

FCC Test Report (Co-Located)

Report No.: RF170110C12-2

FCC ID: I88EMG6765-Q10A

Model: EMG6765-Q10A

Series Model: EMG3426-Q10A

Received Date: Jan. 10, 2017

Test Date: Apr. 17, 2017

Issued Date: Apr. 20, 2017

Applicant: Zyxel Communications Corporation

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

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Test Location: No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)



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Release Control Record

| Issue No. | Description | Date Issued |
|---------------|------------------|---------------|
| RF170110C12-2 | Original release | Apr. 20, 2017 |

1 Certificate of Conformity

Product: AC2200 Gigabit Ethernet MoCA Gateway

AC2200 Gigabit Ethernet Gateway

Brand: ZYXEL

Model: EMG6765-Q10A

Series Model: EMG3426-Q10A

Sample Status: Engineering sample

Applicant: Zyxel Communications Corporation

Test Date: Apr. 17, 2017

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

47 CFR FCC Part 15, Subpart E (Section 15.407)

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. 20, 2017
Pettie Chen / Senior Specialist

Approved by :  , **Date:** Apr. 20, 2017
Ken Liu / Senior Manager

2 Summary of Test Results

| Applied Standard: | 47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407) | | |
|--|--|--------|---|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 15.407(b)(6) | AC Power Conducted Emission | Pass | Meet the requirement of limit. Minimum passing margin is -18.93dB at 0.45097MHz. |
| 15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6) | Radiated Emissions | Pass | Meet the requirement of limit. Minimum passing margin is -0.5dB at 2483.50MHz. |

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 | 2.94 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 200MHz | 3.63 dB |
| | 200MHz ~ 1000MHz | 3.64 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 2.29 dB |
| | 18GHz ~ 40GHz | 2.29 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|-----------------------|--|
| Product | AC2200 Gigabit Ethernet MoCA Gateway AC2200 Gigabit Ethernet Gateway |
| Brand | ZYXEL |
| Model | EMG6765-Q10A |
| Series Model | EMG3426-Q10A |
| Model Difference | Refer to note as below |
| Status of EUT | Engineering sample |
| Test Software | QRCT |
| CPU Model | IPQ8065 |
| RF Chip Model | 2.4G:QCA9381 ,5G:QCA9984 |
| Firmware Version | V1.00(ABHR.0)C0 |
| Power Supply Rating | 12Vdc (Adapter) |
| Modulation Type | CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM |
| Modulation Technology | DSSS, OFDM |
| Transfer Rate | 802.11b:11/5.5/2/1Mbps 802.11a/g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 450Mbps 802.11ac: up to 1733.3Mbps |
| Operating Frequency | 2.4GHz: 2412 ~ 2462MHz 5.0GHz: 5180 ~ 5240MHz, 5745 ~ 5825MHz |
| Number of Channel | 2412 ~ 2462MHz: 11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40) 5180 ~ 5240MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80) 5745 ~ 5825MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80) |
| Output Power | CDD Mode: 2412 ~ 2462MHz: 775.277mW 5180 ~ 5240MHz: 612.029mW 5745 ~ 5825MHz: 814.637mW Beamforming Mode 5180 ~ 5240MHz: 612.029mW 5745 ~ 5825MHz: 670.163mW |
| Antenna Type | Refer to note |
| Antenna Connector | Refer to note |
| Accessory Device | Adapter |
| Data Cable Supplied | NA |

Note:

- The EUT incorporates a MIMO function. Physically, the EUT provides 3 completed transmitters and 3 receivers (For 2.4GHz Band), 4 completed transmitters and 4 receivers (For 5GHz Band)

| Modulation Mode | TX Function | Beamforming |
|-------------------------|-------------|-------------|
| 802.11b | 3TX | Not Support |
| 802.11g | 3TX | Not Support |
| 802.11n (HT20) (2.4GHz) | 3TX | Not Support |
| 802.11n (HT40) (2.4GHz) | 3TX | Not Support |
| 802.11a | 4TX | Not Support |
| 802.11n (HT20) (5GHz) | 4TX | Support |
| 802.11n (HT40) (5GHz) | 4TX | Support |
| 802.11ac (VHT20) | 4TX | Support |
| 802.11ac (VHT40) | 4TX | Support |
| 802.11ac (VHT80) | 4TX | Support |

*The modulation and bandwidth are similar for 802.11n mode for HT20/HT40 and 802.11ac mode for VHT20/VHT40, therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

* CDD mode is the worst case for final test after pretesting CDD mode and beamforming mode.

