dec. 27, 2011 | Dec. 26, 2012 |
| RF Cable | NA | CHHCAB_001 | Oct. 07, 2012 | Oct. 06, 2013 |
| Software | ADT_Radiated_V8.7.05 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | 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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3 The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
5 The CANADA Site Registration No. is IC 7450H-3.
6 Tested Date: Oct. 26, 2012

### 4.2.4 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters 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 height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

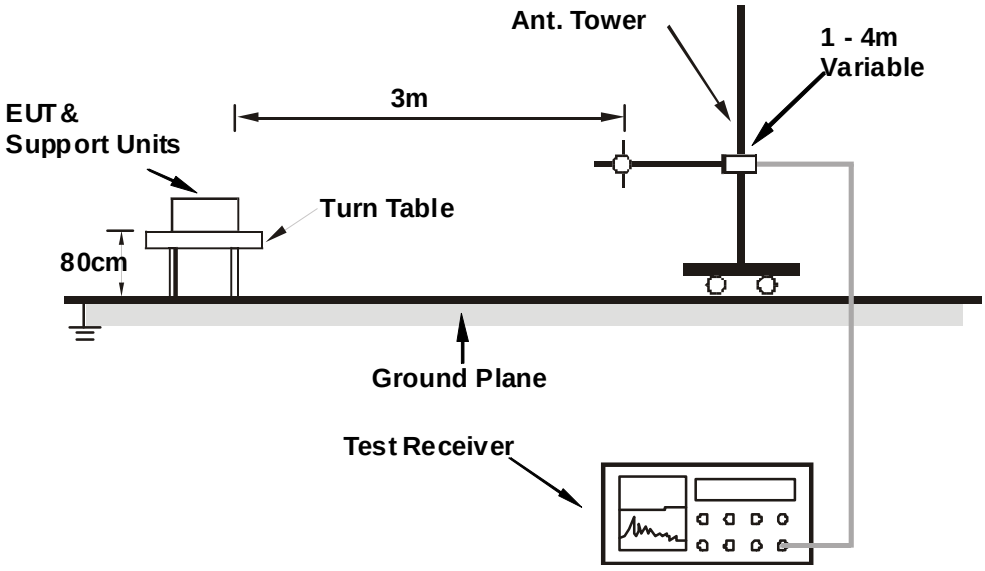
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

### 4.2.5 DEVIATION FROM TEST STANDARD

No deviation

## 4.2.6 TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

## 4.2.7 EUT OPERATING CONDITION

Same as 4.1.6

## 4.2.8 TEST RESULTS

**BELOW 1GHz WORST-CASE DATA**

**802.11n (HT20)**

| | | | |
|---|---|---|---|
| **CHANNEL** | TX Channel 48 | **DETECTOR FUNCTION** | Quasi-Peak (QP) |
| **FREQUENCY RANGE** | Below 1GHz | | |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **NO.** | **FREQ. (MHz)** | **EMISSION LEVEL (dBuV/m)** | **LIMIT (dBuV/m)** | **MARGIN (dB)** | **ANTENNA HEIGHT (m)** | **TABLE ANGLE (Degree)** | **RAW VALUE (dBuV)** | **CORRECTION FACTOR (dB/m)** |
| 1 | 110.00 | 27.4 QP | 43.5 | -16.1 | 1.30 H | 260 | 43.50 | -16.09 |
| 2 | 251.00 | 36.9 QP | 46.0 | -9.1 | 1.00 H | 350 | 51.33 | -14.45 |
| 3 | 500.00 | 43.2 QP | 46.0 | -2.8 | 2.00 H | 103 | 50.92 | -7.76 |
| 4 | 600.02 | 36.3 QP | 46.0 | -9.8 | 1.50 H | 238 | 41.72 | -5.47 |
| 5 | 746.00 | 32.9 QP | 46.0 | -13.1 | 1.00 H | 338 | 35.53 | -2.66 |
| 6 | 948.00 | 30.0 QP | 46.0 | -16.0 | 1.50 H | 314 | 29.52 | 0.52 |
| **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 | 99.00 | 30.8 QP | 43.5 | -12.7 | 1.50 V | 320 | 49.30 | -18.46 |
| 2 | 249.00 | 36.2 QP | 46.0 | -9.8 | 1.80 V | 293 | 50.72 | -14.49 |
| 3 | 448.00 | 36.5 QP | 46.0 | -9.5 | 1.00 V | 13 | 45.27 | -8.80 |
| 4 | 628.00 | 38.0 QP | 46.0 | -8.0 | 1.20 V | 61 | 42.76 | -4.78 |
| 5 | 749.20 | 31.6 QP | 46.0 | -14.4 | 1.00 V | 285 | 34.10 | -2.52 |
| 6 | 946.55 | 30.5 QP | 46.0 | -15.5 | 1.10 V | 297 | 29.96 | 0.55 |

