

FCC Test Report

Report No.: RF160317C23

FCC ID: 2AH30-RBB10

Test Model: RBB1.0

Received Date: Mar. 17, 2016

Test Date: Mar. 21 to Apr. 08, 2016

Issued Date: Apr. 29, 2016

Applicant: Rapsodo Pte Ltd

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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Release Control Record

| Issue No. | Description | Date Issued |
|-------------|-------------------|---------------|
| RF160317C23 | Original release. | Apr. 29, 2016 |

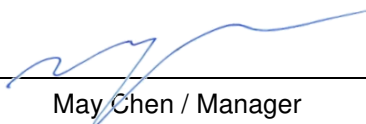


1 Certificate of Conformity

Product: BaseBall Launch Monitor
Brand: Rapsodo BaseBall
Test Model: RBB1.0
Sample Status: ENGINEERING SAMPLE
Applicant: Rapsodo Pte Ltd
Test Date: Mar. 21 to Apr. 08, 2016
Standards: 47 CFR FCC Part 15, Subpart C (Section 15.245)
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:** _____ Apr. 29, 2016
Claire Kuan / Specialist

Approved by :  _____, **Date:** _____ Apr. 29, 2016
May Chen / Manager

2 Summary of Test Results

| APPLIED STANDARD: FCC PART 15, SUBPART C | | | |
|--|-----------------------------|--------|--|
| Standard Paragraph | Test Type | Result | Remark |
| 15.207 | AC Power Conducted Emission | PASS | Meet the requirement of limit. Minimum passing margin is -9.09dB at 0.53281MHz. |
| 15.245 | Radiated Emission Test | PASS | Meet the requirement of limit Minimum passing margin is -3.4dB at 66.42MHz |
| 15.215 (c) | 20dB Bandwidth | PASS | Meet the requirement of limit |
| 15.203 | Antenna Requirement | PASS | No antenna connector is used. |

2.1 Measurement Uncertainty

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

| Measurement | Frequency | Expanded Uncertainty (k=2) (±) |
|------------------------------------|------------------|--------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 2.86 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 200MHz | 5.31 dB |
| | 200MHz ~ 1000MHz | 3.40 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 3.73 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 | BaseBall Launch Monitor |
| Brand | Rapsodo BaseBall |
| Test Model | RBB1.0 |
| Status of EUT | ENGINEERING SAMPLE |
| Power Supply Rating | DC 5V from Adapter / DC 3.7V from battery |
| Modulation Type | CW |
| Carrier Frequency | 24126 MHz |
| Number of Channel | 1 |
| Antenna Type | Refer to Note |
| Antenna Connector | NA |
| Accessory Device | Adapter x 1 |
| Data Cable Supplied | USB cable (unshielded, 3m) |

Note:

1. There are 24GHz wireless transceiver and WLAN 2.4GHz technology used for the EUT.
2. The EUT inside has one WLAN 2.4GHz module (FCC ID: O7P-362)
3. The emission of the simultaneous operation has been evaluated and no non-compliance was found.
4. The antenna provided to the EUT, please refer to the following table:

| Brand | Model | Antenna Type | Gain (dBi) | Antenna Connector |
|----------|---------|--------------|------------|-------------------|
| Innosent | IPS-946 | PCB | 15 | Solder |

5. The EUT could be supplied with DC 3.7V battery or power adapter as the following table:

| Item | Brand | Model No. | Spec. |
|-----------|-------------------------------|-----------|---|
| Battery 1 | Yoku Energy Co Ltd | 805058 | DC 3.7V |
| Battery 2 | Howell Energy Co Ltd | 985056 | DC 3.7V |
| Adapter | Golden Profit Electronics Ltd | - | AC input: 100-240V 50/60Hz 0.2A DC output: DC 5V, 1000mA DC output cable (unshielded, 3m) |

For the above batteries, the battery 1 was chose was selected as representative battery for the test and its data was recorded in this report.

6. The EUT was pre-tested under following test modes:

| Pre-test Mode | Power Source |
|---------------|---------------------|
| Mode A | With Adapter |
| Mode B | With Battery |

The worst radiated emission was found in **Mode A**. Therefore only the test data of the modes were recorded in this report.

7. 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.

