

# HCT CO., LTD.

## CERTIFICATE OF COMPLIANCE

### FCC Certification

**Applicant Name:**  
LG Electronics MobileComm U.S.A., Inc.

**Address:**  
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

**Date of Issue:**

May 23, 2013

**Test Site/Location:**

HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon,  
Icheon-si, Kyunggi-Do, Korea

**Report No.:** HCTR1305FR11-1

**HCT FRN:** 0005866421

**FCC ID : ZNFE440J**

**APPLICANT : LG Electronics MobileComm U.S.A., Inc.**

**FCC Model(s):** LG-E440j

**Additional FCC Model(s):** LGE440j, E440j

**EUT Type:** GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

**Max. RF Output Power:** Wi-Fi 802.11b(22.82 dBm) / Wi-Fi 802.11g (21.45 dBm) / Wi-Fi 802.11n\_20 MHz (18.72 dBm)  
/ Wi-Fi 802.11n\_40 MHz (16.68 dBm)

**Frequency Range:** 2412 MHz - 2462 MHz (2.4 GHz Band)  
2422 MHz - 2452 MHz (2.4 GHz Band)\_40 MHz BW

**Modulation type** CCK/DSSS/OFDM

**FCC Classification:** Digital Transmission System(DTS)

**FCC Rule Part(s):** Part 15.247

#### Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

**HCT CO., LTD.** Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 853(a)



**Report prepared by**  
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**Test engineer of RF Team**



**Approved by**  
**: Chang Seok Choi**  
**Manager of RF Team**

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| FCC PT.15.247<br>TEST REPORT      |                                | FCC CERTIFICATION REPORT                                         |                     | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|-----------------------------------|--------------------------------|------------------------------------------------------------------|---------------------|--------------------------------------------------|
| Test Report No.<br>HCTR1305FR11-1 | Date of Issue:<br>May 23, 2013 | EUT Type:<br>GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n | FCC ID:<br>ZNFE440J |                                                  |

## Version

| TEST REPORT NO. | DATE         | DESCRIPTION                                                                              |
|-----------------|--------------|------------------------------------------------------------------------------------------|
| HCTR1305FR11    | May 14, 2013 | - First Approval Report                                                                  |
| HCTR1305FR11-1  | May 23, 2013 | -DTS measurement procedure KDB558074 V03 on page 5<br>(section 3) change (V03 -> V03r01) |
|                 |              |                                                                                          |
|                 |              |                                                                                          |

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| Test Report No.<br>HCTR1305FR11-1 | Date of Issue:<br>May 23, 2013 | EUT Type:<br>GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n | FCC ID:<br>ZNFE440J                              |

## 1. GENERAL INFORMATION

**Applicant:** LG Electronics MobileComm U.S.A., Inc.

**Address:** 1000 Sylvan Avenue, Englewood Cliffs NJ 07632

**FCC ID:** ZNFE440J

**EUT Type:** GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

**Model name(s):** LG-E440j

**Additional Model name(s):** LGE440j, E440j

**Date(s) of Tests:** April 26, 2012 ~ May 10, 2012

**Place of Tests:** HCT Co., Ltd.  
105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, KOREA.  
(IC Recognition No. : 5944A-3)

## 2. EUT DESCRIPTION

|                                  |                                                                                                                  |                                                                                                                            |
|----------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>EUT Type</b>                  | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n                                                              |                                                                                                                            |
| <b>FCC Model Name</b>            | LG-E440j                                                                                                         |                                                                                                                            |
| <b>Additional FCC Model Name</b> | LGE440j, E440j                                                                                                   |                                                                                                                            |
| <b>Power Supply</b>              | DC 3.8 V                                                                                                         |                                                                                                                            |
| <b>Battery type</b>              | Li-ion Battery(Standard)                                                                                         |                                                                                                                            |
| <b>Frequency Range</b>           | TX: 2412 MHz ~ 2462 MHz, 2422 MHz - 2452 MHz_40 MHz BW<br>RX: 2412 MHz ~ 2462 MHz, 2422 MHz - 2452 MHz_40 MHz BW |                                                                                                                            |
| <b>Max. RF Output Power</b>      | Peak                                                                                                             | Wi-Fi 802.11b(22.82 dBm) / Wi-Fi 802.11g (21.45 dBm) / Wi-Fi 802.11n_20 MHz (18.72 dBm) / Wi-Fi 802.11n_40 MHz (16.68 dBm) |
|                                  | Average                                                                                                          | Wi-Fi 802.11b(16.46 dBm) / Wi-Fi 802.11g (12.74 dBm) / Wi-Fi 802.11n_20 MHz (10.42 dBm) / Wi-Fi 802.11n_40 MHz (8.36 dBm)  |
| <b>Modulation Type</b>           | DSSS/CCK(802.11b), OFDM(802.11g, 802.11n)                                                                        |                                                                                                                            |
| <b>Antenna Specification</b>     | Manufacturer: KOMATECH Co., Ltd.<br>Antenna type: Monopole Antenna<br>Peak Gain : 2.64 dBi                       |                                                                                                                            |

### 3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v03r01 dated April 9, 2013 entitled "Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices(ANSI C63.4-2003) Operating Under §15.247" were used in the measurement.

#### 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

#### 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

#### 3.3 GENERAL TEST PROCEDURES

##### Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version :2003) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

##### Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version: 2003)

##### Conducted Antenna Terminal

See Section from 9.1 to 9.2.(KDB 558074)

#### 3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

| FCC PT.15.247<br>TEST REPORT      |                                | FCC CERTIFICATION REPORT                                         |                     | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|-----------------------------------|--------------------------------|------------------------------------------------------------------|---------------------|--------------------------------------------------|
| Test Report No.<br>HCTR1305FR11-1 | Date of Issue:<br>May 23, 2013 | EUT Type:<br>GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n | FCC ID:<br>ZNFE440J |                                                  |

## 4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

## 5. FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated June 21, 2011 (Registration Number: 90661)

### 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

|                                   |                                |                                                                  |                                                  |
|-----------------------------------|--------------------------------|------------------------------------------------------------------|--------------------------------------------------|
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## 6. ANTENNA REQUIREMENTS

### According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

\* The antennas of this E.U.T are permanently attached.

\*The E.U.T Complies with the requirement of §15.203

|                                   |                                |                                                                  |                                                  |
|-----------------------------------|--------------------------------|------------------------------------------------------------------|--------------------------------------------------|
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## 7. SUMMARY TEST OF RESULTS

| Test Description                    | FCC Part Section(s)        | Test Limit           | Test Condition | Test Result |
|-------------------------------------|----------------------------|----------------------|----------------|-------------|
| 6 dB Bandwidth                      | §15.247(a)(2)              | > 500 kHz            | CONDUCTED      | PASS        |
| Conducted Maximum Peak Output Power | §15.247(b)(3)              | < 1 Watt             |                | PASS        |
| Power Spectral Density              | §15.247(e)                 | < 8 dBm / 3 kHz Band |                | PASS        |
| Band Edge(Out of Band Emissions)    | §15.247(d)                 | Conducted < 20 dBc   |                | PASS        |
| AC Power line Conducted Emissions   | §15.207                    | cf. Section 8.6      |                | PASS        |
| Radiated Spurious Emissions         | §15.205, 15.209            | cf. Section 8.5.1    | RADIATED       | PASS        |
| Radiated Restricted Band Edge       | §15.247(d), 15.205, 15.209 | cf. Section 8.5.2    |                | PASS        |

## 8. TEST RESULT

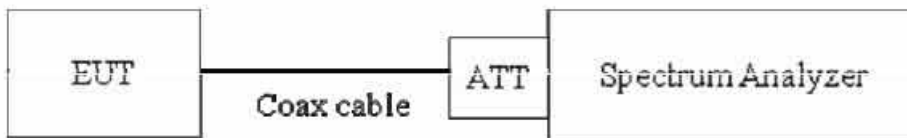
### 8.1 6dB BANDWIDTH (802.11b/g/n)

#### Test Requirements and limit, §15.247(a)(2)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

**The minimum permissible 6dB bandwidth is 500 kHz.**

#### ■ TEST CONFIGURATION



#### ■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to ( Page 5 in KDB 558074, issued 04/09/2013)

RBW = 100 kHz

VBW  $\geq$  3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

**Note :** We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

|                                   |                                |                                                                  |                                                  |
|-----------------------------------|--------------------------------|------------------------------------------------------------------|--------------------------------------------------|
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■ **TEST RESULTS**

