

## Supplemental “Transmit Simultaneously” Test Report

**Report No.:** RF160902E01-2

**FCC ID:** U8G-P1AC8

**Test Model:** Surf SOHO MK-III

**Series Model:** Pismo AC8, SOHO-AC-T, Surf SOHO

**Received Date:** Sep. 02, 2016

**Test Date:** Sep. 15 to 22, 2016

**Issued Date:** Oct. 24, 2016

**Applicant:** Pismo Labs Technology Limited

**Address:** FLAT/RM A5, 5/F, HK SPINNERS IND BLDG PHASE 6, 481 CASTLE PEAK ROAD, CHEUNG SHA WAN, HONG KONG.

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

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### Release Control Record

| Issue No.     | Description       | Date Issued   |
|---------------|-------------------|---------------|
| RF160902E01-2 | Original release. | Oct. 24, 2016 |

## 1 Certificate of Conformity

**Product:** Pepwave / Peplink / Pismo Labs Wireless Product

**Brand:** Pepwave / Peplink / Pismo

**Test Model:** Surf SOHO MK-III

**Series Model:** Pismo AC8, SOHO-AC-T, Surf SOHO

**Sample Status:** ENGINEERING SAMPLE

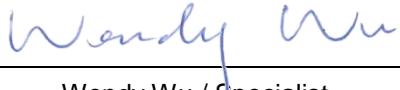
**Applicant:** Pismo Labs Technology Limited

**Test Date:** Sep. 15 to 22, 2016

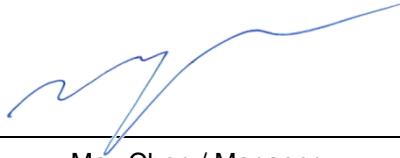
**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)

ANSI C63.10: 2013

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

**Prepared by :**  , **Date:** Oct. 24, 2016

Wendy Wu / Specialist

**Approved by :**  , **Date:** Oct. 24, 2016

May Chen / Manager

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (SECTION 15.247) |  |        |  |
|--|--|--------|--|
| FCC Clause                                     | Test Item                                    | Result | Remarks  |
| 15.207   | AC Power Conducted Emission                  | PASS   | Meet the requirement of limit.<br>Minimum passing margin is -1.81dB at 0.44166MHz. |
| 15.205 /<br>15.209 /<br>15.247(d)              | Radiated Emissions and Band Edge Measurement | PASS   | Meet the requirement of limit.<br>Minimum passing margin is -0.4dB at 4874.00MHz.  |

### 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      | Expended Uncertainty (k=2) (±) |
|------------------------------------|----------------|--------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 1.83 dB                        |
| Radiated Emissions up to 1 GHz     | 30MHz ~ 1GHz   | 5.43 dB                        |
| Radiated Emissions above 1 GHz     | 1GHz ~ 6GHz    | 3.72 dB                        |
|                                    | 6GHz ~ 18GHz   | 4.00 dB                        |
|                                    | 18GHz ~ 40GHz  | 4.11 dB                        |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                       |   |
|-----------------------|---|
| Product               | Pepwave / Peplink / Pismo Labs Wireless Product   |
| Brand                 | Pepwave / Peplink / Pismo   |
| Test Model            | Surf SOHO MK-III  |
| Series Model          | Pismo AC8, SOHO-AC-T, Surf SOHO   |
| Status of EUT         | ENGINEERING SAMPLE  |
| Power Supply Rating   | 12Vdc from power adapter  |
| Modulation Type       | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM<br>256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz band   |
| Modulation Technology | DSSS,OFDM   |
| Transfer Rate         | 802.11b: up to 11Mbps<br>802.11a/g: up to 54Mbps<br>802.11n: up to 450Mbps<br>802.11ac: up to 1300Mbps  |
| Operating Frequency   | <b>2.4GHz:</b> 2.412GHz ~ 2.462GHz<br><b>5GHz:</b> 5.18GHz ~ 5.24GHz, 5.745GHz ~ 5.825GHz   |
| Number of Channel     | <b>2.4GHz:</b><br>802.11b, 802.11g, 802.11n (HT20), VHT20: 11<br>802.11n (HT40), VHT40: 7<br><b>5GHz:</b><br>802.11a, 802.11n (HT20), 802.11ac (VHT20): 9<br>802.11n (HT40), 802.11ac (VHT40): 4<br>802.11ac (VHT80): 2 |
| Antenna Type          | Refer to Note   |
| Antenna Connector     | Refer to Note   |
| Accessory Device      | Adapter x 1   |
| Data Cable Supplied   | NA  |

Note:

1. The EUT has below model names, which are identical to each other in all aspects except for the following:

| Product name                                       | Brand                     | Model            | Difference                   |
|--|---------------------------|------------------|------------------------------|
| Pepwave / Peplink / Pismo<br>Labs Wireless Product | Pepwave / Peplink / Pismo | Surf SOHO        | For marketing<br>requirement |
|  |                           | Pismo AC8        |                              |
|  |                           | SOHO-AC-T        |                              |
|  |                           | Surf SOHO MK-III |                              |

From the above models, model: **Surf SOHO MK-III** was selected as representative model for the test and its data was recorded in this report.