3.2 Description of Test Modes

1 channel is provided:

| Channel | Frequency |
|---------|-----------|
| 1 | 24126 MHz |

3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO | | | | DESCRIPTION |
|--------------------|---------------|-------|-----|----|--------------|
| | RE≥1G | RE<1G | PLC | BW | |
| - | √ | √ | √ | √ | With Adapter |

Where

RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

BW: 20dB Bandwidth 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.

| TESTED CHANNEL | MODULATION TYPE |
|----------------|-----------------|
| 1 | CW |

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.

| TESTED CHANNEL | MODULATION TYPE |
|----------------|-----------------|
| 1 | CW |

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.

| TESTED CHANNEL | MODULATION TYPE |
|----------------|-----------------|
| 1 | CW |

20dB Bandwidth 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.

| TESTED CHANNEL | MODULATION TYPE |
|----------------|-----------------|
| 1 | CW |



Test Condition:

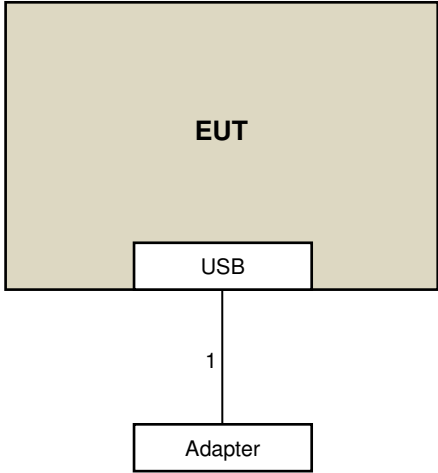
| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER (SYSTEM) | TESTED BY |
|---------------|--------------------------|----------------------|-----------|
| RE \geq 1G | 20deg. C, 64%RH | 120Vac, 60 Hz | Tim Ho |
| RE $<$ 1G | 20deg. C, 60%RH | 120Vac, 60 Hz | Tim Ho |
| PLC | 23deg. C, 82%RH | 120Vac, 60 Hz | Wythe Lin |
| BW | 20deg. C, 60%RH | 120Vac, 60 Hz | Tim Ho |

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.

| ID | Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks |
|----|--------------|------|------------|--------------------|--------------|--------------------|
| 1. | USB | 1 | 3 | Yes | 0 | Supplied by 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 (15.245)

ANSI C63.10-2013

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

NOTE: The EUT 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 Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

According to 15.245 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (dBuV/m) | |
|-----------------------------|--|---------|
| | Peak | Average |
| 24075 ~ 24175 | 147.9 | 127.9 |
| | Field Strength of Harmonics (dBuV/m) | |
| | 107.9 | 87.9 |

Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

| Application | Field Strength of Harmonics (dBuV/m) |
|--|--------------------------------------|
| Field disturbance sensors operating in the 24075-24175 MHz band and for Other field disturbance sensors designed for use only within a building or to open building doors. | 87.9 |
| All other field disturbance sensors | 77.5 |

Note: Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in Section 15.209.

- (1) Field strength limits are specified at a distance of 3 meters.
- (2) 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 in Section 15.209, whichever is the lesser attenuation.

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

NOTE:

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

4.1.2 Test Instruments

For below 1GHz test:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|--|--------------------------|-------------------------------|-----------------|------------------|
| Test Receiver Agilent | N9038A | MY50010156 | Aug. 12, 2015 | Aug. 11, 2016 |
| Pre-Amplifier ^(*) EMCI | EMC001340 | 980142 | Jan. 20, 2016 | Jan. 19, 2018 |
| Loop Antenna ^(*) Electro-Metrics | EM-6879 | 264 | Dec. 16, 2014 | Dec. 15, 2016 |
| RF Cable | NA | LOOPCAB-001 LOOPCAB-002 | Jan. 18, 2016 | Jan. 17, 2017 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2 B | AMP-ZFL-07 | May 08, 2015 | May 07, 2016 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-156 | Jan. 04, 2016 | Jan. 03, 2017 |
| RF Cable | 8D | 966-3-1 966-3-2 966-3-3 | Apr. 03, 2015 | Apr. 02, 2016 |
| Software | ADT_Radiated _V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 3.
3. The FCC Site Registration No. is 147459
4. The CANADA Site Registration No. is 20331-1
5. Tested Date: Mar. 21, 2016



