# RADIO TEST REPORT

| | | |
|---|---|---|
| **Product** | : | DSL Router |
| **Model Name** | : | Vigor2765Vac |
| **Series Model** | : | Vigor2765ac, Vigor2766ac, Vigor2766Vac, Vigor2135ac, Vigor2135Vac, Vigor2135Fac, Vigor2135FVac, Vigor2125ac, Vigor2125Vac, Vigor2125Fac, Vigor2125FVac |
| **FCC ID** | : | VGY2765 |
| **Test Regulation** | : | FCC 47 CFR Part 15 Subpart C (Section 15.247) |
| **Received Date** | : | Sep. 11, 2019 |
| **Test Date** | : | Sep. 27, 2019 ~ Feb 14, 2020 |
| **Issued Date** | : | Apr. 8, 2020 |
| **Applicant** | : | DrayTek Corp.<br>No.26 Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park, Hsin-Chu, Taiwan 303 R.O.C |
| **Issued By** | : | Underwriters Laboratories Taiwan Co., Ltd.<br>Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |

Testing Laboratory
3398

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# REVISION HISTORY

## Original Test Report No.: 4789166774-US-R0-V0

| Rev. | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| Original | 4789166774-US-R0-V0 | Mar. 30, 2020 | - | Initial issue |
| - | 4789166774-US-R0-V0 | Apr. 8, 2020 | P.1, P.4, P.8, P.9, P.13 | Delete the blank space between Vigor and number for all models |
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# 1. Attestation of Test Results

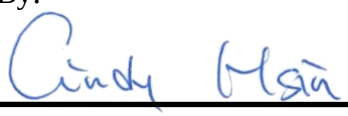
| | |
|---|---|
| **APPLICANT:** | DrayTek Corp.<br>No.26 Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park, Hsin-Chu, Taiwan 303 R.O.C |
| **MANUFACTURER** | DrayTek Corp.<br>No.26 Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park, Hsin-Chu, Taiwan 303 R.O.C |
| **EUT DESCRIPTION:** | DSL Router |
| **BRAND:** | DrayTek |
| **MODEL:** | Vigor2765Vac |
| **SERIES MODEL:** | Vigor2765ac, Vigor2766ac, Vigor2766Vac, Vigor2135ac, Vigor2135Vac, Vigor2135Fac, Vigor2135FVac, Vigor2125ac, Vigor2125Vac, Vigor2125Fac, Vigor2125FVac |
| **SAMPLE STAGE:** | Engineering sample |
| **DATE of TESTED:** | Sep. 27, 2019 ~ Feb 14, 2020 |

| **APPLICABLE STANDARDS** | |
|---|---|
| **STANDARD** | **Test Results** |
| FCC 47 CFR PART 15 Subpart C (Section 15.247) | PASS |

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

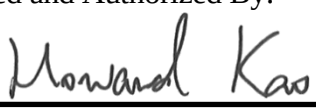
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Cindy Hsin Date : Apr. 8, 2020
Project Handler

Approved and Authorized By:



Howard Kao Date : Apr. 8, 2020
Project Engineer

## 2. Summary of Test Results

| Summary of Test Results | | |
|---|---|---|
| **FCC Clause** | **Test Items** | **Result** |
| 15.247(a)(2) | 6dB Bandwidth | PASS |
| 15.247(b) | Conducted Output Power | PASS |
| 15.247(e) | Power Spectral Density | PASS |
| 15.247(d) | Antenna Port Emission | PASS |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions and Band Edge Measurement | PASS |
| 15.207 | AC Power Conducted Emission | PASS |
| 15.203 | Antenna Requirement | PASS |

Note:
1. For the Radiated Band Edge test plots were recorded in Appendix I, the Radiated Emissions test plots were recorded in Appendix II.

## 3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

## 4. Facilities and Accreditation

| | |
|---|---|
| **Test Location** | Underwriters Laboratories Taiwan Co., Ltd. |
| **Address** | Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |
| **Accreditation Certificate** | Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398 |

## 5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

| Test Item | Measurement Frequency Range | K | U(dB) |
|---|---|---|---|
| Conducted disturbance at mains terminals ports | 0.15MHz ~ 30MHz | 2 | 1.7 |
| RF Conducted | 9 kHz - 40GHz | 2 | 1.0 |
| Radiated disturbance below 30MHz | 9 kHz - 30 MHz | 2 | 2.2 |
| Radiated disturbance below 1 GHz | 30MHz ~ 1GHz | 2 | 5.3 |
| Radiated disturbance above 1GHz | 1GHz ~ 40GHz | 2 | 4.8 |

