



FCC TEST REPORT

REPORT NO.: RF120628D04
MODEL NO.: HKTS 220SUB
FCC ID: APIHKTS220SME
RECEIVED: Jun. 28, 2012
TESTED: Jul. 3 ~ 5, 2012
ISSUED: Jul. 11, 2012

APPLICANT: Harman International Industries, Incorporated

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UNITED STATES

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

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TABLE OF CONTENTS

| | |
|--|----|
| RELEASE CONTROL RECORD | 4 |
| 1. CERTIFICATION | 5 |
| 2. SUMMARY OF TEST RESULTS | 6 |
| 2.1 MEASUREMENT UNCERTAINTY | 6 |
| 3. GENERAL INFORMATION | 7 |
| 3.1 GENERAL DESCRIPTION OF EUT | 7 |
| 3.2 DESCRIPTION OF TEST MODES | 8 |
| 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL | 9 |
| 3.3 DESCRIPTION OF SUPPORT UNITS | 11 |
| 3.3.1 CONFIGURATION OF SYSTEM UNDER TEST | 11 |
| 3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS | 11 |
| 4. TEST TYPES AND RESULTS | 12 |
| 4.1 CONDUCTED EMISSION MEASUREMENT | 12 |
| 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT | 12 |
| 4.1.2 TEST INSTRUMENTS | 12 |
| 4.1.3 TEST PROCEDURES | 13 |
| 4.1.4 DEVIATION FROM TEST STANDARD | 13 |
| 4.1.5 TEST SETUP | 13 |
| 4.1.6 EUT OPERATING CONDITIONS | 14 |
| 4.1.7 TEST RESULTS | 15 |
| 4.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT | 17 |
| 4.2.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT | 17 |
| 4.2.2 TEST INSTRUMENTS | 18 |
| 4.2.3 TEST PROCEDURES | 19 |
| 4.2.4 DEVIATION FROM TEST STANDARD | 19 |
| 4.2.5 TEST SETUP | 20 |
| 4.2.6 EUT OPERATING CONDITIONS | 20 |
| 4.2.7 TEST RESULTS | 21 |
| 4.3 6DB BANDWIDTH MEASUREMENT | 21 |
| 4.3.1 LIMITS OF 6DB BANDWIDTH MEASUREMENT | 25 |
| 4.3.2 TEST SETUP | 25 |
| 4.3.3 TEST INSTRUMENTS | 25 |
| 4.3.4 TEST PROCEDURE | 25 |
| 4.3.5 DEVIATION FROM TEST STANDARD | 25 |
| 4.3.6 EUT OPERATING CONDITIONS | 25 |
| 4.3.7 TEST RESULTS | 26 |
| 4.4 CONDUCTED OUTPUT POWER | 27 |
| 4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT | 27 |
| 4.4.2 TEST SETUP | 27 |
| 4.4.3 TEST INSTRUMENTS | 27 |
| 4.4.4 TEST PROCEDURES | 27 |
| 4.4.5 DEVIATION FROM TEST STANDARD | 27 |



| | | |
|-------|--|----|
| 4.4.6 | EUT OPERATING CONDITIONS..... | 27 |
| 4.4.7 | TEST RESULTS..... | 28 |
| 4.5 | POWER SPECTRAL DENSITY MEASUREMENT..... | 29 |
| 4.5.1 | LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT | 29 |
| 4.5.2 | TEST SETUP..... | 29 |
| 4.5.3 | TEST INSTRUMENTS | 29 |
| 4.5.4 | TEST PROCEDURE | 29 |
| 4.5.5 | DEVIATION FROM TEST STANDARD | 29 |
| 4.5.6 | EUT OPERATING CONDITION | 29 |
| 4.5.7 | TEST RESULTS..... | 30 |
| 4.6 | CONDUCTED OUT OF BAND EMISSION MEASUREMENT..... | 31 |
| 4.6.1 | LIMITS OF CONDUCTED OUT OF BAND EMISSION MEASUREMENT | 31 |
| 4.6.2 | TEST SETUP..... | 31 |
| 4.6.3 | TEST INSTRUMENTS | 31 |
| 4.6.4 | TEST PROCEDURE | 31 |
| 4.6.5 | DEVIATION FROM TEST STANDARD | 32 |
| 4.6.6 | EUT OPERATING CONDITION | 32 |
| 4.6.7 | TEST RESULTS..... | 32 |
| 5. | PHOTOGRAPHS OF THE TEST CONFIGURATION..... | 34 |
| 6. | INFORMATION ON THE TESTING LABORATORIES..... | 35 |
| 7. | APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB..... | 36 |



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RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|-------------|-------------------|---------------|
| RF120628D04 | Original release | Jul. 11, 2012 |



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1. CERTIFICATION

PRODUCT: Home Theater Subwoofer
MODEL NO.: HKTS 220SUB
APPLICANT: Harman International Industries, Incorporated
TESTED: Jul. 3 ~ 5, 2012
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: **FCC Part 15, Subpart C (Section 15.247)**
ANSI C63.10-2009

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 : Jessica Cheng, **DATE:** Jul. 11, 2012
(Jessica Cheng / Specialist)

