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FCC TEST REPORT

REPORT NO.: RF120301C36
MODEL NO.: SWAN-1
FCC ID: WY7-SWAN1
RECEIVED: Mar. 01, 2012
TESTED: Mar. 21 ~ Mar. 27, 2012
ISSUED: Mar. 28, 2012

APPLICANT: SHIMANO INC.

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Japan, 590-8577

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

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

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

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RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|-------------|-------------------|---------------|
| RF120301C36 | Original release | Mar. 28, 2012 |



1. CERTIFICATION

PRODUCT: Wireless Module

MODEL NO.: SWAN-1

BRAND: SHIMANO

APPLICANT: SHIMANO INC.

TESTED: Mar. 21 ~ Mar. 27, 2012

TEST SAMPLE: ENGINEERING SAMPLE

STANDARDS: FCC Part 15, Subpart C (Section 15.249)

ANSI C63.10-2009

The above equipment (model: SWAN-1) 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 : Andrea Hsia , DATE : Mar. 28, 2012
Andrea Hsia / Specialist

APPROVED BY : Gary Chang , DATE : Mar. 28, 2012
Gary Chang / Technical Manager

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part 15, Subpart C (Section 15.249) | | | |
|---|--|--------|--|
| STANDARD PARAGRAPH | TEST TYPE | RESULT | REMARK |
| 15.207 | Conducted Emission Test | PASS | Meet the requirement of limit. Minimum passing margin is -13.78dB at 0.18125MHz. |
| 15.209 15.249 15.249 (d) | Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209 | PASS | Meet the requirement of limit. Minimum passing margin is -1.6dB at 75.68MHz. |

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| MEASUREMENT | FREQUENCY | UNCERTAINTY |
|---------------------|-----------------|-------------|
| Conducted emissions | 9kHz~30MHz | 2.44 dB |
| Radiated emissions | 30MHz ~ 200MHz | 3.34 dB |
| | 200MHz ~1000MHz | 3.35 dB |
| | 1GHz ~ 18GHz | 2.26 dB |
| | 18GHz ~ 40GHz | 1.94 dB |

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

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

| | |
|----------------------------|----------------------------------|
| EUT | Wireless Module |
| MODEL NO. | SWAN-1 |
| POWER SUPPLY | 3Vdc |
| MODULATION TYPE | GFSK |
| DATA RATE | 1Mbps |
| OPERATING FREQUENCY | 2403 ~ 2480MHz |
| NUMBER OF CHANNEL | 78 |
| ANTENNA TYPE | Monopoleantenna with 1.3dBi gain |
| DATA CABLE | NA |
| I/O PORTS | Refer to user's manual |
| ACCESSORY DEVICES | NA |

NOTE:

1. The EUT has transmitter and receiver functions.
2. The above EUT information is declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 DESCRIPTION OF TEST MODES

78 channels are provided to this EUT:

| CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) |
|---------|-------------|---------|-------------|---------|-------------|---------|-------------|
| 1 | 2403 | 21 | 2423 | 41 | 2443 | 61 | 2463 |
| 2 | 2404 | 22 | 2424 | 42 | 2444 | 62 | 2464 |
| 3 | 2405 | 23 | 2425 | 43 | 2445 | 63 | 2465 |
| 4 | 2406 | 24 | 2426 | 44 | 2446 | 64 | 2466 |
| 5 | 2407 | 25 | 2427 | 45 | 2447 | 65 | 2467 |
| 6 | 2408 | 26 | 2428 | 46 | 2448 | 66 | 2468 |
| 7 | 2409 | 27 | 2429 | 47 | 2449 | 67 | 2469 |
| 8 | 2410 | 28 | 2430 | 48 | 2450 | 68 | 2470 |
| 9 | 2411 | 29 | 2431 | 49 | 2451 | 69 | 2471 |
| 10 | 2412 | 30 | 2432 | 50 | 2452 | 70 | 2472 |
| 11 | 2413 | 31 | 2433 | 51 | 2453 | 71 | 2473 |
| 12 | 2414 | 32 | 2434 | 52 | 2454 | 72 | 2474 |
| 13 | 2415 | 33 | 2435 | 53 | 2455 | 73 | 2475 |
| 14 | 2416 | 34 | 2436 | 54 | 2456 | 74 | 2476 |
| 15 | 2417 | 35 | 2437 | 55 | 2457 | 75 | 2477 |
| 16 | 2418 | 36 | 2438 | 56 | 2458 | 76 | 2478 |
| 17 | 2419 | 37 | 2439 | 57 | 2459 | 77 | 2479 |
| 18 | 2420 | 38 | 2440 | 58 | 2460 | 78 | 2480 |
| 19 | 2421 | 39 | 2441 | 59 | 2461 | | |
| 20 | 2422 | 40 | 2442 | 60 | 2462 | | |