2. There are WLAN and WWAN(3G) technology used for the EUT.

3. EUT could be applied with a plug in USB cellular device.

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

| Brand   | Model No.     | Spec.   |
|---------|---------------|---|
| Ten Pao | S040QM1200300 | Input: 100-240Vac, 50/60Hz, 1.0A<br>Output: 12Vdc, 3000mA<br>DC output cable (Unshielded, 1.5m with one core) |

5. Simultaneously transmission condition.

| Condition |               | Technology  |  |  |                               |  |  |
|-----------|---------------|-------------|--|--|-------------------------------|--|--|
| 1         | WLAN (2.4GHz) | WLAN (5GHz) |  |  | WWAN<br>(USB cellular device) |  |  |

**Note:** The emission of the simultaneous operation has been evaluated and no non-compliance was found.

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

| Antenna No. | Chain No. | Brand    | Model           | Antenna Net Gain(dBi) | Frequency range (GHz ~ GHz) | Antenna Type | Connector Type | Cable Length (mm) | Cable Loss (dB) | Antenna Gain(dBi) <excluding cable loss> |
|-------------|-----------|----------|-----------------|-----------------------|-----------------------------|--------------|----------------|-------------------|-----------------|--|
| 1           | Chain 0   | SmartAnt | SAA06-220690-V1 | 1.4                   | 2.4~2.4835                  | Dipole       | R-SMA          | 210               | 1.6             | 3  |
|             |           |          |                 | 3.9                   | 5.15~5.35                   |              |                |                   |                 | 5.5                                      |
|             |           |          |                 | 4.4                   | 5.35~5.85                   |              |                |                   |                 | 6  |
| 2           | Chain 1   | SmartAnt | SAA06-220690-V1 | 1.8                   | 2.4~2.4835                  | Dipole       | R-SMA          | 150               | 1.2             | 3  |
|             |           |          |                 | 4.3                   | 5.15~5.35                   |              |                |                   |                 | 5.5                                      |
|             |           |          |                 | 4.8                   | 5.35~5.85                   |              |                |                   |                 | 6  |
| 3           | Chain 2   | SmartAnt | SAA06-220690-V1 | 2                     | 2.4~2.4835                  | Dipole       | R-SMA          | 120               | 1               | 3  |
|             |           |          |                 | 4.5                   | 5.15~5.35                   |              |                |                   |                 | 5.5                                      |
|             |           |          |                 | 5                     | 5.35~5.85                   |              |                |                   |                 | 6  |

7. The EUT incorporates a MIMO function.

| 2.4GHz Band      |                 |                       |     |
|------------------|-----------------|-----------------------|-----|
| MODULATION MODE  | DATA RATE (MCS) | TX & RX CONFIGURATION |     |
| 802.11b          | 1 ~ 11Mbps      | 3TX                   | 3RX |
| 802.11g          | 6 ~ 54Mbps      | 3TX                   | 3RX |
| 802.11n (HT20)   | MCS 0~7         | 3TX                   | 3RX |
|                  | MCS 8~15        | 3TX                   | 3RX |
|                  | MCS 16~23       | 3TX                   | 3RX |
| 802.11n (HT40)   | MCS 0~7         | 3TX                   | 3RX |
|                  | MCS 8~15        | 3TX                   | 3RX |
|                  | MCS 16~23       | 3TX                   | 3RX |
| VHT20            | MCS 0~7         | 3TX                   | 3RX |
|                  | MCS 8~15        | 3TX                   | 3RX |
|                  | MCS 16~23       | 3TX                   | 3RX |
| VHT40            | MCS 0~7         | 3TX                   | 3RX |
|                  | MCS 8~15        | 3TX                   | 3RX |
|                  | MCS 16~23       | 3TX                   | 3RX |
| 5GHz Band        |                 |                       |     |
| MODULATION MODE  | DATA RATE (MCS) | TX & RX CONFIGURATION |     |
| 802.11a          | 6 ~ 54Mbps      | 3TX                   | 3RX |
| 802.11n (HT20)   | MCS 0~7         | 3TX                   | 3RX |
|                  | MCS 8~15        | 3TX                   | 3RX |
|                  | MCS 16~23       | 3TX                   | 3RX |
| 802.11n (HT40)   | MCS 0~7         | 3TX                   | 3RX |
|                  | MCS 8~15        | 3TX                   | 3RX |
|                  | MCS 16~23       | 3TX                   | 3RX |
| 802.11ac (VHT20) | MCS0~8 Nss=1    | 3TX                   | 3RX |
|                  | MCS0~8 Nss=2    | 3TX                   | 3RX |
|                  | MCS0~9 Nss=3    | 3TX                   | 3RX |
| 802.11ac (VHT40) | MCS0~9 Nss=1    | 3TX                   | 3RX |
|                  | MCS0~9 Nss=2    | 3TX                   | 3RX |
|                  | MCS0~9 Nss=3    | 3TX                   | 3RX |
| 802.11ac (VHT80) | MCS0~9 Nss=1    | 3TX                   | 3RX |
|                  | MCS0~9 Nss=2    | 3TX                   | 3RX |
|                  | MCS0~9 Nss=3    | 3TX                   | 3RX |

Note:

1. The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report.

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

### 3.1.1 Test Mode Applicability and Tested Channel Detail

| EUT<br>Configure<br>Mode | Applicable To |       |     |      | Description |
|--------------------------|---------------|-------|-----|------|-------------|
|                          | RE≥1G         | RE<1G | PLC | APCM |             |
| -                        | √             | √     | √   | √    | -           |

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

#### 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                             | AVAILABLE CHANNEL      | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE |
|----------------------------------|------------------------|----------------|-----------------------|-----------------|
| 802.11g<br>+<br>802.11ac (VHT40) | 1 to 11                | 6              | OFDM                  | BPSK            |
|                                  | 38 to 46<br>151 to 159 | 46             | OFDM                  | BPSK            |