# 6. Equipment under Test

## 6.1. Description of EUT

| | |
|---|---|
| **Product** | DSL Router |
| **Brand Name** | DrayTek |
| **Model Name** | Vigor2765Vac |
| **Series Model** | Vigor2765ac, Vigor2766ac, Vigor2766Vac, Vigor2135ac, Vigor2135Vac, Vigor2135Fac, Vigor2135FVac, Vigor2125ac, Vigor2125Vac, Vigor2125Fac, Vigor2125FVac |
| **S/N** | 191001DAA185F58 |
| **Operating Frequency** | 2412MHz ~ 2462MHz |
| **Modulation** | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM |
| **Transfer Rate** | 802.11b: up to 11 Mbps<br>802.11g: up to 54 Mbps<br>802.11n: up to MCS15 |
| **Number of Channel** | 11 for 802.11b, 802.11g, 802.11n (HT20)<br>7 for 802.11n (HT40) |
| **Maximum Output Power** | 802.11b: 26.55 dBm<br>802.11g: 27.89 dBm<br>802.11n (HT20): 27.57 dBm<br>802.11n (HT40): 25.34 dBm |
| **Normal Voltage** | 12Vdc from adapter |

Note:

1. The models difference table as below:

| Main Model | Function | | | | |
|---|---|---|---|---|---|
| | DSL | gfast | FXS | Eth-RJ45 WAN | Eth-SFP WAN |
| Vigor2765Vac | V | - | V | - | - |
| **Series Model** | **Function difference** | | | | |
| | **DSL** | **gfast** | **FXS** | **Eth-RJ45 WAN** | **Eth-SFP WAN** |
| Vigor2765ac | V | - | - | - | - |
| Vigor2766ac | V | V | - | - | - |
| Vigor2766Vac | V | V | V | - | - |
| Vigor2135ac | - | - | - | V | - |
| Vigor2135Vac | - | - | V | V | - |
| Vigor2135Fac | - | - | - | - | V |
| Vigor2135FVac | - | - | V | - | V |
| Vigor2125ac | - | - | - | V | - |
| Vigor2125Vac | - | - | V | V | - |
| Vigor2125Fac | - | - | - | - | V |
| Vigor2125FVac | - | - | V | - | V |

- The above models are declared for market purpose by the manufacturer, the difference between the main model and the series model is the combination of hardware design and appearance, there are no changes in RF-related parts, which will not affect RF characteristic.

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

| Modulation Mode | Tx,Rx Function |
|---|---|
| 802.11b | 2TX,2RX |
| 802.11g | 2TX,2RX |
| 802.11n (HT20) | 2TX,2RX |
| 802.11n (HT40) | 2TX,2RX |

3. The EUT contains following accessory devices

| Product | Brand | Model | Description |
|---|---|---|---|
| AC Adapter | Channel Well Technology | 2ABL024F US | Input: 100-240Vac, 0.8A,<br>Output: 12Vdc, 2A<br>Length: 1.5 m, non-shielded cable w/o ferrite core |
| RJ-45 Cable | Tung-Li | 5U422-20 | Length: 3 m, non-shielded cable |
| RJ-11 Cable | N/A | N/A | Length: 1.8 m, non-shielded cable, 6P4C |
| RJ-11 to RJ-45 Cable | N/A | N/A | Length: 2.2 m, non-shielded cable, 6P4C |
| RJ-45 to RJ-45 Cable | N/A | N/A | Length: 2.2 m, non-shielded cable, 6P4C |

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

## 6.2. Channel List

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 | - | - |

## 6.3. Test Condition

| Test Item | Test Site No. | Environmental Condition | Input Power | Test Date | Tested by |
|---|---|---|---|---|---|
| Antenna Port Conducted Measurement | SR4 | 23~26°C / 62~66%RH | 120Vac / 60 Hz | Oct. 3, 2019 ~ Feb. 14, 2020 | WaterNil Guan / Wayne Chen |
| Radiated Spurious Emission | 966-2 | 23~27°C / 60~69%RH | 120Vac / 60 Hz | Sep. 27, 2019 ~ Feb. 7, 2020 | WaterNil Guan / Wayne Chen |
| AC power Line Conducted Emission | SR1 | 24~26°C / 63~66%RH | 120Vac / 60 Hz | Oct. 15, 2019 ~ Nov. 8, 2019 | Wayne Chen |