- The EUT consumes power from the following adapter.

| | |
|--------------|--|
| Brand | Asian Power Devices Inc. |
| Model | WA-36A12FU |
| Input Power | 100-240V~50-60Hz 0.9A Max |
| Output Power | 12Vdc, 3A |
| Power Line | 1.45m non-shielded power cable with one core |

- 2.4GHz, 5GHz technology can transmit at same time.

- The EUT with follow antennas gain is listed as table below.

| Ant. Type | Dipole and Couple | | | | |
|-----------------|-------------------|------|------|------|------|
| Connector | IPEX | | | | |
| Frequency (MHz) | 2400 | 2450 | 2500 | | |
| Ant. 1 | 2.94 | 2.28 | 2.93 | | |
| Ant. 2 | 3.36 | 3.32 | 3.40 | | |
| Ant. 3 | 3.14 | 2.76 | 3.42 | | |
| Frequency (MHz) | 5150 | 5350 | 5470 | 5725 | 5850 |
| Ant. 4 | 4.14 | 4.03 | 4.51 | 4.49 | 3.92 |
| Ant. 5 | 3.62 | 4.31 | 4.34 | 4.56 | 4.58 |
| Ant. 6 | 4.08 | 4.32 | 4.30 | 3.66 | 3.07 |
| Ant. 7 | 4.66 | 4.72 | 5.04 | 3.91 | 4.47 |

* The antenna is internal antenna and not user accessible.

* The 5G antennas were cross-polarized antenna. Ant. 4 & Ant. 5 were Vertical antenna, Ant. 6 & Ant. 7 were horizontal antenna.

For 5180 ~ 5240MHz: Ant. 6 & Ant. 7 were the worst for the final test.

For 5745 ~ 5825MHz: Ant. 4 & Ant. 5 were the worst for the final test.

5. The power settings are list as below.

| CDD Mode | | | | | |
|----------|---------|---------|----------------|------|----------------|
| | 802.11b | 802.11g | 802.11n (HT20) | | 802.11n (HT40) |
| CH01 | 23 | 19 | 18 | CH03 | 14 |
| CH06 | 23.5 | 24 | 24 | CH06 | 18 |
| CH11 | 23 | 18 | 17.5 | CH09 | 13.5 |

| CDD Mode | | | | | | |
|----------|---------|----------------|--------|----------------|--------|------------------|
| | 802.11a | 802.11n (HT20) | | 802.11n (HT40) | | 802.11ac (VHT80) |
| CH 36 | 20 | 19.5 | CH 38 | 18.5 | CH 42 | 17 |
| CH 40 | 20 | 20.5 | CH 46 | 20.5 | CH 155 | 20.5 |
| CH 48 | 20 | 20.5 | CH 151 | 21.5 | | |
| CH 149 | 22.5 | 22.5 | CH 159 | 22 | | |
| CH 157 | 22.5 | 22.5 | | | | |
| CH 165 | 22.5 | 23 | | | | |

| Beamforming Mode | | | | | | | |
|------------------|----------------|--|--------|----------------|--|------------------|------|
| | 802.11n (HT20) | | | 802.11n (HT40) | | 802.11ac (VHT80) | |
| CH 36 | 19.5 | | CH 38 | 13.5 | | CH 42 | 11.5 |
| CH 40 | 20.5 | | CH 46 | 20.5 | | CH 155 | 20.5 |
| CH 48 | 20.5 | | CH 151 | 21.5 | | | |
| CH 149 | 22 | | CH 159 | 22 | | | |
| CH 157 | 22 | | | | | | |
| CH 165 | 22.5 | | | | | | |

3.2 Description of Test Modes

For 2.4GHz

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 1 | 2412MHz | 7 | 2442MHz |
| 2 | 2417MHz | 8 | 2447MHz |
| 3 | 2422MHz | 9 | 2452MHz |
| 4 | 2427MHz | 10 | 2457MHz |
| 5 | 2432MHz | 11 | 2462MHz |
| 6 | 2437MHz | | |

7 channels are provided for 802.11n (HT40):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 3 | 2422MHz | 7 | 2442MHz |
| 4 | 2427MHz | 8 | 2447MHz |
| 5 | 2432MHz | 9 | 2452MHz |
| 6 | 2437MHz | | |

For 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 36 | 5180 MHz | 44 | 5220 MHz |
| 40 | 5200 MHz | 48 | 5240 MHz |

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 38 | 5190 MHz | 46 | 5230 MHz |

1 channel is provided for 802.11ac (VHT80):

| Channel | Frequency |
|---------|-----------|
| 42 | 5210MHz |

For 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 149 | 5745MHz | 161 | 5805MHz |
| 153 | 5765MHz | 165 | 5825MHz |
| 157 | 5785MHz | | |

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 151 | 5755MHz | 159 | 5795MHz |

1 channel is provided for 802.11ac (VHT80):

| Channel | Frequency |
|---------|-----------|
| 155 | 5775MHz |

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE \geq 1G**: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 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 **Z-plane**.