**REMARKS:**

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

## ABOVE 1GHz DATA

### 802.11a

| | | | |
|---|---|---|---|
| **CHANNEL** | TX Channel 36 | **DETECTOR FUNCTION** | Peak (PK) |
| **FREQUENCY RANGE** | 1GHz ~ 40GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **NO.** | **FREQ. (MHz)** | **EMISSION LEVEL (dBuV/m)** | **LIMIT (dBuV/m)** | **MARGIN (dB)** | **ANTENNA HEIGHT (m)** | **TABLE ANGLE (Degree)** | **RAW VALUE (dBuV)** | **CORRECTION FACTOR (dB/m)** |
| 1 | 5150.00 | 69.2 PK | 74.0 | -4.8 | 1.00 H | 118 | 26.90 | 42.30 |
| 2 | 5150.00 | 52.1 AV | 54.0 | -1.9 | 1.00 H | 118 | 9.80 | 42.30 |
| 3 | *5180.00 | 101.9 PK | | | 1.00 H | 322 | 59.50 | 42.40 |
| 4 | *5180.00 | 92.9 AV | | | 1.00 H | 322 | 50.50 | 42.40 |
| 5 | #10360.00 | 60.1 PK | 68.3 | -8.2 | 1.48 H | 248 | 10.89 | 49.21 |
| 6 | 15540.00 | 62.0 PK | 74.0 | -12.0 | 1.00 H | 303 | 6.90 | 55.10 |
| 7 | 15540.00 | 51.2 AV | 54.0 | -2.8 | 1.00 H | 303 | -3.90 | 55.10 |
| **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 | 5150.00 | 71.1 PK | 74.0 | -2.9 | 1.00 V | 17 | 28.80 | 42.30 |
| 2 | 5150.00 | 52.9 AV | 54.0 | -1.1 | 1.00 V | 17 | 10.60 | 42.30 |
| 3 | *5180.00 | 106.6 PK | | | 1.10 V | 322 | 64.20 | 42.40 |
| 4 | *5180.00 | 98.1 AV | | | 1.10 V | 322 | 55.70 | 42.40 |
| 5 | #10360.00 | 61.7 PK | 68.3 | -6.6 | 1.07 V | 32 | 12.49 | 49.21 |
| 6 | 15540.00 | 63.2 PK | 74.0 | -10.8 | 1.20 V | 35 | 8.10 | 55.10 |
| 7 | 15540.00 | 52.4 AV | 54.0 | -1.6 | 1.20 V | 35 | -2.70 | 55.10 |

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

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

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *5200.00 | 102.4 PK | | | 1.14 H | 282 | 59.93 | 42.47 |
| 2 | *5200.00 | 93.1 AV | | | 1.14 H | 282 | 50.63 | 42.47 |
| 3 | #10400.00 | 60.2 PK | 68.3 | -8.1 | 1.51 H | 234 | 11.37 | 48.83 |
| 4 | 15600.00 | 61.6 PK | 74.0 | -12.4 | 1.00 H | 312 | 6.63 | 54.97 |
| 5 | 15600.00 | 51.1 AV | 54.0 | -2.9 | 1.00 H | 312 | -3.87 | 54.97 |
| 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 | 107.2 PK | | | 1.23 V | 274 | 64.73 | 42.47 |
| 2 | *5200.00 | 98.3 AV | | | 1.23 V | 274 | 55.86 | 42.47 |
| 3 | #10400.00 | 62.0 PK | 68.3 | -6.3 | 1.11 V | 32 | 13.17 | 48.83 |
| 4 | 15600.00 | 62.7 PK | 74.0 | -11.3 | 1.19 V | 32 | 7.73 | 54.97 |
| 5 | 15600.00 | 52.1 AV | 54.0 | -1.9 | 1.19 V | 32 | -2.87 | 54.97 |

