

# TEST REPORT

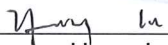
**Product Name:** WIFI+BT Module  
**Trade Mark:** GSD  
**Model No.:** WCT6PA2201  
**HVIN:** WCT6PA2201  
**Report Number:** 171227005RFC-3  
**Test Standards:** FCC 47 CFR Part 15 Subpart C  
RSS-247 Issue 2  
RSS-Gen Issue 4  
**FCC ID:** 2AC23-WCT6LA2701  
**IC:** 12290A-WCT6LA2701  
**Test Result:** PASS  
**Date of Issue:** February 2, 2018

Prepared for:

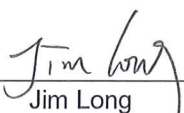
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## Version

| Version No. | Date             | Description |
|-------------|------------------|-------------|
| V1.0        | February 2, 2018 | Original    |



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## 1. GENERAL INFORMATION

### 1.1 CLIENT INFORMATION

|                                 |                                                            |
|---------------------------------|------------------------------------------------------------|
| <b>Applicant:</b>               | Hui Zhou Gaoshengda Technology Co.,LTD                     |
| <b>Address of Applicant:</b>    | NO.75 Zhongkai Development Area, Huizhou, Guangdong, China |
| <b>Manufacturer:</b>            | Hui Zhou Gaoshengda Technology Co.,LTD                     |
| <b>Address of Manufacturer:</b> | NO.75 Zhongkai Development Area, Huizhou, Guangdong, China |

### 1.2 EUT INFORMATION

#### 1.2.1 General Description of EUT

|                               |                                       |                               |                   |
|-------------------------------|---------------------------------------|-------------------------------|-------------------|
| <b>Product Name:</b>          | WIFI+BT Module                        |                               |                   |
| <b>Model No.:</b>             | WCT6PA2201                            |                               |                   |
| <b>HVIN:</b>                  | WCT6PA2201                            |                               |                   |
| <b>Add. Model No.:</b>        | N/A                                   |                               |                   |
| <b>Trade Mark:</b>            | GSD                                   |                               |                   |
| <b>DUT Stage:</b>             | Identical Prototype                   |                               |                   |
| <b>EUT Supports Function:</b> | 2.4 GHz ISM Band:                     | IEEE 802.11b/g/n              |                   |
|                               |                                       | Bluetooth: V3.0+EDR & V4.1 LE |                   |
|                               | 5 GHz U-NII Bands:                    | 5 150 MHz to 5 250 MHz        | IEEE 802.11a/n/ac |
|                               |                                       | 5 250 MHz to 5 350 MHz        | IEEE 802.11a/n/ac |
|                               |                                       | 5 470 MHz to 5 725 MHz        | IEEE 802.11a/n/ac |
|                               |                                       | 5 725 MHz to 5 850 MHz        | IEEE 802.11a/n/ac |
| <b>Sample Received Date:</b>  | December 27, 2017                     |                               |                   |
| <b>Sample Tested Date:</b>    | December 28, 2017 to January 17, 2018 |                               |                   |

#### 1.2.2 Description of Accessories

None.

### 1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

|                             |                                                                                                                                                                                                       |                                                                                                                    |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Frequency Range:</b>     | 2400 MHz to 2483.5 MHz                                                                                                                                                                                |                                                                                                                    |
| <b>Support Standards:</b>   | IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40                                                                                                                                      |                                                                                                                    |
| <b>Type of Modulation:</b>  | IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK)<br>IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK)<br>IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK)<br>IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK) |                                                                                                                    |
| <b>Data Rate:</b>           | IEEE 802.11b: Up to 11 Mbps<br>IEEE 802.11g: Up to 54 Mbps<br>IEEE 802.11n-HT20: Up to MCS15<br>IEEE 802.11n-HT40: Up to MCS15                                                                        |                                                                                                                    |
| <b>Number of Channels:</b>  | IEEE 802.11b: 13<br>IEEE 802.11g: 13<br>IEEE 802.11n-HT20: 13<br>IEEE 802.11n-HT40: 9                                                                                                                 |                                                                                                                    |
| <b>Channel Separation:</b>  | 5 MHz                                                                                                                                                                                                 |                                                                                                                    |
| <b>Antenna Type:</b>        | Chain 0                                                                                                                                                                                               | PIFA Antenna                                                                                                       |
|                             | Chain 1                                                                                                                                                                                               | PIFA Antenna                                                                                                       |
| <b>Antenna Gain:</b>        | Chain 0                                                                                                                                                                                               | 2.02 dBi                                                                                                           |
|                             | Chain 1                                                                                                                                                                                               | 2.29 dBi                                                                                                           |
| <b>Directional gain:</b>    | 5.17 dBi                                                                                                                                                                                              |                                                                                                                    |
| <b>Maximum Peak Power:</b>  | SISO_ Chain 0                                                                                                                                                                                         | IEEE 802.11b: 19.92 dBm<br>IEEE 802.11g: 22.97 dBm<br>IEEE 802.11n-HT20: 18.52 dBm<br>IEEE 802.11n-HT40: 18.59 dBm |
|                             | SISO_ Chain 1                                                                                                                                                                                         | IEEE 802.11b: 20.49 dBm<br>IEEE 802.11g: 22.82 dBm<br>IEEE 802.11n-HT20: 17.33 dBm<br>IEEE 802.11n-HT40: 17.26 dBm |
|                             | MIMO_ Chain 0+1                                                                                                                                                                                       | IEEE 802.11n-HT20: 20.71 dBm<br>IEEE 802.11n-HT40: 20.90 dBm                                                       |
| <b>Maximum EIRP:</b>        | SISO_ Chain 0                                                                                                                                                                                         | IEEE 802.11b: 21.94 dBm<br>IEEE 802.11g: 24.99 dBm<br>IEEE 802.11n-HT20: 20.54 dBm<br>IEEE 802.11n-HT40: 20.61 dBm |
|                             | SISO_ Chain 1                                                                                                                                                                                         | IEEE 802.11b: 22.78 dBm<br>IEEE 802.11g: 25.11 dBm<br>IEEE 802.11n-HT20: 19.62 dBm<br>IEEE 802.11n-HT40: 19.55 dBm |
|                             | MIMO_ Chain 0+1                                                                                                                                                                                       | IEEE 802.11n-HT20: 22.84 dBm<br>IEEE 802.11n-HT40: 23.03 dBm                                                       |
| <b>Normal Test Voltage:</b> | 3.3 Vdc                                                                                                                                                                                               |                                                                                                                    |

### 1.4 OTHER INFORMATION

| Operation Frequency Each of Channel                                         |                                               |
|-----------------------------------------------------------------------------|-----------------------------------------------|
| IEEE 802.11b,<br>IEEE 802.11g,<br>IEEE 802.11n-HT20                         | $f = 2407 + 5k \text{ MHz}, k = 1, \dots, 13$ |
| IEEE 802.11n-HT40                                                           | $f = 2407 + 5k \text{ MHz}, k = 3, \dots, 11$ |
| Note:<br>f is the operating frequency (MHz);<br>k is the operating channel. |                                               |

## 1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

### 1) Support Equipment

| Description | Manufacturer | Model No. | Serial Number | Supplied by |
|-------------|--------------|-----------|---------------|-------------|
| Notebook    | Lenovo       | E450      | SL10G10780    | UnionTrust  |
| --          | --           | --        | --            | --          |

### 2) Support Cable

| Cable No. | Description       | Connector | Length     | Supplied by |
|-----------|-------------------|-----------|------------|-------------|
| 1         | Antenna Cable * 2 | SMA       | 0.30 Meter | UnionTrust  |
| 2         | USB Cable         | USB       | 0.80 Meter | UnionTrust  |

## 1.6 TEST LOCATION

### Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109  
Telephone: +86 (0) 755 2823 0888  
Fax: +86 (0) 755 2823 0886

## 1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

### CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

### IC-Registration No.: 21600-1

The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

### A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

### FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

## 1.8 DEVIATION FROM STANDARDS

None.