FCC Test Firm Registration Number: 498077

## 6.4. Description Of Available Antennas

| Antenna | Brand Name | Model Name | Antenna Type | Antenna Gain(dBi) |
|---|---|---|---|---|
| Chain(0) | Walsin | RFDPA131300SBLB805 | Dipole | 2.18 |
| Chain(1) | Walsin | RFDPA131300SBLB805 | Dipole | 2.18 |

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

## 6.5. Test Mode Applicability and Tested Channel Detail

- 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).
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- The fundamental of the EUT was investigated in three orthogonal axes X/Y/Z, it was determined that X axis was worst-case. Therefore, all final radiated testing was performed with the EUT in X axis.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For AC power line conducted emissions, the pre-scan has been determined by AC power 120Vac/60Hz (worst case)
- Pre-scan radiation has been determined by the model Vigor2765Vac (the worst case). Therefore, only the model Vigor2765Vac tests was performed and recorded in this report.

### Non-Beamforming Mode

| Test item | Mode | Modulation Technology | Modulation Type | Available Channel | Test Channel | Data Rate |
|---|---|---|---|---|---|---|
| Radiated Emissions (Above 1GHz) | 802.11b | DSSS | DBPSK | 1 to 11 | 1,6,11 | 1.0 |
| | 802.11g | OFDM | BPSK | 1 to 11 | 1,6,11 | 6.0 |
| | 802.11n(HT20) | OFDM | BPSK | 1 to 11 | 1,6,11 | MCS0 |
| | 802.11n(HT40) | OFDM | BPSK | 3 to 9 | 3,6,9 | MCS0 |
| Radiated Emissions (Below 1GHz) | 802.11n(HT20) | OFDM | BPSK | 1 to 11 | 11 | MCS0 |
| AC Power Line Conducted Emission | 802.11n(HT20) | OFDM | BPSK | 1 to 11 | 11 | MCS0 |
| Antenna Port Conducted Measurement | 802.11b | DSSS | DBPSK | 1 to 11 | 1,6,11 | 1.0 |
| | 802.11g | OFDM | BPSK | 1 to 11 | 1,6,11 | 6.0 |
| | 802.11n(HT20) | OFDM | BPSK | 1 to 11 | 1,6,11 | MCS0 |
| | 802.11n(HT40) | OFDM | BPSK | 3 to 9 | 3,6,9 | MCS0 |

### Co-Location Mode

| Test item | Mode | Modulation Technology | Modulation Type | Available Channel | Test Channel | Data Rate |
|---|---|---|---|---|---|---|
| Radiated Emissions | 802.11b | DSSS | DBPSK | 1 to 11 | 6+48 | 1.0 |
| | 802.11a | OFDM | BPSK | 36 to 48 | | 6.0 |
| | | | | 149 to 165 | | |

## 6.6. Duty cycle

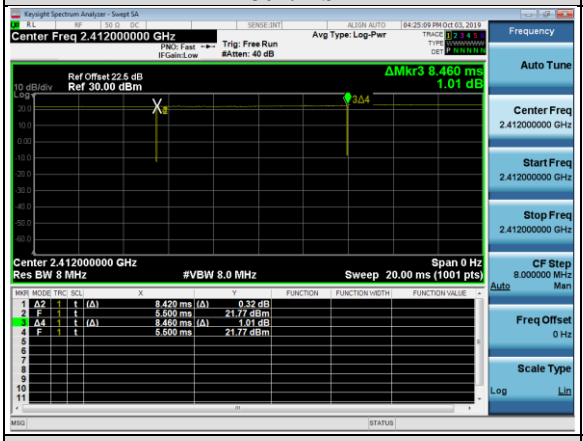
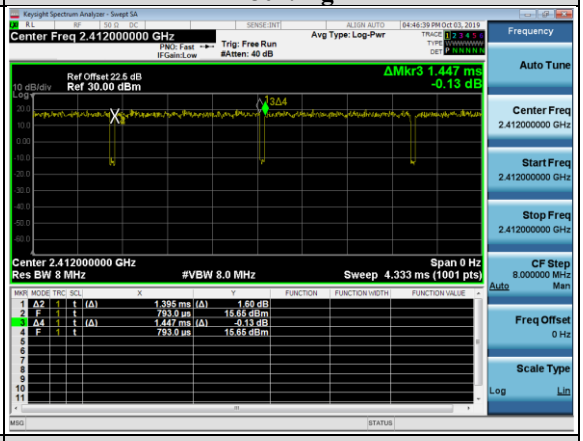
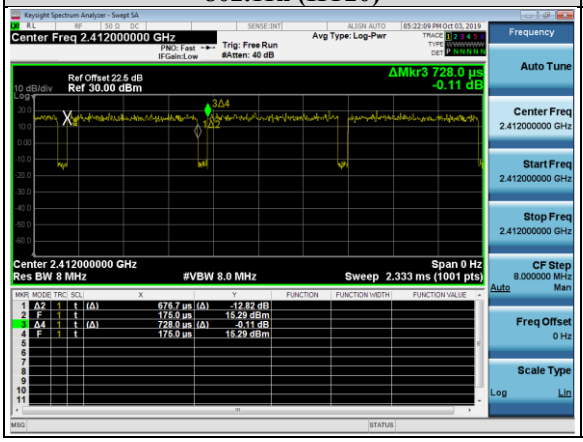
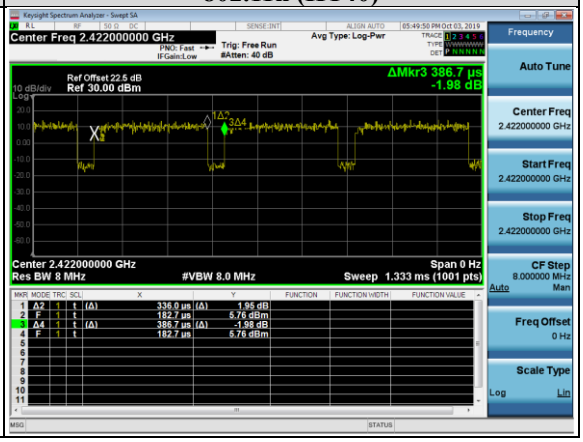
### Non-Beamforming Mode