**REMARKS:**

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

| CHANNEL | TX Channel 48 | DETECTOR FUNCTION | Peak (PK) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *5240.00 | 102.6 PK | | | 1.12 H | 265 | 60.09 | 42.51 |
| 2 | *5240.00 | 93.2 AV | | | 1.12 H | 265 | 50.69 | 42.51 |
| 3 | #10480.00 | 59.9 PK | 68.3 | -8.4 | 1.50 H | 227 | 10.51 | 49.39 |
| 4 | 15720.00 | 61.3 PK | 74.0 | -12.7 | 1.00 H | 321 | 6.60 | 54.70 |
| 5 | 15720.00 | 50.9 AV | 54.0 | -3.1 | 1.00 H | 321 | -3.80 | 54.70 |
| 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 | *5240.00 | 108.1 PK | | | 1.21 V | 265 | 65.59 | 42.51 |
| 2 | *5240.00 | 99.1 AV | | | 1.21 V | 265 | 56.59 | 42.51 |
| 3 | #10480.00 | 64.7 PK | 68.3 | -3.6 | 1.17 V | 15 | 15.31 | 49.39 |
| 4 | 15720.00 | 63.1 PK | 74.0 | -10.9 | 1.03 V | 249 | 8.40 | 54.70 |
| 5 | 15720.00 | 51.5 AV | 54.0 | -2.5 | 1.03 V | 249 | -3.20 | 54.70 |

**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.

## 802.11n (HT20)

| | | | |
|---|---|---|---|
| **CHANNEL** | TX Channel 36 | **DETECTOR FUNCTION** | Peak (PK) |
| **FREQUENCY RANGE** | 1GHz ~ 40GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **NO.** | **FREQ. (MHz)** | **EMISSION LEVEL (dBuV/m)** | **LIMIT (dBuV/m)** | **MARGIN (dB)** | **ANTENNA HEIGHT (m)** | **TABLE ANGLE (Degree)** | **RAW VALUE (dBuV)** | **CORRECTION FACTOR (dB/m)** |
| 1 | 5150.00 | 68.5 PK | 74.0 | -5.5 | 1.00 H | 342 | 26.20 | 42.30 |
| 2 | 5150.00 | 51.2 AV | 54.0 | -2.8 | 1.00 H | 342 | 8.90 | 42.30 |
| 3 | *5180.00 | 102.9 PK | | | 1.00 H | 359 | 60.50 | 42.40 |
| 4 | *5180.00 | 96.3 AV | | | 1.00 H | 359 | 53.90 | 42.40 |
| 5 | #10360.00 | 59.5 PK | 68.3 | -8.8 | 1.52 H | 211 | 10.29 | 49.21 |
| 6 | 15540.00 | 61.2 PK | 74.0 | -12.8 | 1.05 H | 323 | 6.10 | 55.10 |
| 7 | 15540.00 | 50.5 AV | 54.0 | -3.5 | 1.05 H | 323 | -4.60 | 55.10 |
| **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 | 5150.00 | 71.8 PK | 74.0 | -2.2 | 1.34 V | 92 | 29.50 | 42.30 |
| 2 | 5150.00 | 52.3 AV | 54.0 | -1.7 | 1.34 V | 92 | 10.00 | 42.30 |
| 3 | *5180.00 | 107.1 PK | | | 1.34 V | 77 | 64.70 | 42.40 |
| 4 | *5180.00 | 98.1 AV | | | 1.34 V | 77 | 55.70 | 42.40 |
| 5 | #10360.00 | 62.0 PK | 68.3 | -6.3 | 1.06 V | 17 | 12.79 | 49.21 |
| 6 | 15540.00 | 62.9 PK | 74.0 | -11.1 | 1.18 V | 42 | 7.80 | 55.10 |
| 7 | 15540.00 | 52.2 AV | 54.0 | -1.8 | 1.18 V | 42 | -2.90 | 55.10 |

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

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

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *5200.00 | 103.2 PK | | | 1.00 H | 360 | 60.73 | 42.47 |
| 2 | *5200.00 | 93.7 AV | | | 1.00 H | 360 | 51.23 | 42.47 |
| 3 | #10400.00 | 59.8 PK | 68.3 | -8.5 | 1.51 H | 199 | 10.97 | 48.83 |
| 4 | 15600.00 | 60.6 PK | 74.0 | -13.4 | 1.00 H | 334 | 5.63 | 54.97 |
| 5 | 15600.00 | 50.1 AV | 54.0 | -3.9 | 1.00 H | 334 | -4.87 | 54.97 |
| 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 | 105.4 PK | | | 1.22 V | 274 | 62.93 | 42.47 |
| 2 | *5200.00 | 96.9 AV | | | 1.22 V | 274 | 54.43 | 42.47 |
| 3 | #10400.00 | 62.5 PK | 68.3 | -5.8 | 1.11 V | 4 | 13.67 | 48.83 |
| 4 | 15600.00 | 63.3 PK | 74.0 | -10.7 | 1.20 V | 42 | 8.33 | 54.97 |
| 5 | 15600.00 | 52.3 AV | 54.0 | -1.7 | 1.20 V | 42 | -2.67 | 54.97 |