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## 1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

## 1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

## 1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| No. | Item                            | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1   | Conducted emission 9KHz-150KHz  | ±3.8 dB                 |
| 2   | Conducted emission 150KHz-30MHz | ±3.4 dB                 |
| 3   | Radiated emission 9KHz-30MHz    | ±4.9 dB                 |
| 4   | Radiated emission 30MHz-1GHz    | ±4.7 dB                 |
| 5   | Radiated emission 1GHz-18GHz    | ±5.1 dB                 |
| 6   | Radiated emission 18GHz-26GHz   | ±5.2 dB                 |
| 7   | Radiated emission 26GHz-40GHz   | ±5.2 dB                 |

## 2. TEST SUMMARY

| FCC 47 CFR Part 15 Subpart C Test Cases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                              |                                     |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------|---------------|
| Test Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Test Requirement                                                                             | Test Method                         | Result        |
| Antenna Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c)<br>RSS-Gen Issue 4, Section 8.3       | ANSI C63.10-2013                    | PASS          |
| AC Power Line Conducted Emission                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | FCC 47 CFR Part 15 Subpart C Section 15.207<br>RSS-Gen Issue 4, Section 8.8                  | ANSI C63.10-2013                    | N/A NOTE 1, 2 |
| Conducted Peak Output Power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3)<br>RSS-247 Issue 2, Section 5.4(d)        | KDB 558074 D01 v04<br>Section 9.1.3 | PASS NOTE 3   |
| 6dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)<br>RSS-247 Issue 2, Section 5.2(a)        | KDB 558074 D01 v04<br>Section 8.1   | PASS NOTE 3   |
| Occupied Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RSS-Gen section 6.6                                                                          | RSS-Gen section 6.6                 | PASS NOTE 3   |
| Power Spectral Density                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | FCC 47 CFR Part 15 Subpart C Section 15.247 (e)<br>RSS-247 Issue 2, Section 5.2(b)           | KDB 558074 D01 v04<br>Section 10.2  | PASS NOTE 3   |
| Conducted Out of Band Emission                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | FCC 47 CFR Part 15 Subpart C Section 15.247(d)<br>RSS-247 Issue 2, Section 5.5               | KDB 558074 D01 v04<br>Section 11    | PASS NOTE 3   |
| Radiated Spurious Emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | FCC 47 CFR Part 15 Subpart C Section 15.205/15.209<br>RSS-Gen Issue 4, Section 6.13/8.9/8.10 | KDB 558074 D01 v04<br>Section 12.1  | PASS NOTE 3   |
| Band Edge Measurements (Radiated)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FCC 47 CFR Part 15 Subpart C Section 15.205/15.209<br>RSS-247 Issue 2, Section 5.5           | KDB 558074 D01 v04<br>Section 12.1  | PASS NOTE 3   |
| <b>Note:</b><br>1) N/A: In this whole report not application.<br>2) This EUT is powered by DC.<br>3) The EUT (WCT6PA2201) this time and original model (WCT6LA2701) both WIFI+BT Module are identical in chipset, about the difference between the both WIFI+BT Module, please refer to the difference statement. After assessment, all technical data is referred to previous report no. 170615002RFC-3 dated July 10, 2017 except Radiated Emissions, Band edge (Radiated), e.i.r.p. and all other items that increase the channels. |                                                                                              |                                     |               |

### 3. EQUIPMENT LIST

| Radiated Emission Test Equipment List (3M Chamber) |                                  |              |           |                            |                         |                             |
|----------------------------------------------------|----------------------------------|--------------|-----------|----------------------------|-------------------------|-----------------------------|
| Used                                               | Equipment                        | Manufacturer | Model No. | Serial Number              | Cal. date (mm dd, yyyy) | Cal. Due date (mm dd, yyyy) |
| <input checked="" type="checkbox"/>                | 3M Chamber & Accessory Equipment | ETS-LINDGREN | 3M        | N/A                        | Dec. 20, 2015           | Dec. 19, 2018               |
| <input checked="" type="checkbox"/>                | Receiver                         | R&S          | ESIB26    | 100114                     | Dec. 10, 2017           | Dec. 10, 2018               |
| <input checked="" type="checkbox"/>                | EXA Spectrum Analyzer            | KEYSIGHT     | N9010A    | MY51440197                 | Dec.10, 2017            | Dec. 10, 2018               |
| <input checked="" type="checkbox"/>                | Loop Antenna                     | ETS-LINDGREN | 6502      | 00202525                   | Dec. 17, 2017           | Dec. 17, 2018               |
| <input checked="" type="checkbox"/>                | Broadband Antenna                | ETS-LINDGREN | 3142E     | 00201566                   | Dec. 17, 2017           | Dec. 17, 2018               |
| <input checked="" type="checkbox"/>                | Preamplifier                     | HP           | 8447F     | 2805A02960                 | Dec. 10, 2017           | Dec. 10, 2018               |
| <input checked="" type="checkbox"/>                | Horn Antenna (Pre-amplifier)     | ETS-LINDGREN | 3117-PA   | 00201874                   | Dec. 17, 2017           | Dec. 17, 2018               |
| <input checked="" type="checkbox"/>                | Horn Antenna                     | ETS-LINDGREN | 3116C     | 00200180                   | Jul. 28, 2015           | Jul. 27, 2018               |
| <input checked="" type="checkbox"/>                | Horn Antenna (Pre-amplifier)     | ETS-LINDGREN | 3116C-PA  | 00202652                   | Dec. 17, 2017           | Dec. 17, 2018               |
| <input checked="" type="checkbox"/>                | Multi device Controller          | ETS-LINDGREN | 7006-001  | 00160105                   | N/A                     | N/A                         |
| <input checked="" type="checkbox"/>                | Test Software                    | Audix        | e3        | Software Version: 9.160323 |                         |                             |

| Conducted RF test Equipment List    |                           |              |           |               |                         |                             |
|-------------------------------------|---------------------------|--------------|-----------|---------------|-------------------------|-----------------------------|
| Used                                | Equipment                 | Manufacturer | Model No. | Serial Number | Cal. date (mm dd, yyyy) | Cal. Due date (mm dd, yyyy) |
| <input checked="" type="checkbox"/> | EXA Spectrum Analyzer     | KEYSIGHT     | N9010A    | MY51440197    | Dec. 10, 2017           | Dec. 10, 2018               |
| <input checked="" type="checkbox"/> | USB Wideband Power Sensor | KEYSIGHT     | U2021XA   | MY55430035    | Dec. 10, 2017           | Dec. 10, 2018               |
| <input checked="" type="checkbox"/> | USB Wideband Power Sensor | KEYSIGHT     | U2021XA   | MY55430023    | Dec. 10, 2017           | Dec. 10, 2018               |

## 4. TEST CONFIGURATION

### 4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

#### 4.1.1 Normal or Extreme Test Conditions

| Environment Parameter                                           | Selected Values During Tests |             |                       |
|-----------------------------------------------------------------|------------------------------|-------------|-----------------------|
| Test Condition                                                  | Ambient                      |             |                       |
|                                                                 | Temperature (°C)             | Voltage (V) | Relative Humidity (%) |
| NT/NV                                                           | +15 to +35                   | 3.3         | 20 to 75              |
| <b>Remark:</b><br>1) NV: Normal Voltage; NT: Normal Temperature |                              |             |                       |

### 4.2 TEST CHANNELS

| Mode              | Tx/Rx Frequency      | Test RF Channel Lists |           |              |              |              |
|-------------------|----------------------|-----------------------|-----------|--------------|--------------|--------------|
|                   |                      | Lowest(L)             | Middle(M) | Highest(H11) | Highest(H12) | Highest(H13) |
| IEEE 802.11b      | 2412 MHz to 2472 MHz | Channel 1             | Channel 7 | Channel 11   | Channel 12   | Channel 13   |
|                   |                      | 2412 MHz              | 2437 MHz  | 2462 MHz     | 2467 MHz     | 2472 MHz     |
| IEEE 802.11g      | 2412 MHz to 2472 MHz | Channel 1             | Channel 7 | Channel 11   | Channel 12   | Channel 13   |
|                   |                      | 2412 MHz              | 2437 MHz  | 2462 MHz     | 2467 MHz     | 2472 MHz     |
| IEEE 802.11n-HT20 | 2412 MHz to 2472 MHz | Channel 1             | Channel 7 | Channel 11   | Channel 12   | Channel 13   |
|                   |                      | 2412 MHz              | 2437 MHz  | 2462 MHz     | 2467 MHz     | 2472 MHz     |
| Mode              | Tx/Rx Frequency      | Test RF Channel Lists |           |              |              |              |
|                   |                      | Lowest(L)             | Middle(M) | Highest(H9)  | Highest(H10) | Highest(H11) |
| IEEE 802.11n-HT40 | 2422 MHz to 2462 MHz | Channel 3             | Channel 7 | Channel 9    | Channel 10   | Channel 11   |
|                   |                      | 2422 MHz              | 2437 MHz  | 2452 MHz     | 2457 MHz     | 2462 MHz     |

### 4.3 EUT TEST STATUS

| Mode                                                                   | Tx/Rx Function | Description                                                                            |
|------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------|
| IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n-HT20<br>IEEE 802.11n-HT40 | 1Tx/1Rx        | 1. Keep the EUT in continuously transmitting or receiving with modulation test single. |
| IEEE 802.11n-HT20<br>IEEE 802.11n-HT40                                 | 2Tx/2Rx        | 2. Keep the EUT in continuously transmitting or receiving with modulation test single. |

