

Variant FCC Test Report

Report No.: RF190111C05A-2

FCC ID: HD5-CK65L0N

Test Model: CK65L0N

Received Date: Oct. 04, 2019

Test Date: Oct. 22, 2019 ~ Nov. 28, 2019

Issued Date: Dec. 04, 2019

Applicant: Honeywell International Inc.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 788550 / TW0003



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Release Control Record

| Issue No. | Description | Date Issued |
|----------------|------------------|---------------|
| RF190111C05A-2 | Original Release | Dec. 04, 2019 |

1 Certificate of Conformity

Product: Mobile computer

Brand: Honeywell

Test Model: CK65L0N

Sample Status: Engineering Sample

Applicant: Honeywell International Inc.

Test Date: Oct. 22, 2019 ~ Nov. 28, 2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

This report is issued as a supplementary report to BV CPS report no.: RF190111C05-2. This report shall be used by combining with its original report.

Prepared by : Rona Chen , **Date:** Dec. 04, 2019
Rona Chen / Specialist

Approved by : Dylan Chiou , **Date:** Dec. 04, 2019
Dylan Chiou / Project Engineer

2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.247) | | | |
|--|--|--------|--|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 | AC Power Conducted Emission | N/A | Without AC power port of the EUT. |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions and Band Edge Measurement | Pass | Meet the requirement of limit. Minimum passing margin is -1.3 dB at 2390 MHz. |
| 15.247(d) | Antenna Port Emission | N/A | Refer to Note |
| 15.247(a)(2) | 6 dB Bandwidth | N/A | Refer to Note |
| --- | Occupied Bandwidth Measurement | N/A | Refer to Note |
| 15.247(b) | Conducted power | Pass | Meet the requirement of limit. |
| 15.247(e) | Power Spectral Density | N/A | Refer to Note |
| 15.203 | Antenna Requirement | Pass | Antenna connector is POGO pin not a standard connector. |

Note:

1. Only Radiated Emissions and Conducted power tests were performed for this addendum. Refer to original report for other test data.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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) (±) |
|--------------------------------|--------------------|--------------------------------|
| Radiated Emissions up to 1 GHz | 9 kHz ~ 30 MHz | 3.04 dB |
| | 30 MHz ~ 200 MHz | 2.93 dB |
| | 200 MHz ~ 1000 MHz | 2.95 dB |
| Radiated Emissions above 1 GHz | 1 GHz ~ 18 GHz | 2.26 dB |
| | 18 GHz ~ 40 GHz | 1.94 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|------------------------------|--|
| Product | Mobile computer |
| Brand | Honeywell |
| Test Model | CK65L0N |
| Status of EUT | Engineering Sample |
| Power Supply Rating | 3.6 Vdc or 3.7 Vdc (Battery) |
| Modulation Type | CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM |
| Modulation Technology | DSSS, OFDM |
| Transfer Rate | 802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 300 Mbps 802.11ac: up to 400 Mbps |
| Operating Frequency | 2412 ~ 2462 MHz |
| Number of Channel | 11 for 802.11b, 802.11g, 802.11n (HT20), 802.11ac (VHT20) 7 for 802.11n (HT40), 802.11ac (VHT40) |
| Output Power | 628.946 mW |
| Antenna Type | Refer to Note as below |
| Antenna Connector | Refer to Note as below |
| Accessory Device | Refer to Note as below |
| Data Cable Supplied | N/A |
| HW Version | 3.1 |
| HW P/N | DVT |
| SW Version | 01.03.00.0686 |
| SW P/N | 88.00.00-DEBUG-(0327) |

Note:

- This report is issued as a supplementary report to BV CPS report no.: RF190111C0-2. The differences compared with original report are listed as below. Radiated Emissions were verified on the worst case of original report and verified Radiated Emissions in reduced power channel and recorded in this report.
 - Add new scanner Gen 8, the Gen 8 is the next generation of the N6703 scanner.
 - Add Cold Storage.
 - Add Battery 2 for Cold Storage SKU.
 - NFC matching optimize.
 - Add Heater function.
 - Non-camera.

