



## FCC Test Report (WIFI)

**FCC ID** : 2AFI5TU-IS01

**Applicant** : **Lenoge Technology Ltd.**  
Room 24, 7/F. Nan Fung Commercial Centre, 19 Lam Lok Street,  
Kowloon Bay, Hong Kong

### Sample Description

**Product Name** : **MINI PC**

**Model No.** : TU-IS01

**Serial No.** : N/A

**Trademark** : N/A

**Receipt Date** : 2015-09-14

**Test Date** : 2015-09-15 to 2015-09-18

**Issue Date** : 2015-09-21

**Test Standard(s)** : **FCC CFR Title 47 Part 15 Subpart C Section 15.247**

**Conclusions** : **PASSED\***

\*In the configuration tested, the EUT complied with the standards specified above.

**Test/Witness Engineer** :

*Jason Deng*

**Approved & Authorized** :

*Frank Zhang*

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.



## Contents

|                                                                  |           |
|------------------------------------------------------------------|-----------|
| <b>CONTENTS.....</b>                                             | <b>2</b>  |
| <b>1. GENERAL INFORMATION.....</b>                               | <b>4</b>  |
| 1.1 Client Information.....                                      | 4         |
| 1.2 General Description of EUT (Equipment Under Test).....       | 4         |
| 1.3 Description of Test Mode.....                                | 5         |
| 1.4 Test Instruments List.....                                   | 7         |
| 1.5 Laboratory Location.....                                     | 8         |
| <b>2. TEST SUMMARY.....</b>                                      | <b>9</b>  |
| <b>3. ANTENNA REQUIREMENT.....</b>                               | <b>10</b> |
| 3.1. Standard Requirement.....                                   | 10        |
| 3.2. Antenna Connected Construction.....                         | 10        |
| <b>4. CONDUCTED EMISSION TEST.....</b>                           | <b>11</b> |
| 4.1 Test Standard and Limit.....                                 | 11        |
| 4.2 Test Setup.....                                              | 11        |
| 4.3 Test Procedure.....                                          | 11        |
| 4.4 Test Data.....                                               | 12        |
| <b>5. PEAK OUTPUT POWER TEST.....</b>                            | <b>15</b> |
| 5.1. Test Standard and Limit.....                                | 15        |
| 5.2. Test Setup.....                                             | 15        |
| 5.3. Test Procedure.....                                         | 15        |
| 5.4. Test Data.....                                              | 15        |
| <b>6. OCCUPY BANDWIDTH TEST.....</b>                             | <b>16</b> |
| 6.1. Test Standard and Limit.....                                | 16        |
| 6.2. Test Setup.....                                             | 16        |
| 6.3. Test Procedure.....                                         | 16        |
| 6.4. Test Data.....                                              | 16        |
| <b>7. POWER SPECTRAL DENSITY TEST.....</b>                       | <b>23</b> |
| 7.1. Test Standard and Limit.....                                | 23        |
| 7.2. Test Setup.....                                             | 23        |
| 7.3. Test Procedure.....                                         | 23        |
| 7.4. Test Data.....                                              | 23        |
| <b>8. BAND EDGE REQUIREMENT (CONDUCTED EMISSION METHOD).....</b> | <b>30</b> |
| 8.1. Test Standard and Limit.....                                | 30        |
| 8.2. Test Setup.....                                             | 30        |
| 8.3. Test Procedure.....                                         | 30        |
| 8.4. Test Data.....                                              | 30        |
| <b>9. BAND EDGE REQUIREMENT (RADIATED EMISSION METHOD).....</b>  | <b>33</b> |



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 3 of 57

|                                                               |           |
|---------------------------------------------------------------|-----------|
| 9.1. Test Standard and Limit.....                             | 33        |
| 9.2. Test Setup.....                                          | 33        |
| 9.3. Test Procedure.....                                      | 33        |
| 9.4. Test Data.....                                           | 34        |
| <b>10. SPURIOUS EMISSION (RADIATED EMISSION METHOD).....</b>  | <b>37</b> |
| 10.1 Test Standard and Limit.....                             | 37        |
| 10.2 Test Setup.....                                          | 37        |
| 10.3 Test Procedure.....                                      | 37        |
| 10.4 Test Data.....                                           | 38        |
| <b>11. SPURIOUS EMISSION (CONDUCTED EMISSION METHOD).....</b> | <b>53</b> |
| 11.1 Test Standard and Limit.....                             | 53        |
| 11.2 Test Setup.....                                          | 53        |
| 11.3 Test Procedure.....                                      | 53        |
| 11.4 Test Data.....                                           | 53        |



## 1. General Information

### 1.1 Client Information

|              |   |                                                                                     |
|--------------|---|-------------------------------------------------------------------------------------|
| Applicant    | : | Lenoge Technology Ltd.                                                              |
| Address      | : | Room 24, 7/F. Nan Fung Commercial Centre, 19 Lam Lok Street, Kowloon Bay, Hong Kong |
| Manufacturer | : | Lenoge Technology Ltd.                                                              |
| Address      | : | Room 24, 7/F. Nan Fung Commercial Centre, 19 Lam Lok Street, Kowloon Bay, Hong Kong |

### 1.2 General Description of EUT (Equipment Under Test)

|                     |                        |                                                                                                   |
|---------------------|------------------------|---------------------------------------------------------------------------------------------------|
| Product Name        | :                      | MINI PC                                                                                           |
| Models No.          | :                      | TU-IS01                                                                                           |
| Trademark           | :                      | N/A                                                                                               |
| Remark: N/A         |                        |                                                                                                   |
| Product Description | Operation Frequency:   | 2412MHz~2462MHz<br>(802.11b/802.11g/802.11n(H20))<br>2422MHz-2452MHz<br>(802.11n(H40))            |
|                     | Transfer Rate:         | 802.11b: 1/ 2/ 5.5/ 11Mbps<br>802.11g: 6/ 9/ 12/ 18/ 24/ 36/, 48/54 Mbps<br>802.11n: Up to 65Mbps |
|                     | Number of Channel:     | 11 for 802.11b/802.11g/802.11(H20)<br>7 for 802.11n(H40)                                          |
|                     | Channel separation     | 5MHz                                                                                              |
|                     | Modulation Technology: | 802.11b:DSSS<br>802.11g/ 802.11n:OFDM                                                             |
|                     | Antenna Type:          | Integral Antenna                                                                                  |
|                     | Antenna Gain:          | 0 dBi                                                                                             |
| Power Supply        | :                      | USB DC 5V from USB Port, DC 3.7V from Li-ion battery                                              |

**Note:**

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



## (2) Channel List:

CH 01~CH 11 for 802.11b/ g/ n(20M)

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
| 01      | 2412            | 05      | 2432            | 09      | 2452            |
| 02      | 2417            | 06      | 2437            | 10      | 2457            |
| 03      | 2422            | 07      | 2442            | 11      | 2462            |
| 04      | 2427            | 08      | 2447            |         |                 |

CH 03~CH 09 for 802.11b/ g/ n(40M)

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
|         |                 | 05      | 2432            | 09      | 2452            |
|         |                 | 06      | 2437            |         |                 |
| 03      | 2422            | 07      | 2442            |         |                 |
| 04      | 2427            | 08      | 2447            |         |                 |

## 1.3 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

| Test Mode         | Description                                             |
|-------------------|---------------------------------------------------------|
| Transmitting mode | Keep the EUT in continuous transmitting with modulation |

**Remark:** The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 6 of 57

| Per-scan all kind of data rate in lowest channel,<br>and found the follow list which it was worst case.                                                                                                                                                                                           |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Mode                                                                                                                                                                                                                                                                                              | Data rate |
| 802.11b                                                                                                                                                                                                                                                                                           | 1Mbps     |
| 802.11g                                                                                                                                                                                                                                                                                           | 6Mbps     |
| 802.11n(H20)                                                                                                                                                                                                                                                                                      | 6.5Mbps   |
| 802.11n(H40)                                                                                                                                                                                                                                                                                      | 13.5 Mbps |
| <b>Final Test Mode:</b>                                                                                                                                                                                                                                                                           |           |
| According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup” 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20) and 13.5 Mbps for 802.11n(H40). Duty cycle setting during the transmission is 100% with maximum power setting for all modulations. |           |



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 7 of 57

## 1.4 Test Instruments List

| Item | Test Equipment                             | Manufacturer                         | Model No.                   | Cal. Date     | Cal. Due date |
|------|--------------------------------------------|--------------------------------------|-----------------------------|---------------|---------------|
| 1    | Bilog Antenna                              | SCHWARZBECK<br>MESS-ELEKTRONIK       | VULB9163                    | May 22, 2015  | May 21, 2016  |
| 2    | Double -ridged<br>waveguide horn           | SCHWARZBECK<br>MESS-ELEKTRONIK       | BBHA9120D                   | May 27, 2015  | May 26, 2016  |
| 3    | Coaxial Cable                              | N/A                                  | N/A                         | Mar. 30, 2015 | Mar. 29, 2016 |
| 4    | Coaxial Cable                              | N/A                                  | N/A                         | Mar. 30, 2015 | Mar. 29, 2016 |
| 5    | Coaxial cable                              | N/A                                  | N/A                         | Mar. 30, 2015 | Mar. 29, 2016 |
| 6    | Coaxial Cable                              | N/A                                  | N/A                         | Mar. 30, 2015 | Mar. 29, 2016 |
| 7    | Coaxial Cable                              | N/A                                  | N/A                         | Mar. 30, 2015 | Mar. 29, 2016 |
| 8    | Amplifier<br>(10kHz-1.3GHz)                | HP                                   | 8447D                       | Mar. 30, 2015 | Mar. 29, 2016 |
| 9    | Amplifier<br>(1GHz-18GHz)                  | Compliance Direction<br>Systems Inc. | PAP-1G18                    | Jun. 07, 2015 | Jun. 06, 2016 |
| 10   | Pre-amplifier<br>(18-26GHz)                | Rohde & Schwarz                      | AFS33-18002<br>650-30-8P-44 | Mar. 30, 2015 | Mar. 29, 2016 |
| 11   | Horn Antenna                               | ETS-LINDGREN                         | 3160                        | Mar. 30, 2015 | Mar. 29, 2016 |
| 12   | Positioning<br>Controller                  | UC                                   | UC3000                      | N/A           | N/A           |
| 13   | Spectrum<br>analyzer<br>9kHz-30GHz         | Rohde & Schwarz                      | FSP                         | May 27, 2015  | May 26, 2016  |
| 14   | EMI Test<br>Receiver                       | Rohde & Schwarz                      | ESPI                        | Mar. 30, 2015 | Mar. 29, 2016 |
| 15   | Loop antenna                               | Laplace instrument                   | RF300                       | May 23, 2015  | May 22, 2016  |
| 16   | Universal radio<br>communication<br>tester | Rhode & Schwarz                      | CMU200                      | May 27, 2015  | May 26, 2016  |
| 17   | Signal Analyzer                            | Rohde & Schwarz                      | FSIQ3                       | May 27, 2015  | May 26, 2016  |
| 18   | L.I.S.N.#1                                 | Rohde & Schwarz                      | NSLK8126                    | May 27, 2015  | May 26, 2016  |
| 19   | L.I.S.N.#2                                 | Rohde & Schwarz                      | ENV216                      | May 27, 2015  | May 26, 2016  |
| 20   | Power Meter                                | Anritsu                              | ML2496A                     | May 27, 2015  | May 26, 2016  |
| 21   | Power sensor                               | Anritsu                              | MA2491A                     | May 27, 2015  | May 26, 2016  |



# ATA Testing Technology Service Co., Ltd.

---

Report No.: ATA150921003F

Page: 8 of 57

## 1.5 Laboratory Location

Shenzhen TOBY technology Co., Ltd

Address: 1 A/F., Bldg.6, Yusheng Industrial Zone The National Road No.107 Xixiang Section 467,  
Xixiang, Bao'an, Shenzhen, Guangdong, 518057, China

At the time of testing, the Laboratory is accredited. It is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 811562 7.