For above 1GHz~40GHz test:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|----------------------------------|---|----------------------------|-----------------|------------------|
| Test Receiver Agilent | N9038A | MY50010156 | Aug. 12, 2015 | Aug. 11, 2016 |
| Horn_Antenna SCHWARZBECK | BBHA9120-D | 9120D-406 | Jan. 20, 2016 | Jan. 19, 2017 |
| Pre-Amplifier Agilent | 8449B | 3008A02465 | Apr. 06, 2015 | Apr. 05, 2016 |
| RF Cable | EMC104-SM- SM-2000 EMC104-SM- SM-5000 EMC104-SM- SM-5000 | 150317 150321 150322 | Mar. 31, 2015 | Mar. 30, 2016 |
| Spectrum Analyzer Keysight | N9030A | MY54490520 | July 26, 2015 | July 25, 2016 |
| Pre-Amplifier EMCI | EMC184045 | 980143 | Jan. 15, 2016 | Jan. 14, 2017 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170608 | Jan. 08, 2016 | Jan. 07, 2017 |
| RF Cable | SUCOFLEX 102 | 36432/2 36441/2 | Jan. 16, 2016 | Jan. 15, 2017 |
| Software | ADT_Radiated _V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | NA | NA | NA |
| Boresight Antenna Fixture | NA | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 3.
3. The FCC Site Registration No. is 147459
4. The CANADA Site Registration No. is 20331-1
5. Tested Date: Mar. 21, 2016



For above 40GHz test:

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---------------------------------------|-----------|------------|-----------------|------------------|
| Spectrum Analyzer Agilent | E4446A | MY48250253 | Dec. 22, 2015 | Dec. 21, 2016 |
| *Harmonic Mixer (33~55GHz) OML | M22HWD | 110215-1 | Apr. 07, 2015 | Apr. 06, 2017 |
| *Horn Antenna (33~55GHz) OML | M22RH | 110215-1 | Apr. 07, 2015 | Apr. 06, 2017 |
| *Harmonic Mixer (50~75GHz) OML | M15RH | 110215-1 | Apr. 09, 2015 | Apr. 08, 2017 |
| *Horn Antenna (50~75GHz) OML | M15HWD | 110215-1 | Apr. 09, 2015 | Apr. 08, 2017 |
| *Harmonic Mixer (75~110GHz) OML | M10HWD | 110215-1 | Apr. 14, 2015 | Apr. 13, 2017 |
| *Horn Antenna (75~110GHz) OML | M10RH | 110215-1 | Apr. 14, 2015 | Apr. 13, 2017 |
| *Diplexer EMCI | DPL26 | DPL26_01 | Apr. 06, 2015 | Apr. 05, 2017 |
| *Diplexer EMCI | DPL26 | DPL26_02 | Apr. 06, 2015 | Apr. 05, 2017 |
| CT Antenna Tower & Turn Table | NA | NA | NA | NA |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The 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. G.
4. The FCC Site Registration No. is 966073.
5. The VCCI Site Registration No. is G-137.
6. The CANADA Site Registration No. is IC 7450H-2.
7. Test Date: Mar. 21, 2016

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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 suitable distance 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.

Note:

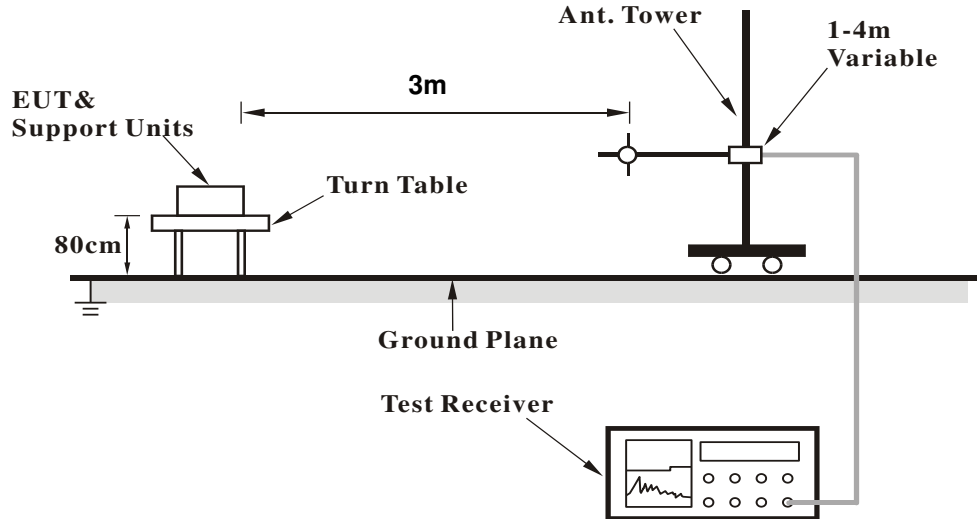
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

