

# Test Report of FCC CFR 47 Part 15 Subpart C

On Behalf of

**HOBBYWING TECHNOLOGY CO.,LTD.**

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|                 |                                                                                                                                                                                                                                                                                    |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:   | <b>Wifi express</b>                                                                                                                                                                                                                                                                |
| Model/Type No.: | <b>HW313</b>                                                                                                                                                                                                                                                                       |
| FCC ID:         | <b>2AIWP-HW313</b>                                                                                                                                                                                                                                                                 |
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| Report Number:  | HCT16FR131E-1                                                                                                                                                                                                                                                                      |
| Tested Date:    | June 30~July 4, 2016                                                                                                                                                                                                                                                               |
| Issued Date:    | July 4, 2016                                                                                                                                                                                                                                                                       |
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## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

|                          |                                                                                                                                    |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Applicant:               | HOBBYWING TECHNOLOGY CO.,LTD.                                                                                                      |
| Address of Applicant:    | Building 4,Yasen Chuangxin Hi-tech Industrial Park,8 Chengxin Road,Baolong Industrial Town, Longgang District,Shenzhen,P.R. China. |
| Manufacturer:            | HOBBYWING TECHNOLOGY CO.,LTD.                                                                                                      |
| Address of Manufacturer: | Building 4,Yasen Chuangxin Hi-tech Industrial Park,8 Chengxin Road,Baolong Industrial Town, Longgang District,Shenzhen,P.R. China. |

#### General Description of E.U.T

| Items                   | Description                                                                                                 |
|-------------------------|-------------------------------------------------------------------------------------------------------------|
| EUT Description:        | Wifi express                                                                                                |
| Model No.:              | HW313                                                                                                       |
| Supplementary Model:    | N/A                                                                                                         |
| Frequency Band:         | IEEE 802.11b : 2412MHz~2462MHz;<br>IEEE 802.11g : 2412MHz~2462MHz;<br>IEEE 802.11n(HT20) : 2412MHz~2462MHz; |
| Channel Spacing:        | IEEE 802.11b : 5MHz<br>IEEE 802.11g : 5MHz<br>IEEE 802.11n(HT20) : 5MHz                                     |
| Number of Channels:     | IEEE 802.11b :11 Channels;<br>IEEE 802.11g :11 Channels;<br>IEEE 802.11n(HT20) : 11 Channels;               |
| Transmit Data Rate:     | maximum of 150Mbps                                                                                          |
| Type of Modulation:     | IEEE 802.11b: CCK<br>IEEE 802.11g: OFDM<br>IEEE 802.11n(HT20): OFDM                                         |
| Hardware(HVIN):         | HW313-YT2-V1.1                                                                                              |
| Firmware release(FVIN): | WF_HW313_V1.1_D0501.bin                                                                                     |
| Antenna Type:           | Integral Antenna                                                                                            |
| Antenna Gain:           | 3dBi                                                                                                        |
| Power Rating:           | DC5V-12.6V                                                                                                  |

Remark: \* The test data gathered are from the production sample provided by the manufacturer.

## 1.2 Test standards

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

KDB558074 D01 V03r03: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

RSS-GEN Issue 4: General Requirements for Compliance of Radio Apparatus.

RSS 247 Issue 1: Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

## 1.3 Test Facility

All measurement required was performed at laboratory of Shenzhen CTL Testing Technology Co., Ltd. Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China. There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

### **FCC – Registration No.: 970318**

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December, 2013.

### **IC Registration No.: 9618B**

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

## 2. SYSTEM TEST CONFIGURATION

### 2.1 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.

### 2.2 EUT Exercise

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

### 2.3 General Test Procedures

**Conducted Emissions:** The EUT is placed on the table, which is 0.8 m above ground plane According to the requirements in ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

**Radiated Emissions:** The EUT is a placed on as turntable, 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 3m away from the receiving antenna, which varied from 1m to 4m 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10-2013.

### 2.4 Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter                               | Uncertainty |
|-----------------------------------------|-------------|
| Transmitter power conducted             | +/- 0.57 dB |
| Transmitter power Radiated              | +/- 2.20 dB |
| Conducted spurious emission 9KHz-40 GHz | +/- 2.20 dB |
| Occupied Bandwidth                      | +/- 0.01 dB |
| Power Line Conducted Emission           | +/- 3.20 dB |
| Radiated Emission                       | +/- 4.32 dB |

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 2.5 Measure Results Explanation Example

For all conducted test items:

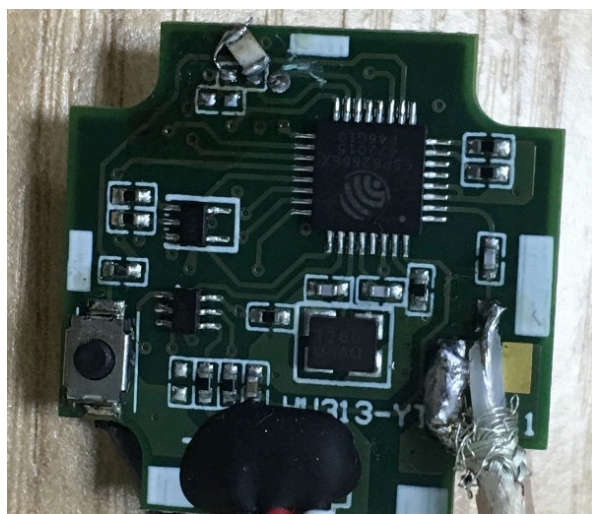
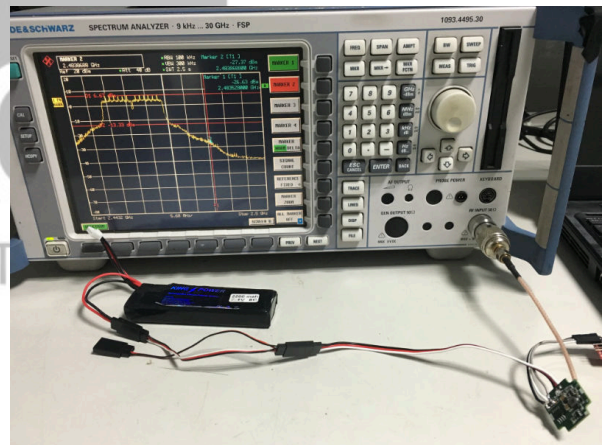
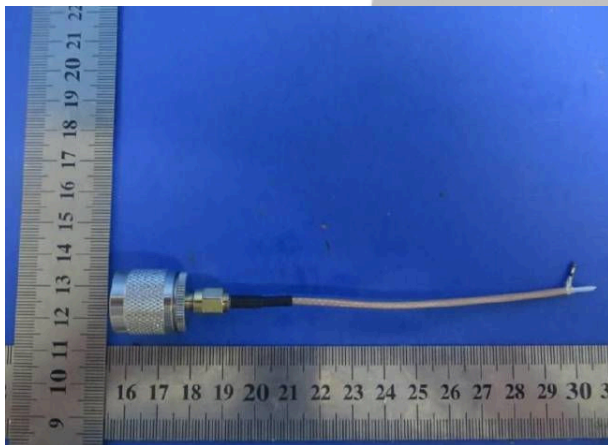
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable less and attenuator factor.

Offset= RF cable less+ attenuator factor.

Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

| Equipment | Manufacturer               | Model No. | Frequency range(GHz) | Attenuation values(dBm) |
|-----------|----------------------------|-----------|----------------------|-------------------------|
| Line      | Zhenjiang south electronic | RG316     | 1-12                 | 0.08                    |
| Connector | Zhenjiang south electronic | SMA-K/N-J | 1-12                 | 0.01                    |



## 2.6 List of Measuring Equipments Used

| No. | Instrument no. | Equipment                    | Manufacturer    | Model No.    | S/N        | Last Calibration | Due Calibration |
|-----|----------------|------------------------------|-----------------|--------------|------------|------------------|-----------------|
| 1   | BCT-EMC001     | EMI Test Receiver            | R&S             | ESCI         | 100687     | 2015-12-25       | 2016-12-24      |
| 2   | BCT-EMC002     | EMI Test Receiver            | R&S             | ES PI        | 100097     | 2015-11-1        | 2016-10-31      |
| 3   | BCT-EMC003     | Amplifier                    | HP              | 8447D        | 1937A02492 | 2015-12-25       | 2016-12-24      |
| 4   | BCT-EMC018     | TRILOGBroadband Test-Antenna | SCHWARZBECK     | VULB9163     | 9163-324   | 2015-12-25       | 2016-12-24      |
| 5   | BCT-EMC021     | Triple-Loop Antenna          | EVERFINE        | LLA-2        | 711002     | 2015-11-1        | 2016-10-31      |
| 6   | BCT-EMC026     | RF POWER AMPLIFIER           | FRANKONIA       | FLL-75       | 1020A1109  | 2015-12-25       | 2016-12-24      |
| 7   | BCT-EMC029     | 6DB Attenuator               | FRANKONIA       | N/A          | 1001698    | 2015-12-25       | 2016-12-24      |
| 8   | BCT-EMC032     | 10dB attenuator              | ELECTRO-METRICS | EM-7600      | 836        | 2015-12-25       | 2016-12-24      |
| 9   | BCT-EMC036     | Spectrum Analyzer            | R&S             | FSP          | 100397     | 2015-11-1        | 2016-10-31      |
| 10  | BCT-EMC037     | Broadband preamplifier       | SCHWARZBECK     | BBV9718      | 9718-182   | 2015-12-25       | 2016-12-24      |
| 11  | BCT-EMC039     | Horn Antenna                 | SCHWARZBECK     | BBHA 9120D   | 0437       | 2015-12-25       | 2016-12-24      |
| 12  | BCT-EMC038     | Horn Antenna                 | SCHWARZBECK     | BBHA9170     | 0483       | 2015-12-25       | 2016-12-24      |
| 13  | BCT-EMC050     | Pulse power sensor           | Anritsu         | MA2411B      | 110553     | 2015-11-1        | 2016-10-31      |
| 14  | BCT-EMC050     | Power Meter                  | Anritsu         | ML2487B      | 100345     | 2015-11-1        | 2016-10-31      |
| 15  | BCT-EMC053     | 5V1A Adapter                 | HUAWEI          | HW-050100C2W | 100651     | 2015-10-10       | 2016-10-9       |

### 3. SUMMARY OF Test RESULTS

| FCC/IC Rules                                                                | Description of Test                    | Result |
|-----------------------------------------------------------------------------|----------------------------------------|--------|
| FCC §15.207<br>IC RSS-GEN Clause 8.8                                        | AC Power Line Conducted Emission       | N/A    |
| FCC §15.247(b)<br>IC RSS-247 Issue1 Clause 5.4 (4)                          | Output Power Measurement               | Pass   |
| FCC §15.247(e)<br>IC RSS-247 Issue1 Clause 5.2 (2)                          | Power Spectral Density                 | Pass   |
| FCC §15.247(a)<br>IC RSS-247 Issue1 Clause 5.2 (1)<br>IC RSS-GEN Clause 6.6 | 6dB Bandwidth<br>99%Occupied Bandwidth | Pass   |
| FCC §15.247 (d)<br>IC RSS-247 Issue1 Clause 5.5                             | Conducted Spurious Emission            | Pass   |
| FCC §15.205 and §15.209<br>IC RSS-247 Issue1 Clause 5.5                     | Radiated Spurious Emission             | Pass   |
| FCC§15.247 (d) and §15.205 and §15.209<br>IC RSS-247 Issue1 Clause 5.5      | Unwanted Emissions                     | Pass   |
| FCC §15.203/15.247(b)/(c)<br>IC RSS-GEN Clause 8.3                          | Antenna Requirement                    | Pass   |

## 4. Test OF AC POWER LINE CONDUCTED EMISSION

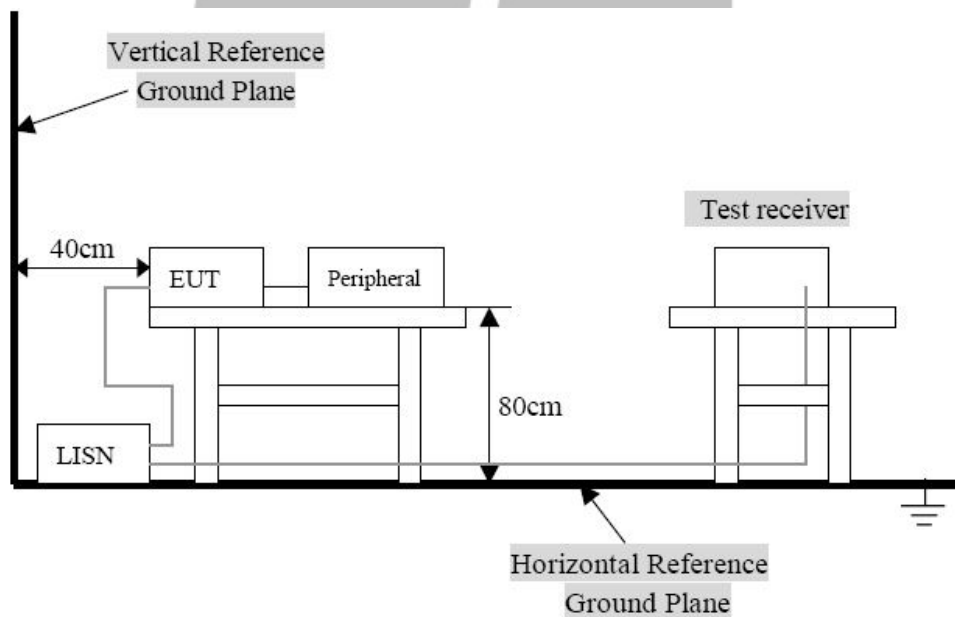
### 4.1 Applicable standard

Refer to FCC §15.207 and IC RSS-GEN Clause 8.8

For a Low-power Radio-frequency Device is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

| Frequency Range (MHz) | Limits ( dBuV) |         |
|-----------------------|----------------|---------|
|                       | Quasi-Peak     | Average |
| 0.150~0.500           | 66~56          | 56~46   |
| 0.500~5.000           | 56             | 46      |
| 5.000~30.00           | 60             | 50      |

### 4.2 Test Setup Diagram



Remark: The EUT was connected to a 120 VAC/ 60Hz power source.

### 4.3 Test Result

|                                         |                              |
|-----------------------------------------|------------------------------|
| Temperature ( °C ) : 23~25              | EUT: Wifi express            |
| Humidity (%RH) : 45~58                  | M/N:HW313                    |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition: Tx Mode |

Test result:N/A. EUT is powered by battery.

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## 5. Output Power Measurement

### 5.1 Applicable standard

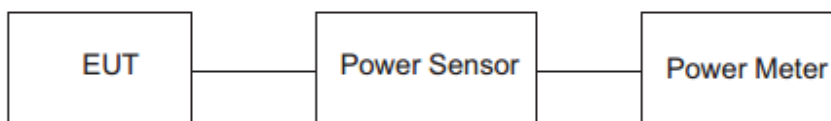
Refer to FCC §15.247 (b) and IC RSS-247 Issue1 Clause 5.4 (4).

KDB 558074 v03r03 – Section 9.1.2 PKPM1 Peak Power, Method

KDB 558074 v03r03 – Section 9.2.3.2 Method AVGPM-G

The maximum permissible conducted output power is 1Watt.

### 5.2 EUT Setup



### 5.3 Test Equipment List and Details

See section 2.5.

### 5.4 Test Procedure

#### Method PKPM1 (Peak Power Measurement)

Peak power measurement were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor, The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was than or equal to 50MHz.

#### Method AVGPM-G (Average Power Measurement)

Average power measurement were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor, The pulse meter implemented triggering and fating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter, The trace was averaged over 100 traces to obtain the final measured average power.

## 5.5 Test Result

|                                         |                              |
|-----------------------------------------|------------------------------|
| Temperature ( °C ) : 22~23              | EUT: Wifi express            |
| Humidity (%RH) : 50~54                  | M/N: HW313                   |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition: Tx Mode |

### IEEE 802.11b mode

| Channel | Channel Frequency (MHz) | Average Power (dBm) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---------|-------------------------|---------------------|------------------|------------------------|-------------|
| Low     | 2412                    | 16.53               | 19.68            | 30                     | PASS        |
| Middle  | 2437                    | 16.36               | 19.71            | 30                     | PASS        |
| High    | 2462                    | 16.49               | 19.59            | 30                     | PASS        |

### IEEE 802.11g mode

| Channel | Channel Frequency (MHz) | Average Power (dBm) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---------|-------------------------|---------------------|------------------|------------------------|-------------|
| Low     | 2412                    | 18.11               | 23.59            | 30                     | PASS        |
| Middle  | 2437                    | 18.46               | 23.53            | 30                     | PASS        |
| High    | 2462                    | 18.24               | 23.77            | 30                     | PASS        |

### IEEE 802.11n(HT20) mode

| Channel | Channel Frequency (MHz) | Average Power (dBm) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---------|-------------------------|---------------------|------------------|------------------------|-------------|
| Low     | 2412                    | 19.31               | 23.65            | 30                     | PASS        |
| Middle  | 2437                    | 19.56               | 23.59            | 30                     | PASS        |
| High    | 2462                    | 19.74               | 23.62            | 30                     | PASS        |

## 6. Test of Peak Power Spectral Density

### 6.1 Applicable standard

Refer to FCC §15.247 (e) and IC RSS-247 Issue1 Clause 5.2 (2).

