

## FCC RADIO TEST REPORT

**No. 180400376SHA-001**

Applicant : Foner Electronics Co.,Ltd  
201, Floor 2, No.2 Building, Foxda Industrial Zone,  
Northern Lanzhu Road, Pingshan

Manufacturing site : Xiamen Topstar Lighting Co., Ltd  
676 Meixi Avenue, Tong'an District, Xiamen, Fujian, China

Product Name : Self-ballasted LED Lamp

Type/Model : L2

**TEST RESULT : PASS**

### SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

**47CFR Part 15 (2017):** Radio Frequency Devices (Subpart C)

**ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

**RSS-247 Issue 2 (February 2017):** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

**RSS-Gen Issue 4 (December 2014):** General Requirements for Compliance of Radio Apparatus

Date of issue: May 15, 2018

Prepared by:



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## Contents

|                                                                |           |
|----------------------------------------------------------------|-----------|
| <b>SUMMARY.....</b>                                            | <b>1</b>  |
| <b>REVISION HISTORY.....</b>                                   | <b>4</b>  |
| <b>1 GENERAL INFORMATION .....</b>                             | <b>5</b>  |
| 1.1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT) .....            | 5         |
| 1.2 RF TECHNICAL INFORMATION .....                             | 5         |
| 1.3 DESCRIPTION OF TEST FACILITY .....                         | 6         |
| <b>2 TEST SPECIFICATIONS.....</b>                              | <b>7</b>  |
| 2.1 STANDARDS OR SPECIFICATION .....                           | 7         |
| 2.2 MODE OF OPERATION DURING THE TEST.....                     | 7         |
| 2.3 TEST ENVIRONMENT CONDITION:.....                           | 8         |
| 2.4 TEST PERIPHERALS USED .....                                | 8         |
| 2.5 TEST SOFTWARE LIST: .....                                  | 8         |
| 2.6 INSTRUMENT LIST .....                                      | 9         |
| 2.7 MEASUREMENT UNCERTAINTY .....                              | 10        |
| 2.8 TEST SUMMARY .....                                         | 11        |
| <b>3 MINIMUM 6DB BANDWIDTH.....</b>                            | <b>12</b> |
| 3.1 LIMIT .....                                                | 12        |
| 3.2 MEASUREMENT PROCEDURE .....                                | 12        |
| 3.3 TEST CONFIGURATION .....                                   | 12        |
| 3.4 TEST RESULTS OF MINIMUM 6DB BANDWIDTH .....                | 12        |
| <b>4 MAXIMUM CONDUCTED OUTPUT POWER AND E.I.R.P.....</b>       | <b>13</b> |
| 4.1 LIMIT .....                                                | 13        |
| 4.2 MEASUREMENT PROCEDURE .....                                | 13        |
| 4.3 TEST CONFIGURATION .....                                   | 14        |
| 4.4 TEST RESULTS OF MAXIMUM CONDUCTED OUTPUT POWER.....        | 14        |
| <b>5 POWER SPECTRUM DENSITY .....</b>                          | <b>15</b> |
| 5.1 LIMIT .....                                                | 15        |
| 5.2 MEASUREMENT PROCEDURE .....                                | 15        |
| 5.3 TEST CONFIGURATION .....                                   | 16        |
| 5.4 TEST RESULTS OF POWER SPECTRUM DENSITY .....               | 16        |
| <b>6 EMISSION OUTSIDE THE FREQUENCY BAND .....</b>             | <b>17</b> |
| 6.1 LIMIT .....                                                | 17        |
| 6.2 MEASUREMENT PROCEDURE .....                                | 17        |
| 6.3 TEST CONFIGURATION .....                                   | 18        |
| 6.4 THE RESULTS OF EMISSION OUTSIDE THE FREQUENCY BAND.....    | 18        |
| <b>7 RADIATED EMISSIONS IN RESTRICTED FREQUENCY BANDS.....</b> | <b>19</b> |
| 7.1 LIMIT .....                                                | 19        |
| 7.2 MEASUREMENT PROCEDURE .....                                | 19        |
| 7.3 TEST CONFIGURATION .....                                   | 21        |
| 7.4 TEST RESULTS OF RADIATED EMISSIONS .....                   | 23        |

|                                       |                                                    |           |
|---------------------------------------|----------------------------------------------------|-----------|
| <b>8</b>                              | <b>POWER LINE CONDUCTED EMISSION.....</b>          | <b>28</b> |
| 8.1                                   | MEASUREMENT PROCEDURE .....                        | 28        |
| 8.2                                   | TEST CONFIGURATION .....                           | 28        |
| 8.3                                   | TEST RESULTS OF POWER LINE CONDUCTED EMISSION..... | 29        |
| <b>9</b>                              | <b>ANTENNA REQUIREMENT .....</b>                   | <b>31</b> |
| <b>10</b>                             | <b>OCCUPIED BANDWIDTH .....</b>                    | <b>32</b> |
| 10.1                                  | LIMIT .....                                        | 32        |
| 10.2                                  | MEASUREMENT PROCEDURE .....                        | 32        |
| 10.3                                  | TEST CONFIGURATION .....                           | 32        |
| 10.4                                  | THE RESULTS OF OCCUPIED BANDWIDTH .....            | 32        |
| <b>APPENDIX A: TEST RESULTS .....</b> |                                                    | <b>33</b> |
| 1.1                                   | DUTY CYCLE .....                                   | 33        |
| 1.1.1                                 | Test Result and Data .....                         | 33        |
| 1.2                                   | RF OUTPUT POWER .....                              | 36        |
| 1.2.1                                 | Test Result and Data .....                         | 36        |
| 1.3                                   | 6dB DOWN BANDWIDTH.....                            | 39        |
| 1.3.1                                 | Test Result and Data .....                         | 39        |
| 1.4                                   | 99% BANDWIDTH .....                                | 42        |
| 1.4.1                                 | Test Result and Data .....                         | 42        |
| 1.5                                   | POWER SPECTRAL DENSITY .....                       | 45        |
| 1.5.1                                 | Test Result and Data .....                         | 45        |
| 1.6                                   | TRANSMITTER SPURIOUS EMISSION .....                | 48        |
| 1.6.1                                 | Test Result and Data .....                         | 48        |

### Revision History

| Issue No.        | Version | Description             | Date Issued  |
|------------------|---------|-------------------------|--------------|
| 180400376SHA-001 | Rev. 01 | Initial issue of report | May 15, 2018 |

## 1 GENERAL INFORMATION

### 1.1 Description of Equipment Under Test (EUT)

Product name : Self-ballasted LED Lamp

Type/Model : L2

Description of EUT : The EUT is a smart bulb with 2.4G WIFI, there is only one mode, we test it and list the results in this report.

Rating : 120V/60Hz 8.5w

Sample received date : April 03, 2018

Date of test : April 04, 2018 – April 28, 2018

### 1.2 RF Technical Information

Assigned Frequency : 2400MHz to 2483.5MHz  
Band

Operating Frequency : 802.11b/g/n(HT20): 2412MHz to 2462MHz

Type of Modulation : 802.11b: DSSS (DBPSK, DQPSK, CCK)  
802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM)  
802.11n(HT20): OFDM (BPSK, QPSK, 16QAM, 64QAM)

Number of Channels : 802.11b/g/n(HT20): 11 Channels

Channel Separation : 5MHz

Antenna Type : PCB antenna

Antenna Gain : -1.31dBi

FCC ID : 2AMIL-L2

IC ID : 23374-L2

### 1.3 Description of Test Facility

Name : Intertek Testing Services Shanghai  
Address : Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China  
Telephone : 86 21 61278200  
Telefax : 86 21 54262353

The test facility is : CNAS Accreditation Lab  
recognized, certified, or Registration No. CNAS L0139  
accredited by these FCC Accredited Lab  
organizations Designation Number: CN1175  
IC Registration Lab  
Registration code No.: 2042B-1  
VCCI Registration Lab  
Registration No.: R-4243, G-845, C-4723, T-2252  
NVLAP Accreditation Lab  
NVLAP LAB CODE: 200849-0  
A2LA Accreditation Lab  
Certificate Number: 3309.02

## 2 TEST SPECIFICATIONS

### 2.1 Standards or specification

47CFR Part 15 (2017)  
ANSI C63.10 (2013)  
KDB 558074 (v04)  
KDB 662911 D01 (v02r01)  
RSS-247 Issue 2 (February 2017)  
RSS-Gen Issue 4 (December 2014)

### 2.2 Mode of operation during the test

Three axes (X, Y, Z) were observed while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded. Compare with the test results that X axis is the worst case.