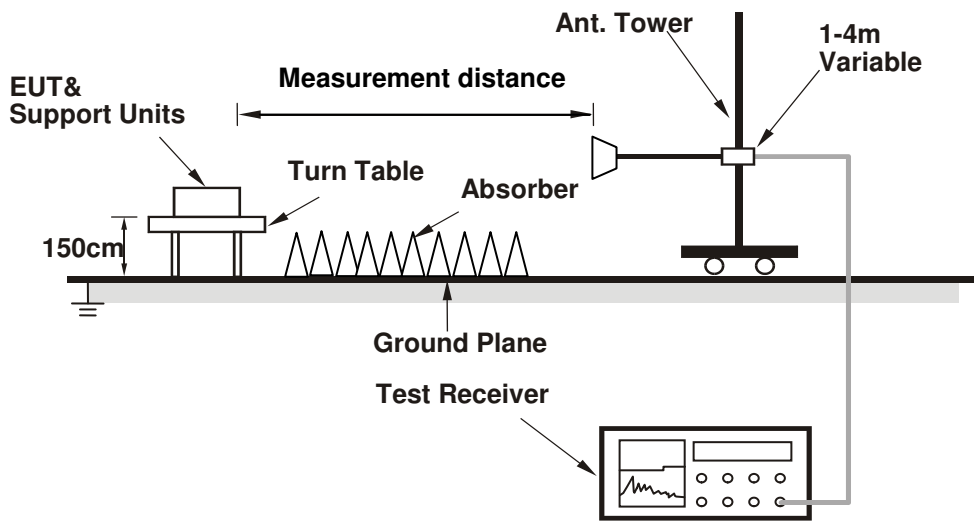
No deviation.

4.1.5 Test Setup

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

EUT was under transmission/receiving condition continuously.

4.1.7 Test Results

Above 1GHz Data :

| | | | |
|------------------------|--------------|------------------------------|--------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 18GHz | | 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 | 1968.15 | 41.4 PK | 74.0 | -32.6 | 1.50 H | 86 | 47.28 | -5.90 |
| 2 | 1968.15 | 22.7 AV | 54.0 | -31.4 | 1.50 H | 86 | 28.55 | -5.90 |
| 3 | 14090.42 | 55.3 PK | 74.0 | -18.7 | 2.00 H | 0 | 36.06 | 19.22 |
| 4 | 14090.42 | 41.7 AV | 54.0 | -12.3 | 2.00 H | 0 | 22.47 | 19.22 |

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 | 3618.43 | 56.5 PK | 74.0 | -17.6 | 1.00 V | 40 | 57.62 | -1.17 |
| 2 | 3618.43 | 26.9 AV | 54.0 | -27.1 | 1.00 V | 40 | 28.07 | -1.17 |
| 3 | 14387.50 | 54.7 PK | 74.0 | -19.3 | 1.50 V | 222 | 35.47 | 19.25 |
| 4 | 14387.50 | 42.0 AV | 54.0 | -12.0 | 1.50 V | 222 | 22.71 | 19.25 |