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

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

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

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

RADIATED EMISSION TEST (ABOVE 1 GHz):

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

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|-------------------|----------------|-----------------|
| 1 to 78 | 1, 38, 78 | GFSK |

RADIATED EMISSION TEST (BELOW 1 GHz):

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

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|-------------------|----------------|-----------------|
| 1 to 78 | 1 | GFSK |

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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|-------------------|----------------|-----------------|
| 1 to 78 | 1 | GFSK |

TEST CONDITION:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|-------------|------------|
| RE \geq 1G | 24deg. C, 68%RH | 5.0Vdc | Aska Huang |
| RE $<$ 1G | 25deg. C, 65%RH | 5.0Vdc | Aska Huang |

3.3 DESCRIPTION OF SUPPORT UNITS

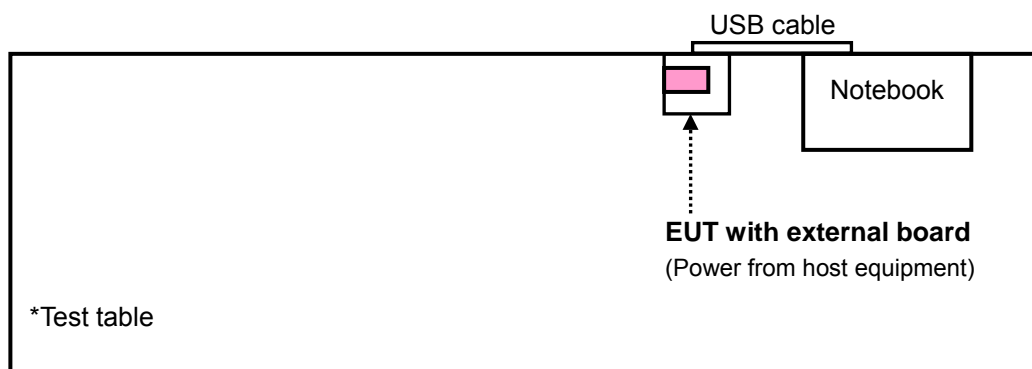
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|-----|----------------|-------|-----------|------------|--------|
| 1. | NOTEBOOK | DELL | E5420 | 33MLMQ1 | NA |
| 2 | EXTERNAL BOARD | NA | NA | NA | NA |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|-----|---|
| 1. | NA |
| 2 | 1.8m non-shielded cable without core |

- NOTE:** 1. All power cords of the above support units are non shielded (1.8m).
 2. Item 2 & USB cable were supplied from client.

3.3.1 CONFIGURATION OF SYSTEM UNDER TEST



3.4 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 C (Section 15.249)

ANSI C63.10-2009

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

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

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BAND EDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

| Fundamental Frequency | Field Strength of Fundamental (millivolts/meter) | Field Strength of Harmonics (microvolts/meter) |
|-----------------------|--|--|
| 902 ~ 928 MHz | 50 | 500 |
| 2400 ~ 2483.5 MHz | 50 | 500 |
| 5725 ~ 5875 MHz | 50 | 500 |
| 24 ~ 24.25 GHz | 250 | 2500 |

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

| Frequencies (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

NOTE:

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



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4.1.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|---|------------------------------|----------------------|---------------------|-------------------------|
| Test Receiver ROHDE & SCHWARZ | ESIB7 | 100212 | Aug. 02, 2011 | Aug. 01, 2012 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSP40 | 100041 | Jul. 21, 2011 | Jul. 20, 2012 |
| BILOG Antenna SCHWARZBECK | VULB9168 | 9168-160 | Apr. 13, 2011 | Apr. 12, 2012 |
| HORN Antenna SCHWARZBECK | 9120D | 209 | Aug. 25, 2011 | Aug. 24, 2012 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | 148 | Jul. 20, 2011 | Jul. 19, 2012 |
| Preamplifier Agilent | 8447D | 2944A10633 | Oct. 29, 2011 | Oct. 28, 2012 |
| Preamplifier Agilent | 8449B | 3008A01964 | Oct. 29, 2011 | Oct. 28, 2012 |
| RF signal cable HUBER+SUHNNER | SUCOFLEX 104 | 250723/4 | Aug. 30, 2011 | Aug. 29, 2012 |
| RF signal cable HUBER+SUHNNER | SUCOFLEX 106 | 12738/6+309224/ 4 | Aug. 30, 2011 | Aug. 29, 2012 |
| Software ADT. | ADT_Radiated_ V7.6.15.9.2 | NA | NA | NA |
| Antenna Tower inn-co GmbH | MA 4000 | 013303 | NA | NA |
| Antenna Tower Controller inn-co GmbH | CO2000 | 017303 | NA | NA |
| Turn Table ADT. | TT100 | TT93021703 | NA | NA |
| Turn Table Controller ADT. | SC100 | SC93021703 | NA | NA |