2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

| Modulation Mode | Tx Function |
|------------------|-------------|
| 802.11b | 2TX |
| 802.11g | 2TX |
| 802.11n (HT20) | 2TX |
| 802.11n (HT40) | 2TX |
| 802.11ac (VHT20) | 2TX |
| 802.11ac (VHT40) | 2TX |

* 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)

3. There're 4 configurations for the EUT listed as below.

| Sample | Scanner | Keypad | Antenna Type | | | |
|--------|---------|---------------|--------------|-----------|------------|---------|
| | | | Type | Connector | Gain (dBi) | |
| | | | | | Chain 0 | Chain 1 |
| A | GEN8 | Alpha | FPC antenna | POGO pin | 2.62 | 2.85 |
| B | GEN8 | Large Numeric | FPC antenna | POGO pin | 2.62 | 2.85 |
| C | EX20 | Alpha | FPC antenna | POGO pin | 2.64 | 2.88 |
| D | EX20 | Num-F | FPC antenna | POGO pin | 2.64 | 2.88 |

*Above samples had been pre-tested, the worst case was found on Sample C. Therefore, only Sample C were chosen as a representative for final test and recorded in the report.

4. The EUT contains following accessory devices.

| Product | Brand | Model | Description |
|-----------|-----------------------------------|-----------|----------------------------|
| Battery 1 | Intermec Technologies Corporation | AB18 | 3.7 Vdc, 5.1 Ah, 18.9 Wh |
| Battery 2 | Honeywell | CK65-BTCS | 3.6 Vdc, 5200 mAh, 18.7 Wh |

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

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), and 802.11ac (VHT20):

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

7 channels are provided for 802.11n (HT40) and 802.11ac (VHT40):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To | | | Description |
|--------------------|---------------|-----------|------|-------------|
| | RE \geq 1G | RE $<$ 1G | APCM | |
| - | √ | √ | √ | Sample C |

Where **RE \geq 1G**: Radiated Emission above 1 GHz **RE $<$ 1G**: Radiated Emission below 1 GHz
APCM: Antenna Port Conducted Measurement

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

Radiated Emission Test (Above 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, 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 | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|--------------------|----------------|-------------------|----------------|-----------------------|-----------------|------------------|
| - | 802.11g | 1 to 11 | 1, 11 | OFDM | BPSK | 6.0 |
| | 802.11n (HT20) | 1 to 11 | 1, 11 | OFDM | BPSK | 6.5 |
| | 802.11n (HT40) | 3 to 9 | 3, 6 | OFDM | BPSK | 13.5 |

Radiated Emission Test (Below 1 GHz):

- 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 | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|--------------------|----------------|-------------------|----------------|-----------------------|-----------------|------------------|
| - | 802.11n (HT40) | 3 to 9 | 6 | OFDM | BPSK | 13.5 |

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 | Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|--------------------|----------------|-------------------|----------------|-----------------------|-----------------|------------------|
| - | 802.11b | 1 to 11 | 1, 6, 11 | DSSS | DBPSK | 1.0 |
| | 802.11g | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6.0 |
| | 802.11n (HT20) | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6.5 |
| | 802.11n (HT40) | 3 to 9 | 3, 6, 9 | OFDM | BPSK | 13.5 |

Test Condition:

| Applicable To | Environmental Conditions | Input Power | Tested by |
|---------------|--------------------------|-------------|----------------------|
| RE≥1G | 25 deg. C, 65 % RH | 3.6 Vdc | Tim Chen, Getaz Yang |
| RE<1G | 25 deg. C, 65 % RH | 3.6 Vdc | Tim Chen |
| APCM | 25 deg. C, 65 % RH | 3.6 Vdc | Gavin Wu |

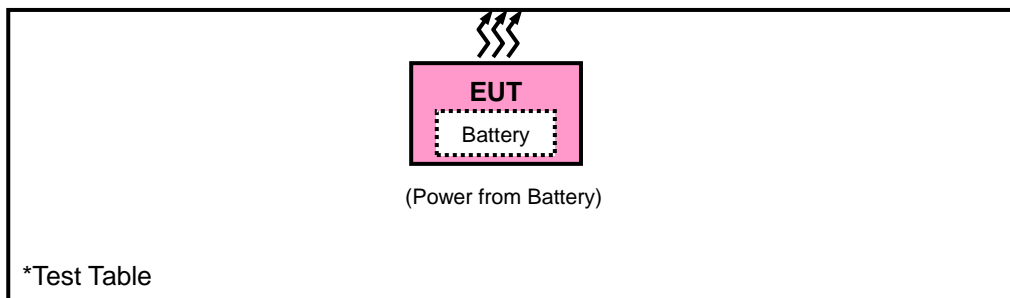
3.3 Description of Support Units

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

| No. | Product | Brand | Model No. | Serial No. | FCC ID |
|-----|-----------|-----------|-----------|------------|--------|
| 1. | Battery 2 | Honeywell | CK65-BTCS | N/A | N/A |

| No. | Signal Cable Description Of The Above Support Units |
|-----|---|
| 1. | N/A |

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)

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

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 20 dB 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 1000 MHz, 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 20 dB under any condition of modulation.