APPROVED BY : Ken Liu, **DATE:** Jul. 11, 2012
(Ken Liu / Manager)

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) | | | |
|---|-----------------------------|--------|--|
| STANDARD SECTION | TEST TYPE | RESULT | REMARK |
| 15.207 | AC Power Conducted Emission | PASS | Meet the requirement of limit. Minimum passing margin is -23.08dB at 0.15000MHz. |
| 15.247(d) 15.209 | Radiated Emissions | PASS | Meet the requirement of limit. Minimum passing margin is -1.4dB at 4806.00MHz. |
| 15.247(d) | Band Edge Measurement | PASS | Meet the requirement of limit. |
| 15.247(a)(2) | 6dB bandwidth | PASS | Meet the requirement of limit. |
| 15.247(b) | Conducted power | PASS | Meet the requirement of limit. |
| 15.247(e) | Power Spectral Density | PASS | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | PASS | No antenna connector is used. |

2.1 MEASUREMENT UNCERTAINTY

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

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

| MEASUREMENT | FREQUENCY | UNCERTAINTY |
|---------------------|----------------|-------------|
| Conducted emissions | 150kHz ~ 30MHz | 3.43 dB |
| Radiated emissions | 30MHz ~ 1GHz | 3.78 dB |
| | Above 1GHz | 3.36 dB |



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

| | |
|---------------------|----------------------------------|
| EUT | Home Theater Subwoofer |
| MODEL NO. | HKTS 220SUB |
| POWER SUPPLY | 5Vdc from AC adapter |
| MODULATION TYPE | FSK |
| OPERATING FREQUENCY | 2403~2478MHz |
| NUMBER OF CHANNEL | 26 |
| OUTPUT POWER | 10.2mW |
| ANTENNA TYPE | Dipole antenna with 1.53dBi gain |
| ANTENNA CONNECTOR | N/A |
| DATA CABLE | N/A |
| I/O PORTS | Refer to user's manual |
| ACCESSORY DEVICES | Refer to note as below |

NOTE:

1. The EUT is a Home Theater Subwoofer, which including TX Box and Speaker (RX).
2. The EUT consumes power from the following AC adapters as follows:

| Adapter | BRAND | MODEL NO. | SPEC. |
|---------|------------------------------|----------------|---|
| 1 | 3Y SWITCHING ADAPTER | GQ30-050100-E2 | AC I/P: 100-240V, 50/60Hz, 1.0A DC O/P: 5V/1.0A Non-shielded AC 2-pin (1.8m) Non-shielded DC (1.7m) with one ferrite core |
| 2 | GOLDEN PROEFIT ELECTRONIC LT | GPE152-050100W | AC I/P: 100-240V, 50/60Hz, 0.45A DC O/P: 5V/1000mA Non-shielded AC 2-pin (1.8m) Non-shielded DC (1.9m) with one ferrite core |

After pre-tested, the **Adapter 1** was the worse case and only its test data was recorded in this report

3. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 DESCRIPTION OF TEST MODES

26 channels are provided to this EUT:

| GROUP1: | | GROUP2: | | GROUP3: | |
|---------|-------------|---------|-------------|---------|-------------|
| CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) |
| 0 | 2403 | 1 | 2406 | 2 | 2409 |
| 3 | 2412 | 4 | 2415 | 5 | 2418 |
| 6 | 2421 | 7 | 2424 | 8 | 2427 |
| 9 | 2430 | 10 | 2433 | 11 | 2436 |
| 12 | 2439 | 13 | 2442 | 14 | 2445 |
| 15 | 2448 | 16 | 2451 | 17 | 2454 |
| 18 | 2457 | 19 | 2460 | 20 | 2463 |
| 21 | 2466 | 22 | 2469 | 23 | 2472 |
| 24 | 2475 | 25 | 2478 | 25 | 2478 |

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

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

Where **RE[≥]1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **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.

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 0 to 25 | 0, 12, 25 | FSK |

RADIATED EMISSION TEST (BELOW 1GHz):

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 0 to 25 | 0 | FSK |

POWER LINE CONDUCTED EMISSION TEST:

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 0 to 25 | 0 | FSK |

**BANDEDGE MEASUREMENT:**

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 0 to 25 | 0, 25 | FSK |

ANTENNA PORT CONDUCTED MEASUREMENT:

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

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| - | 0 to 25 | 0, 12, 25 | FSK |