Conducted 6dB Bandwidth Measurements for 802.11b

| 802.11b Mode    |             | Measured Bandwidth<br>[MHz] | Minimum Bandwidth<br>[MHz] | Pass / Fail |
|-----------------|-------------|-----------------------------|----------------------------|-------------|
| Frequency [MHz] | Channel No. |                             |                            |             |
| 2412            | 1           | 9.690                       | 0.500                      | Pass        |
| 2437            | 6           | 9.405                       | 0.500                      | Pass        |
| 2462            | 11          | 9.855                       | 0.500                      | Pass        |

Conducted 6dB Bandwidth Measurements for 802.11g

| 802.11g Mode    |             | Measured Bandwidth<br>[MHz] | Minimum Bandwidth<br>[MHz] | Pass / Fail |
|-----------------|-------------|-----------------------------|----------------------------|-------------|
| Frequency [MHz] | Channel No. |                             |                            |             |
| 2412            | 1           | 16.480                      | 0.500                      | Pass        |
| 2437            | 6           | 16.490                      | 0.500                      | Pass        |
| 2462            | 11          | 16.500                      | 0.500                      | Pass        |

Conducted 6dB Bandwidth Measurements for 802.11n\_20 MHz BW

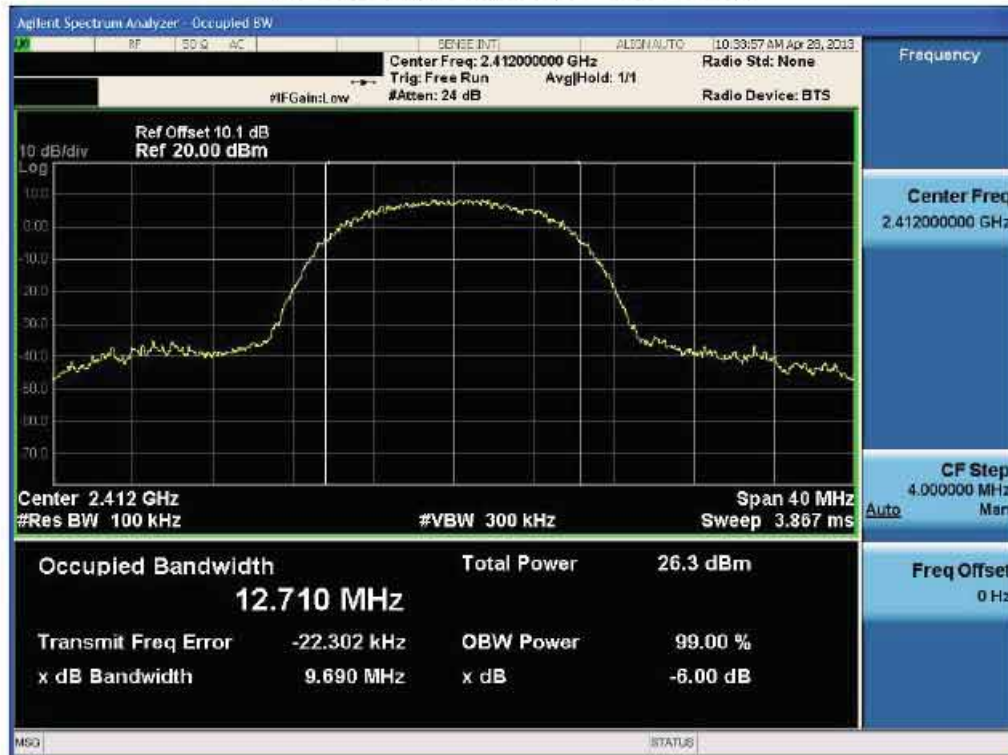
| 802.11n Mode    |             | Measured Bandwidth<br>[MHz] | Minimum Bandwidth<br>[MHz] | Pass / Fail |
|-----------------|-------------|-----------------------------|----------------------------|-------------|
| Frequency [MHz] | Channel No. |                             |                            |             |
| 2412            | 1           | 17.730                      | 0.500                      | Pass        |
| 2437            | 6           | 17.730                      | 0.500                      | Pass        |
| 2462            | 11          | 17.740                      | 0.500                      | Pass        |

Conducted 6dB Bandwidth Measurements for 802.11n\_40 MHz BW

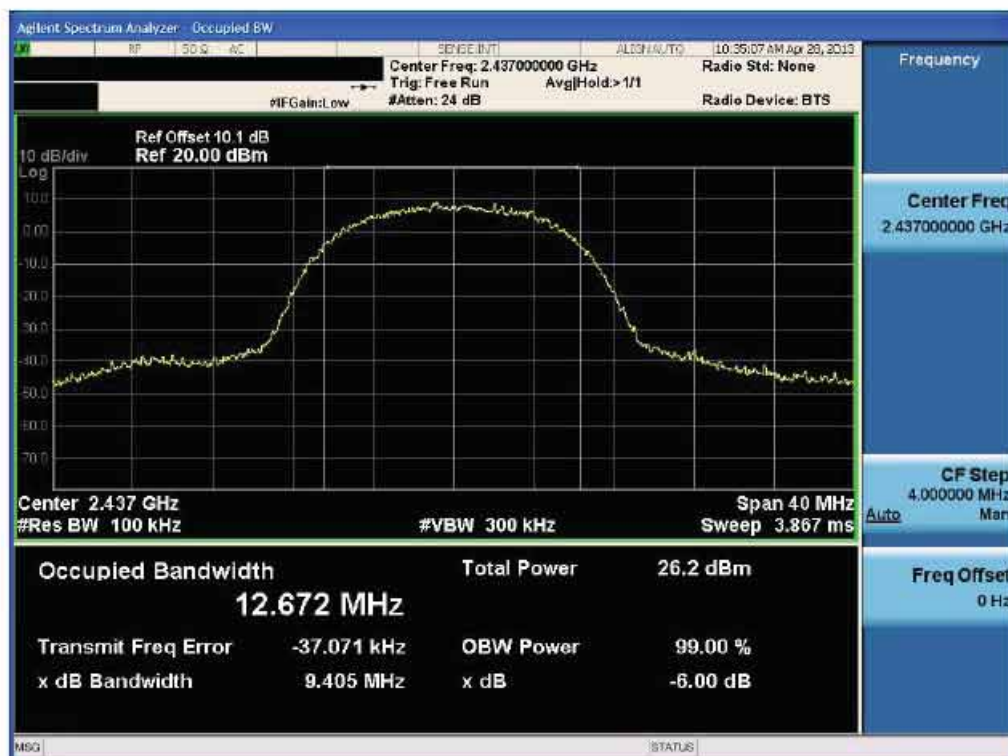
| 802.11n Mode    |             | Measured Bandwidth<br>[MHz] | Minimum Bandwidth<br>[MHz] | Pass / Fail |
|-----------------|-------------|-----------------------------|----------------------------|-------------|
| Frequency [MHz] | Channel No. |                             |                            |             |
| 2422            | 3           | 35.210                      | 0.500                      | Pass        |
| 2437            | 6           | 35.200                      | 0.500                      | Pass        |
| 2452            | 9           | 35.210                      | 0.500                      | Pass        |