4.1.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date of Calibration |
|--|----------------------------|-------------------------------|---------------------|-------------------------|
| Test Receiver Agilent | N9038A | MY51210203 | Mar. 18, 2019 | Mar. 17, 2020 |
| Spectrum Analyzer Agilent | N9010A | MY52220314 | Dec. 13, 2018 | Dec. 12, 2019 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSU43 | 101261 | Apr. 15, 2019 | Apr. 14, 2020 |
| Broadband Horn Antenna SCHWARZBECK | BBHA 9170 | 148 | Nov. 25, 2018 | Nov. 24, 2019 |
| | | | Nov. 24, 2019 | Nov. 23, 2020 |
| HORN Antenna SCHWARZBECK | BBHA 9120D | 9120D-969 | Nov. 25, 2018 | Nov. 24, 2019 |
| | | | Nov. 24, 2019 | Nov. 23, 2020 |
| BILOG Antenna SCHWARZBECK | VULB 9168 | 9168-472 | Nov. 23, 2018 | Nov. 22, 2019 |
| | | | Nov. 08, 2019 | Nov. 07, 2020 |
| Fixed Attenuator WOKEN | MDCS18N-10 | MDCS18N-10-01 | Apr. 15, 2019 | Apr. 14, 2020 |
| Loop Antenna | EM-6879 | 269 | Sep. 16, 2019 | Sep. 15, 2020 |
| Preamplifier EMCI | EMC001340 | 980269 | Jun. 17, 2019 | Jun. 16, 2020 |
| Preamplifier EMCI | EMC 012645 | 980115 | Oct. 08, 2019 | Oct. 07, 2020 |
| Preamplifier EMCI | EMC 184045 | 980116 | Oct. 08, 2019 | Oct. 07, 2020 |
| Preamplifier EMCI | EMC 330H | 980112 | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Coaxial Cable HUBER+SUHNNER | EMC104-SM-SM-8 000&3000 | 140811+170717 | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Coaxial Cable HUBER+SUHNNER | SUCOFLEX 104 | EMC104-SM-SM-1 000(140807) | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Coaxial Cable WOKEN | 8D-FB | Cable-Ch10-01 | Oct. 08, 2019 | Oct. 07, 2020 |
| Software BV ADT | E3 6.120103 | NA | NA | NA |
| Antenna Tower MF | MFA-440H | NA | NA | NA |
| Turn Table MF | MFT-201SS | NA | NA | NA |
| Antenna Tower & Turn Table Controller MF | MF-7802 | 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 Chamber 10.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- 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. Parallel, perpendicular, and ground-parallel orientations 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 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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:

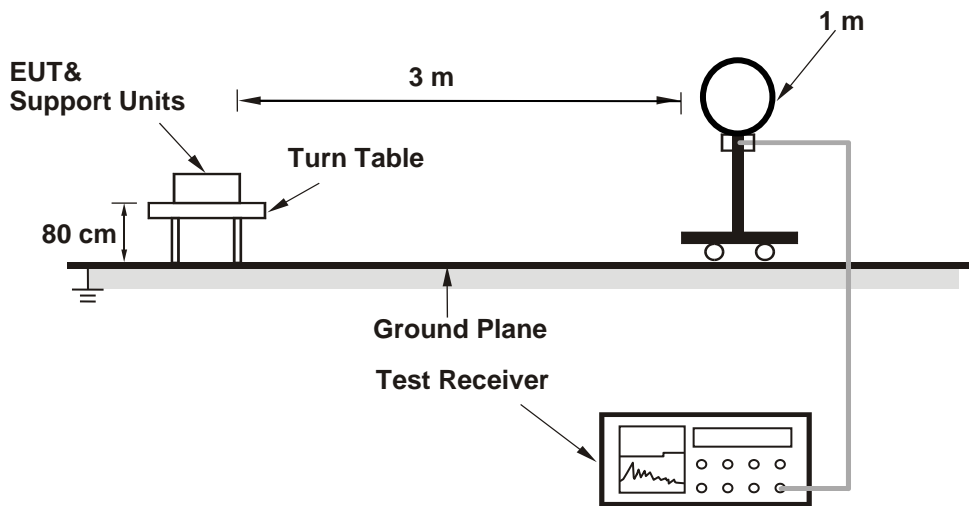
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10 Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1 GHz.
(11n (HT20): RBW = 1 MHz, VBW = 1 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