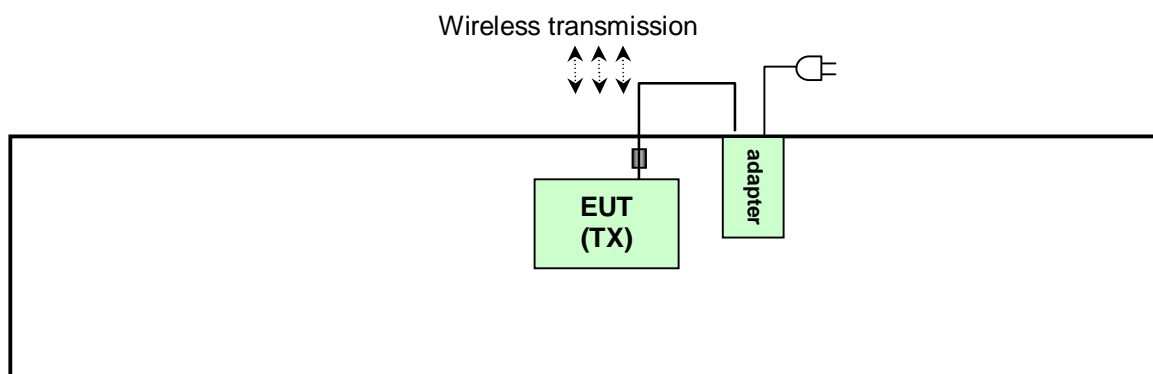
TEST CONDITION:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|--------------------|--------------------------|--------------|------------|
| RE ³ 1G | 26deg. C, 73%RH | 120Vac, 60Hz | Antony Lee |
| RE<1G | 26deg. C, 82%RH | 120Vac, 60Hz | Antony Lee |
| PLC | 26deg. C, 70%RH | 120Vac, 60Hz | Antony Lee |
| APCM | 25deg. C, 80%RH | 120Vac, 60Hz | Jun Wu |

3.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without any necessary accessory or support unit.

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 (15.247)

ANSI C63.10-2009

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

NOTE: The product 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 CONDUCTED EMISSION MEASUREMENT

4.1.1 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. 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.

4.1.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|--|-----------------|--------------|-----------------|------------------|
| ROHDE & SCHWARZ Test Receiver | ESCS 30 | 100276 | Jan. 04, 2012 | Jan. 03, 2013 |
| ROHDE & SCHWARZ Artificial Mains Network (for EUT) | ESH3-Z5 | 100219 | Nov. 24, 2011 | Nov. 23, 2012 |
| LISN With Adapter (for EUT) | AD10 | C10Ada-001 | Nov. 24, 2011 | Nov. 23, 2012 |
| ROHDE & SCHWARZ Artificial Mains Network (for peripherals) | ESH3-Z5 | 100218 | Dec. 08, 2011 | Dec. 07, 2012 |
| Software | ADT_Cond_V7.3.7 | NA | NA | NA |
| Software | ADT_ISN_V7.3.7 | NA | NA | NA |
| RF cable (JYEBAO) | 5D-FB | Cable-C10.01 | Feb. 20, 2012 | Feb. 19, 2013 |
| SUHNER Terminator (For ROHDE & SCHWARZ LISN) | 65BNC-5001 | E1-010773 | Feb. 22, 2012 | Feb. 21, 2013 |

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in Shielded Room No. 10.
 3. The VCCI Site Registration No. C-1852.

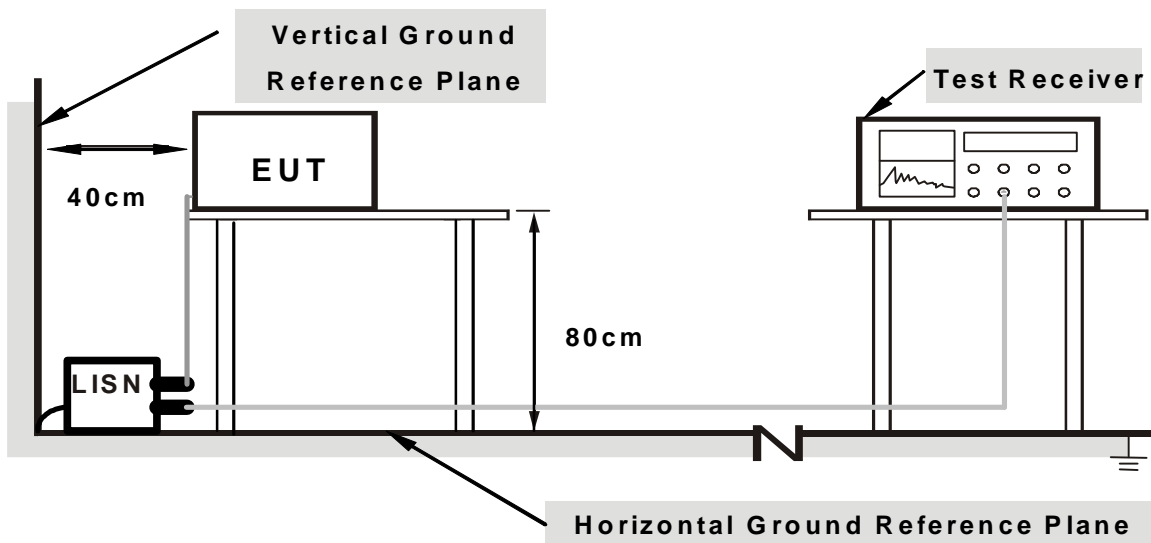
4.1.3 TEST PROCEDURES

- 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. 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.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 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 related item – Photographs of the Test Configuration.



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4.1.6 EUT OPERATING CONDITIONS

- a. Connected the EUT with AC adapter placed on testing table.
- b. Turn on the power of all equipment.
- c. EUT ran a test program (provided by manufacture) to enable it under transmitting condition at specific channel continuously.