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

4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

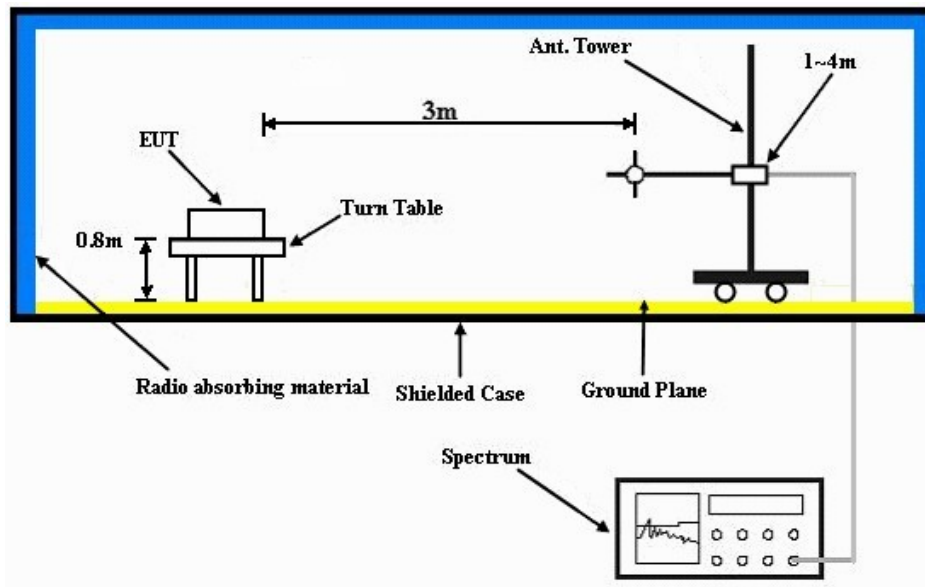
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. 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 the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT OPERATING CONDITIONS

- a. Connected the EUT with Notebook via USB cable and placed on a testing table.
- b. Set the EUT under transmission condition continuously at specific channel frequency.



4.1.7 TEST RESULTS

ABOVE 1GHz DATA

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|--------------------------|-----------------|--------------------|---------------------------|
| CHANNEL | Channel 1 | FREQUENCY RANGE | 1 ~ 25GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK) Average (AV) |
| ENVIRONMENTAL CONDITIONS | 24deg. C, 68%RH | TESTED BY | Aska Huang |