Tel:0086-755-26509301 Fax: 0086-755-26509195



## 2. Test Summary

| Standard Section | Test Item                          | Judgment |
|------------------|------------------------------------|----------|
| 15.203/15.247(c) | Antenna Requirement                | PASSED   |
| 15.207           | Conducted Emission                 | PASSED   |
| 15.247(b)(3)     | Conducted Peak Output Power        | PASSED   |
| 15.247(a)(2)     | 99% OBW and 6dB Emission Bandwidth | PASSED   |
| 15.247(e)        | Power Spectral Density             | PASSED   |
| 15.247(d)        | Band Edge                          | PASSED   |
| 15.205/15.209    | Spurious Emission                  | PASSED   |



## 3. Antenna Requirement

### 3.1. Standard Requirement

#### 3.1.1 Test standard

FCC Part15 Section 15.203 /247(c)

#### 3.1.2 Requirement

1) 15.203 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, 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.

2) 15.247(c) (1)(i) requirement:

Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

### 3.2. Antenna Connected Construction

The antenna is an integral antenna which permanently attached, and the best case gain of the antenna is 0dBi. It complies with the standard requirement.



## 4. Conducted Emission Test

### 4.1 Test Standard and Limit

#### 4.1.1 Test Standard

FCC Part15 Section 15.207

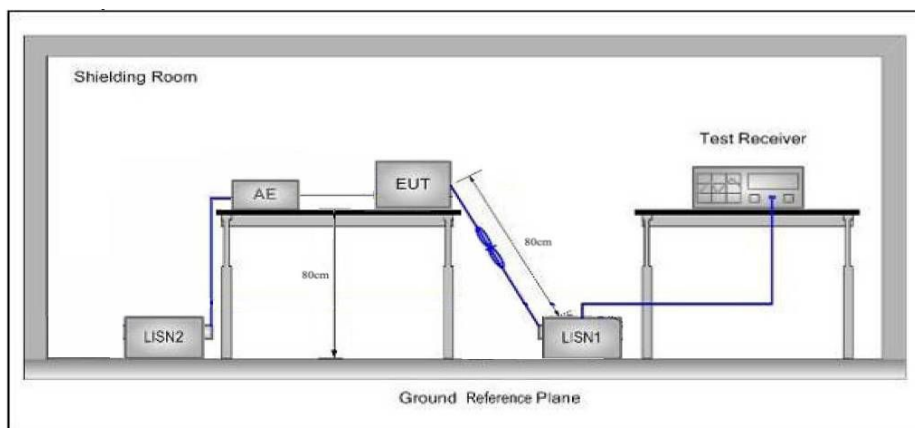
#### 4.1.2 Test Limit

Conducted Emission Test Limit

| Frequency     | Maximum RF Line Voltage (dB $\mu$ V) |               |
|---------------|--------------------------------------|---------------|
|               | Quasi-peak Level                     | Average Level |
| 150kHz~500kHz | 66 ~ 56 *                            | 56 ~ 46 *     |
| 500kHz~5MHz   | 56                                   | 46            |
| 5MHz~30MHz    | 60                                   | 50            |

Remark: (1) \*Decreasing linearly with logarithm of the frequency.  
(2) The lower limit shall apply at the transition frequencies.

### 4.2 Test Setup



### 4.3 Test Procedure

- 1) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a  $50\ \Omega / 50\ \mu\text{H} + 5\ \Omega$  linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 2) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal



ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

## 4.4 Test Data

Please refer to the following pages



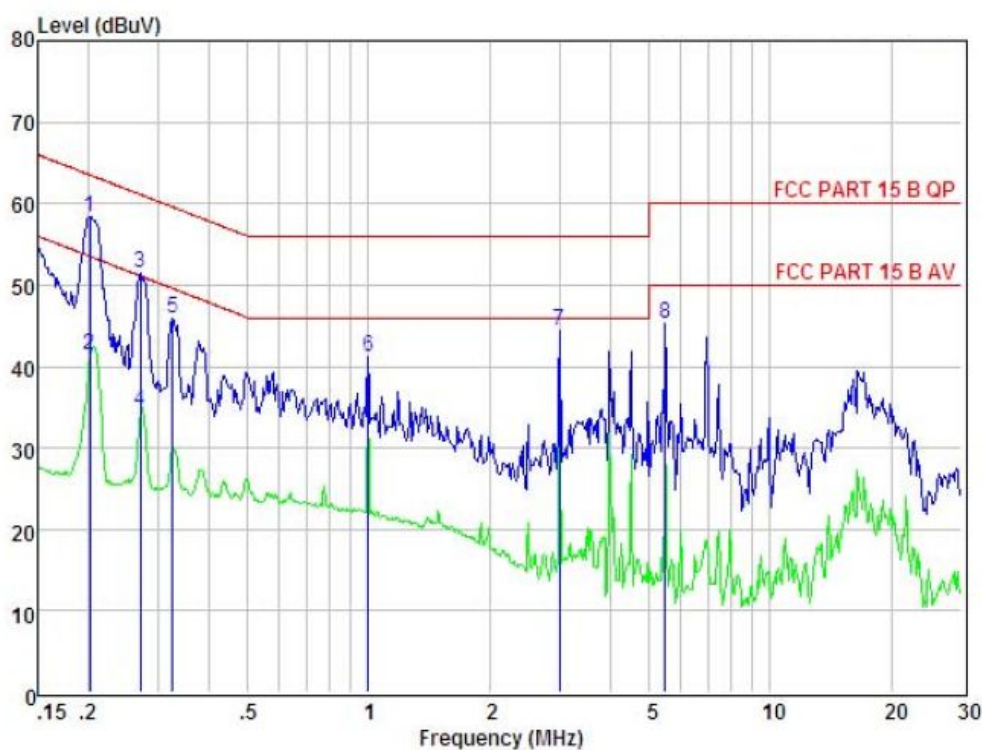
# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 13 of 57

## Conducted Emission Test Data

EUT: MINI PC M/N: TU-IS01  
Operating Condition: WIFI mode  
Test Site: Shielded room  
Operator: Tom  
Test Specification: AC 120V/60Hz  
Polarization: Line  
Note: Tem:25°C Hum:50%



| Condition |       | : FCC PART 15 B QP |        | POL: LINE |       | Temp:24.3°C |       | Hum:51 % |         |
|-----------|-------|--------------------|--------|-----------|-------|-------------|-------|----------|---------|
| Item      | Freq  | Read               | LISN   | Preamp    | Cable | Level       | Limit | Margin   | Remark  |
|           | MHz   | dBuV               | Factor | Factor    | Loss  | dBuV        | dBuV  | dBuV     |         |
| 1         | 0.202 | 58.25              | 0.03   | 0.00      | 0.10  | 58.38       | 63.54 | -5.16    | Peak    |
| 2         | 0.202 | 41.29              | 0.03   | 0.00      | 0.10  | 41.42       | 53.54 | -12.12   | Average |
| 3         | 0.270 | 51.25              | 0.03   | 0.00      | 0.10  | 51.38       | 61.12 | -9.74    | Peak    |
| 4         | 0.270 | 34.43              | 0.03   | 0.00      | 0.10  | 34.56       | 51.12 | -16.56   | Average |
| 5         | 0.325 | 45.83              | 0.03   | 0.00      | 0.10  | 45.96       | 59.57 | -13.61   | Peak    |
| 6         | 1.000 | 41.13              | 0.04   | 0.00      | 0.10  | 41.27       | 56.00 | -14.73   | Peak    |
| 7         | 2.993 | 44.14              | 0.07   | 0.00      | 0.12  | 44.33       | 56.00 | -11.67   | Peak    |
| 8         | 5.476 | 45.04              | 0.10   | 0.00      | 0.13  | 45.27       | 60.00 | -14.73   | Peak    |

Remarks: Level = Read + LISN Factor - Preamp Factor + Cable loss



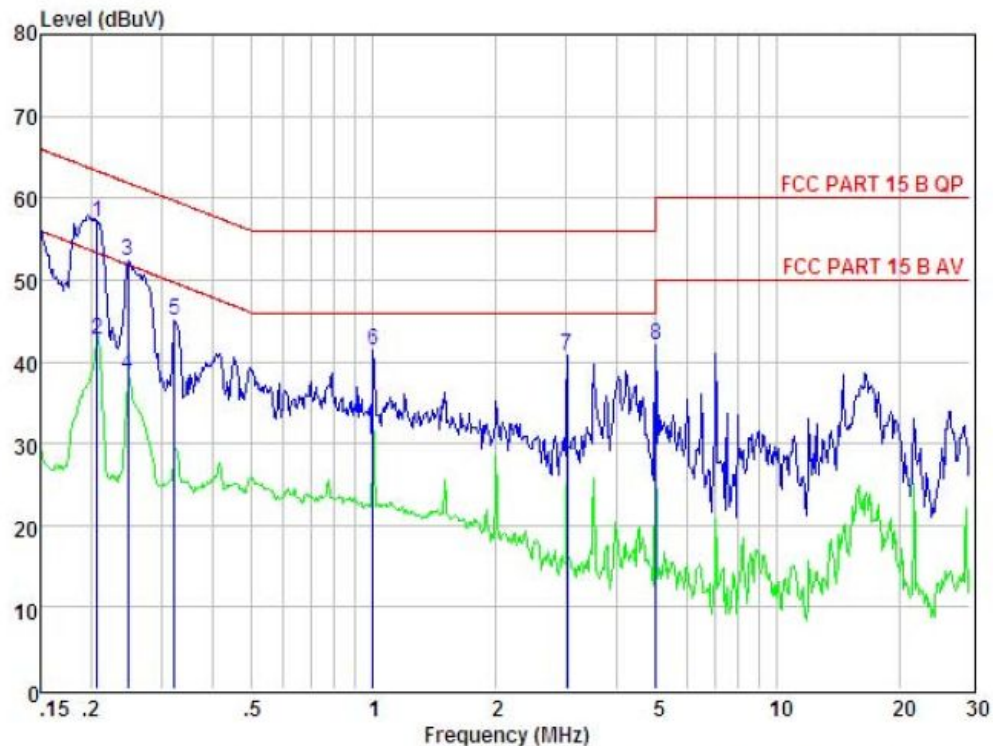
# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 14 of 57

## Conducted Emission Test Data

EUT: MINI PC M/N: TU-IS01  
Operating Condition: WIFI mode  
Test Site: Shielded room  
Operator: Tom  
Test Specification: AC 120V/60Hz  
Polarization: Neutral  
Note: Tem:25°C Hum:50%



| Condition : FCC PART 15 B QP |       |       |        | POL: NEUTRAL Temp:24.3°C Hum:51 % |       |       |       |        |         |  |
|------------------------------|-------|-------|--------|-----------------------------------|-------|-------|-------|--------|---------|--|
| Item                         | Freq  | Read  | LISN   | Preamp                            | Cable | Level | Limit | Margin | Remark  |  |
|                              | MHz   | dBuV  | Factor | Factor                            | Loss  | dBuV  | dBuV  | dBuV   |         |  |
| 1                            | 0.207 | 56.97 | 0.03   | 0.00                              | 0.10  | 57.10 | 63.32 | -6.22  | Peak    |  |
| 2                            | 0.207 | 42.56 | 0.03   | 0.00                              | 0.10  | 42.69 | 53.32 | -10.63 | Average |  |
| 3                            | 0.247 | 52.15 | 0.03   | 0.00                              | 0.10  | 52.28 | 61.86 | -9.58  | Peak    |  |
| 4                            | 0.247 | 38.26 | 0.03   | 0.00                              | 0.10  | 38.39 | 51.86 | -13.47 | Average |  |
| 5                            | 0.322 | 44.82 | 0.03   | 0.00                              | 0.10  | 44.95 | 59.66 | -14.71 | Peak    |  |
| 6                            | 1.000 | 41.20 | 0.04   | 0.00                              | 0.10  | 41.34 | 56.00 | -14.66 | Peak    |  |
| 7                            | 3.025 | 40.62 | 0.07   | 0.00                              | 0.12  | 40.81 | 56.00 | -15.19 | Peak    |  |
| 8                            | 5.005 | 41.72 | 0.10   | 0.00                              | 0.12  | 41.94 | 60.00 | -18.06 | Peak    |  |

Remarks: Level = Read + LISN Factor - Preamp Factor + Cable loss



## 5. Peak Output Power Test

### 5.1. Test Standard and Limit

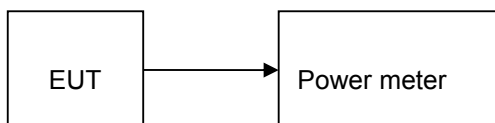
#### 5.1.1 Test Standard

FCC Part15 C Section 15.247 (b)(3)

#### 5.1.2 Test Limit

| FCC Part 15 Subpart C(15.247) |                  |                       |
|-------------------------------|------------------|-----------------------|
| Test Item                     | Limit            | Frequency Range (MHz) |
| Peak Output Power             | 1 Watt or 30 dBm | 2400~2483.5           |

### 5.2. Test Setup



### 5.3. Test Procedure

- (1) The EUT was directly connected to peak power meter and antenna output port as show in the block diagram above.
- (2) Measure out each mode and each bands peak output power of EUT.
- (3) The EUT was set to continuously transmitting in the max power during the test.