4.1.7 TEST RESULTS

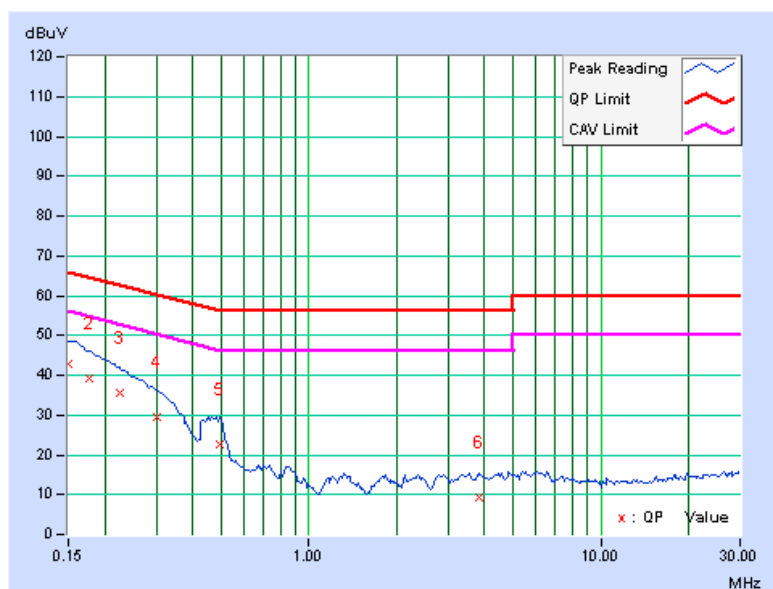
CONDUCTED WORST CASE DATA

| | | | |
|----------------|-----------|----------------------|-------|
| PHASE | Line 1 | 6dB BANDWIDTH | 9 kHz |
| CHANNEL | Channel 0 | | |

| No | Freq. [MHz] | Corr. Factor (dB) | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|----|----------------|-------------------------|----------------------------|---------|-----------------------------|-------|--------------------|-------|----------------|-------|
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| | | | 1 | 0.15000 | 0.15 | 42.77 | - | 42.92 | - | 66.00 |
| 2 | 0.17734 | 0.15 | 39.15 | - | 39.30 | - | 64.61 | 54.61 | -25.31 | - |
| 3 | 0.22422 | 0.15 | 35.24 | - | 35.39 | - | 62.66 | 52.66 | -27.27 | - |
| 4 | 0.30234 | 0.17 | 29.37 | - | 29.54 | - | 60.18 | 50.18 | -30.64 | - |
| 5 | 0.49766 | 0.20 | 22.44 | - | 22.64 | - | 56.04 | 46.04 | -33.40 | - |
| 6 | 3.85156 | 0.41 | 9.03 | - | 9.44 | - | 56.00 | 46.00 | -46.56 | - |

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.

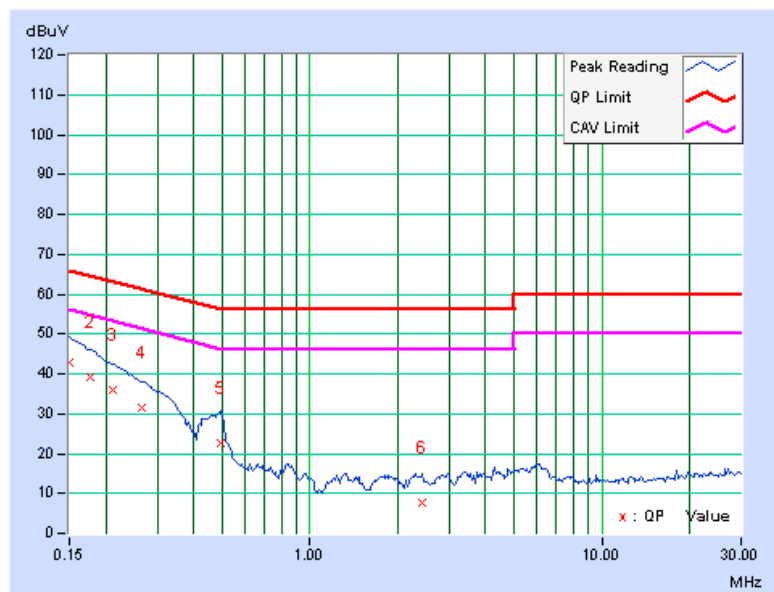


| | | | |
|----------------|-----------|----------------------|-------|
| PHASE | Line 2 | 6dB BANDWIDTH | 9 kHz |
| CHANNEL | Channel 0 | | |

| 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 | 0.15000 | 0.14 | 42.67 | - | 42.81 | - | 66.00 | 56.00 | -23.19 | - |
| 2 | 0.17734 | 0.15 | 39.09 | - | 39.24 | - | 64.61 | 54.61 | -25.37 | - |
| 3 | 0.21250 | 0.15 | 35.87 | - | 36.02 | - | 63.11 | 53.11 | -27.08 | - |
| 4 | 0.26719 | 0.16 | 31.41 | - | 31.57 | - | 61.20 | 51.20 | -29.63 | - |
| 5 | 0.49766 | 0.20 | 22.38 | - | 22.58 | - | 56.04 | 46.04 | -33.46 | - |
| 6 | 2.42188 | 0.30 | 7.32 | - | 7.62 | - | 56.00 | 46.00 | -48.38 | - |

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.