## 4.4 PRE-SCAN

### 4.4.1 Pre-scan under all rates

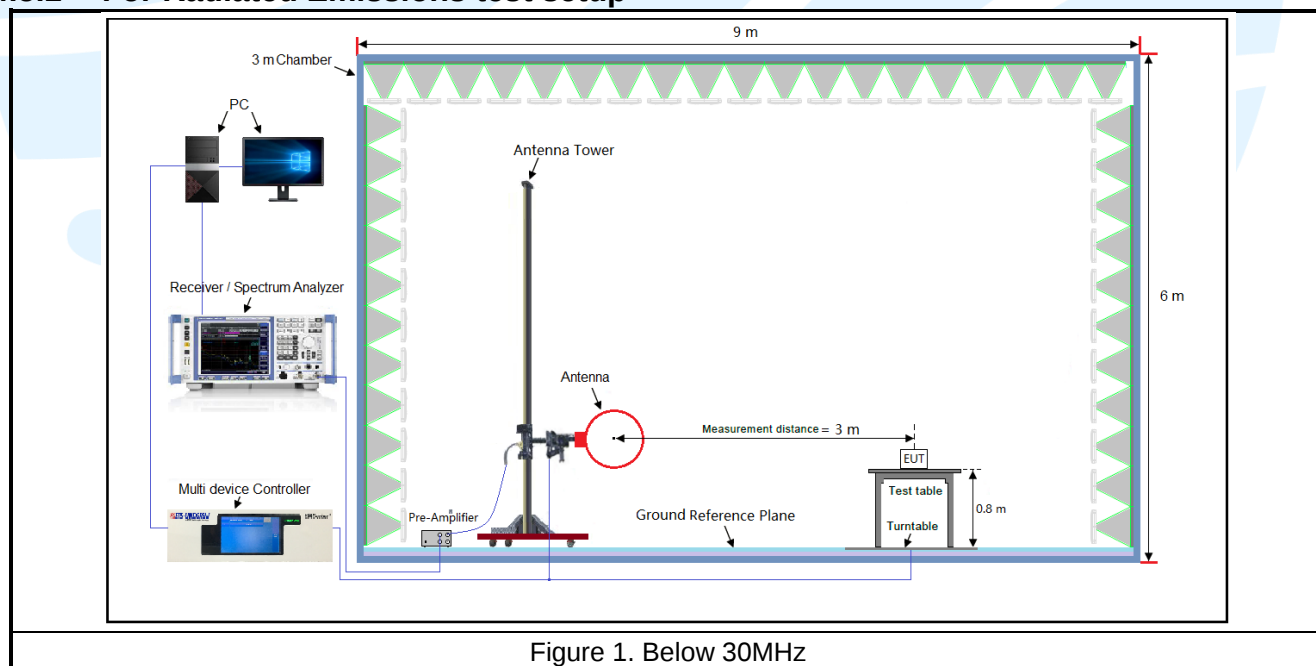
| Mode and Frequency            | Maximum Conducted Average Power (dBm)_Chain 0 |       |       |       |       |       |       |       |
|-------------------------------|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                               | 1                                             |       | 2     |       | 5.5   |       | 11    |       |
| IEEE 802.11b<br>2437 MHz      | <b>16.77</b>                                  |       | 16.69 |       | 16.62 |       | 16.50 |       |
| IEEE 802.11g<br>2437 MHz      | 6                                             | 9     | 12    | 18    | 24    | 36    | 48    | 54    |
|                               | <b>16.55</b>                                  | 16.54 | 16.40 | 16.38 | 16.31 | 16.09 | 15.01 | 15.04 |
| IEEE 802.11n-HT20<br>2437 MHz | MCS0                                          | MCS1  | MCS2  | MCS3  | MCS4  | MCS5  | MCS6  | MCS7  |
|                               | 11.51                                         | 11.39 | 11.7  | 12.09 | 10.09 | 10.03 | 10.13 | 10.03 |
|                               | MCS8                                          | MCS9  | MCS10 | MCS11 | MCS12 | MCS13 | MCS14 | MCS15 |
| IEEE 802.11n-HT40<br>2437 MHz | <b>11.57</b>                                  | 11.50 | 11.46 | 11.45 | 10.86 | 10.81 | 10.77 | 10.77 |
|                               | MCS0                                          | MCS1  | MCS2  | MCS3  | MCS4  | MCS5  | MCS6  | MCS7  |
|                               | 11.22                                         | 11.07 | 10.83 | 10.52 | 9.26  | 9.16  | 9.22  | 9.10  |
|                               | MCS8                                          | MCS9  | MCS10 | MCS11 | MCS12 | MCS13 | MCS14 | MCS15 |
|                               | <b>11.27</b>                                  | 11.30 | 11.26 | 11.25 | 9.56  | 9.51  | 9.46  | 9.43  |

### 4.4.2 Worst-case data rates

| Mode              | Worst-case data rates |
|-------------------|-----------------------|
| IEEE 802.11b      | 1 Mbps                |
| IEEE 802.11g      | 6 Mbps                |
| IEEE 802.11n-HT20 | MCS0                  |
| IEEE 802.11n-HT40 | MCS0                  |

## 4.5 TEST SETUP

### 4.5.1 For Radiated Emissions test setup



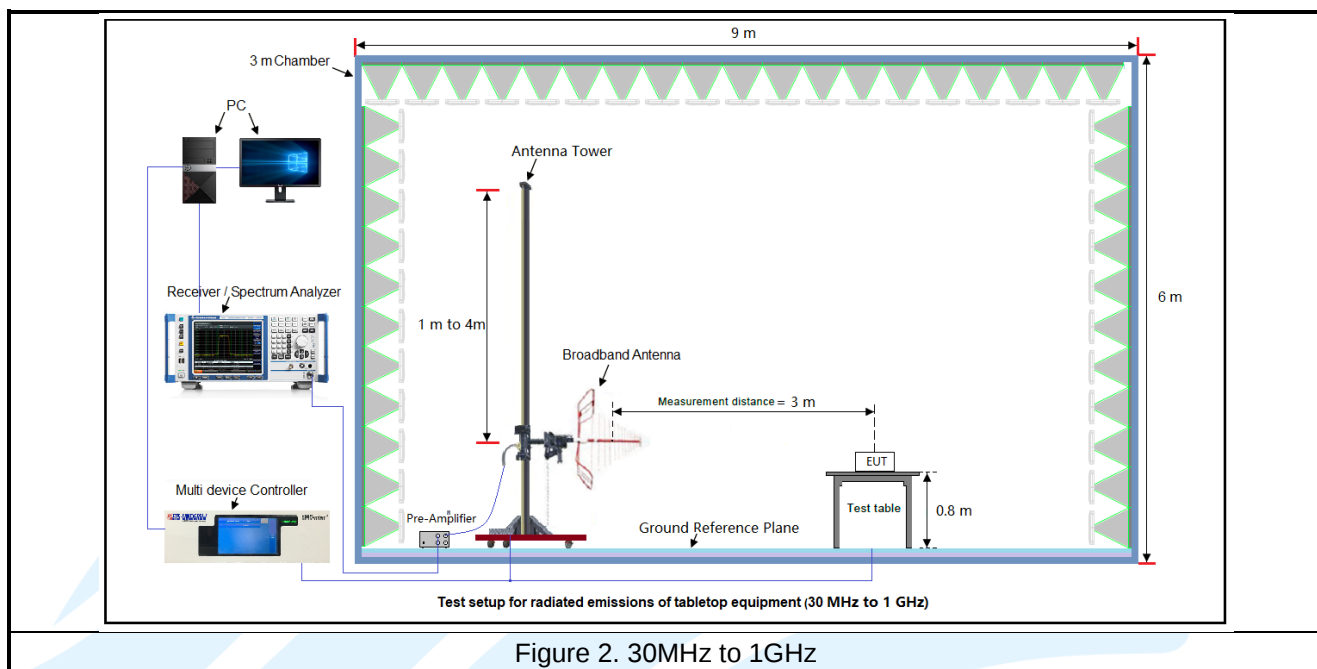
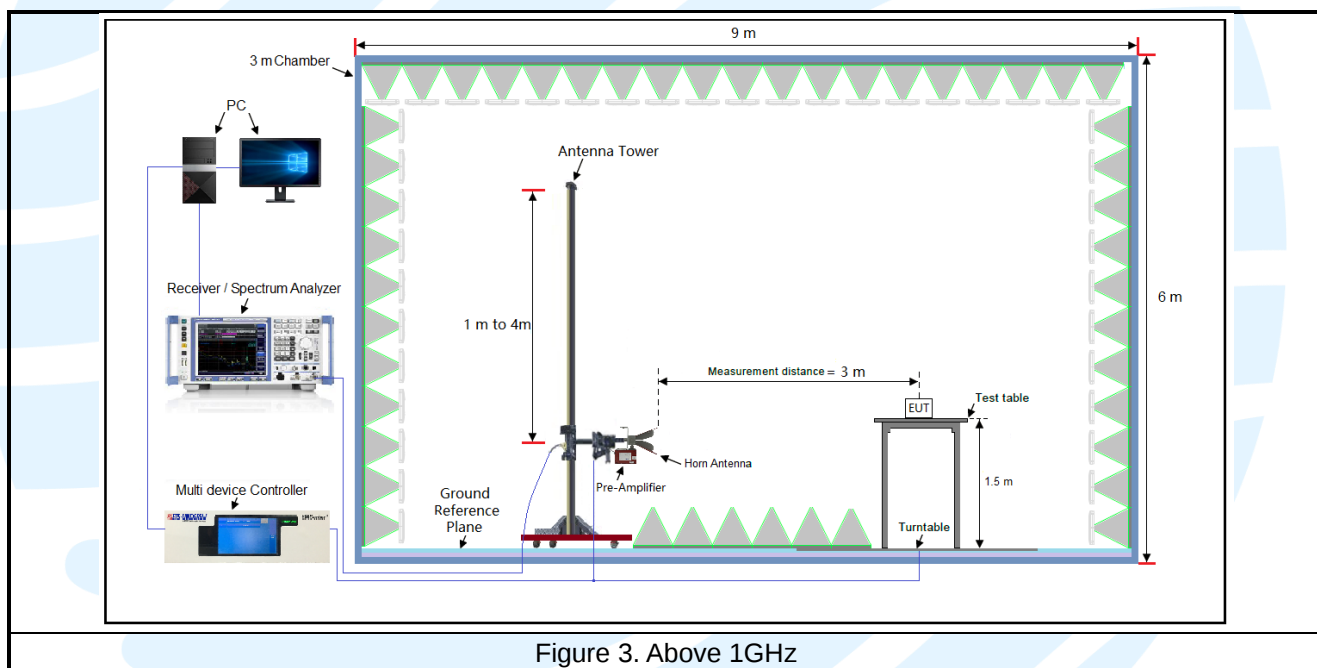
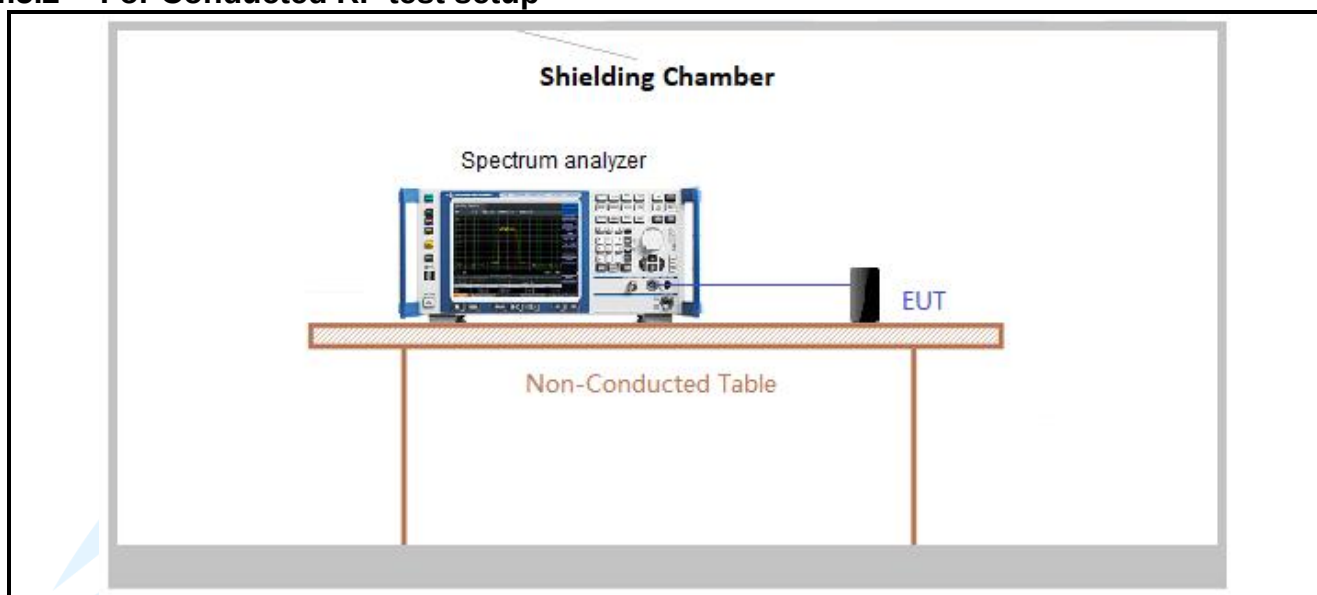