While testing transmitting mode of EUT, the continuously transmission was applied by following software.

| Software name | Manufacturer | Version | Supplied by |
|---------------|--------------|---------|-------------|
| QA Tool       | -            | -       | Client      |

The lowest, middle and highest channel were tested as representatives.

| Frequency Band (MHz) | Mode          | Lowest (MHz) | Middle (MHz) | Highest (MHz) |
|----------------------|---------------|--------------|--------------|---------------|
| 2400-2483.5          | 802.11b       | 2412         | 2437         | 2462          |
|                      | 802.11g       | 2412         | 2437         | 2462          |
|                      | 802.11n(HT20) | 2412         | 2437         | 2462          |
|                      | 802.11n(HT40) | 2422         | 2437         | 2452          |

MIMO Function Description:

| Frequency Band (MHz) | Mode          | Tx/Rx Function | Beamforming function | CDD function | Directional gain (dBi) | Note |
|----------------------|---------------|----------------|----------------------|--------------|------------------------|------|
| 2400-2483.5          | 802.11b       | 1TX/1RX        | NO                   | NO           | G <sub>ANT</sub>       | -    |
|                      | 802.11g       | 1TX/1RX        | NO                   | NO           | G <sub>ANT</sub>       | -    |
|                      | 802.11n(HT20) | 2TX/2RX        | NO                   | NO           | 3.02                   | -    |
|                      | 802.11n(HT40) | 2TX/2RX        | NO                   | NO           | 3.02                   | -    |

Note: all transmit signals are completely uncorrelated with each other.

After this pre-scan, the following data rate was chosen to do the test as the worst case.

| Frequency Band (MHz) | Mode          | Worst case data rate |
|----------------------|---------------|----------------------|
| 2400-2483.5          | 802.11b       | 1Mbps                |
|                      | 802.11g       | 6Mbps                |
|                      | 802.11n(HT20) | MCS8                 |
|                      | 802.11n(HT40) | MCS8                 |

### 2.3 Test environment condition:

|                       |            |
|-----------------------|------------|
| Temperature:          | 20-26°C    |
| Humidity:             | 52-60% RH  |
| Atmospheric Pressure: | 101-102kPa |

### 2.4 Test peripherals used

| Item No | Description     | Manufacturer | Model No. | Serial Number |
|---------|-----------------|--------------|-----------|---------------|
| 1       | Laptop computer | HP           | 4230s     | -             |

### 2.5 Test software list:

| Test Items         | Software | Manufacturer | Version |
|--------------------|----------|--------------|---------|
| Conducted emission | ESxS-K1  | R&S          | V2.1.0  |
| Radiated emission  | ES-K1    | R&S          | V1.71   |



## 2.6 Instrument list

| Conducted Emission                  |                              |                   |                   |              |            |
|-------------------------------------|------------------------------|-------------------|-------------------|--------------|------------|
| Used                                | Equipment                    | Manufacturer      | Type              | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | Test Receiver                | R&S               | ESCS 30           | EC 2107      | 2018-09-12 |
| <input checked="" type="checkbox"/> | A.M.N.                       | R&S               | ESH2-Z5           | EC 3119      | 2018-12-01 |
| <input type="checkbox"/>            | A.M.N.                       | R&S               | ENV 216           | EC 3393      | 2018-07-30 |
| Radiated Emission                   |                              |                   |                   |              |            |
| Used                                | Equipment                    | Manufacturer      | Type              | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | Test Receiver                | R&S               | ESIB 26           | EC 3045      | 2018-09-12 |
| <input checked="" type="checkbox"/> | Bilog Antenna                | TESEQ             | CBL 6112D         | EC 4206      | 2018-05-30 |
| <input type="checkbox"/>            | Horn antenna                 | R&S               | HF 906            | EC 3049      | 2018-09-23 |
| <input checked="" type="checkbox"/> | Horn antenna                 | ETS               | 3117              | EC 4792-1    | 2018-08-24 |
| <input checked="" type="checkbox"/> | Horn antenna                 | TOYO              | HAP18-26W         | EC 4792-3    | 2020-07-09 |
| <input checked="" type="checkbox"/> | Pre-amplifier                | R&S               | Pre-amp 18        | EC5881       | 2018-06-19 |
| <input checked="" type="checkbox"/> | Active loop antenna          | Schwarzbeck       | FMZB1519          | EC 5345      | 2019-01-25 |
| RF test                             |                              |                   |                   |              |            |
| Used                                | Equipment                    | Manufacturer      | Type              | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | PXA Signal Analyzer          | Keysight          | N9030A            | EC 5338      | 2018-09-10 |
| <input type="checkbox"/>            | Power sensor/<br>Power meter | Agilent           | N1911A/<br>N1921A | EC4318       | 2019-05-12 |
| <input type="checkbox"/>            | Test Receiver                | R&S               | ESCI 7            | EC 4501      | 2018-09-12 |
| Tet Site                            |                              |                   |                   |              |            |
| Used                                | Equipment                    | Manufacturer      | Type              | Internal no. | Due date   |
| <input type="checkbox"/>            | Shielded room                | Zhongyu           | -                 | EC 2838      | 2019-01-08 |
| <input checked="" type="checkbox"/> | Semi-anechoic chamber        | Albatross project | -                 | EC 3048      | 2019-03-09 |
| Additional instrument               |                              |                   |                   |              |            |
| Used                                | Equipment                    | Manufacturer      | Type              | Internal no. | Due date   |
| <input type="checkbox"/>            | Therom-Hygrograph            | ZJ1-2A            | S.M.I.F.          | EC 3323      | 2018-06-14 |
| <input type="checkbox"/>            | Therom-Hygrograph            | ZJ1-2A            | S.M.I.F.          | EC 3324      | 2019-04-09 |
| <input checked="" type="checkbox"/> | Therom-Hygrograph            | ZJ1-2A            | S.M.I.F.          | EC 3325      | 2019-03-23 |
| <input checked="" type="checkbox"/> | Pressure meter               | YM3               | Shanghai Mengde   | EC 3320      | 2018-06-28 |

## 2.7 Measurement Uncertainty

| Test Items                                                     | Expanded Uncertainty<br>(k=2) ( $\pm$ ) |
|----------------------------------------------------------------|-----------------------------------------|
| Maximum conducted output power                                 | 0.74dB                                  |
| Radiated Emissions in restricted frequency bands<br>below 1GHz | 4.90dB                                  |
| Radiated Emissions in restricted frequency bands<br>above 1GHz | 5.02dB                                  |
| Emission outside the frequency band                            | 2.89dB                                  |
| Power line conducted emission                                  | 3.19dB                                  |

## 2.8 Test Summary

**This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Services Shanghai.**

| TEST ITEM                                           | FCC REFERENCE   | IC REFERENCE                         | RESULT |
|-----------------------------------------------------|-----------------|--------------------------------------|--------|
| Minimum 6dB bandwidth                               | 15.247(a)(2)    | RSS-247 Issue 2<br>Clause 5.2        | Pass   |
| Maximum conducted output power<br>and e.i.r.p.      | 15.247(b)       | RSS-247 Issue 2<br>Clause 5.4        | Pass   |
| Power Spectrum density                              | 15.247(e)       | RSS-247 Issue 2<br>Clause 5.2        | Pass   |
| Emission outside the frequency band                 | 15.247(d)       | RSS-247 Issue 2<br>Clause 5.5        | Pass   |
| Radiated Emissions in restricted<br>frequency bands | 15.205 & 15.209 | RSS-Gen Issue 4<br>Clause 8.9 & 8.10 | Pass   |
| Power line conducted emission                       | 15.207          | RSS-Gen Issue 4<br>Clause 8.8        | Pass   |
| Antenna requirement                                 | 15.203          | -                                    | Pass   |
| Occupied bandwidth                                  | -               | RSS-Gen Issue 4<br>Clause 6.6        | Tested |

Notes: 1: NA =Not Applicable

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### 3 Minimum 6dB bandwidth

Test result: Pass

#### 3.1 Limit

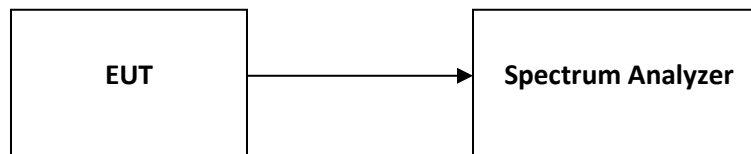
For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

#### 3.2 Measurement Procedure

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- 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.