### 5.4. Test Data

| Test CH                      | Maximum Conducted Output Power (dBm) |         |              |              | Limit(dBm) | Result |
|------------------------------|--------------------------------------|---------|--------------|--------------|------------|--------|
|                              | 802.11b                              | 802.11g | 802.11n(H20) | 802.11n(H40) |            |        |
| Lowest                       | 9.77                                 | 8.59    | 8.47         | 7.57         | 30.00dBm   | PASSED |
| Middle                       | 9.28                                 | 8.45    | 8.32         | 7.72         |            | PASSED |
| Highest                      | 9.37                                 | 8.51    | 8.38         | 7.29         |            | PASSED |
| Remark: Test plot as follows |                                      |         |              |              |            |        |



## 6. Occupy Bandwidth Test

### 6.1. Test Standard and Limit

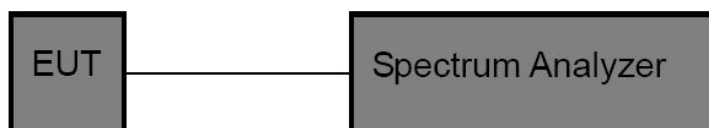
#### 6.1.1 Test Standard

FCC Part15 C Section 15.247 (a)(2)

#### 6.1.2 Test Limit

| FCC Part 15 Subpart C(15.247) |                          |                  |
|-------------------------------|--------------------------|------------------|
| Test Item                     | Limit                    | Frequency Range  |
| Bandwidth                     | >500 kHz (6dB bandwidth) | 2400~2483.5(MHz) |

### 6.2. Test Setup



### 6.3. Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) The bandwidth is measured at an amplitude level reduced 6dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.
- (3) Spectrum Setting:  
Bandwidth: RBW=100 kHz, VBW=300 kHz, detector= Peak

### 6.4. Test Data

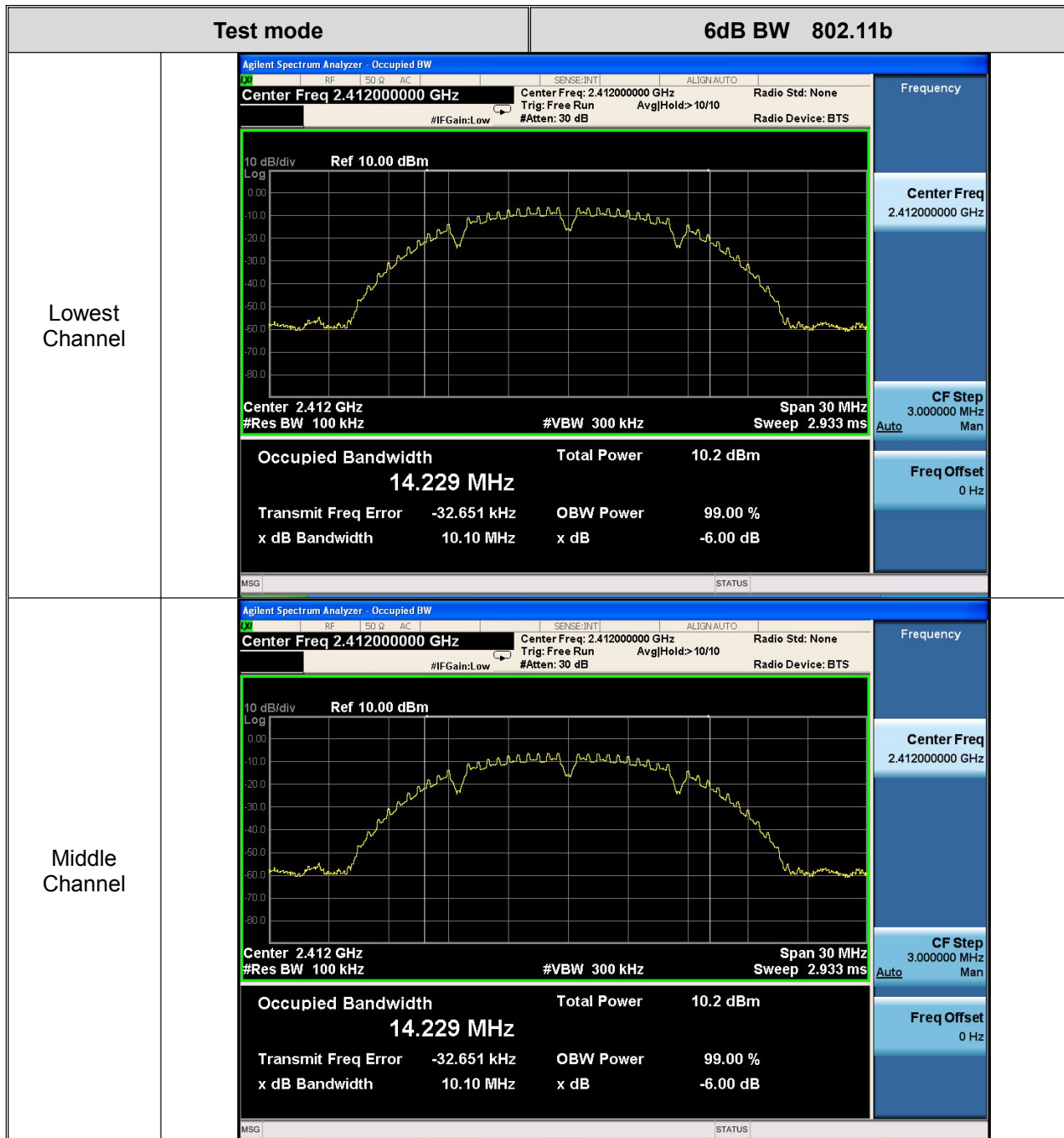
| Test CH                      | 6dB Occupy Bandwidth (MHz) |         |              |              | Limit (kHz) | Result |
|------------------------------|----------------------------|---------|--------------|--------------|-------------|--------|
|                              | 802.11b                    | 802.11g | 802.11n(H20) | 802.11n(H40) |             |        |
| Lowest                       | 10.10                      | 16.38   | 17.61        | 35.96        | >=500 kHz   | PASSED |
| Middle                       | 10.09                      | 16.40   | 17.62        | 36.33        |             | PASSED |
| Highest                      | 10.10                      | 16.40   | 17.60        | 36.33        |             | PASSED |
| Remark: Test plot as follows |                            |         |              |              |             |        |



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 17 of 57

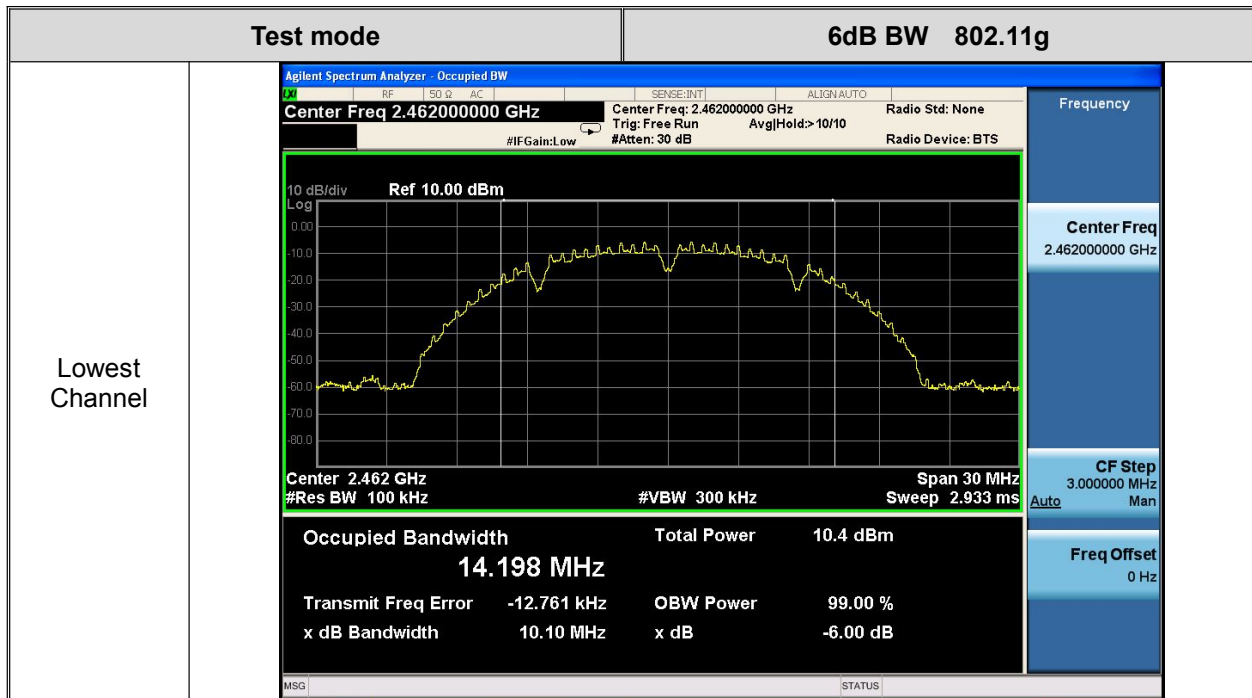
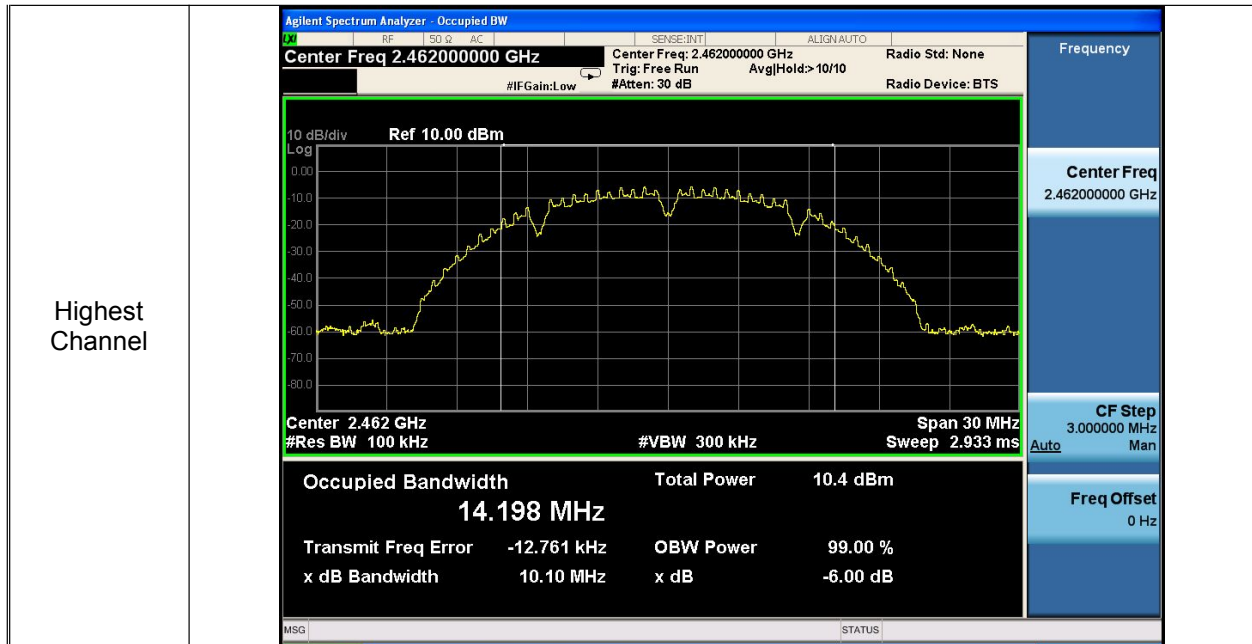