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 | MODE | FREQ. RANGE (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY |
|--------------------|--------------------------|-------------------|-------------------|----------------|-----------------------|
| - | 802.11g + 802.11n (HT20) | 2412 ~ 2462 | 1 to 11 | 6 + 149 | BPSK |
| | | 5180 ~ 5240 | 36 to 48 | | BPSK |
| | | 5745 ~ 5825 | 149 to 165 | | BPSK |

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 | MODE | FREQ. RANGE (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY |
|--------------------|--------------------------|-------------------|-------------------|----------------|-----------------------|
| - | 802.11g + 802.11n (HT20) | 2412 ~ 2462 | 1 to 11 | 6 + 149 | BPSK |
| | | 5180 ~ 5240 | 36 to 48 | | BPSK |
| | | 5745 ~ 5825 | 149 to 165 | | BPSK |

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 | MODE | FREQ. RANGE (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY |
|--------------------|--------------------------|-------------------|-------------------|----------------|-----------------------|
| - | 802.11g + 802.11n (HT20) | 2412 ~ 2462 | 1 to 11 | 6 + 149 | BPSK |
| | | 5180 ~ 5240 | 36 to 48 | | BPSK |
| | | 5745 ~ 5825 | 149 to 165 | | BPSK |

Test Condition:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|--------------|-----------|
| RE \geq 1G | 20deg. C, 69%RH | 120Vac, 60Hz | Bayu Chen |
| RE<1G | 20deg. C, 69%RH | 120Vac, 60Hz | Bayu Chen |
| PLC | 20deg. C, 69%RH | 120Vac, 60Hz | Bayu Chen |

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.

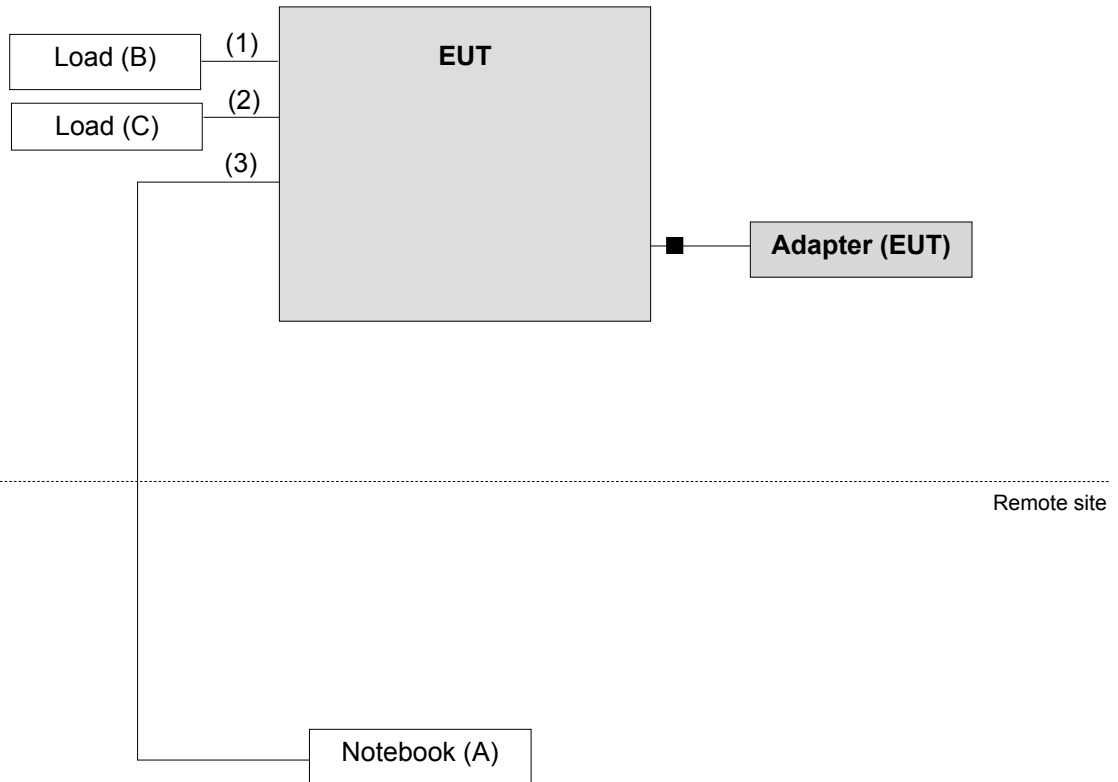
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|----------|-------|-----------|------------|------------------|---------|
| A. | Notebook | DELL | E5410 | 6RP2YM1 | FCC DoC Approved | - |
| B. | Load | N/A | N/A | N/A | N/A | - |
| C. | Load | N/A | N/A | N/A | N/A | - |