#### 3.3 Test Configuration



#### 3.4 Test Results of Minimum 6dB bandwidth

Please refer to Appendix A

## 4 Maximum conducted output power and e.i.r.p.

Test result: Pass

### 4.1 Limit

- ☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
- ☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
- ☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 W. (The e.i.r.p. shall not exceed 4 W)

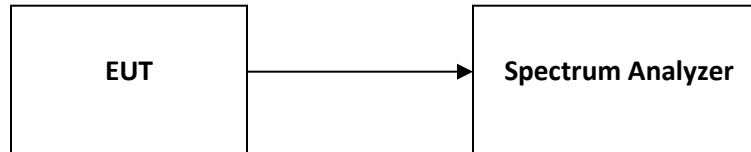
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

### 4.2 Measurement Procedure

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 9.2.2.4).

- a) Measure the duty cycle,  $x$ , of the transmitter output signal as described in Section 6.0.
- b) Set span to at least  $1.5 \times \text{OBW}$ .
- c) Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
- d) Set VBW  $\geq 3 \times \text{RBW}$ .
- e) Number of points in sweep  $\geq 2 \times \text{span} / \text{RBW}$ . (This gives bin-to-bin spacing  $\leq \text{RBW}/2$ , so that narrowband signals are not lost between frequency bins.)
- f) Sweep time = auto.
- g) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- h) Do not use sweep triggering. Allow the sweep to “free run”.
- i) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
- j) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
- k) Add  $10 \log (1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on- and off-times of the transmission). For example, add  $10 \log (1/0.25) = 6 \text{ dB}$  if the duty cycle is 25 %.

#### 4.3 Test Configuration



#### 4.4 Test Results of Maximum conducted output power

Please refer to Appendix A

## 5 Power spectrum density

Test result: Pass

### 5.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and  $8 + (6 - \text{antenna gain} - \text{beam forming gain})$ .

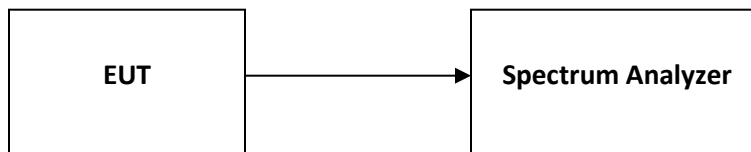
### 5.2 Measurement Procedure

The power output per FCC §15.247(e) was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” (clause 10.5) for compliance to FCC 47CFR 15.247 requirements.

This procedure is applicable when the EUT cannot be configured to transmit continuously (i.e., duty cycle < 98 %), and when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than  $\pm 2$  %):

- a) Measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.
- b) Set instrument center frequency to DTS channel center frequency.
- c) Set span to at least  $1.5 \times \text{OBW}$ .
- d) Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- e) Set VBW  $\geq 3 \times \text{RBW}$ .
- f) Detector = power averaging (RMS) or sample detector (when RMS not available).
- g) Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span/RBW}$ .
- h) Sweep time = auto couple.
- i) Do not use sweep triggering. Allow sweep to “free run”.
- j) Employ trace averaging (RMS) mode over a minimum of 100 traces.
- k) Use the peak marker function to determine the maximum amplitude level.
- l) Add  $10 \log (1/x)$ , where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.
- m) If resultant value exceeds the limit, then reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

### 5.3 Test Configuration



### 5.4 Test Results of Power spectrum density

Please refer to Appendix A



## 6 Emission outside the frequency band

Test result: Pass

### 6.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 6.2 Measurement Procedure

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

#### Reference level measurement

Establish a reference level by using the following procedure:

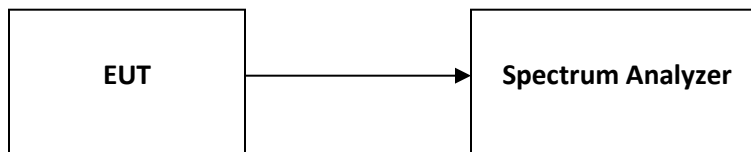
- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to  $\geq 1.5$  times the DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW  $\geq 3 \times$  RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

#### Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW  $\geq 3 \times$  RBW.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

### 6.3 Test Configuration



### 6.4 The results of Emission outside the frequency band

Please refer to Appendix A

## 7 Radiated Emissions in restricted frequency bands

**Test result:** Pass

### 7.1 Limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

| Frequencies<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                                |

### 7.2 Measurement Procedure

**For Radiated emission below 30MHz:**

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Both X and Y axes of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**NOTE:**

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

**For Radiated emission above 30MHz:**

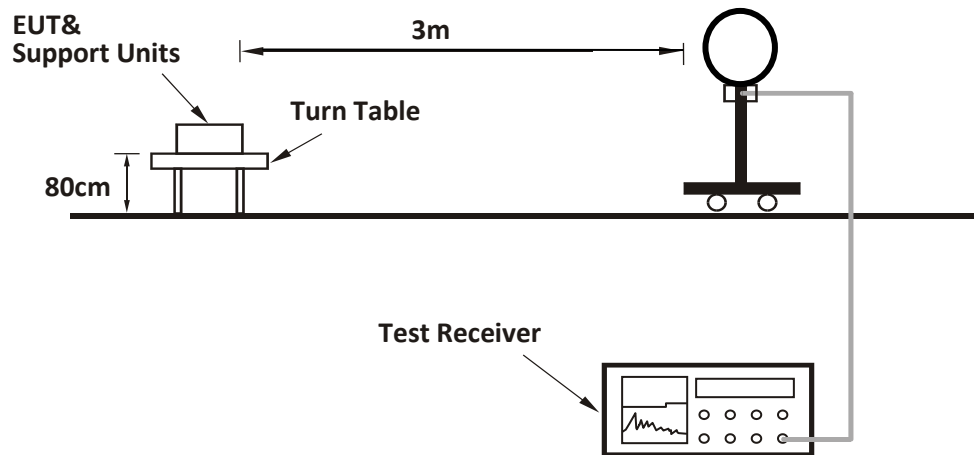
- a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

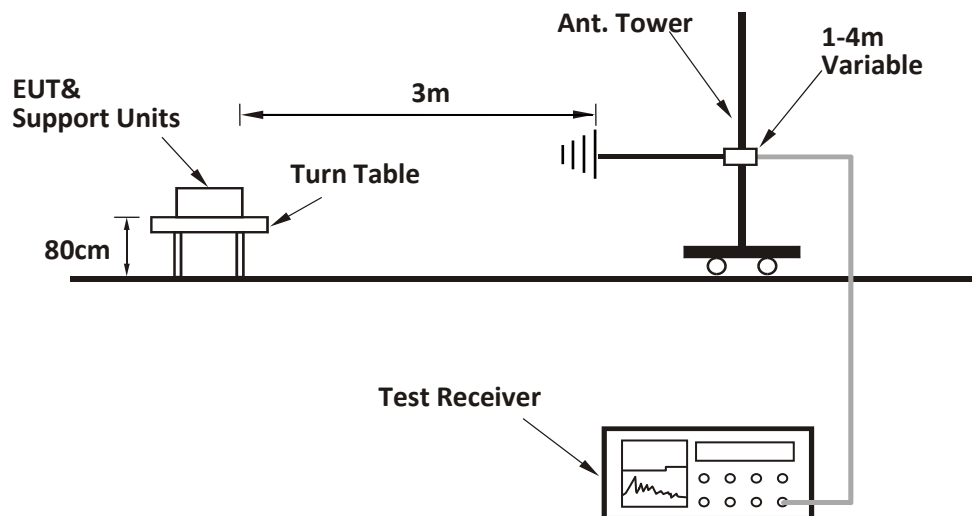
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