#### Radiated Emission Test (Below 1GHz):

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

| MODE                             | AVAILABLE CHANNEL      | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE |
|----------------------------------|------------------------|----------------|-----------------------|-----------------|
| 802.11g<br>+<br>802.11ac (VHT40) | 1 to 11                | 6              | OFDM                  | BPSK            |
|                                  | 38 to 46<br>151 to 159 | 46             | OFDM                  | BPSK            |

#### Power Line Conducted Emission Test:

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

| MODE                             | AVAILABLE CHANNEL      | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE |
|----------------------------------|------------------------|----------------|-----------------------|-----------------|
| 802.11g<br>+<br>802.11ac (VHT40) | 1 to 11                | 6              | OFDM                  | BPSK            |
|                                  | 38 to 46<br>151 to 159 | 46             | OFDM                  | BPSK            |

#### Conducted Out-Band Emission Measurement:

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

| MODE                             | AVAILABLE CHANNEL      | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE |
|----------------------------------|------------------------|----------------|-----------------------|-----------------|
| 802.11g<br>+<br>802.11ac (VHT40) | 1 to 11                | 6              | OFDM                  | BPSK            |
|                                  | 38 to 46<br>151 to 159 | 46             | OFDM                  | BPSK            |

**Test Condition:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER  | TESTED BY |
|---------------|--------------------------|--------------|-----------|
| RE≥1G         | 25deg. C, 66%RH          | 120Vac, 60Hz | Weiwei Lo |
| RE<1G         | 25deg. C, 70%RH          | 120Vac, 60Hz | Andy Ho   |
| PLC           | 25deg. C, 75%RH          | 120Vac, 60Hz | Andy Ho   |
| OB            | 25deg. C, 60%RH          | 120Vac, 60Hz | Andy Ho   |

### 3.2 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.

| ID | Product   | Brand  | Model No. | Serial No.    | FCC ID  | Remarks         |
|----|-----------|--------|-----------|---------------|---------|-----------------|
| A. | Laptop    | DELL   | E6440     | F9LYQ32       | FCC DoC | Provided by Lab |
| B. | Laptop    | DELL   | E6420     | B92T3R1       | FCC DoC | Provided by Lab |
| C. | 3G Dongle | D-Link | DWM-156   | Q2011A4000812 | NA      | Provided by Lab |

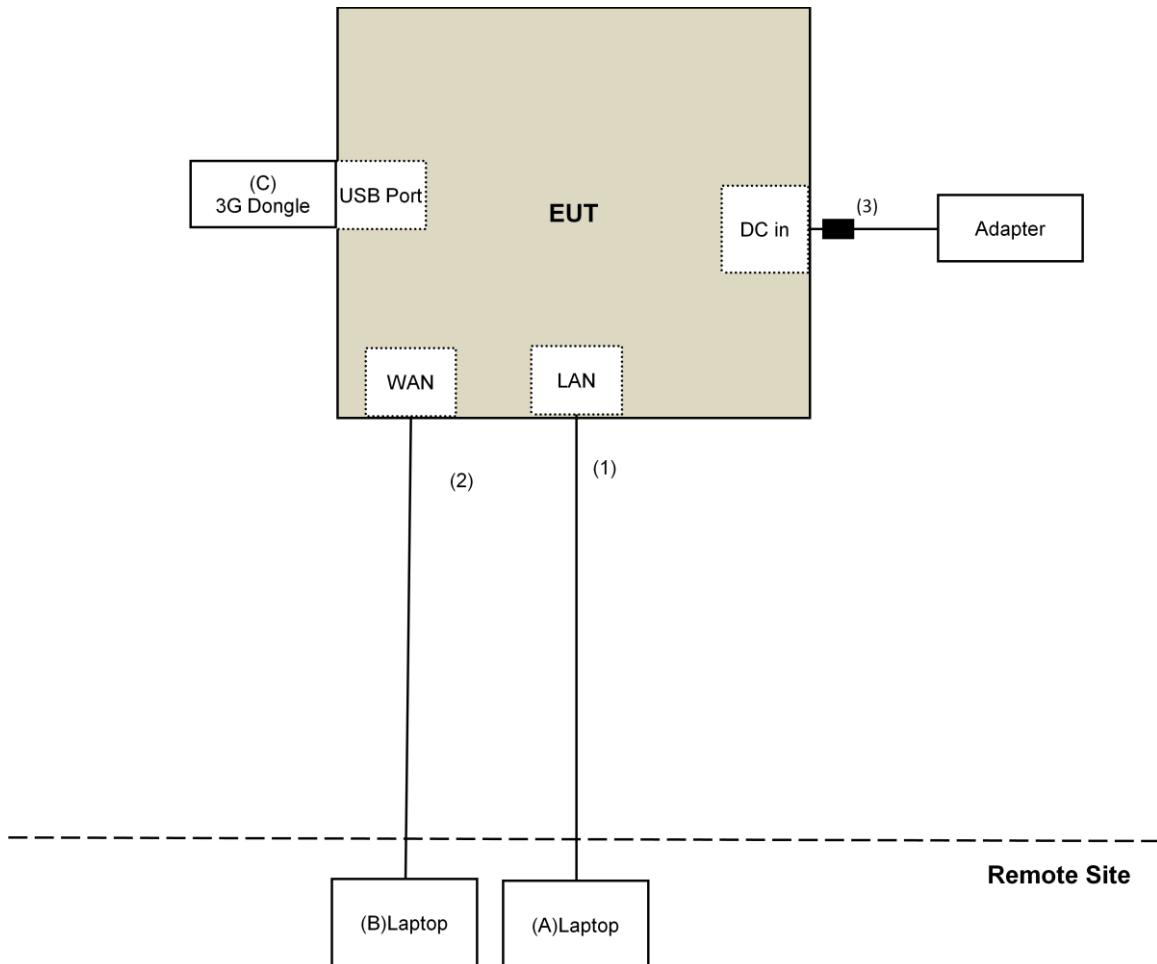
Note:

1. All power cords of the above support units are non-shielded (1.8m).

| ID | Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks            |
|----|--------------|------|------------|--------------------|--------------|--------------------|
| 1. | RJ-45 Cable  | 1    | 10         | No                 | 0            | Provided by Lab    |
| 2. | RJ-45 Cable  | 1    | 10         | No                 | 0            | Provided by Lab    |
| 3. | DC Cable     | 1    | 1.5        | No                 | 1            | Supplied by client |

Note: The core(s) is(are) originally attached to the cable(s).

### 3.2.1 Configuration of System under Test



## 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. Other emissions shall be at least 20dB below the highest level of the desired power:

| 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 (dB<sub>u</sub>V/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 Test Instruments

| DESCRIPTION & MANUFACTURER              | MODEL NO.            | SERIAL NO.                                | CALIBRATED DATE | CALIBRATED UNTIL |
|---|----------------------|---|-----------------|------------------|
| Test Receiver<br>Agilent                | N9038A               | MY51210202                                | Dec. 16, 2015   | Dec. 15, 2016    |
| Pre-Amplifier <sup>(*)</sup><br>EMCI    | EMC001340            | 980142                                    | Jan. 20, 2016   | Jan. 19, 2018    |
| Loop Antenna(*)<br>Electro-Metrics      | EM-6879              | 264                                       | Dec. 16, 2014   | Dec. 15, 2016    |
| RF Cable                                | NA                   | LOOPCAB-001<br>LOOPCAB-002                | Jan. 18, 2016   | Jan. 17, 2017    |
| Pre-Amplifier<br>Mini-Circuits          | ZFL-1000VH2B         | AMP-ZFL-04                                | Nov. 11, 2015   | Nov. 10, 2016    |
| Trilog Broadband Antenna<br>SCHWARZBECK | VULB 9168            | 9168-361                                  | Jan. 07, 2016   | Jan. 06, 2017    |
| RF Cable                                | 8D-FB                | CHHCAB-001-1<br>CHHCAB-001-2              | Oct. 04, 2015   | Oct. 03, 2016    |
|   | RF-141               | CHHCAB-004                                | Oct. 04, 2015   | Oct. 03, 2016    |
| Horn_Antenna<br>FT-RF                   | HA-07M18G-NF         | 0000220091110                             | Jan. 18, 2016   | Jan. 17, 2017    |
| Pre-Amplifier<br>Agilent                | 8449B                | 3008A01923                                | Oct. 27, 2015   | Oct. 26, 2016    |
| RF Cable                                | NA                   | 131206<br>131213<br>131215<br>SNMY23685/4 | Jan. 15, 2016   | Jan. 14, 2017    |
| Spectrum Analyzer<br>Agilent            | E4446A               | MY48250254                                | Nov. 25, 2015   | Nov. 24, 2016    |
| Pre-Amplifier<br>SPACEK LABS            | SLKKa-48-6           | 9K16                                      | Dec. 11, 2015   | Dec. 10, 2016    |
| Horn_Antenna<br>SCHWARZBECK             | BBHA 9170            | 9170-424                                  | Jan. 18, 2016   | Jan. 17, 2017    |
| RF Cable                                | SUCOFLEX 102         | 36442/2<br>36434/2                        | Dec. 10, 2015   | Dec. 09, 2016    |
| Software                                | ADT_Radiated_V8.7.08 | NA  | NA              | NA               |
| Antenna Tower & Turn Table<br>CT        | CM100                | NA  | NA              | NA               |
| Boresight Antenna Fixture               | FBA-01               | FBA-WD02                                  | 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 above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
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. Loop antenna was used for all emissions below 30 MHz.
7. Tested Date: Sep. 15 to 22, 2016

#### 4.1.3 Test Procedures

##### For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

##### For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average 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:

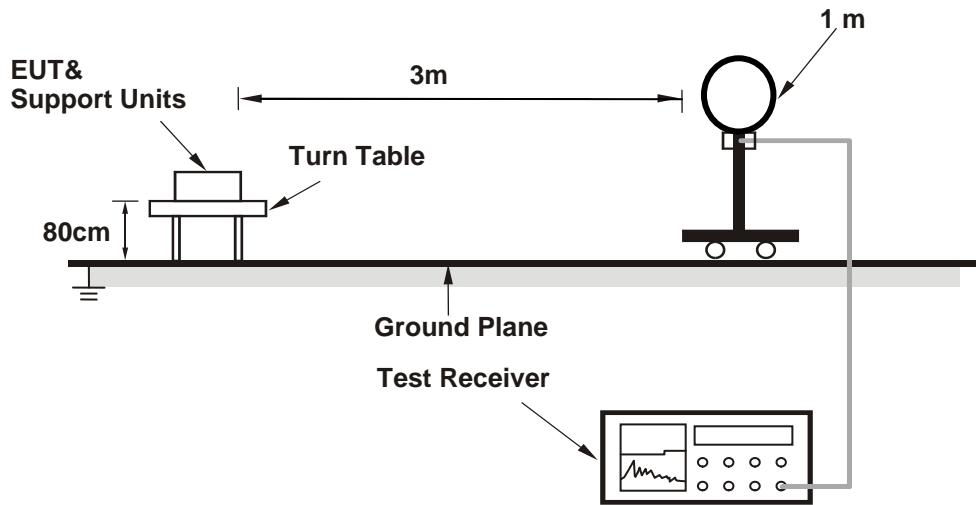
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