Figure 2. 30MHz to 1GHz



#### 4.5.2 For Conducted RF test setup



### 4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.3Vdc. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

| Frequency  | Mode | Antenna Port | Worst-case axis positioning |
|------------|------|--------------|-----------------------------|
| Above 1GHz | 1TX  | Chain 0      | Y axis                      |
|            | 1TX  | Chain 1      | Y axis                      |
|            | 2TX  | Chain 0+1    | Y axis                      |

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

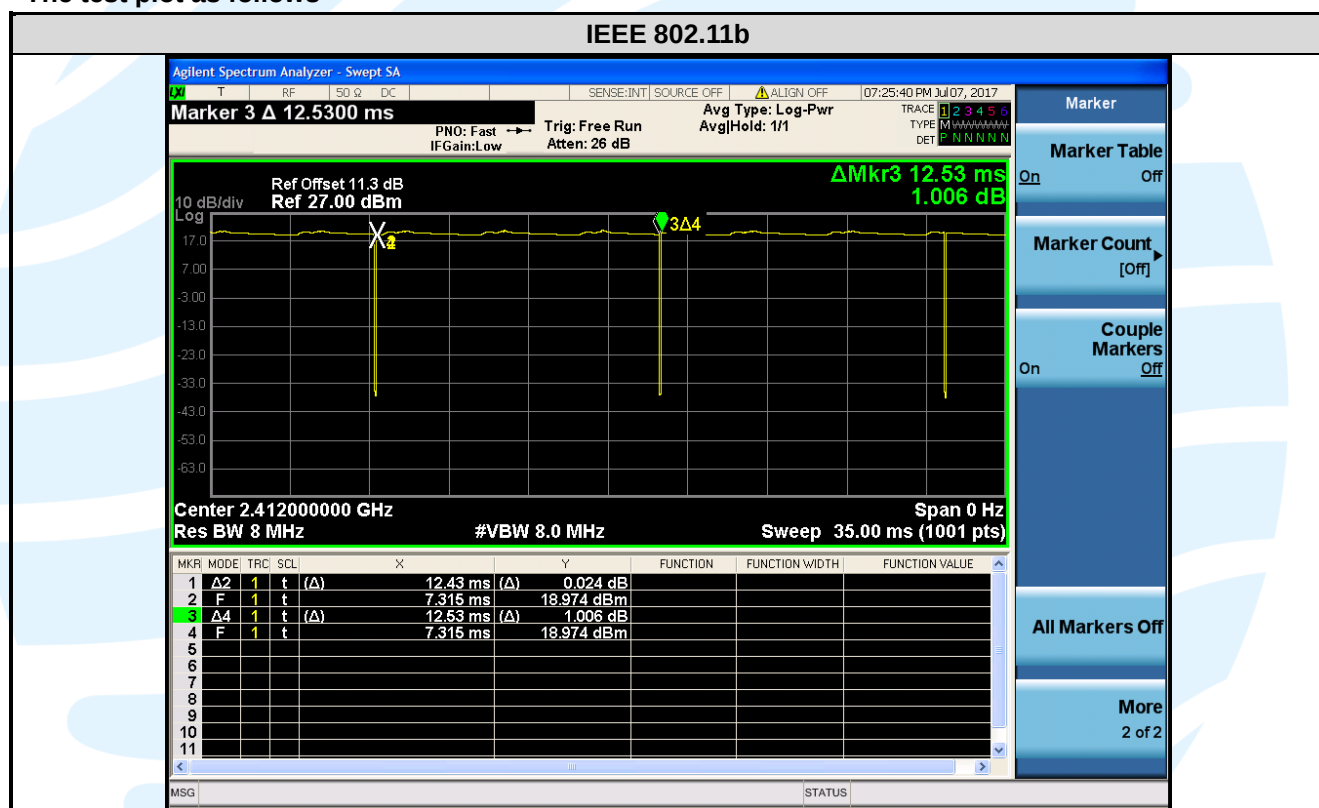
## 4.7 DUTY CYCLE

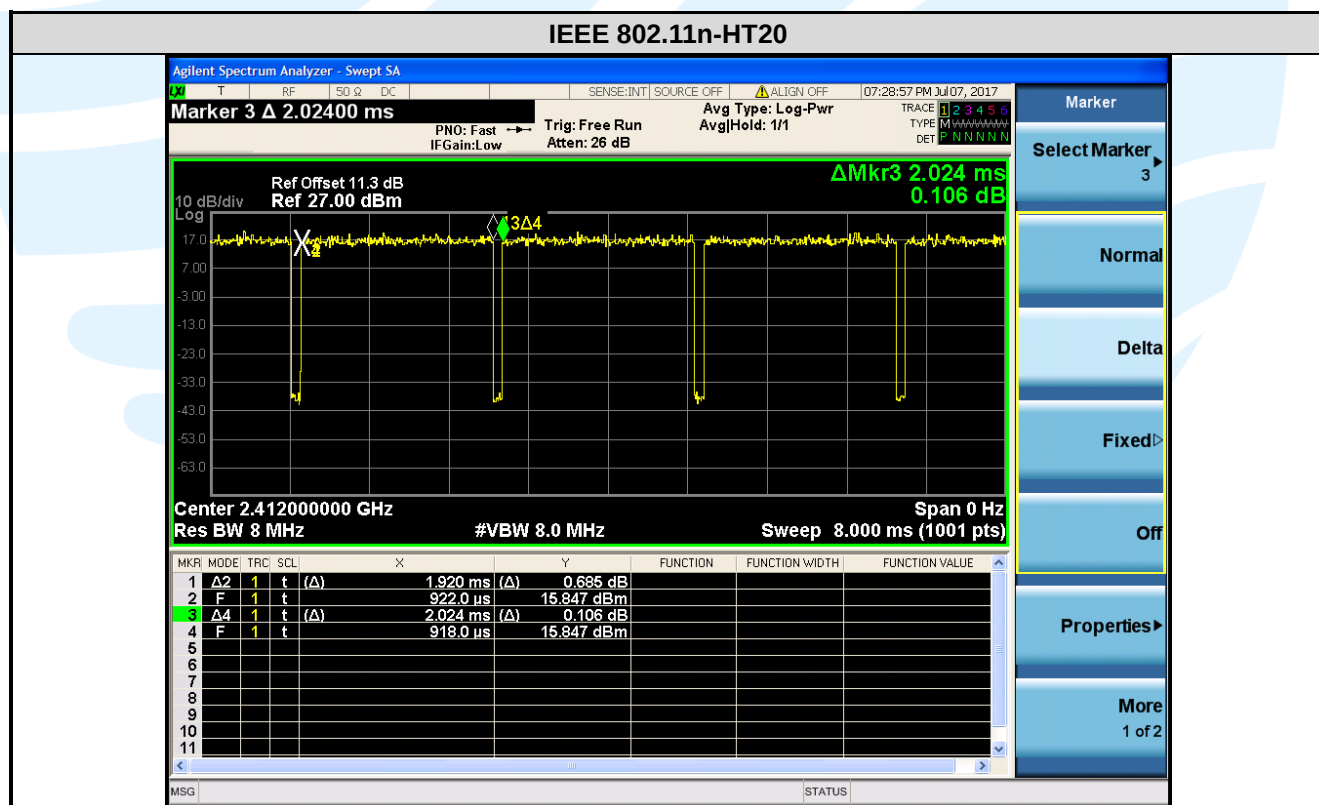
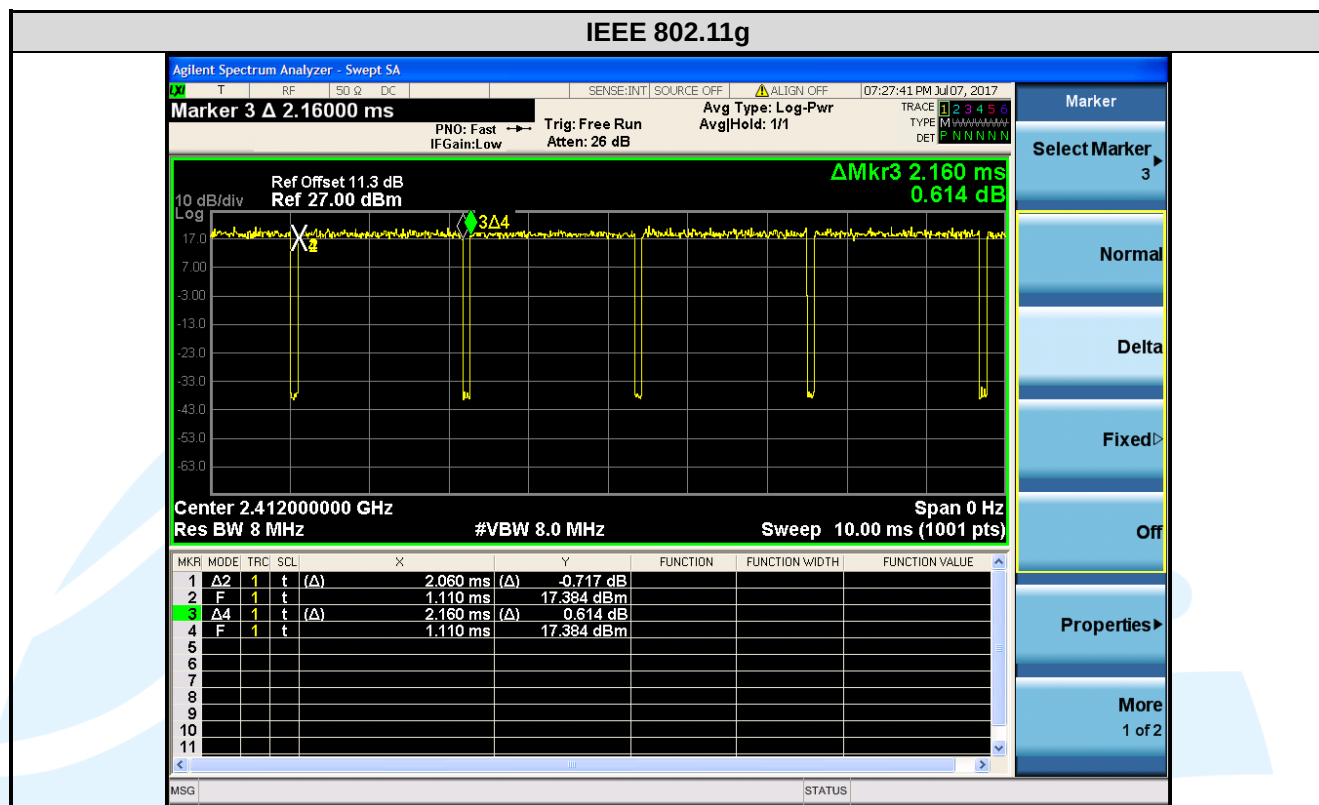
| Mode              | Data rates (Mbps) | On Time (msec) | Period (msec) | Duty Cycle (linear) | Duty Cycle (%) | Duty Cycle Factor (dB) | 1/ T Minimum VBW (kHz) | Average Factor (dB) |
|-------------------|-------------------|----------------|---------------|---------------------|----------------|------------------------|------------------------|---------------------|