802.11b: Duty cycle = 8.42/8.46 = 0.995, duty cycle of test signal is ≥ 98 %, duty factor is not required.

802.11g: Duty cycle = 1.395/1.447 = 0.964, Duty factor = 10 * log( 1/0.964) = 0.16

802.11n (HT20): Duty cycle = 0.6767/0.728 = 0.93, Duty factor = 10 * log( 1/0.93) = 0.32

802.11n (HT40): Duty cycle = 0.336/0.3867 = 0.869, Duty factor = 10 * log( 1/0.869) = 0.61

| 802.11b | 802.11g |
|---|---|
|  |  |
| **802.11n (HT20)** | **802.11n (HT40)** |
|  |  |

# 7. Test Equipment

| Test Equipment List | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal. Date** | **Cal. Interval** |
| **Radiated Spurious Emission** | | | | | |
| Spectrum Analyzer | Keysight | N9010A | MY56070827 | Nov. 8, 2018<br>Nov. 13, 2019 | 1 year |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101754 | Nov. 8, 2018<br>Dec. 4, 2019 | 1 year |
| Loop Antenna | ETS lindgren | 6502 | 00213440 | Dec. 11, 2018<br>Dec. 19, 2019 | 1 year |
| Trilog-Broadband Antenna with 5dB Attenuator | Schwarzbeck & EMCI | VULB 9168 & N-6-05 | 774 & AT-N0538 | Jan. 14, 2019<br>Jan. 3, 2020 | 1 year |
| Horn Antenna (1-18 GHz) | Schwarzbeck | BBHA 9120 D | 01690 | Jan. 25, 2019<br>Jan. 3, 2020 | 1 year |
| Horn Antenna(18-40 GHz) | Schwarzbeck | BBHA 9170 | 781 | Jan. 16, 2019<br>Dec. 27, 2019 | 1 year |
| Preamplifier (30-1000 MHz) | EMCI | EMC330E | 980405 | Jan. 30, 2019<br>Feb. 4, 2020 | 1 year |
| Preamplifier (1-18 GHz) | EMCI | EMC051835BE | 980406 | Jan. 29, 2019<br>Feb. 4, 2020 | 1 year |
| Preamplifier (18-40GHz) | EMCI | EMC184040SE E | 980426 | May. 8, 2019 | 1 year |
| Cables | Hanyitek | K1K50-UP0264-K1K50-2500 | 170214-4 & 170425-2 | Jan. 29, 2019<br>Jan. 8, 2020 | 1 year |
| Cables | Hanyitek | K1K50-UP0264-K1K50-2500 | 170214-1 & 170214-2 | Jan. 29, 2019<br>Jan. 8, 2020 | 1 year |