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. 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 (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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4.2.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|------------------------------|------------|-----------------|------------------|
| HP Preamplifier | 8447D | 2432A03504 | Feb. 29, 2012 | Feb. 28, 2013 |
| HP Preamplifier | 8449B | 3008A01201 | Feb. 29, 2012 | Feb. 28, 2013 |
| Agilent Spectrum Analyzer | E4446A | MY46180403 | Jun. 13, 2012 | Jun. 12, 2013 |
| ROHDE & SCHWARZ Test Receiver | ESCS 30 | 838251/021 | Oct. 14, 2011 | Oct. 13, 2012 |
| Schwarzbeck Antenna | VULB 9168 | 137 | Apr. 03, 2012 | Apr. 02, 2013 |
| Schwarzbeck Antenna | VHBA 9123 | 480 | May 22, 2012 | May 21, 2013 |
| ADT. Turn Table | TT100 | 0306 | NA | NA |
| ADT. Tower | AT100 | 0306 | NA | NA |
| Software | ADT_Radiated_V 7.6.15.9.2 | NA | NA | NA |
| SUHNER RF cable | SF102 | CABLE-CH6 | Aug. 19, 2011 | Aug. 18, 2012 |
| Schwarzbeck Horn Antenna | BBHA 9120-D1 | D130 | May 18, 2012 | May 17, 2013 |
| Highpass filter Wainwright Instruments | WHK 3.1/18G-10SS | SN 8 | NA | NA |
| ROHDE & SCHWARZ Spectrum Analyzer | FSP 40 | 100036 | May 09, 2012 | May 08, 2013 |
| Anritsu Power Sensor | MA2411B | 0738404 | Apr. 28, 2012 | Apr. 27, 2013 |
| Anritsu Power Meter | ML2495A | 0842014 | Apr. 28, 2012 | Apr. 27, 2013 |

- NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters 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. Height of receiving 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 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.

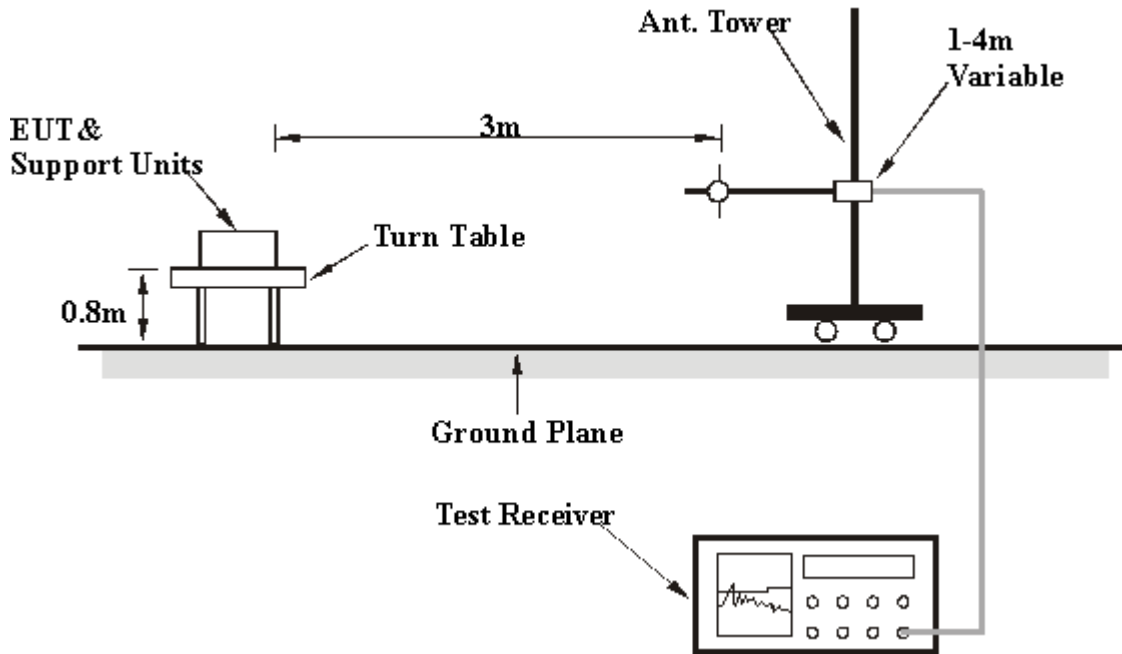
NOTE:

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. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3kHz for Average detection (AV) at frequency above 1GHz.
4. 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



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

4.2.6 EUT OPERATING CONDITIONS

Set the EUT under transmission condition continuously at specific channel frequency.