| 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 | 2390.00 | 52.7 PK | 74.0 | -21.3 | 1.04 H | 28 | 21.40 | 31.30 |
| 2 | 2390.00 | 30.8 AV | 54.0 | -23.2 | 1.04 H | 28 | -0.50 | 31.30 |
| 3 | 2398.00 | 54.3 PK | 74.0 | -19.7 | 1.04 H | 28 | 23.00 | 31.30 |
| 4 | 2398.00 | 32.6 AV | 54.0 | -21.4 | 1.04 H | 28 | 1.30 | 31.30 |
| 5 | 2400.00 | 68.8 PK | 74.0 | -5.2 | 1.04 H | 28 | 37.50 | 31.30 |
| 6 | 2400.00 | 38.9 AV | 54.0 | -15.1 | 1.04 H | 28 | 7.60 | 31.30 |
| 7 | *2403.00 | 95.0 PK | 114.0 | -19.0 | 1.04 H | 28 | 63.60 | 31.40 |
| 8 | *2403.00 | 65.1 AV | 94.0 | -28.9 | 1.04 H | 28 | 33.70 | 31.40 |
| 9 | 4806.00 | 59.4 PK | 74.0 | -14.6 | 1.31 H | 43 | 22.20 | 37.20 |
| 10 | 4806.00 | 29.5 AV | 54.0 | -24.5 | 1.31 H | 43 | -7.70 | 37.20 |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | |
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | 2390.00 | 51.9 PK | 74.0 | -22.1 | 1.24 V | 181 | 20.60 | 31.30 |
| 2 | 2390.00 | 29.4 AV | 54.0 | -24.6 | 1.24 V | 181 | -1.90 | 31.30 |
| 3 | 2398.00 | 52.7 PK | 74.0 | -21.3 | 1.24 V | 181 | 21.40 | 31.30 |
| 4 | 2398.00 | 30.8 AV | 54.0 | -23.2 | 1.24 V | 181 | -0.50 | 31.30 |
| 5 | 2400.00 | 65.7 PK | 74.0 | -8.3 | 1.24 V | 181 | 34.40 | 31.30 |
| 6 | 2400.00 | 35.8 AV | 54.0 | -18.2 | 1.24 V | 181 | 4.50 | 31.30 |
| 7 | *2403.00 | 91.7 PK | 114.0 | -22.3 | 1.24 V | 181 | 60.30 | 31.40 |
| 8 | *2403.00 | 61.8 AV | 94.0 | -32.2 | 1.24 V | 181 | 30.40 | 31.40 |
| 9 | 4806.00 | 59.3 PK | 74.0 | -14.7 | 1.00 V | 163 | 22.10 | 37.20 |
| 10 | 4806.00 | 29.4 AV | 54.0 | -24.6 | 1.00 V | 163 | -7.80 | 37.20 |

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
 2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. “ * ” : Fundamental frequency
 6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (0.246 \text{ ms} \times 13 / 100 \text{ ms}) = -29.9 \text{ dB}$
Please see page 17 for plotted duty.



| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|--------------------------|-----------------|--------------------|---------------------------|
| CHANNEL | Channel 38 | FREQUENCY RANGE | 1 ~ 25GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK) Average (AV) |
| ENVIRONMENTAL CONDITIONS | 24deg. C, 68%RH | TESTED BY | Aska Huang |

| 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 | *2440.00 | 95.6 PK | 114.0 | -18.4 | 1.68 H | 85 | 64.10 | 31.50 |
| 2 | *2440.00 | 65.7 AV | 94.0 | -28.3 | 1.68 H | 85 | 34.20 | 31.50 |
| 3 | 4880.00 | 58.6 PK | 74.0 | -15.4 | 1.72 H | 52 | 21.30 | 37.30 |
| 4 | 4880.00 | 28.7 AV | 54.0 | -25.3 | 1.72 H | 52 | -8.60 | 37.30 |
| 5 | 7320.00 | 53.8 PK | 74.0 | -20.2 | 1.48 H | 327 | 10.30 | 43.50 |
| 6 | 7320.00 | 23.9 AV | 54.0 | -30.1 | 1.48 H | 327 | -19.60 | 43.50 |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | |
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *2440.00 | 92.0 PK | 114.0 | -22.0 | 1.47 V | 218 | 60.50 | 31.50 |
| 2 | *2440.00 | 62.1 AV | 94.0 | -31.9 | 1.47 V | 218 | 30.60 | 31.50 |
| 3 | 4880.00 | 59.5 PK | 74.0 | -14.5 | 1.09 V | 171 | 22.20 | 37.30 |
| 4 | 4880.00 | 29.6 AV | 54.0 | -24.4 | 1.09 V | 171 | -7.70 | 37.30 |
| 5 | 7320.00 | 50.4 PK | 74.0 | -23.6 | 1.05 V | 337 | 6.90 | 43.50 |
| 6 | 7320.00 | 20.5 AV | 54.0 | -33.5 | 1.05 V | 337 | -23.00 | 43.50 |

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
 2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. “ * “ : Fundamental frequency
 6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (0.246 \text{ ms} \times 13 / 100 \text{ ms}) = -29.9 \text{ dB}$
Please see page 17 for plotted duty.