■ **RESULT PLOTS**

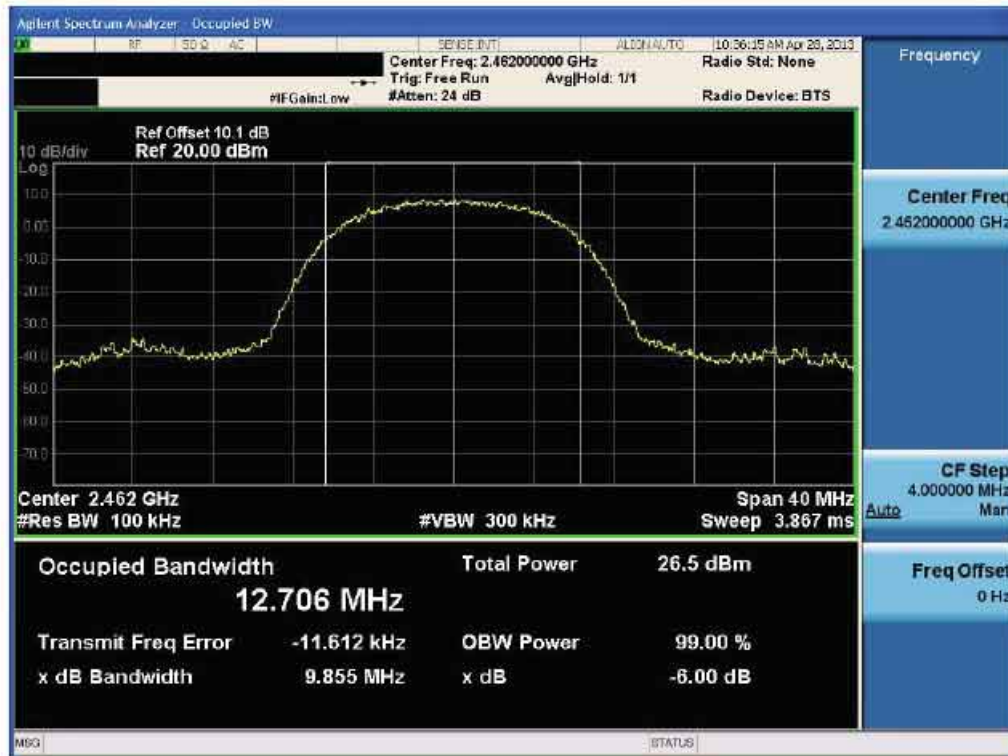
**6dB Bandwidth plot (802.11b-CH 1)**



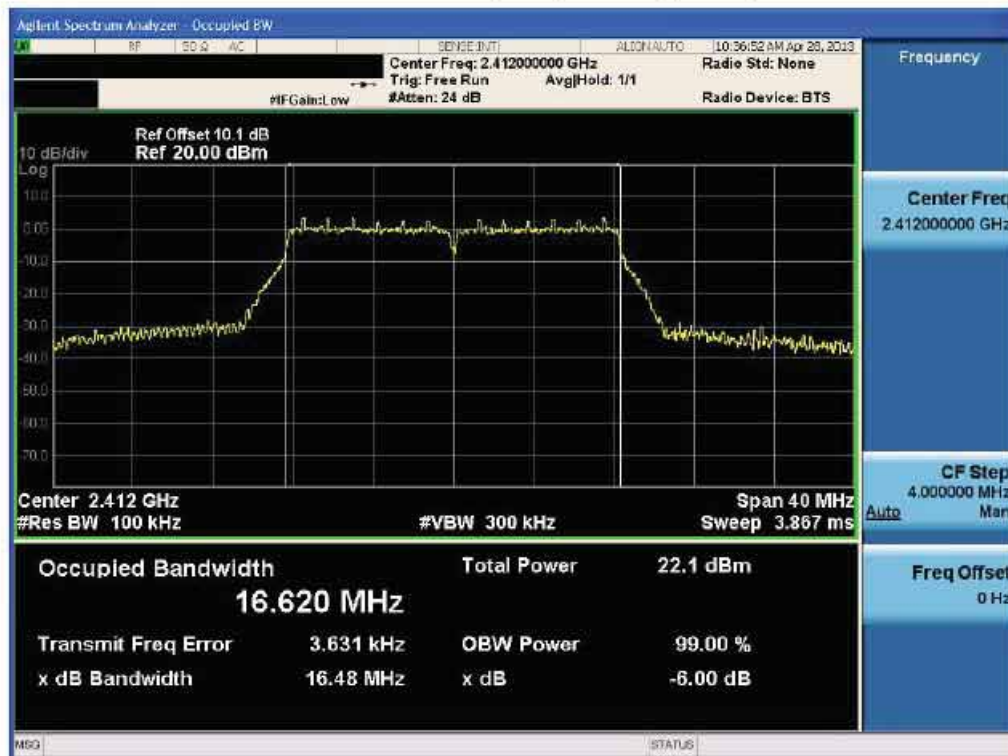
**6dB Bandwidth plot (802.11b-CH 6)**



### 6dB Bandwidth plot (802.11b-CH 11)



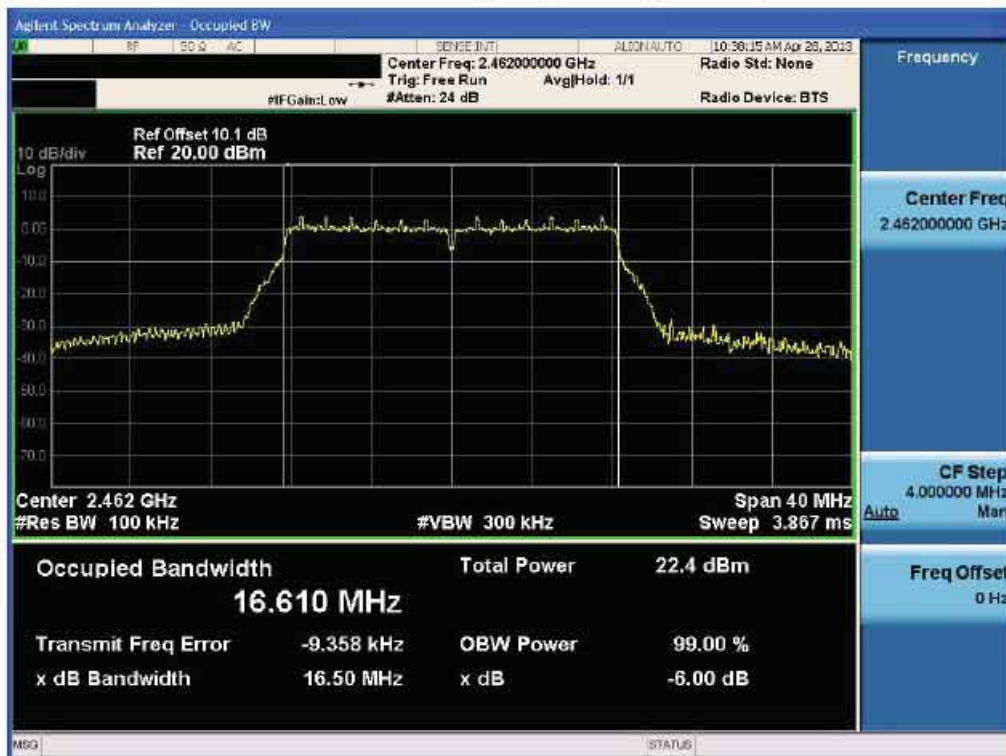
### 6dB Bandwidth plot (802.11g-CH 1)



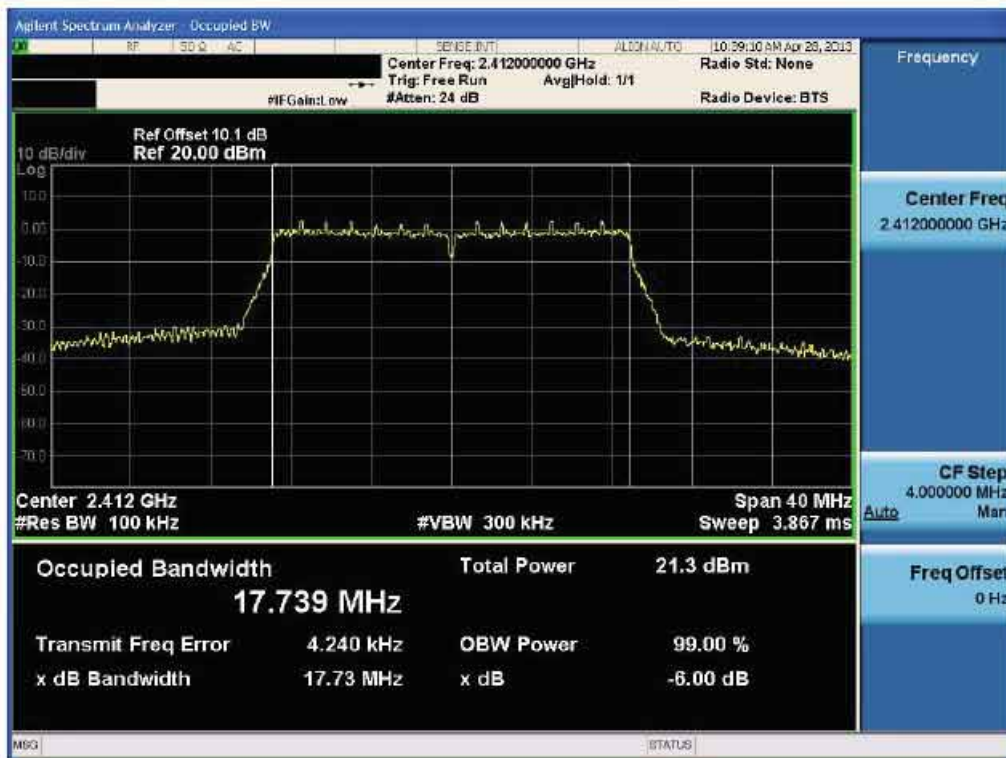
### 6dB Bandwidth plot (802.11g-CH 6)