KDB 558074v03r03 – Section 10.2 Method PKPSD

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 6.2 EUT Setup



### 6.3 Test Equipment List and Details

See section 2.5.

### 6.4 Test Procedure

The transmitter output was connected to the spectrum analyzer and the parameter was set as below:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW  $\geq 3$  kHz.
4. Set the VBW  $\geq 3 \times$  RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

## 6.5 Test Result

|                                         |                              |
|-----------------------------------------|------------------------------|
| Temperature ( °C ) : 22~23              | EUT: Wifi express            |
| Humidity (%RH) : 50~54                  | M/N: HW313                   |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition: Tx Mode |

### IEEE 802.11b mode

| Channel | Channel Frequency (MHz) | Power Level in 3KHz RBW (dBm) | Maximum Limit (dBm) | Pass / Fail |
|---------|-------------------------|-------------------------------|---------------------|-------------|
| Low     | 2412                    | -7.62                         | 8                   | PASS        |
| Middle  | 2437                    | -8.16                         | 8                   | PASS        |
| High    | 2462                    | -7.70                         | 8                   | PASS        |

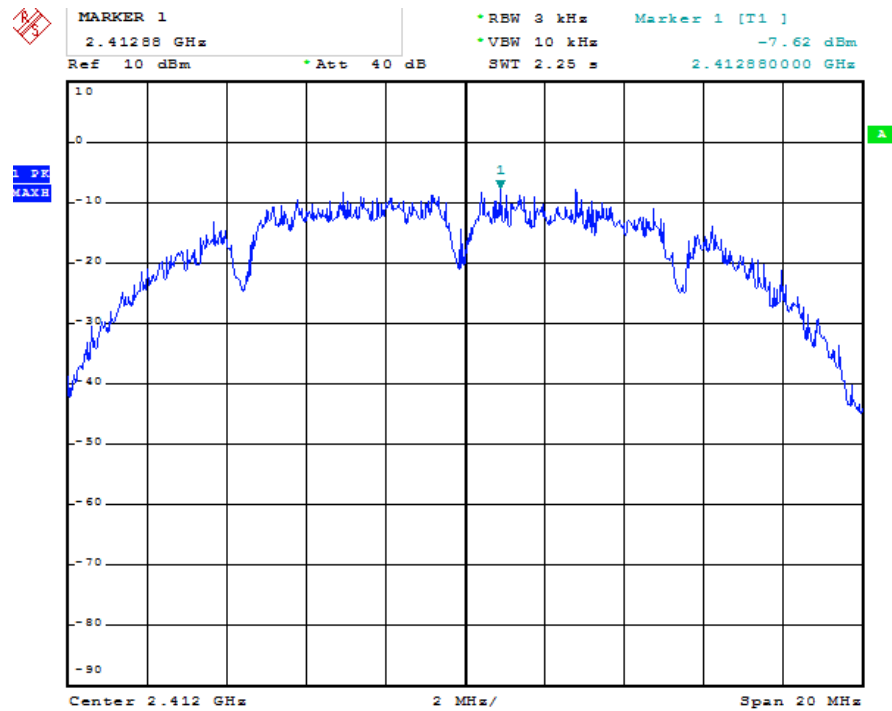
### IEEE 802.11 gmode

| Channel | Channel Frequency (MHz) | Power Level in 3KHz RBW (dBm) | Maximum Limit (dBm) | Pass / Fail |
|---------|-------------------------|-------------------------------|---------------------|-------------|
| Low     | 2412                    | -8.32                         | 8                   | PASS        |
| Middle  | 2437                    | -8.89                         | 8                   | PASS        |
| High    | 2462                    | -7.92                         | 8                   | PASS        |

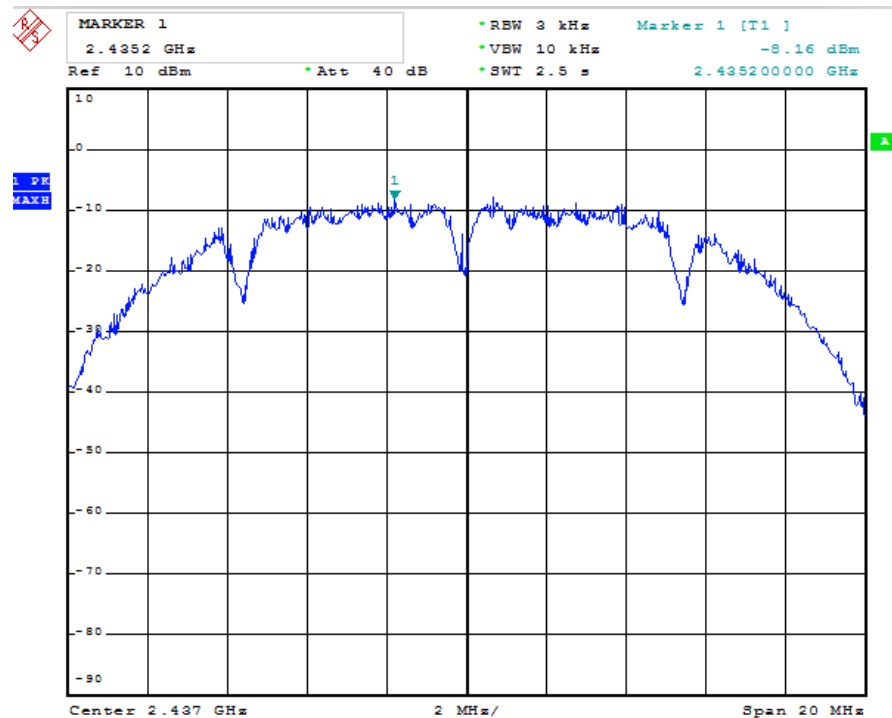
### IEEE 802.11 n(HT20) mode

| Channel | Channel Frequency (MHz) | Power Level in 3KHz RBW (dBm) | Maximum Limit (dBm) | Pass / Fail |
|---------|-------------------------|-------------------------------|---------------------|-------------|
| Low     | 2412                    | -6.12                         | 8                   | PASS        |
| Middle  | 2437                    | -8.56                         | 8                   | PASS        |
| High    | 2462                    | -8.26                         | 8                   | PASS        |

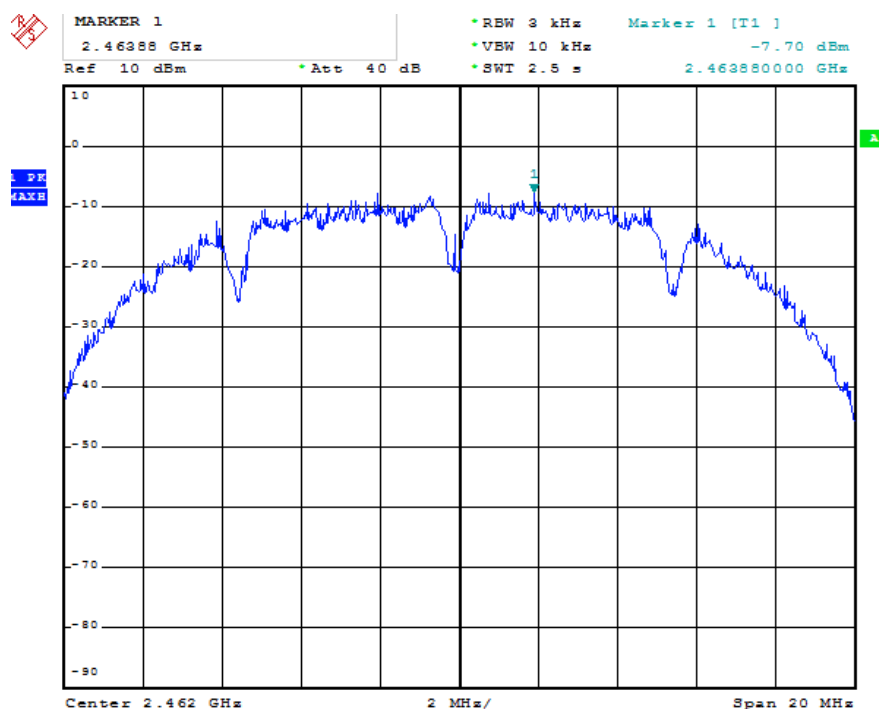
## POWER SPECTRAL DENSITY (IEEE 802.11b MODE CH Low)



## POWER SPECTRAL DENSITY (IEEE 802.11b MODE CH Mid)

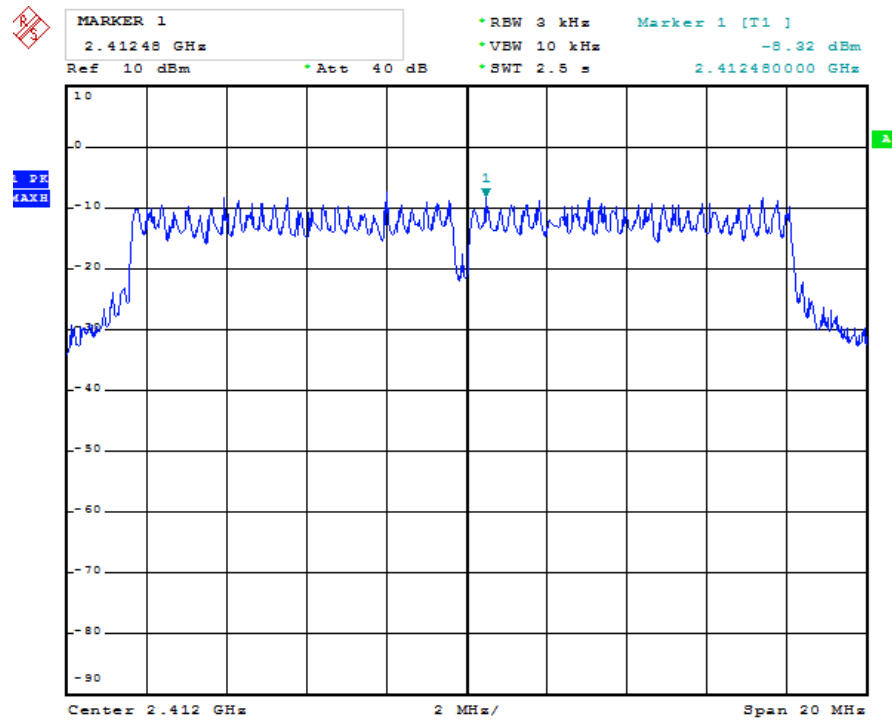


**POWER SPECTRAL DENSITY (IEEE 802.11b MODE CH High)**

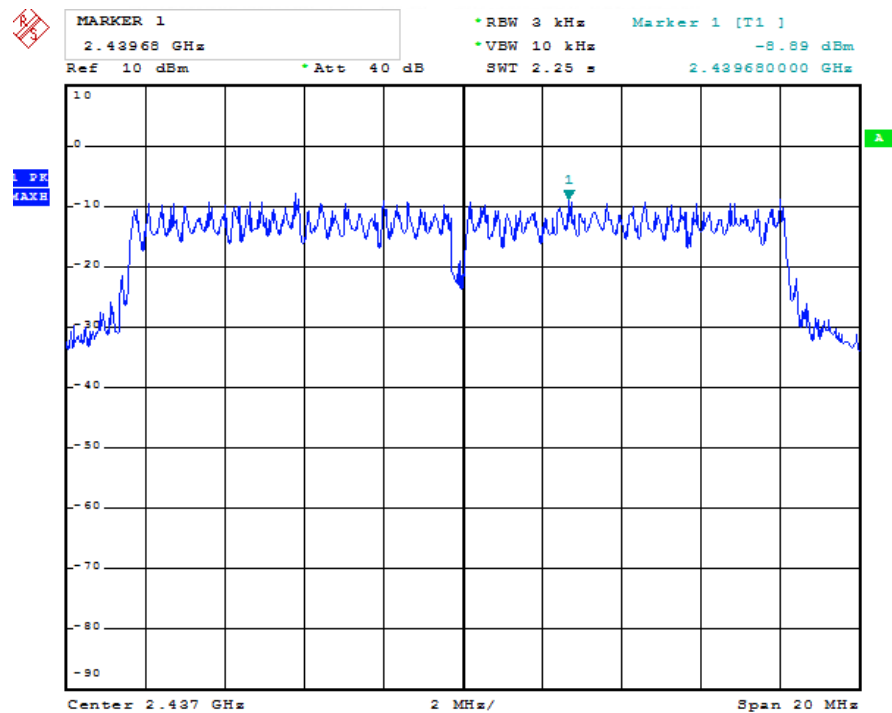


**HCT**  
HONGCAI TESTING

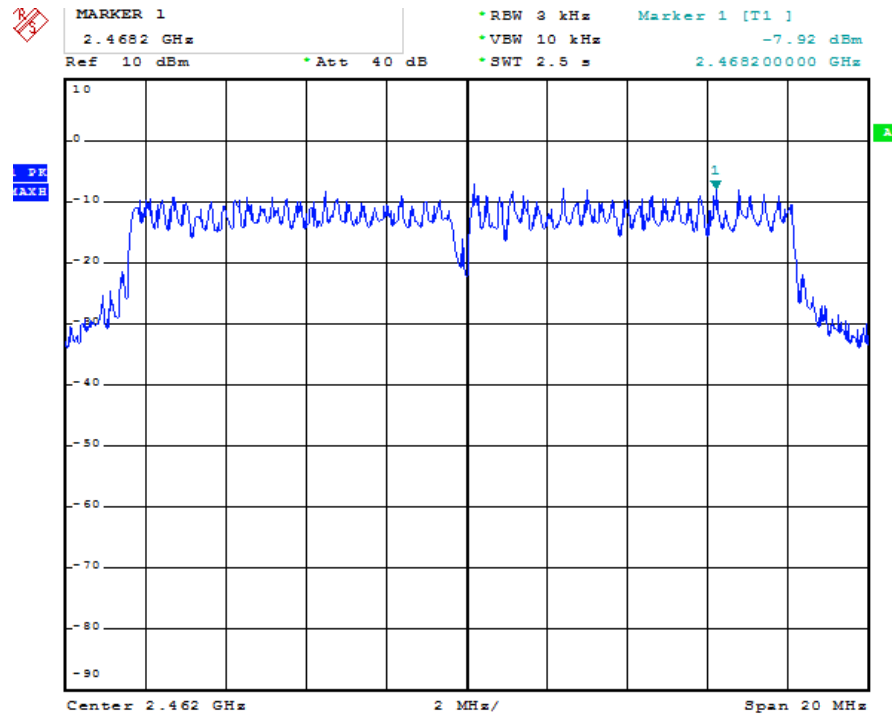
### POWER SPECTRAL DENSITY (IEEE 802.11g MODE CH Low)