| IEEE 802.11b      | 1                 | 12.43          | 12.53         | 0.99                | 99.20          | 0.00                   | 0.01                   | -0.07               |
| IEEE 802.11g      | 6                 | 2.06           | 2.16          | 0.95                | 95.37          | 0.21                   | 0.49                   | -0.41               |
| IEEE 802.11n-HT20 | MCS0              | 1.92           | 2.024         | 0.95                | 94.86          | 0.23                   | 0.52                   | -0.46               |
| IEEE 802.11n-HT40 | MCS0              | 0.95           | 1.05          | 0.90                | 90.48          | 0.43                   | 1.05                   | -0.87               |

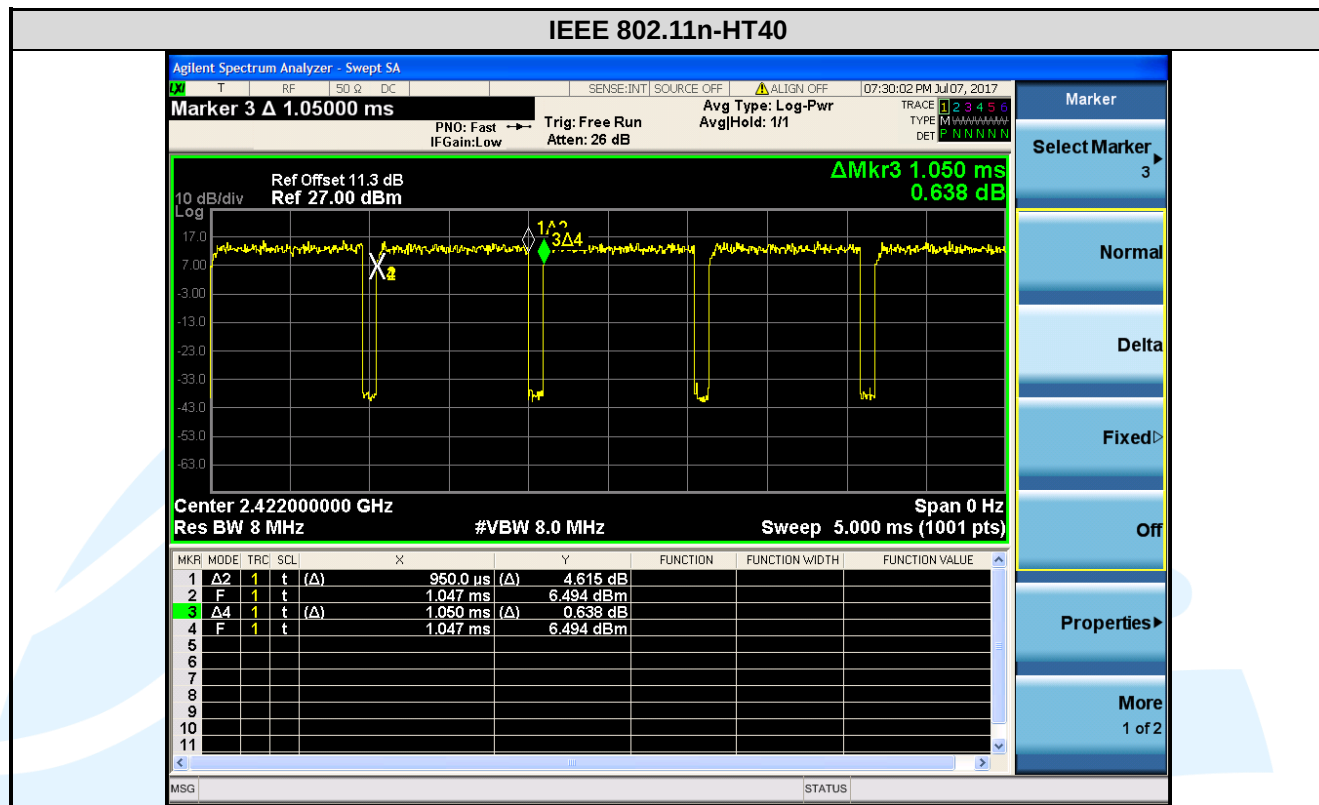
### Remark:

- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor =  $10 * \log(1/ \text{Duty cycle})$ ;
- 3) Average factor =  $20 \log_{10} \text{Duty Cycle}$ .