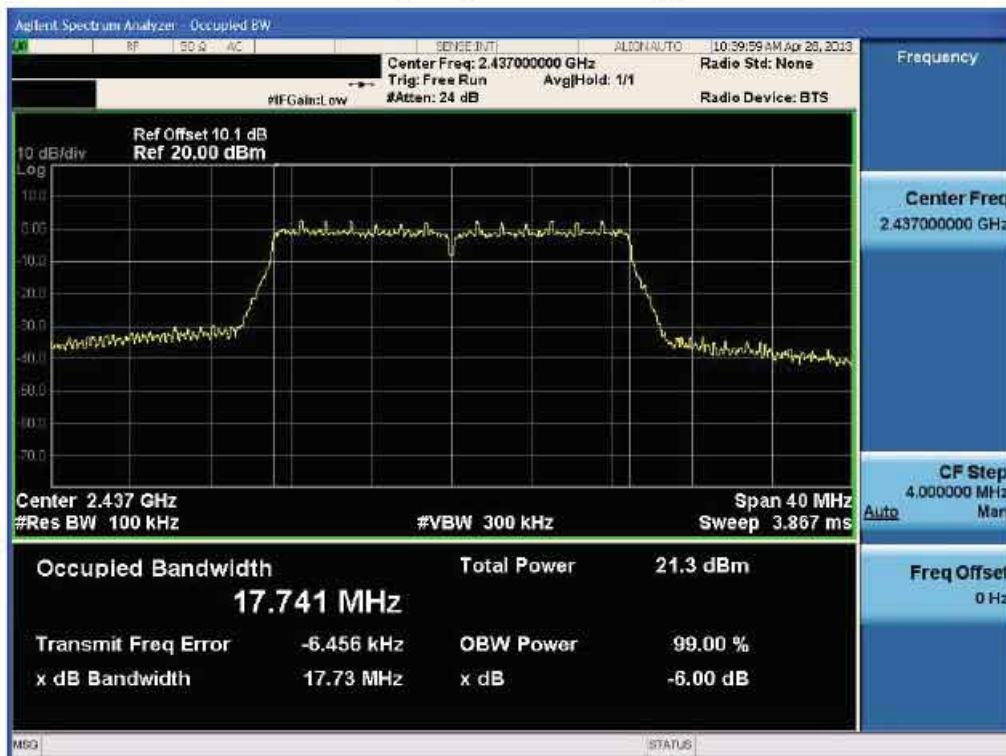
### 6dB Bandwidth plot (802.11g-CH 11)



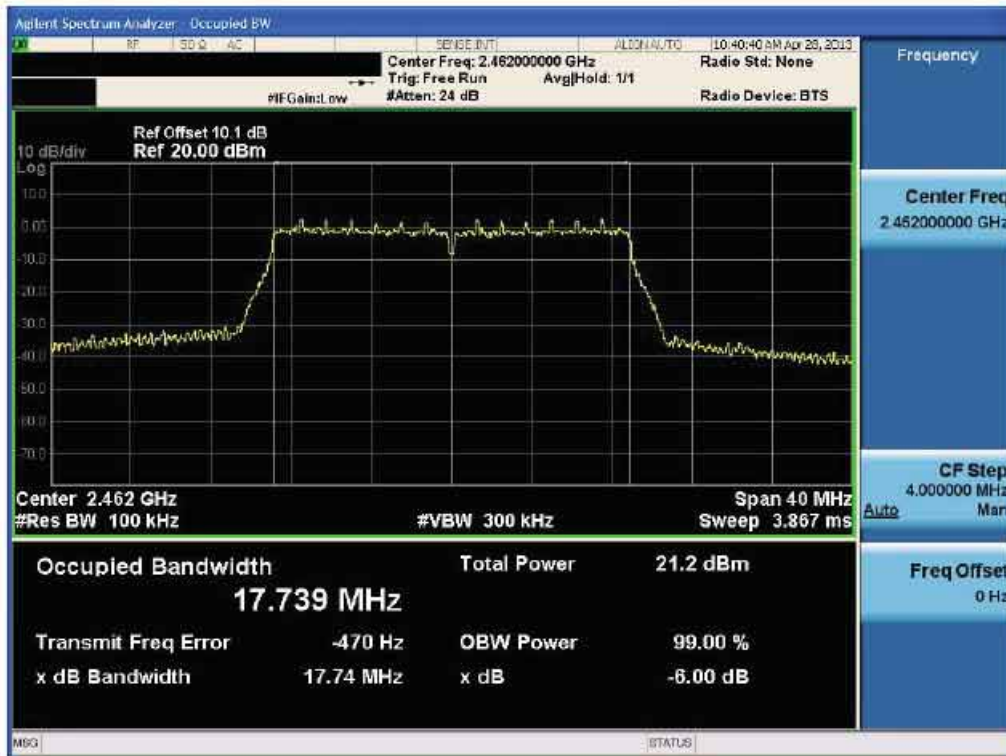
**6dB Bandwidth plot (802.11n-CH 1) \_20 MHz BW**



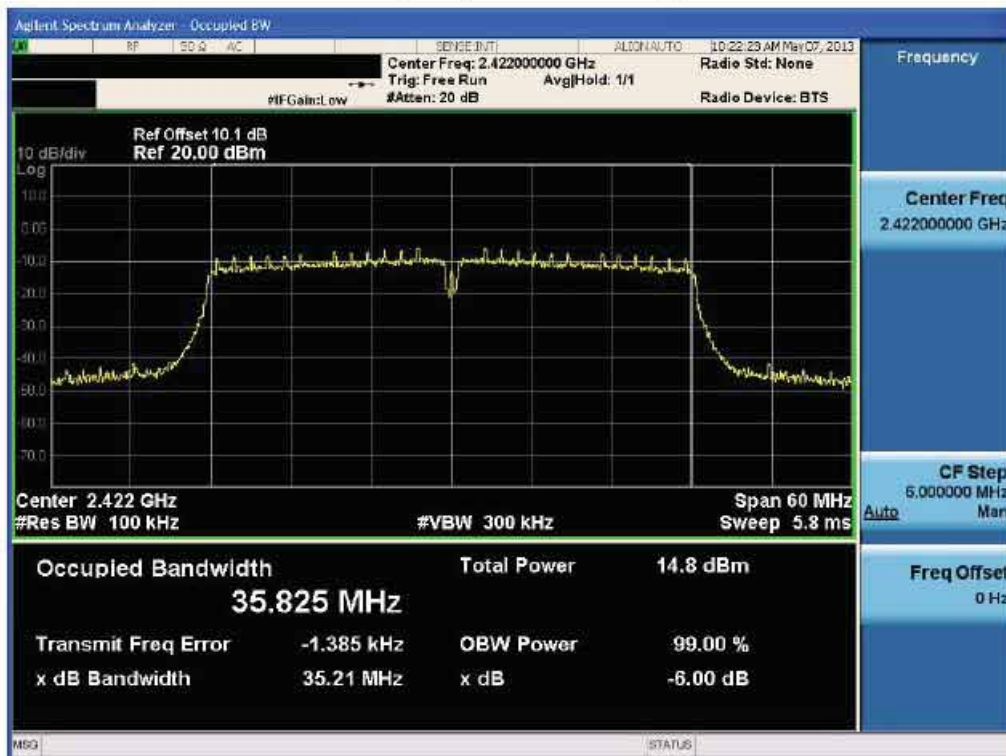
**6dB Bandwidth plot (802.11n-CH 6) \_20 MHz BW**