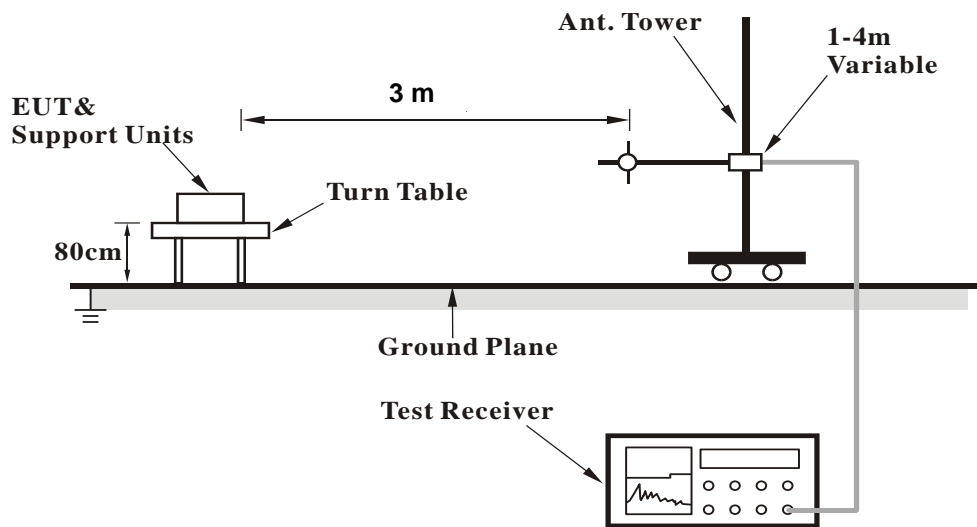
No deviation.

4.1.5 Test Set Up

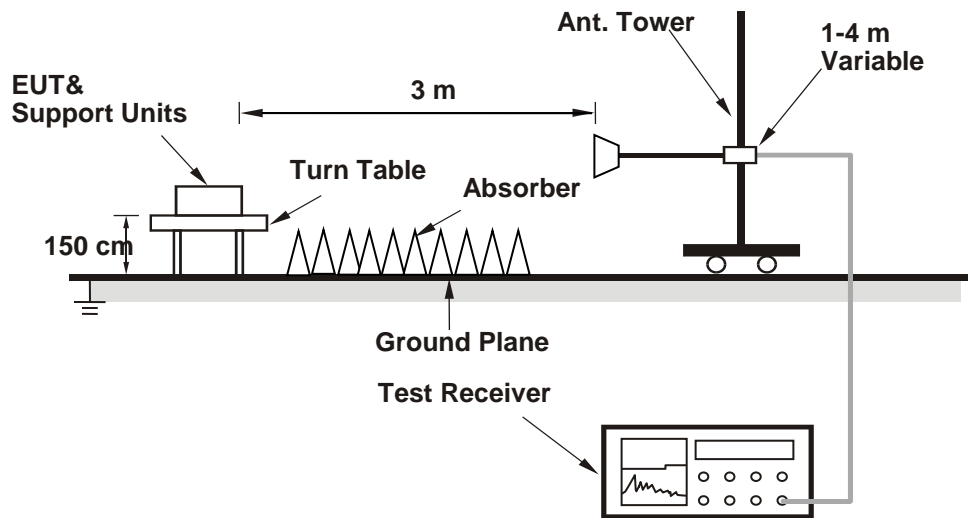
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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 a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data :
802.11g

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 1 | Frequency Range | 1 GHz ~ 25 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Getaz Yang |

Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 2389.94 | 51.2 | 56.2 | -5 | 54 | -2.8 | 111 | 152 | Average |
| 2389.94 | 68.69 | 73.69 | -5 | 74 | -5.31 | 111 | 152 | Peak |
| 2412 | 101.73 | 106.74 | -5.01 | | | 111 | 152 | Average |
| 2412 | 111.1 | 116.11 | -5.01 | | | 111 | 152 | Peak |
| 4824 | 33.45 | 47.83 | -14.38 | 54 | -20.55 | 102 | 71 | Average |
| 4824 | 42.42 | 56.8 | -14.38 | 74 | -31.58 | 102 | 71 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 2389.94 | 47.11 | 52.11 | -5 | 54 | -6.89 | 136 | 271 | Average |
| 2389.94 | 67.49 | 72.49 | -5 | 74 | -6.51 | 136 | 271 | Peak |
| 2412 | 99.19 | 104.2 | -5.01 | | | 136 | 271 | Average |
| 2412 | 108.52 | 113.53 | -5.01 | | | 136 | 271 | Peak |
| 4824 | 43.22 | 57.6 | -14.38 | 54 | -10.78 | 135 | 275 | Average |
| 4824 | 42.29 | 56.67 | -14.38 | 74 | -31.71 | 135 | 275 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 11 | Frequency Range | 1 GHz ~ 25 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Getaz Yang |