### 7.3 Test Configuration

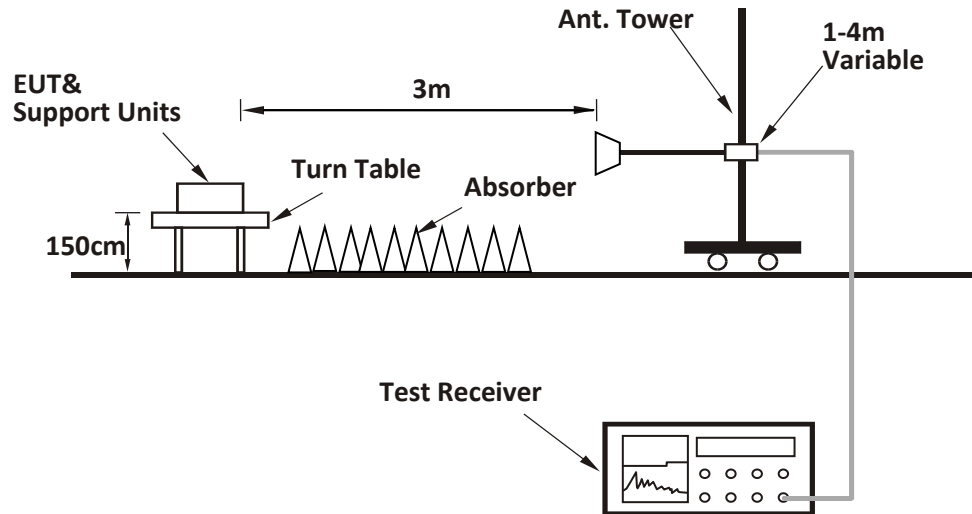
**For Radiated emission below 30MHz:**



**For Radiated emission 30MHz to 1GHz:**



**For Radiated emission above 1GHz:**



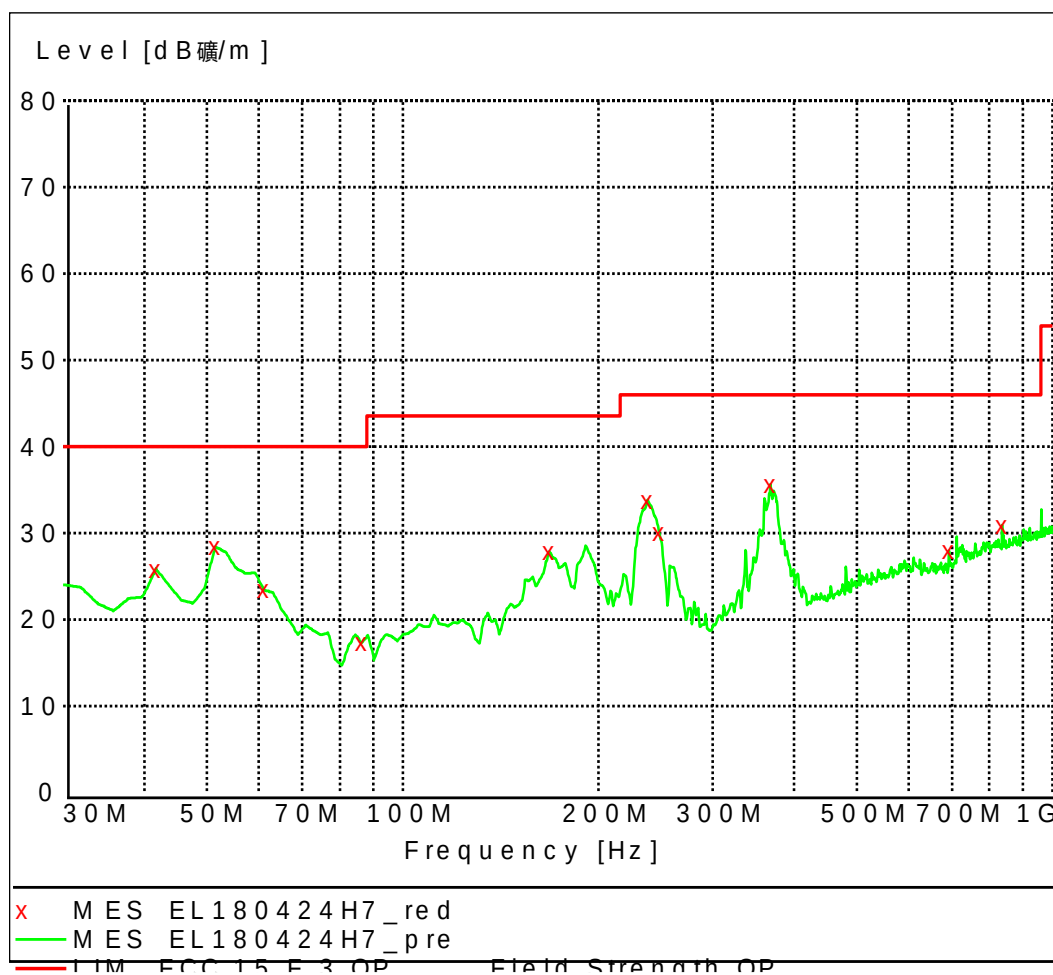
## 7.4 Test Results of Radiated Emissions

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

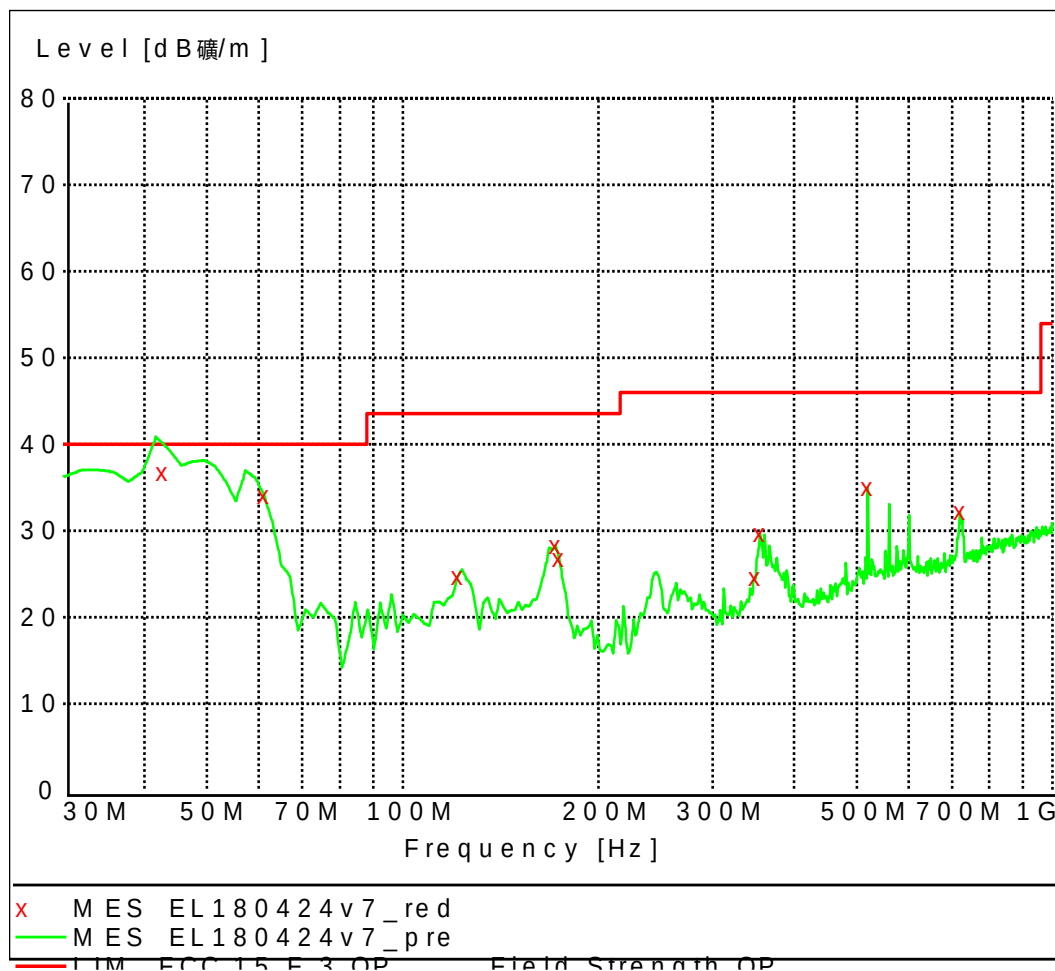
EUT was tested with Bluetooth on and off, and the worst data was listed in the report.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