#### 4.1.4 Deviation from Test Standard

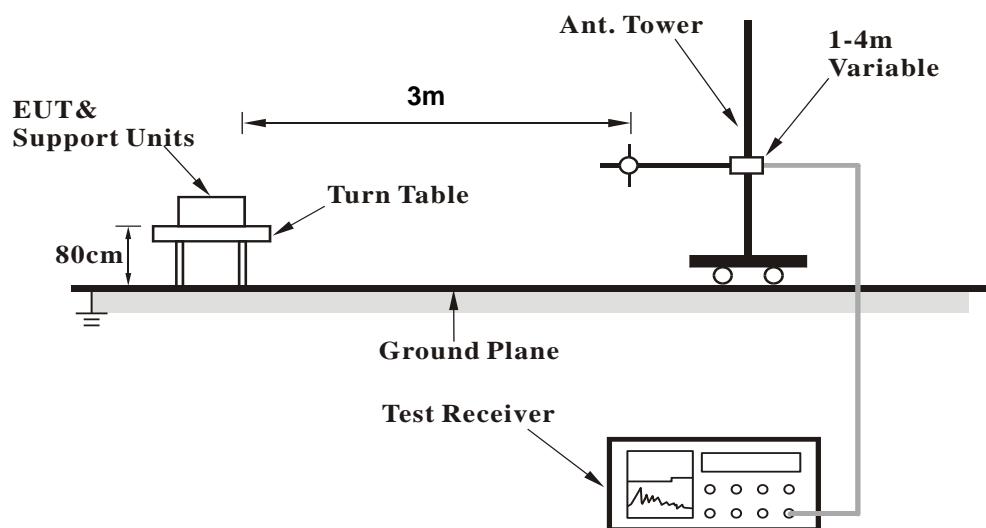
No deviation.

#### 4.1.5 Test Setup

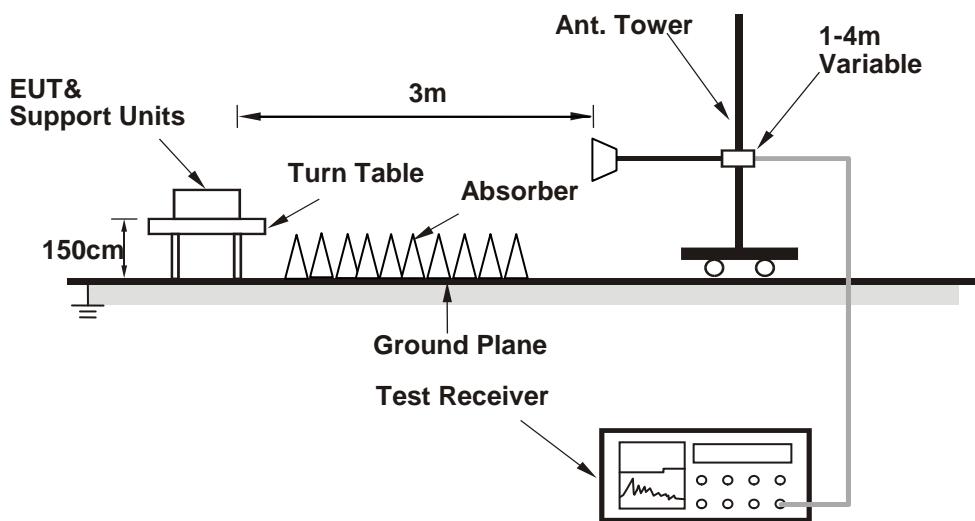
##### For Radiated emission below 30MHz



##### For Radiated emission 30MHz to 1GHz



**For Radiated emission above 1GHz**



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

#### 4.1.6 EUT Operating Conditions

- Connected the EUT with the laptop which is placed on remote site.
- Controlling software (Atheros Radio Test 2 (ART2-GUI)) has been activated to set the EUT on specific status.