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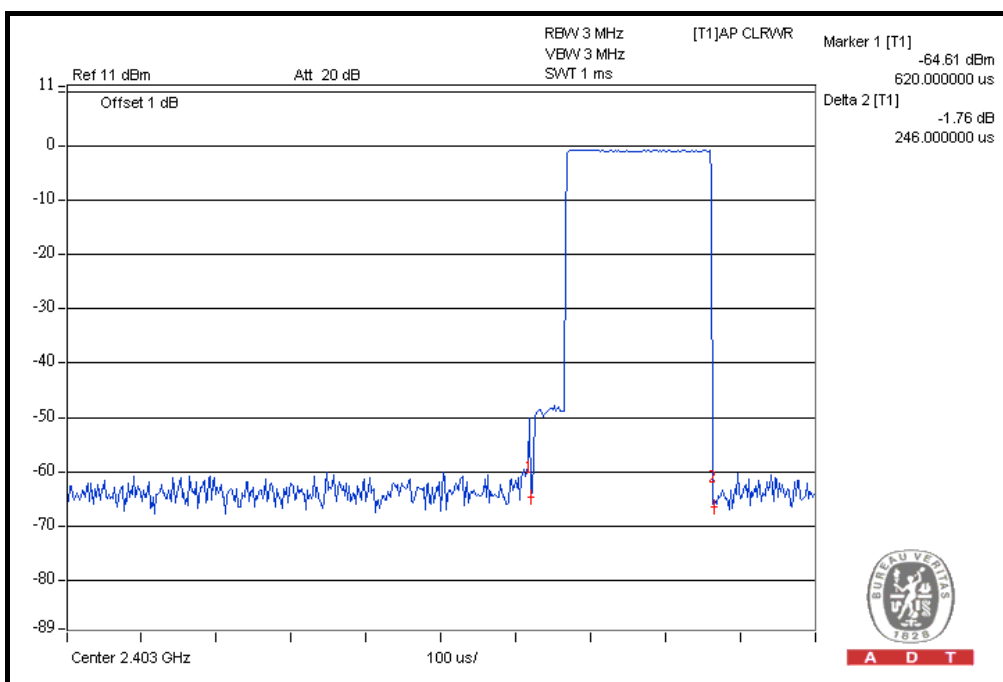
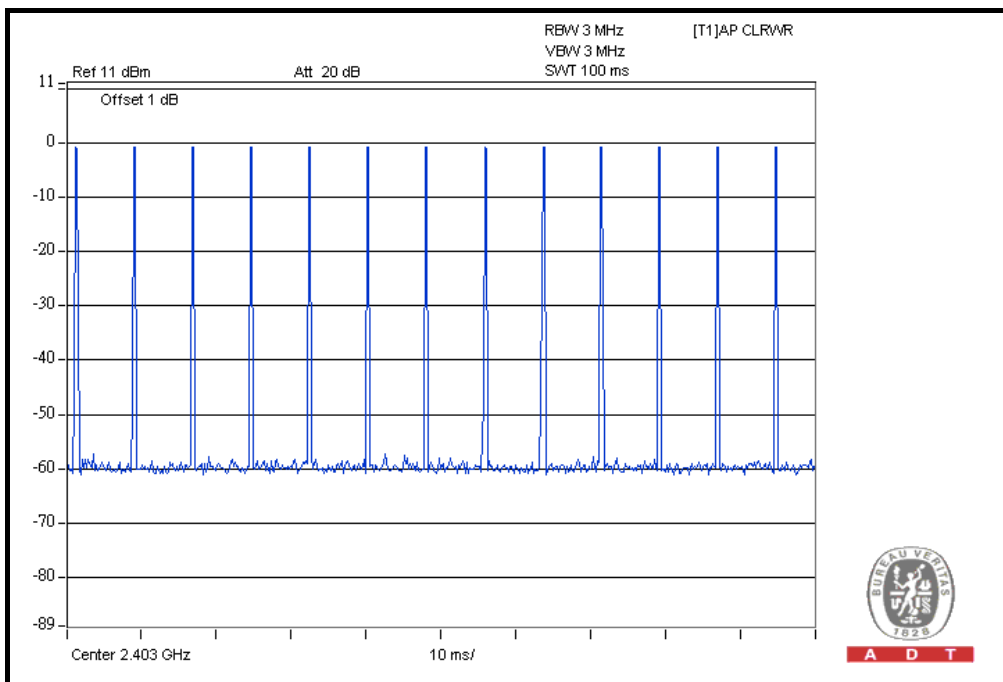
| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|--------------------------|-----------------|--------------------|---------------------------|
| CHANNEL | Channel 78 | FREQUENCY RANGE | 1 ~ 25GHz |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | DETECTOR FUNCTION | Peak (PK) Average (AV) |
| ENVIRONMENTAL CONDITIONS | 24deg. C, 68%RH | TESTED BY | Aska Huang |