Test data below 1GHz

| Antenna | Frequency (MHz) | Corrected Reading (dBuV/m) | Correct Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---------|-----------------|----------------------------|-----------------------|----------------|-------------|----------|
| H       | 41.66           | 25.80                      | 12.6                  | 40.000         | 14.20       | PK       |
| H       | 51.38           | 28.4                       | 8.500                 | 40.00          | 11.60       | PK       |
| H       | 168.02          | 27.9                       | 10.800                | 43.50          | 15.60       | PK       |
| H       | 238.00          | 33.8                       | 12.600                | 46.00          | 12.20       | PK       |
| H       | 368.24          | 35.6                       | 16.500                | 46.00          | 10.40       | PK       |
| H       | 836.71          | 30.9                       | 22.600                | 46.00          | 15.10       | PK       |
| V       | 42.68           | 36.8                       | 12.600                | 40.00          | 3.30        | PK       |



|   |        |      |        |       |       |    |
|---|--------|------|--------|-------|-------|----|
| V | 61.10  | 34.1 | 7.000  | 40.00 | 5.90  | PK |
| V | 171.90 | 28.3 | 10.700 | 43.50 | 15.20 | PK |
| V | 173.85 | 26.8 | 10.600 | 43.50 | 16.70 | PK |
| V | 519.86 | 35.1 | 19.500 | 46.00 | 10.90 | PK |
| V | 720.08 | 32.2 | 21.200 | 46.00 | 13.80 | PK |

### Test result above 1GHz:

The emission was conducted from 1GHz to 25GHz

#### 802.11b

| CH | Antenna | Frequency (MHz) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|----------------------------|----------------|-------------|----------|
| L  | H       | 2412            | 106.55                     | Fundamental    | /           | PK       |
|    | H       | 2344.87         | 53.58                      | 74             | 20.42       | PK       |
|    | V       | 2453.87         | 52.41                      | 74             | 21.59       | PK       |
|    | H       | 4824.54         | 44.4                       | 74             | 29.6        | PK       |
| M  | H       | 2437            | 106.01                     | Fundamental    | /           | PK       |
|    | H       | 4874.15         | 45.8                       | 74             | 28.2        | PK       |
| H  | H       | 2462            | 106                        | Fundamental    | /           | PK       |
|    | H       | 2483.63         | 43.23                      | 74             | 30.77       | PK       |
|    | V       | 2483.63         | 52.3                       | 74             | 21.7        | PK       |
|    | H       | 4924.8          | 45.74                      | 74             | 28.26       | PK       |

#### 802.11g

| CH | Antenna | Frequency (MHz) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|----------------------------|----------------|-------------|----------|
| L  | H       | 2412            | 107.56                     | Fundamental    | /           | PK       |
|    | H       | 2388.48         | 58.08                      | 74             | 15.92       | PK       |
|    | H       | 2388.48         | 45.15                      | 54             | 8.85        | AV       |
|    | V       | 2388.48         | 60.2                       | 74             | 13.8        | PK       |

|   |   |         |        |             |       |    |
|---|---|---------|--------|-------------|-------|----|
|   | V | 2388.48 | 43.5   | 54          | 10.5  | AV |
| M | H | 2437    | 105.23 | Fundamental | /     | PK |
|   | H | 4874.6  | 51.98  | 74          | 22.02 | PK |
| H | H | 2462    | 105.98 | Fundamental | /     | PK |
|   | H | 2483.5  | 60.13  | 74          | 13.87 | PK |
|   | H | 2483.5  | 44     | 54          | 10    | AV |
|   | V | 2483.5  | 57.8   | 74          | 16.2  | PK |
|   | V | 2483.5  | 43     | 54          | 11    | AV |

802.11n(HT20)

| CH | Antenna | Frequency (MHz) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|----------------------------|----------------|-------------|----------|
| L  | H       | 2412            | 109.4                      | Fundamental    | /           | PK       |
|    | H       | 2390            | 66.92                      | 74             | 7.08        | PK       |
|    | H       | 2390            | 49.5                       | 54             | 4.5         | AV       |
|    | V       | 2390            | 63.02                      | 74             | 10.98       | PK       |
|    | V       | 2390            | 46.5                       | 54             | 7.5         | AV       |
|    | H       | 4824.6          | 47.2                       | 74             | 26.8        | PK       |
| M  | H       | 2437            | 108.7                      | Fundamental    | /           | PK       |
|    | H       | 4874.2          | 49.23                      | 74             | 24.77       | PK       |
| H  | H       | 2462            | 107.9                      | Fundamental    | /           | PK       |
|    | H       | 2483.5          | 65.94                      | 74             | 8.06        | PK       |
|    | H       | 2483.5          | 47                         | 54             | 7           | AV       |
|    | V       | 2483.5          | 62.5                       | 74             | 11.5        | PK       |
|    | V       | 2483.5          | 46                         | 54             | 8           | AV       |

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.  
2. Corrected Reading = Original Receiver Reading + Correct Factor  
3. Margin = Limit - Corrected Reading  
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,  
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,  
Limit = 40.00dBuV/m.  
Then Correct Factor =  $30.20 + 2.00 - 32.00 = 0.20\text{dB/m}$ ;  
Corrected Reading =  $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$ ;  
Margin =  $40.00\text{dBuV/m} - 10.20\text{dBuV/m} = 29.80\text{dB}$ .

## 8 Power line conducted emission

**Test result:** Pass

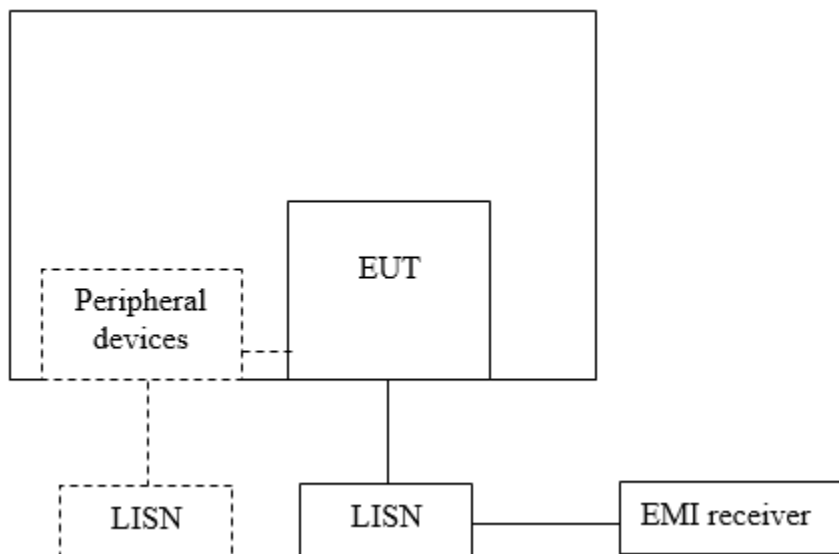
### 8.1 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50  $\Omega$  LISN port (to which the EUT is connected), where permitted, terminated into a 50  $\Omega$  measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50  $\Omega$  measuring port is terminated by a measuring instrument having 50  $\Omega$  input impedance. All other ports are terminated in 50  $\Omega$  loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