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 18 of 57

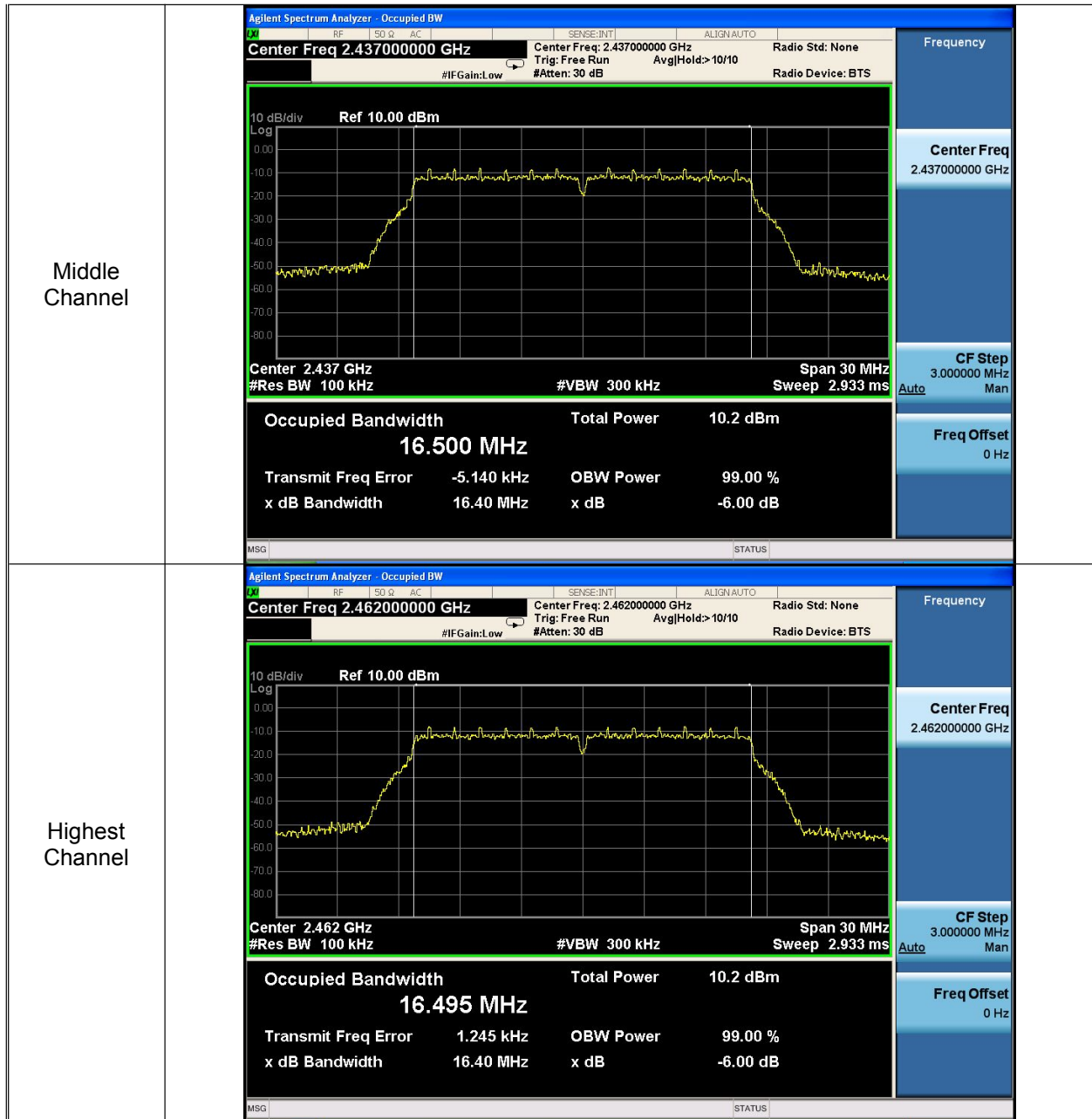




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 19 of 57

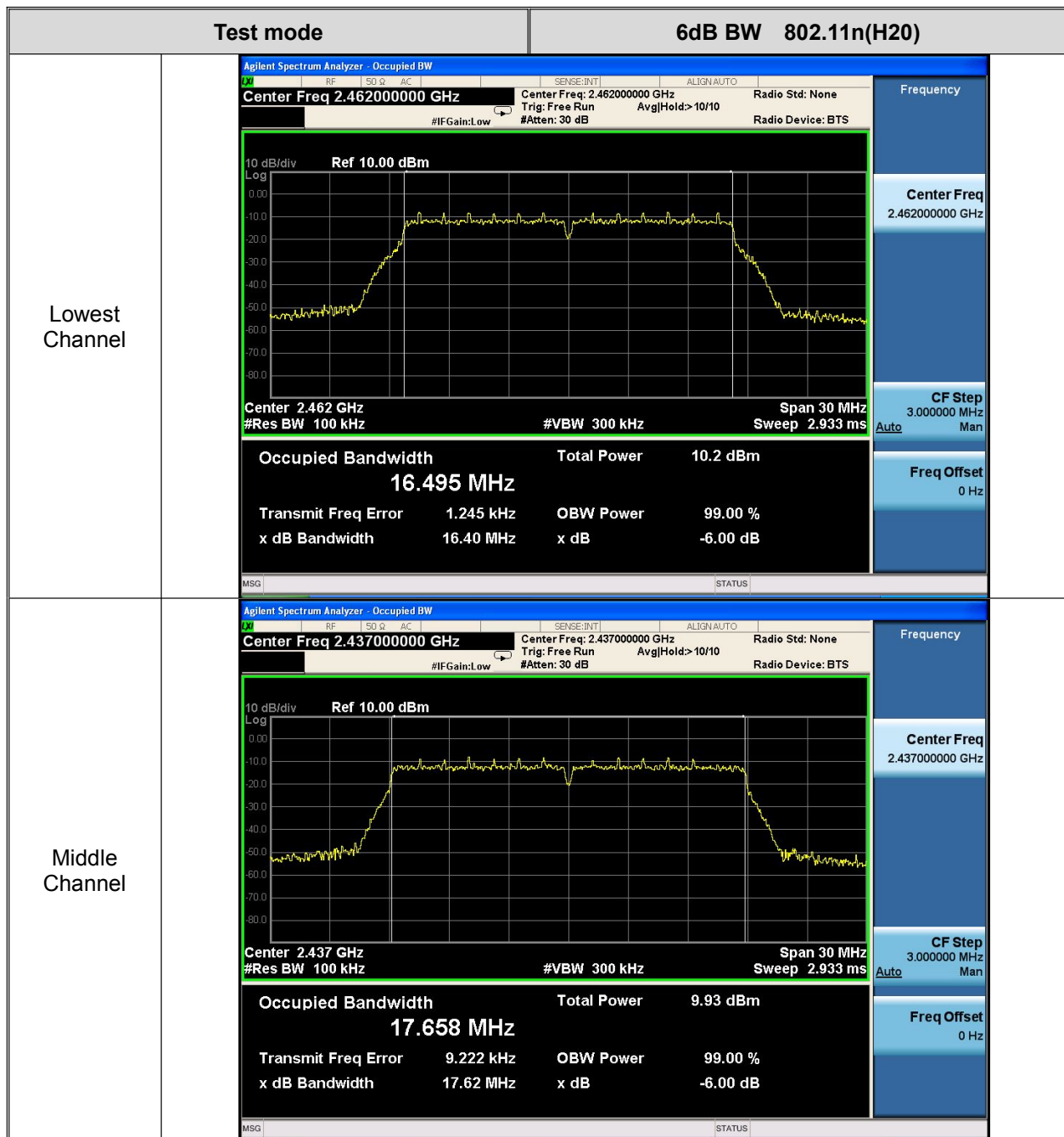




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 20 of 57

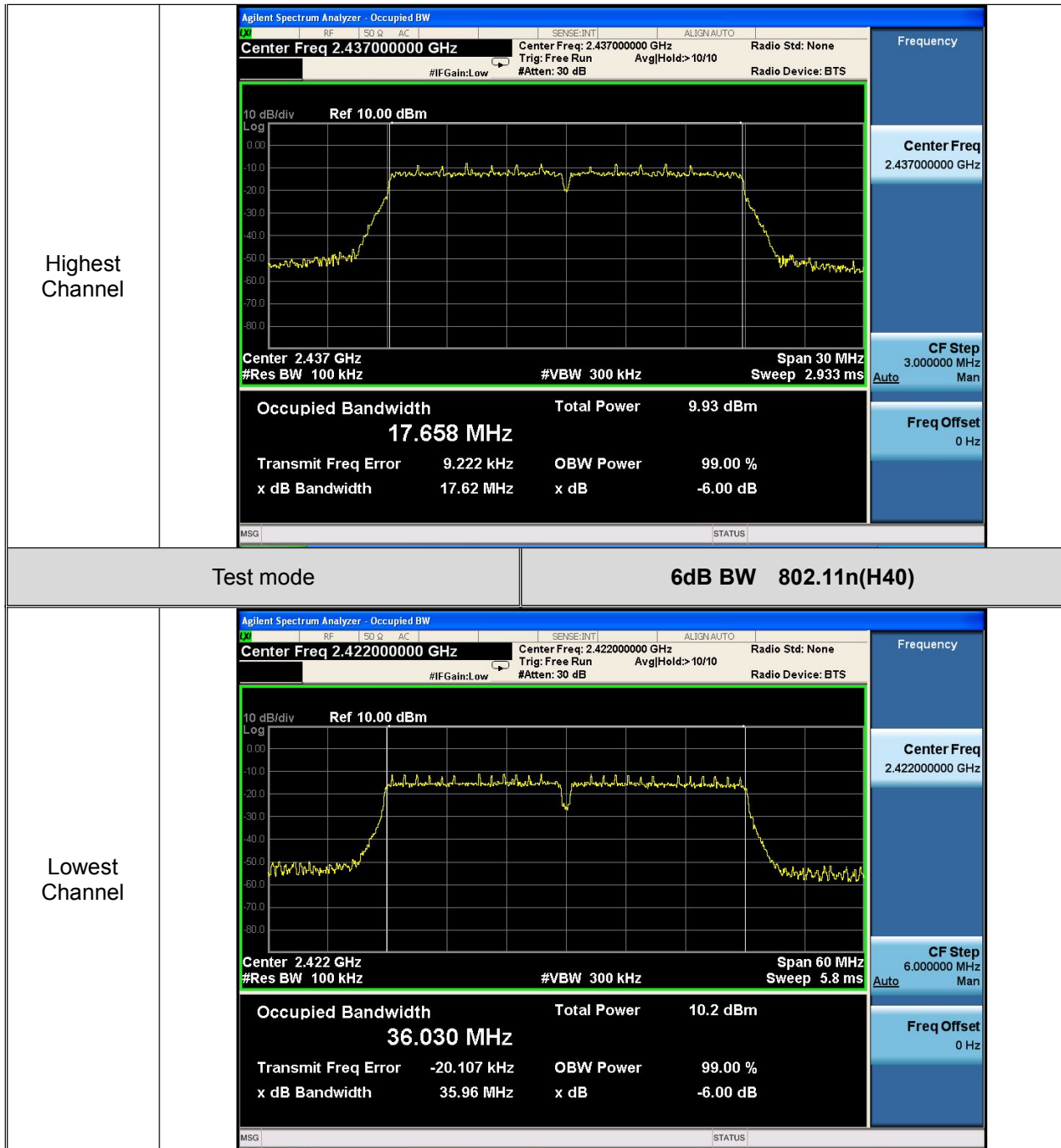




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 21 of 57

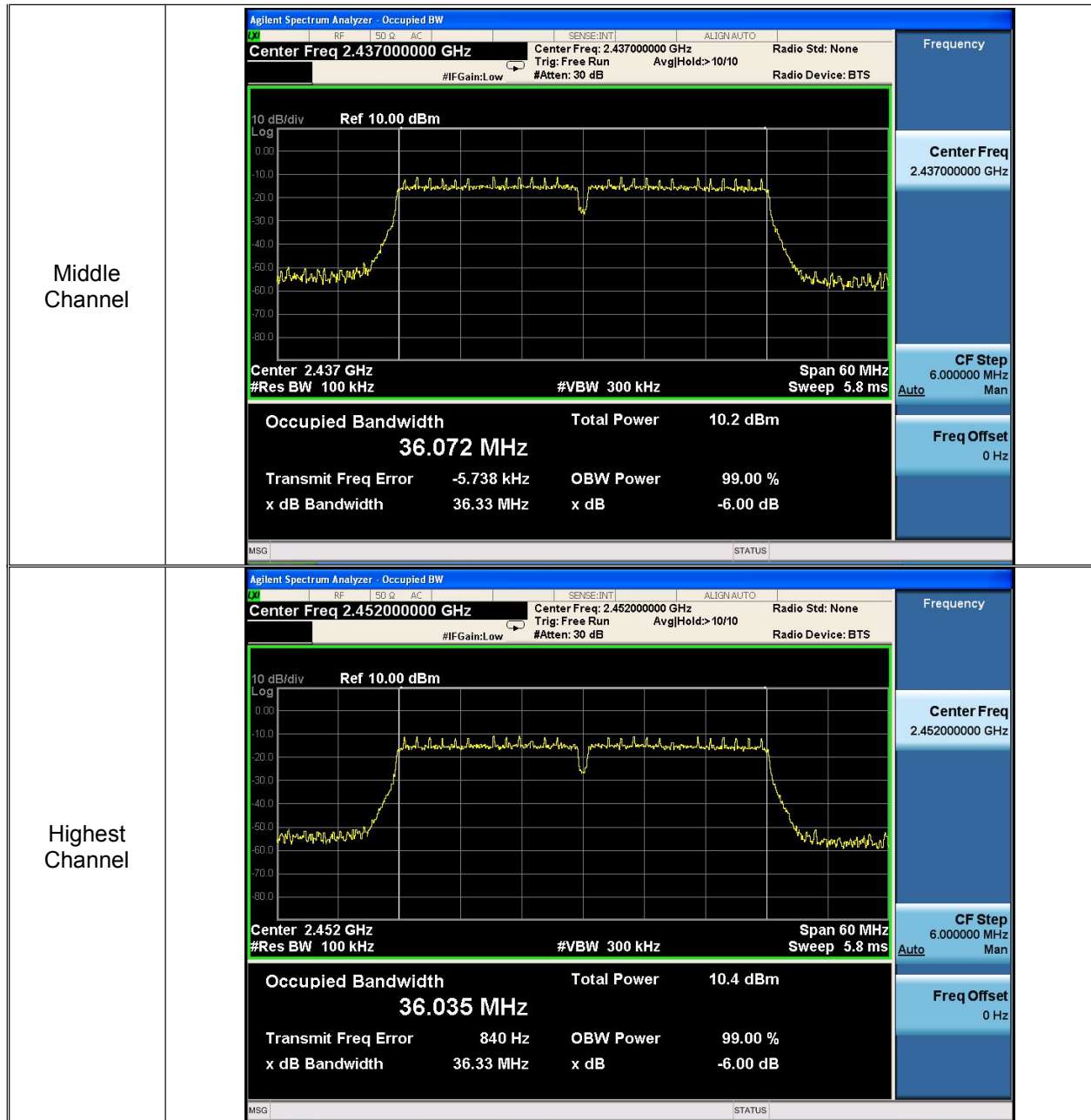




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 22 of 57





## 7. Power Spectral Density Test

### 7.1. Test Standard and Limit

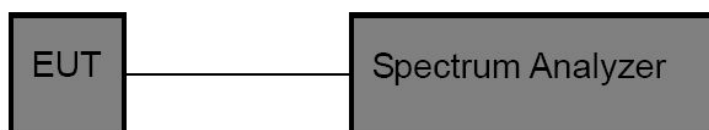
#### 7.1.1 Test Standard

FCC Part15 C Section 15.247 (e)

#### 7.1.2 Test Limit

| FCC Part 15 Subpart C(15.247) |                    |                       |
|-------------------------------|--------------------|-----------------------|
| Test Item                     | Limit              | Frequency Range (MHz) |
| Power Spectral Density        | 8dBm(in any 3 kHz) | 2400~2483.5           |