| 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 | *2480.00 | 96.2 PK | 114.0 | -17.8 | 1.89 H | 84 | 64.60 | 31.60 |
| 2 | *2480.00 | 66.3 AV | 94.0 | -27.7 | 1.89 H | 84 | 34.70 | 31.60 |
| 3 | 2483.50 | 70.0 PK | 74.0 | -4.0 | 1.89 H | 84 | 38.40 | 31.60 |
| 4 | 2483.50 | 40.1 AV | 54.0 | -13.9 | 1.89 H | 84 | 8.50 | 31.60 |
| 5 | 2485.50 | 65.6 PK | 74.0 | -8.4 | 1.89 H | 84 | 34.00 | 31.60 |
| 6 | 2485.50 | 33.4 AV | 54.0 | -20.6 | 1.89 H | 84 | 1.80 | 31.60 |
| 7 | 4960.00 | 59.4 PK | 74.0 | -14.6 | 1.81 H | 65 | 21.90 | 37.50 |
| 8 | 4960.00 | 29.5 AV | 54.0 | -24.5 | 1.81 H | 65 | -8.00 | 37.50 |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | |
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | *2480.00 | 92.5 PK | 114.0 | -21.5 | 1.50 V | 212 | 60.90 | 31.60 |
| 2 | *2480.00 | 62.6 AV | 94.0 | -31.4 | 1.50 V | 212 | 31.00 | 31.60 |
| 3 | 2483.50 | 65.0 PK | 74.0 | -9.0 | 1.50 V | 212 | 33.40 | 31.60 |
| 4 | 2483.50 | 35.1 AV | 54.0 | -18.9 | 1.50 V | 212 | 3.50 | 31.60 |
| 5 | 2485.50 | 61.1 PK | 74.0 | -12.9 | 1.50 V | 212 | 29.50 | 31.60 |
| 6 | 2485.50 | 30.9 AV | 54.0 | -23.1 | 1.50 V | 212 | -0.70 | 31.60 |
| 7 | 4960.00 | 59.1 PK | 74.0 | -14.9 | 1.07 V | 157 | 21.60 | 37.50 |
| 8 | 4960.00 | 29.2 AV | 54.0 | -24.8 | 1.07 V | 157 | -8.30 | 37.50 |

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
 2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. “ * “ : Fundamental frequency
 6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (0.246 \text{ ms} \times 13 / 100 \text{ ms}) = -29.9 \text{ dB}$
Please see page 17 for plotted duty.



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$$20 \log (\text{Duty cycle}) = 20 \log (0.246\text{ms} \times 13 / 100 \text{ ms}) = -29.9 \text{ dB}$$



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BELOW 1GHz WORST-CASE DATA

| EUT TEST CONDITION | | MEASUREMENT DETAIL | |
|--------------------------|-----------------|--------------------|---------------|
| CHANNEL | Channel 1 | FREQUENCY RANGE | Below 1000MHz |
| INPUT POWER (SYSTEM) | 5.0Vdc | DETECTOR FUNCTION | Quasi-Peak |
| ENVIRONMENTAL CONDITIONS | 25deg. C, 65%RH | TESTED BY | Aska Huang |

| 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 | 75.68 | 38.4 QP | 40.0 | -1.6 | 1.64 H | 26 | 27.40 | 11.00 |
| 2 | 96.09 | 39.5 QP | 43.5 | -4.0 | 2.00 H | 9 | 30.50 | 9.00 |
| 3 | 239.94 | 36.5 QP | 46.0 | -9.5 | 1.00 H | 253 | 23.90 | 12.60 |
| 4 | 335.19 | 30.4 QP | 46.0 | -15.6 | 1.00 H | 5 | 14.50 | 15.90 |
| 5 | 527.64 | 33.8 QP | 46.0 | -12.2 | 1.50 H | 290 | 13.30 | 20.50 |
| 6 | 667.60 | 37.1 QP | 46.0 | -8.9 | 1.00 H | 249 | 14.40 | 22.70 |

| 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 | 35.73 | 29.2 QP | 40.0 | -10.8 | 1.25 V | 68 | 16.20 | 13.00 |
| 2 | 74.62 | 38.4 QP | 40.0 | -1.6 | 2.00 V | 273 | 27.20 | 11.20 |
| 3 | 335.15 | 27.7 QP | 46.0 | -18.3 | 1.25 V | 238 | 11.80 | 15.90 |
| 4 | 432.37 | 29.5 QP | 46.0 | -16.5 | 1.00 V | 330 | 11.20 | 18.30 |
| 5 | 527.64 | 29.7 QP | 46.0 | -16.3 | 1.50 V | 331 | 9.20 | 20.50 |
| 6 | 667.63 | 32.7 QP | 46.0 | -13.3 | 1.25 V | 229 | 10.00 | 22.70 |

- 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.