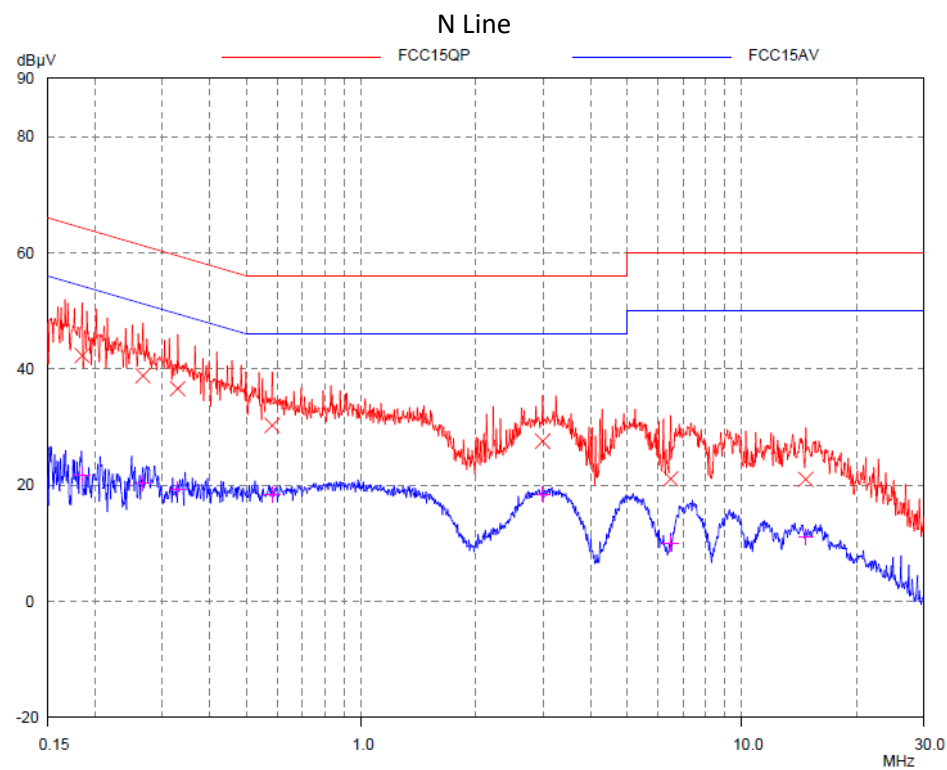
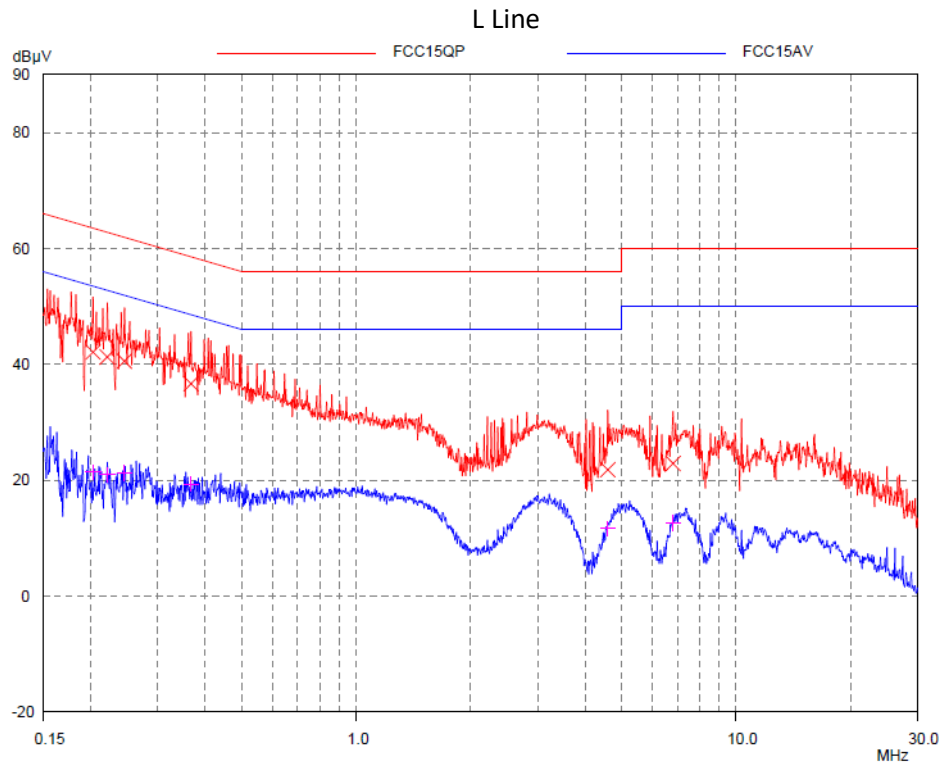
The bandwidth of the test receiver is set at 9 kHz.

### 8.2 Test Configuration



### 8.3 Test Results of Power line conducted emission

Test Curve:



**Test Data:**

| Frequency<br>(MHz)                                              | Quasi-peak                     |                 |                | Average                        |                 |                | Line |
|-----------------------------------------------------------------|--------------------------------|-----------------|----------------|--------------------------------|-----------------|----------------|------|
|                                                                 | Corrected<br>Reading<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Corrected<br>Reading<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) |      |
| 0.202                                                           | 42.11                          | 63.5            | 21.400         | 21.37                          | 53.5            | 32.140         | L    |
| 0.221                                                           | 41.29                          | 62.8            | 21.490         | 20.96                          | 52.8            | 31.820         | L    |
| 0.245                                                           | 40.56                          | 61.9            | 21.360         | 21.28                          | 51.9            | 30.640         | L    |
| 0.367                                                           | 36.67                          | 58.6            | 21.900         | 19.35                          | 48.6            | 29.220         | L    |
| 4.591                                                           | 21.82                          | 56.0            | 34.180         | 11.68                          | 46.0            | 34.320         | L    |
| 6.816                                                           | 22.91                          | 60.0            | 37.090         | 12.65                          | 50.0            | 37.350         | L    |
| 0.185                                                           | 42.32                          | 64.3            | 21.960         | 21.73                          | 54.3            | 32.550         | N    |
| 0.267                                                           | 38.84                          | 61.2            | 22.390         | 20.33                          | 51.2            | 30.900         | N    |
| 0.329                                                           | 36.60                          | 59.5            | 22.870         | 19.34                          | 49.5            | 30.130         | N    |
| 0.583                                                           | 30.29                          | 56.0            | 25.710         | 18.41                          | 46.0            | 27.590         | N    |
| 2.995                                                           | 27.58                          | 56.0            | 28.420         | 18.48                          | 46.0            | 27.520         | N    |
| 6.497                                                           | 21.09                          | 60.0            | 38.910         | 9.98                           | 50.0            | 40.020         | N    |
| Note: * means the emission level 20dB below the relevant limit. |                                |                 |                |                                |                 |                |      |

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming LISN Factor = 10.00dB, Cable Loss = 2.00dB,

Original Receiver Reading = 10.00dBuV, Limit = 66.00dBuV.

Then Correct Factor = 10.00 + 2.00 = 12.00dB;

Corrected Reading = 10dBuV + 12.00dB = 22.00dBuV;

Margin = 66.00dBuV – 22.00dBuV = 44.00dB.

## 9 Antenna requirement

**Requirement:**

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.

**Result:**

EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

## 10 Occupied Bandwidth

**Test result:**      **Pass**

### 10.1 Limit

None

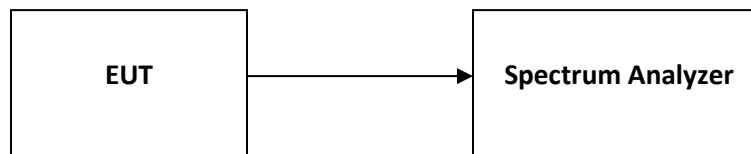
### 10.2 Measurement Procedure

The occupied bandwidth per RSS-Gen Issue 4 Clause 6.6 was measured using the Spectrum Analyzer.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