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as communication partner to transfer data.

| ID | Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks |
|----|---------------|------|------------|--------------------|--------------|---------|
| 1. | RJ45 Cable | 3 | 1.8 | N | 0 | Cat5e |
| 2. | Coaxial Cable | 1 | 2 | N | 0 | - |
| 3. | RJ45 Cable | 1 | 10 | N | 0 | Cat5e |

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)

FCC Part 15, Subpart E (15.407)

ANSI C63.10-2013

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 Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (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.

Limits of unwanted emission out of the restricted bands

| Applicable To | | Limit | |
|---|---|--|---|
| 789033 D02 General UNII Test Procedure New Rules v01r03 | | Field Strength at 3m | |
| | | PK:74 (dBuV/m) | AV:54 (dBuV/m) |
| Frequency Band | Applicable To | EIRP Limit | Equivalent Field Strength at 3m |
| 5150~5250 MHz | 15.407(b)(1) | PK:-27 (dBm/MHz) | PK:68.2(dBuV/m) |
| 5250~5350 MHz | 15.407(b)(2) | | |
| 5470~5725 MHz | 15.407(b)(3) | | |
| 5725~5850 MHz | <input checked="" type="checkbox"/> 15.407(b)(4)(i) | PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4} | PK: 68.2(dBuV/m) ^{*1} PK:105.2 (dBuV/m) ^{*2} PK: 110.8(dBuV/m) ^{*3} PK:122.2 (dBuV/m) ^{*4} |
| | <input type="checkbox"/> 15.407(b)(4)(ii) | Emission limits in section 15.247(d) | |
| ^{*1} beyond 75 MHz or more above of the band edge. ^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. | | ^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. ^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. | |

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

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

4.1.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|--------------------------------------|------------------------------|-----------------------|---------------|---------------|
| Test Receiver ROHDE & SCHWARZ | ESCI | 100424 | Oct. 24, 2016 | Oct. 23, 2017 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSP40 | 100040 | Aug. 16, 2016 | Aug. 15, 2017 |
| BILOG Antenna SCHWARZBECK | VULB9168 | 9168-155 | Dec. 28, 2016 | Dec. 27, 2017 |
| HORN Antenna SCHWARZBECK | BBHA 9120D | 9120D-1170 | Dec. 15, 2016 | Dec. 14, 2017 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | BBHA9170241 | Dec. 14, 2016 | Dec. 13, 2017 |
| Loop Antenna | EM-6879 | 269 | Aug. 11, 2016 | Aug. 10, 2017 |
| Preamplifier Agilent | 8449B | 3008A01960 | Aug. 09, 2016 | Aug. 08, 2017 |
| Preamplifier Agilent | 8447D | 2944A10631 | Aug. 09, 2016 | Aug. 08, 2017 |
| RF signal cable HUBER+SUHNER | SUCOFLEX 104 | MY 13380+295012/04 | Aug. 09, 2016 | Aug. 08, 2017 |
| RF signal cable HUBER+SUHNER | SUCOFLEX 104 | Cable-CH4-03 (250724) | Aug. 09, 2016 | Aug. 08, 2017 |
| Software BV ADT | ADT_Radiated_ V7.6.15.9.4 | NA | NA | NA |
| Antenna Tower inn-co GmbH | MA 4000 | 010303 | NA | NA |
| Antenna Tower Controller BV ADT | AT100 | AT93021703 | NA | NA |
| Turn Table BV ADT | TT100 | TT93021703 | NA | NA |
| Turn Table Controller BV 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 4.
 3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 460141.
 5. The IC Site Registration No. is IC7450F-4.