| Antenna Polarity & Test Distance: Horizontal at 3 m | | | | | | | | |
|---|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 2462 | 101.9 | 106.81 | -4.91 | | | 130 | 156 | Average |
| 2462 | 111.41 | 116.32 | -4.91 | | | 130 | 156 | Peak |
| 2483.52 | 51.72 | 56.57 | -4.85 | 54 | -2.28 | 130 | 156 | Average |
| 2483.52 | 70.42 | 75.27 | -4.85 | 74 | -3.58 | 130 | 156 | Peak |
| 4924 | 34.39 | 48.35 | -13.96 | 54 | -19.61 | 89 | 58 | Average |
| 4924 | 43.61 | 57.57 | -13.96 | 74 | -30.39 | 89 | 58 | Peak |
| Antenna Polarity & Test Distance: Vertical at 3 m | | | | | | | | |
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 2462 | 100.14 | 105.05 | -4.91 | | | 144 | 263 | Average |
| 2462 | 109.86 | 114.77 | -4.91 | | | 144 | 263 | Peak |
| 2483.6 | 50.43 | 55.28 | -4.85 | 54 | -3.57 | 144 | 263 | Average |
| 2483.6 | 69.79 | 74.64 | -4.85 | 74 | -4.21 | 144 | 263 | Peak |
| 4924 | 34.75 | 48.71 | -13.96 | 54 | -19.25 | 129 | 282 | Average |
| 4924 | 43.73 | 57.69 | -13.96 | 74 | -30.27 | 129 | 282 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

802.11n (HT20)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 1 | Frequency Range | 1 GHz ~ 25 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Getaz Yang |

Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 2389.8 | 51.12 | 58.12 | -5 | 54 | -2.88 | 100 | 139 | Average |
| 2389.8 | 69.24 | 74.24 | -5 | 74 | -4.76 | 100 | 139 | Peak |
| 2412 | 101.69 | 106.7 | -5.01 | | | 100 | 139 | Average |
| 2412 | 111.27 | 116.28 | -5.01 | | | 100 | 139 | Peak |
| 4824 | 33.98 | 48.36 | -14.38 | 54 | -20.02 | 94 | 53 | Average |
| 4824 | 42.85 | 57.23 | -14.38 | 74 | -31.15 | 94 | 53 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 2389.94 | 51.11 | 56.11 | -5 | 54 | -2.89 | 131 | 272 | Average |
| 2389.94 | 68.12 | 73.12 | -5 | 74 | -5.88 | 131 | 272 | Peak |
| 2412 | 99.4 | 104.41 | -5.01 | | | 131 | 272 | Average |
| 2412 | 108.5 | 113.51 | -5.01 | | | 131 | 272 | Peak |
| 4824 | 34.12 | 48.5 | -14.38 | 54 | -19.88 | 127 | 265 | Average |
| 4824 | 43.22 | 57.6 | -14.38 | 74 | -30.78 | 127 | 265 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 11 | Frequency Range | 1 GHz ~ 25 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Getaz Yang |

| Antenna Polarity & Test Distance: Horizontal at 3 m | | | | | | | | |
|---|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 2462 | 101.83 | 106.74 | -4.91 | | | 137 | 156 | Average |
| 2462 | 111.52 | 116.43 | -4.91 | | | 137 | 156 | Peak |
| 2483.64 | 52.28 | 57.13 | -4.85 | 54 | -1.72 | 137 | 156 | Average |
| 2483.64 | 69.46 | 74.31 | -4.85 | 74 | -4.54 | 137 | 156 | Peak |
| 4924 | 35.37 | 49.33 | -13.96 | 54 | -18.63 | 112 | 83 | Average |
| 4924 | 44.39 | 58.35 | -13.96 | 74 | -29.61 | 112 | 83 | Peak |
| Antenna Polarity & Test Distance: Vertical at 3 m | | | | | | | | |
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 2462 | 99.67 | 104.58 | -4.91 | | | 120 | 263 | Average |
| 2462 | 109.19 | 114.1 | -4.91 | | | 120 | 263 | Peak |
| 2483.64 | 48.66 | 53.51 | -4.85 | 54 | -5.34 | 120 | 263 | Average |
| 2483.64 | 67.31 | 72.16 | -4.85 | 74 | -6.69 | 120 | 263 | Peak |
| 4924 | 34.75 | 48.71 | -13.96 | 54 | -19.25 | 149 | 271 | Average |
| 4924 | 43.73 | 57.69 | -13.96 | 74 | -30.27 | 149 | 271 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