### 10.3 Test Configuration



### 10.4 The results of Occupied Bandwidth

Please refer to Appendix A

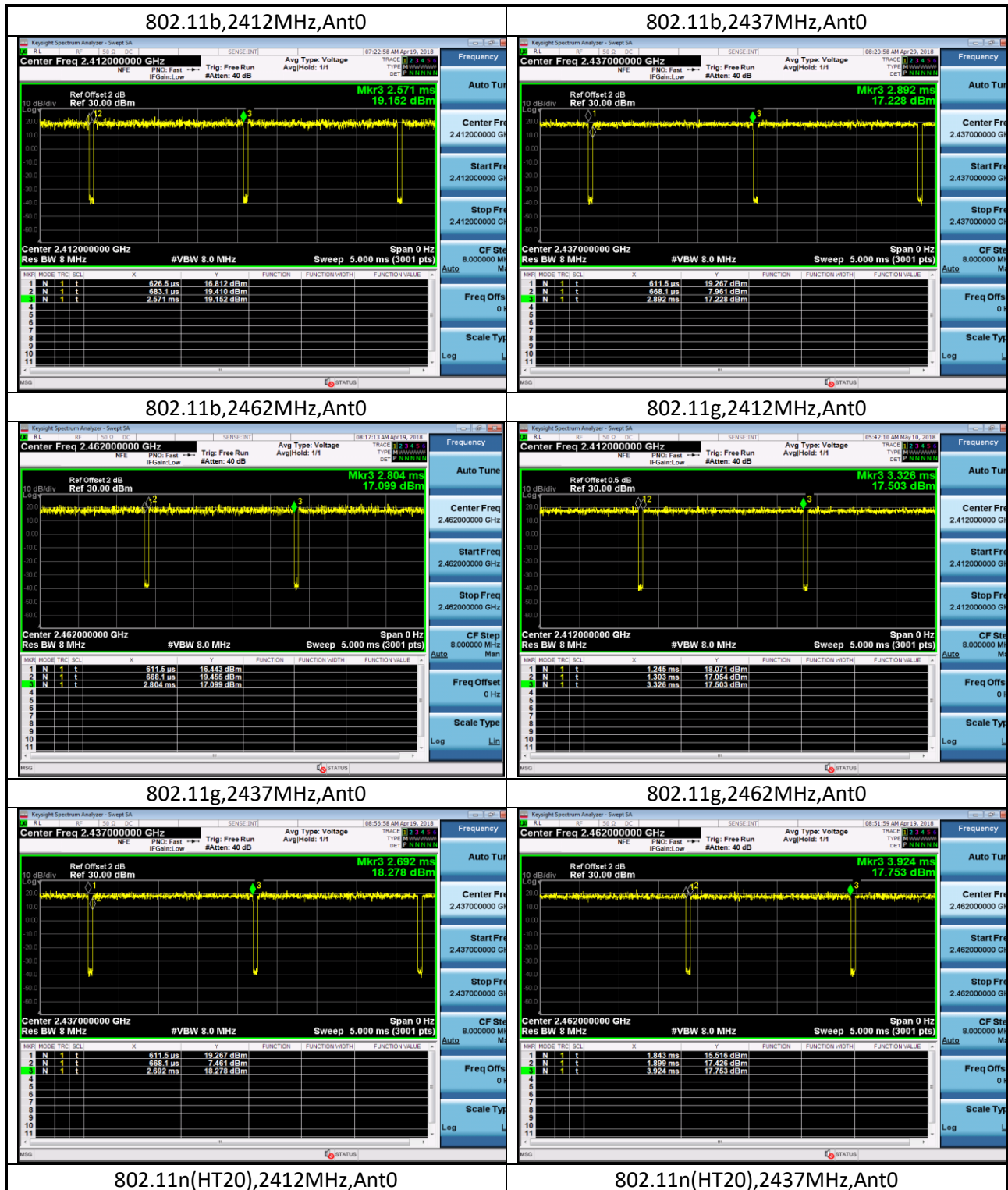


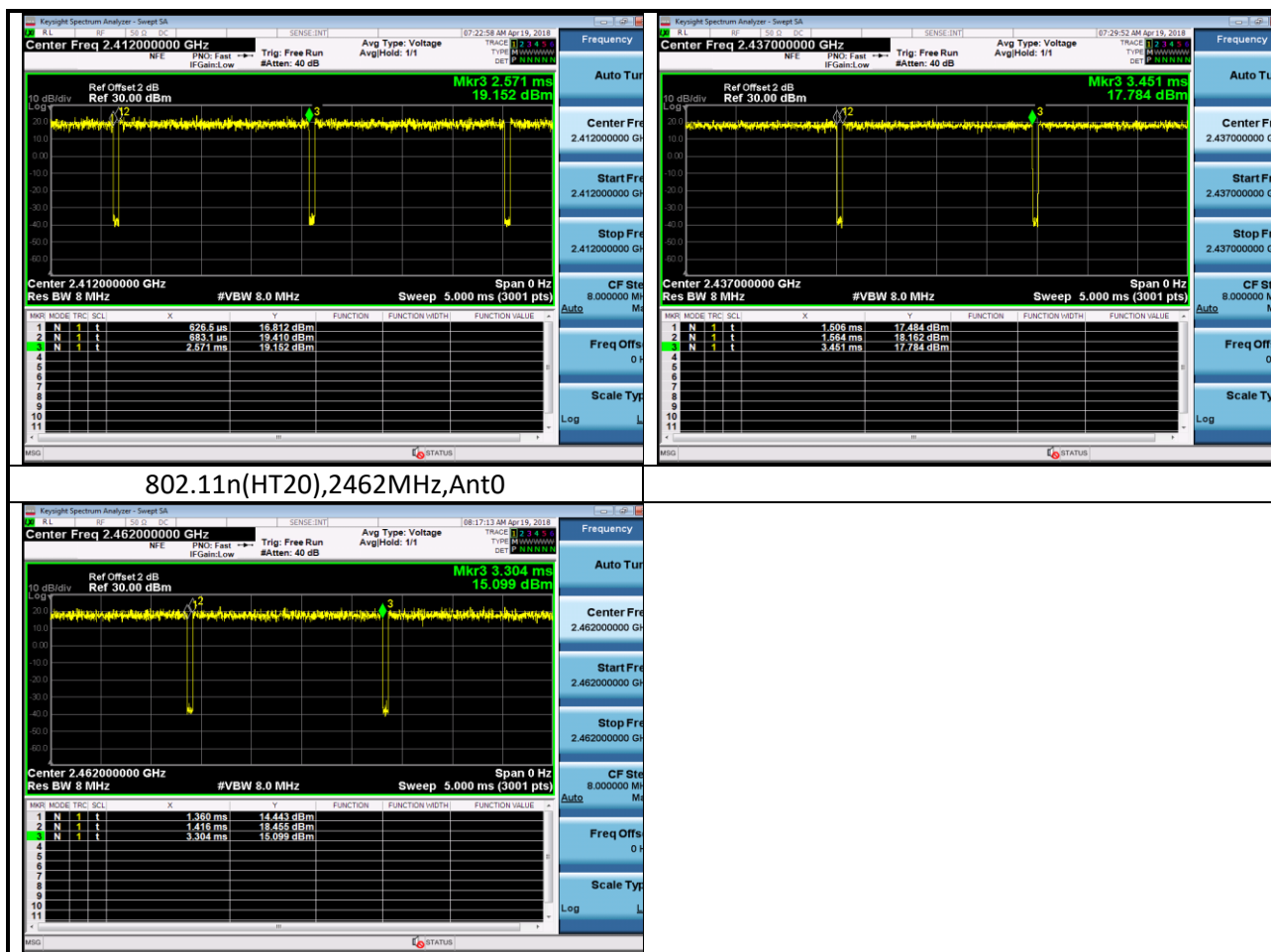
## Appendix A: Test results

### 1.1 Duty Cycle

#### 1.1.1 Test Result and Data

| WLAN Duty Cycle |                     |      |               |                        |
|-----------------|---------------------|------|---------------|------------------------|
| Mode            | Test Frequency(MHz) | Ant  | Duty Cycle(%) | Duty Cycle Factor (dB) |
| 802.11b         | 2412                | Ant0 | 97.35         | 0.12                   |
| 802.11b         | 2437                | Ant0 | 97.52         | 0.12                   |
| 802.11b         | 2462                | Ant0 | 97.42         | 0.12                   |
| 802.11g         | 2412                | Ant0 | 97.20         | 0.12                   |
| 802.11g         | 2437                | Ant0 | 97.28         | 0.12                   |
| 802.11g         | 2462                | Ant0 | 97.28         | 0.12                   |
| 802.11n(HT20)   | 2412                | Ant0 | 97.09         | 0.13                   |
| 802.11n(HT20)   | 2437                | Ant0 | 97.00         | 0.13                   |
| 802.11n(HT20)   | 2462                | Ant0 | 97.09         | 0.13                   |