4.1.3 Test Procedures

For Radiated emission below 30MHz

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

NOTE:

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

For Radiated emission above 30MHz

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

Note:

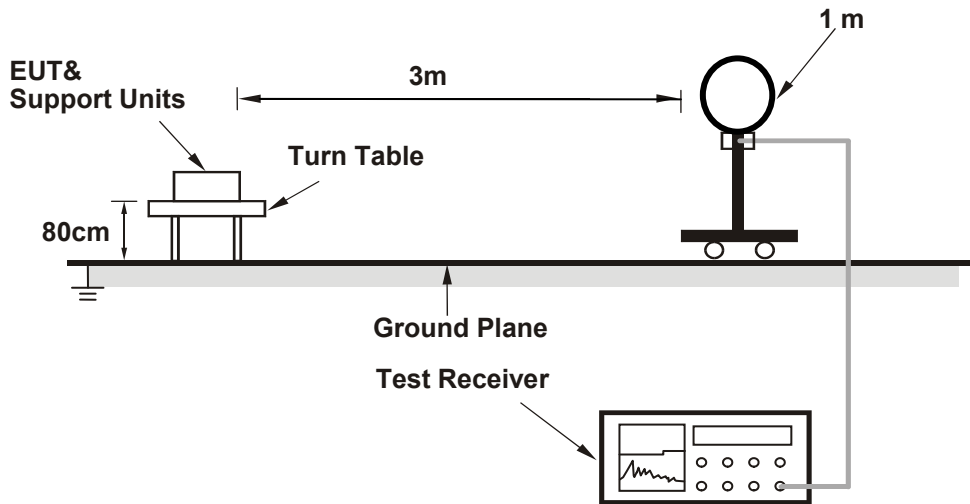
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

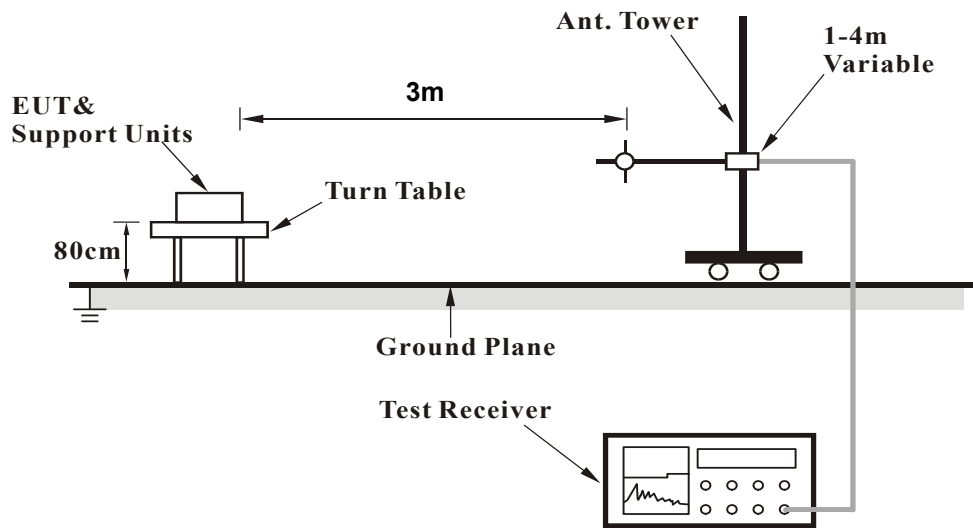
No deviation.

4.1.5 Test Setup

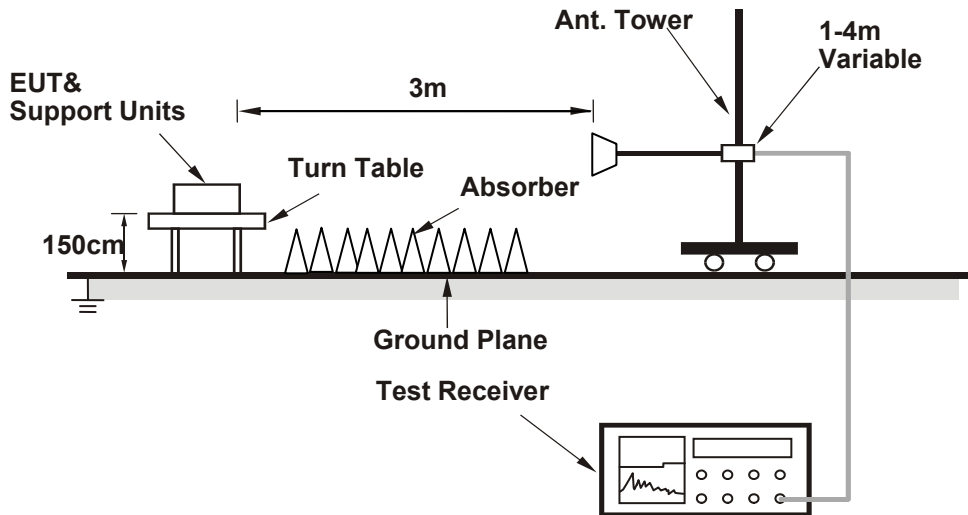
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Prepared a notebook to act as a communication partner and placed it outside of testing area.
- c. The communication partner connected with EUT via a RJ45 cable and ran a test program (QRCT) to enable EUT under transmission condition continuously at specific channel frequency.
- d. The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz Data:

802.11g + 802.11n (HT20)

| | | | |
|-----------------|---------------|-------------------|---------------------------|
| CHANNEL | CH 6 + CH 149 | DETECTOR FUNCTION | Peak (PK) Average (AV) |
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | |
|---|----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1 | 2288.00 | 58.2 PK | 74.0 | -15.8 | 1.08 H | 3 | 23.2 | 35.0 |
| 2 | 2288.00 | 50.0 AV | 54.0 | -4.0 | 1.08 H | 3 | 15.0 | 35.0 |
| 3 | *2437.00 | 121.2 PK | | | 2.51 H | 37 | 88.8 | 32.4 |
| 4 | *2437.00 | 112.1 AV | | | 2.51 H | 37 | 79.7 | 32.4 |
| 5 | 2483.50 | 71.0 PK | 74.0 | -3.0 | 2.43 H | 254 | 38.3 | 32.7 |
| 6 | 2483.50 | 53.5 AV | 54.0 | -0.5 | 2.43 H | 254 | 20.8 | 32.7 |
| 7 | 4874.00 | 48.4 PK | 74.0 | -25.6 | 1.41 H | 251 | 46.2 | 2.2 |
| 8 | 4874.00 | 35.9 AV | 54.0 | -18.1 | 1.41 H | 251 | 33.7 | 2.2 |
| 9 | #5632.80 | 58.9 PK | 68.2 | -9.3 | 1.13 H | 238 | 56.0 | 2.9 |
| 10 | *5745.00 | 119.6 PK | | | 1.13 H | 238 | 79.7 | 39.9 |
| 11 | *5745.00 | 108.8 AV | | | 1.13 H | 238 | 68.9 | 39.9 |
| 12 | #5968.80 | 60.0 PK | 68.2 | -8.2 | 1.13 H | 238 | 56.7 | 3.3 |
| 13 | 11490.00 | 62.1 PK | 74.0 | -11.9 | 1.47 H | 54 | 47.5 | 14.6 |
| 14 | 11490.00 | 49.9 AV | 54.0 | -4.1 | 1.47 H | 54 | 35.3 | 14.6 |

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.

| | | | |
|-----------------|---------------|-------------------|---------------------------|
| CHANNEL | CH 6 + CH 149 | DETECTOR FUNCTION | Peak (PK) Average (AV) |
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| 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 | 2288.00 | 62.8 PK | 74.0 | -11.2 | 1.43 V | 83 | 27.8 | 35.0 |
| 2 | 2288.00 | 52.9 AV | 54.0 | -1.1 | 1.43 V | 83 | 17.9 | 35.0 |
| 3 | *2437.00 | 123.3 PK | | | 1.09 V | 347 | 90.9 | 32.4 |
| 4 | *2437.00 | 113.2 AV | | | 1.09 V | 347 | 80.8 | 32.4 |
| 5 | 2483.50 | 69.5 PK | 74.0 | -4.5 | 1.00 V | 358 | 36.8 | 32.7 |
| 6 | 2483.50 | 53.5 AV | 54.0 | -0.5 | 1.00 V | 358 | 20.8 | 32.7 |
| 7 | 4874.00 | 50.3 PK | 74.0 | -23.7 | 1.34 V | 255 | 48.1 | 2.2 |
| 8 | 4874.00 | 37.0 AV | 54.0 | -17.0 | 1.34 V | 255 | 34.8 | 2.2 |
| 9 | #5641.60 | 59.7 PK | 68.2 | -8.5 | 1.76 V | 323 | 56.8 | 2.9 |
| 10 | *5745.00 | 121.8 PK | | | 1.76 V | 323 | 81.9 | 39.9 |
| 11 | *5745.00 | 112.0 AV | | | 1.76 V | 323 | 72.1 | 39.9 |
| 12 | #5928.00 | 60.2 PK | 68.2 | -8.0 | 1.76 V | 323 | 57.0 | 3.2 |
| 13 | 11490.00 | 63.2 PK | 74.0 | -10.8 | 1.17 V | 236 | 48.6 | 14.6 |
| 14 | 11490.00 | 50.8 AV | 54.0 | -3.2 | 1.17 V | 236 | 36.2 | 14.6 |

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.