**REMARKS:**

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

| CHANNEL | TX Channel 48 | DETECTOR FUNCTION | Peak (PK) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *5240.00 | 102.2 PK | | | 1.01 H | 360 | 59.69 | 42.51 |
| 2 | *5240.00 | 96.1 AV | | | 1.01 H | 360 | 53.59 | 42.51 |
| 3 | #10480.00 | 60.3 PK | 68.3 | -8.0 | 1.46 H | 215 | 10.91 | 49.39 |
| 4 | 15720.00 | 60.4 PK | 74.0 | -13.6 | 1.00 H | 329 | 5.70 | 54.70 |
| 5 | 15720.00 | 49.7 AV | 54.0 | -4.3 | 1.00 H | 329 | -5.00 | 54.70 |
| 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 | *5240.00 | 107.6 PK | | | 1.57 V | 344 | 65.09 | 42.51 |
| 2 | *5240.00 | 98.2 AV | | | 1.57 V | 344 | 55.69 | 42.51 |
| 3 | #10480.00 | 62.7 PK | 68.3 | -5.6 | 1.17 V | 16 | 13.31 | 49.39 |
| 4 | 15720.00 | 63.5 PK | 74.0 | -10.5 | 1.18 V | 35 | 8.80 | 54.70 |
| 5 | 15720.00 | 52.3 AV | 54.0 | -1.7 | 1.18 V | 35 | -2.40 | 54.70 |

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

### 802.11n (HT40)

| CHANNEL | TX Channel 38 | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | 5150.00 | 63.8 PK | 74.0 | -10.2 | 1.08 H | 220 | 21.50 | 42.30 |
| 2 | 5150.00 | 52.0 AV | 54.0 | -2.0 | 1.08 H | 220 | 9.70 | 42.30 |
| 3 | *5190.00 | 97.6 PK | | | 1.03 H | 326 | 55.16 | 42.44 |
| 4 | *5190.00 | 87.2 AV | | | 1.03 H | 326 | 44.76 | 42.44 |
| 5 | #10380.00 | 59.8 PK | 68.3 | -8.5 | 1.42 H | 226 | 10.78 | 49.02 |
| 6 | 15570.00 | 60.9 PK | 74.0 | -13.1 | 1.00 H | 322 | 5.86 | 55.04 |
| 7 | 15570.00 | 49.9 AV | 54.0 | -4.1 | 1.00 H | 322 | -5.14 | 55.04 |
| **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 | 66.7 PK | 74.0 | -7.3 | 1.20 V | 21 | 24.40 | 42.30 |
| **2** | **5150.00** | **53.0 AV** | **54.0** | **-1.0** | **1.20 V** | **21** | **10.70** | **42.30** |
| 3 | *5190.00 | 101.6 PK | | | 1.62 V | 360 | 59.16 | 42.44 |
| 4 | *5190.00 | 90.9 AV | | | 1.62 V | 360 | 48.46 | 42.44 |
| 5 | #10380.00 | 62.8 PK | 68.3 | -5.5 | 1.15 V | 7 | 13.78 | 49.02 |
| 6 | 15570.00 | 63.9 PK | 74.0 | -10.1 | 1.17 V | 26 | 8.86 | 55.04 |
| 7 | 15570.00 | 52.7 AV | 54.0 | -1.3 | 1.17 V | 26 | -2.34 | 55.04 |

**REMARKS:**

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

| CHANNEL | TX Channel 46 | DETECTOR FUNCTION | Peak (PK) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *5230.00 | 99.8 PK | | | 1.03 H | 345 | 57.28 | 42.50 |
| 2 | *5230.00 | 89.2 AV | | | 1.03 H | 345 | 46.70 | 42.50 |
| 3 | #10460.00 | 59.8 PK | 68.3 | -8.5 | 1.41 H | 213 | 10.55 | 49.25 |
| 4 | 15690.00 | 60.9 PK | 74.0 | -13.1 | 1.00 H | 319 | 6.23 | 54.67 |
| 5 | 15690.00 | 49.8 AV | 54.0 | -4.2 | 1.00 H | 319 | -4.87 | 54.67 |
| 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 | 101.3 PK | | | 1.62 V | 360 | 58.80 | 42.50 |
| 2 | *5230.00 | 91.2 AV | | | 1.62 V | 360 | 48.70 | 42.50 |
| 3 | #10460.00 | 62.6 PK | 68.3 | -5.7 | 1.22 V | 12 | 13.35 | 49.25 |
| 4 | 15690.00 | 63.1 PK | 74.0 | -10.9 | 1.15 V | 28 | 8.43 | 54.67 |
| 5 | 15690.00 | 51.9 AV | 54.0 | -2.1 | 1.15 V | 28 | -2.77 | 54.67 |