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

| | | | |
|------------------------|---------------|--------------------------|--------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 18GHz ~ 40GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 1M | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 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 | 24075.00 | 57.4 PK | 83.5 | -26.1 | 1.59 H | 26 | 67.03 | -9.63 |
| 2 | 24075.00 | 43.9 AV | 63.5 | -19.6 | 1.59 H | 26 | 53.53 | -9.63 |
| 3 | *24126.00 | 104.3 PK | 157.4 | -53.1 | 1.59 H | 26 | 113.81 | -9.51 |
| 4 | *24126.00 | 103.8 AV | 137.4 | -33.6 | 1.59 H | 26 | 113.31 | -9.51 |
| 5 | 24715.00 | 59.2 PK | 83.5 | -24.3 | 1.58 H | 26 | 68.51 | -9.31 |
| 6 | 24715.00 | 46.0 AV | 63.5 | -17.5 | 1.58 H | 26 | 55.31 | -9.31 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 1 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 | 24075.00 | 57.4 PK | 83.5 | -26.1 | 1.60 V | 336 | 67.03 | -9.63 |
| 2 | 24075.00 | 44.1 AV | 63.5 | -19.4 | 1.60 V | 336 | 53.73 | -9.63 |
| 3 | *24126.00 | 121.4 PK | 157.4 | -36.0 | 1.60 V | 336 | 130.91 | -9.51 |
| 4 | *24126.00 | 121.2 AV | 137.4 | -16.2 | 1.60 V | 336 | 130.71 | -9.51 |
| 5 | 24715.00 | 58.5 PK | 83.5 | -25.0 | 1.60 V | 336 | 67.81 | -9.31 |
| 6 | 24715.00 | 45.9 AV | 63.5 | -17.6 | 1.60 V | 336 | 55.21 | -9.31 |

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
 - Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
 - The other emission levels were very low against the limit.
 - Margin value = Emission Level – Limit value
 - " * ": Fundamental frequency.
 - Shorter measurement distances may be used to improve the measurement system's noise floor. As Subpart C description is based on the measurement in distance of 3 meters, the data obtained at 1-meter distance was compared to the calculate limit for 1-m distance:
 Limit at 1-meter distance (dBuV)
 = Limit at 3 meter distance (dBuV) -20log(1/3)(dB)
 = Limit at 3 meter distance (dBuV)+9.5(dB).
- ※Measurements made at 1 meter distance and Limit converted to account for 1-meter measurement distance.

| | | | |
|------------------------|----------------|--------------------------|--------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 40GHz ~ 100GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 0.8 M

| NO. | FREQ. (GHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | EIRP Level (dBm) | Measured Power (dBm) | Receiver Antenna Gain (dBi) |
|-----|-------------|-------------------------|----------------|-------------|------------------|----------------------|-----------------------------|
| 1 | 48.252 PK | 87.5 | 109 | -21.5 | -19.2 | -59.5 | 23.9 |
| 2 | 48.252 AV | 72.8 | 89 | -16.2 | -33.9 | -74.2 | 23.9 |
| 3 | 72.378 PK | 88.8 | 109 | -20.2 | -17.9 | -61.7 | 23.9 |
| 4 | 72.378 AV | 73.8 | 89 | -15.2 | -32.9 | -76.7 | 23.9 |
| 5 | 96.504 | - | - | - | - | - | - |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 0.8 M

| NO. | FREQ. (GHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | EIRP Level (dBm) | Measured Power (dBm) | Receiver Antenna Gain (dBi) |
|-----|-------------|-------------------------|----------------|-------------|------------------|----------------------|-----------------------------|
| 1 | 48.252 PK | 86 | 109 | -23.0 | -20.7 | -61.0 | 23.9 |
| 2 | 48.252 AV | 73.4 | 89 | -15.6 | -33.3 | -73.6 | 23.9 |
| 3 | 72.378 PK | 87.5 | 109 | -21.5 | -19.2 | -63.0 | 23.9 |
| 4 | 72.378 AV | 74 | 89 | -15.0 | -32.7 | -76.5 | 23.9 |
| 5 | 96.504 | - | - | - | - | - | - |

REMARKS:

1. The measured power level is converted to EIRP using the Friis equation:

$$EIRP = P_T * G_T = (P_R / G_R) * (4 * \pi * D / \lambda)^2$$

where:

PR is the power of the receive measurement

GR is the gain of the receive measurement antenna

D is the measurement distance

λ is the wavelength

2. Field strength is then converted to EIRP as follows:

$$EIRP = ((E * D)^2) / 30$$

Working in dB units, the above equation is equivalent to:

$$EIRP[dBm] = E[dBuV/m] + 20 \log(D[meters]) - 104.8$$

$$E = EIRP - 20 * \log(D) + 104.8$$

3. " - ": The emission levels were too low to be detected.