### 7.2. Test Setup



### 7.3. Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2)Measure the spectral power density the spectrum analyzer was set to Resolution Bandwidth=3kHz, and Video Bandwidth=10 kHz, Detector= Peak, Span to 1.5 times the DTS bandwidth, Sweep time auto.

(3)Allow trace to fully stabilize, and then use the peak marker function to determine the maximum PSD level.

### 7.4. Test Data

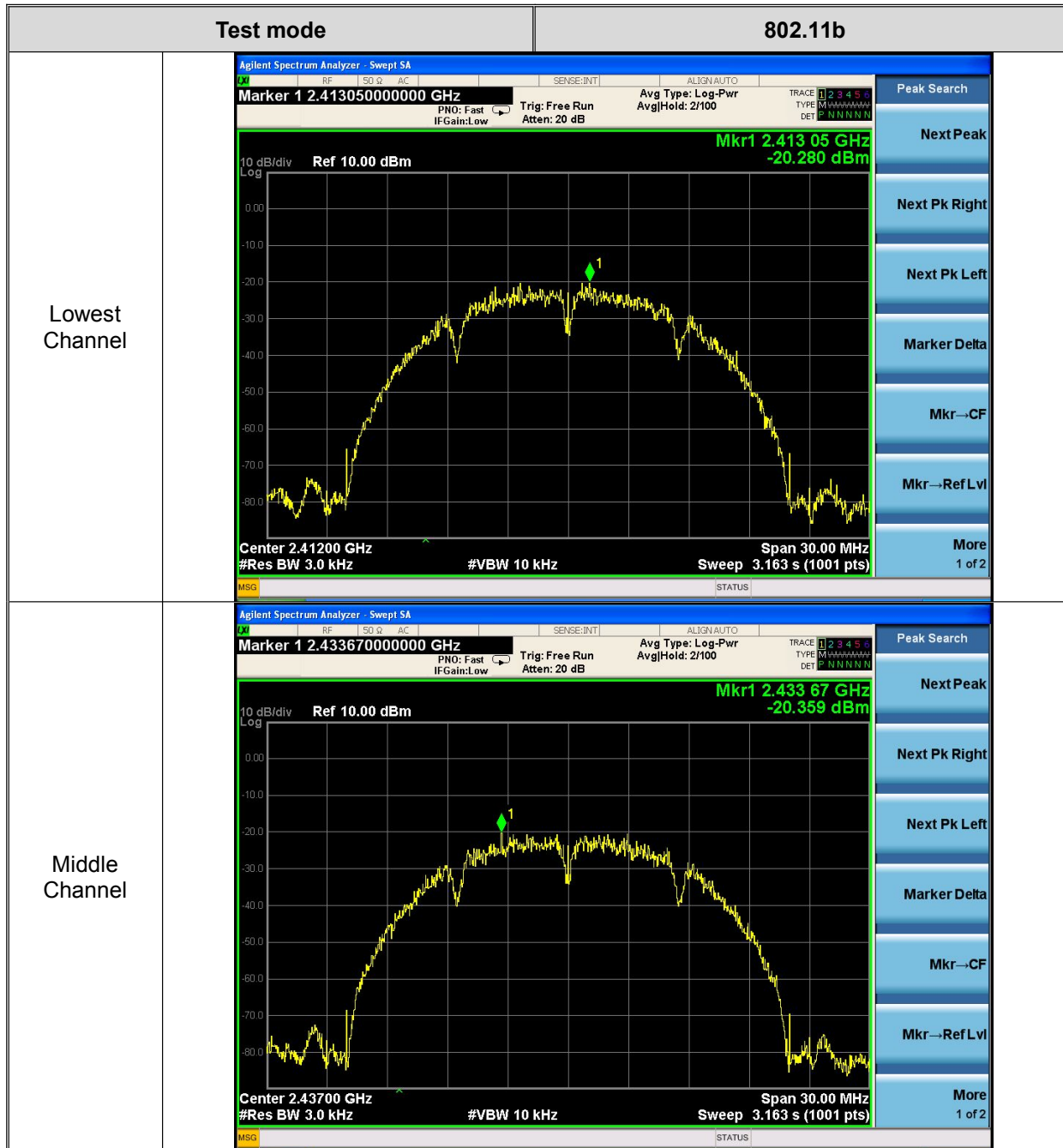
| Test CH                      | Power Spectral Density (dBm) |         |              |              | Limit (dBm) | Result |
|------------------------------|------------------------------|---------|--------------|--------------|-------------|--------|
|                              | 802.11b                      | 802.11g | 802.11n(H20) | 802.11n(H40) |             |        |
| Lowest                       | -20.28                       | -21.778 | -21.393      | -24.960      | 8.00        | PASSED |
| Middle                       | -20.359                      | -20.742 | -21.421      | -24.753      |             | PASSED |
| Highest                      | -21.026                      | -21.412 | -21.511      | -24.133      |             | PASSED |
| Remark: Test plot as follows |                              |         |              |              |             |        |