**REMARKS:**

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

## 4.3 TRANSMIT POWER MEASUREMENT

### 4.3.1 LIMITS OF TRANSMIT POWER MEASUREMENT

| Frequency Band | Limit |
|---|---|
| 5.15 – 5.25GHz | The lesser of 50mW (17dBm) or 4dBm + 10logB |
| 5.25 – 5.35GHz | The lesser of 250mW (24dBm) or 11dBm + 10logB |
| 5.47 – 5.725GHz | The lesser of 250mW (24dBm) or 11dBm + 10logB |
| 5.725 – 5.825GHz | The lesser of 1W (30dBm) or 17dBm + 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 INSTRUMENTS

**FOR POWER OUTPUT MEASUREMENT**

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Power Meter Anritsu | ML2495A | 0824006 | May 20, 2013 | May 19, 2014 |
| Power Sensor Anritsu | MA2411B | 0738172 | May 20, 2013 | May 19, 2014 |

**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. Tested date : July 17, 2013

**FOR 26dB OCCUPIED BANDWIDTH**

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| SPECTRUM ANALYZER R&S | FSP40 | 100036 | Jan. 21, 2013 | Jan. 20, 2014 |

**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. Tested date : July 17, 2013

## 4.3.3 TEST PROCEDURE

**FOR POWER OUTPUT 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 OCCUPIED BANDWIDTH**

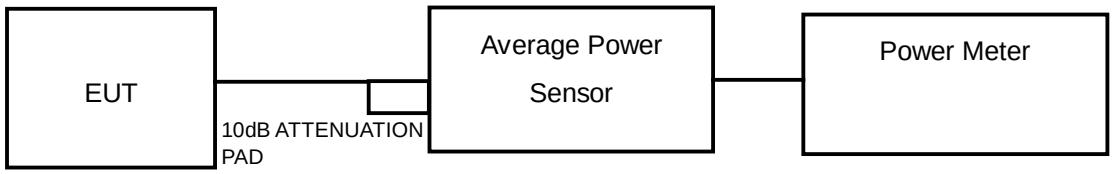
1) Set RBW = approximately 1% of the emission bandwidth.
2) Set the VBW > RBW.
3) Detector = Peak.
4) Trace mode = max hold.
5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

### 4.3.4 DEVIATION FROM TEST STANDARD

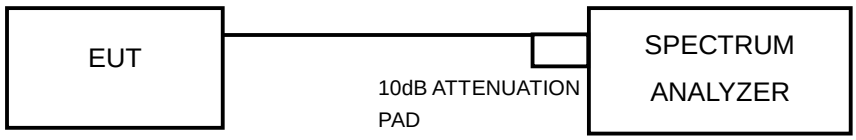
No deviation

### 4.3.5 TEST SETUP

**FOR POWER OUTPUT MEASUREMENT**




**FOR 26dB OCCUPIED BANDWIDTH**




### 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**

| CHANNEL | CHANNEL FREQUENCY (MHz) | AVERAGE POWER (mW) | AVERAGE POWER (dBm) | POWER LIMIT (dBm) | PASS/FAIL |
|---|---|---|---|---|---|
| 36 | 5180 | 29.854 | 14.75 | 16.95 | PASS |
| 40 | 5200 | 28.314 | 14.52 | 16.92 | PASS |
| 48 | 5240 | 27.040 | 14.32 | 16.97 | PASS |

**26dB OCCUPIED BANDWIDTH:**

**802.11a**

| CHANNEL | CHANNEL FREQUENCY (MHz) | 26dBc BANDWIDTH (MHz) |
|---|---|---|
| 36 | 5180 | 19.73 |
| 40 | 5200 | 19.62 |
| 48 | 5240 | 19.83 |

**Note: For FCC output power limitation is determined based on 26dB bandwidth.**

| Power Limit = 4dBm + 10logB < Band 1> | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Limit (dBm) |
| 36 | 5180 | 19.73 | 16.95 < 17 |
| 40 | 5200 | 19.62 | 16.92 < 17 |
| 48 | 5240 | 19.83 | 16.97 < 17 |