#### 4.1.7 Test Results

##### Above 1GHz Data

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

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|---|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.   | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1   | 4874.00        | 53.1 PK                       | 74.0              | -20.9          | 1.78 H                   | 203                        | 42.4                   | 10.7                           |
| 2   | 4874.00        | 43.7 AV                       | 54.0              | -10.3          | 1.78 H                   | 203                        | 33.0                   | 10.7                           |
| 3   | 7311.00        | 56.9 PK                       | 74.0              | -17.1          | 1.49 H                   | 319                        | 41.7                   | 15.2                           |
| 4   | 7311.00        | 44.2 AV                       | 54.0              | -9.8           | 1.49 H                   | 319                        | 29.0                   | 15.2                           |
| 5   | 10460.00       | 58.5 PK                       | 74.0              | -15.5          | 1.44 H                   | 234                        | 41.4                   | 17.1                           |
| 6   | 10460.00       | 47.6 AV                       | 54.0              | -6.4           | 1.44 H                   | 234                        | 30.5                   | 17.1                           |
| 7   | 15690.00       | 61.8 PK                       | 74.0              | -12.2          | 1.43 H                   | 232                        | 40.1                   | 21.7                           |
| 8   | 15690.00       | 49.5 AV                       | 54.0              | -4.5           | 1.43 H                   | 232                        | 27.8                   | 21.7                           |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.   | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1   | 4874.00        | 66.4 PK                       | 74.0              | -7.6           | 1.91 V                   | 344                        | 55.7                   | 10.7                           |
| 2   | 4874.00        | 53.6 AV                       | 54.0              | -0.4           | 1.91 V                   | 344                        | 42.9                   | 10.7                           |
| 3   | 7311.00        | 59.1 PK                       | 74.0              | -14.9          | 1.92 V                   | 329                        | 43.9                   | 15.2                           |
| 4   | 7311.00        | 46.2 AV                       | 54.0              | -7.8           | 1.92 V                   | 329                        | 31.0                   | 15.2                           |
| 5   | 10460.00       | 58.8 PK                       | 74.0              | -15.2          | 1.41 V                   | 157                        | 41.7                   | 17.1                           |
| 6   | 10460.00       | 47.5 AV                       | 54.0              | -6.5           | 1.41 V                   | 157                        | 30.4                   | 17.1                           |
| 7   | 15690.00       | 62.9 PK                       | 74.0              | -11.1          | 1.42 V                   | 114                        | 41.2                   | 21.7                           |
| 8   | 15690.00       | 50.6 AV                       | 54.0              | -3.4           | 1.42 V                   | 114                        | 28.9                   | 21.7                           |

##### REMARKS:

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

**Below 1GHz Data:**

| FREQUENCY RANGE |  | 9kHz ~ 30MHz |  | DETECTOR FUNCTION |  | Quasi-Peak (QP) |  |
|-----------------|--|--------------|--|-------------------|--|-----------------|--|
|-----------------|--|--------------|--|-------------------|--|-----------------|--|

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

| NO. | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1   | 125.01         | 33.7 QP                       | 43.5              | -9.8           | 2.00 H                   | 96                         | 43.3                   | -9.6                           |
| 2   | 250.00         | 34.9 QP                       | 46.0              | -11.1          | 1.50 H                   | 93                         | 43.9                   | -9.0                           |
| 3   | 300.02         | 38.0 QP                       | 46.0              | -8.0           | 1.00 H                   | 212                        | 44.6                   | -6.6                           |
| 4   | 374.98         | 37.4 QP                       | 46.0              | -8.6           | 1.00 H                   | 65                         | 42.1                   | -4.7                           |
| 5   | 625.00         | 39.8 QP                       | 46.0              | -6.2           | 1.50 H                   | 329                        | 38.5                   | 1.3                            |
| 6   | 949.68         | 38.6 QP                       | 46.0              | -7.4           | 1.00 H                   | 153                        | 31.7                   | 6.9                            |

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

| NO. | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1   | 125.01         | 35.1 QP                       | 43.5              | -8.4           | 1.00 V                   | 360                        | 44.7                   | -9.6                           |
| 2   | 300.00         | 37.7 QP                       | 46.0              | -8.3           | 1.50 V                   | 344                        | 44.3                   | -6.6                           |
| 3   | 375.00         | 38.6 QP                       | 46.0              | -7.4           | 1.50 V                   | 181                        | 43.3                   | -4.7                           |
| 4   | 499.99         | 36.6 QP                       | 46.0              | -9.4           | 1.00 V                   | 239                        | 38.1                   | -1.5                           |
| 5   | 625.00         | 38.8 QP                       | 46.0              | -7.2           | 1.00 V                   | 90                         | 37.5                   | 1.3                            |
| 6   | 874.99         | 41.8 QP                       | 46.0              | -4.2           | 2.00 V                   | 247                        | 36.6                   | 5.2                            |

**REMARKS:**

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

## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) |         |
|-----------------|------------------------|---------|
|                 | Quasi-peak             | Average |
| 0.15 - 0.5      | 66 - 56                | 56 - 46 |
| 0.50 - 5.0      | 56                     | 46      |
| 5.0 - 30.0      | 60                     | 50      |

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 4.2.2 Test Instruments

| DESCRIPTION & MANUFACTURER  | MODEL NO.           | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---------------------|------------|-----------------|------------------|
| Test Receiver<br>R&S  | ESCS 30             | 100375     | May 09, 2016    | May 08, 2017     |
| Line-Impedance<br>Stabilization Network<br>(for EUT)<br>SCHWARZBECK | NSLK-8127           | 8127-522   | Aug. 31, 2016   | Aug. 30, 2017    |
| Line-Impedance<br>Stabilization Network<br>(for Peripheral )<br>R&S | ENV216              | 100072     | June 13, 2016   | June 12, 2017    |
| RF Cable  | 5D-FB               | COACAB-002 | Mar. 04, 2016   | Mar. 03, 2017    |
| 10 dB PAD<br>Mini-Circuits  | HAT-10+             | CONATT-003 | Sep. 13, 2016   | Sep. 12, 2017    |
| 50 ohms Terminator  | N/A                 | 04         | Nov. 18, 2015   | Nov. 17, 2016    |
| 50 ohms Terminator  | 50                  | 3          | Oct. 21, 2015   | Oct. 20, 2016    |
| Software<br>BVADT   | BVADT_Cond_V7.3.7.4 | NA         | NA              | NA               |