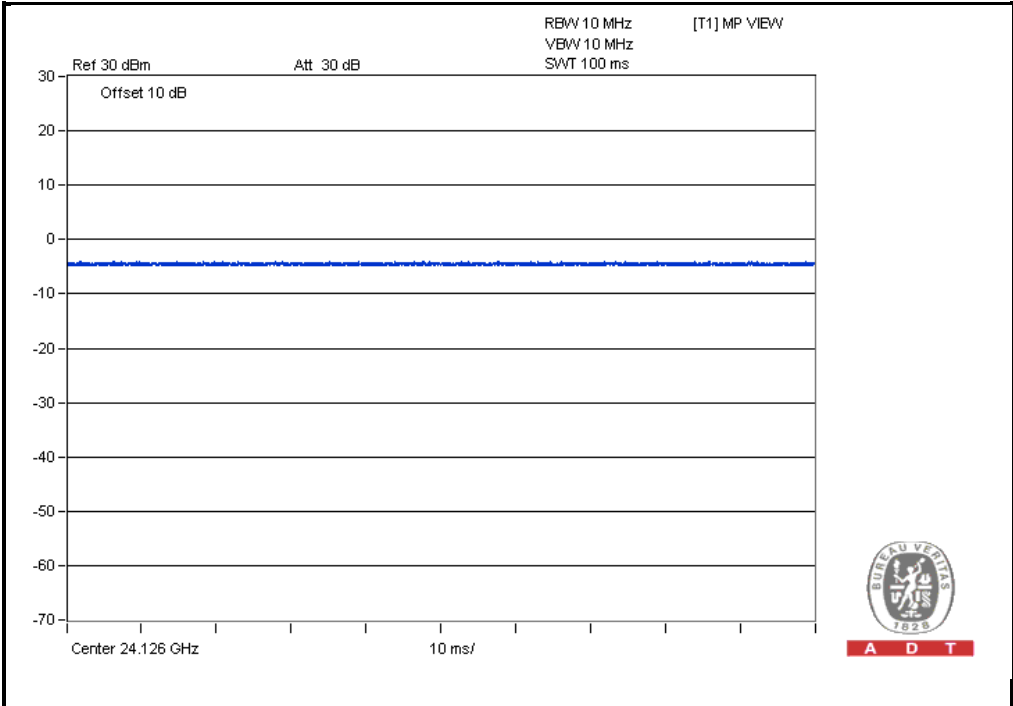
4. Shorter measurement distances may be used to improve the measurement system's noise floor. As Subpart C description is based on the measurement in distance of 3 meters, the data obtained at 0.8-meter distance was compared to the calculate limit for 0.8-m distance:

Limit at 0.8-meter distance (dBuV)

$$= \text{Limit at 3 meter distance (dBuV)} - 20 \log(0.8/3) \text{ (dB)}$$

$$= \text{Limit at 3 meter distance (dBuV)} + 11.5 \text{ (dB)}$$

※ Measurements made at 0.8 meter distance and Limit converted to account for 0.8-meter measurement distance.



Duty cycle of test signal is 100 %, duty factor is not required.

Below 1GHz Data:

| | | | |
|------------------------|--------------|------------------------------|-----------------|
| CHANNEL | TX Channel 1 | 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 | 35.29 | 33.7 QP | 40.0 | -6.3 | 1.00 H | 274 | 33.37 | 0.30 |
| 2 | 66.42 | 36.6 QP | 40.0 | -3.4 | 1.50 H | 230 | 36.68 | -0.09 |
| 3 | 159.71 | 27.0 QP | 43.5 | -16.5 | 1.00 H | 360 | 25.49 | 1.55 |
| 4 | 195.19 | 25.9 QP | 43.5 | -17.6 | 1.00 H | 251 | 27.64 | -1.78 |
| 5 | 438.37 | 30.7 QP | 46.0 | -15.3 | 2.00 H | 51 | 25.20 | 5.51 |
| 6 | 854.99 | 36.6 QP | 46.0 | -9.4 | 2.00 H | 135 | 24.15 | 12.49 |