802.11n (HT40)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 3 | Frequency Range | 1 GHz ~ 25 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Getaz Yang |

Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 2389.94 | 51.54 | 56.54 | -5 | 54 | -2.46 | 100 | 156 | Average |
| 2389.94 | 67.18 | 72.18 | -5 | 74 | -6.82 | 100 | 156 | Peak |
| 2422 | 95.96 | 100.93 | -4.97 | | | 100 | 156 | Average |
| 2422 | 105.8 | 110.77 | -4.97 | | | 100 | 156 | Peak |
| 2483.64 | 38.32 | 43.17 | -4.85 | 54 | -15.68 | 100 | 156 | Average |
| 2483.64 | 50.79 | 55.64 | -4.85 | 74 | -23.21 | 100 | 156 | Peak |
| 4844 | 33.59 | 47.86 | -14.27 | 54 | -20.41 | 105 | 71 | Average |
| 4844 | 42.6 | 56.87 | -14.27 | 74 | -31.4 | 105 | 71 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 2390 | 49.22 | 54.22 | -5 | 54 | -4.78 | 165 | 266 | Average |
| 2390 | 63.85 | 68.85 | -5 | 74 | -10.15 | 165 | 266 | Peak |
| 2422 | 93.69 | 98.66 | -4.97 | | | 165 | 266 | Average |
| 2422 | 103.18 | 108.15 | -4.97 | | | 165 | 266 | Peak |
| 2483.5 | 37.34 | 42.19 | -4.85 | 54 | -16.66 | 165 | 266 | Average |
| 2483.5 | 54.26 | 59.11 | -4.85 | 74 | -19.74 | 165 | 266 | Peak |
| 4844 | 34.86 | 49.13 | -14.27 | 54 | -19.14 | 138 | 282 | Average |
| 4844 | 43.79 | 58.06 | -14.27 | 74 | -30.21 | 138 | 282 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2422 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 6 | Frequency Range | 1 GHz ~ 25 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Getaz Yang |

| Antenna Polarity & Test Distance: Horizontal at 3 m | | | | | | | | |
|---|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 2390 | 52.7 | 57.7 | -5 | 54 | -1.3 | 100 | 143 | Average |
| 2390 | 70.6 | 75.6 | -5 | 74 | -3.4 | 100 | 143 | Peak |
| 2437 | 96.35 | 101.33 | -4.98 | | | 100 | 143 | Average |
| 2437 | 108.22 | 113.2 | -4.98 | | | 100 | 143 | Peak |
| 2483.5 | 51.96 | 56.81 | -4.85 | 54 | -2.04 | 100 | 143 | Average |
| 2483.5 | 68.1 | 72.95 | -4.85 | 74 | -5.9 | 100 | 143 | Peak |
| 4874 | 35.63 | 49.71 | -14.08 | 54 | -18.37 | 100 | 66 | Average |
| 4874 | 44.89 | 58.97 | -14.08 | 74 | -29.11 | 100 | 66 | Peak |
| Antenna Polarity & Test Distance: Vertical at 3 m | | | | | | | | |
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 2390 | 50.22 | 55.22 | -5 | 54 | -3.78 | 100 | 260 | Average |
| 2390 | 67.04 | 72.04 | -5 | 74 | -6.96 | 100 | 260 | Peak |
| 2437 | 94.41 | 99.39 | -4.98 | | | 100 | 260 | Average |
| 2437 | 104.76 | 109.74 | -4.98 | | | 100 | 260 | Peak |
| 2483.5 | 46.78 | 51.63 | -4.85 | 54 | -7.22 | 100 | 260 | Average |
| 2483.5 | 64.22 | 69.07 | -4.85 | 74 | -9.78 | 100 | 260 | Peak |
| 4874 | 35.43 | 49.51 | -14.08 | 54 | -18.57 | 133 | 277 | Average |
| 4874 | 44.42 | 58.5 | -14.08 | 74 | -29.58 | 133 | 277 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