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4.2.7 TEST RESULTS

ABOVE 1GHz DATA

| | | | |
|------------------------|--------------|--------------------------|--------------|
| CHANNEL | TX Channel 0 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | 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 | 2390.00 | 57.0 PK | 74.0 | -17.0 | 1.25 H | 195 | 26.78 | 30.24 |
| 2 | 2390.00 | 45.4 AV | 54.0 | -8.6 | 1.25 H | 195 | 15.14 | 30.24 |
| 3 | #2400.00 | 75.0 PK | 85.0 | -10.0 | 1.25 H | 192 | 44.69 | 30.29 |
| 4 | #2400.00 | 63.6 AV | 73.6 | -10.0 | 1.25 H | 192 | 33.26 | 30.29 |
| 5 | *2403.00 | 105.0 PK | | | 1.25 H | 192 | 74.68 | 30.30 |
| 6 | *2403.00 | 93.6 AV | | | 1.25 H | 192 | 63.25 | 30.30 |
| 7 | 4806.00 | 61.6 PK | 74.0 | -12.4 | 1.00 H | 183 | 25.00 | 36.60 |
| 8 | 4806.00 | 50.1 AV | 54.0 | -3.9 | 1.00 H | 183 | 13.50 | 36.60 |

| 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 | 54.6 PK | 74.0 | -19.4 | 1.00 V | 328 | 24.36 | 30.24 |
| 2 | 2390.00 | 44.5 AV | 54.0 | -9.5 | 1.00 V | 328 | 14.22 | 30.24 |
| 3 | #2400.00 | 73.7 PK | 83.7 | -10.0 | 1.00 V | 328 | 43.42 | 30.29 |
| 4 | #2400.00 | 62.4 AV | 72.4 | -10.0 | 1.00 V | 328 | 32.11 | 30.29 |
| 5 | *2403.00 | 103.7 PK | | | 1.00 V | 328 | 73.41 | 30.30 |
| 6 | *2403.00 | 92.4 AV | | | 1.00 V | 328 | 62.10 | 30.30 |
| 7 | 4806.00 | 62.7 PK | 74.0 | -11.3 | 1.00 V | 182 | 26.07 | 36.60 |
| 8 | 4806.00 | 52.6 AV | 54.0 | -1.4 | 1.00 V | 182 | 16.01 | 36.60 |

REMARKS:

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



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| | | | |
|------------------------|---------------|--------------------------|--------------|
| CHANNEL | TX Channel 12 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | 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 | *2439.00 | 97.9 PK | | | 1.02 H | 232 | 67.52 | 30.42 |
| 2 | *2439.00 | 90.1 AV | | | 1.02 H | 232 | 59.65 | 30.42 |
| 3 | 4878.00 | 61.1 PK | 74.0 | -12.9 | 1.00 H | 88 | 24.29 | 36.78 |
| 4 | 4878.00 | 50.5 AV | 54.0 | -3.5 | 1.00 H | 88 | 13.70 | 36.78 |

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 | *2439.00 | 96.4 PK | | | 1.00 V | 231 | 65.95 | 30.42 |
| 2 | *2439.00 | 89.0 AV | | | 1.00 V | 231 | 58.60 | 30.42 |
| 3 | 4878.00 | 61.4 PK | 74.0 | -12.6 | 1.00 V | 88 | 24.61 | 36.78 |
| 4 | 4878.00 | 51.1 AV | 54.0 | -2.9 | 1.00 V | 88 | 14.29 | 36.78 |

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.



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| | | | |
|------------------------|---------------|--------------------------|--------------|
| CHANNEL | TX Channel 25 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | 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 | *2478.00 | 97.0 PK | | | 1.00 H | 186 | 66.43 | 30.56 |
| 2 | *2478.00 | 86.9 AV | | | 1.00 H | 186 | 56.35 | 30.56 |
| 3 | 2483.50 | 49.8 PK | 74.0 | -24.2 | 1.00 H | 186 | 19.22 | 30.57 |
| 4 | 2483.50 | 39.7 AV | 54.0 | -14.3 | 1.00 H | 186 | 9.14 | 30.57 |
| 5 | 4956.00 | 60.2 PK | 74.0 | -13.8 | 1.00 H | 86 | 23.22 | 36.98 |
| 6 | 4956.00 | 50.1 AV | 54.0 | -3.9 | 1.00 H | 86 | 13.12 | 36.98 |

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 | *2478.00 | 95.8 PK | | | 1.00 V | 59 | 65.27 | 30.56 |
| 2 | *2478.00 | 85.2 AV | | | 1.00 V | 59 | 54.65 | 30.56 |
| 3 | 2483.50 | 48.6 PK | 74.0 | -25.4 | 1.00 V | 59 | 18.06 | 30.57 |
| 4 | 2483.50 | 38.0 AV | 54.0 | -16.0 | 1.00 V | 59 | 7.44 | 30.57 |
| 5 | 4956.00 | 61.4 PK | 74.0 | -12.6 | 1.00 V | 266 | 24.42 | 36.98 |
| 6 | 4956.00 | 51.8 AV | 54.0 | -2.2 | 1.00 V | 266 | 14.82 | 36.98 |

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.