The test plot as follows







## 5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

### 5.1 REFERENCE DOCUMENTS FOR TESTING

| No. | Identity                                          | Document Title                                                                                                               |
|-----|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| 1   | FCC 47 CFR Part 2                                 | Frequency allocations and radio treaty matters; general rules and regulations                                                |
| 2   | FCC 47 CFR Part 15                                | Radio Frequency Devices                                                                                                      |
| 3   | RSS-247 Issue 2                                   | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |
| 4   | RSS-Gen Issue 4                                   | General Requirements for Compliance of Radio Apparatus                                                                       |
| 5   | ANSI C63.10-2013                                  | American National Standard for Testing Unlicensed Wireless Devices                                                           |
| 6   | KDB 558074 D01 DTS Meas Guidance v04              | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247                |
| 7   | KDB 662911 D01 Multiple Transmitter Output v02r01 | Emissions Testing of Transmitters with Multiple Outputs in the Same Band                                                     |

### 5.2 ANTENNA REQUIREMENT

| Standard Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>15.203 requirement:</b><br/>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, 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.</p> <p><b>15.247(b) (4) requirement:</b><br/>The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> <p><b>RSS-Gen Issue 4, Section 8.3 requirement:</b><br/>According to RSS-Gen Issue 4, section 8.3, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.</p> <p><b>EUT Antenna:</b><br/>Both antenna in the interior of the equipment and no consideration of replacement. The Tx chains are correlated and the antenna gain is unequal among the chains and the best case directional gain of the antenna is 5.17dBi (See section 5.3).</p> |

### 5.3 CONDUCTED PEAK OUTPUT POWER

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3)  
RSS-247 Issue 2, Section 5.4(d)

**Test Method:** KDB 558074 D01 v04, Section 9.1.3

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

**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.4.3 for details.

**Instruments Used:** Refer to section 3 for details

**Test Mode:** Transmitter mode

**Test Results:** Pass

**Test Data:**

#### The worst case test data:

#### For maximum peak conducted output power

| Mode              | Channel/<br>Frequency<br>(MHz) | Maximum Conducted Peak Output Power (dBm) |               |                                   |                | Pass / Fail |
|-------------------|--------------------------------|-------------------------------------------|---------------|-----------------------------------|----------------|-------------|
|                   |                                | SISO_ Chain 0                             | SISO_ Chain 1 | Total Power<br>MIMO_ Chain<br>0+1 | Limit<br>(dBm) |             |
| IEEE 802.11b      | 1(2412)                        | 19.12                                     | 19.97         | ---                               | 30             | Pass        |
|                   | 6(2437)                        | 19.21                                     | 20.06         | ---                               | 30             | Pass        |
|                   | 11(2462)                       | <b>19.92</b>                              | <b>20.49</b>  | ---                               | 30             | Pass        |
|                   | 12(2467)                       | 14.84                                     | 16.29         | ---                               | 30             | Pass        |
|                   | 13(2472)                       | 14.86                                     | 16.30         | ---                               | 30             | Pass        |
| IEEE 802.11g      | 1(2412)                        | 22.65                                     | 22.57         | ---                               | 30             | Pass        |
|                   | 6(2437)                        | 22.72                                     | 22.72         | ---                               | 30             | Pass        |
|                   | 11(2462)                       | <b>22.97</b>                              | <b>22.82</b>  | ---                               | 30             | Pass        |
|                   | 12(2467)                       | 16.77                                     | 18.36         | ---                               | 30             | Pass        |
|                   | 13(2472)                       | 16.93                                     | 18.27         | ---                               | 30             | Pass        |
| IEEE 802.11n-HT20 | 1(2412)                        | 18.37                                     | 16.42         | 20.51                             | 30             | Pass        |
|                   | 6(2437)                        | 18.36                                     | 16.62         | 20.59                             | 30             | Pass        |
|                   | 11(2462)                       | <b>18.52</b>                              | 16.69         | <b>20.71</b>                      | 30             | Pass        |
|                   | 12(2467)                       | 15.91                                     | 17.21         | 19.62                             | 30             | Pass        |
|                   | 13(2472)                       | 15.82                                     | <b>17.33</b>  | 19.65                             | 30             | Pass        |
| IEEE 802.11n-HT40 | 3(2422)                        | 18.59                                     | 16.84         | 20.81                             | 30             | Pass        |
|                   | 6(2437)                        | <b>18.59</b>                              | 17.05         | <b>20.90</b>                      | 30             | Pass        |
|                   | 9(2452)                        | 18.57                                     | 16.79         | 20.78                             | 30             | Pass        |
|                   | 10(2457)                       | 16.13                                     | 17.22         | 19.72                             | 30             | Pass        |
|                   | 11(2462)                       | 15.94                                     | <b>17.26</b>  | 19.66                             | 30             | Pass        |

Remark:

1. Power with Duty Factor = Measured Power + Duty Cycle Factor
2. Total (Chain 0+1) =  $10 \cdot \log[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10})]$
3. Directional gain and the maximum conducted output power limit see table below:

| Frequency Band                                                                                                                                                                                                                                                                                                                                                                             | Chain 0 Antenna Gain (dBi) | Chain 1 Antenna Gain (dBi) | Correlated chains directional gain (dBi) | Peak Power Limit (dBm) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------|------------------------------------------|------------------------|
| 2400 MHz to 2483.5 MHz                                                                                                                                                                                                                                                                                                                                                                     | 2.02                       | 2.29                       | 5.17                                     | 30.00                  |
| Unequal antenna gains, with equal transmit powers. Directional gain is to be computed as follows:<br>If transmit signals are correlated, then<br>Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N]$ dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.] |                            |                            |                                          |                        |

For maximum e.i.r.p.

| Mode              | Channel/<br>Frequency<br>(MHz) | Maximum Conducted Peak Output Power (dBm) |               |                             |             | Pass / Fail |
|-------------------|--------------------------------|-------------------------------------------|---------------|-----------------------------|-------------|-------------|
|                   |                                | SISO_ Chain 0                             | SISO_ Chain 1 | Total Power MIMO_ Chain 0+1 | Limit (dBm) |             |
| IEEE 802.11b      | 1(2412)                        | 21.14                                     | 22.26         | ---                         | 30          | Pass        |
|                   | 6(2437)                        | 21.23                                     | 22.35         | ---                         | 30          | Pass        |
|                   | 11(2462)                       | <b>21.94</b>                              | <b>22.78</b>  | ---                         | 30          | Pass        |
|                   | 12(2467)                       | 16.86                                     | 18.58         | ---                         | 30          | Pass        |
|                   | 13(2472)                       | 16.88                                     | 18.59         | ---                         | 30          | Pass        |
| IEEE 802.11g      | 1(2412)                        | 24.67                                     | 24.86         | ---                         | 30          | Pass        |
|                   | 6(2437)                        | 24.74                                     | 25.01         | ---                         | 30          | Pass        |
|                   | 11(2462)                       | <b>24.99</b>                              | <b>25.11</b>  | ---                         | 30          | Pass        |
|                   | 12(2467)                       | 18.79                                     | 20.65         | ---                         | 30          | Pass        |
|                   | 13(2472)                       | 18.95                                     | 20.56         | ---                         | 30          | Pass        |
| IEEE 802.11n-HT20 | 1(2412)                        | 20.39                                     | 18.71         | 22.64                       | 30          | Pass        |
|                   | 6(2437)                        | 20.38                                     | 18.91         | 22.72                       | 30          | Pass        |
|                   | 11(2462)                       | <b>20.54</b>                              | 18.98         | <b>22.84</b>                | 30          | Pass        |
|                   | 12(2467)                       | 17.93                                     | 19.50         | 21.80                       | 30          | Pass        |
|                   | 13(2472)                       | 17.84                                     | <b>19.62</b>  | 21.83                       | 30          | Pass        |
| IEEE 802.11n-HT40 | 3(2422)                        | 20.61                                     | 19.13         | 22.94                       | 30          | Pass        |
|                   | 6(2437)                        | <b>20.61</b>                              | 19.34         | <b>23.03</b>                | 30          | Pass        |
|                   | 9(2452)                        | 20.59                                     | 19.08         | 22.91                       | 30          | Pass        |
|                   | 10(2457)                       | 18.15                                     | 19.51         | 21.89                       | 30          | Pass        |
|                   | 11(2462)                       | 17.96                                     | <b>19.55</b>  | 21.84                       | 30          | Pass        |