| Test Equipment List | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal. Date** | **Cal. Interval** |
| **Antenna Port Conducted Measurement** | | | | | |
| Spectrum Analyzer | Keysight | N9010A | MY56070834 | Nov. 8, 2018<br>Nov. 6, 2019 | 1 year |
| Pulse Power Sensor | Anrisu | MA2411B | 1531202 | Dec. 17, 2018<br>Dec. 23, 2019 | 1 year |
| Power Meter | Anrisu | ML2495A | 1645002 | Dec. 17, 2018<br>Dec. 23, 2019 | 1 year |
| **AC power Line Conducted Emission** | | | | | |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101753 | Nov. 14, 2018<br>Nov. 19, 2019 | 1 year |
| Two-Line V-Network | Rohde & Schwarz | ENV216 | 102136 | Aug. 8, 2019 | 1 year |
| Impuls-Begrenzer Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 102219-Qt | Aug. 6, 2019 | 1 year |
| Cables | HARBOUR INDUSTRIES | LL142 | 170205-5000-1 | Jan. 29, 2019<br>Feb. 5, 2020 | 1 year |

| UL Software | | |
|---|---|---|
| **Description** | **Name** | **Version** |
| Radiated measurement | EZ_EMC | 1.1.4.2 |
| Conducted measurement | Keysight.TestSystem | 1.0.0.0 |
| AC power Line Conducted Emission | EZ_EMC | 1.1.4.2 |

# 8. Description of Test Setup

## Support Equipment

| Equipment | Brand Name | Model Name | S/N | Remark |
|---|---|---|---|---|
| Notebook | DELL | Latitude E5470 | 3JFKWF2 | N/A |
| Connector | N/A | N/A | N/A | RJ-45 to RJ-45 |
| USB Device | SP Widget | TOUCH T03 | N/A | 8GB |
| USB Device | SP Widget | TOUCH T03 | N/A | 8GB |

## I/O Cables

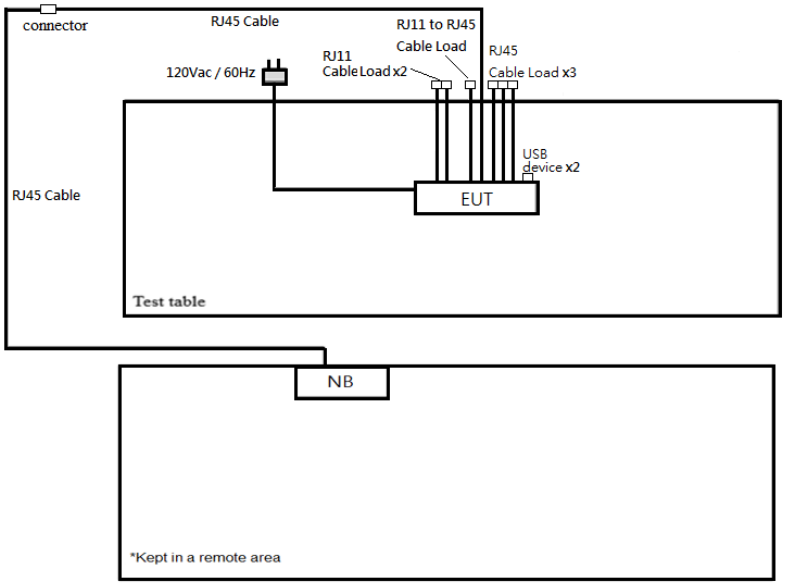
| Equipment | Brand Name | Model Name | S/N | Remark |
|---|---|---|---|---|
| RJ-45 cable | N/A | N/A | N/A | Length : 10m |
| RJ-45 cable | N/A | N/A | N/A | Length : 1.5m |
| RJ-45 cable | N/A | N/A | N/A | Length : 1.5m |
| RJ-45 cable | N/A | N/A | N/A | Length : 1.5m |

## Test Setup

Controlled using a bespoke application (MT7615D QAtool package_UIv1.84_DLLv3.81) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

## Setup Diagram for Test

### Non-Beamforming Mode



# 9. Test Results

## 9.1. 6dB Bandwidth

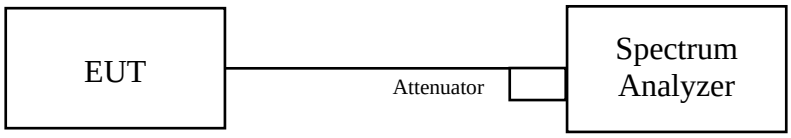
**Requirements**

The minimum 6 dB bandwidth shall be at least 500 kHz.