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BELOW 1GHz WORST-CASE DATA

| | | | |
|------------------------|--------------|--------------------------|-----------------|
| CHANNEL | TX Channel 0 | DETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 30MHz ~ 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 | 107.60 | 40.4 QP | 43.5 | -3.1 | 1.25 H | 284 | 30.05 | 10.36 |
| 2 | 228.85 | 42.6 QP | 46.0 | -3.4 | 1.75 H | 148 | 30.12 | 12.47 |
| 3 | 343.63 | 41.0 QP | 46.0 | -5.0 | 1.50 H | 202 | 24.19 | 16.84 |
| 4 | 539.25 | 33.7 QP | 46.0 | -12.3 | 1.25 H | 148 | 11.74 | 21.93 |
| 5 | 720.32 | 34.0 QP | 46.0 | -12.1 | 1.00 H | 189 | 8.99 | 24.96 |
| 6 | 870.67 | 28.3 QP | 46.0 | -17.7 | 1.25 H | 182 | 0.72 | 27.56 |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | |
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | 57.48 | 33.5 QP | 40.0 | -6.6 | 1.24 V | 286 | 19.81 | 13.64 |
| 2 | 75.27 | 36.9 QP | 40.0 | -3.1 | 1.00 V | 15 | 25.88 | 11.00 |
| 3 | 262.80 | 28.3 QP | 46.0 | -17.7 | 1.50 V | 320 | 14.21 | 14.07 |
| 4 | 523.08 | 29.6 QP | 46.0 | -16.4 | 1.00 V | 15 | 7.97 | 21.60 |
| 5 | 602.30 | 29.3 QP | 46.0 | -16.7 | 1.75 V | 62 | 6.02 | 23.24 |
| 6 | 859.35 | 29.0 QP | 46.0 | -17.0 | 1.25 V | 91 | 1.56 | 27.41 |

REMARKS:

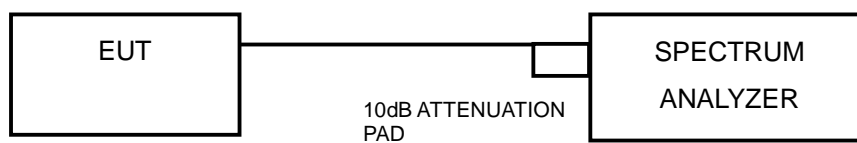
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

4.3 6dB BANDWIDTH MEASUREMENT

4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 TEST SETUP



4.3.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.3.4 TEST PROCEDURE

- a. Set resolution bandwidth (RBW) = approximately 1% of the emission bandwidth
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

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.



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4.3.7 TEST RESULTS

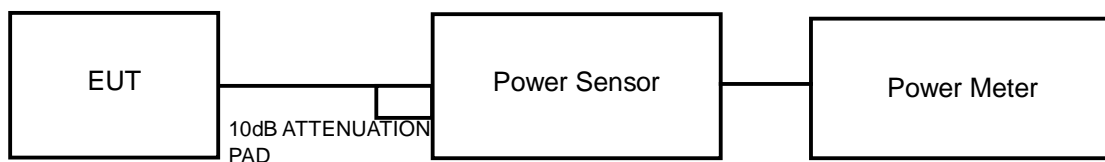
| CHANNEL | FREQUENCY (MHz) | 6dB BANDWIDTH (MHz) | MINIMUM LIMIT (MHz) | PASS / FAIL |
|---------|-----------------|---------------------|---------------------|-------------|
| 0 | 2403 | 1.13 | 0.5 | PASS |
| 12 | 2439 | 1.26 | 0.5 | PASS |
| 25 | 2478 | 1.13 | 0.5 | PASS |

4.4 CONDUCTED OUTPUT POWER

4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.4.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the peak power level.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6.



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4.4.7 TEST RESULTS

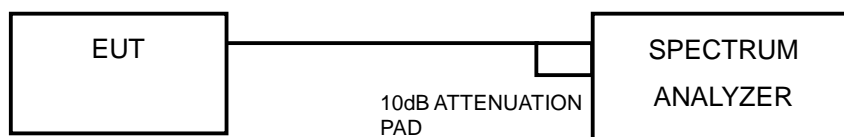
| CHANNEL | FREQUENCY (MHz) | PEAK POWER (mW) | PEAK POWER (dBm) | LIMIT (dBm) | PASS/FAIL |
|---------|-----------------|-----------------|------------------|-------------|-----------|
| 0 | 2403 | 10.2 | 10.1 | 30 | PASS |
| 12 | 2439 | 9.8 | 9.9 | 30 | PASS |
| 25 | 2478 | 9.3 | 9.7 | 30 | PASS |

4.5 POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.5.4 TEST PROCEDURE

- Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
- Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3 \text{ kHz}/100\text{kHz})$

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

4.5.6 EUT OPERATING CONDITION

Same as Item 4.3.6



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4.5.7 TEST RESULTS

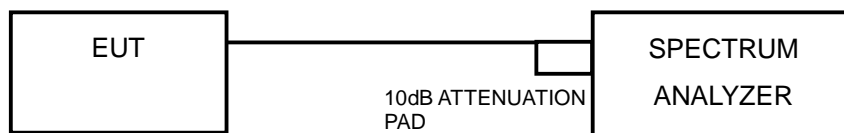
| Channel | FREQ. (MHz) | PSD (dBm/100kHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | PASS /FAIL |
|---------|-------------|------------------|----------------|------------------|------------|
| 0 | 2403 | 9.98 | -5.22 | 8 | PASS |
| 12 | 2439 | 9.53 | -5.67 | 8 | PASS |
| 25 | 2478 | 9.72 | -5.48 | 8 | PASS |