### POWER SPECTRAL DENSITY (IEEE 802.11g MODE CH Mid)

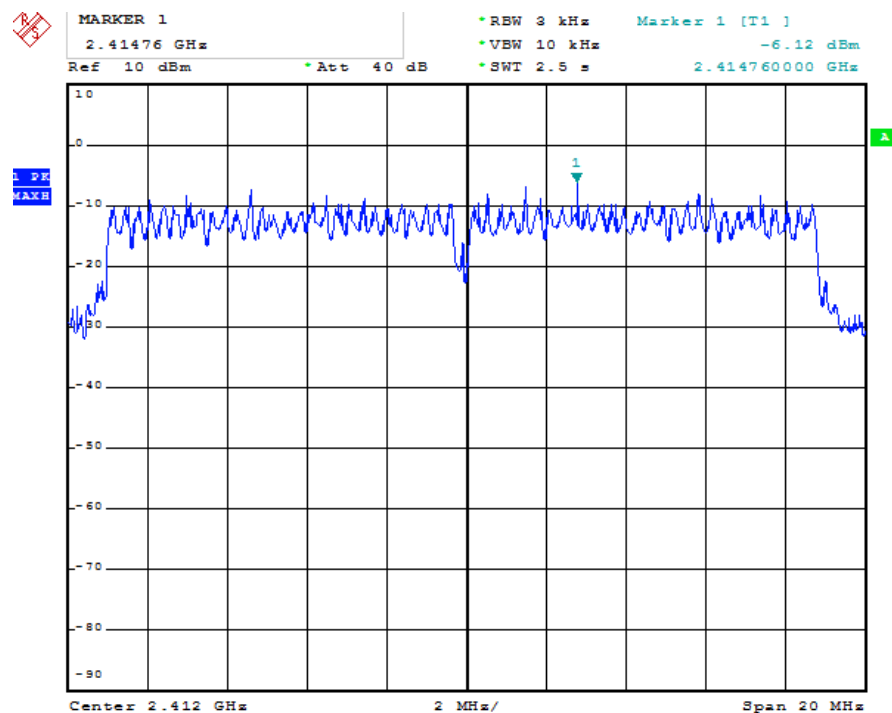


## POWER SPECTRAL DENSITY (IEEE 802.11g MODE CH High)

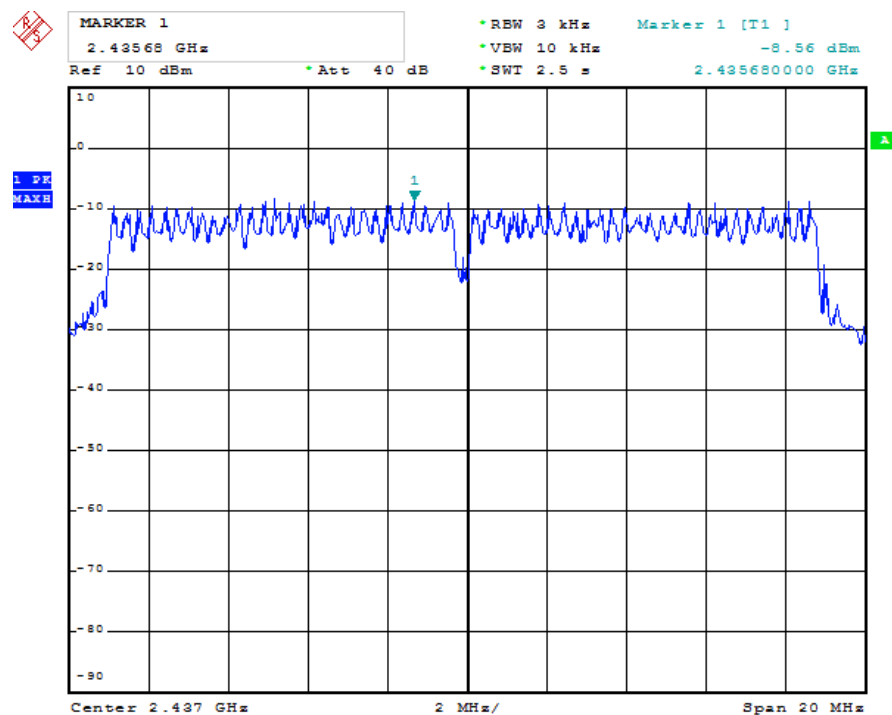


HONGCAI TESTING

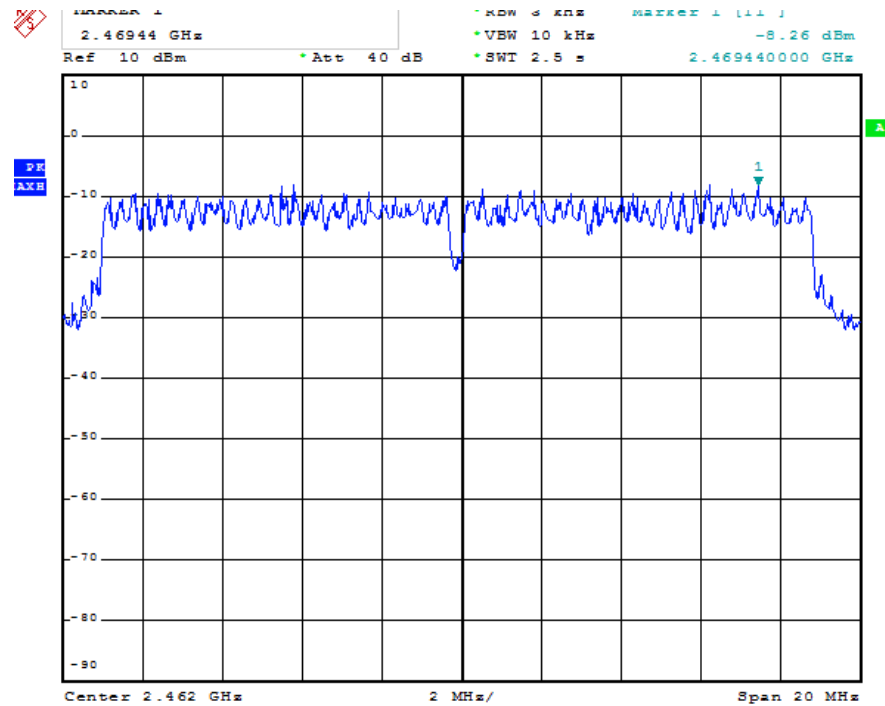
## POWER SPECTRAL DENSITY (IEEE 802.11 n(HT20) MODE CH Low)



## POWER SPECTRAL DENSITY (IEEE 802.11 n(HT20) MODE CH Mid)



**POWER SPECTRAL DENSITY (IEEE 802.11 n(HT20) MODE CH High)**



**HCT**  
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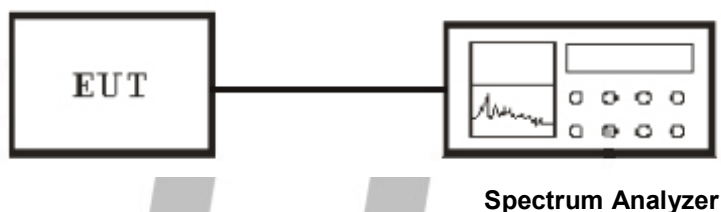
## 7. Test of 6dB Bandwidth

### 7.1 Applicable standard

Refer to FCC §15.247 (a) (2) and IC RSS-247 Issue1 Clause 5.2 (1), IC RSS-GEN Clause 6.6  
KDB558074 v03r03 – Section 8.2 Option 2

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

### 7.2 EUT Setup



### 7.3 Test Equipment List and Details

See section 2.5.

### 7.4 Test Procedure

The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. The transmitter output was connected to a spectrum analyzer and the parameter was set as below:

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

## 7.5 Test Result

|                                         |                              |
|-----------------------------------------|------------------------------|
| Temperature ( °C ) : 22~23              | EUT: Wifi express            |
| Humidity (%RH ) : 50~54                 | M/N: HW313                   |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition: Tx Mode |

### IEEE 802.11b mode

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (kHz) | Pass / Fail |
|---------|-------------------------|---------------------|---------------------|-------------|
| Low     | 2412                    | 10.24               | 500                 | PASS        |
| Middle  | 2437                    | 10.16               | 500                 | PASS        |
| High    | 2462                    | 10.24               | 500                 | PASS        |

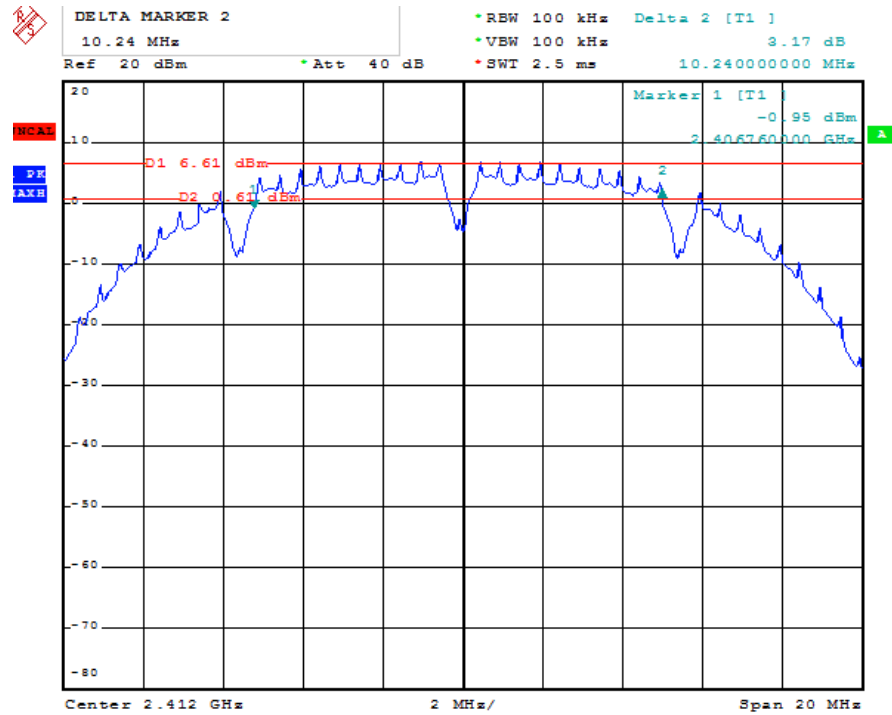
### IEEE 802.11g mode

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (kHz) | Pass / Fail |
|---------|-------------------------|---------------------|---------------------|-------------|
| Low     | 2412                    | 16.48               | 500                 | PASS        |
| Middle  | 2437                    | 16.48               | 500                 | PASS        |
| High    | 2462                    | 16.60               | 500                 | PASS        |

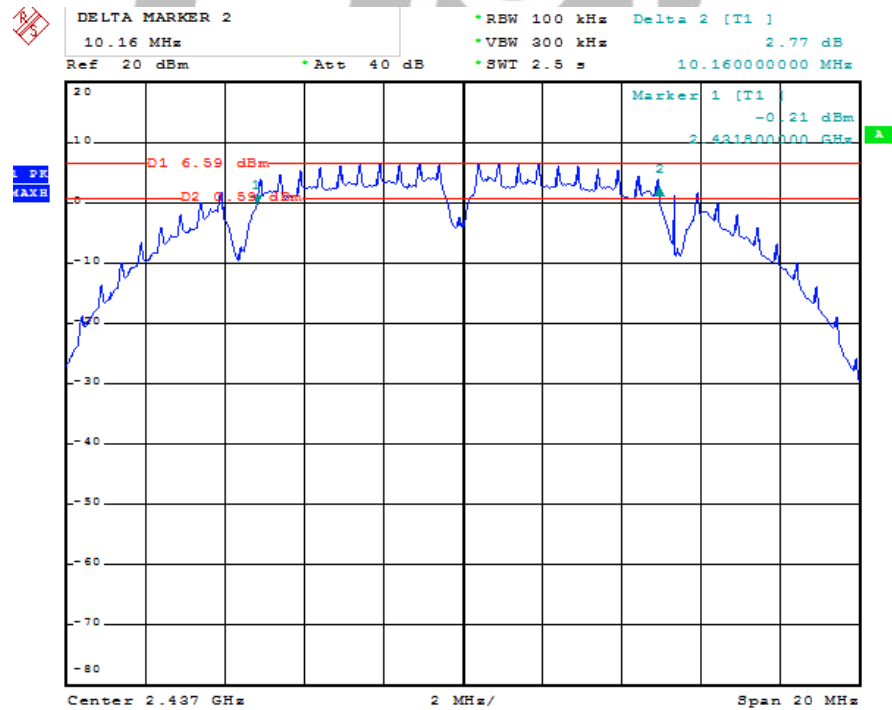
### IEEE 802.11n(HT20) mode

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (kHz) | Pass / Fail |
|---------|-------------------------|---------------------|---------------------|-------------|
| Low     | 2412                    | 17.68               | 500                 | PASS        |
| Middle  | 2437                    | 17.68               | 500                 | PASS        |
| High    | 2462                    | 17.68               | 500                 | PASS        |

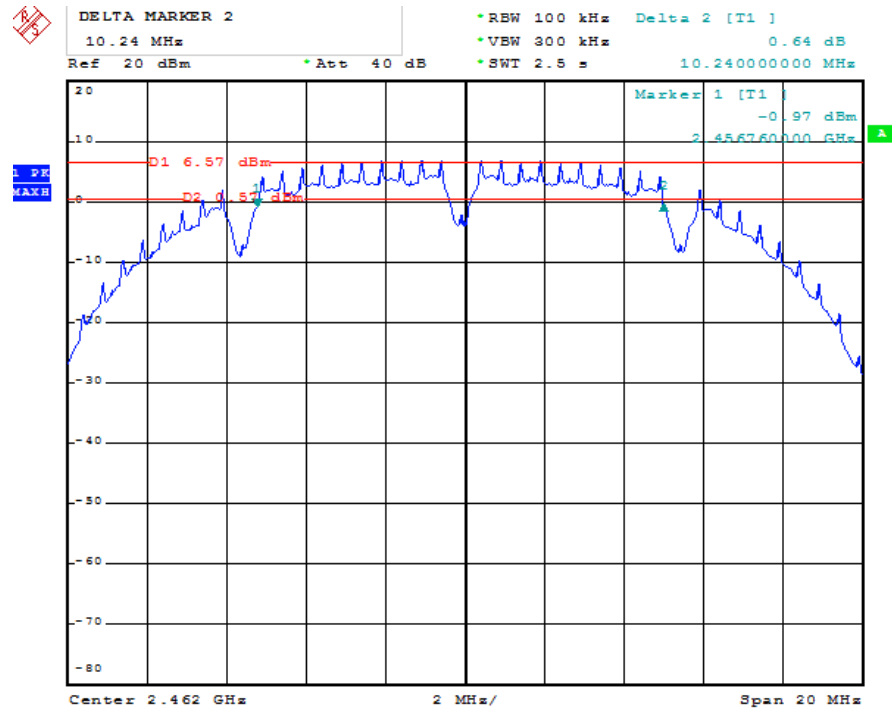
### 6dB BANDWIDTH ( IEEE 802.11b MODE CH Low)



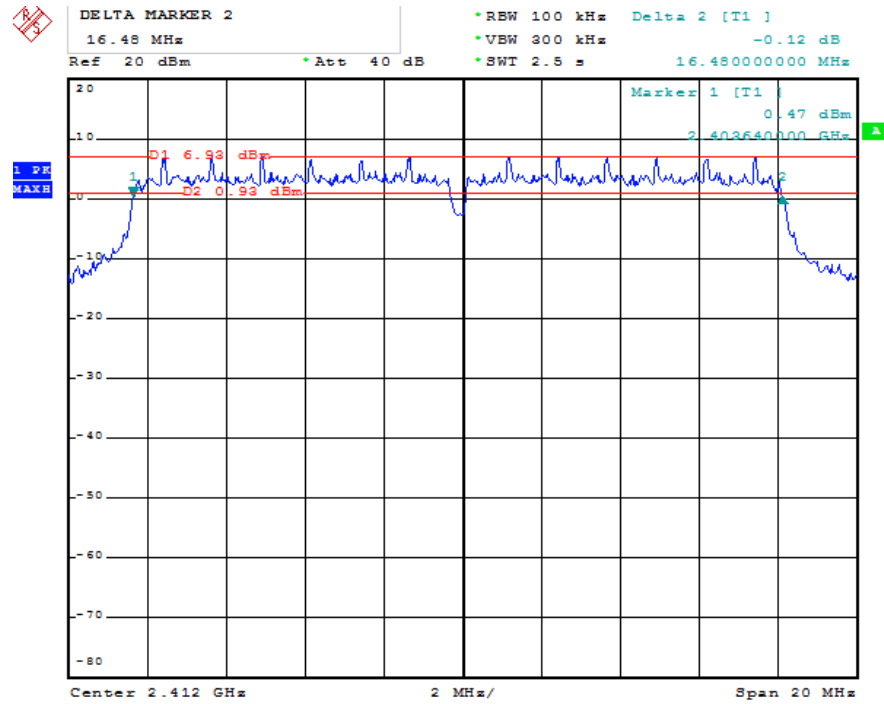
### 6dB BANDWIDTH (IEEE 802.11b MODE CH Mid)



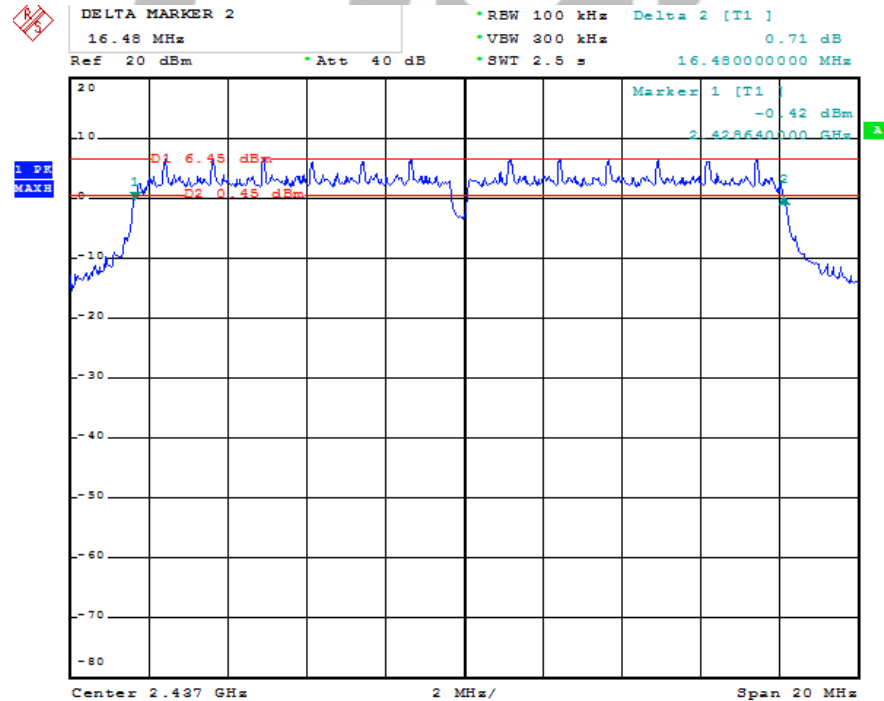
### 6dB BANDWIDTH (IEEE 802.11b MODE CH High)