4.2 CONDUCTED EMISSION MEASUREMENT

4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dB μ V) | |
|-----------------------------|------------------------------|----------|
| | Quasi-peak | Average |
| 0.15 ~ 0.5 | 66 to 56 | 56 to 46 |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

- NOTE:** 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|----------------------------------|---------------------|----------------|---------------------|-------------------------|
| Test Receiver ROHDE & SCHWARZ | ESCS30 | 100289 | Nov. 19, 2011 | Nov. 18, 2012 |
| RF signal cable Woken | 5D-FB | Cable-HYCO2-01 | Dec. 22, 2011 | Dec. 21, 2012 |
| LISN ROHDE & SCHWARZ | ESH2-Z5 | 100100 | Dec. 30, 2011 | Dec. 29, 2012 |
| LISN ROHDE & SCHWARZ | ESH3-Z5 | 100312 | Jul. 07, 2011 | Jul. 06, 2012 |
| V-LISN SCHWARZBECK | NNBL 8226-2 | 8226-142 | Jun. 30, 2011 | Jun. 29, 2012 |
| LISN ROHDE & SCHWARZ | ENV216 | 100072 | Jun. 10, 2011 | Jun. 09, 2012 |
| Software ADT | ADT_Cond_ V7.3.7 | NA | NA | NA |

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 2.
3. The VCCI Site Registration No. is C-2047.

4.2.3 TEST PROCEDURES

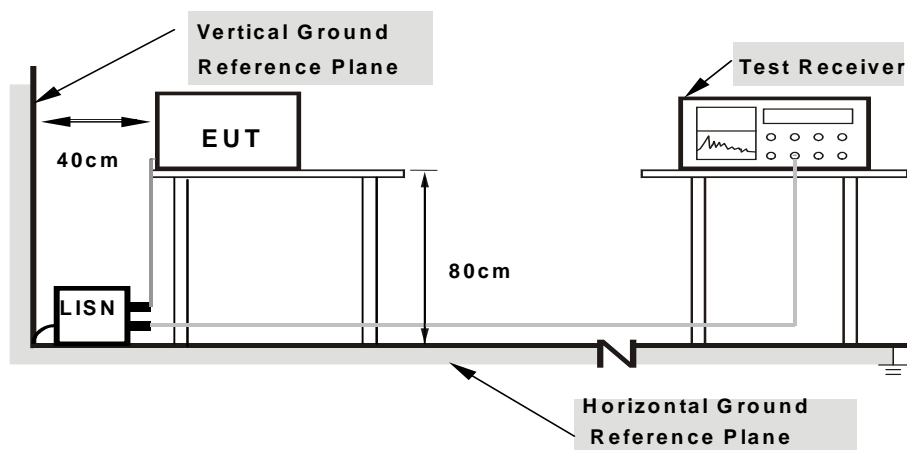
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6.

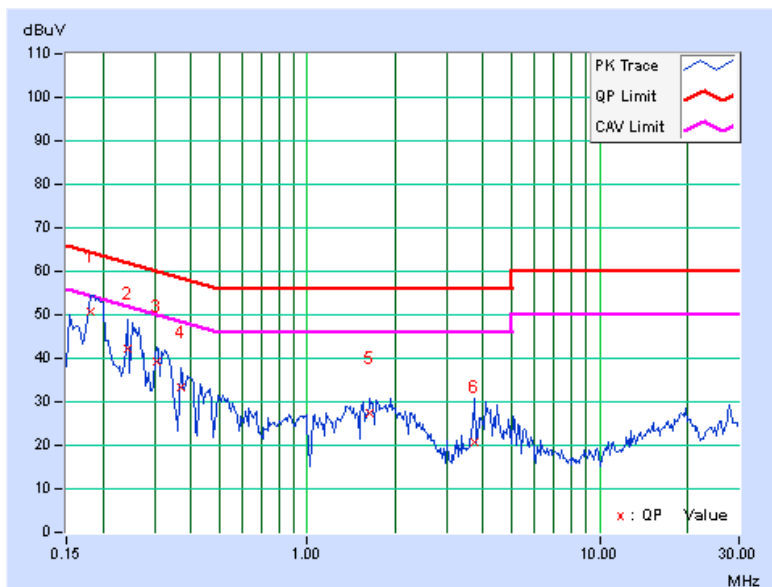
4.2.7 TEST RESULTS

CONDUCTED WORST-CASE DATA :