#### Note:

1. The calibration interval of the above test instruments are 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: Sep. 15, 2016

#### 4.2.3 Test Procedures

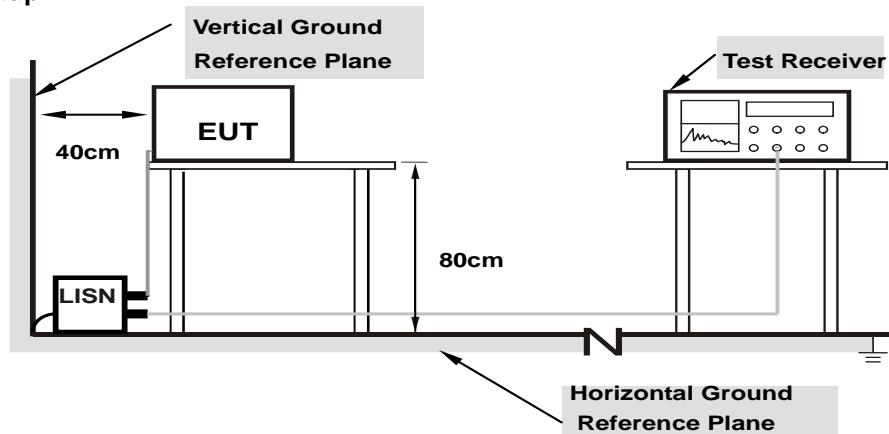
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



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

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.

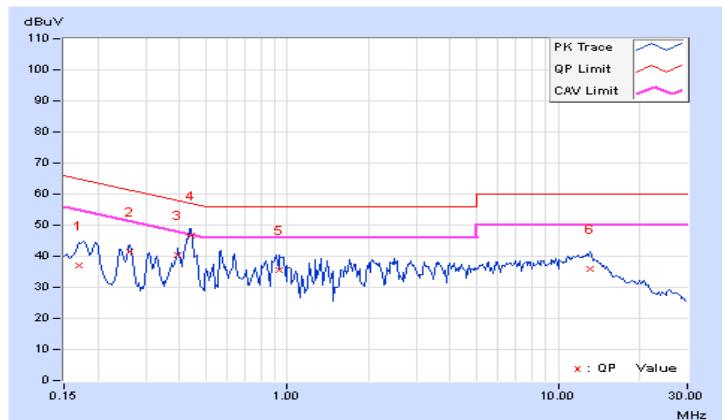
#### 4.2.7 Test Results

| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|----------|-------------------|--------------------------------|
|-------|----------|-------------------|--------------------------------|

| Phase Of Power : Line (L) |                 |                        |                      |              |                       |              |              |              |               |              |
|---------------------------|-----------------|------------------------|----------------------|--------------|-----------------------|--------------|--------------|--------------|---------------|--------------|
| No                        | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |              | Emission Level (dBuV) |              | Limit (dBuV) |              | Margin (dB)   |              |
|                           |                 |                        | Q.P.                 | AV.          | Q.P.                  | AV.          | Q.P.         | AV.          | Q.P.          | AV.          |
| 1                         | 0.16953         | 10.24                  | 26.92                | 22.67        | 37.16                 | 32.91        | 64.98        | 54.98        | -27.82        | -22.07       |
| 2                         | 0.26328         | 10.25                  | 31.33                | 29.09        | 41.58                 | 39.34        | 61.33        | 51.33        | -19.75        | -11.99       |
| 3                         | 0.39609         | 10.24                  | 30.12                | 26.69        | 40.36                 | 36.93        | 57.93        | 47.93        | -17.57        | -11.00       |
| <b>4</b>                  | <b>0.44166</b>  | <b>10.24</b>           | <b>36.40</b>         | <b>34.98</b> | <b>46.64</b>          | <b>45.22</b> | <b>57.03</b> | <b>47.03</b> | <b>-10.39</b> | <b>-1.81</b> |
| 5                         | 0.93516         | 10.28                  | 25.37                | 15.81        | 35.65                 | 26.09        | 56.00        | 46.00        | -20.35        | -19.91       |
| 6                         | 13.10156        | 10.99                  | 25.11                | 20.70        | 36.10                 | 31.69        | 60.00        | 50.00        | -23.90        | -18.31       |

#### Remarks:

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

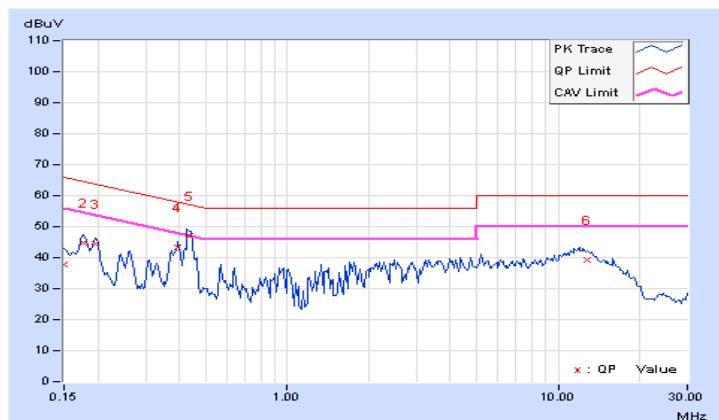


|       |             |                   |                                   |
|-------|-------------|-------------------|-----------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) /<br>Average (AV) |
|-------|-------------|-------------------|-----------------------------------|