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 24 of 57

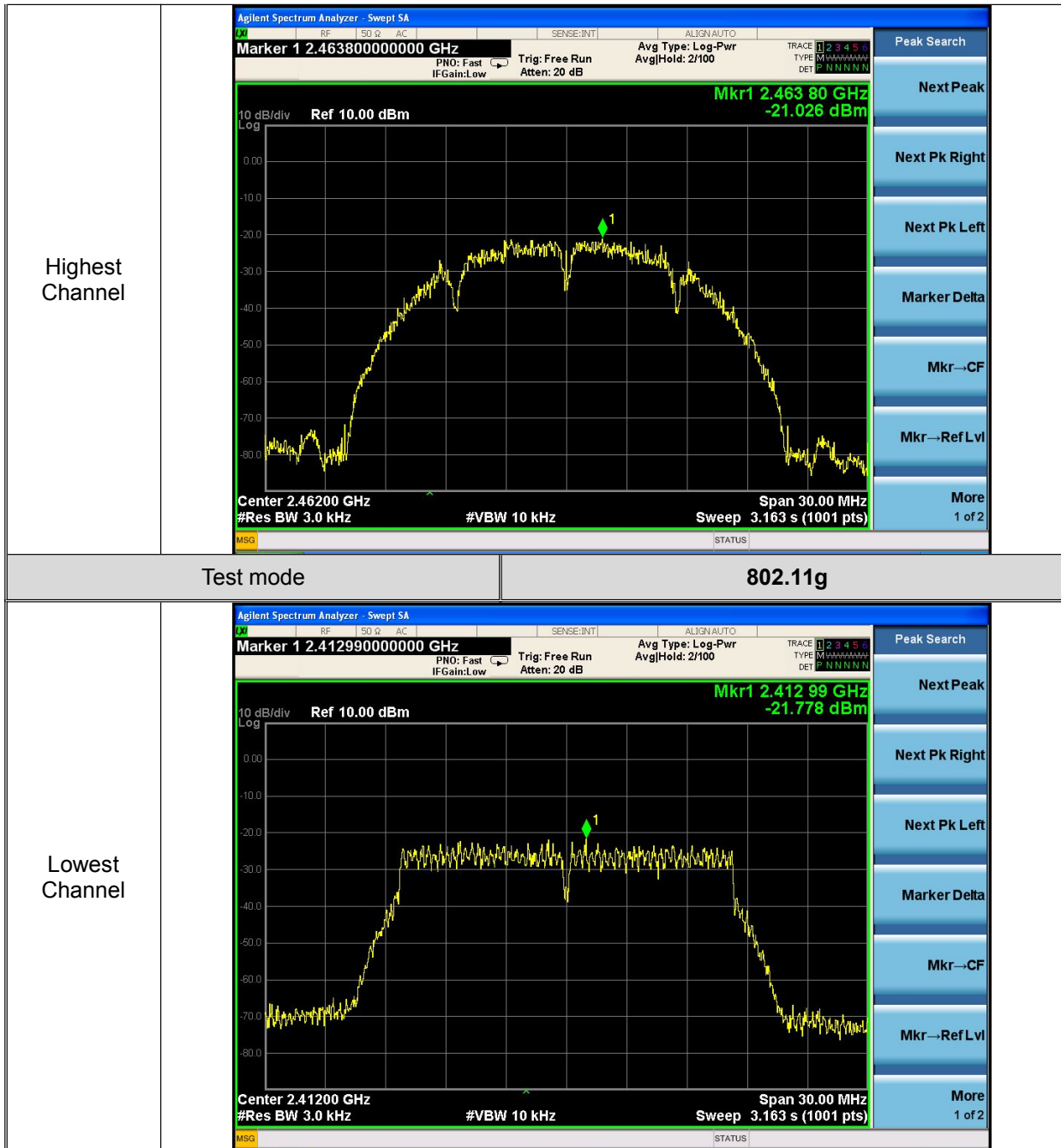




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 25 of 57

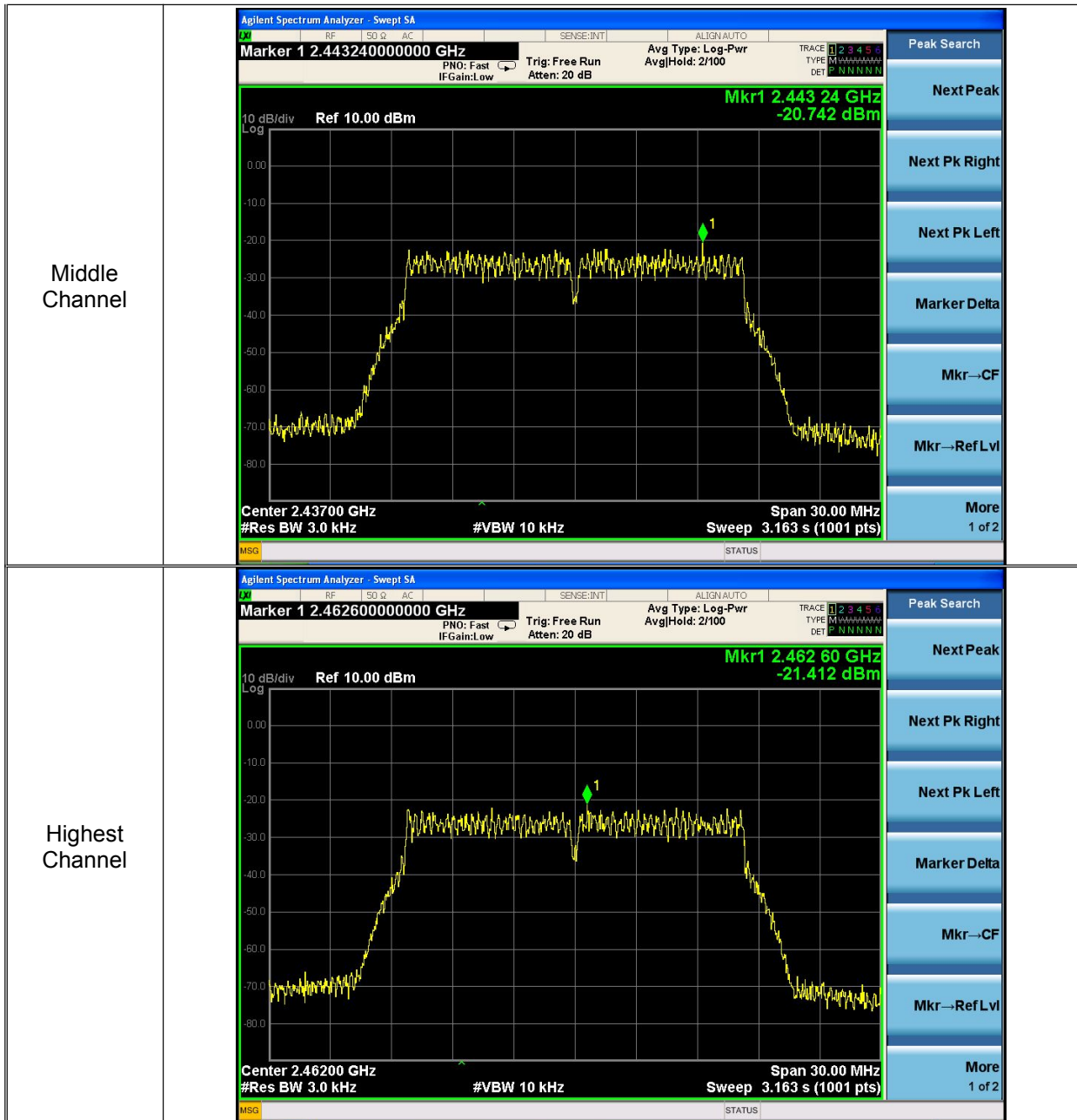




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 26 of 57



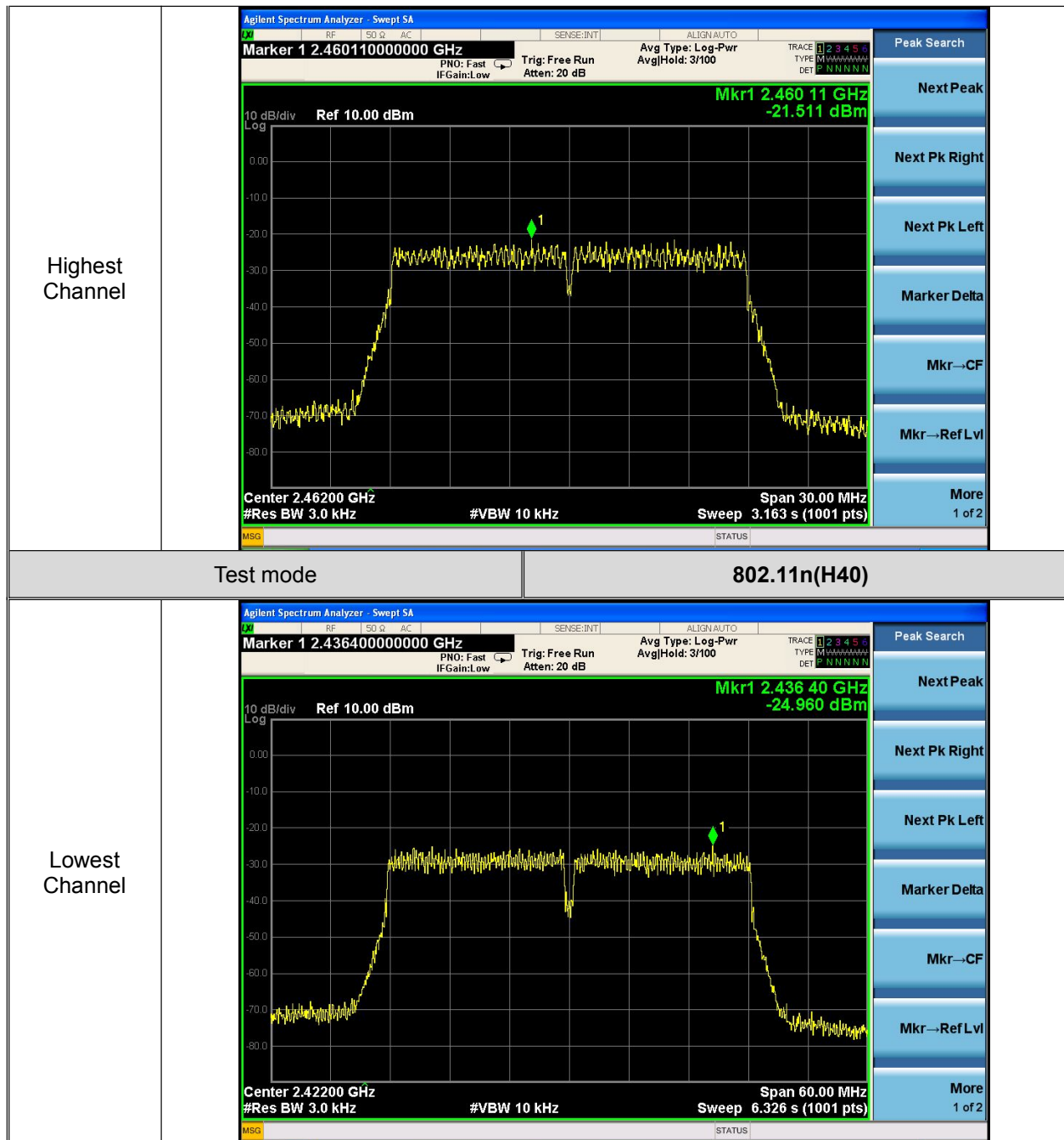




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 28 of 57

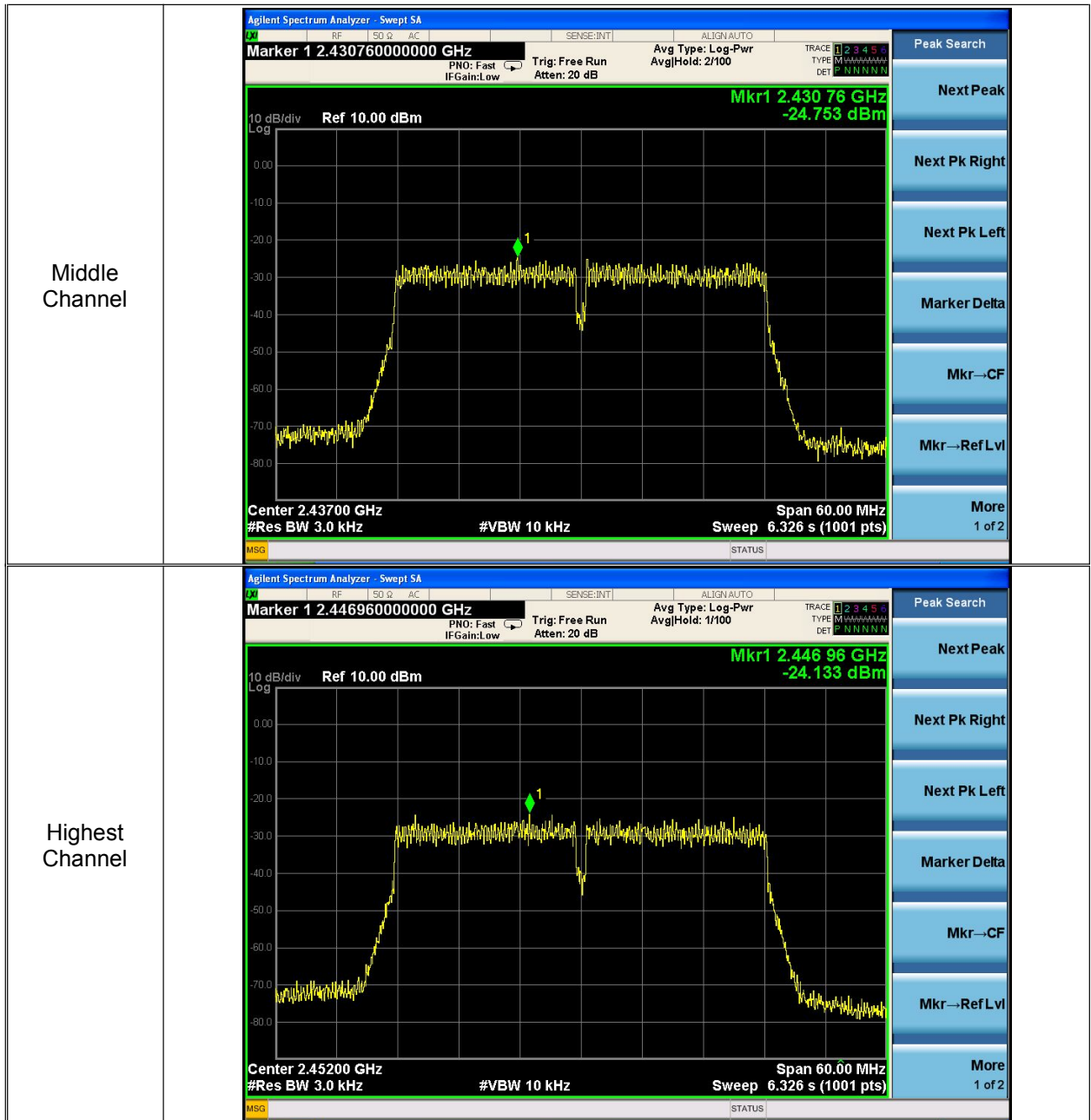




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 29 of 57