Below 1GHz data

802.11g + 802.11n (HT20)

| | | | |
|-----------------|---------------|-------------------|-----------------|
| CHANNEL | CH 6 + CH 149 | 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 | 30.00 | 25.4 QP | 40.0 | -14.6 | 1.50 H | 184 | 41.4 | -16.0 |
| 2 | 101.69 | 27.5 QP | 43.5 | -16.0 | 1.25 H | 180 | 45.4 | -17.9 |
| 3 | 124.98 | 37.3 QP | 43.5 | -6.2 | 1.50 H | 17 | 52.7 | -15.4 |
| 4 | 375.29 | 34.3 QP | 46.0 | -11.7 | 1.00 H | 285 | 43.7 | -9.4 |
| 5 | 625.60 | 39.2 QP | 46.0 | -6.8 | 1.00 H | 358 | 42.2 | -3.0 |
| 6 | 875.91 | 39.2 QP | 46.0 | -6.8 | 2.00 H | 342 | 37.0 | 2.2 |
| 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 | 49.30 | 29.3 QP | 40.0 | -10.7 | 1.25 V | 241 | 43.3 | -14.0 |
| 2 | 101.69 | 33.4 QP | 43.5 | -10.1 | 1.25 V | 199 | 51.3 | -17.9 |
| 3 | 124.98 | 30.2 QP | 43.5 | -13.3 | 1.00 V | 257 | 45.6 | -15.4 |
| 4 | 375.29 | 33.0 QP | 46.0 | -13.0 | 2.00 V | 305 | 42.4 | -9.4 |
| 5 | 625.60 | 35.3 QP | 46.0 | -10.7 | 1.25 V | 143 | 38.3 | -3.0 |
| 6 | 875.91 | 39.0 QP | 46.0 | -7.0 | 1.00 V | 31 | 36.8 | 2.2 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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. | Cal. Date | Cal. Due |
|--|--------------------------|----------------|---------------|---------------|
| Test Receiver ROHDE & SCHWARZ | ESCI | 100613 | Nov. 21, 2016 | Nov. 20, 2017 |
| RF signal cable (with 10dB PAD) Woken | 5D-FB | Cable-cond1-01 | Dec. 22, 2016 | Dec. 21, 2017 |
| LISN ROHDE & SCHWARZ (EUT) | ESH3-Z5 | 835239/001 | Mar. 10, 2017 | Mar. 09, 2018 |
| LISN ROHDE & SCHWARZ (Peripheral) | ESH3-Z5 | 100311 | Jul. 28, 2016 | Jul. 27, 2017 |
| Software ADT | BV ADT_Cond_ V7.3.7.3 | NA | NA | NA |

- Note:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Shielded Room 1.
 3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

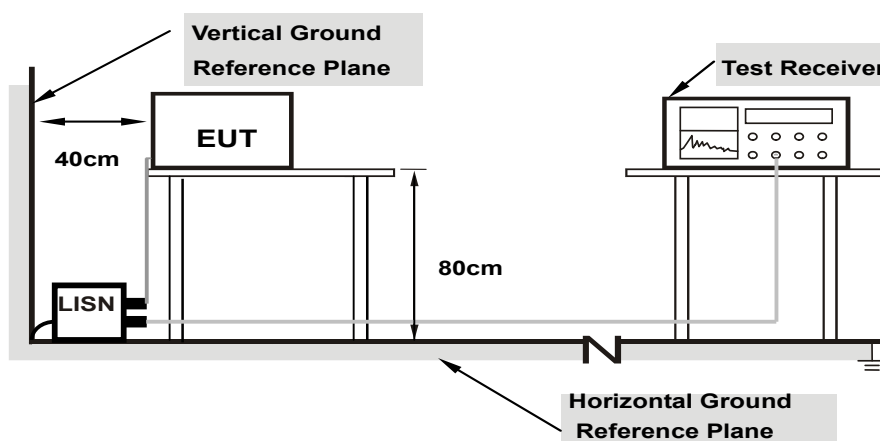
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were 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