4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

4.6.1 LIMITS OF CONDUCTED OUT OF BAND EMISSION MEASUREMENT

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

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.6.4 TEST PROCEDURE

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. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

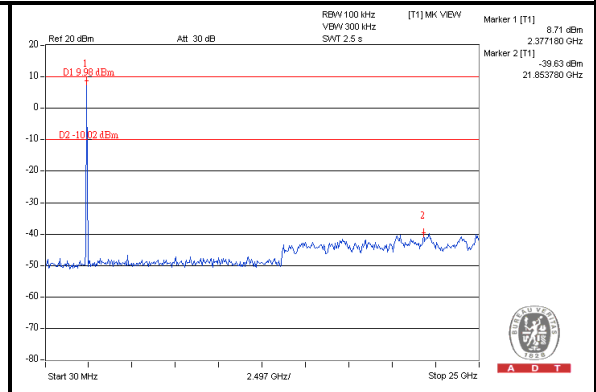
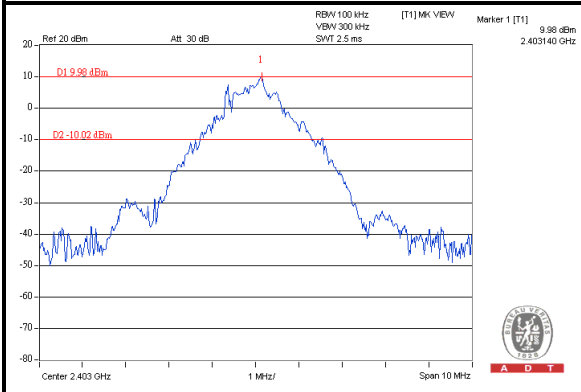
4.6.7 TEST RESULTS

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.

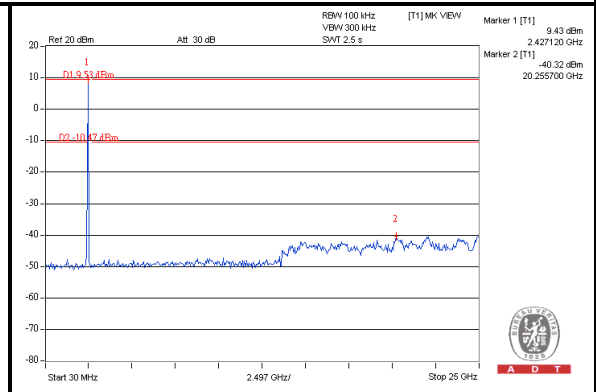
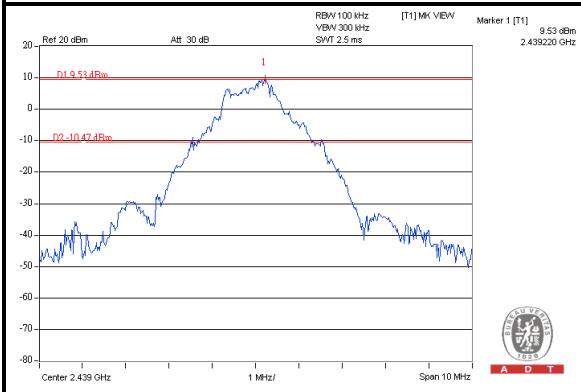


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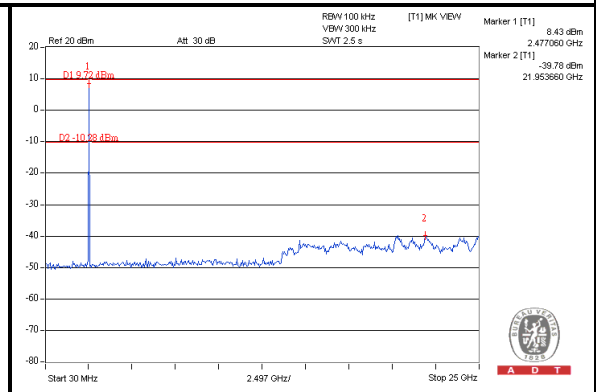
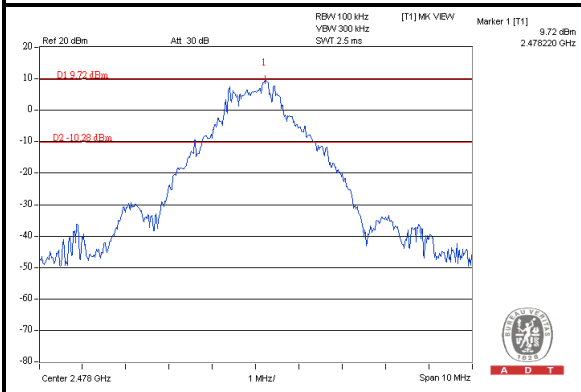
CH 0



CH 12



CH 25





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5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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6. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343

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Fax: 886-3-3270892

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.



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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---