## 8. Band Edge Requirement (Conducted Emission Method)

### 8.1. Test Standard and Limit

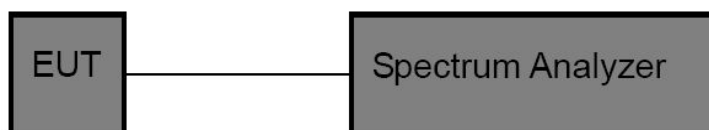
#### 8.1.1 Test Standard

FCC Part15 C Section 15.247 (d)

#### 8.1.2 Test 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, based on either an RF conducted or a radiated measurement.

### 8.2. Test Setup



### 8.3. Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting: RBW=100 kHz, VBW=300 kHz, Detector=Peak

### 8.4. Test Data

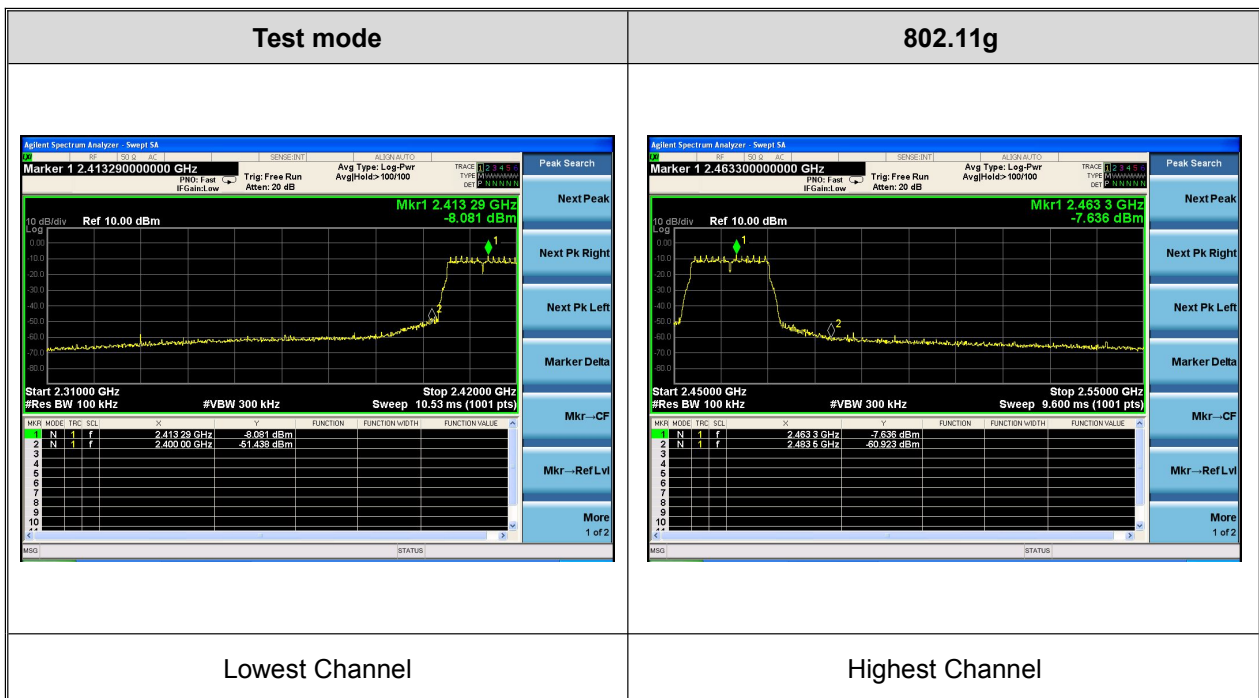
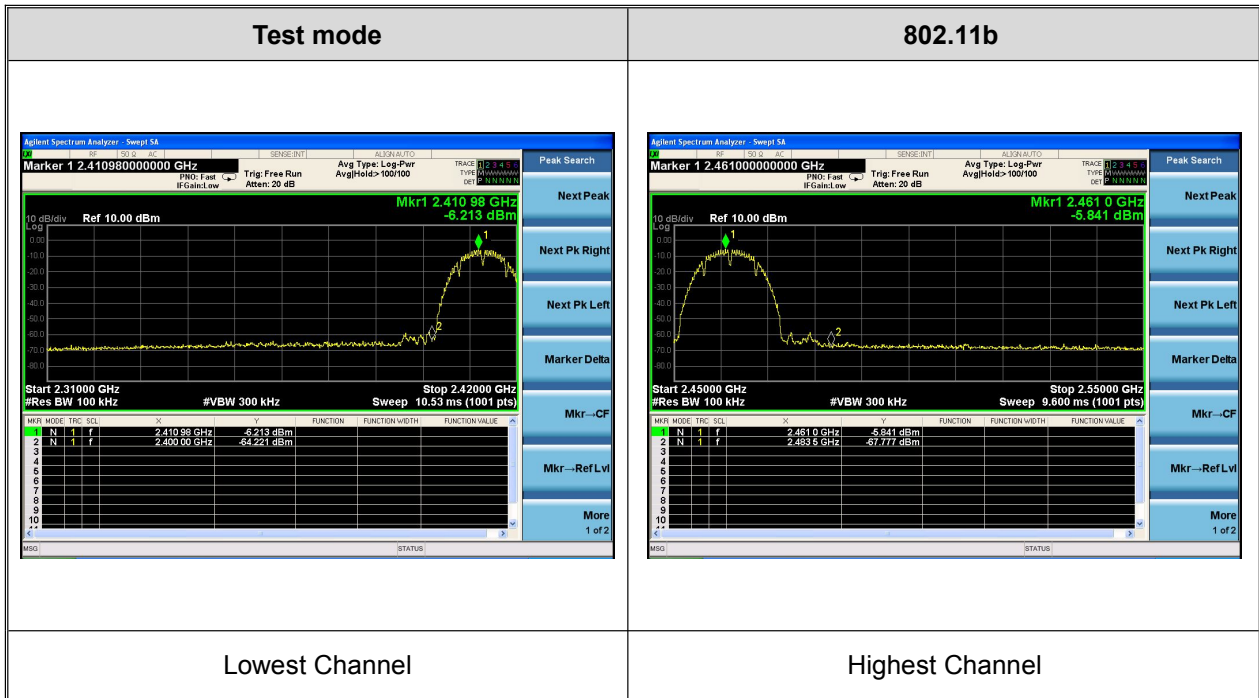
Test plot as follows