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

| No | Freq. [MHz] | Corr. Factor (dB) | Reading Value | | Emission Level | | Limit | | Margin | |
|----|----------------|-------------------------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
| | | | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.18125 | 0.15 | 50.50 | 29.80 | 50.65 | 29.95 | 64.43 | 54.43 | -13.78 | -24.48 |
| 2 | 0.24375 | 0.15 | 41.99 | 23.28 | 42.14 | 23.43 | 61.97 | 51.97 | -19.82 | -28.53 |
| 3 | 0.30625 | 0.16 | 38.95 | 21.98 | 39.11 | 22.14 | 60.07 | 50.07 | -20.96 | -27.93 |
| 4 | 0.36875 | 0.17 | 33.05 | 11.93 | 33.22 | 12.10 | 58.53 | 48.53 | -25.31 | -36.43 |
| 5 | 1.63672 | 0.23 | 27.08 | 11.85 | 27.31 | 12.08 | 56.00 | 46.00 | -28.69 | -33.92 |
| 6 | 3.73828 | 0.33 | 20.33 | 6.37 | 20.66 | 6.70 | 56.00 | 46.00 | -35.34 | -39.30 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.



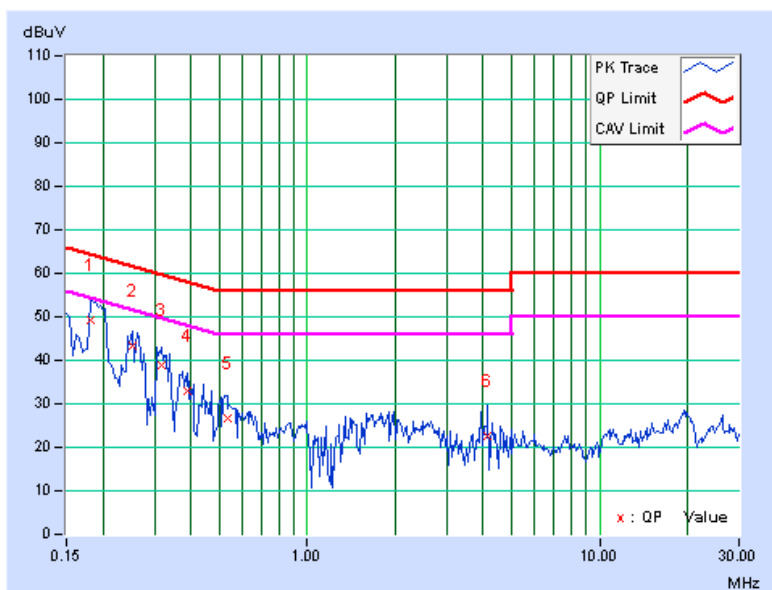


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| | | | |
|-------|--------|---------------|------|
| PHASE | Line 2 | 6dB BANDWIDTH | 9kHz |
|-------|--------|---------------|------|

| No | Freq. [MHz] | Corr. Factor (dB) | Reading Value | | Emission Level | | Limit | | Margin | |
|----|----------------|-------------------------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
| | | | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.18125 | 0.14 | 48.98 | 27.89 | 49.12 | 28.03 | 64.43 | 54.43 | -15.31 | -26.40 |
| 2 | 0.25156 | 0.15 | 43.06 | 27.96 | 43.21 | 28.11 | 61.71 | 51.71 | -18.50 | -23.60 |
| 3 | 0.31797 | 0.15 | 38.72 | 24.01 | 38.87 | 24.16 | 59.76 | 49.76 | -20.89 | -25.60 |
| 4 | 0.38828 | 0.16 | 32.72 | 12.97 | 32.88 | 13.13 | 58.10 | 48.10 | -25.22 | -34.97 |
| 5 | 0.53281 | 0.17 | 26.59 | 10.00 | 26.76 | 10.17 | 56.00 | 46.00 | -29.24 | -35.83 |
| 6 | 4.12109 | 0.35 | 22.10 | 4.04 | 22.45 | 4.39 | 56.00 | 46.00 | -33.55 | -41.61 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.



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.

Copies of accreditation and authorization certificates of our laboratories obtained from approval agencies can be downloaded from our web site:

<http://www.adt.com.tw/index.5.phtml>. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab

Tel: 886-3-3183232

Fax: 886-3-3185050

Email: service.adt@tw.bureauveritas.com

Web Site: www.adt.com.tw

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

7. APPENDIX A – MODIFICATION RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---