9 kHz ~ 30 MHz Data:

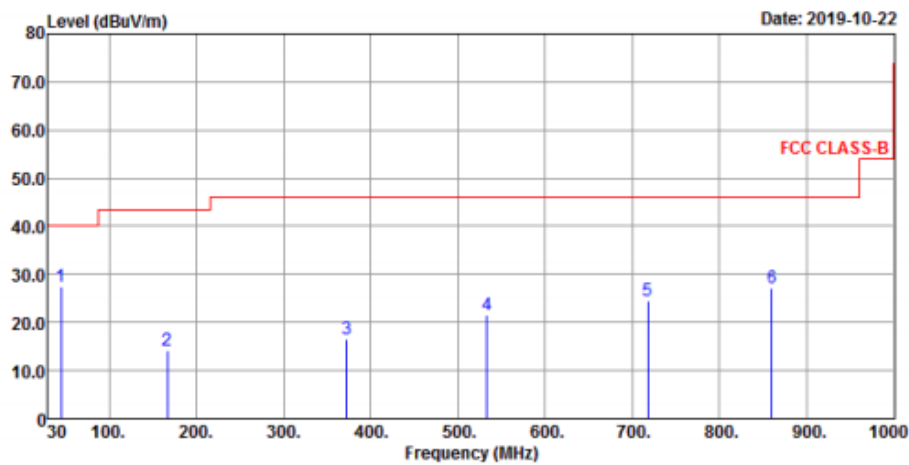
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

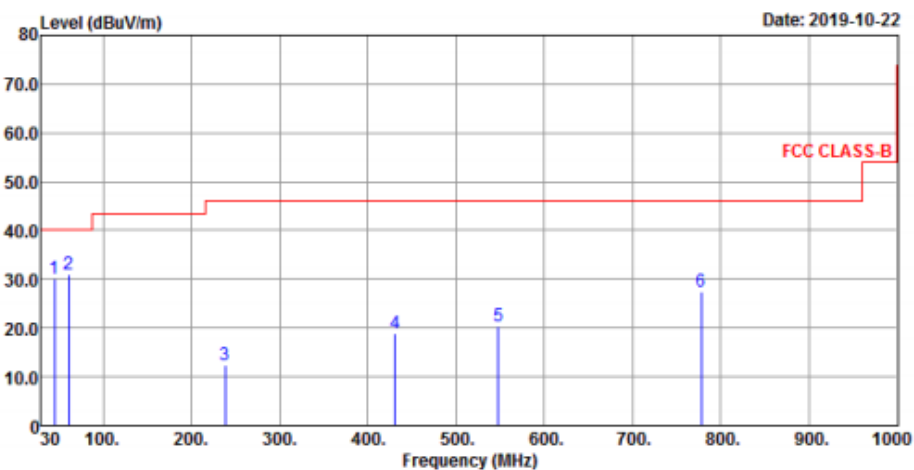
802.11n (HT40)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|------------------------------|
| Channel | Channel 6 | Frequency Range | 30 MHz ~ 1 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Quasi-peak (QP) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Tim Chen |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 44.55 | 27.52 | 44.53 | -17.01 | 40 | -12.48 | 109 | 12 | Peak |
| 166.77 | 14.22 | 31.59 | -17.37 | 43.5 | -29.28 | 123 | 12 | Peak |
| 372.41 | 16.59 | 31.72 | -15.13 | 46 | -29.41 | 139 | 9 | Peak |
| 533.43 | 21.44 | 31.56 | -10.12 | 46 | -24.56 | 125 | 36 | Peak |
| 717.73 | 24.63 | 31.67 | -7.04 | 46 | -21.37 | 111 | 209 | Peak |
| 860.32 | 27.05 | 31.22 | -4.17 | 46 | -18.95 | 134 | 138 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 44.55 | 30.03 | 47.04 | -17.01 | 40 | -9.97 | 122 | 239 | Peak |
| 61.04 | 31.09 | 49.89 | -18.8 | 40 | -8.91 | 112 | 11 | Peak |
| 238.55 | 12.44 | 30.7 | -18.26 | 46 | -33.56 | 101 | 261 | Peak |
| 430.61 | 19.03 | 31.32 | -12.29 | 46 | -26.97 | 114 | 290 | Peak |
| 547.98 | 20.51 | 30.92 | -10.41 | 46 | -25.49 | 108 | 181 | Peak |
| 777.87 | 27.55 | 32.06 | -4.51 | 46 | -18.45 | 121 | 254 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value.
- The emission levels of other frequencies were very low against the limit.