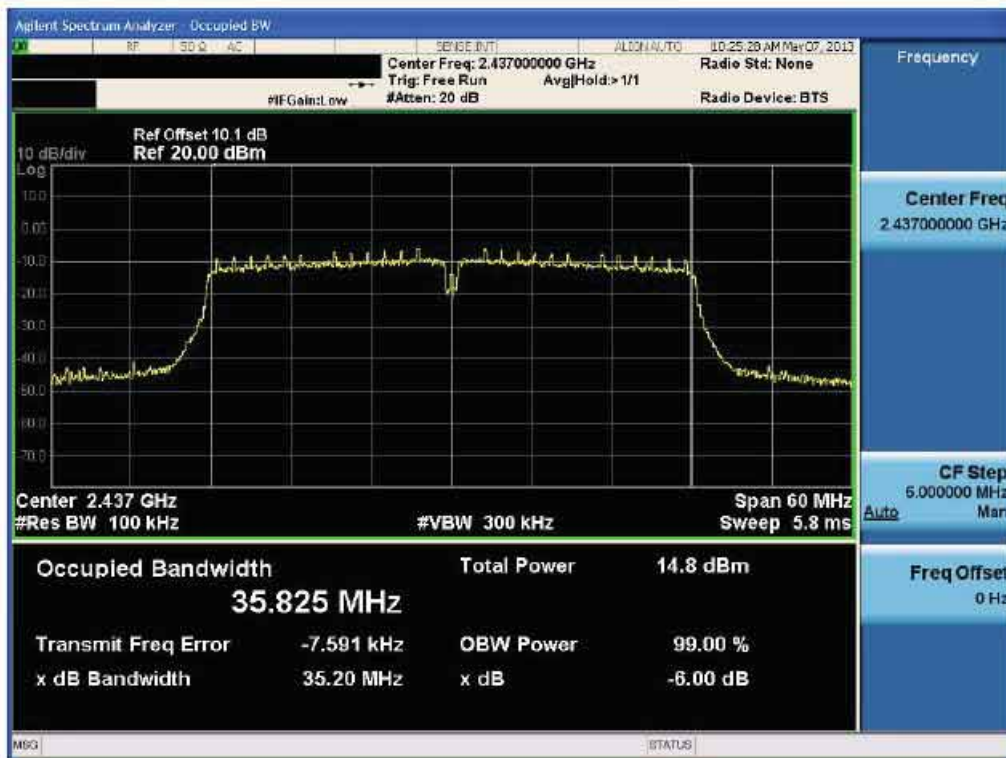
### 6dB Bandwidth plot (802.11n-CH 11) \_20 MHz BW



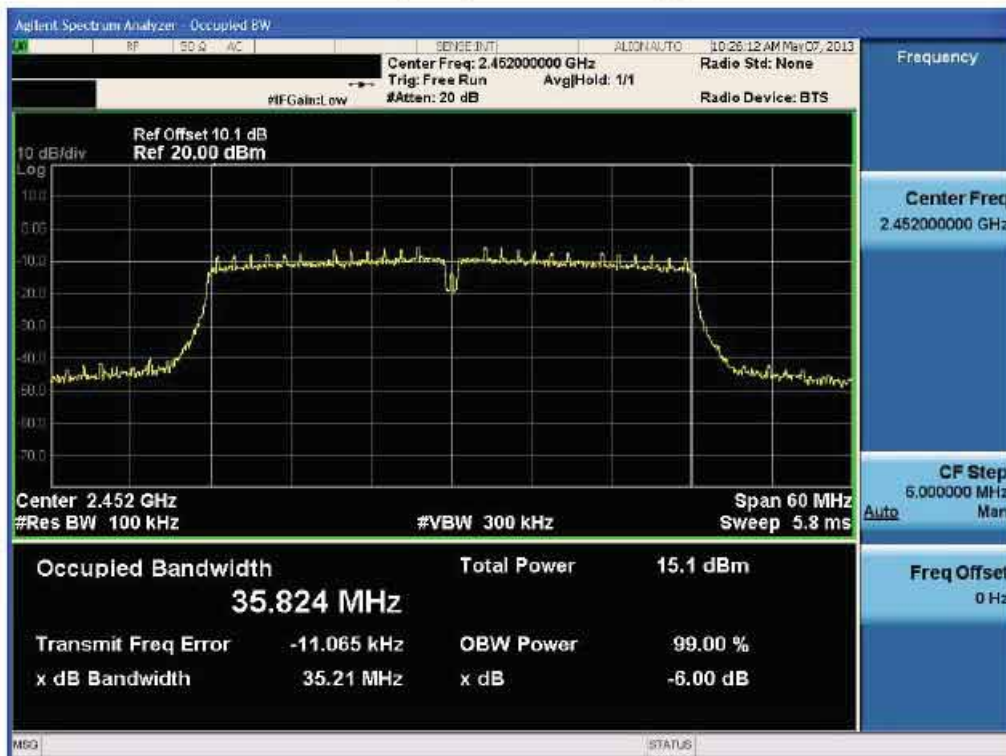
### 6dB Bandwidth plot (802.11n-CH 3) \_40 MHz BW



### 6dB Bandwidth plot (802.11n-CH 6) \_40 MHz BW



### 6dB Bandwidth plot (802.11n-CH 9) \_40 MHz BW



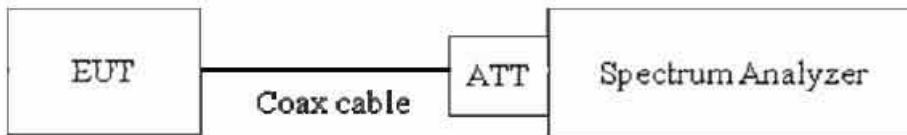
## 8.2 OUTPUT POWER (802.11b/g/n)

### Test Requirements and limit, §15.247(b)(3)

A transmitter antenna terminal of EUT is connected to the input of a Spectrum Analyzer. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

**The maximum permissible conducted output power is 1 Watt.**

#### ■ TEST CONFIGURATION



#### ■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We use the spectrum analyzer's integrated band power measurement function.

The Spectrum Analyzer is set to

- Peak Power ( Procedure 9.1.2 in KDB 558074, issued 04/09/2013)

RBW = 1 MHz

VBW  $\geq$  3 x RBW

SPAN  $\geq$  1.5 x DTS bandwidth

Detector Mode = Peak

Sweep = auto couple

Trace Mode = max hold

Allow trace to fully stabilize.

Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector).

- Average Power ( Procedure 9.2.2.4 in KDB 558074, issued 04/09/2013)

Measure the duty cycle

Set span to at least 1.5 times the OBW

RBW = 1-5 % of the OBW, not to exceed 1 MHz.

VBW  $\geq$  3 x RBW.

Number of points in sweep  $\geq$  2 x span / RBW. (This gives bin-to-bin spacing  $\leq$  RBW/2, so that narrowband signals are not lost between frequency bins.)

Sweep time = auto.

Detector = RMS(i.e., power averaging)

Do not use sweep triggering. Allow the sweep to "free run".

Trace average at least 100 traces in power averaging(RMS) mode.

Compute power by integrating the spectrum across the OBW of the signal using the instrument's band

|                                          |                                       |                                                                         |                                                  |
|------------------------------------------|---------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------|
| <b>FCC PT.15.247<br/>TEST REPORT</b>     | <b>FCC CERTIFICATION REPORT</b>       |                                                                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
| <b>Test Report No.</b><br>HCTR1305FR11-1 | <b>Date of Issue:</b><br>May 23, 2013 | <b>EUT Type:</b><br>GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n | <b>FCC ID:</b><br>ZNFE440J                       |

power measurement function with band limits set equal to the OBW band edges.

Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

### ■ Sample Calculation

$$\begin{aligned} \text{Output Power} &= \text{Reading Value} + \text{ATT loss} + \text{Cable loss(1 ea)} + \text{Duty Cycle Factor} \\ &= 10 \text{ dBm} + 10 \text{ dB} + 0.8 \text{ dB} + 0.2 \text{ dB} = 21.0 \text{ dBm} \end{aligned}$$

#### Note:

1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. Actual value of loss for the attenuator and cable combination is below table.  
So, 10.1 dB is offset. And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result.

| Band    | Frequency(MHz) | Loss(dB) |
|---------|----------------|----------|
| 2.4 GHz | 2412           | 10.11    |
|         | 2437           | 10.10    |
|         | 2462           | 10.12    |

(Actual value of loss for the attenuator and cable combination)

■ **Duty Cycle Factor**

| Mode               | Data Rate         | T <sub>on</sub><br>(ms) | T <sub>total</sub><br>(ms) | Duty Cycle       | Duty Cycle Factor<br>(dB) |
|--------------------|-------------------|-------------------------|----------------------------|------------------|---------------------------|
| <b>b</b>           | <b>1 Mbps</b>     | <b>8.400</b>            | <b>8.490</b>               | <b>0.9893993</b> | <b>0.046</b>              |
|                    | <b>2 Mbps</b>     | <b>4.286</b>            | <b>4.392</b>               | <b>0.9758652</b> | <b>0.106</b>              |
|                    | <b>5.5 Mbps</b>   | <b>1.683</b>            | <b>1.782</b>               | <b>0.9444444</b> | <b>0.248</b>              |
|                    | <b>11 Mbps</b>    | <b>0.938</b>            | <b>1.038</b>               | <b>0.9036609</b> | <b>0.440</b>              |
| <b>g</b>           | <b>6 Mbs</b>      | <b>1.394</b>            | <b>1.500</b>               | <b>0.9293333</b> | <b>0.318</b>              |
|                    | <b>9 Mbs</b>      | <b>0.940</b>            | <b>1.044</b>               | <b>0.9002874</b> | <b>0.456</b>              |
|                    | <b>12 Mbs</b>     | <b>0.710</b>            | <b>0.816</b>               | <b>0.8702955</b> | <b>0.603</b>              |
|                    | <b>18 Mbs</b>     | <b>0.483</b>            | <b>0.589</b>               | <b>0.8200340</b> | <b>0.862</b>              |
|                    | <b>24 Mbs</b>     | <b>0.356</b>            | <b>0.472</b>               | <b>0.7542373</b> | <b>1.225</b>              |
|                    | <b>36 Mbs</b>     | <b>0.244</b>            | <b>0.360</b>               | <b>0.6777778</b> | <b>1.689</b>              |
|                    | <b>48 Mbs</b>     | <b>0.185</b>            | <b>0.301</b>               | <b>0.6139767</b> | <b>2.118</b>              |
|                    | <b>54 Mbs</b>     | <b>0.168</b>            | <b>0.285</b>               | <b>0.5905097</b> | <b>2.288</b>              |
| <b>n_20 MHz BW</b> | <b>6.5 Mbs</b>    | <b>1.292</b>            | <b>1.408</b>               | <b>0.9176136</b> | <b>0.373</b>              |
|                    | <b>13 Mbs</b>     | <b>0.659</b>            | <b>0.776</b>               | <b>0.8497229</b> | <b>0.707</b>              |
|                    | <b>19.5 Mbs</b>   | <b>0.451</b>            | <b>0.568</b>               | <b>0.7940141</b> | <b>1.002</b>              |
|                    | <b>26 Mbs</b>     | <b>0.344</b>            | <b>0.460</b>               | <b>0.7478261</b> | <b>1.262</b>              |
|                    | <b>39 Mbs</b>     | <b>0.240</b>            | <b>0.356</b>               | <b>0.6741573</b> | <b>1.712</b>              |
|                    | <b>52 Mbs</b>     | <b>0.188</b>            | <b>0.305</b>               | <b>0.6174056</b> | <b>2.094</b>              |
|                    | <b>58.5 Mbs</b>   | <b>0.173</b>            | <b>0.289</b>               | <b>0.5979203</b> | <b>2.234</b>              |
|                    | <b>65 Mbs</b>     | <b>0.157</b>            | <b>0.273</b>               | <b>0.5743119</b> | <b>2.409</b>              |
| <b>n_40 MHz BW</b> | <b>13.5 Mbps</b>  | <b>0.639</b>            | <b>0.756</b>               | <b>0.8458791</b> | <b>0.727</b>              |
|                    | <b>27 Mbps</b>    | <b>0.336</b>            | <b>0.451</b>               | <b>0.7450111</b> | <b>1.278</b>              |
|                    | <b>40.5 Mbps</b>  | <b>0.232</b>            | <b>0.346</b>               | <b>0.6697460</b> | <b>1.741</b>              |
|                    | <b>54 Mbps</b>    | <b>0.185</b>            | <b>0.299</b>               | <b>0.6170569</b> | <b>2.097</b>              |
|                    | <b>81 Mbps</b>    | <b>0.133</b>            | <b>0.247</b>               | <b>0.5364372</b> | <b>2.705</b>              |
|                    | <b>108 Mbps</b>   | <b>0.108</b>            | <b>0.223</b>               | <b>0.4843049</b> | <b>3.149</b>              |
|                    | <b>121.5 Mbps</b> | <b>0.096</b>            | <b>0.211</b>               | <b>0.4549763</b> | <b>3.420</b>              |
|                    | <b>135 Mbps</b>   | <b>0.092</b>            | <b>0.207</b>               | <b>0.4444444</b> | <b>3.522</b>              |

Note : Duty Cycle Factor =  $10 \cdot \log(1/\text{Duty Cycle})$ , where, Duty Cycle =  $T_{on} / T_{total}$

■ **TEST RESULTS-Peak**

Conducted Output Power Measurements (802.11b Mode)

| 802.11b Mode   |             | Rate<br>(Mbps) | Measured<br>Power(dBm) | Limit<br>(dBm) |
|----------------|-------------|----------------|------------------------|----------------|
| Frequency[MHz] | Channel No. |                |                        |                |
| 2412           | 1           | 1 Mbps         | 19.58                  | 30             |
|                |             | 2 Mbps         | 19.84                  | 30             |
|                |             | 5.5 Mbps       | 20.24                  | 30             |
|                |             | 11 Mbps        | 21.44                  | 30             |
| 2437           | 6           | 1 Mbps         | 19.18                  | 30             |
|                |             | 2 Mbps         | 20.14                  | 30             |
|                |             | 5.5 Mbps       | 20.85                  | 30             |
|                |             | 11 Mbps        | 22.82                  | 30             |
| 2462           | 11          | 1 Mbps         | 19.74                  | 30             |
|                |             | 2 Mbps         | 20.38                  | 30             |
|                |             | 5.5 Mbps       | 20.51                  | 30             |
|                |             | 11 Mbps        | 21.04                  | 30             |

## Conducted Output Power Measurements (802.11g Mode)

| 802.11g Mode   |             | Rate<br>(Mbps) | Measured<br>Power(dBm) | Limit<br>(dBm) |
|----------------|-------------|----------------|------------------------|----------------|
| Frequency[MHz] | Channel No. |                |                        |                |
| 2412           | 1           | 6 Mbps         | 17.87                  | 30             |
|                |             | 9 Mbps         | 17.89                  | 30             |
|                |             | 12 Mbps        | 18.26                  | 30             |
|                |             | 18 Mbps        | 18.50                  | 30             |
|                |             | 24 Mbps        | 18.93                  | 30             |
|                |             | 36 Mbps        | 19.08                  | 30             |
|                |             | 48 Mbps        | 19.22                  | 30             |
|                |             | 54 Mbps        | 19.28                  | 30             |
| 2437           | 6           | 6 Mbps         | 20.09                  | 30             |
|                |             | 9 Mbps         | 20.24                  | 30             |
|                |             | 12 Mbps        | 20.55                  | 30             |
|                |             | 18 Mbps        | 20.63                  | 30             |
|                |             | 24 Mbps        | 21.09                  | 30             |
|                |             | 36 Mbps        | 21.24                  | 30             |
|                |             | 48 Mbps        | 21.41                  | 30             |
|                |             | 54 Mbps        | 21.45                  | 30             |
| 2462           | 11          | 6 Mbps         | 19.15                  | 30             |
|                |             | 9 Mbps         | 19.16                  | 30             |
|                |             | 12 Mbps        | 19.53                  | 30             |
|                |             | 18 Mbps        | 19.68                  | 30             |
|                |             | 24 Mbps        | 20.09                  | 30             |
|                |             | 36 Mbps        | 20.24                  | 30             |
|                |             | 48 Mbps        | 20.38                  | 30             |
|                |             | 54 Mbps        | 20.45                  | 30             |

Conducted Output Power Measurements (802.11n Mode)\_20 MHz BW

| 802.11n Mode   |             | Rate<br>(Mbps) | Measured<br>Power(dBm) | Limit<br>(dBm) |
|----------------|-------------|----------------|------------------------|----------------|
| Frequency[MHz] | Channel No. |                |                        |                |
| 2412           | 1           | 6.5 Mbps       | 15.60                  | 30             |
|                |             | 13 Mbps        | 15.87                  | 30             |
|                |             | 19.5 Mbps      | 15.96                  | 30             |
|                |             | 26 Mbps        | 16.40                  | 30             |
|                |             | 39 Mbps        | 17.04                  | 30             |
|                |             | 52 Mbps        | 16.97                  | 30             |
|                |             | 58.5 Mbps      | 16.96                  | 30             |
|                |             | 65 Mbps        | 17.23                  | 30             |
| 2437           | 6           | 6.5 Mbps       | 17.46                  | 30             |
|                |             | 13 Mbps        | 17.68                  | 30             |
|                |             | 19.5 Mbps      | 17.84                  | 30             |
|                |             | 26 Mbps        | 18.15                  | 30             |
|                |             | 39 Mbps        | 18.36                  | 30             |
|                |             | 52 Mbps        | 18.48                  | 30             |
|                |             | 58.5 Mbps      | 18.66                  | 30             |
|                |             | 65 Mbps        | 18.72                  | 30             |
| 2462           | 11          | 6.5 Mbps       | 17.24                  | 30             |
|                |             | 13 Mbps        | 17.46                  | 30             |
|                |             | 19.5 Mbps      | 17.64                  | 30             |
|                |             | 26 Mbps        | 18.06                  | 30             |
|                |             | 39 Mbps        | 18.18                  | 30             |
|                |             | 52 Mbps        | 18.37                  | 30             |
|                |             | 58.5 Mbps      | 18.49                  | 30             |
|                |             | 65 Mbps        | 18.54                  | 30             |

■ **TEST RESULTS**

Conducted Output Power Measurements (802.11n Mode)\_40 MHz BW

| 802.11n Mode   |             | Rate<br>(Mbps) | Measured<br>Power(dBm) | Limit<br>(dBm) |
|----------------|-------------|----------------|------------------------|----------------|
| Frequency[MHz] | Channel No. |                |                        |                |
| 2422           | 3           | 13.5 Mbps      | 15.05                  | 30             |
|                |             | 27 Mbps        | 15.48                  | 30             |
|                |             | 40.5 Mbps      | 15.77                  | 30             |
|                |             | 54 Mbps        | 16.15                  | 30             |
|                |             | 81 Mbps        | 16.19                  | 30             |
|                |             | 108 Mbps       | 16.37                  | 30             |
|                |             | 121.5 Mbps     | 16.54                  | 30             |
|                |             | 135 Mbps       | 16.55                  | 30             |
| 2437           | 6           | 13.5 Mbps      | 15.28                  | 30             |
|                |             | 27 Mbps        | 15.57                  | 30             |
|                |             | 40.5 Mbps      | 15.70                  | 30             |
|                |             | 54 Mbps        | 16.06                  | 30             |
|                |             | 81 Mbps        | 16.24                  | 30             |
|                |             | 108 Mbps       | 16.36                  | 30             |
|                |             | 121.5 Mbps     | 16.45                  | 30             |
|                |             | 135 Mbps       | 16.54                  | 30             |
| 2452           | 9           | 13.5 Mbps      | 15.62                  | 30             |
|                |             | 27 Mbps        | 15.86                  | 30             |
|                |             | 40.5 Mbps      | 16.13                  | 30             |
|                |             | 54 Mbps        | 16.37                  | 30             |
|                |             | 81 Mbps        | 16.47                  | 30             |
|                |             | 108 Mbps       | 16.58                  | 30             |
|                |             | 121.5 Mbps     | 16.64                  | 30             |
|                |             | 135 Mbps       | 16.68                  | 30             |

■ **TEST RESULTS-Average**

Conducted Output Power Measurements (802.11b Mode)

| 802.11b Mode    |             | Rate (Mbps) | Measured Power(dBm) | Duty Cycle Factor | Measured Power(dBm) + Duty Cycle Factor | Limit (dBm) |
|-----------------|-------------|-------------|---------------------|-------------------|-----------------------------------------|-------------|
| Frequency [MHz] | Channel No. |             |                     |                   |                                         |             |
| 2412            | 1           | 1 Mbps      | 15.04               | 0.05              | 15.09                                   | 30          |
|                 |             | 2 Mbps      | 14.96               | 0.11              | 15.07                                   | 30          |
|                 |             | 5.5 Mbps    | 14.85               | 0.25              | 15.10                                   | 30          |
|                 |             | 11 Mbps     | 14.81               | 0.44              | 15.25                                   | 30          |
| 2437            | 6           | 1 Mbps      | 16.41               | 0.05              | 16.46                                   | 30          |
|                 |             | 2 Mbps      | 16.28               | 0.11              | 16.39                                   | 30          |
|                 |             | 5.5 Mbps    | 16.11               | 0.25              | 16.36                                   | 30          |
|                 |             | 11 Mbps     | 15.97               | 0.44              | 16.41                                   | 30          |
| 2462            | 11          | 1 Mbps      | 14.46               | 0.05              | 14.51                                   | 30          |
|                 |             | 2 Mbps      | 14.44               | 0.11              | 14.55                                   | 30          |
|                 |             | 5.5 Mbps    | 14.35               | 0.25              | 14.60                                   | 30          |
|                 |             | 11 Mbps     | 14.27               | 0.44              | 14.71                                   | 30          |

## Conducted Output Power Measurements (802.11g Mode)

| 802.11g Mode    |             | Rate (Mbps) | Measured Power(dBm) | Duty Cycle Factor | Measured Power(dBm) + Duty Cycle Factor | Limit (dBm) |
|-----------------|-------------|-------------|---------------------|-------------------|-----------------------------------------|-------------|
| Frequency [MHz] | Channel No. |             |                     |                   |                                         |             |
| 2412            | 1           | 6 Mbps      | 9.62                | 0.32              | 9.94                                    | 30          |
|                 |             | 9 Mbps      | 9.60                | 0.46              | 10.06                                   | 30          |
|                 |             | 12 Mbps     | 9.53                | 0.60              | 10.13                                   | 30          |
|                 |             | 18 Mbps     | 9.14                | 0.86              | 10.00                                   | 30          |
|                 |             | 24 Mbps     | 8.89                | 1.22              | 10.11                                   | 30          |
|                 |             | 36 Mbps     | 8.58                | 1.69              | 10.27                                   | 30          |
|                 |             | 48 Mbps     | 8.36                | 2.12              | 10.48                                   | 30          |
|                 |             | 54 Mbps     | 8.23                | 2.29              | 10.52                                   | 30          |
| 2437            | 6           | 6 Mbps      | 11.60               | 0.32              | 11.92                                   | 30          |
|                 |             | 9 Mbps      | 11.41               | 0.46              | 11.87                                   | 30          |
|                 |             | 12 Mbps     | 11.30               | 0.60              | 11.90                                   | 30          |
|                 |             | 18 Mbps     | 11.21               | 0.86              | 12.07                                   | 30          |
|                 |             | 24 Mbps     | 11.10               | 1.22              | 12.32                                   | 30          |
|                 |             | 36 Mbps     | 10.67               | 1.69              | 12.36                                   | 30          |
|                 |             | 48 Mbps     | 10.51               | 2.12              | 12.63                                   | 30          |
|                 |             | 54 Mbps     | 10.45               | 2.29              | 12.74                                   | 30          |
| 2462            | 11          | 6 Mbps      | 10.78               | 0.32              | 11.10                                   | 30          |
|                 |             | 9 Mbps      | 10.63               | 0.46              | 11.09                                   | 30          |
|                 |             | 12 Mbps     | 10.55               | 0.60              | 11.15                                   | 30          |
|                 |             | 18 Mbps     | 10.40               | 0.86              | 11.26                                   | 30          |
|                 |             | 24 Mbps     | 10.33               | 1.22              | 11.55                                   | 30          |
|                 |             | 36 Mbps     | 10.14               | 1.69              | 11.83                                   | 30          |
|                 |             | 48 Mbps     | 9.88                | 2.12              | 12.00                                   | 30          |
|                 |             | 54 Mbps     | 9.75                | 2.29              | 12.04                                   | 30          |

**Conducted Output Power Measurements (802.11n Mode) \_20 MHz BW**

| <b>802.11n Mode</b>    |                    | <b>Rate (Mbps)</b> | <b>Measured Power(dBm)</b> | <b>Duty Cycle Factor</b> | <b>Measured Power(dBm) + Duty Cycle Factor</b> | <b>Limit (dBm)</b> |
|------------------------|--------------------|--------------------|----------------------------|--------------------------|------------------------------------------------|--------------------|
| <b>Frequency [MHz]</b> | <b>Channel No.</b> |                    |                            |                          |                                                |                    |
| <b>2412</b>            | <b>1</b>           | <b>6.5 Mbps</b>    | <b>7.86</b>                | <b>0.37</b>              | <b>8.23</b>                                    | <b>30</b>          |
|                        |                    | <b>13 Mbps</b>     | <b>7.80</b>                | <b>0.71</b>              | <b>8.51</b>                                    | <b>30</b>          |
|                        |                    | <b>19.5 Mbps</b>   | <b>7.42</b>                | <b>1.00</b>              | <b>8.42</b>                                    | <b>30</b>          |
|                        |                    | <b>26 Mbps</b>     | <b>7.26</b>                | <b>1.26</b>              | <b>8.52</b>                                    | <b>30</b>          |
|                        |                    | <b>39 Mbps</b>     | <b>7.06</b>                | <b>1.71</b>              | <b>8.77</b>                                    | <b>30</b>          |
|                        |                    | <b>52 Mbps</b>     | <b>6.89</b>                | <b>2.09</b>              | <b>8.98</b>                                    | <b>30</b>          |
|                        |                    | <b>58.5 Mbps</b>   | <b>6.76</b>                | <b>2.23</b>              | <b>8.99</b>                                    | <b>30</b>          |
|                        |                    | <b>65 Mbps</b>     | <b>6.70</b>                | <b>2.41</b>              | <b>9.11</b>                                    | <b>30</b>          |
| <b>2437</b>            | <b>6</b>           | <b>6.5 Mbps</b>    | <b>9.21</b>                | <b>0.37</b>              | <b>9.58</b>                                    | <b>30</b>          |
|                        |                    | <b>13 Mbps</b>     | <b>9.08</b>                | <b>0.71</b>              | <b>9.79</b>                                    | <b>30</b>          |
|                        |                    | <b>19.5 Mbps</b>   | <b>8.85</b>                | <b>1.00</b>              | <b>9.85</b>                                    | <b>30</b>          |
|                        |                    | <b>26 Mbps</b>     | <b>8.71</b>                | <b>1.26</b>              | <b>9.97</b>                                    | <b>30</b>          |
|                        |                    | <b>39 Mbps</b>     | <b>8.43</b>                | <b>1.71</b>              | <b>10.14</b>                                   | <b>30</b>          |
|                        |                    | <b>52 Mbps</b>     | <b>8.19</b>                | <b>2.09</b>              | <b>10.28</b>                                   | <b>30</b>          |
|                        |                    | <b>58.5 Mbps</b>   | <b>8.11</b>                | <b>2.23</b>              | <b>10.34</b>                                   | <b>30</b>          |
|                        |                    | <b>65 Mbps</b>     | <b>8.01</b>                | <b>2.41</b>              | <b>10.42</b>                                   | <b>30</b>          |
| <b>2462</b>            | <b>11</b>          | <b>6.5 Mbps</b>    | <b>9.05</b>                | <b>0.37</b>              | <b>9.42</b>                                    | <b>30</b>          |
|                        |                    | <b>13 Mbps</b>     | <b>8.85</b>                | <b>0.71</b>              | <b>9.56</b>                                    | <b>30</b>          |
|                        |                    | <b>19.5 Mbps</b>   | <b>8.71</b>                | <b>1.00</b>              | <b>9.71</b>                                    | <b>30</b>          |
|                        |                    | <b>26 Mbps</b>     | <b>8.56</b>                | <b>1.26</b>              | <b>9.82</b>                                    | <b>30</b>          |
|                        |                    | <b>39 Mbps</b>     | <b>8.30</b>                | <b>1.71</b>              | <b>10.01</b>                                   | <b>30</b>          |
|                        |                    | <b>52 Mbps</b>     | <b>8.06</b>                | <b>2.09</b>              | <b>10.15</b>                                   | <b>30</b>          |
|                        |                    | <b>58.5 Mbps</b>   | <b>8.00</b>                | <b>2.23</b>              | <b>10.23</b>                                   | <b>30</b>          |
|                        |                    | <b>65 Mbps</b>     | <b>7.87</b>                | <b>2.41</b>              | <b>10.28</b>                                   | <b>30</b>          |

■ **TEST RESULTS**

Conducted Output Power Measurements (802.11n Mode)\_40 MHz BW

| 802.11n Mode    |             | Rate (Mbps) | Measured Power(dBm) | Duty Cycle Factor | Measured Power(dBm) + Duty Cycle Factor | Limit (dBm) |
|-----------------|-------------|-------------|---------------------|-------------------|-----------------------------------------|-------------|
| Frequency [MHz] | Channel No. |             |                     |                   |                                         |             |
| 2422            | 3           | 13.5 Mbps   | 6.70                | 0.73              | 7.43                                    | 30          |
|                 |             | 27 Mbps     | 6.08                | 1.28              | 7.36                                    | 30          |
|                 |             | 40.5 Mbps   | 5.82                | 1.74              | 7.56                                    | 30          |
|                 |             | 54 Mbps     | 5.53                | 2.10              | 7.63                                    | 30          |
|                 |             | 81 Mbps     | 5.10                | 2.70              | 7.80                                    | 30          |
|                 |             | 108 Mbps    | 4.77                | 3.15              | 7.92                                    | 30          |
|                 |             | 121.5 Mbps  | 4.61                | 3.42              | 8.03                                    | 30          |
|                 |             | 135 Mbps    | 4.11                | 3.52              | 7.63                                    | 30          |
| 2437            | 6           | 13.5 Mbps   | 6.64                | 0.73              | 7.37                                    | 30          |
|                 |             | 27 Mbps     | 6.47                | 1.28              | 7.75                                    | 30          |
|                 |             | 40.5 Mbps   | 6.02                | 1.74              | 7.76                                    | 30          |
|                 |             | 54 Mbps     | 5.75                | 2.10              | 7.85                                    | 30          |
|                 |             | 81 Mbps     | 5.34                | 2.70              | 8.04                                    | 30          |
|                 |             | 108 Mbps    | 4.97                | 3.15              | 8.12                                    | 30          |
|                 |             | 121.5 Mbps  | 4.81                | 3.42              | 8.23                                    | 30          |
|                 |             | 135 Mbps    | 4.72                | 3.52              | 8.24                                    | 30          |
| 2452            | 9           | 13.5 Mbps   | 6.69                | 0.73              | 7.42                                    | 30          |
|                 |             | 27 Mbps     | 6.62                | 1.28              | 7.90                                    | 30          |
|                 |             | 40.5 Mbps   | 6.33                | 1.74              | 8.07                                    | 30          |
|                 |             | 54 Mbps     | 5.57                | 2.10              | 7.67                                    | 30          |
|                 |             | 81 Mbps     | 5.56                | 2.70              | 8.26                                    | 30          |
|                 |             | 108 Mbps    | 5.21                | 3.15              | 8.36                                    | 30          |
|                 |             | 121.5 Mbps  | 4.62                | 3.42              | 8.04                                    | 30          |
|                 |             | 135 Mbps    | 4.53                | 3.52              | 8.05                                    | 30          |