## POWER OUTPUT

### 802.11n (HT20)

| CHAN. | CHAN. FREQ. (MHz) | AVERAGE POWER (dBm) | | TOTAL POWER (mW) | TOTAL POWER (dBm) | POWER LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | | | | |
| 36 | 5180 | 12.12 | 11.42 | 30.161 | 14.79 | 16.97 | PASS |
| 40 | 5200 | 12.05 | 10.62 | 27.567 | 14.40 | 16.97 | PASS |
| 48 | 5240 | 11.65 | 10.56 | 25.998 | 14.15 | 16.95 | PASS |

### 26dB OCCUPIED BANDWIDTH:

### 802.11n (HT20)

| CHANNEL | CHANNEL FREQUENCY (MHz) | 26dBc BANDWIDTH (MHz) | |
|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 |
| 36 | 5180 | 19.85 | 19.93 |
| 40 | 5200 | 19.93 | 19.83 |
| 48 | 5240 | 19.86 | 19.75 |

**Note: For FCC output power limitation is determined based on 26dB bandwidth.**

| Power Limit = 4dBm + 10logB < Band 1> | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Limit (dBm) |
| 36 | 5180 | 19.85 | 16.97 < 17 |
| 40 | 5200 | 19.83 | 16.97 < 17 |
| 48 | 5240 | 19.75 | 16.95 < 17 |

## POWER OUTPUT

### 802.11n (HT40)

| CHAN. | CHAN. FREQ. (MHz) | AVERAGE POWER (dBm) | | TOTAL POWER (mW) | TOTAL POWER (dBm) | POWER LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | | | | |
| 38 | 5190 | 10.84 | 10.16 | 22.509 | 13.52 | 17 | PASS |
| 46 | 5230 | 11.14 | 10.07 | 23.164 | 13.65 | 17 | PASS |

## 26dB OCCUPIED BANDWIDTH:

### 802.11n (HT40)

| CHANNEL | CHANNEL FREQUENCY (MHz) | 26dBc BANDWIDTH (MHz) | |
|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 |
| 38 | 5190 | 41.37 | 42.91 |
| 46 | 5230 | 41.49 | 41.38 |

**Note: For FCC output power limitation is determined based on 26dB bandwidth.**

| Power Limit = 4dBm + 10logB < Band 1> | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Limit (dBm) |
| 38 | 5190 | 41.37 | 20.16 > 17 |
| 46 | 5230 | 41.38 | 20.16 > 17 |

## 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 |
| 5.25 ~ 5.35GHz | 11dBm |
| 5.47 – 5.725GHz | 11dBm |
| 5.725 ~ 5.825GHz | 17dBm |

### 4.4.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| R&S Spectrum Analyzer | FSP40 | 100036 | Jan. 21, 2013 | Jan. 20, 2014 |

**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. Tested date : July 17, 2013

### 4.4.3 TEST PROCEDURES

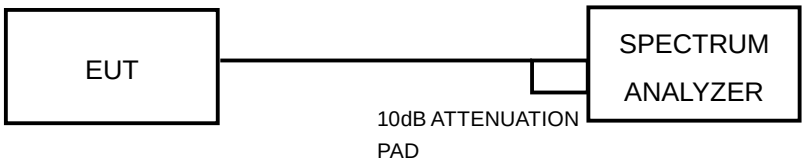
Using method SA-2

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 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 and add 10 log (1/duty cycle)

### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

## 4.4.5 TEST SETUP




## 4.4.6 EUT OPERATING CONDITIONS

Same as 4.3.6

## 4.4.7 TEST RESULTS

**802.11a**

| CHANNEL | FREQUENCY (MHz) | PSD (dBm) | DUTY FACTOR (dB) | TOTAL POWER DENSITY (dBm) | MAXIMUM LIMIT (dBm) | PASS/FAIL |
|---|---|---|---|---|---|---|
| 36 | 5180 | 1.30 | 0.30 | 1.60 | 4 | PASS |
| 40 | 5200 | 1.83 | 0.30 | 2.13 | 4 | PASS |
| 48 | 5240 | 2.18 | 0.30 | 2.48 | 4 | PASS |

**802.11n (HT20)**

| CHAN. | CHANNEL FREQUENCY (MHz) | PSD (dBm) | | DUTY FACTOR (dB) | TOTAL POWER DENSITY (dBm) | MAX. LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | | | | |
| 36 | 5180 | -1.71 | -1.71 | 0.18 | 1.48 | 2.48 | PASS |
| 40 | 5200 | -2.00 | -1.03 | 0.18 | 1.70 | 2.48 | PASS |
| 48 | 5240 | -2.71 | -1.82 | 0.18 | 0.95 | 2.48 | 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 = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 7.52dBi > 6dBi , so the power density limit shall be reduced to 4-(7.52-6) = 2.48dBm.