**Test procedure**

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

**Test Setup**




The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

## Test Data

### 802.11b

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 9.09 | 9.0675 | 0.5 | Pass |
| 6 | 2437 | 10.07625 | 9.0975 | 0.5 | Pass |
| 11 | 2462 | 9.0975 | 9.07875 | 0.5 | Pass |

### 802.11g

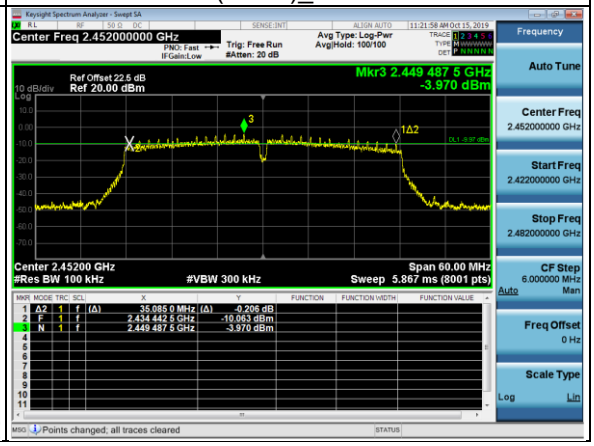
| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 15.0825 | 15.12 | 0.5 | Pass |
| 6 | 2437 | 15.1275 | 15.6975 | 0.5 | Pass |
| 11 | 2462 | 15.12 | 15.105 | 0.5 | Pass |

### 802.11n (HT20)

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 15.1275 | 15.6825 | 0.5 | Pass |
| 6 | 2437 | 15.1275 | 15.1275 | 0.5 | Pass |
| 11 | 2462 | 15.1275 | 15.69 | 0.5 | Pass |

### 802.11n (HT40)

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 3 | 2422 | 35.0925 | 35.085 | 0.5 | Pass |
| 6 | 2437 | 35.0925 | 35.0925 | 0.5 | Pass |
| 9 | 2452 | 35.0925 | 35.085 | 0.5 | Pass |

| Spectrum Plot of Worst Value | |
|---|---|
| 802.11b_Chain 1 / CH1 | 802.11g_Chain 0 / CH1 |
|  |  |
| 802.11n (HT20)_Chain 0 / CH11 | 802.11n (HT40)_Chain 1 / CH9 |
|  |  |

## 9.2. Conducted output power

### Requirements

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

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

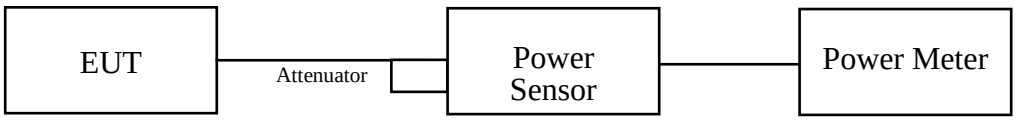
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any $N_{ANT}$;
Array Gain = 5 log($N_{ANT}/N_{SS}$) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = 10 log($N_{ANT}/N_{SS}$) dB.

### Test Procedure

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.

### Test Setup




The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.

# Test Data

## 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 | 20.73 | 18.93 | 196.467 | 22.93 | 30 | Pass |
| 6 | 2437 | 23.93 | 23.12 | 452.288 | 26.55 | 30 | Pass |
| 11 | 2462 | 21.59 | 19.87 | 241.263 | 23.82 | 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 | 22.07 | 21.22 | 293.499 | 24.68 | 30 | Pass |
| 6 | 2437 | 24.33 | 25.36 | 614.577 | 27.89 | 30 | Pass |
| 11 | 2462 | 21.78 | 20.63 | 266.272 | 24.25 | 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 | 20.63 | 19.69 | 208.722 | 23.20 | 30 | Pass |
| 6 | 2437 | 24.07 | 25.00 | 571.498 | 27.57 | 30 | Pass |
| 11 | 2462 | 20.62 | 19.38 | 202.041 | 23.05 | 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 | 19.00 | 17.48 | 135.409 | 21.32 | 30 | Pass |
| 6 | 2437 | 22.64 | 22.00 | 342.143 | 25.34 | 30 | Pass |
| 9 | 2452 | 20.41 | 18.16 | 175.365 | 22.44 | 30 | Pass |

## Average Power (Reference Only)

### 802.11b

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 18.64 | 16.7 | 119.888 | 20.79 |
| 6 | 2437 | 22.46 | 21.15 | 306.515 | 24.86 |
| 11 | 2462 | 19.61 | 17.66 | 149.756 | 21.75 |

### 802.11g

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 13.27 | 11.44 | 35.164 | 15.46 |
| 6 | 2437 | 19.94 | 21.31 | 233.835 | 23.69 |
| 11 | 2462 | 12.87 | 10.9 | 31.667 | 15.01 |

### 802.11n (HT20)

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 1 | 2412 | 12.61 | 10.90 | 30.542 | 14.85 |
| 6 | 2437 | 20.00 | 20.60 | 214.815 | 23.32 |
| 11 | 2462 | 12.65 | 10.58 | 29.837 | 14.75 |

### 802.11n (HT40)

| Channel | Frequency (MHz) | Average Power (dBm) | | Total Power (mW) | Total Power (dBm) |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | | |
| 3 | 2422 | 10.11 | 8.53 | 17.386 | 12.40 |
| 6 | 2437 | 15.24 | 13.48 | 55.704 | 17.46 |
| 9 | 2452 | 11.63 | 9.10 | 22.683 | 13.56 |

## 9.3. Power Spectral Density

### Requirements

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz (If $G_{TX}$ > 6 dBi, then PSD = 8 – ($G_{TX}$ – 6)).

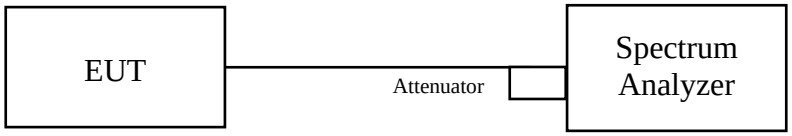
Note:
1. PSD = power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz.
2. $G_{TX}$ = the maximum transmitting antenna directional gain in dBi.
3. Directional Gain = $G_{ant}$ + 10 log (Nant) dBi.

   N*a*nt: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas (Same for Each Antenna)

### Test procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

### Test Setup




The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

## Test Data

### 802.11b

| TX Chain | Channel | Freq. (MHz) | PSD (dBm/3 kHz) | 10 log (N=2) dB | Total PSD (dBm/3 kHz) | Limit (dBm/3 kHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2412 | -7.18 | 3.01 | -4.17 | 8 | Pass |
| | 6 | 2437 | -4.16 | 3.01 | -1.14 | 8 | Pass |
| | 11 | 2462 | -6.11 | 3.01 | -3.10 | 8 | Pass |
| 1 | 1 | 2412 | -8.67 | 3.01 | -5.66 | 8 | Pass |
| | 6 | 2437 | -4.51 | 3.01 | -1.50 | 8 | Pass |
| | 11 | 2462 | -8.00 | 3.01 | -4.99 | 8 | Pass |

**NOTE:** Directional gain = 5.19 dBi < 6 dBi, so the limit no need to reduced.

### 802.11g

| TX Chain | Channel | Freq. (MHz) | PSD (dBm/3 kHz) | 10 log (N=2) dB | Total PSD (dBm/3 kHz) | Limit (dBm/3 kHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2412 | -12.76 | 3.01 | -9.75 | 8 | Pass |
| | 6 | 2437 | -6.90 | 3.01 | -3.89 | 8 | Pass |
| | 11 | 2462 | -13.54 | 3.01 | -10.52 | 8 | Pass |
| 1 | 1 | 2412 | -14.90 | 3.01 | -11.89 | 8 | Pass |
| | 6 | 2437 | -5.30 | 3.01 | -2.29 | 8 | Pass |
| | 11 | 2462 | -15.03 | 3.01 | -12.02 | 8 | Pass |