| Phase Of Power : Neutral (N) |                    |                              |                         |       |                          |       |                 |       |                |        |
|------------------------------|--------------------|------------------------------|-------------------------|-------|--------------------------|-------|-----------------|-------|----------------|--------|
| No                           | Frequency<br>(MHz) | Correction<br>Factor<br>(dB) | Reading Value<br>(dBuV) |       | Emission Level<br>(dBuV) |       | Limit<br>(dBuV) |       | Margin<br>(dB) |        |
|                              |                    |                              | Q.P.                    | AV.   | Q.P.                     | AV.   | Q.P.            | AV.   | Q.P.           | AV.    |
| 1                            | 0.15000            | 10.28                        | 27.39                   | 22.52 | 37.67                    | 32.80 | 66.00           | 56.00 | -28.33         | -23.20 |
| 2                            | 0.17734            | 10.25                        | 34.44                   | 31.19 | 44.69                    | 41.44 | 64.61           | 54.61 | -19.92         | -13.17 |
| 3                            | 0.19687            | 10.22                        | 34.20                   | 30.93 | 44.42                    | 41.15 | 63.74           | 53.74 | -19.32         | -12.59 |
| 4                            | 0.39609            | 10.30                        | 33.00                   | 29.96 | 43.30                    | 40.26 | 57.93           | 47.93 | -14.63         | -7.67  |
| 5                            | 0.43859            | 10.31                        | 36.63                   | 34.90 | 46.94                    | 45.21 | 57.09           | 47.09 | -10.15         | -1.88  |
| 6                            | 12.73047           | 11.02                        | 28.10                   | 23.48 | 39.12                    | 34.50 | 60.00           | 50.00 | -20.88         | -15.50 |

**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 Conducted Out of Band Emission Measurement

#### 4.3.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

#### 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 Test Procedures

##### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

##### MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

#### 4.3.5 Deviation from Test Standard

No deviation.

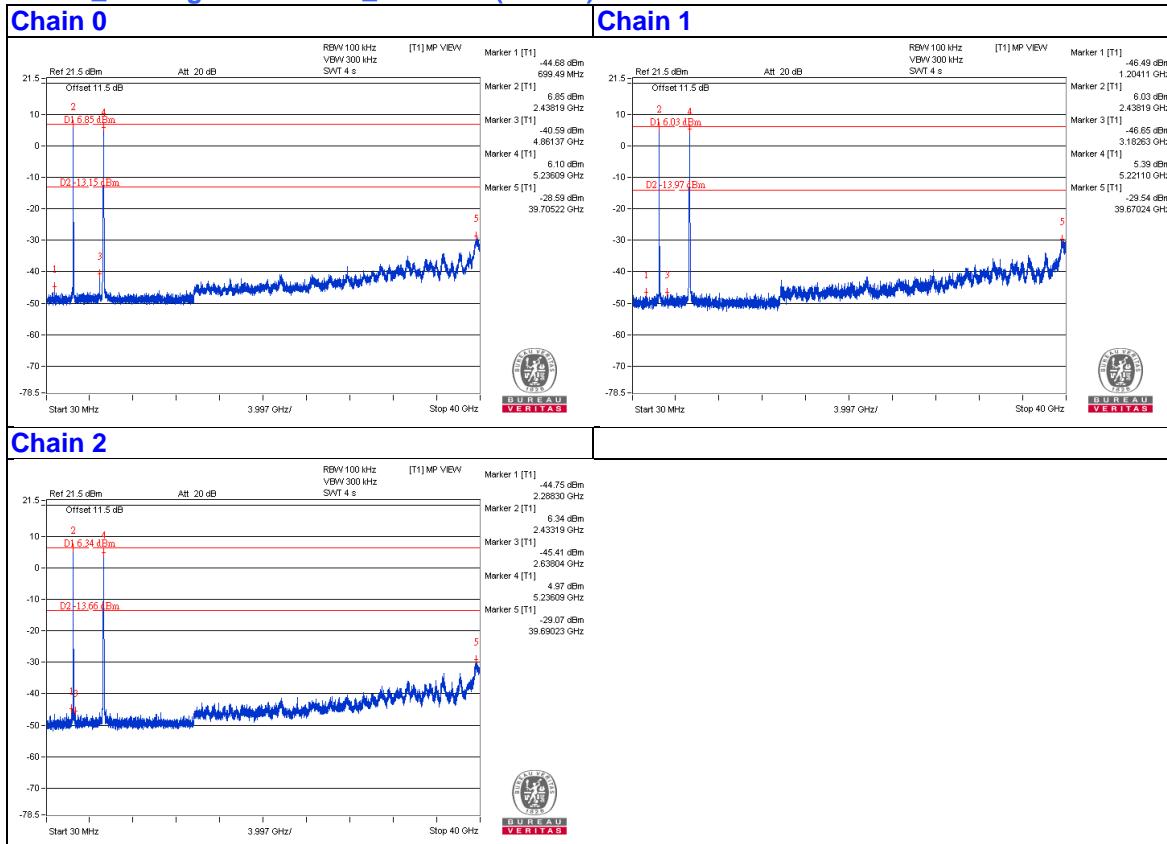
#### 4.3.6 EUT Operating Conditions

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

#### 4.3.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

## 2.4GHz\_802.11g CH6 + 5GHz\_802.11ac (VHT40) CH46



## 5 Pictures of Test Arrangements

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

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

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

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