**802.11n (HT40)**

| CHAN. | CHANNEL FREQUENCY (MHz) | PSD (dBm) | | DUTY FACTOR (dB) | TOTAL POWER DENSITY (dBm) | MAX. LIMIT (dBm) | PASS / FAIL |
|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | | | | |
| 38 | 5190 | -1.71 | -1.71 | 0.63 | -2.16 | 2.48 | PASS |
| 46 | 5230 | -2.00 | -1.03 | 0.63 | -2.07 | 2.48 | 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 = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 7.52dBi > 6dBi , so the power density limit shall be reduced to 4-(7.52-6) = 2.48dBm.

## 4.5 PEAK POWER EXCURSION MEASUREMENT

### 4.5.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

Shall not exceed 13 dB

### 4.5.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| R&S Spectrum Analyzer | FSP40 | 100036 | Jan. 21, 2013 | Jan. 20, 2014 |

**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. Tested date : July 17, 2013

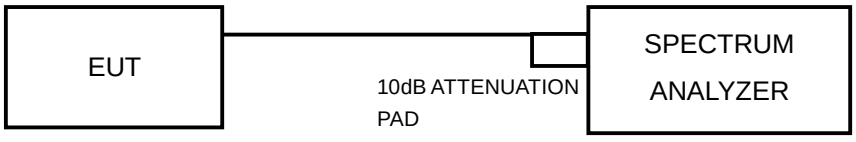
### 4.5.3 TEST PROCEDURE

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.

### 4.5.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.5.5 TEST SETUP




### 4.5.6 EUT OPERATING CONDITIONS

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

## 4.5.7 TEST RESULTS

**802.11a**

| CHANNEL | CHANNEL FREQUENCY (MHz) | PEAK VALUE (dBm) | PPSD (dBm) | PEAK EXCURSION (dB) | LIMIT (dB) | PASS/FAIL |
|---|---|---|---|---|---|---|
| 36 | 5180 | 12.15 | 1.60 | 10.55 | 13 | PASS |
| 40 | 5200 | 12.47 | 2.13 | 10.34 | 13 | PASS |
| 48 | 5240 | 11.91 | 2.48 | 9.43 | 13 | PASS |

**802.11n (HT20)**

| CHAN. | CHAN. FREQ. (MHz) | PEAK VALUE (dBm) | | PPSD (dBm) | | PEAK EXCURSION (dB) | | LIMIT (dB) | PASS/ FAIL |
|---|---|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | CHAIN 0 | CHAIN 1 | CHAIN 0 | CHAIN 1 | | |
| 36 | 5180 | 6.95 | 7.28 | -1.55 | -1.55 | 8.50 | 8.83 | 13 | PASS |
| 40 | 5200 | 7.59 | 9.96 | -1.84 | -0.87 | 9.43 | 10.83 | 13 | PASS |
| 48 | 5240 | 6.92 | 9.64 | -2.55 | -1.66 | 9.47 | 11.30 | 13 | PASS |

**802.11n (HT40)**

| CHAN. | CHAN. FREQ. (MHz) | PEAK VALUE (dBm) | | PPSD (dBm) | | PEAK EXCURSION (dB) | | LIMIT (dB) | PASS/ FAIL |
|---|---|---|---|---|---|---|---|---|---|
| | | CHAIN 0 | CHAIN 1 | CHAIN 0 | CHAIN 1 | CHAIN 0 | CHAIN 1 | | |
| 38 | 5190 | 4.01 | 5.80 | -6.04 | -4.45 | 10.05 | 10.25 | 13 | PASS |
| 46 | 5230 | 3.53 | 6.31 | -5.86 | -4.42 | 9.39 | 10.73 | 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 INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| R&S Spectrum Analyzer | FSP40 | 100036 | Jan. 21, 2013 | Jan. 20, 2014 |
| Temperature & Humidity Chamber GIANTFORCE | GTH-150-40-SP-AR | MAA0812-008 | Jan. 17, 2013 | Jan. 16, 2014 |