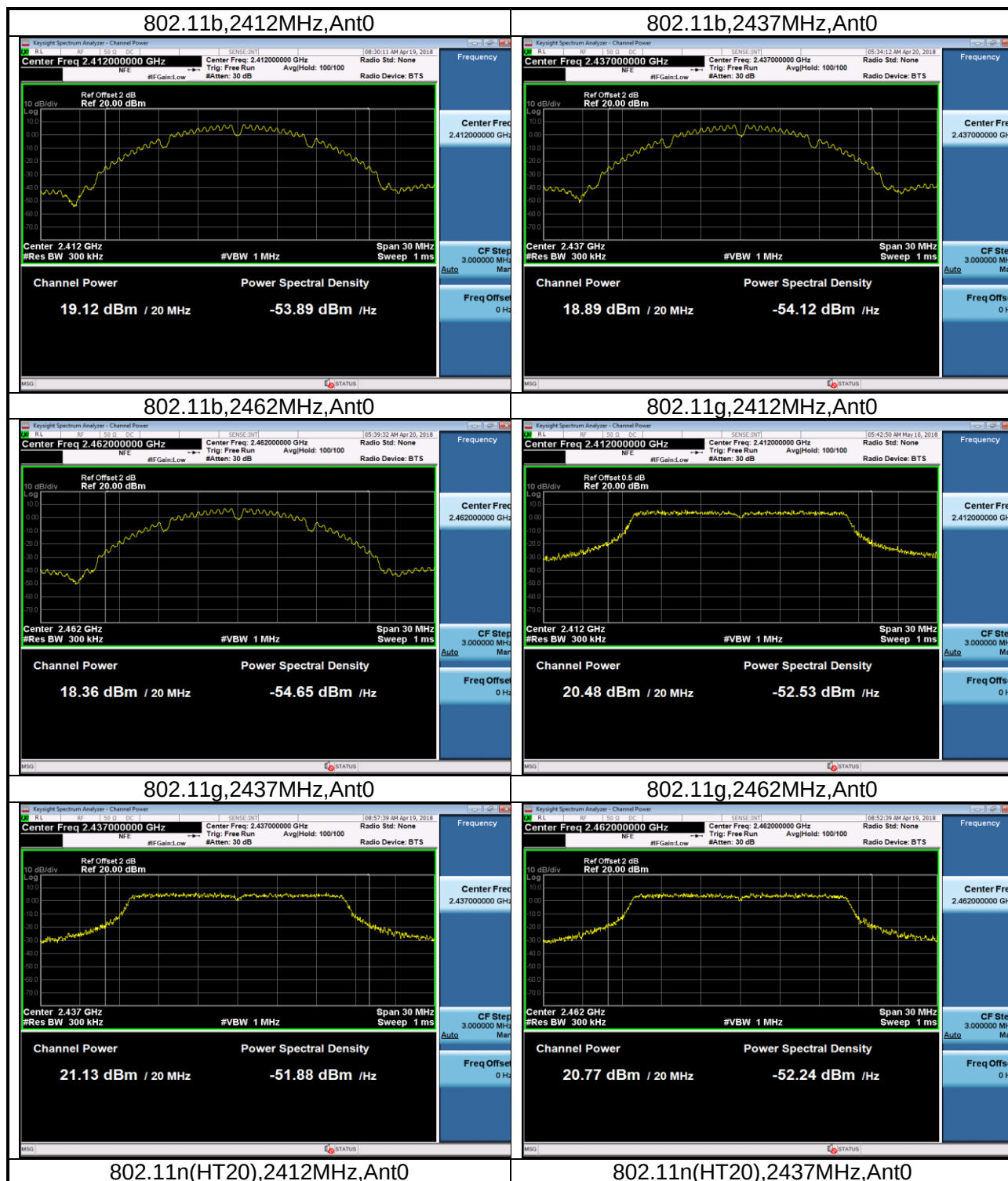


## 1.2 RF Output Power

### 1.2.1 Test Result and Data

| WLAN AVGSA Output Power |                      |      |                        |                 |             |            |        |
|-------------------------|----------------------|------|------------------------|-----------------|-------------|------------|--------|
| Mode                    | Test Frequency (MHz) | Ant  | Duty Cycle Factor (dB) | Max Power (dBm) | Limit (dBm) | EIRP (dBm) | Result |
| 802.11b                 | 2412                 | Ant0 | 0.12                   | 19.24           | 30          | 17.93      | Pass   |
| 802.11b                 | 2437                 | Ant0 | 0.12                   | 19.01           | 30          | 17.70      | Pass   |
| 802.11b                 | 2462                 | Ant0 | 0.12                   | 18.48           | 30          | 17.17      | Pass   |
| 802.11g                 | 2412                 | Ant0 | 0.12                   | 20.60           | 30          | 19.29      | Pass   |
| 802.11g                 | 2437                 | Ant0 | 0.12                   | 21.25           | 30          | 19.94      | Pass   |
| 802.11g                 | 2462                 | Ant0 | 0.12                   | 20.89           | 30          | 19.58      | Pass   |
| 802.11n (HT20)          | 2412                 | Ant0 | 0.13                   | 21.77           | 30          | 20.46      | Pass   |
| 802.11n (HT20)          | 2437                 | Ant0 | 0.13                   | 21.31           | 30          | 20.00      | Pass   |
| 802.11n (HT20)          | 2462                 | Ant0 | 0.13                   | 20.79           | 30          | 19.48      | Pass   |

The Max EIRP is 20.46dBm=0.111W<4W, complies with IC requirements.





### 1.3 6dB Down Bandwidth

#### 1.3.1 Test Result and Data

| WLAN Occupied 6dB Bandwidth |                      |      |                          |        |
|-----------------------------|----------------------|------|--------------------------|--------|
| Mode                        | Test Frequency (MHz) | Ant  | Occupied Bandwidth (MHz) | Result |
| 802.11b                     | 2412                 | Ant0 | 8.05                     | Pass   |
| 802.11b                     | 2437                 | Ant0 | 8.58                     | Pass   |
| 802.11b                     | 2462                 | Ant0 | 8.57                     | Pass   |
| 802.11g                     | 2412                 | Ant0 | 16.34                    | Pass   |
| 802.11g                     | 2437                 | Ant0 | 16.30                    | Pass   |
| 802.11g                     | 2462                 | Ant0 | 16.36                    | Pass   |
| 802.11n (HT20)              | 2412                 | Ant0 | 17.13                    | Pass   |
| 802.11n (HT20)              | 2437                 | Ant0 | 17.31                    | Pass   |
| 802.11n (HT20)              | 2462                 | Ant0 | 17.33                    | Pass   |







## 1.4 99% BandWidth

### 1.4.1 Test Result and Data

| WLAN 99% Occupied Bandwidth |                      |      |                              |        |
|-----------------------------|----------------------|------|------------------------------|--------|
| Mode                        | Test Frequency (MHz) | Ant  | 99% Occupied Bandwidth (MHz) | Result |
| 802.11b                     | 2412                 | Ant0 | 13.961                       | Pass   |
| 802.11b                     | 2437                 | Ant0 | 13.966                       | Pass   |
| 802.11b                     | 2462                 | Ant0 | 13.979                       | Pass   |
| 802.11g                     | 2412                 | Ant0 | 16.668                       | Pass   |
| 802.11g                     | 2437                 | Ant0 | 16.656                       | Pass   |
| 802.11g                     | 2462                 | Ant0 | 16.665                       | Pass   |
| 802.11n (HT20)              | 2412                 | Ant0 | 17.775                       | Pass   |
| 802.11n (HT20)              | 2437                 | Ant0 | 17.785                       | Pass   |
| 802.11n (HT20)              | 2462                 | Ant0 | 17.781                       | Pass   |





## 1.5 Power Spectral Density

### 1.5.1 Test Result and Data

| WLAN AVGSA Power Spectral Density |                      |      |                        |           |           |             |        |
|-----------------------------------|----------------------|------|------------------------|-----------|-----------|-------------|--------|
| Mode                              | Test Frequency (MHz) | Ant  | Duty Cycle Factor (dB) | PSD (dBm) | RBW (kHz) | Limit (dBm) | Result |
| 802.11b                           | 2412                 | Ant0 | 0.12                   | 6.750     | 100       | 8           | Pass   |
| 802.11b                           | 2437                 | Ant0 | 0.12                   | 6.146     | 100       | 8           | Pass   |
| 802.11b                           | 2462                 | Ant0 | 0.12                   | 5.803     | 100       | 8           | Pass   |
| 802.11g                           | 2412                 | Ant0 | 0.12                   | 4.140     | 100       | 8           | Pass   |
| 802.11g                           | 2437                 | Ant0 | 0.12                   | 5.053     | 100       | 8           | Pass   |
| 802.11g                           | 2462                 | Ant0 | 0.12                   | 3.603     | 100       | 8           | Pass   |
| 802.11n (HT20)                    | 2412                 | Ant0 | 0.13                   | 5.222     | 100       | 8           | Pass   |
| 802.11n (HT20)                    | 2437                 | Ant0 | 0.13                   | 5.114     | 100       | 8           | Pass   |
| 802.11n (HT20)                    | 2462                 | Ant0 | 0.13                   | 3.811     | 100       | 8           | Pass   |