4.2 Conducted Output Power Measurement

4.2.1 Limits of Conducted Output Power Measurement

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

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

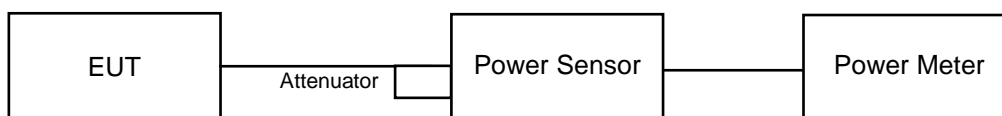
Array Gain = 0 dB (i.e., no array gain) for $NANT \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;

Array Gain = $5 \log(NANT/NSS)$ dB or 3 dB, whichever is less for 20 MHz channel widths with $NANT \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(NANT/NSS)$ dB.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 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 power level.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

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

4.2.7 Test Results

<Peak Power>

802.11b

| Channel | Frequency (MHz) | Peak Power (dBm) | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---------|-----------------|------------------|---------|------------------|-------------------|-------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 1 | 2412 | 21.87 | 21.75 | 303.439 | 24.82 | 30 | Pass |
| 6 | 2437 | 21.93 | 21.86 | 309.417 | 24.91 | 30 | Pass |
| 11 | 2462 | 22.02 | 21.92 | 314.818 | 24.98 | 30 | Pass |

802.11g

| Channel | Frequency (MHz) | Peak Power (dBm) | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---------|-----------------|------------------|---------|------------------|-------------------|-------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 1 | 2412 | 22.45 | 22.26 | 344.059 | 25.37 | 30 | Pass |
| 6 | 2437 | 25.06 | 24.89 | 628.946 | 27.99 | 30 | Pass |
| 11 | 2462 | 23.16 | 23.03 | 407.923 | 26.11 | 30 | Pass |

802.11n (HT20)

| Channel | Frequency (MHz) | Peak Power (dBm) | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---------|-----------------|------------------|---------|------------------|-------------------|-------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 1 | 2412 | 22.00 | 21.80 | 309.845 | 24.91 | 30 | Pass |
| 6 | 2437 | 24.44 | 24.15 | 537.987 | 27.31 | 30 | Pass |
| 11 | 2462 | 22.72 | 22.70 | 373.277 | 25.72 | 30 | Pass |

802.11n (HT40)

| Channel | Frequency (MHz) | Peak Power (dBm) | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---------|-----------------|------------------|---------|------------------|-------------------|-------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 3 | 2422 | 20.60 | 19.90 | 212.539 | 23.27 | 30 | Pass |
| 6 | 2437 | 22.38 | 22.16 | 337.419 | 25.28 | 30 | Pass |
| 9 | 2452 | 22.05 | 21.85 | 313.434 | 24.96 | 30 | Pass |

<Average Power (For Reference)>

802.11b

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---------|-----------------|---------------------|---------|------------------|-------------------|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 19.34 | 19.11 | 167.371 | 22.24 |
| 6 | 2437 | 19.23 | 19.20 | 166.929 | 22.23 |
| 11 | 2462 | 19.31 | 19.29 | 170.228 | 22.31 |

802.11g

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---------|-----------------|---------------------|---------|------------------|-------------------|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 16.16 | 16.05 | 81.577 | 19.12 |
| 6 | 2437 | 19.42 | 19.25 | 171.638 | 22.35 |
| 11 | 2462 | 14.96 | 14.92 | 62.379 | 17.95 |

802.11n (HT20)

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---------|-----------------|---------------------|---------|------------------|-------------------|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 14.98 | 14.90 | 62.38 | 17.95 |
| 6 | 2437 | 18.91 | 18.87 | 154.894 | 21.90 |
| 11 | 2462 | 15.24 | 15.19 | 66.457 | 18.23 |

802.11n (HT40)

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---------|-----------------|---------------------|---------|------------------|-------------------|
| | | Chain 0 | Chain 1 | | |
| 3 | 2422 | 12.12 | 12.11 | 32.548 | 15.13 |
| 6 | 2437 | 14.97 | 14.91 | 62.379 | 17.95 |
| 9 | 2452 | 13.61 | 13.58 | 45.764 | 16.61 |

5 Pictures of Test Arrangements

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

Appendix – Information of 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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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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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