**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. Tested date : July 17, 2013

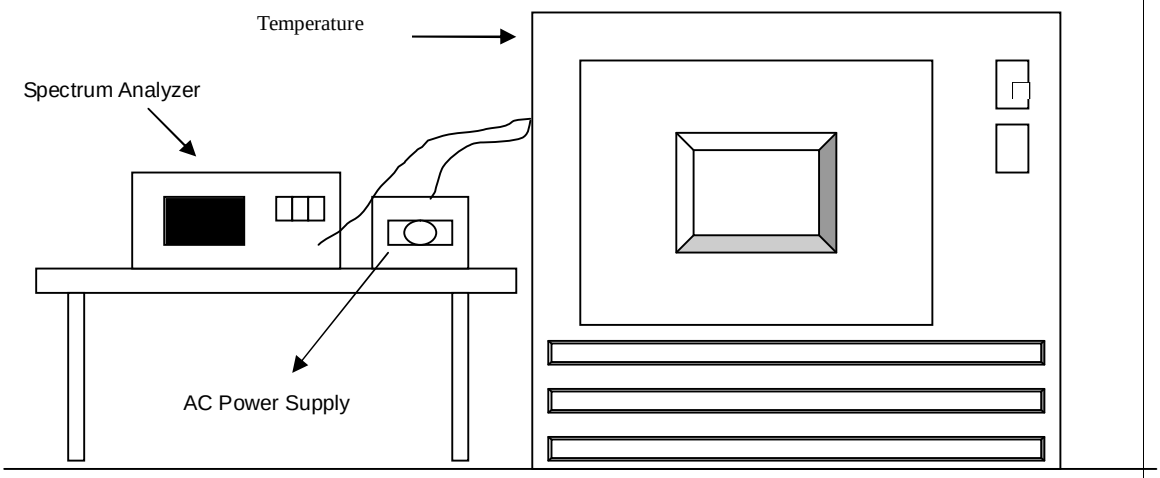
### 4.6.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. 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.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. 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.

### 4.6.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.6.5 TEST SETUP




### 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: 5240MHz | | | | | | | | | |
| TEMP. (℃) | POWER SUPPLY (Vac) | 0 MINUTE | | 2 MINUTE | | 5 MINUTE | | 10 MINUTE | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 50 | 120 | 5239.9762 | -0.00045 | 5239.9784 | -0.00041 | 5239.9747 | -0.00048 | 5239.9759 | -0.00046 |
| 40 | 120 | 5239.9955 | -0.00009 | 5239.9914 | -0.00016 | 5239.9925 | -0.00014 | 5239.9905 | -0.00018 |
| 30 | 120 | 5239.9875 | -0.00024 | 5239.9869 | -0.00025 | 5239.9958 | -0.00008 | 5239.9954 | -0.00009 |
| 20 | 120 | 5239.9964 | -0.00007 | 5239.9962 | -0.00007 | 5240.0064 | 0.00012 | 5240.0028 | 0.00005 |
| 10 | 120 | 5240.0148 | 0.00028 | 5240.0193 | 0.00037 | 5240.0185 | 0.00035 | 5240.0199 | 0.00038 |
| 0 | 120 | 5240.0089 | 0.00017 | 5240.0101 | 0.00019 | 5240.008 | 0.00015 | 5240.0087 | 0.00017 |
| -10 | 120 | 5240.0099 | 0.00019 | 5240.0058 | 0.00011 | 5240.0072 | 0.00014 | 5240.0057 | 0.00011 |
| -20 | 120 | 5240.0102 | 0.00019 | 5240.0102 | 0.00019 | 5240.0145 | 0.00028 | 5240.0103 | 0.00020 |
| -30 | 120 | 5240.0182 | 0.00035 | 5240.0254 | 0.00048 | 5240.0266 | 0.00051 | 5240.018 | 0.00034 |

| FREQUEMCY STABILITY VERSUS VOLTAGE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OPERATING FREQUENCY: 5240MHz | | | | | | | | | |
| TEMP. (℃) | POWER SUPPLY (Vac) | 0 MINUTE | | 2 MINUTE | | 5 MINUTE | | 10 MINUTE | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 20 | 138 | 5239.9967 | -0.00006 | 5239.9953 | -0.00009 | 5240.0067 | 0.00013 | 5240.0022 | 0.00004 |
| | 120 | 5239.9964 | -0.00007 | 5239.9962 | -0.00007 | 5240.0064 | 0.00012 | 5240.0028 | 0.00005 |
| | 102 | 5239.997 | -0.00006 | 5239.9969 | -0.00006 | 5240.007 | 0.00013 | 5240.0024 | 0.00005 |

# 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 ---**