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 | 34.73 | 32.8 QP | 40.0 | -7.2 | 1.00 V | 194 | 32.47 | 0.33 |
| 2 | 66.40 | 35.3 QP | 40.0 | -4.7 | 1.50 V | 114 | 35.40 | -0.08 |
| 3 | 162.24 | 27.8 QP | 43.5 | -15.7 | 1.50 V | 168 | 26.34 | 1.47 |
| 4 | 609.41 | 34.2 QP | 46.0 | -11.8 | 2.00 V | 41 | 25.18 | 9.04 |
| 5 | 768.39 | 35.3 QP | 46.0 | -10.7 | 1.50 V | 185 | 23.76 | 11.56 |
| 6 | 890.75 | 37.7 QP | 46.0 | -8.3 | 1.00 V | 241 | 24.40 | 13.33 |

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 R&S | ESCS 30 | 100375 | May 06, 2015 | May 05, 2016 |
| Line-Impedance Stabilization Network (for EUT) SCHWARZBECK | NSLK-8127 | 8127-522 | Sep. 01, 2015 | Aug. 31, 2016 |
| Line-Impedance Stabilization Network (for Peripheral) R&S | ENV216 | 100072 | June 11, 2015 | June 10, 2016 |
| RF Cable | 5D-FB | COCCAB-001 | Mar. 08, 2016 | Mar. 07, 2017 |
| 50 ohms Terminator | N/A | EMC-03 | Sep. 23, 2015 | Sep. 22, 2016 |
| 50 ohms Terminator | N/A | EMC-02 | Oct. 01, 2015 | Sep. 30, 2016 |
| 50 ohms Terminator | E1-011315 | 13 | Dec. 11 2015 | Dec. 10 2016 |
| Software BVADT | BVADT_Cond_ V7.3.7.3 | 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: Apr. 08, 2016

4.2.3 Test Procedures

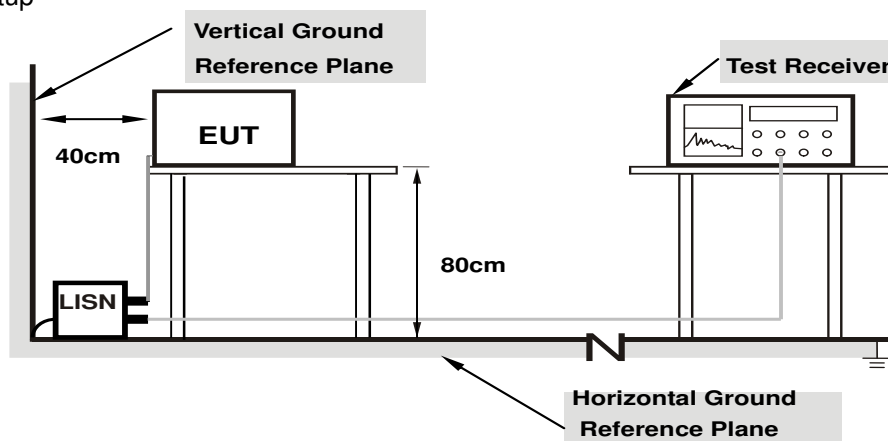
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling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