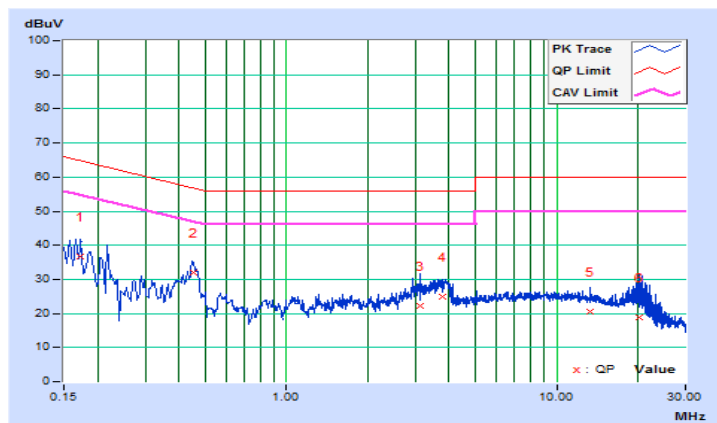
802.11g + 802.11n (HT20)

| | | | |
|---------|---------------|-------------------|--------------------------------|
| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
| Channel | CH 6 + CH 149 | | |

| 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 | 0.17346 | 10.42 | 26.42 | 18.89 | 36.84 | 29.31 | 64.79 | 54.79 | -27.95 | -25.48 |
| 2 | 0.45335 | 10.51 | 21.47 | 17.11 | 31.98 | 27.62 | 56.81 | 46.81 | -24.83 | -19.19 |
| 3 | 3.12160 | 10.60 | 11.60 | 5.76 | 22.20 | 16.36 | 56.00 | 46.00 | -33.80 | -29.64 |
| 4 | 3.77848 | 10.64 | 14.14 | 6.64 | 24.78 | 17.28 | 56.00 | 46.00 | -31.22 | -28.72 |
| 5 | 13.36580 | 11.07 | 9.48 | 4.90 | 20.55 | 15.97 | 60.00 | 50.00 | -39.45 | -34.03 |
| 6 | 20.14183 | 11.43 | 7.32 | 2.45 | 18.75 | 13.88 | 60.00 | 50.00 | -41.25 | -36.12 |

Remarks:

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

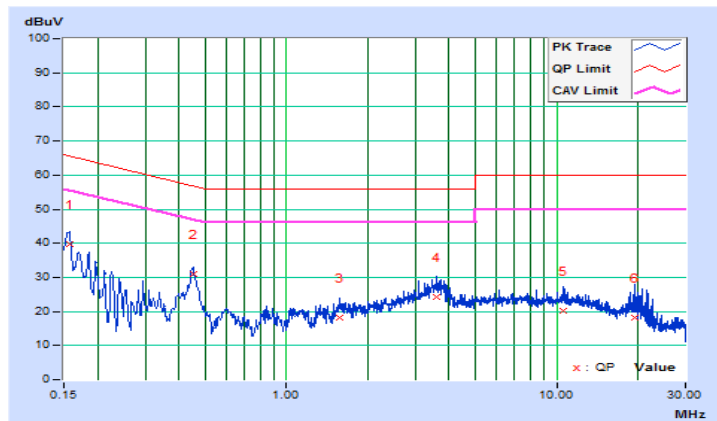


| | | | |
|---------|---------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
| Channel | CH 6 + CH 149 | | |

| 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 | 0.15719 | 10.16 | 29.69 | 20.07 | 39.85 | 30.23 | 65.61 |
| 2 | 0.45097 | 10.23 | 20.90 | 17.70 | 31.13 | 27.93 | 56.86 | 46.86 | -25.73 | -18.93 |
| 3 | 1.58106 | 10.28 | 8.05 | 3.77 | 18.33 | 14.05 | 56.00 | 46.00 | -37.67 | -31.95 |
| 4 | 3.57907 | 10.40 | 13.90 | 7.26 | 24.30 | 17.66 | 56.00 | 46.00 | -31.70 | -28.34 |
| 5 | 10.64053 | 10.67 | 9.66 | 4.96 | 20.33 | 15.63 | 60.00 | 50.00 | -39.67 | -34.37 |
| 6 | 19.42239 | 11.03 | 7.09 | 1.19 | 18.12 | 12.22 | 60.00 | 50.00 | -41.88 | -37.78 |

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



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:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

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Email: service.adt@tw.bureauveritas.com

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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