**NOTE:** Directional gain = 5.19 dBi < 6 dBi, so the limit no need to reduced.

### 802.11n (HT20)

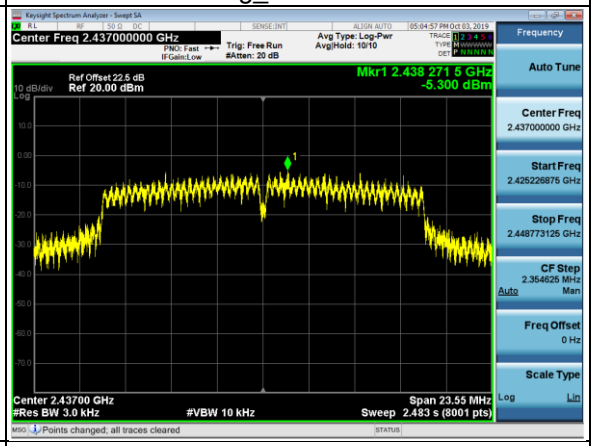
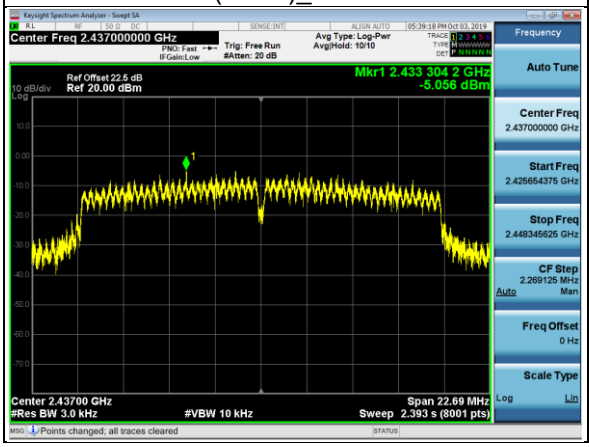
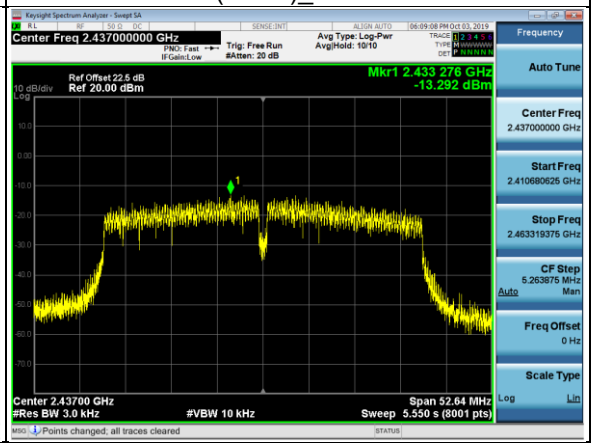
| TX Chain | Channel | Freq. (MHz) | PSD (dBm/3 kHz) | 10 log (N=2) dB | Total PSD (dBm/3 kHz) | Limit (dBm/3 kHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2412 | -13.53 | 3.01 | -10.52 | 8 | Pass |
| | 6 | 2437 | -6.73 | 3.01 | -3.71 | 8 | Pass |
| | 11 | 2462 | -13.51 | 3.01 | -10.50 | 8 | Pass |
| 1 | 1 | 2412 | -14.51 | 3.01 | -11.50 | 8 | Pass |
| | 6 | 2437 | -5.06 | 3.01 | -2.05 | 8 | Pass |
| | 11 | 2462 | -15.74 | 3.01 | -12.72 | 8 | Pass |

**NOTE:** Directional gain = 5.19 dBi < 6 dBi, so the limit no need to reduced.

### 802.11n (HT40)

| TX Chain | Channel | Freq. (MHz) | PSD (dBm/3 kHz) | 10 log (N=2) dB | Total PSD (dBm/3 kHz) | Limit (dBm/3 kHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| 0 | 3 | 2422 | -18.08 | 3.01 | -15.07 | 8 | Pass |
| | 6 | 2437 | -13.29 | 3.01 | -10.28 | 8 | Pass |
| | 9 | 2452 | -17.94 | 3.01 | -14.93 | 8 | Pass |
| 1 | 3 | 2422 | -18.98 | 3.01 | -15.97 | 8 | Pass |
| | 6 | 2437 | -15.16 | 3.01 | -12.15 | 8 | Pass |
| | 9 | 2452 | -19.92 | 3.01 | -16.91 | 8 | Pass |

**NOTE:** Directional gain = 5.19 dBi < 6 dBi, so the limit no need to reduced.

| Spectrum Plot of Worst Value | |
|---|---|
| 802.11b_Chain 0 / CH6 | 802.11g_Chain 1 / CH6 |
|  |  |
| 802.11n (HT20)_Chain 1 / CH6 | 802.11n (HT40)_Chain 0 / CH6 |
|  |  |

## 9.4. Conducted Out of Band Emission

### Requirements

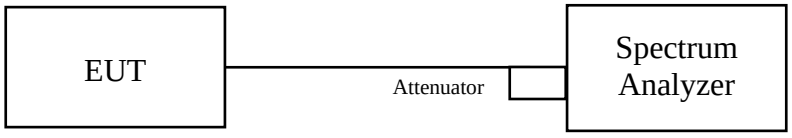
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b) (3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209 (a) is not required.

### Test procedure

Measurement Procedure REF
a. Set the RBW = 100 kHz.
b. Set the VBW ≥ 300 kHz.
c. Set the span to 1.5 times the DTS bandwidth.
d. Detector = peak.
e. Sweep time = auto couple.
f. Trace mode = max hold.
g. Allow trace to fully stabilize.
h. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE
a. Set RBW = 100 kHz.
b. Set VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep = auto couple.
e. Trace Mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum amplitude level.

### Test Setup




The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.