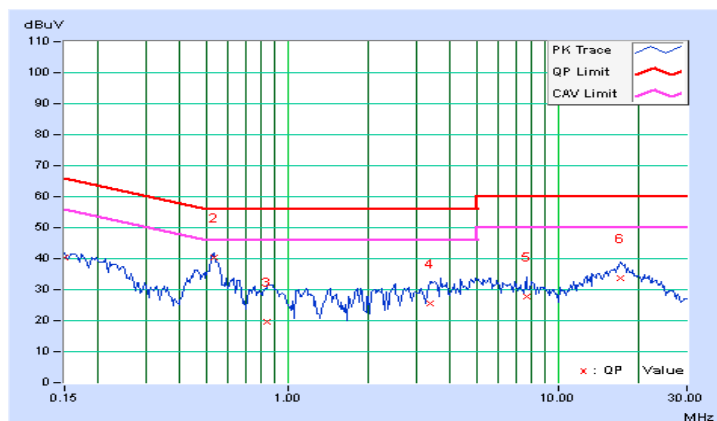
4.2.7 Test Results

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

| No | Freq. [MHz] | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|----------|----------------|--------------|---------------|--------------|----------------|--------------|--------------|--------------|---------------|--------------|
| | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | |
| 1 | 0.15000 | 10.44 | 30.01 | 21.88 | 40.45 | 32.32 | 66.00 | 56.00 | -25.55 | -23.68 |
| 2 | 0.53281 | 10.42 | 29.86 | 26.49 | 40.28 | 36.91 | 56.00 | 46.00 | -15.72 | -9.09 |
| 3 | 0.83750 | 10.39 | 9.29 | 5.63 | 19.68 | 16.02 | 56.00 | 46.00 | -36.32 | -29.98 |
| 4 | 3.35938 | 10.57 | 14.84 | 6.27 | 25.41 | 16.84 | 56.00 | 46.00 | -30.59 | -29.16 |
| 5 | 7.62891 | 10.81 | 17.14 | 9.18 | 27.95 | 19.99 | 60.00 | 50.00 | -32.05 | -30.01 |
| 6 | 16.98828 | 11.35 | 22.21 | 11.99 | 33.56 | 23.34 | 60.00 | 50.00 | -26.44 | -26.66 |

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.

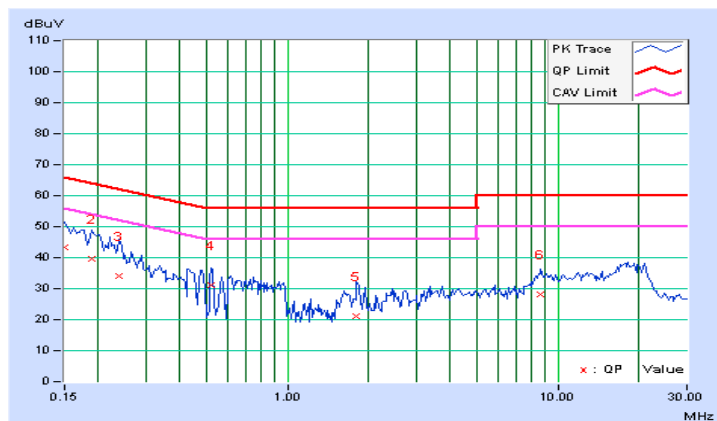


| | | | |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| No | Freq. [MHz] | Corr. | Reading Value | | Emission Level | | Limit | | Margin | |
|----|----------------|--------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
| | | Factor | [dB (uV)] | | [dB (uV)] | | [dB (uV)] | | (dB) | |
| | | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 10.44 | 32.75 | 21.74 | 43.19 | 32.18 | 66.00 | 56.00 | -22.81 | -23.82 |
| 2 | 0.18906 | 10.45 | 29.10 | 2.54 | 39.55 | 12.99 | 64.08 | 54.08 | -24.53 | -41.09 |
| 3 | 0.23984 | 10.46 | 23.79 | 10.27 | 34.25 | 20.73 | 62.10 | 52.10 | -27.86 | -31.38 |
| 4 | 0.52109 | 10.47 | 20.60 | 6.89 | 31.07 | 17.36 | 56.00 | 46.00 | -24.93 | -28.64 |
| 5 | 1.80078 | 10.49 | 10.46 | -0.06 | 20.95 | 10.43 | 56.00 | 46.00 | -35.05 | -35.57 |
| 6 | 8.67188 | 10.89 | 17.15 | 5.35 | 28.04 | 16.24 | 60.00 | 50.00 | -31.96 | -33.76 |

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 20dB bandwidth Measurement

4.3.1 Limits of 20dB bandwidth Measurement

According to 15.215(c), the requirement is to ensure the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.3.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|----------------------------|-----------|------------|-----------------|------------------|
| Spectrum Analyzer R&S | FSP40 | 100060 | May 08, 2015 | May 07, 2016 |

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Mar. 21, 2016

4.3.3 Test Procedures

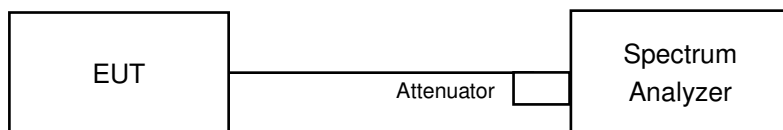
The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300 kHz RBW and 1 MHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Set both RBW and VBW of spectrum analyzer to 300 kHz and 1 MHz with suitable frequency span from band edge. The bandedge was measured and recorded.

4.3.4 Deviation from Test Standard

No deviation

4.3.5 Test Setup



4.3.6 EUT Operating Conditions

Set the EUT under transmission / receiver condition continuously.



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

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

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