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 31 of 57

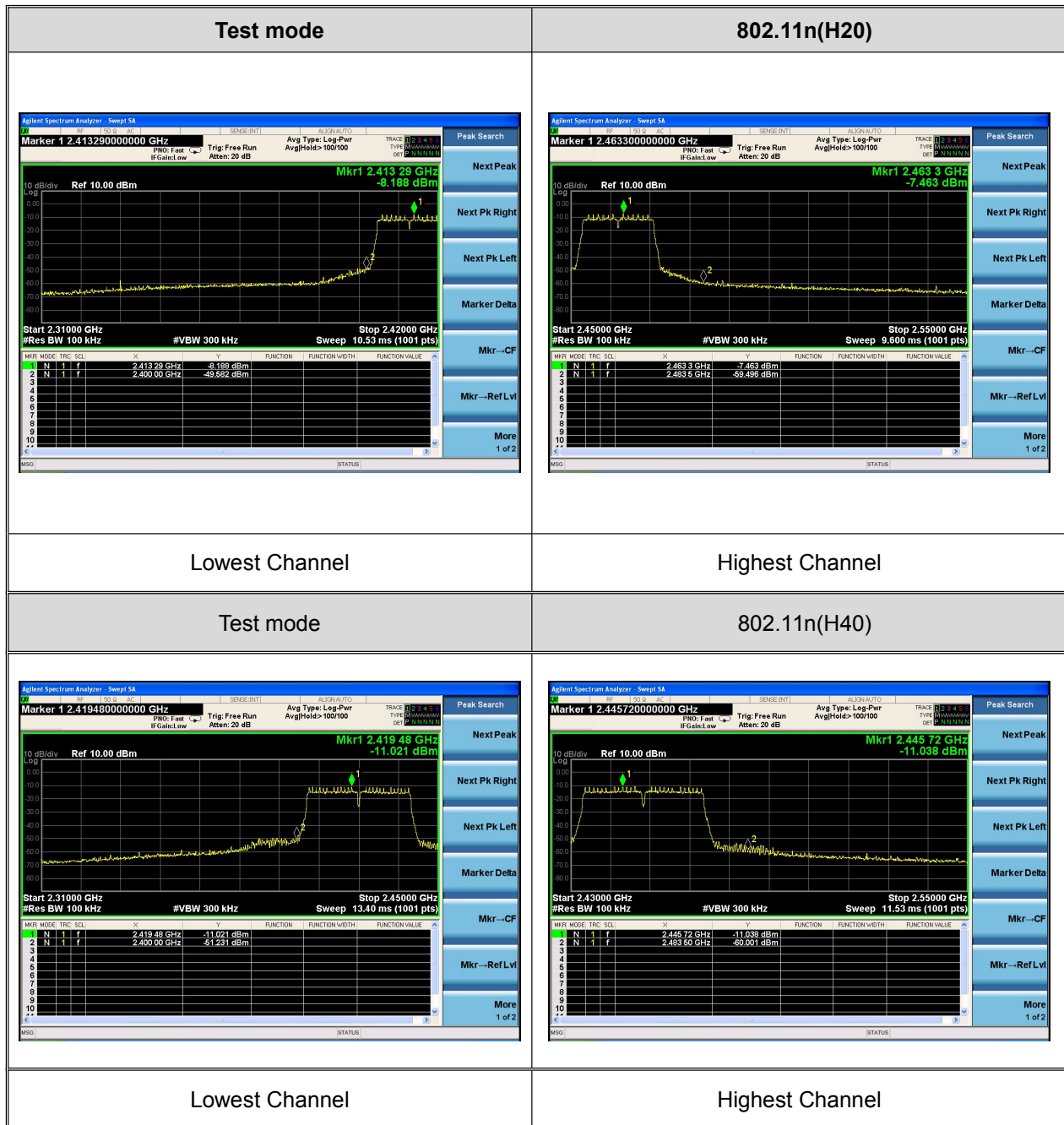




# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 32 of 57





## 9. Band Edge Requirement (Radiated Emission Method)

### 9.1. Test Standard and Limit

#### 9.1.1 Test Standard

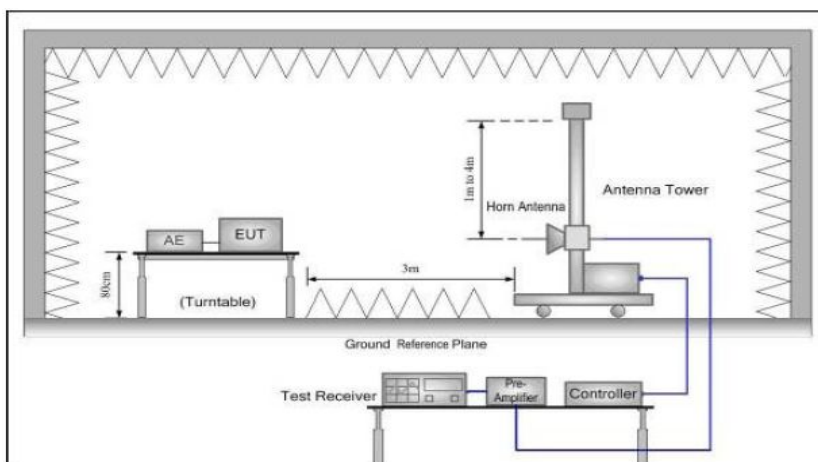
FCC Part15 C Section 15.209 and 15.205

#### 9.1.2 Test Limit

**Radiated Emission Test Limit**

| Frequency  | Limit (dB $\mu$ V/m @3m) | Remark        |
|------------|--------------------------|---------------|
| Above 1GHz | 54.00                    | Average value |
|            | 74.00                    | Peak value    |

### 9.2. Test Setup



### 9.3. Test Procedure

- 1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The antenna height 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.
- 4) 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.
- 5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 34 of 57

- 6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

## 9.4. Test Data

| Test mode: 802.11b |                   |                       |                 |                    | Test channel: Lowest  |                |                 |      |       |
|--------------------|-------------------|-----------------------|-----------------|--------------------|-----------------------|----------------|-----------------|------|-------|
| Frequency (MHz)    | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2390.00            | 18.65             | 27.58                 | 5.67            | 0                  | 51.9                  | 74.00          | -22.10          | H    | PEAK  |
| 2390.00            | 19.13             | 27.58                 | 5.67            | 0                  | 52.38                 | 74.00          | -21.62          | V    | PEAK  |
| 2390.00            | 9.03              | 27.58                 | 5.67            | 0                  | 42.28                 | 54.00          | -11.72          | H    | AVG.  |
| 2390.00            | 9.57              | 27.58                 | 5.67            | 0                  | 42.82                 | 54.00          | -11.18          | V    | AVG.  |
| Test mode: 802.11b |                   |                       |                 |                    | Test channel: Highest |                |                 |      |       |
| Frequency (MHz)    | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2483.50            | 19.73             | 27.52                 | 5.7             | 0                  | 52.95                 | 74.00          | -21.05          | H    | PEAK  |
| 2483.50            | 20.16             | 27.52                 | 5.7             | 0                  | 53.38                 | 74.00          | -20.62          | V    | PEAK  |
| 2483.50            | 9.13              | 27.52                 | 5.7             | 0                  | 42.35                 | 54.00          | -11.65          | H    | AVG.  |
| 2483.50            | 9.69              | 27.52                 | 5.7             | 0                  | 42.91                 | 54.00          | -11.09          | V    | AVG.  |



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 35 of 57

| Test mode: 802.11g |                   |                       |                 |                          | Test channel: Lowest  |                |                 |      |       |
|--------------------|-------------------|-----------------------|-----------------|--------------------------|-----------------------|----------------|-----------------|------|-------|
| Frequency (MHz)    | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2390.00            | 20.53             | 27.58                 | 5.67            | 0                        | 53.78                 | 74.00          | -20.22          | H    | PEAK  |
| 2390.00            | 20.99             | 27.58                 | 5.67            | 0                        | 54.24                 | 74.00          | -19.76          | V    | PEAK  |
| 2390.00            | 9.33              | 27.58                 | 5.67            | 0                        | 42.58                 | 54.00          | -11.42          | H    | AVG.  |
| 2390.00            | 10.23             | 27.58                 | 5.67            | 0                        | 43.48                 | 54.00          | -10.52          | V    | AVG.  |
| Test mode: 802.11g |                   |                       |                 |                          | Test channel: Highest |                |                 |      |       |
| Frequency (MHz)    | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2483.50            | 20.93             | 27.52                 | 5.7             | 0                        | 54.15                 | 74.00          | -19.85          | H    | PEAK  |
| 2483.50            | 21.1              | 27.52                 | 5.7             | 0                        | 54.32                 | 74.00          | -19.68          | V    | PEAK  |
| 2483.50            | 9.52              | 27.52                 | 5.7             | 0                        | 42.74                 | 54.00          | -11.26          | H    | AVG.  |
| 2483.50            | 10.17             | 27.52                 | 5.7             | 0                        | 43.39                 | 54.00          | -10.61          | V    | AVG.  |

| Test mode: 802.11n(H20) |                   |                       |                 |                          | Test channel: Lowest  |                |                 |      |       |
|-------------------------|-------------------|-----------------------|-----------------|--------------------------|-----------------------|----------------|-----------------|------|-------|
| Frequency (MHz)         | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2390.00                 | 19.77             | 27.58                 | 5.67            | 0                        | 53.02                 | 74.00          | -20.98          | H    | PEAK  |
| 2390.00                 | 20.9              | 27.58                 | 5.67            | 0                        | 54.15                 | 74.00          | -19.85          | V    | PEAK  |
| 2390.00                 | 9.94              | 27.58                 | 5.67            | 0                        | 43.19                 | 54.00          | -10.81          | H    | AVG.  |
| 2390.00                 | 10.75             | 27.58                 | 5.67            | 0                        | 44                    | 54.00          | -10.00          | V    | AVG.  |
| Test mode: 802.11n(H20) |                   |                       |                 |                          | Test channel: Highest |                |                 |      |       |
| Frequency (MHz)         | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2483.50                 | 21.15             | 27.52                 | 5.7             | 0                        | 54.37                 | 74.00          | -19.63          | H    | PEAK  |
| 2483.50                 | 21.24             | 27.52                 | 5.7             | 0                        | 54.46                 | 74.00          | -19.54          | V    | PEAK  |
| 2483.50                 | 9.75              | 27.52                 | 5.7             | 0                        | 42.97                 | 54.00          | -11.03          | H    | AVG.  |
| 2483.50                 | 10.12             | 27.52                 | 5.7             | 0                        | 43.34                 | 54.00          | -10.66          | V    | AVG.  |



# ATA Testing Technology Service Co., Ltd.

Report No.: ATA150921003F

Page: 36 of 57

| Test mode: 802.11n(H40) |                   |                       |                 |                          | Test channel: Lowest  |                |                 |      |       |
|-------------------------|-------------------|-----------------------|-----------------|--------------------------|-----------------------|----------------|-----------------|------|-------|
| Frequency (MHz)         | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2390.00                 | 19.33             | 27.58                 | 5.67            | 0                        | 52.58                 | 74.00          | -21.42          | H    | PEAK  |
| 2390.00                 | 19.59             | 27.58                 | 5.67            | 0                        | 52.84                 | 74.00          | -21.16          | V    | PEAK  |
| 2390.00                 | 10.28             | 27.58                 | 5.67            | 0                        | 43.53                 | 54.00          | -10.47          | H    | AVG.  |
| 2390.00                 | 10.62             | 27.58                 | 5.67            | 0                        | 43.87                 | 54.00          | -10.13          | V    | AVG.  |
| Test mode: 802.11n(H20) |                   |                       |                 |                          | Test channel: Highest |                |                 |      |       |
| Frequency (MHz)         | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m)        | Limit (dBuV/m) | Over Limit (dB) | Pol. | Level |
| 2483.50                 | 20.5              | 27.52                 | 5.7             | 0                        | 53.72                 | 74.00          | -20.28          | H    | PEAK  |
| 2483.50                 | 21.29             | 27.52                 | 5.7             | 0                        | 54.51                 | 74.00          | -19.49          | V    | PEAK  |
| 2483.50                 | 9.23              | 27.52                 | 5.7             | 0                        | 42.45                 | 54.00          | -11.55          | H    | AVG.  |
| 2483.50                 | 9.84              | 27.52                 | 5.7             | 0                        | 43.06                 | 54.00          | -10.94          | V    | AVG.  |

## Remark:

1. Final Level = Read Level + Antenna Factor + Cable Loss
2. The emission levels of other frequencies are very lower than the limit and not show in test report.



## 10. Spurious Emission (Radiated Emission Method)

### 10.1 Test Standard and Limit

#### 10.1.1 Test Standard

FCC Part15 C Section 15.209 and 15.205

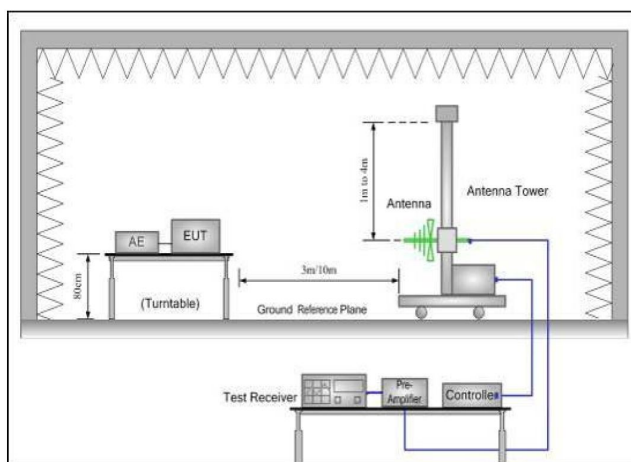
#### 10.1.2 Test Limit

| Frequency<br>(MHz) | Limit (dB $\mu$ V/m) |            |
|--------------------|----------------------|------------|
|                    | At 3m Distance       |            |
| 30MHz~88MHz        | 40                   | Quasi-peak |
| 88MHz~216MHz       | 43.5                 | Quasi-peak |
| 216MHz~960MHz      | 46                   | Quasi-peak |
| 960MHz~1000MHz     | 54                   | Quasi-peak |
| Above 1000MHz      | 54                   | Average    |
|                    | 74                   | Peak       |

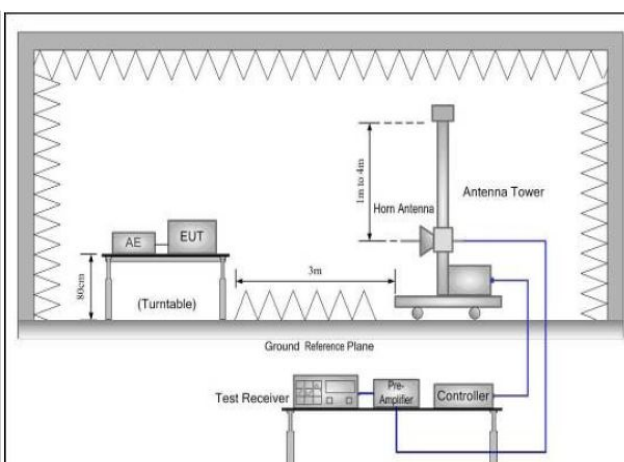
**Remark:** 1. The lower limit shall apply at the transition frequency.

### 10.2 Test Setup

#### Below 1GHz



#### Above 1GHz



### 10.3 Test Procedure

- 1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.