| Mode              | Channel/<br>Frequency<br>(MHz) | Maximum Conducted Average Power (dBm) |         |                           |                        |         |             |
|-------------------|--------------------------------|---------------------------------------|---------|---------------------------|------------------------|---------|-------------|
|                   |                                | SISO                                  |         | Duty Cycle<br>Factor (dB) | SISO                   |         | MIMO        |
|                   |                                | Measured Power                        |         |                           | Power with Duty Factor |         | Total Power |
|                   |                                | Chain 0                               | Chain 1 |                           | Chain 0                | Chain 1 | Chain 0+1   |
| IEEE 802.11b      | 1(2412)                        | 16.77                                 | 16.55   | 0.00                      | 16.77                  | 16.55   | --          |
|                   | 6(2437)                        | 16.70                                 | 16.62   |                           | 16.70                  | 16.62   | --          |
|                   | 11(2462)                       | 17.19                                 | 17.12   |                           | 17.19                  | 17.12   | --          |
|                   | 12(2467)                       | 12.78                                 | 13.44   |                           | 12.78                  | 13.44   | --          |
|                   | 13(2472)                       | 12.69                                 | 13.42   |                           | 12.69                  | 13.42   | --          |
| IEEE 802.11g      | 1(2412)                        | 16.57                                 | 15.73   | 0.21                      | 16.78                  | 15.94   | --          |
|                   | 6(2437)                        | 16.55                                 | 15.92   |                           | 16.76                  | 16.13   | --          |
|                   | 11(2462)                       | 16.72                                 | 16.02   |                           | 16.72                  | 16.02   | --          |
|                   | 12(2467)                       | 10.76                                 | 12.82   |                           | 10.76                  | 12.82   | --          |
|                   | 13(2472)                       | 10.73                                 | 12.24   |                           | 10.94                  | 12.45   | --          |
| IEEE 802.11n-HT20 | 1(2412)                        | 11.54                                 | 9.36    | 0.23                      | 11.77                  | 9.59    | 13.83       |
|                   | 6(2437)                        | 12.09                                 | 9.48    |                           | 12.32                  | 9.71    | 14.22       |
|                   | 11(2462)                       | 11.64                                 | 9.70    |                           | 11.64                  | 9.70    | 13.79       |
|                   | 12(2467)                       | 9.75                                  | 10.77   |                           | 9.75                   | 10.77   | 13.30       |
|                   | 13(2472)                       | 9.62                                  | 10.92   |                           | 9.85                   | 11.15   | 13.56       |
| IEEE 802.11n-HT40 | 3(2422)                        | 11.22                                 | 9.28    | 0.43                      | 11.65                  | 9.71    | 13.80       |
|                   | 6(2437)                        | 11.30                                 | 9.32    |                           | 11.73                  | 9.75    | 13.86       |
|                   | 9(2452)                        | 11.32                                 | 9.37    |                           | 11.32                  | 9.37    | 13.46       |
|                   | 10(2457)                       | 9.17                                  | 10.54   |                           | 9.17                   | 10.54   | 12.92       |
|                   | 11(2462)                       | 9.13                                  | 10.94   |                           | 9.56                   | 11.37   | 13.57       |

Remark:

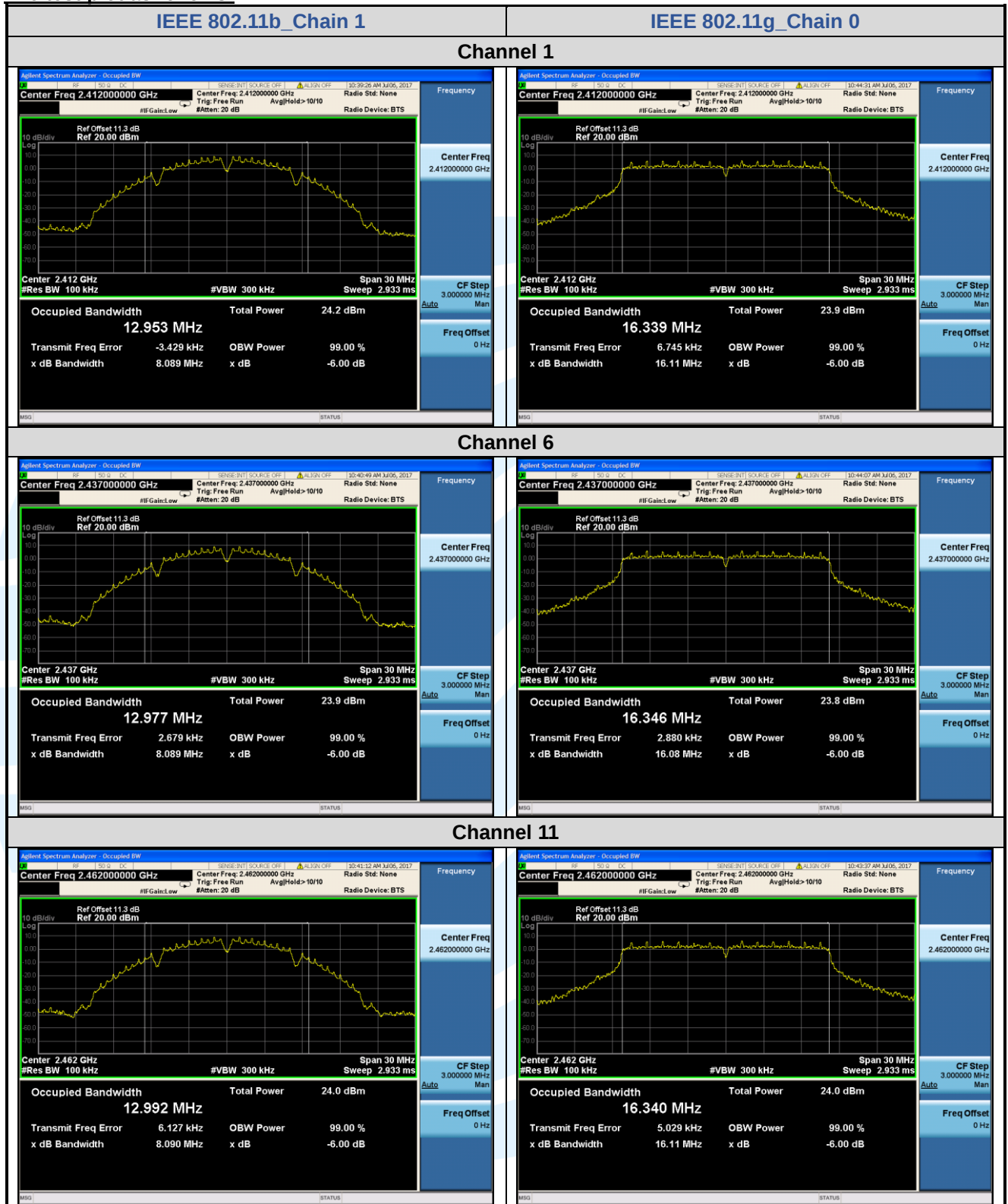
1. Power with Duty Factor = Measured Power + Duty Cycle Factor
2. Total (Chain 0+1) =  $10 \cdot \log[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10})]$