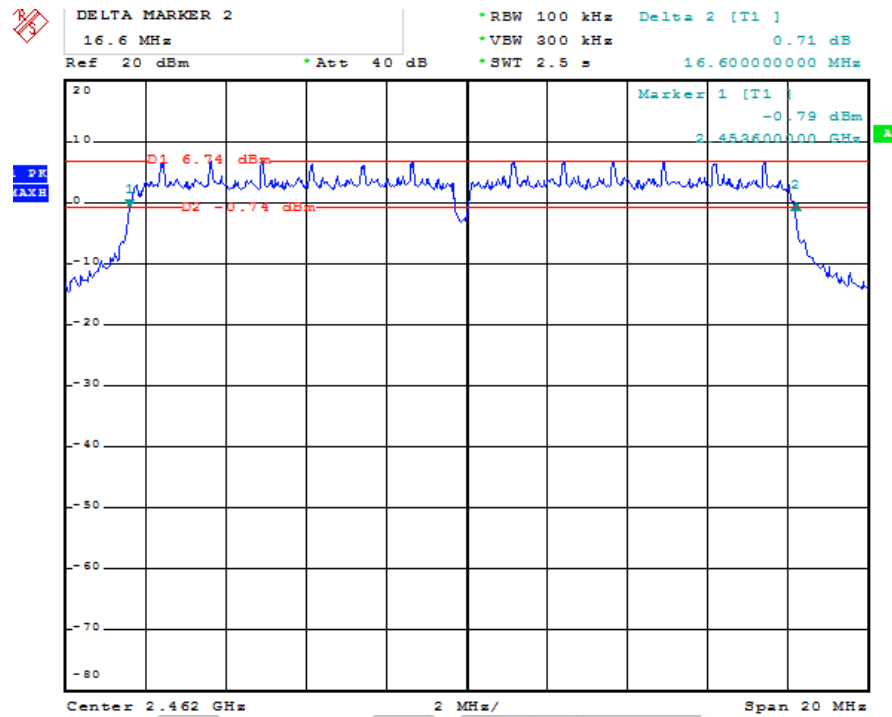
### 6dB BANDWIDTH (IEEE 802.11g MODE CH Low)



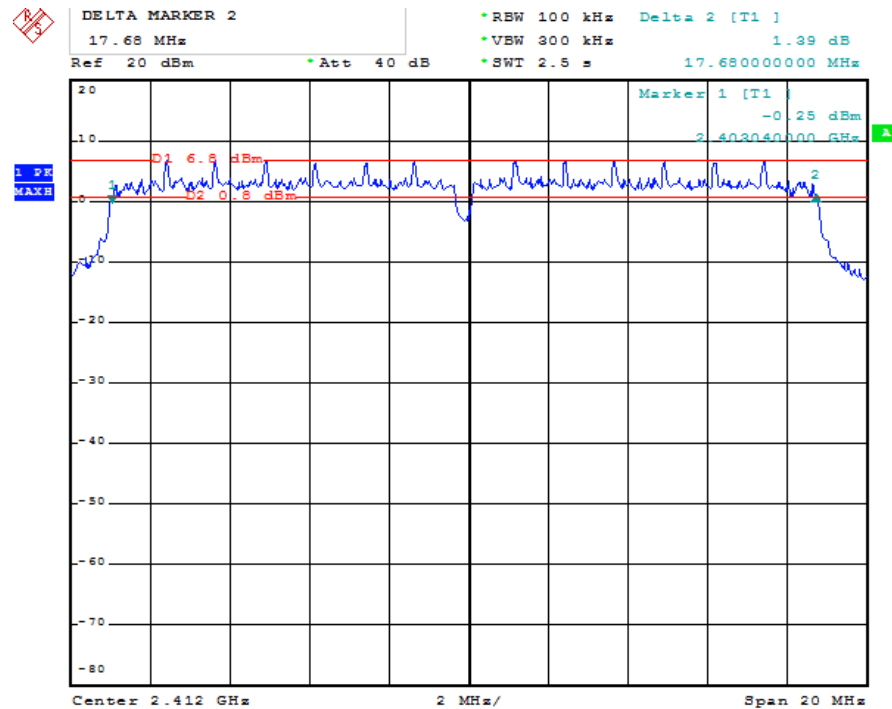
### 6dB BANDWIDTH (IEEE 802.11g MODE CH Mid)



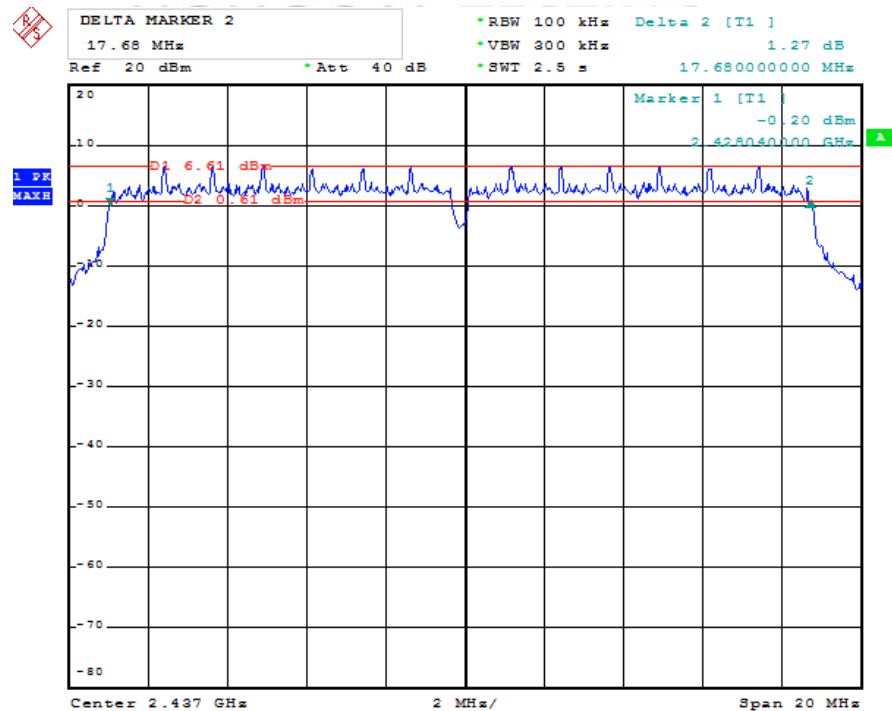
## 6dB BANDWIDTH (IEEE 802.11g MODE CH High)



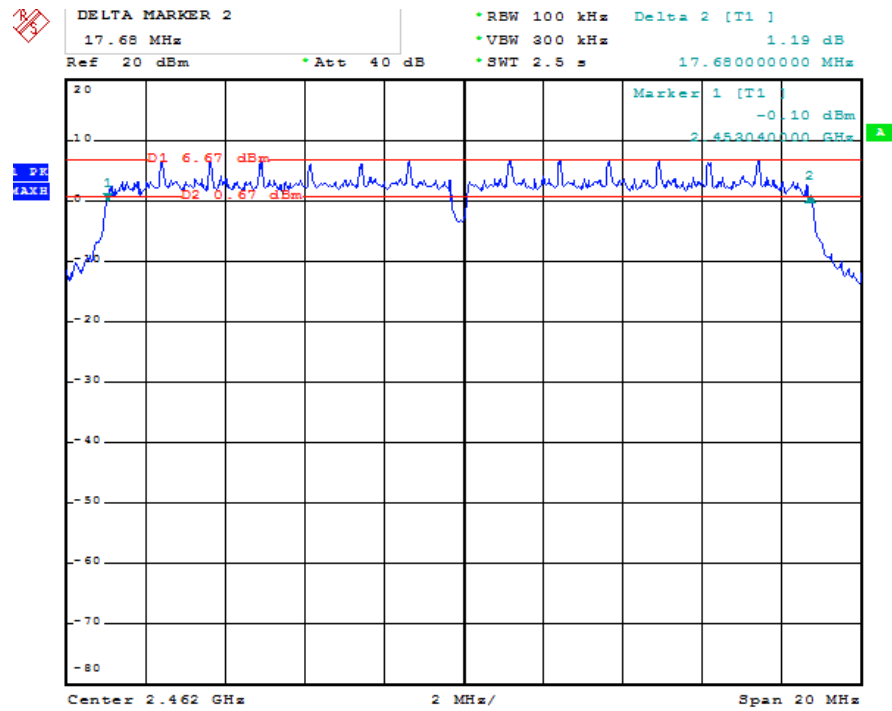
## 6dB BANDWIDTH ( IEEE 802.11n(HT20) MODE CH Low)



## 6dB BANDWIDTH (IEEE 802.11n(HT20) MODE CH Mid)



## 6dB BANDWIDTH (IEEE 802.11 n(HT20) MODE CH High)



## 8. Test of Conducted Spurious Emission

### 8.1 Applicable standard

Refer to FCC §15.247 (d) and IC RSS-247 Issue1 Clause 5.5.

KDB 558074 v03r03 – Section 11.3

Section 15.247(d): 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. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

### 8.2 EUT Setup



### 8.3 Test Equipment List and Details

See section 2.5.

### 8.4 Test Procedure

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW  $\geq$  300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

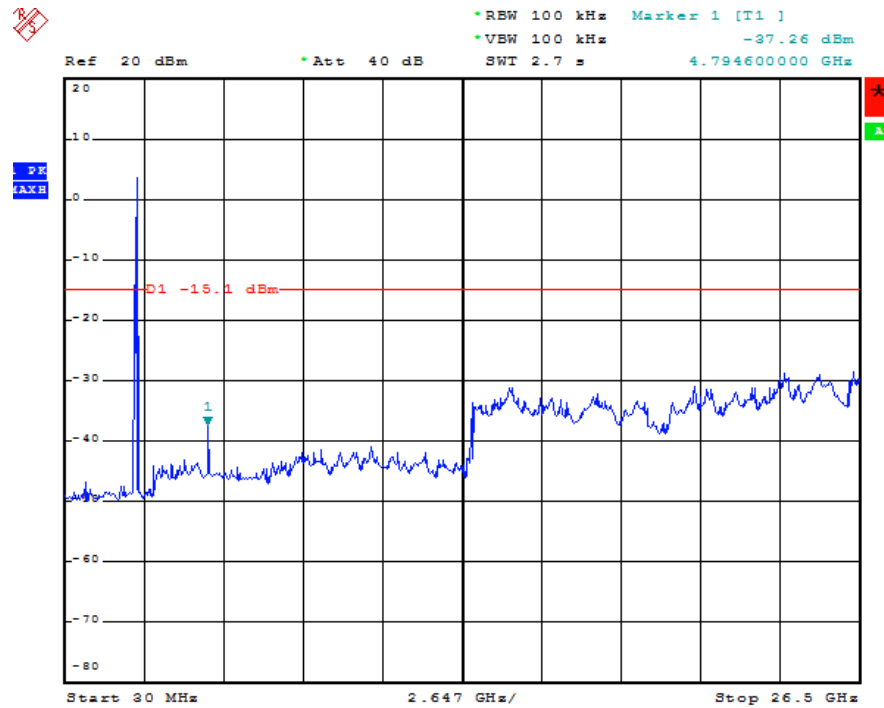
### 8.5 Test Result

|                                         |                              |
|-----------------------------------------|------------------------------|
| Temperature ( °C ) : 22~23              | EUT: Wifi express            |
| Humidity (%RH) : 50~54                  | M/N: HW313                   |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition: TX Mode |

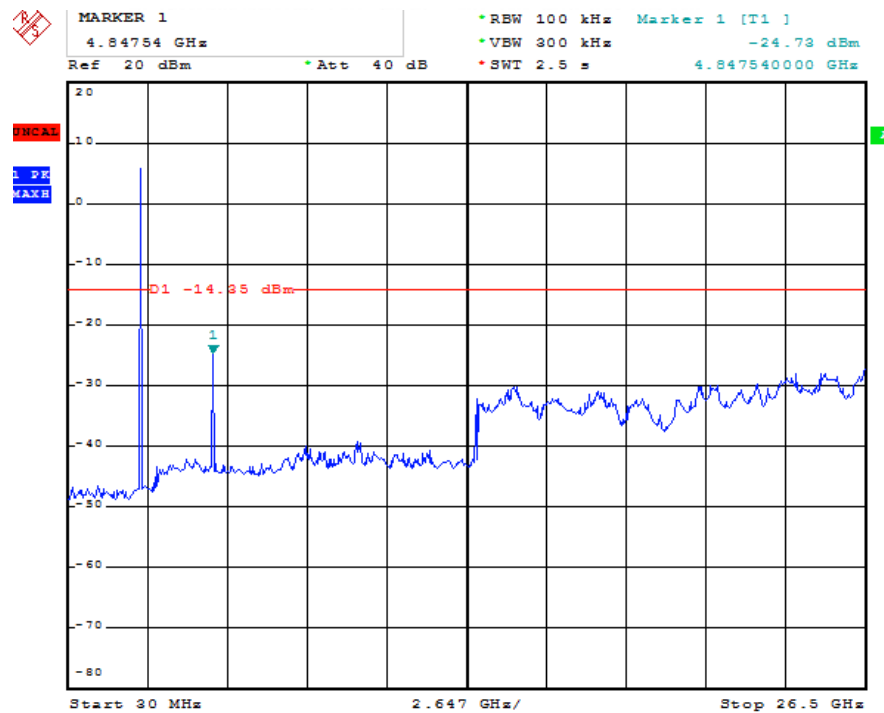
Test Result: PASS

IEEE 802.11b mode

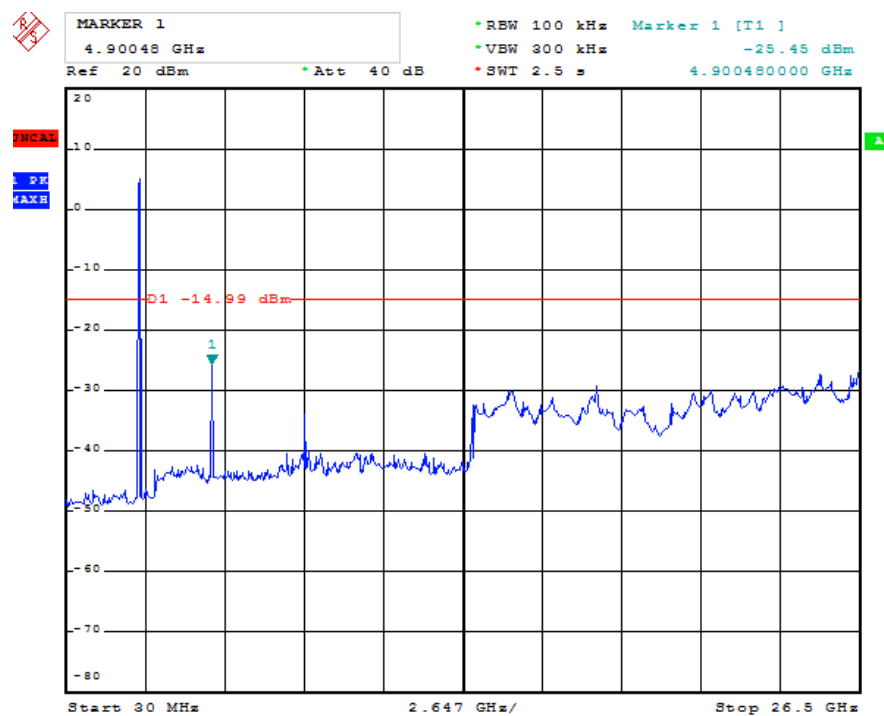
CH Low



CH Mid



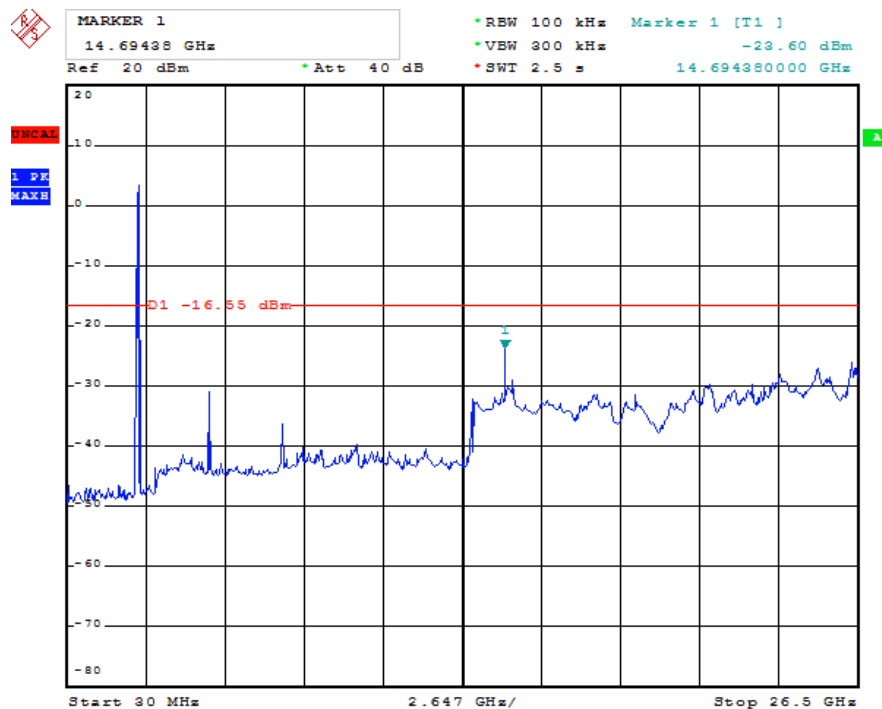
## CH High



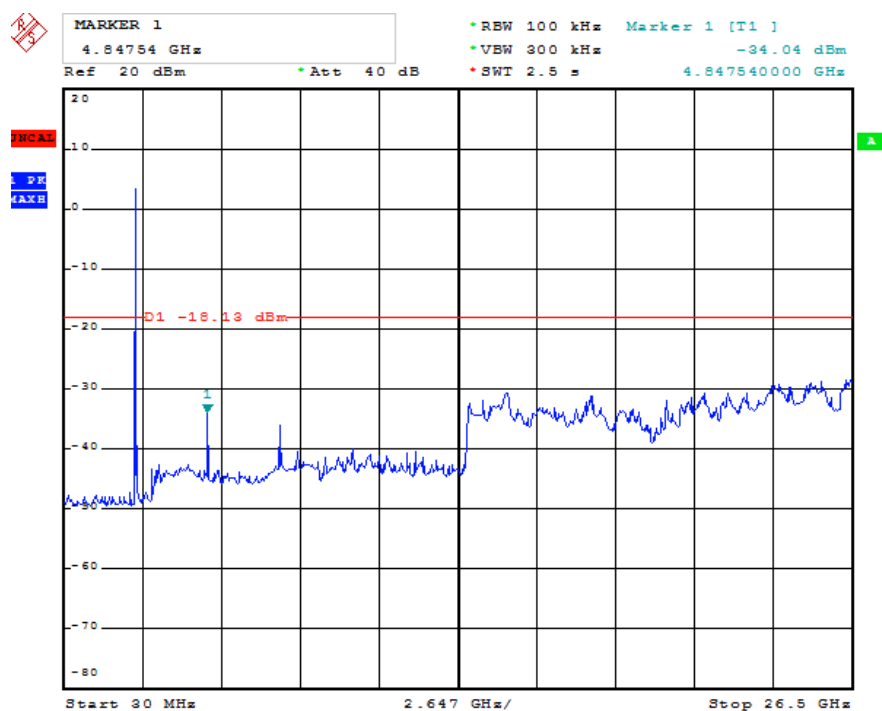
**HCT**  
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## IEEE 802.11g mode

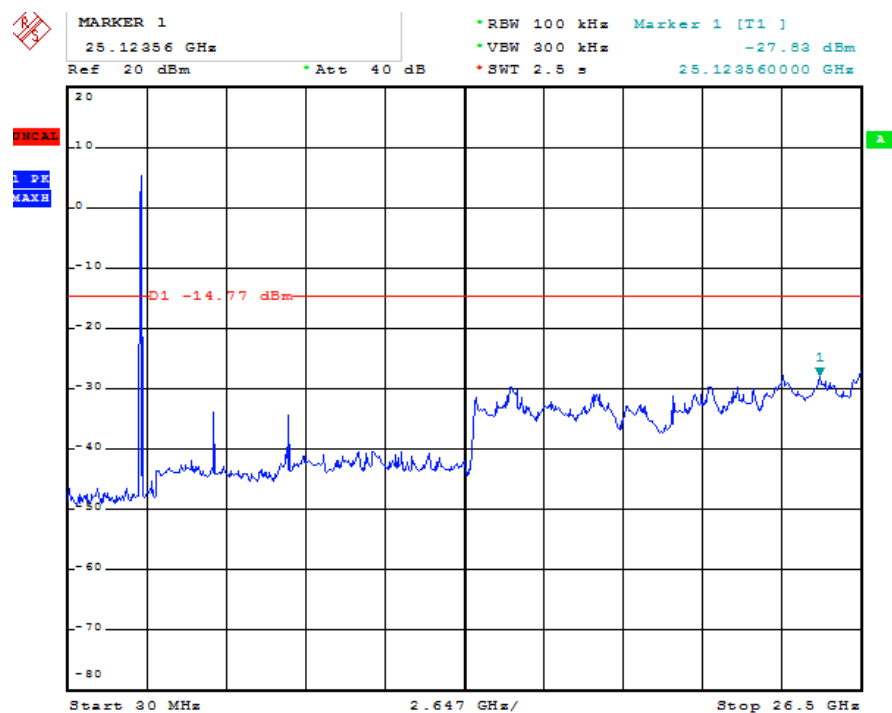
### CH Low



### CH Mid



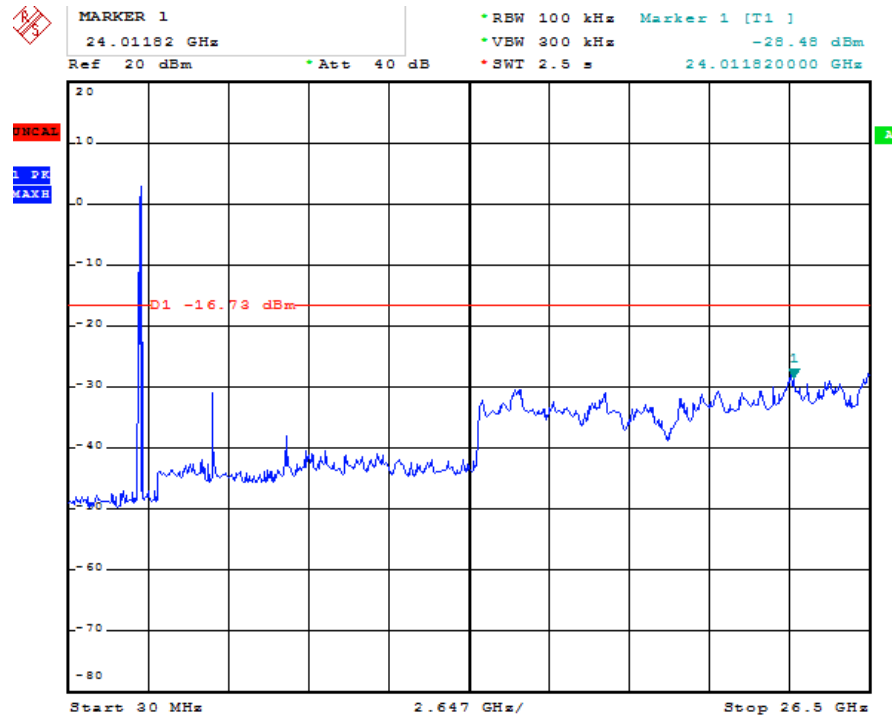
## CH High



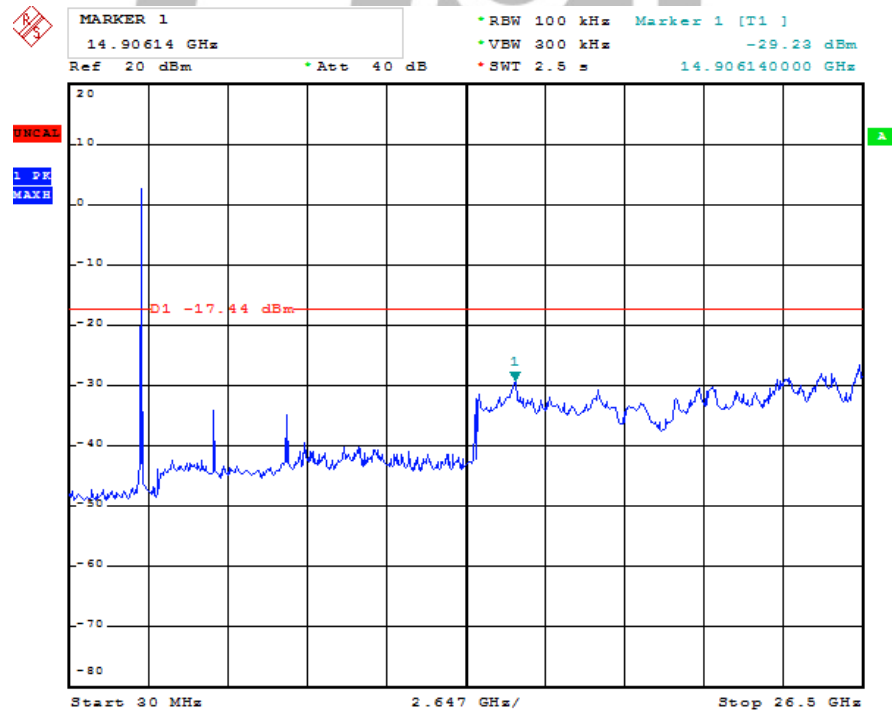
**HCT**  
HONGCAI TESTING

## IEEE 802.11n(HT20) mode

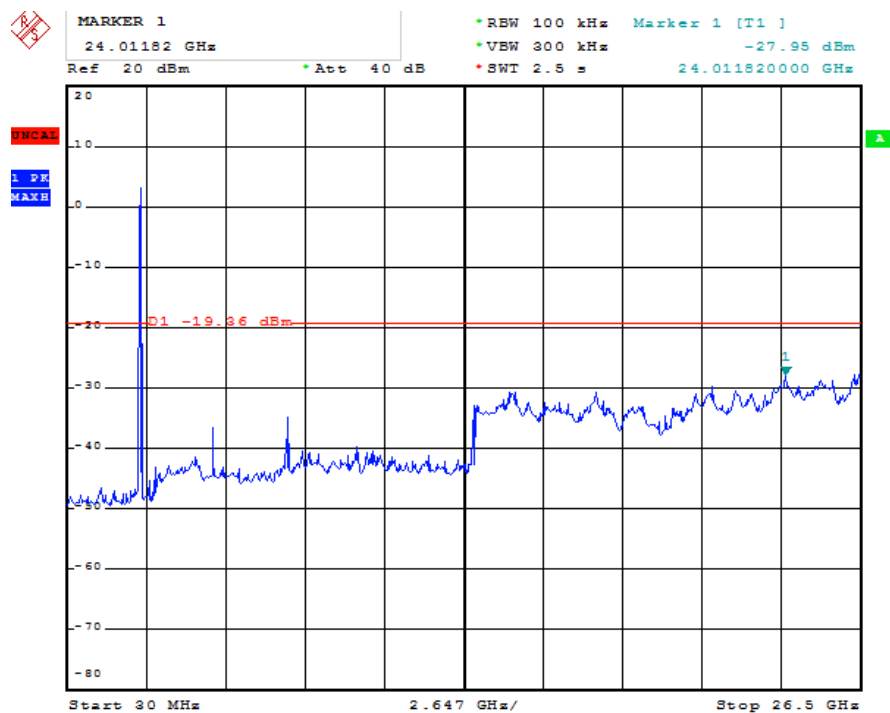
### CH Low



### CH Mid



## CH High



## 9. Test of Radiated Spurious Emission

### 9.1 Radiated Spurious Emission

Refer to FCC §15.205 and §15.209, IC RSS-247 Clause 5.5

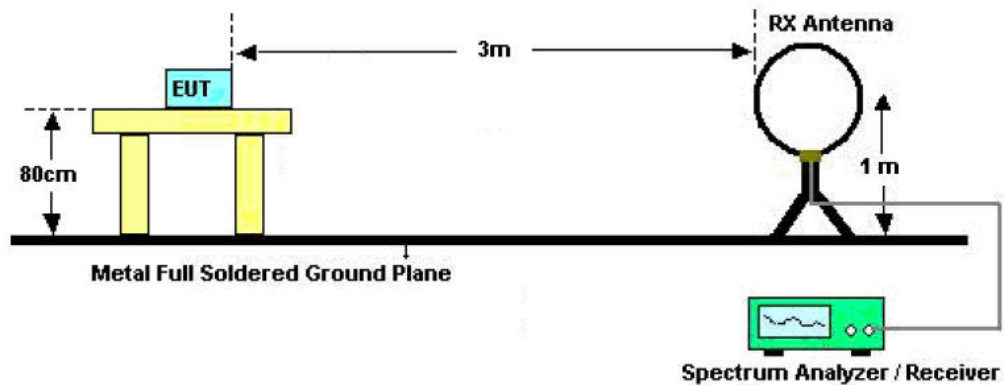
#### 9.1.1 Limits

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

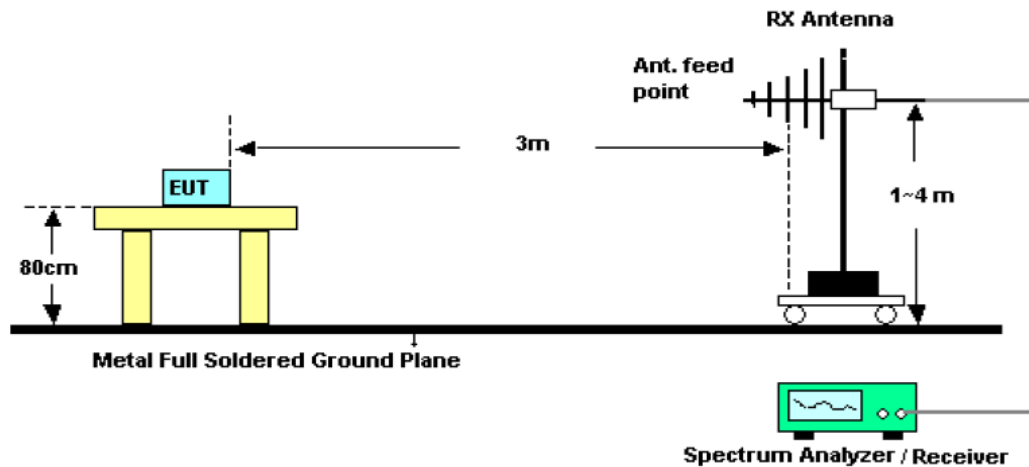
| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(meters) |
|--------------------|--------------------------------------|----------------------------------|
| 0.009 – 0.490      | 2400/F(kHz)                          | 300                              |
| 0.490 – 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                                |

#### 9.1.2 EUT Setup

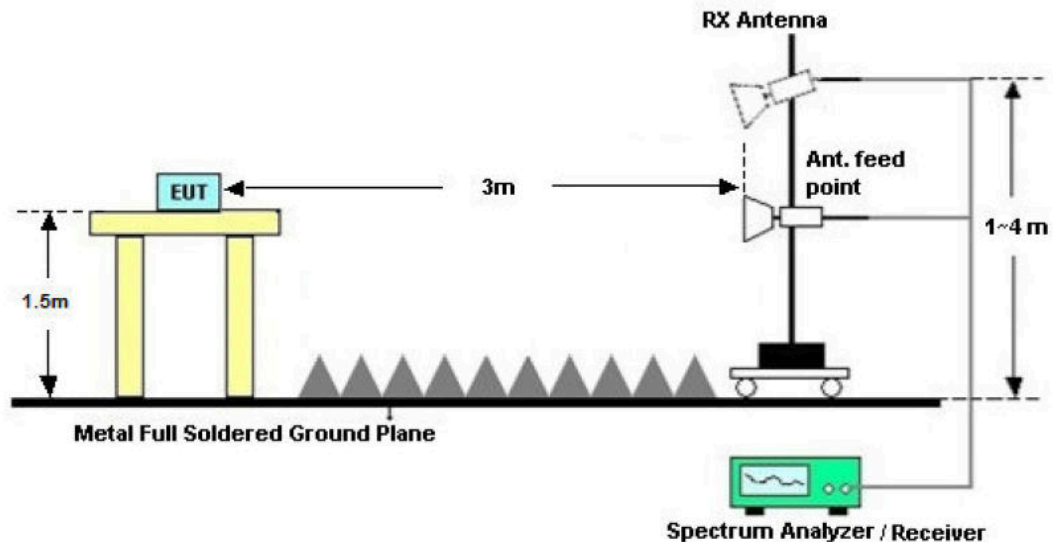
For radiated emission below 30MHz



For radiated emission from 30MHz to 1GHz



For radiated emission from above 1GHz



### 9.1.3 Test Procedure

KDB 558074 v03r03 – Section 12.1, 12.2.7

#### Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 120kHz(for emissions from 30MHz-1GHz)
3. Detector = Quasi-Peak
4. Trace Mode = max hold.
5. Sweep = auto couple.
6. Trace was allowed to stabilize

### **Peak Field Strength Measurements**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = Peak
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Trace was allowed to stabilize

### **Average Field Strength Measurements**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points=1001 (  $\geq 2 \times \text{span/RBW}$  )
6. Sweep = auto couple.
7. Trace (RMS) averaging was performed over at least 100 traces

### **NOTE:**

1. Configure the EUT according to ANSI C63.10-2013
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

### 9.1.4 Test Result

|                                         |                                                             |
|-----------------------------------------|-------------------------------------------------------------|
| Temperature ( °C ) : 22~23              | EUT: Wifi express                                           |
| Humidity (%RH ) : 50~54                 | M/N: HW313                                                  |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition:<br>Charging, Normal operation ,TX Mode |

Note:

1. Worst-case radiated emission below 30MHz is IEEE 802.11n(HT20) TX (CH Low) mode;
2. Worst-case radiated emission below 1GHz is IEEE 802.11g TX (CH Low, Middle, High) mode.
3. Worst-case radiated emission above 1GHz is IEEE 802.11b TX (CH Low, Middle, High) and IEEE 802.11n(HT20) TX (CH Low, Mid, High) mode.

### RADIATED EMISSION BELOW 30 MHz

IEEE 802.11 n(HT20) TX (CH Low) operating Mode:

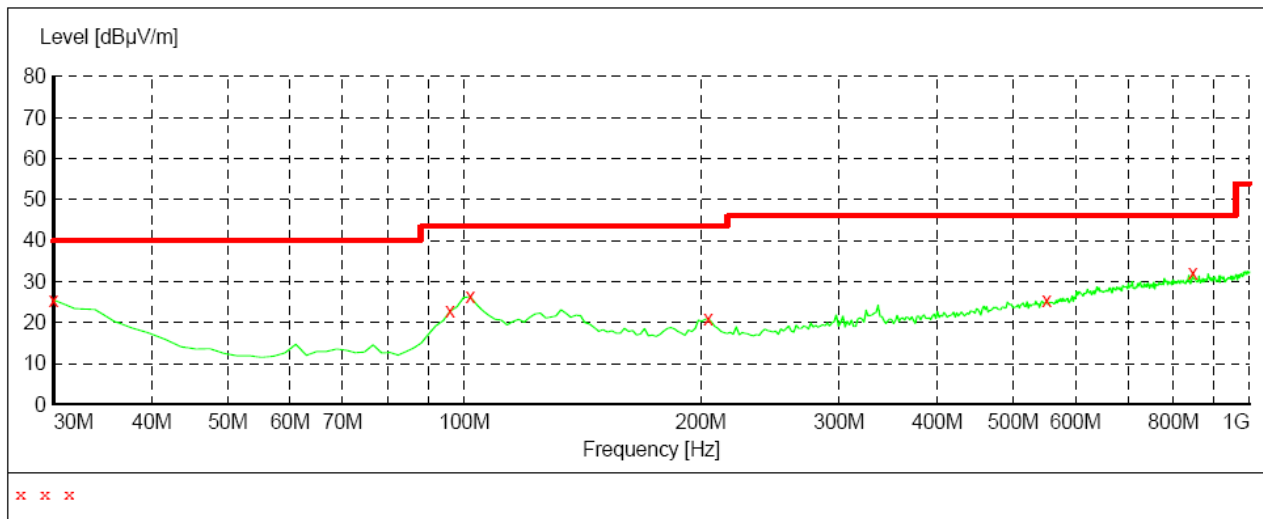
| Frequency | Meter Reading | Antenna Factor | Cable Loss | Emission Levels | Limits     | Margin | Detector Mode |
|-----------|---------------|----------------|------------|-----------------|------------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/M)         | (dB)       | (dBμV/M)        | (dB μ V/M) | (dB)   | PK/QP         |
| 5.48      | 21.76         | 8.23           | 1.03       | 31.02           | 67         | -35.98 | QP            |
| 18.83     | 21.47         | 9.07           | 1.19       | 31.73           | 49.5       | -17.70 | QP            |
| 23.37     | 22.79         | 9.25           | 1.08       | 33.12           | 49.5       | -16.38 | QP            |
| 28.32     | 22.89         | 8.43           | 1.66       | 32.98           | 49.5       | -16.52 | QP            |

## Spurious Emission Below 1GHz: IEEE 802.11g TX (CH Low)

EUT: Wifi express  
M/N: HW313  
Operating Condition: TX Mode  
Test Site: 3m CHAMBER  
Operator: Chen  
Test Specification: DC 7.4V from battery  
Comment: Polarization: Horizontal

### ***SWEEP TABLE: "test (30M-1G)"***

| Short Description: |           | Field Strength |            |           |            |
|--------------------|-----------|----------------|------------|-----------|------------|
| Start              | Stop      | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency          | Frequency |                |            |           |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |



### ***MEASUREMENT RESULT:***

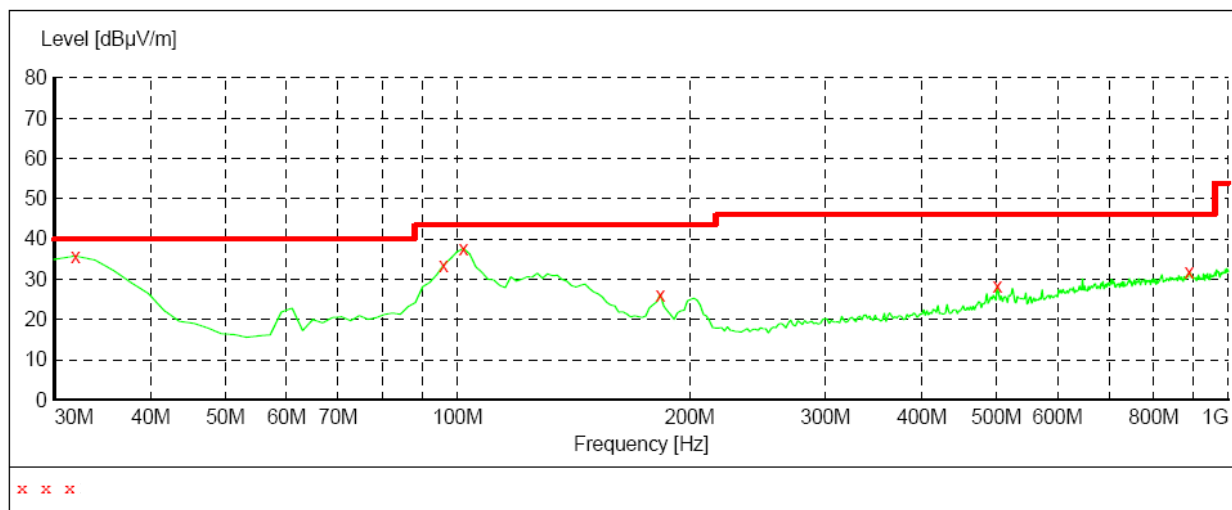
| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 25.50           | 20.8         | 40.0            | 14.5         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 95.960000        | 22.80           | 10.2         | 43.5            | 20.7         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 101.780000       | 26.30           | 11.6         | 43.5            | 17.2         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 204.600000       | 21.00           | 14.1         | 43.5            | 22.5         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 551.860000       | 25.40           | 21.0         | 46.0            | 20.6         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 846.740000       | 32.30           | 25.1         | 46.0            | 13.7         | QP   | 0.0          | 0.00           | HORIZONTAL   |

## Spurious Emission Below 1GHz : IEEE 802.11g TX (CH Low)

EUT: Wifi express  
M/N: HW313  
Operating Condition: TX Mode  
Test Site: 3m CHAMBER  
Operator: Chen  
Test Specification: DC 7.4V from battery  
Comment: Polarization: Vertical

### ***SWEEP TABLE: "test (30M-1G)"***

| Short Description: |           | Field Strength |            |           |            |
|--------------------|-----------|----------------|------------|-----------|------------|
| Start              | Stop      | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency          | Frequency |                |            |           |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |



### ***MEASUREMENT RESULT:***

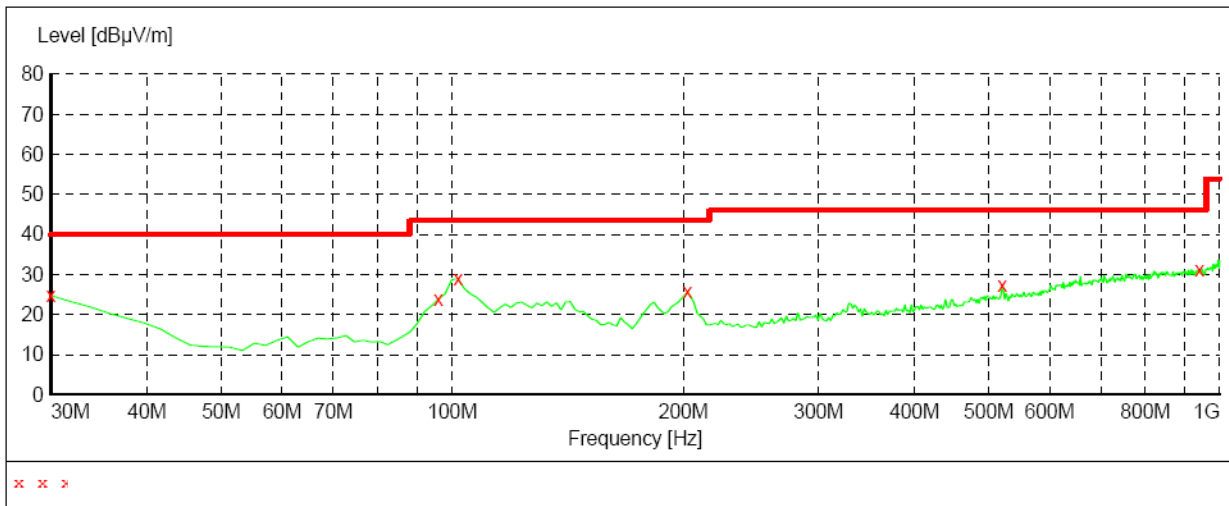
| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 31.940000        | 35.80           | 19.2         | 40.0            | 4.2          | QP   | 0.0          | 0.00           | VERTICAL     |
| 95.960000        | 33.50           | 10.2         | 43.5            | 10.0         | QP   | 0.0          | 0.00           | VERTICAL     |
| 101.780000       | 37.70           | 11.6         | 43.5            | 5.8          | QP   | 0.0          | 0.00           | VERTICAL     |
| 183.260000       | 26.20           | 13.1         | 43.5            | 17.3         | QP   | 0.0          | 0.00           | VERTICAL     |
| 501.420000       | 28.40           | 20.3         | 46.0            | 17.6         | QP   | 0.0          | 0.00           | VERTICAL     |
| 889.420000       | 31.90           | 25.8         | 46.0            | 14.1         | QP   | 0.0          | 0.00           | VERTICAL     |

## Spurious Emission Below 1GHz: IEEE 802.11g TX (CH Mid)

EUT: Wifi express  
M/N: HW313  
Operating Condition: TX Mode  
Test Site: 3m CHAMBER  
Operator: Chen  
Test Specification: DC 7.4V from battery  
Comment: Polarization: Horizontal

### SWEEP TABLE: "test (30M-1G)"

|                    |           |                |            |           |            |
|--------------------|-----------|----------------|------------|-----------|------------|
| Short Description: |           | Field Strength |            |           |            |
| Start              | Stop      | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency          | Frequency |                |            |           |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |



### MEASUREMENT RESULT:

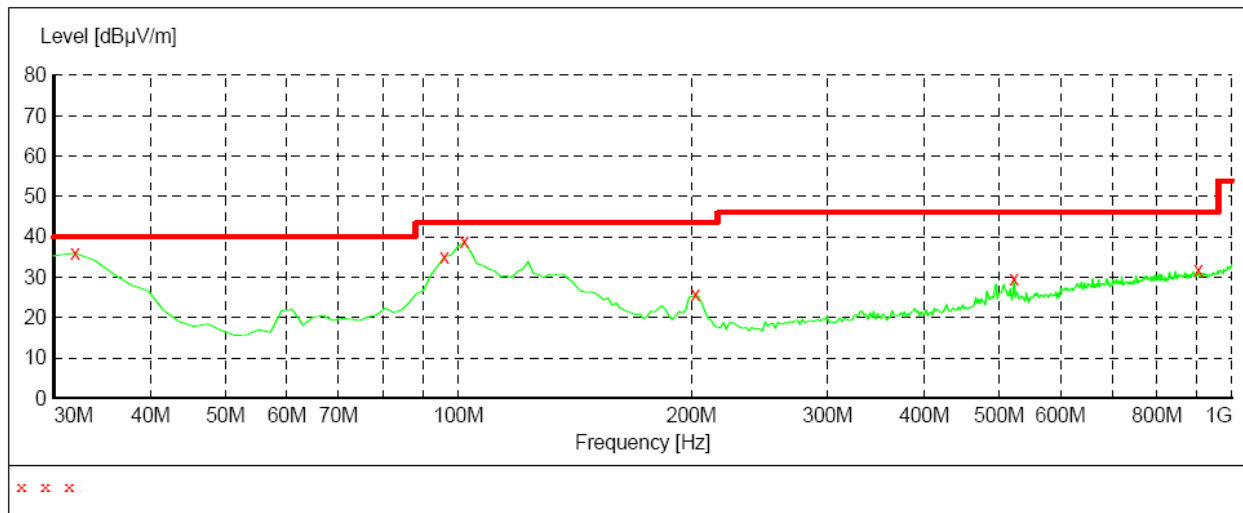
| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 24.70           | 20.8         | 40.0            | 15.3         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 95.960000        | 23.90           | 10.2         | 43.5            | 19.6         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 101.780000       | 29.00           | 11.6         | 43.5            | 14.5         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 202.660000       | 25.60           | 14.1         | 43.5            | 17.9         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 520.820000       | 27.30           | 20.3         | 46.0            | 18.7         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 941.800000       | 31.30           | 26.4         | 46.0            | 14.7         | QP   | 0.0          | 0.00           | HORIZONTAL   |

## Spurious Emission Below 1GHz: IEEE 802.11g TX (CH Mid)

EUT: Wifi express  
M/N: HW313  
Operating Condition: TX Mode  
Test Site: 3m CHAMBER  
Operator: Chen  
Test Specification: DC 7.4V from battery  
Comment: Polarization: Vertical

### SWEEP TABLE: "test (30M-1G)"

| Short Description: |         | Field Strength |            |           |            |
|--------------------|---------|----------------|------------|-----------|------------|
| Start              | Stop    | Detector       | Meas. Time | IF Bandw. | Transducer |
| 30.0 MHz           | 1.0 GHz | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |



### MEASUREMENT RESULT:

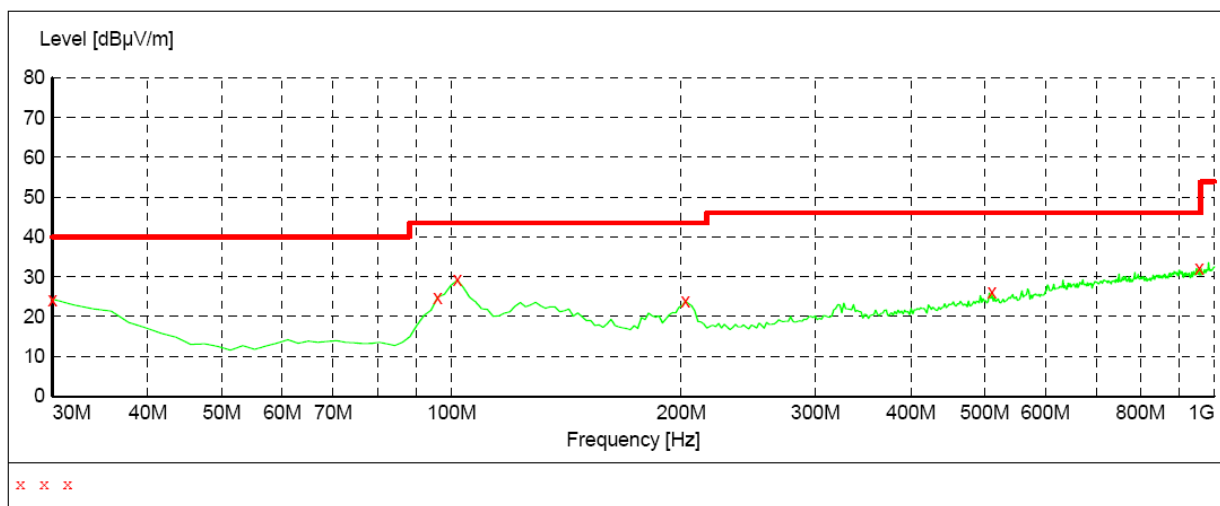
| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 31.940000        | 35.90           | 19.2         | 40.0            | 4.1          | QP   | 0.0          | 0.00           | VERTICAL     |
| 95.960000        | 35.10           | 10.2         | 43.5            | 8.4          | QP   | 0.0          | 0.00           | VERTICAL     |
| 101.780000       | 38.70           | 11.6         | 43.5            | 4.8          | QP   | 0.0          | 0.00           | VERTICAL     |
| 202.660000       | 25.70           | 14.1         | 43.5            | 17.8         | QP   | 0.0          | 0.00           | VERTICAL     |
| 522.760000       | 29.60           | 20.3         | 46.0            | 16.4         | QP   | 0.0          | 0.00           | VERTICAL     |
| 904.940000       | 31.70           | 26.0         | 46.0            | 14.3         | QP   | 0.0          | 0.00           | VERTICAL     |

## Spurious Emission Below 1GHz: IEEE 802.11g TX (CH High)

EUT: Wifi express  
M/N: HW313  
Operating Condition: TX Mode  
Test Site: 3m CHAMBER  
Operator: Chen  
Test Specification: DC 7.4V from battery  
Comment: Polarization: Horizontal

### SWEEP TABLE: "test (30M-1G)"

| Short Description:                            | Field Strength |
|-----------------------------------------------|----------------|
| Start Stop Detector Meas. IF Transducer       |                |
| Frequency Frequency Time Bandw.               |                |
| 30.0 MHz 1.0 GHz MaxPeak 300.0 ms 120 kHz JB1 |                |



### MEASUREMENT RESULT:

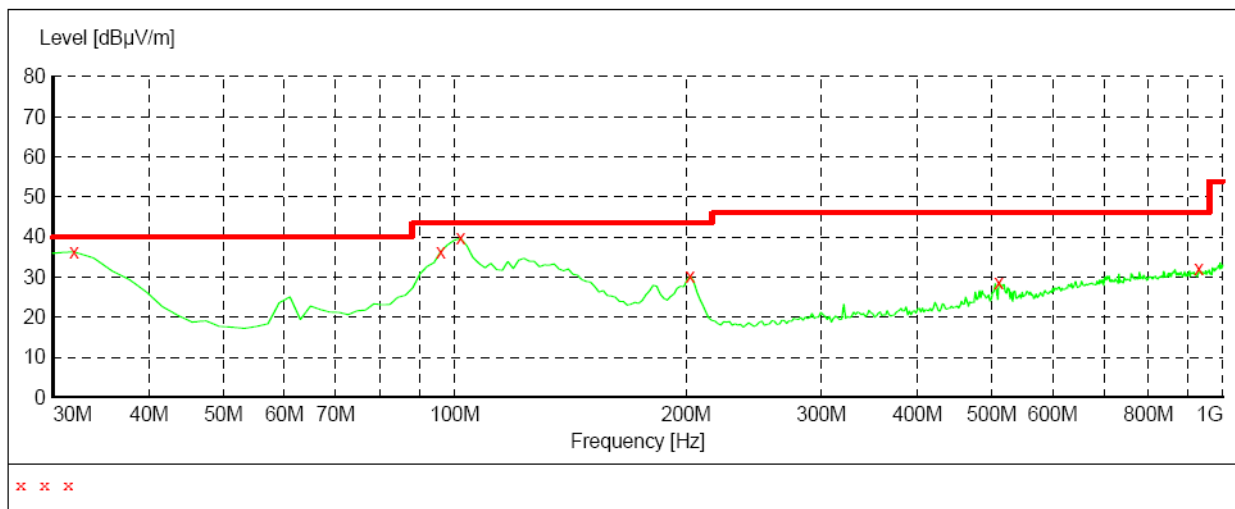
| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 24.40           | 20.8         | 40.0            | 15.6         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 95.960000        | 24.90           | 10.2         | 43.5            | 18.6         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 101.780000       | 29.20           | 11.6         | 43.5            | 14.3         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 202.660000       | 23.90           | 14.1         | 43.5            | 19.6         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 511.120000       | 26.10           | 20.3         | 46.0            | 19.9         | QP   | 0.0          | 0.00           | HORIZONTAL   |
| 955.380000       | 32.10           | 26.6         | 46.0            | 13.9         | QP   | 0.0          | 0.00           | HORIZONTAL   |

## Spurious Emission Below 1GHz: IEEE 802.11g TX (CH High)

EUT: Wifi express  
M/N: HW313  
Operating Condition: TX Mode  
Test Site: 3m CHAMBER  
Operator: Chen  
Test Specification: DC 7.4V from battery  
Comment: Polarization: Vertical

### SWEEP TABLE: "test (30M-1G)"

| Short Description: |                   | Field Strength |            |           |            |
|--------------------|-------------------|----------------|------------|-----------|------------|
| Start              | Stop              | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency 30.0 MHz | Frequency 1.0 GHz | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |



### MEASUREMENT RESULT:

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 31.940000        | 36.30           | 19.2         | 40.0            | 3.7          | QP   | 0.0          | 0.00           | VERTICAL     |
| 95.960000        | 36.40           | 10.2         | 43.5            | 7.1          | QP   | 0.0          | 0.00           | VERTICAL     |
| 101.780000       | 39.70           | 11.6         | 43.5            | 3.8          | QP   | 0.0          | 0.00           | VERTICAL     |
| 202.660000       | 30.10           | 14.1         | 43.5            | 13.4         | QP   | 0.0          | 0.00           | VERTICAL     |
| 511.120000       | 28.70           | 20.3         | 46.0            | 17.3         | QP   | 0.0          | 0.00           | VERTICAL     |
| 930.160000       | 32.10           | 26.3         | 46.0            | 13.9         | QP   | 0.0          | 0.00           | VERTICAL     |

# RADIATED EMISSION ABOVE 1 GHz

## IEEE 802.11b TX (CH Low)

| Channel Low (2412MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |            |              |        |               |                |                 |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|--------------|--------|---------------|----------------|-----------------|--------------|
| Maximum Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Polarity and Level |            |              |        |               | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Polarity           | Height (m) | Reading dBμV | Transd | Result dBμV/m |                |                 |              |
| 1380.66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | H                  | 1          | 48.99        | -7.65  | 41.34         | 74             | -32.66          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 36.23        | -7.65  | 28.58         | 54             | -25.42          | A            |
| 1380.22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | V                  | 1          | 48.41        | -7.65  | 40.76         | 74             | -33.24          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 35.84        | -7.65  | 28.19         | 54             | -25.81          | A            |
| 2412                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | H                  | 1          | 106.15       | -6.15  | 100           | ----           | ----            | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 95.54        | -6.15  | 89.39         | ----           | ----            | A            |
| 2412                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | V                  | 1          | 108.14       | -6.15  | 101.99        | ----           | ----            | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 97.34        | -6.15  | 91.19         | ----           | ----            | A            |
| 4824                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | H                  | 1          | 43.61        | 0.84   | 44.45         | 74             | -29.55          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 33.23        | 0.84   | 34.07         | 54             | -19.93          | A            |
| 4824                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | V                  | 1          | 44.43        | 0.84   | 45.27         | 74             | -28.73          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 33.14        | 0.84   | 33.98         | 54             | -20.02          | A            |
| 7236                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | H                  | 1          | 43.51        | 7.73   | 51.24         | 74             | -22.76          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 33.6         | 7.73   | 41.33         | 54             | -12.67          | A            |
| 7236                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | V                  | 1          | 44.3         | 7.73   | 52.03         | 74             | -21.97          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | 33.71        | 7.73   | 41.44         | 54             | -12.56          | A            |
| 11145.34                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | H                  | 1          | ----         | ----   | ----          | ----           | ----            | ----         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |            | ----         | ----   | ----          | ----           | ----            | ----         |
| 16327.65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| 25376.32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| Remark: 1. Transd=Antenna Factor + Cable Loss - Pre-amplifier<br>Margin = Level-Limit<br>Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value<br>2. Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.<br>3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.<br>4. The test limit distance is 3m limit |                    |            |              |        |               |                |                 |              |

# IEEE 802.11b TX (CH Middle)

| Channel Middle (2437MHz) |                    |            |              |        |               |                |                 |              |
|--------------------------|--------------------|------------|--------------|--------|---------------|----------------|-----------------|--------------|
| Maximum Frequency (MHz)  | Polarity and Level |            |              |        |               | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
|                          | Polarity           | Height (m) | Reading dBμV | Transd | Result dBμV/m |                |                 |              |
| 1326.33                  | H                  | 1          | 48.5         | -8.64  | 39.86         | 74             | -34.14          | P            |
|                          |                    |            | 37.02        | -8.23  | 28.79         | 54             | -25.21          | A            |
| 1326.22                  | V                  | 1          | 49.93        | -8.23  | 41.7          | 74             | -32.3           | P            |
|                          |                    |            | 37.24        | -8.23  | 29.01         | 54             | -24.99          | A            |
| 2437                     | H                  | 1          | 105.9        | -6.37  | 99.53         | ----           | ----            | P            |
|                          |                    |            | 96.42        | -6.37  | 90.05         | ----           | ----            | A            |
| 2437                     | V                  | 1          | 109.4        | -6.37  | 103.03        | ----           | ----            | P            |
|                          |                    |            | 97.93        | -6.37  | 91.56         | ----           | ----            | A            |
| 4874                     | H                  | 1          | 45.09        | 0.75   | 45.84         | 74             | -28.16          | P            |
|                          |                    |            | 34.4         | 0.75   | 35.15         | 54             | -18.85          | A            |
| 4874                     | V                  | 1          | 45.22        | 0.75   | 45.97         | 74             | -28.03          | P            |
|                          |                    |            | 34.42        | 0.75   | 35.17         | 54             | -18.83          | A            |
| 7311                     | H                  | 1          | 44.29        | 7.48   | 51.77         | 74             | -22.23          | P            |
|                          |                    |            | 33.93        | 7.48   | 41.41         | 54             | -12.59          | A            |
| 7311                     | V                  | 1          | 44.4         | 7.48   | 51.88         | 74             | -22.12          | P            |
|                          |                    |            | 34.31        | 7.48   | 41.79         | 54             | -12.21          | A            |
| 11238.52                 | H                  | 1          | ----         | ----   | ----          | ----           | ----            | ----         |
|                          |                    |            | ----         | ----   | ----          | ----           | ----            | ----         |
| 16327.71                 | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| 25376.58                 | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |

Remark: 1. Transd=Antenna Factor + Cable Loss - Pre-amplifier  
 Margin = Level-Limit  
 Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value  
 2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.  
 3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.  
 4. The test limit distance is 3m limit

# IEEE 802.11b TX (CH High)

| Channel High (2462MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |            |              |        |               |                |                 |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|--------------|--------|---------------|----------------|-----------------|--------------|
| Maximum Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Polarity and Level |            |              |        |               | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Polarity           | Height (m) | Reading dBμV | Transd | Result dBμV/m |                |                 |              |
| 1312.66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | H                  | 1          | 49.51        | -7.9   | 41.61         | 74             | -32.39          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 37.73        | -7.9   | 29.83         | 54             | -24.17          | A            |
| 1311.67                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | V                  | 1          | 50.22        | -7.9   | 42.32         | 74             | -31.68          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 38.31        | -7.9   | 30.41         | 54             | -23.59          | A            |
| 2462                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | H                  | 1          | 105.42       | -5.95  | 99.47         | ----           | ----            | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 95.53        | -5.95  | 89.58         | ----           | ----            | A            |
| 2462                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | V                  | 1          | 108.42       | -5.95  | 102.47        | ----           | ----            | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 96.46        | -5.95  | 90.51         | ----           | ----            | A            |
| 4924                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | H                  | 1          | 44.45        | 1.3    | 45.75         | 74             | -28.25          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 34.26        | 1.3    | 35.56         | 54             | -18.44          | A            |
| 4924                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | V                  | 1          | 47.25        | 1.3    | 48.55         | 74             | -25.45          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 35.57        | 1.3    | 36.87         | 54             | -17.13          | A            |
| 7386                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | H                  | 1          | 45.46        | 7.89   | 53.35         | 74             | -20.65          | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 34.53        | 7.89   | 42.42         | 54             | -11.58          | A            |
| 7386                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | V                  | 1          | 44.31        | 7.89   | 52.2          | 74             | -21.8           | P            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | 34.26        | 7.89   | 42.15         | 54             | -11.85          | A            |
| 11243.58                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | H                  | 1          | ----         | ----   | ----          | ----           | ----            | ----         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |            | ----         | ----   | ----          | ----           | ----            | ----         |
| 16327.45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| 25376.26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| Remark: 1. Transd=Antenna Factor + Cable Loss - Pre-amplifier<br>Margin = Level-Limit<br>Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value<br>2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.<br>3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.<br>4. The test limit distance is 3m limit |                    |            |              |        |               |                |                 |              |

# IEEE 802.11n(HT20) TX (CH Low)

| Channel Low (2422MHz)   |                    |            |              |        |               |                |                 |              |
|-------------------------|--------------------|------------|--------------|--------|---------------|----------------|-----------------|--------------|
| Maximum Frequency (MHz) | Polarity and Level |            |              |        |               | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
|                         | Polarity           | Height (m) | Reading dBμV | Transd | Result dBμV/m |                |                 |              |
| 1382                    | H                  | 1          | 50.76        | -8.25  | 42.51         | 74             | -31.49          | P            |
|                         |                    |            | 37.85        | -8.25  | 29.6          | 54             | -24.4           | A            |
| 1364                    | V                  | 1          | 50.85        | -8.25  | 42.6          | 74             | -31.4           | P            |
|                         |                    |            | 37.23        | -8.25  | 28.98         | 54             | -25.02          | A            |
| 2412                    | H                  | 1          | 110.73       | -6.75  | 103.98        | ----           | ----            | P            |
|                         |                    |            | 104.03       | -6.75  | 97.28         | ----           | ----            | A            |
| 2412                    | V                  | 1          | 114.73       | -6.75  | 107.98        | ----           | ----            | P            |
|                         |                    |            | 104.74       | -6.75  | 97.99         | ----           | ----            | A            |
| 4824                    | H                  | 1          | 45.78        | 0.24   | 46.02         | 74             | -27.98          | P            |
|                         |                    |            | 34.76        | 0.24   | 35            | 54             | -19             | A            |
| 4824                    | V                  | 1          | 47.2         | 0.24   | 47.44         | 74             | -26.56          | P            |
|                         |                    |            | 34.71        | 0.24   | 34.95         | 54             | -19.05          | A            |
| 7236                    | H                  | 1          | 44.64        | 7.13   | 51.77         | 74             | -22.23          | P            |
|                         |                    |            | 35.12        | 7.13   | 42.25         | 54             | -11.75          | A            |
| 7236                    | V                  | 1          | 44.64        | 7.13   | 51.77         | 74             | -22.23          | P            |
|                         |                    |            | 34.95        | 7.13   | 42.08         | 54             | -11.92          | A            |
| 11145.34                | H                  | 1          | ----         | ----   | ----          | ----           | ----            | ----         |
|                         |                    |            | ----         | ----   | ----          | ----           | ----            | ----         |
| 16327.65                | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| 25376.32                | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |

Remark: 1. Transd=Antenna Factor + Cable Loss - Pre-amplifier  
Margin = Level-Limit  
Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value  
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.  
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.  
4. The test limit distance is 3m limit

# IEEE 802.11n(HT20)TX (CH Middle)

| Channel Middle (2437MHz) |                    |            |              |        |               |                |                 |              |
|--------------------------|--------------------|------------|--------------|--------|---------------|----------------|-----------------|--------------|
| Maximum Frequency (MHz)  | Polarity and Level |            |              |        |               | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
|                          | Polarity           | Height (m) | Reading dBμV | Transd | Result dBμV/m |                |                 |              |
| 1310.26                  | H                  | 1          | 49.46        | -7.49  | 41.97         | 74             | -32.03          | P            |
|                          |                    |            | 38.07        | -7.49  | 30.58         | 54             | -23.42          | A            |
| 1310.88                  | V                  | 1          | 50.04        | -7.49  | 42.55         | 74             | -31.45          | P            |
|                          |                    |            | 38.77        | -7.49  | 31.28         | 54             | -22.72          | A            |
| 2437                     | H                  | 1          | 110.22       | -5.63  | 104.59        | ----           | ----            | P            |
|                          |                    |            | 99.15        | -5.63  | 93.52         | ----           | ----            | A            |
| 2437                     | V                  | 1          | 114.26       | -5.63  | 108.63        | ----           | ----            | P            |
|                          |                    |            | 103.3        | -5.63  | 97.67         | ----           | ----            | A            |
| 4874                     | H                  | 1          | 44.8         | 1.49   | 46.29         | 74             | -27.71          | P            |
|                          |                    |            | 34.67        | 1.49   | 36.16         | 54             | -17.84          | A            |
| 4874                     | V                  | 1          | 46.28        | 1.49   | 47.77         | 74             | -26.23          | P            |
|                          |                    |            | 35.67        | 1.49   | 37.16         | 54             | -16.84          | A            |
| 7311                     | H                  | 1          | 43.44        | 8.22   | 51.66         | 74             | -22.34          | P            |
|                          |                    |            | 34.87        | 8.22   | 43.09         | 54             | -10.91          | A            |
| 7311                     | V                  | 1          | 44.11        | 8.22   | 52.33         | 74             | -21.67          | P            |
|                          |                    |            | 34.76        | 8.22   | 42.98         | 54             | -11.02          | A            |
| 11238.52                 | H                  | 1          | ----         | ----   | ----          | ----           | ----            | ----         |
|                          |                    |            | ----         | ----   | ----          | ----           | ----            | ----         |
| 16327.71                 | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| 25376.58                 | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |

Remark: 1. Transd=Antenna Factor + Cable Loss - Pre-amplifier  
Margin = Level-Limit  
Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value  
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.  
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.  
4. The test limit distance is 3m limit

# IEEE 802.11n(HT20) TX (CH High)

| Channel High (2452MHz)  |                    |            |              |        |               |                |                 |              |
|-------------------------|--------------------|------------|--------------|--------|---------------|----------------|-----------------|--------------|
| Maximum Frequency (MHz) | Polarity and Level |            |              |        |               | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
|                         | Polarity           | Height (m) | Reading dBμV | Transd | Result dBμV/m |                |                 |              |
| 1318.66                 | H                  | 1          | 50.32        | -8.45  | 41.87         | 74             | -32.13          | P            |
|                         |                    |            | 38.22        | -8.45  | 29.77         | 54             | -24.23          | A            |
| 1318.66                 | V                  | 1          | 50.82        | -8.45  | 42.37         | 74             | -31.63          | P            |
|                         |                    |            | 38.33        | -8.45  | 29.88         | 54             | -24.12          | A            |
| 2462                    | H                  | 1          | 113.29       | -6.5   | 106.79        | ----           | ----            | P            |
|                         |                    |            | 100.29       | -6.5   | 93.79         | ----           | ----            | A            |
| 2462                    | V                  | 1          | 114.82       | -6.5   | 108.32        | ----           | ----            | P            |
|                         |                    |            | 104.03       | -6.5   | 97.53         | ----           | ----            | A            |
| 4924                    | H                  | 1          | 45.62        | 0.75   | 46.37         | 74             | -27.63          | P            |
|                         |                    |            | 35.29        | 0.75   | 36.04         | 54             | -17.96          | A            |
| 4924                    | V                  | 1          | 49.14        | 0.75   | 49.89         | 74             | -24.11          | P            |
|                         |                    |            | 36.28        | 0.75   | 37.03         | 54             | -16.97          | A            |
| 7386                    | H                  | 1          | 45.03        | 7.34   | 52.37         | 74             | -21.63          | P            |
|                         |                    |            | 34.79        | 7.34   | 42.13         | 54             | -11.87          | A            |
| 7386                    | V                  | 1          | 44.39        | 7.34   | 51.73         | 74             | -22.27          | P            |
|                         |                    |            | 34.3         | 7.34   | 41.64         | 54             | -12.36          | A            |
| 11243.58                | H                  | 1          | ----         | ----   | ----          | ----           | ----            | ----         |
|                         |                    |            | ----         | ----   | ----          | ----           | ----            | ----         |
| 16327.45                | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |
| 25376.26                | ----               | ----       | ----         | ----   | ----          | ----           | ----            | ----         |

Remark: 1. Transd=Antenna Factor + Cable Loss - Pre-amplifier  
Margin = Level-Limit  
Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value  
2. Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.  
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.  
4. The test limit distance is 3m limit

## 10. Test of Band Edges Emission

### 10.1 Applicable standard

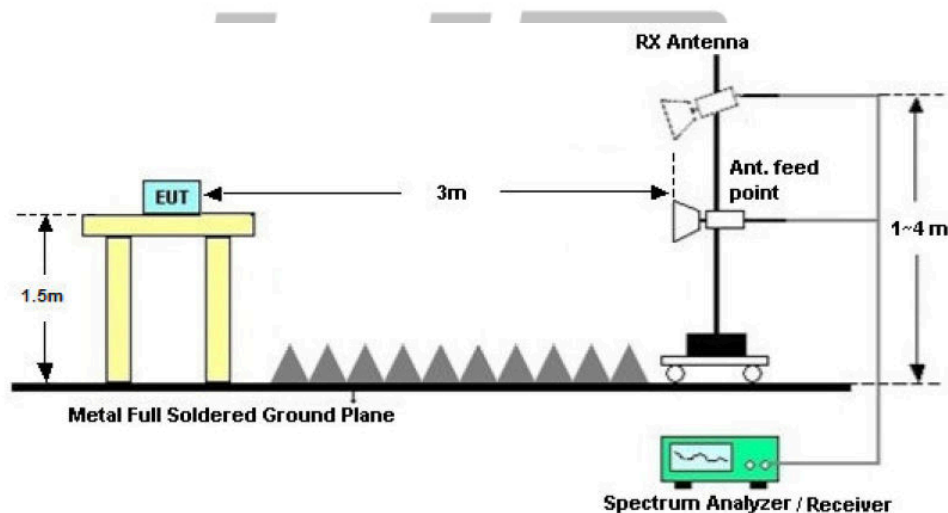
Refer to FCC §15.247 (d), IC RSS-247 Issue1 Clause 5.5

KDB558074 v03r03 – Section 11.3

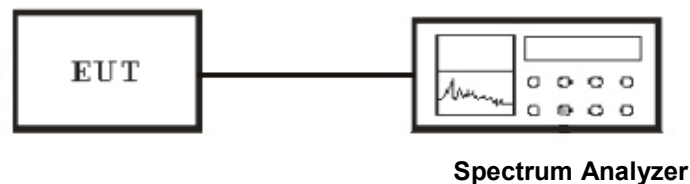
Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

### 10.2 EUT Setup

#### Radiated Measurement Setup



#### Conducted Measurement Setup



### 10.3 Test Equipment List and Details

See section 2.5.

### 10.4 Test Procedure

#### Conducted Measurement

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1. Set the center frequency and span to encompass frequency range to be measured.

2. Set the RBW = 100 kHz.
3. Set the VBW  $\geq 3 \times$  RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

### **Radiated Measurement**

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#### Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = Peak
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Trace was allowed to stabilize

#### Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = power average (RMS)
5. Sweep = auto couple.
6. Trace (RMS) averaging was performed over at least 100 traces

#### NOTE :

1. Configure the EUT according to ANSI C63.10-2013
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

## 10.5 Test Result

|                                         |                              |
|-----------------------------------------|------------------------------|
| Temperature ( °C ) : 22~23              | EUT: Wifi express            |
| Humidity (%RH ) : 50~54                 | M/N: HW313                   |
| Barometric Pressure ( mbar ) : 950~1000 | Operation Condition: Tx Mode |

PASS

## Radiated Test Result

IEEE 802.11b mode

| Channel | Freq.(MHz) | Level(dBuV) | Limit(dBuV) | Margin(dB) | Detector |
|---------|------------|-------------|-------------|------------|----------|
|         | 2390       | 49.72       | 74          | -24.28     | Peak     |
| LOW     | 2390       | 37.53       | 54          | -16.47     | Average  |
|         | 2483.5     | 48.76       | 74          | -25.24     | Peak     |
| HIGH    | 2483.5     | 37.33       | 54          | -16.67     | Average  |

IEEE 802.11g mode

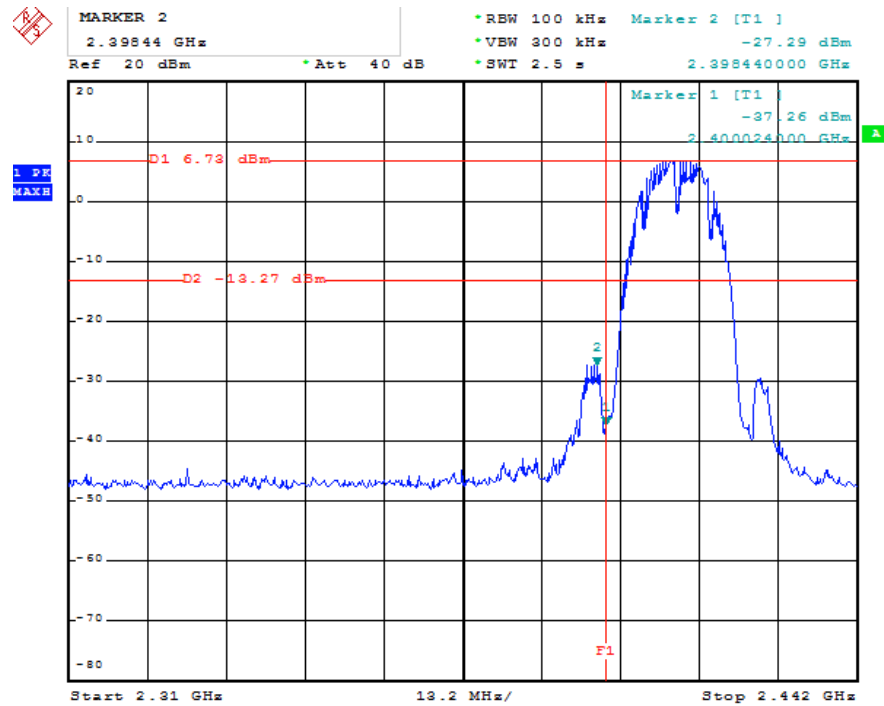
| Channel | Freq.(MHz) | Level(dBuV) | Limit(dBuV) | Margin(dB) | Detector |
|---------|------------|-------------|-------------|------------|----------|
|         | 2390       | 48.70       | 74          | -25.30     | Peak     |
| LOW     | 2390       | 36.55       | 54          | -17.45     | Average  |
|         | 2483.5     | 49.56       | 74          | -24.44     | Peak     |
| HIGH    | 2483.5     | 37.34       | 54          | -16.66     | Average  |

IEEE 802.11n(HT20) mode

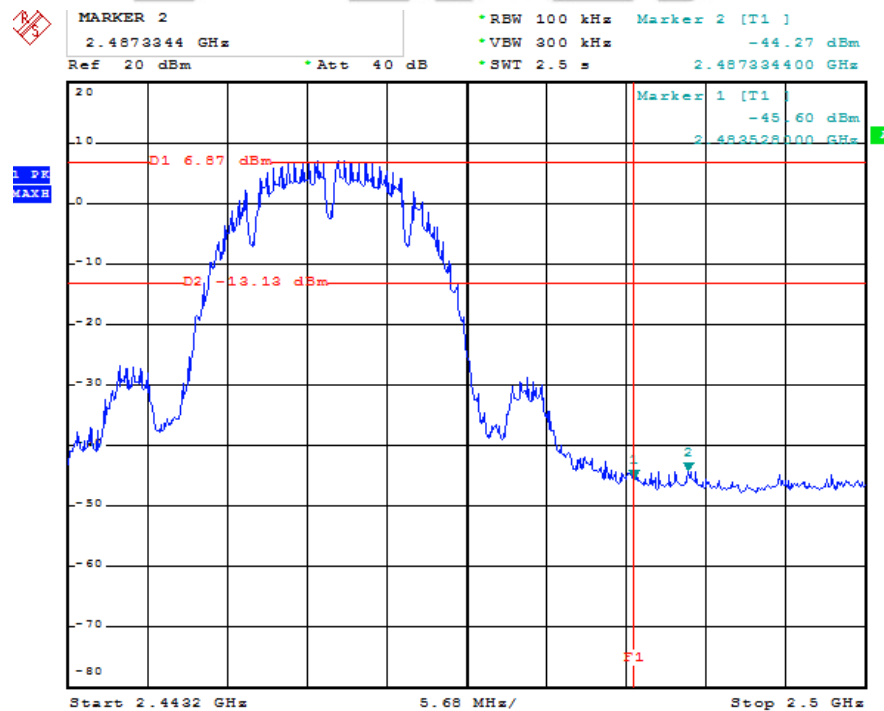
| Channel | Freq.(MHz) | Level(dBuV) | Limit(dBuV) | Margin(dB) | Detector |
|---------|------------|-------------|-------------|------------|----------|
|         | 2390       | 45.29       | 74          | -28.71     | Peak     |
| LOW     | 2390       | 34.32       | 54          | -19.68     | Average  |
|         | 2483.5     | 47.33       | 74          | -26.67     | Peak     |
| HIGH    | 2483.5     | 35.11       | 54          | -18.89     | Average  |

## Test of Conducted band edges

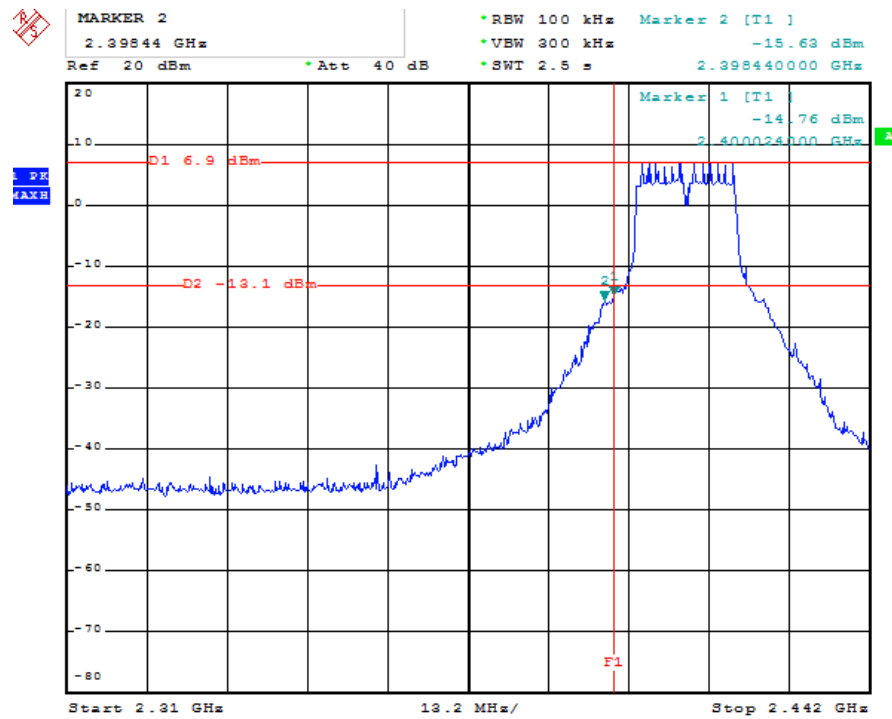
### CH Low (802.11b MODE)



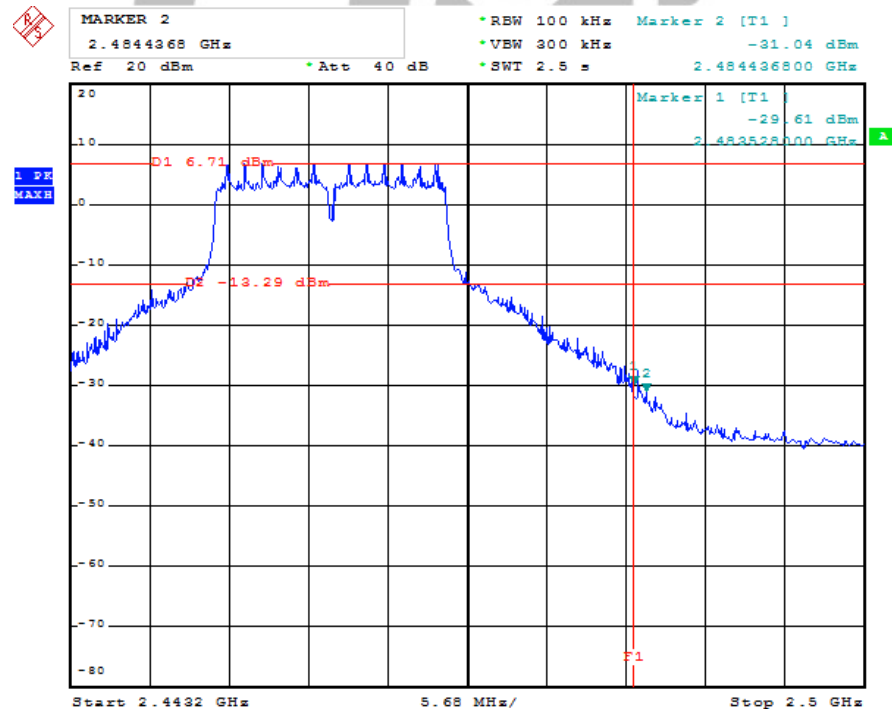
### CH High (802.11b MODE)



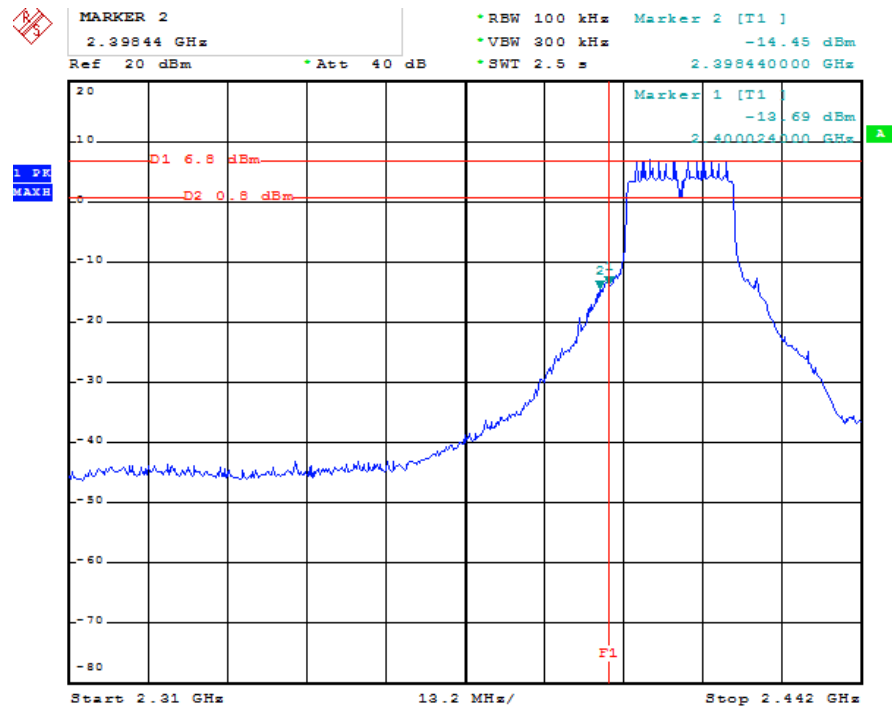
### CH Low (802.11g MODE)



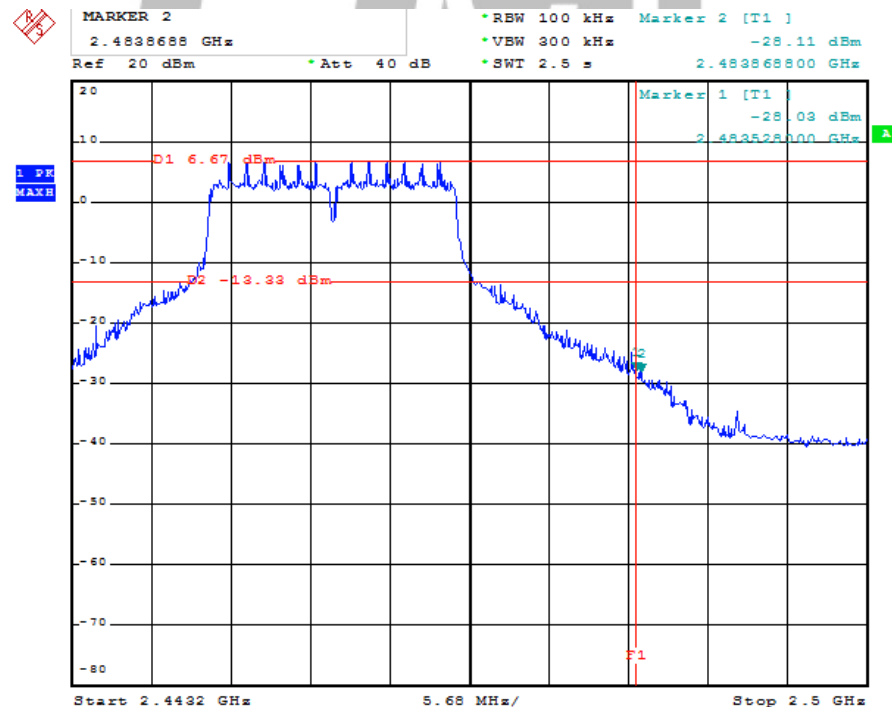
### CH High (802.11g MODE)



### CH Low (802.11n(HT20) MODE)



### CH High (802.11n(HT20) MODE)



## 11. ANTENNA REQUIREMENT

### 11.1 standard Applicable

Section 15.203 & IC RSS-GEN Clause 8.3

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Section 15.247(b)/(c)

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

### 11.2 Antenna Connected Construction

There are no provisions for connections to an external antenna.  
The antenna is designed with permanent attachment and no consideration of replacement.  
The antenna used in this product is complied with standard. The maximum Gain of the antenna lower than 6.0dBi and have the definite antenna Specification.

...End of Report...