## 5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

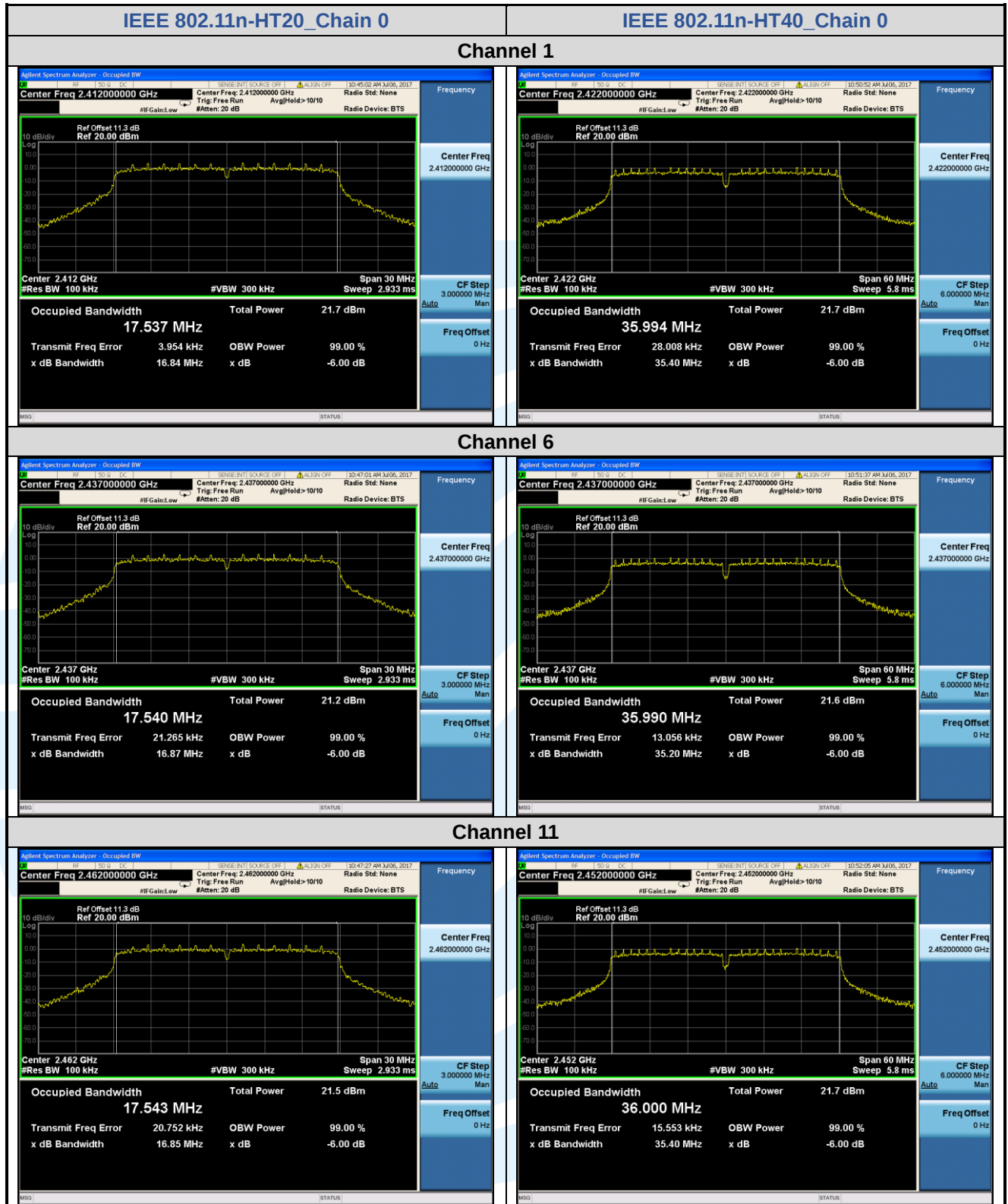
|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)<br>RSS-247 Issue 2, Section 5.2(a)<br>RSS-Gen Issue 4, Section 6.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Test Method:</b>      | KDB 558074 D01 v04, Section 8.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Limit:</b>            | For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Test Procedure:</b>   | Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.<br>Use the following spectrum analyzer settings:<br>a) Set RBW = 100 kHz.<br>b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.<br>c) Detector = Peak.<br>d) Trace mode = max hold.<br>e) Sweep = auto couple.<br>f) Allow the trace to stabilize.<br>g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.<br><br>Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset. |
| <b>Test Setup:</b>       | Refer to section 4.4.3 for details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Instruments Used:</b> | Refer to section 3 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Test Mode:</b>        | Transmitter mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Test Results:</b>     | Pass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Test Data:</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| Mode                              | Channel/<br>Frequency<br>(MHz) | 6 dB<br>Bandwidth<br>(MHz) | 99%<br>Bandwidth<br>(MHz) | 6 dB<br>Bandwidth<br>Limit | Pass / Fail |
|-----------------------------------|--------------------------------|----------------------------|---------------------------|----------------------------|-------------|
| <b>The worst case test data:</b>  |                                |                            |                           |                            |             |
| IEEE 802.11b<br>SISO_Chain 1      | 1(2412)                        | 8.089                      | 12.953                    | > 500 kHz                  | Pass        |
|                                   | 6(2437)                        | 8.089                      | 12.977                    | > 500 kHz                  | Pass        |
|                                   | 11(2462)                       | 8.090                      | 12.992                    | > 500 kHz                  | Pass        |
|                                   | 12(2467)                       | 8.091                      | 13.014                    | > 500 kHz                  | Pass        |
|                                   | 13(2472)                       | 8.091                      | 13.023                    | > 500 kHz                  | Pass        |
| IEEE 802.11g<br>SISO_Chain 0      | 1(2412)                        | 16.11                      | 16.339                    | > 500 kHz                  | Pass        |
|                                   | 6(2437)                        | 16.08                      | 16.346                    | > 500 kHz                  | Pass        |
|                                   | 11(2462)                       | 16.11                      | 16.340                    | > 500 kHz                  | Pass        |
|                                   | 12(2467)                       | 16.30                      | 16.342                    | > 500 kHz                  | Pass        |
|                                   | 13(2472)                       | 16.31                      | 16.342                    | > 500 kHz                  | Pass        |
| IEEE 802.11n-HT20<br>MIMO_Chain 0 | 1(2412)                        | 16.84                      | 17.537                    | > 500 kHz                  | Pass        |
|                                   | 6(2437)                        | 16.87                      | 17.540                    | > 500 kHz                  | Pass        |
|                                   | 11(2462)                       | 16.85                      | 17.543                    | > 500 kHz                  | Pass        |
|                                   | 12(2467)                       | 16.89                      | 17.540                    | > 500 kHz                  | Pass        |
|                                   | 13(2472)                       | 16.89                      | 17.533                    | > 500 kHz                  | Pass        |
| IEEE 802.11n-HT40<br>MIMO_Chain 0 | 3(2422)                        | 35.40                      | 35.994                    | > 500 kHz                  | Pass        |
|                                   | 6(2437)                        | 35.20                      | 35.990                    | > 500 kHz                  | Pass        |
|                                   | 9(2452)                        | 35.40                      | 36.000                    | > 500 kHz                  | Pass        |
|                                   | 10(2457)                       | 35.24                      | 36.016                    | > 500 kHz                  | Pass        |
|                                   | 11(2462)                       | 35.37                      | 36.003                    | > 500 kHz                  | Pass        |

The test plot as follows:









## 5.5 POWER SPECTRAL DENSITY

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC 47 CFR Part 15 Subpart C Section 15.247 (e)<br>RSS-247 Issue 2, Section 5.2(b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Test Method:</b>      | KDB 558074 D01 v04, Section 10.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Limit:</b>            | For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Test Procedure:</b>   | <p>Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.</p> <p>Use the following spectrum analyzer settings:</p> <ol style="list-style-type: none"> <li>Set analyzer center frequency to DTS channel center frequency.</li> <li>Set the span to 1.5 times the DTS bandwidth.</li> <li>Set the RBW to: <math>3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}</math>.</li> <li>Set the VBW <math>\geq 3 \times \text{RBW}</math>.</li> <li>Detector = peak.</li> <li>Sweep time = auto couple.</li> <li>Trace mode = max hold.</li> <li>Allow trace to fully stabilize.</li> <li>Use the peak marker function to determine the maximum amplitude level within the RBW.</li> <li>If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.</li> </ol> <p>Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.</p> |
| <b>Test Setup:</b>       | Refer to section 4.4.3 for details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Instruments Used:</b> | Refer to section 3 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Test Mode:</b>        | Transmitter mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Test Results:</b>     | Pass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Test Data:</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

### The worst case test data:

| Mode              | Channel/<br>Frequency<br>(MHz) | Power spectral density (dBm) |                |                                |                      | Pass / Fail |
|-------------------|--------------------------------|------------------------------|----------------|--------------------------------|----------------------|-------------|
|                   |                                | SISO_Chain 0                 | SISO_Chain 1   | Total PSD<br>MIMO_Chain<br>0+1 | Limit @3kHz<br>(dBm) |             |
| IEEE 802.11b      | 1(2412)                        | ---                          | <b>-6.212</b>  | ---                            | 8                    | Pass        |
|                   | 6(2437)                        | ---                          | -7.608         | ---                            | 8                    | Pass        |
|                   | 11(2462)                       | ---                          | -6.752         | ---                            | 8                    | Pass        |
|                   | 12(2467)                       | ---                          | -9.353         | ---                            | 8                    | Pass        |
|                   | 13(2472)                       | ---                          | -9.636         | ---                            | 8                    | Pass        |
| IEEE 802.11g      | 1(2412)                        | -11.027                      | ---            | ---                            | 8                    | Pass        |
|                   | 6(2437)                        | -11.365                      | ---            | ---                            | 8                    | Pass        |
|                   | 11(2462)                       | <b>-10.072</b>               | ---            | ---                            | 8                    | Pass        |
|                   | 12(2467)                       | ---                          | -14.804        | ---                            | 8                    | Pass        |
|                   | 13(2472)                       | ---                          | -14.537        | ---                            | 8                    | Pass        |
| IEEE 802.11n-HT20 | 1(2412)                        | -13.463                      | -14.405        | -10.90                         | 8                    | Pass        |
|                   | 6(2437)                        | -12.240                      | -13.936        | <b>-10.00</b>                  | 8                    | Pass        |
|                   | 11(2462)                       | <b>-12.089</b>               | -14.567        | -10.14                         | 8                    | Pass        |
|                   | 12(2467)                       | -17.701                      | <b>-12.951</b> | -11.70                         | 8                    | Pass        |
|                   | 13(2472)                       | -16.570                      | -13.481        | -11.75                         | 8                    | Pass        |
| IEEE 802.11n-HT40 | 3(2422)                        | -14.388                      | -16.616        | -12.35                         | 8                    | Pass        |
|                   | 6(2437)                        | -14.270                      | -16.284        | -12.15                         | 8                    | Pass        |
|                   | 9(2452)                        | <b>-14.255</b>               | -16.049        | <b>-12.05</b>                  | 8                    | Pass        |
|                   | 10(2457)                       | -19.481                      | <b>-13.960</b> | -12.89                         | 8                    | Pass        |
|                   | 11(2462)                       | -19.268                      | -14.380        | -13.16                         | 8                    | Pass        |

### Remark:

1. Power with Duty Factor = Measured Power + Duty Cycle Factor
2. Total (Chain 0+1) =  $10 \cdot \log[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10})]$
3. Directional gain and the maximum conducted power spectral density limit see table below:

| Frequency Band         | Chain 0 Antenna<br>Gain (dBi) | Chain 1 Antenna<br>Gain (dBi) | Correlated chains<br>directional gain (dBi) | Peak Power Limit<br>(dBm) |
|------------------------|-------------------------------|-------------------------------|---------------------------------------------|---------------------------|
| 2400 MHz to 2483.5 MHz | 2.35                          | 2.35                          | 5.36                                        | 8.00                      |

Basic methodology with  $N_{ANT}$  transmit antennas, each with the same directional gain  $G_{ANT}$  dBi, being driven by  $N_{ANT}$  transmitter outputs of equal power. Directional gain is to be computed as follows:

If any transmit signals are *correlated* with each other,

$$\text{Directional gain} = G_{ANT} + 10 \log(N_{ANT}) \text{ dBi}$$

The test plot as follows:

