

REPORT  
TIMEWAY TESTING LABORATORIES  
TECHNICAL  
REPORT  
ZBEE3  
TESTING  
RESULTS  
T



Report No.:  
File reference No.:

TW2103039E  
2021-04-25

Applicant: Hangzhou Grom Technology Co.,Ltd.

Product: ZBEE3

Model No.: ZBEE3S2F8C, ZBEE3S2F8U

Trademark: N/A

Test Standards: FCC Part 15.247

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.10, FCC Part 15.247 for the evaluation of electromagnetic compatibility

Approved By

*Jack Chung*

Jack Chung

Manager

Dated: April 25, 2021

**Results appearing herein relate only to the sample tested  
The technical reports is issued errors and omissions exempt and is subject to withdrawal at**

**SHENZHEN TIMEWAY TESTING LABORATORIES**

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



## **Special Statement:**

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAL. This approval result is accepted by MRA of APLAC.

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

### **CNAL-LAB Code: L2292**

The EMC Laboratory has been assessed and in compliance with CNAL/AC01:2002 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of testing Laboratories.

### **FCC-Registration No.: 744189**

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 744189.

### **Industry Canada (IC) —Registration No.:5205A**

The EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 5205A.

### **A2LA (Certification Number:5013.01)**

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number:5013.01

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## Test Report Conclusion

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## 1.0 General Details

### 1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.  
Address: Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China  
Telephone: (755) 83448688  
Fax: (755) 83442996  
Site Listed with Federal Communications commission (FCC)  
Registration Number: 744189  
For 3m Anechoic Chamber  
Site Listed with Industry Canada of Ottawa, Canada  
Registration Number: IC: 5205A  
For 3m Anechoic Chamber

### 1.2 Applicant Details

Applicant: Hangzhou Grom Technology Co.,Ltd.  
Address: Room815-2, Building3#, Longtan Rd 16#, Cangqian street, Yuhang District, Hangzhou  
Telephone: --  
Fax: --

### 1.3 Description of EUT

Product: ZBEE3  
Manufacturer: Hangzhou Grom Technology Co.,Ltd.  
Address: Room815-2, Building3#, Longtan Rd 16#, Cangqian street, Yuhang District, Hangzhou  
Brand Name: N/A  
Additional Brand Name: N/A  
Model Number: ZBEE3S2F8C, ZBEE3S2F8U  
Hardware Version: ZBee3\_V3\_2  
Software Version: RAIL Test App v1.00  
Type of Modulation: OQPSK  
Frequency range: 2400-2483.5MHz  
Channel Separation: 5MHz  
Channel List:

| Channel         | 11   | 12   | 13   | 14   |
|-----------------|------|------|------|------|
| Frequency (MHz) | 2405 | 2410 | 2415 | 2420 |
| Channel         | 15   | 16   | 17   | 18   |
| Frequency (MHz) | 2425 | 2430 | 2435 | 2440 |
| Channel         | 19   | 20   | 21   | 22   |

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|                 |      |      |      |      |
|-----------------|------|------|------|------|
| Frequency (MHz) | 2445 | 2450 | 2455 | 2460 |
| Channel         | 23   | 24   | 25   | 26   |
| Frequency (MHz) | 2465 | 2470 | 2475 | 2480 |

Rating: DC3.3V, 200mA, 0.66W

1.4 Submitted Sample: 2 Samples

1.5 Test Duration

2021-03-04 to 2021-04-23

1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions below 1GHz Uncertainty =4.7dB

Radiated Emissions above 1GHz Uncertainty =6.0dB

Conducted Power Uncertainty =6.0dB

Occupied Channel Bandwidth Uncertainty =5%

Note: The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

1.7 Test Engineer

The sample tested by \_\_\_\_\_

Print Name: Terry Tang

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## 2.0 Test Equipment

| Instrument Type    | Manufacturer | Model            | Serial No.   | Date of Cal. | Due Date   |
|--------------------|--------------|------------------|--------------|--------------|------------|
| ESPI Test Receiver | R&S          | ESPI 3           | 100379       | 2020-06-23   | 2021-06-22 |
| TWO Line-V-NETW    | R&S          | EZH3-Z5          | 100294       | 2020-06-23   | 2021-06-22 |
| TWO Line-V-NETW    | R&S          | EZH3-Z5          | 100253       | 2020-06-23   | 2021-06-22 |
| Impuls-Begrenzer   | R&S          | ESH3-Z2          | 100281       | 2020-06-23   | 2021-06-22 |
| Loop Antenna       | EMCO         | 6507             | 00078608     | 2020-06-23   | 2021-06-22 |
| Spectrum           | R&S          | FSIQ26           | 100292       | 2020-06-23   | 2021-06-22 |
| Horn Antenna       | A-INFO       | LB-180400-KF     | J211060660   | 2020-06-23   | 2021-06-22 |
| Horn Antenna       | R&S          | BBHA 9120D       | 9120D-631    | 2018-07-09   | 2021-07-08 |
| Power meter        | Anritsu      | ML2487A          | 6K00003613   | 2020-06-23   | 2021-06-22 |
| Power sensor       | Anritsu      | MA2491A          | 32263        | 2020-06-23   | 2021-06-22 |
| Bilog Antenna      | Schwarebeck  | VULB9163         | 9163/340     | 2018-07-04   | 2021-07-03 |
| 9*6*6 Anechoic     | --           | --               | N/A          | 2020-07-06   | 2021-07-05 |
| EMI Test Receiver  | RS           | ESVB             | 826156/011   | 2020-06-23   | 2021-06-22 |
| EMI Test Receiver  | RS           | ESH3             | 860904/006   | 2020-06-23   | 2021-06-22 |
| Spectrum           | HP/Agilent   | ESA-L1500A       | US37451154   | 2020-06-23   | 2021-06-22 |
| Spectrum           | HP/Agilent   | E4407B           | MY50441392   | 2020-06-23   | 2021-06-22 |
| Spectrum           | RS           | FSP              | 1164.4391.38 | 2021-01-17   | 2022-01-16 |
| RF Cable           | Zhengdi      | ZT26-NJ-NJ-8M/FA | --           | 2020-06-23   | 2021-06-22 |
| RF Cable           | Zhengdi      | 7m               | --           | 2020-06-23   | 2021-06-22 |
| RF Switch          | EM           | EMSW18           | 060391       | 2020-06-23   | 2021-06-22 |
| Pre-Amplifier      | Schwarebeck  | BBV9743          | #218         | 2020-06-23   | 2021-06-22 |
| Pre-Amplifier      | HP/Agilent   | 8449B            | 3008A00160   | 2020-06-23   | 2021-06-22 |
| LISN               | SCHAFFNER    | NNB42            | 00012        | 2021-01-06   | 2022-01-05 |

## 2.2 Automation Test Software

For Conducted Emission Test

| Name   | Version           |
|--------|-------------------|
| EZ-EMC | Ver.EMC-CON 3A1.1 |

For Radiated Emissions

| Name  | Version |
|---|---------|
| EMI Test Software BL410-EV18.91                 | V18.905 |
| EMI Test Software BL410-EV18.806 High Frequency | V18.06  |

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### 3.0 Technical Details

#### 3.1 Summary of test results

| <b>The EUT has been tested according to the following specifications:</b> |   |               |                 |
|---|---|---------------|-----------------|
| <b>Standard</b>   | <b>Test Type</b>  | <b>Result</b> | <b>Notes</b>    |
| <b>FCC Part 15, Paragraph 15.207</b>                                      | <b>Conducted Emission Test</b>  | <b>Pass</b>   | <b>Complies</b> |
| <b>FCC Part 15 Subpart C<br/>Paragraph 15.247(a)(2) Limit</b>             | <b>Spectrum bandwidth of a<br/>Orthogonal Frequency<br/>Division Multiplex System<br/>Limit: 6dB<br/>bandwidth&gt;500kHz</b>  | <b>Pass</b>   | <b>Complies</b> |
| <b>FCC Part 15, Paragraph<br/>15.247(b)</b>                               | <b>Maximum peak output<br/>power<br/>Limit: max. 30dBm</b>  | <b>Pass</b>   | <b>Complies</b> |
| <b>FCC Part 15, Paragraph<br/>15.109,15.205 &amp; 15.209</b>              | <b>Transmitter Radiated<br/>Emission<br/>Limit: Table 15.209</b>  | <b>Pass</b>   | <b>Complies</b> |
| <b>FCC Part 15, Paragraph<br/>15.247(e)</b>                               | <b>Power Spectral Density<br/>Limit: max. 8dBm/3kHz</b>   | <b>Pass</b>   | <b>Complies</b> |
| <b>FCC Part 15, Paragraph<br/>15.247(d)</b>                               | <b>Out of Band Emission and<br/>Restricted Band<br/>Radiation<br/>Limit: 20dB less than<br/>peak value of fundamental<br/>frequency<br/>Restricted band limit:<br/>Table 15.209</b> | <b>Pass</b>   | <b>Complies</b> |

#### 3.2 Test Standards

**FCC Part 15 Subpart & Subpart C, Paragraph 15.247**

#### 4.0 EUT Modification

**No modification by SHENZHEN TIMEWAY TESTING LABORATORIES.**

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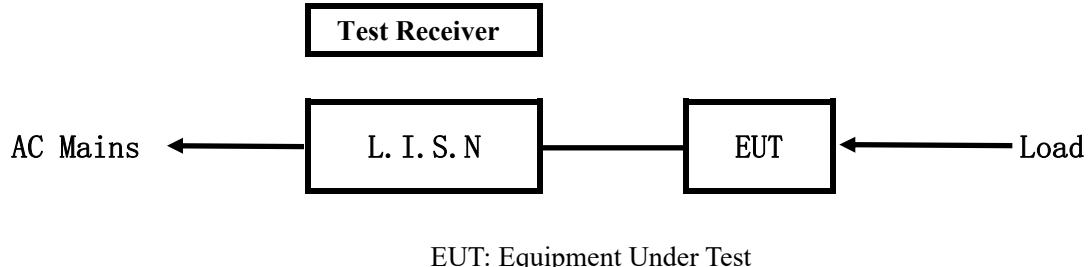
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## 5. Power Line Conducted Emission Test

### 5.1 Schematics of the test

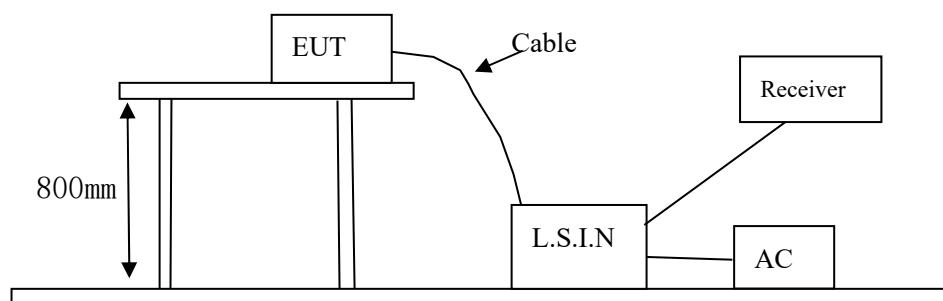


### 5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.10-2013. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.10 –2013.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



### 5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.10-2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

#### A. EUT

| Device | Manufacturer                      | Model                  | FCC ID           |
|--------|-----------------------------------|------------------------|------------------|
| ZBEE3  | Hangzhou Grom Technology Co.,Ltd. | ZBEE3S2F8C, ZBEE3S2F8U | 2AZEG-ZBEE3S2F8C |

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B. Internal Device

| Device | Manufacturer | Model | Rating |
|--------|--------------|-------|--------|
|        |              |       |        |

C. Peripherals

| Device | Manufacturer | Model | Rating |
|--------|--------------|-------|--------|
| PC     | ThinkPad     | R4    | --     |

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.10-2013.

A Setup the EUT and simulators as shown on follow  
B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207

| Frequency<br>(MHz) | Limits (dB $\mu$ V) |               |
|--------------------|---------------------|---------------|
|                    | Quasi-peak Level    | Average Level |
| 0.15 ~ 0.50        | 66.0~56.0*          | 56.0~46.0*    |
| 0.50 ~ 5.00        | 56.0                | 46.0          |
| 5.00 ~ 30.00       | 60.0                | 50.0          |

Notes: 1. \*Decreasing linearly with logarithm of frequency.  
2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

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**A: Conducted Emission on Live Terminal (150kHz to 30MHz)**

**EUT Operating Environment**

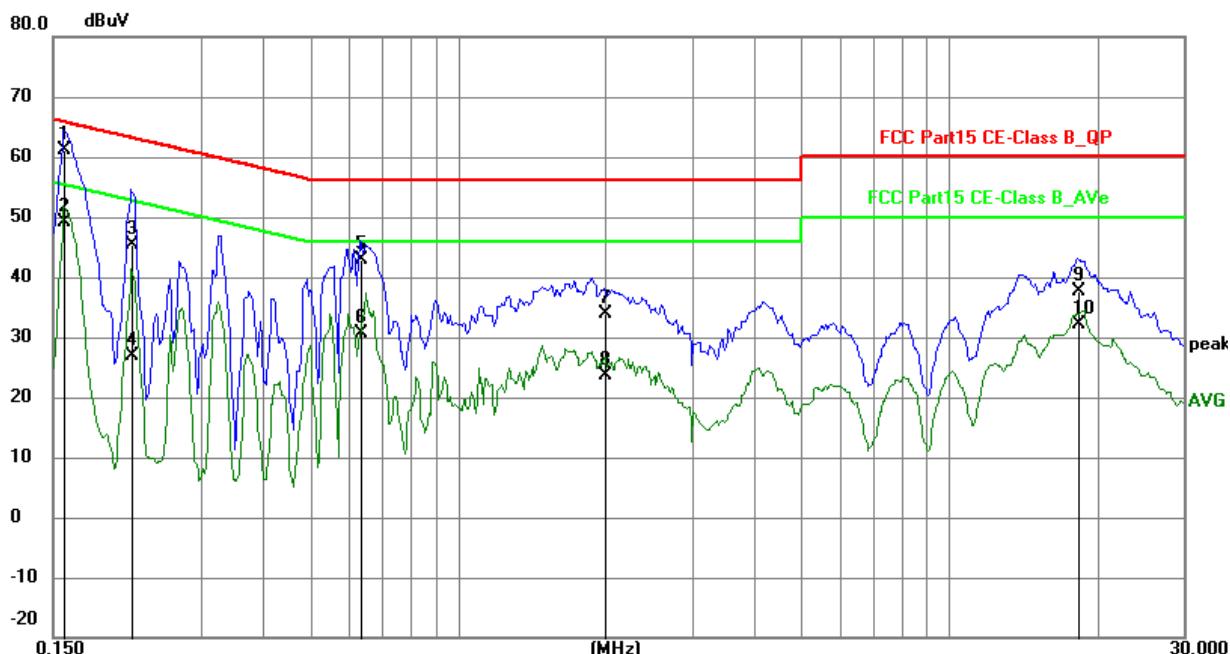
Temperature: 26°C      Humidity: 65%RH      Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Zigbee Transmitting**

**Equipment Level: Class B**

**Results: PASS**

Please refer to following diagram for individual



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|
| 1   | 0.1578          | 51.32          | 9.78        | 61.10        | 65.58        | -4.48       | QP       | P   |
| 2   | 0.1578          | 39.28          | 9.78        | 49.06        | 55.58        | -6.52       | AVG      | P   |
| 3   | 0.2163          | 35.72          | 9.75        | 45.47        | 62.96        | -17.49      | QP       | P   |
| 4   | 0.2163          | 17.10          | 9.75        | 26.85        | 52.96        | -26.11      | AVG      | P   |
| 5   | 0.6336          | 33.20          | 9.78        | 42.98        | 56.00        | -13.02      | QP       | P   |
| 6   | 0.6336          | 20.97          | 9.78        | 30.75        | 46.00        | -15.25      | AVG      | P   |
| 7   | 1.9869          | 24.02          | 9.80        | 33.82        | 56.00        | -22.18      | QP       | P   |
| 8   | 1.9869          | 13.80          | 9.80        | 23.60        | 46.00        | -22.40      | AVG      | P   |
| 9   | 18.2334         | 27.03          | 10.57       | 37.60        | 60.00        | -22.40      | QP       | P   |
| 10  | 18.2334         | 21.53          | 10.57       | 32.10        | 50.00        | -17.90      | AVG      | P   |

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**B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)**

**EUT Operating Environment**

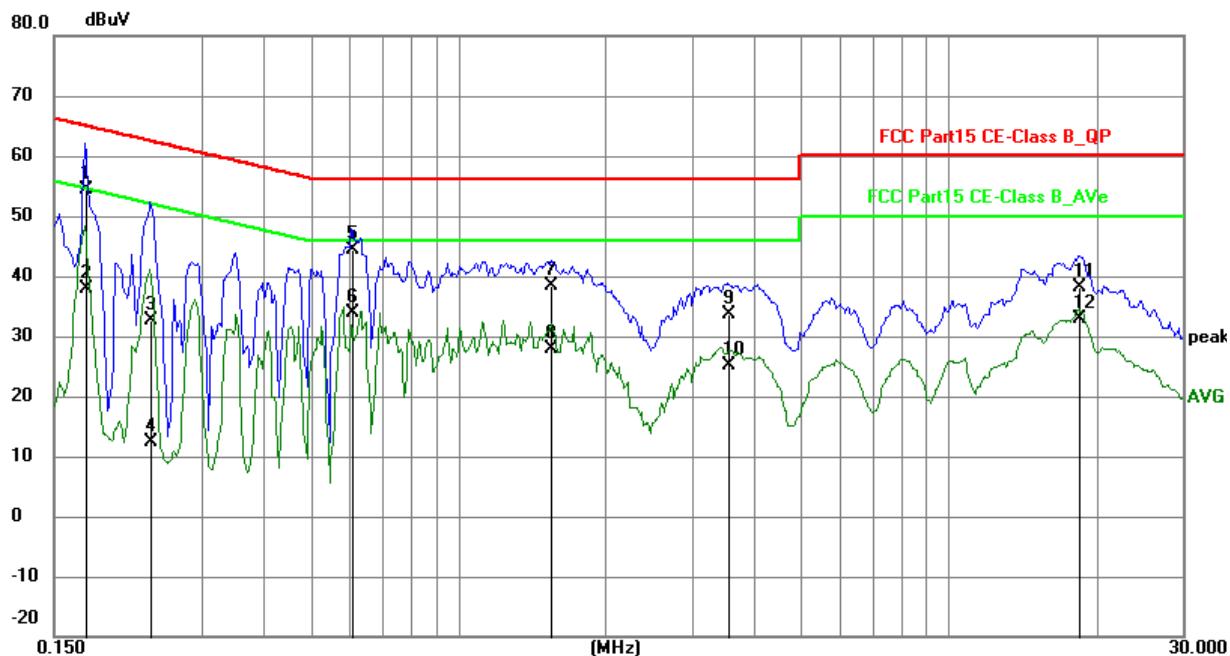
Temperature: 26°C      Humidity: 65%RH      Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Zigbee Transmitting**

**Equipment Level: Class B**

**Results: Pass**

Please refer to following diagram for individual



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|
| 1   | 0.1734          | 44.68          | 9.77        | 54.45        | 64.80        | -10.35      | QP       | P   |
| 2   | 0.1734          | 28.10          | 9.77        | 37.87        | 54.80        | -16.93      | AVG      | P   |
| 3   | 0.2358          | 22.99          | 9.75        | 32.74        | 62.24        | -29.50      | QP       | P   |
| 4   | 0.2358          | 2.61           | 9.75        | 12.36        | 52.24        | -39.88      | AVG      | P   |
| 5   | 0.6063          | 34.48          | 9.78        | 44.26        | 56.00        | -11.74      | QP       | P   |
| 6   | 0.6063          | 24.18          | 9.78        | 33.96        | 46.00        | -12.04      | AVG      | P   |
| 7   | 1.5462          | 28.70          | 9.80        | 38.50        | 56.00        | -17.50      | QP       | P   |
| 8   | 1.5462          | 18.15          | 9.80        | 27.95        | 46.00        | -18.05      | AVG      | P   |
| 9   | 3.5499          | 23.68          | 9.87        | 33.55        | 56.00        | -22.45      | QP       | P   |
| 10  | 3.5499          | 15.28          | 9.87        | 25.15        | 46.00        | -20.85      | AVG      | P   |
| 11  | 18.3894         | 27.64          | 10.58       | 38.22        | 60.00        | -21.78      | QP       | P   |
| 12  | 18.3894         | 22.19          | 10.58       | 32.77        | 50.00        | -17.23      | AVG      | P   |

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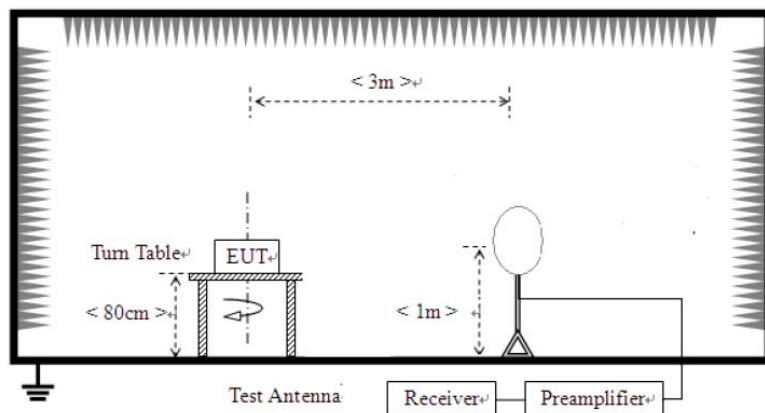
## 6 Radiated Emission Test

### 6.1 Test Method and test Procedure:

- (1) The EUT was tested according to ANSI C63.10-2013. The radiated test was performed at Timeway EMC Laboratory. This site is on file with the FCC laboratory division, Registration No.744189
- (2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2013.
- (3) The frequency spectrum from 30 MHz to 25 GHz was investigated. All readings from 30 MHz to 1 GHz are Quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=1MHz VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector. Measurements were made at 3 meters.
- (4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
- (5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a “QP” in the data table.
- (6) The antenna polarization : Vertical polarization and Horizontal polarization.

### Block diagram of Test setup

For radiated emissions from 9kHz to 30MHz



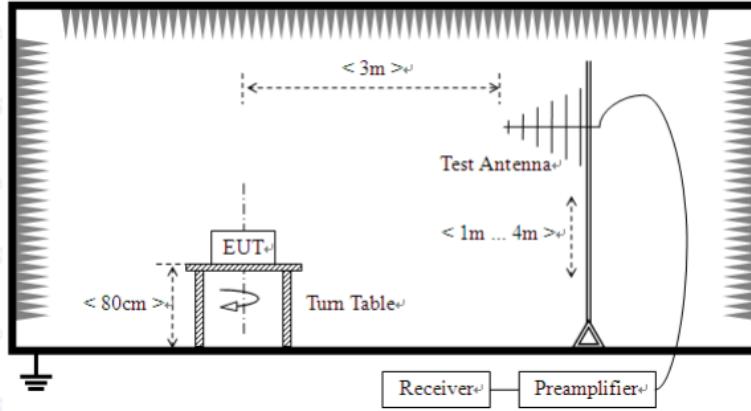
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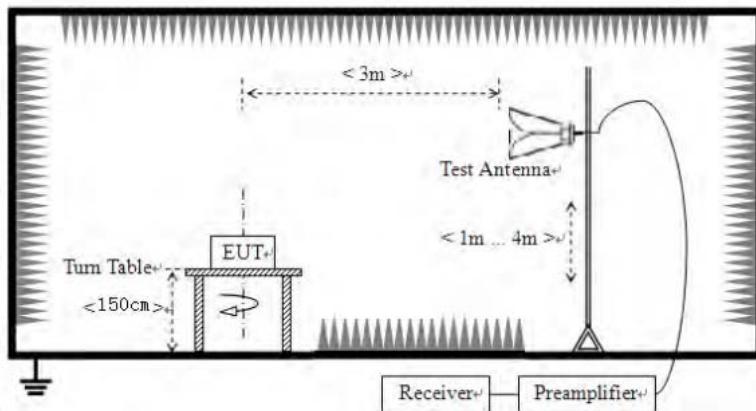
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For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



## 6.2 Configuration of The EUT

Same as section 5.3 of this report

## 6.3 EUT Operating Condition

Same as section 5.4 of this report.

## 6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

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**Frequencies in restricted band are complied to limit on Paragraph 15.209 and 15.109**

| Frequency Range (MHz) | Distance (m) | Field strength (dB $\mu$ V/m) |
|-----------------------|--------------|-------------------------------|
| 30-88                 | 3            | 40.0                          |
| 88-216                | 3            | 43.5                          |
| 216-9 0               | 3            | 46.0                          |
| Above 960             | 3            | 54.0                          |

Note:

1. RF Voltage (dBuV) =  $20 \log_{10} \text{RF Voltage (uV)}$
2. In the Above Table, the higher limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT

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### Test result

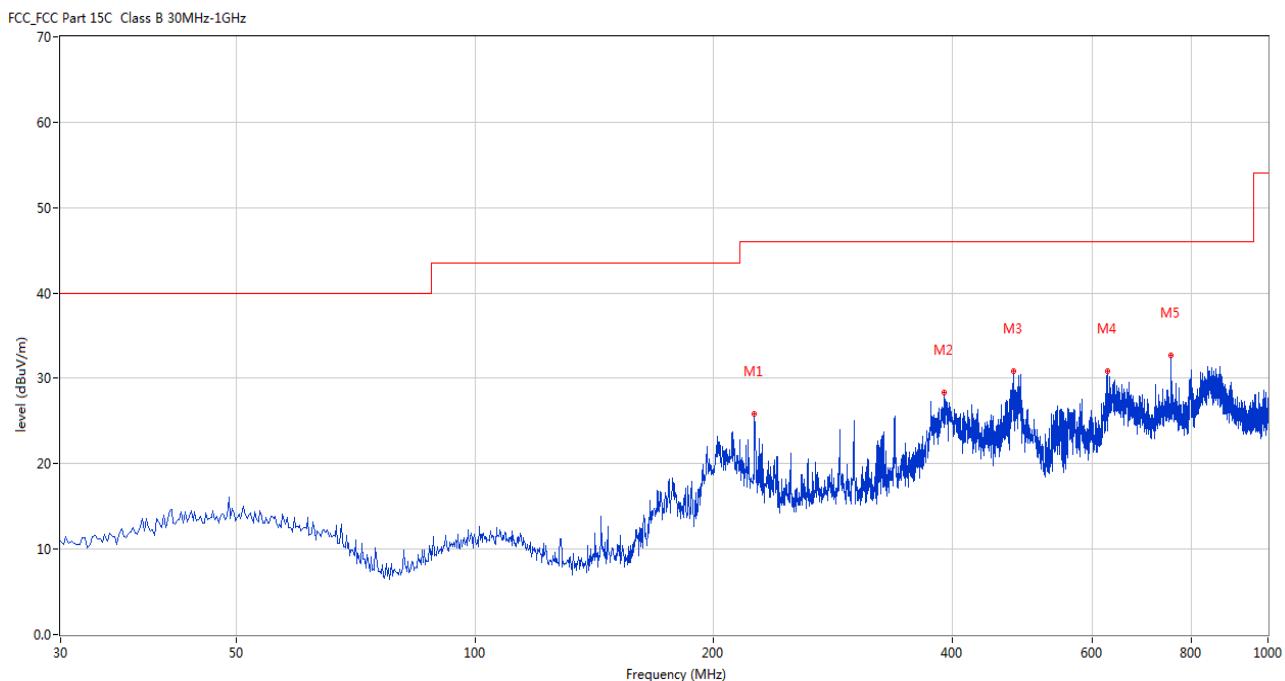
### General Radiated Emission Data and Harmonics Radiated Emission Data

#### Radiated Emission In Horizontal (30MHz---1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with chip antenna**

**Results:** **Pass**

Test Figure:



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 1   | 225.164         | 25.87            | -12.91      | 46.0           | -20.13          | Peak     | 306.00    | 100         | Horizontal | Pass    |
| 2   | 390.022         | 28.34            | -8.88       | 46.0           | -17.66          | Peak     | 360.00    | 100         | Horizontal | Pass    |
| 3   | 478.028         | 30.80            | -7.45       | 46.0           | -15.20          | Peak     | 151.00    | 100         | Horizontal | Pass    |
| 4   | 628.098         | 30.82            | -4.95       | 46.0           | -15.18          | Peak     | 263.00    | 100         | Horizontal | Pass    |
| 5   | 755.379         | 32.72            | -3.22       | 46.0           | -13.28          | Peak     | 332.00    | 100         | Horizontal | Pass    |

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### Test result

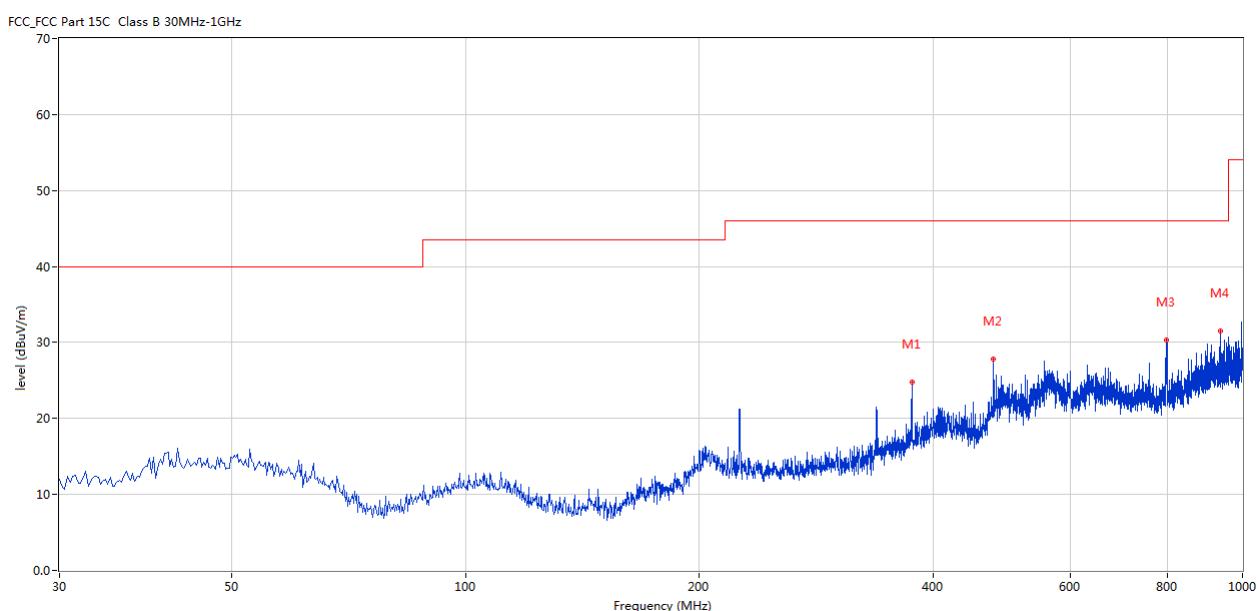
### General Radiated Emission Data and Harmonics Radiated Emission Data

#### Radiated Emission In Vertical (30MHz---1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with chip antenna**

**Results:** **Pass**

Test Figure:



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 1   | 375.476         | 24.73            | -9.41       | 46.0           | -21.27          | Peak     | 0.00      | 100         | Vertical | Pass    |
| 2   | 478.270         | 27.76            | -7.45       | 46.0           | -18.24          | Peak     | 63.00     | 100         | Vertical | Pass    |
| 3   | 797.321         | 30.38            | -3.03       | 46.0           | -15.62          | Peak     | 7.00      | 100         | Vertical | Pass    |
| 4   | 936.723         | 31.52            | -1.74       | 46.0           | -14.48          | Peak     | 14.00     | 100         | Vertical | Pass    |

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### Test result

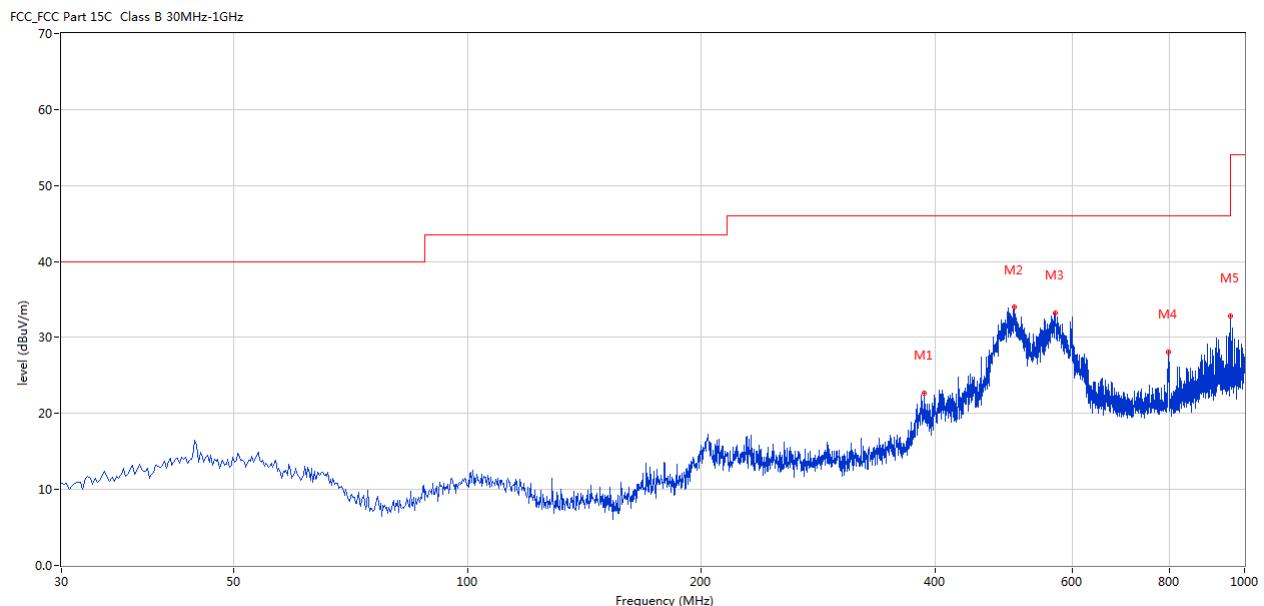
### General Radiated Emission Data and Harmonics Radiated Emission Data

#### Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: Keep Zigbee Transmitting with UFL antenna

Results: **Pass**

Test Figure:



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 1   | 387.113         | 22.63            | -9.01       | 46.0           | -23.37          | Peak     | 3.00      | 100         | Horizontal | Pass    |
| 2   | 506.151         | 33.95            | -6.89       | 46.0           | -12.05          | Peak     | 15.00     | 100         | Horizontal | Pass    |
| 3   | 570.640         | 33.17            | -5.82       | 46.0           | -12.83          | Peak     | 1.00      | 100         | Horizontal | Pass    |
| 4   | 798.533         | 28.09            | -3.01       | 46.0           | -17.91          | Peak     | 3.00      | 100         | Horizontal | Pass    |
| 5   | 960.240         | 32.79            | -1.63       | 54.0           | -21.21          | Peak     | 8.00      | 100         | Horizontal | Pass    |

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### Test result

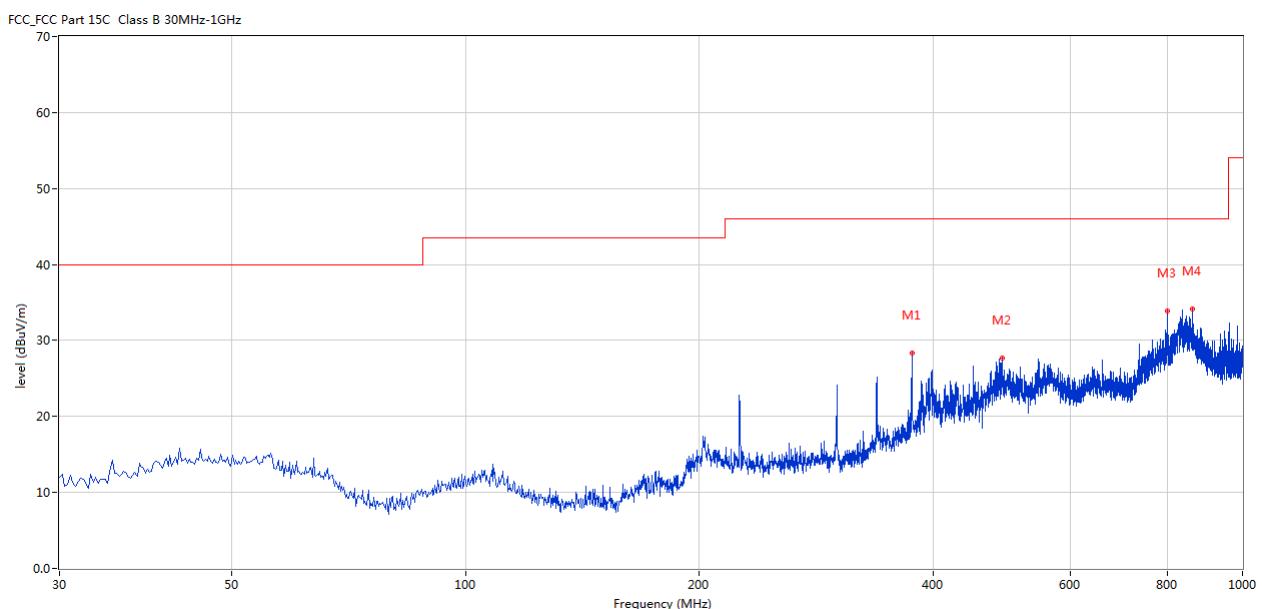
### General Radiated Emission Data and Harmonics Radiated Emission Data

#### Radiated Emission In Vertical (30MHz---1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with UFL antenna**

**Results:** **Pass**

Test Figure:



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 1   | 375.476         | 28.36            | -9.41       | 46.0           | -17.64          | Peak     | 311.00    | 100         | Vertical | Pass    |
| 2   | 490.635         | 27.69            | -7.20       | 46.0           | -18.31          | Peak     | 201.00    | 100         | Vertical | Pass    |
| 3   | 799.988         | 33.84            | -2.96       | 46.0           | -12.16          | Peak     | 345.00    | 100         | Vertical | Pass    |
| 4   | 861.567         | 34.11            | -2.28       | 46.0           | -11.89          | Peak     | 278.00    | 100         | Vertical | Pass    |

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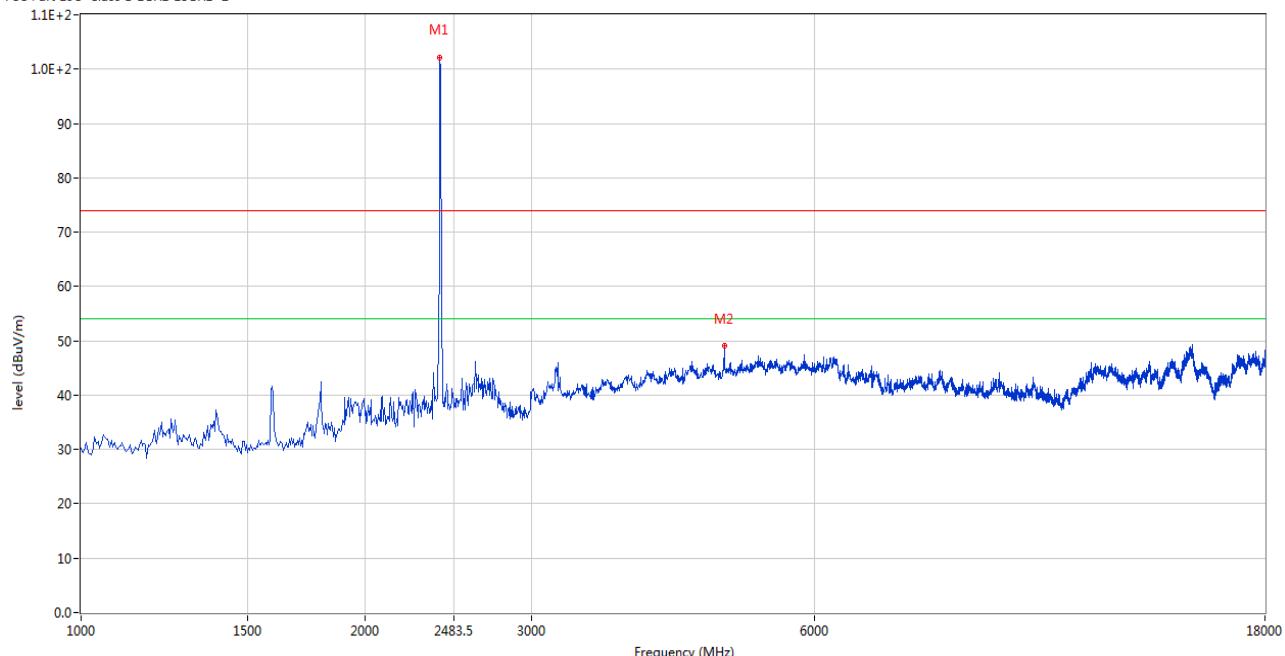


### Test data with Chip Antenna from page 19-24

Please refer to the following test plots for details:

#### Low Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 2   | 4808.000        | 49.03            | 3.13        | 74.0           | -24.97          | Peak     | 106.00    | 100         | Vertical | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

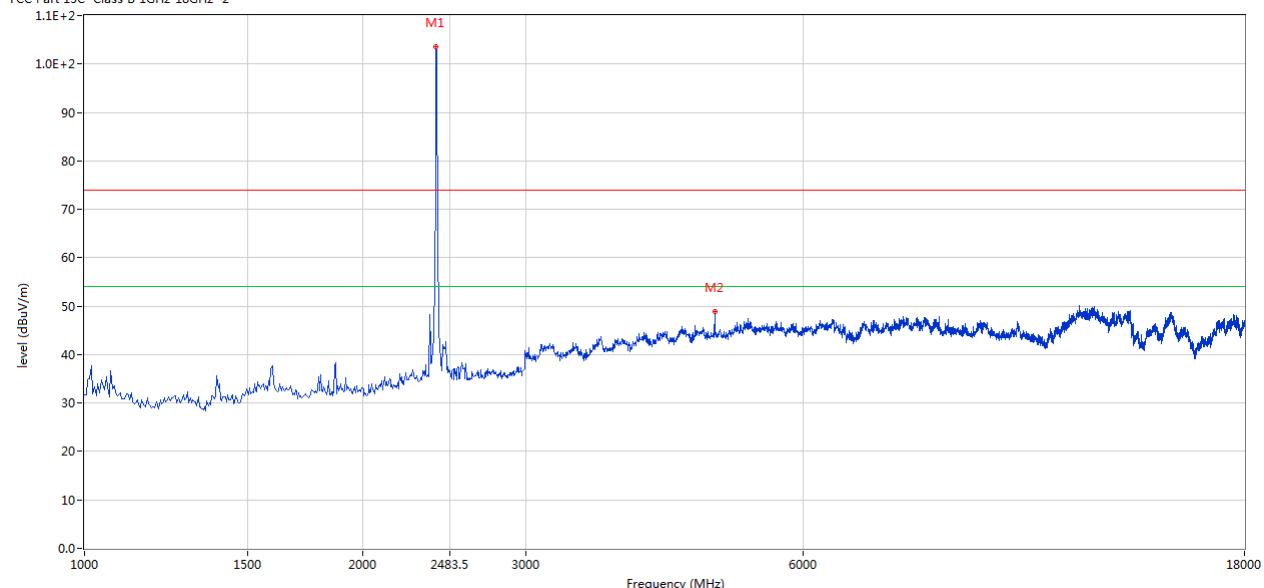
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### Low Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 4808.000        | 48.95            | 3.13        | 74.0           | -25.05          | Peak     | 166.00    | 100         | Horizontal | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

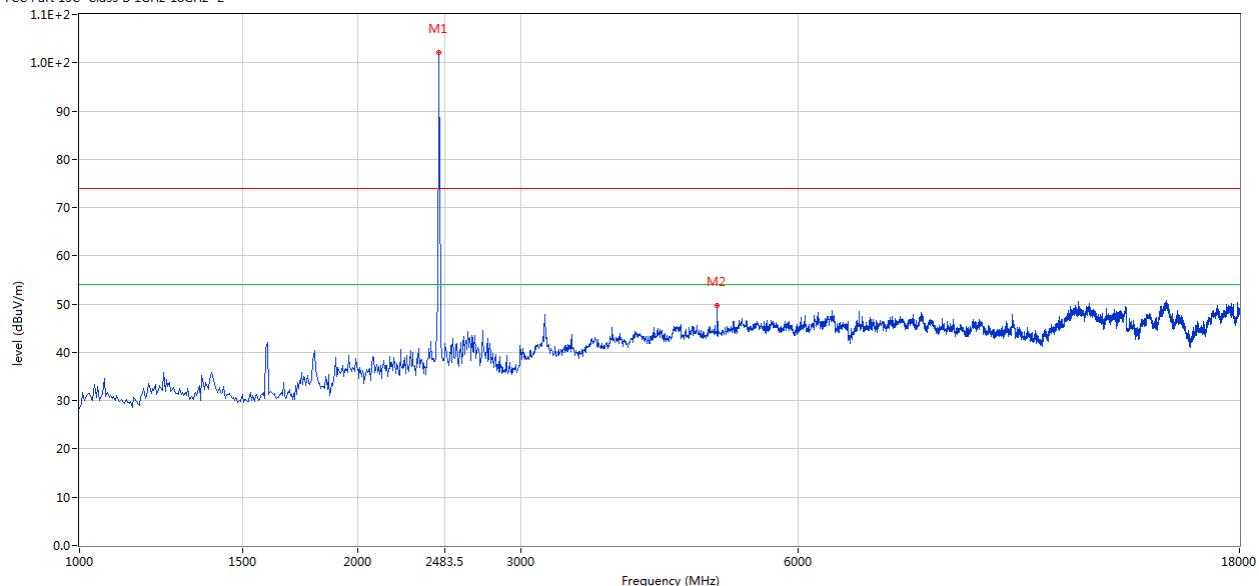
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### Middle Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 2   | 4901.500        | 49.69            | 3.22        | 74.0           | -24.31          | Peak     | 171.00    | 100         | Vertical | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

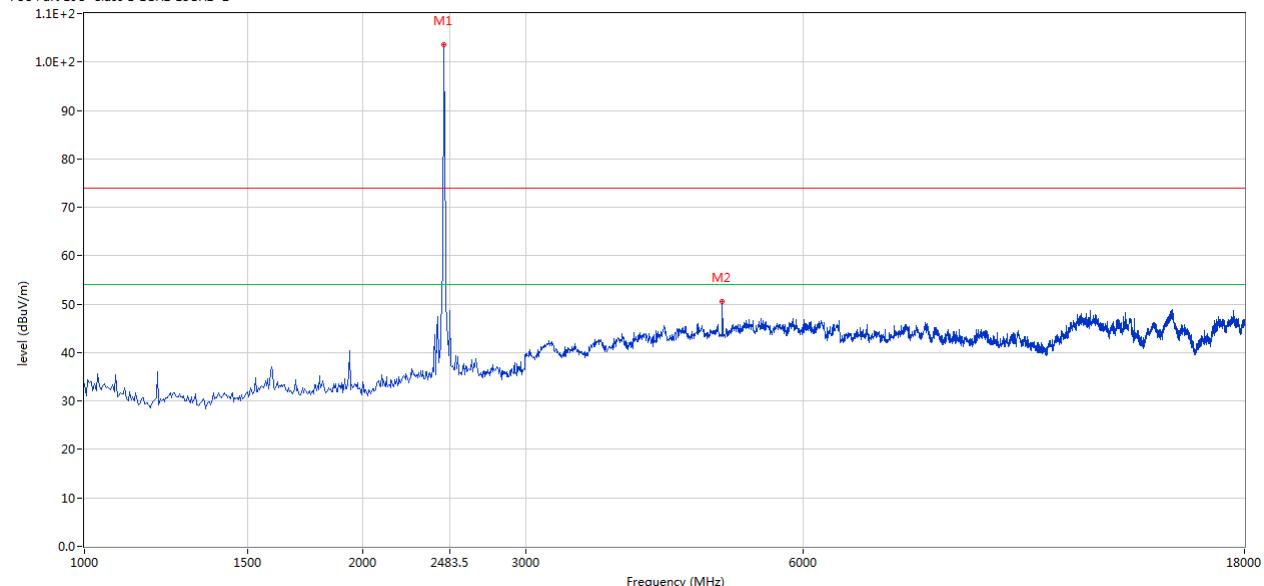
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### Middle Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 4901.500        | 50.59            | 3.22        | 74.0           | -23.41          | Peak     | 150.00    | 100         | Horizontal | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

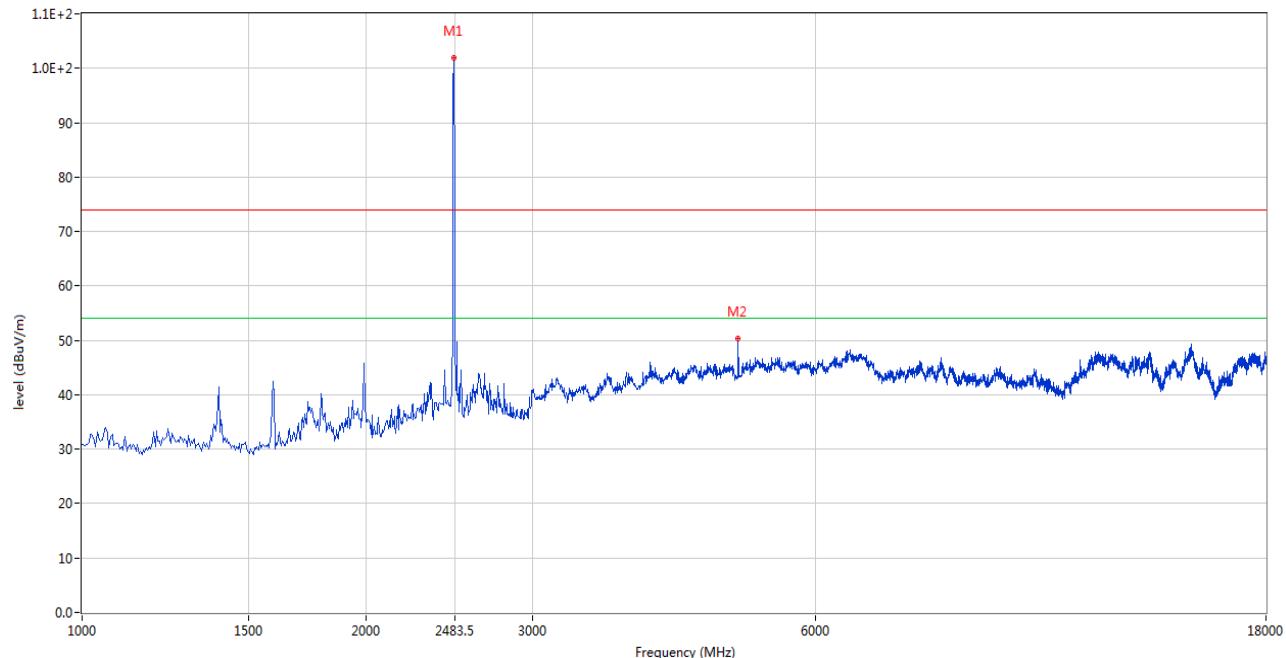
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### High Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 2   | 4961.000        | 50.43            | 3.36        | 74.0           | -23.57          | Peak     | 37.00     | 100         | Vertical | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

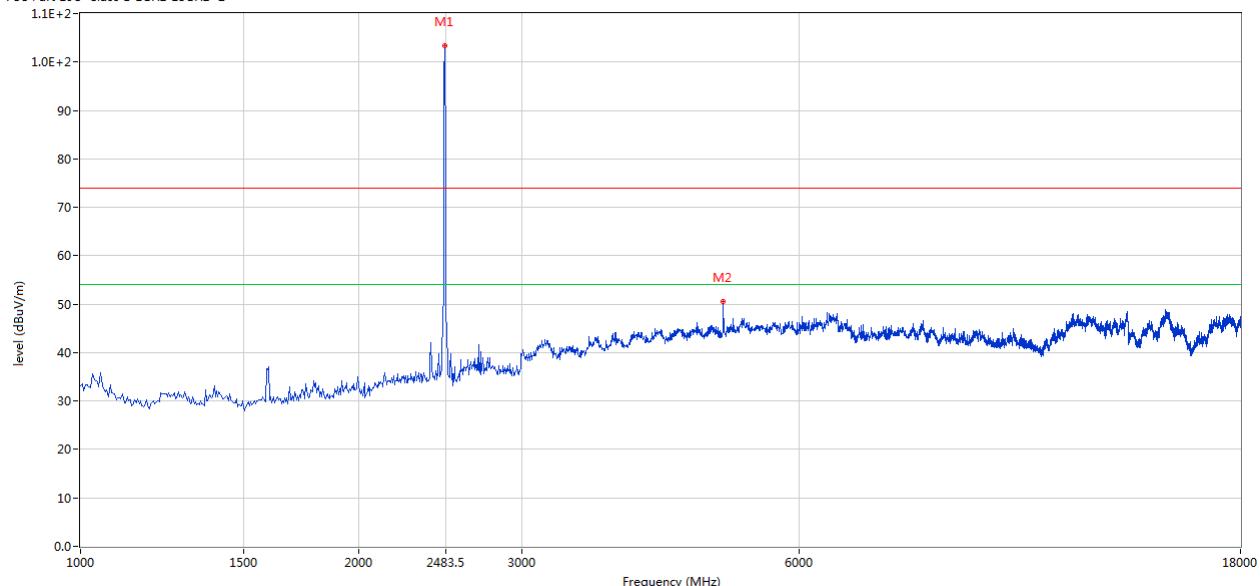
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### High Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 4961.000        | 51.49            | 3.36        | 74.0           | -22.51          | Peak     | 311.00    | 100         | Horizontal | Pass    |

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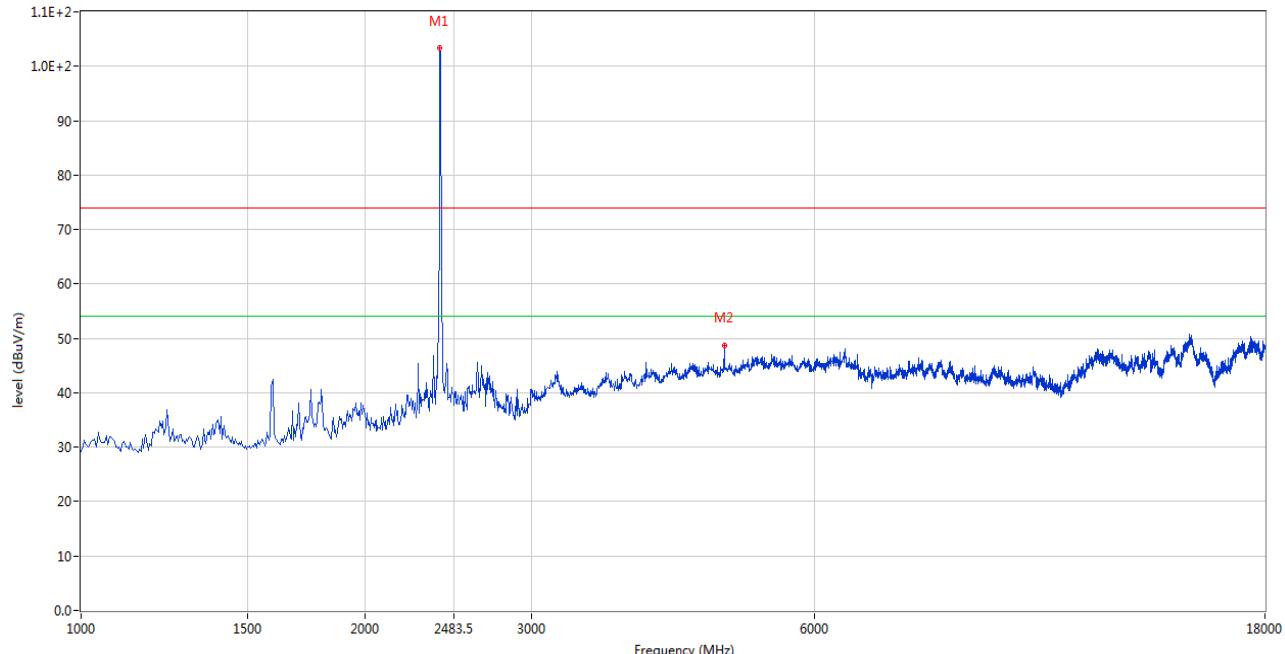


### Test data with UFL Antenna from page 25-30

Please refer to the following test plots for details:

#### Low Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 2   | 4808.000        | 48.60            | 3.13        | 74.0           | -25.40          | Peak     | 83.00     | 100         | Vertical | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

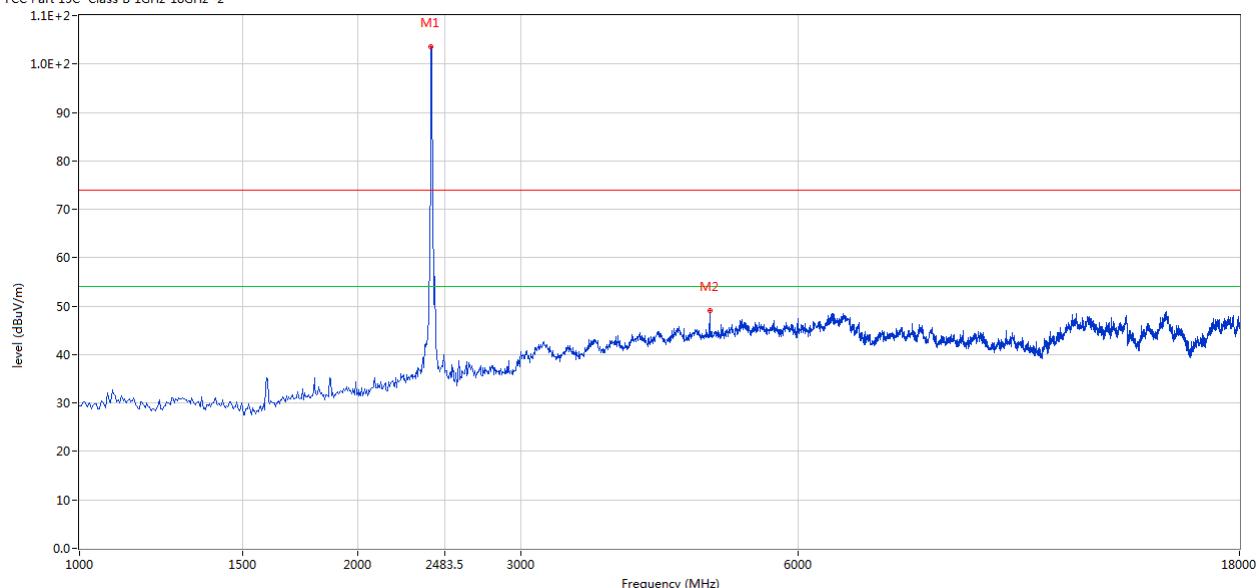
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### Low Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 4808.000        | 49.13            | 3.13        | 74.0           | -24.87          | Peak     | 275.00    | 100         | Horizontal | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

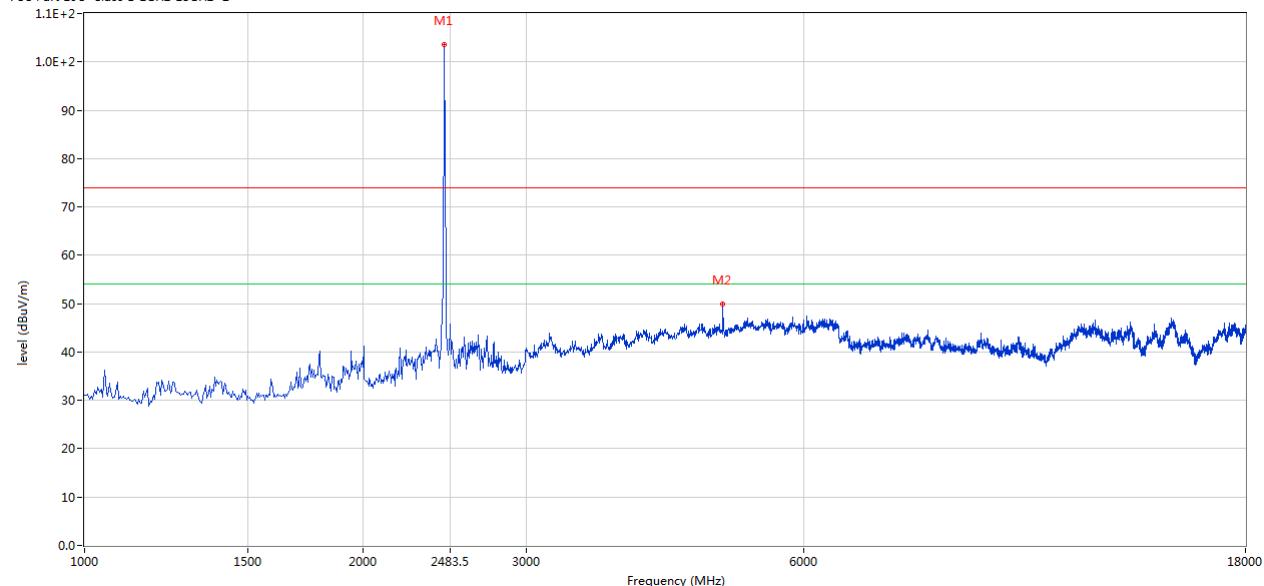
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### Middle Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 2   | 4901.500        | 49.91            | 3.22        | 74.0           | -24.09          | Peak     | 84.00     | 100         | Vertical | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

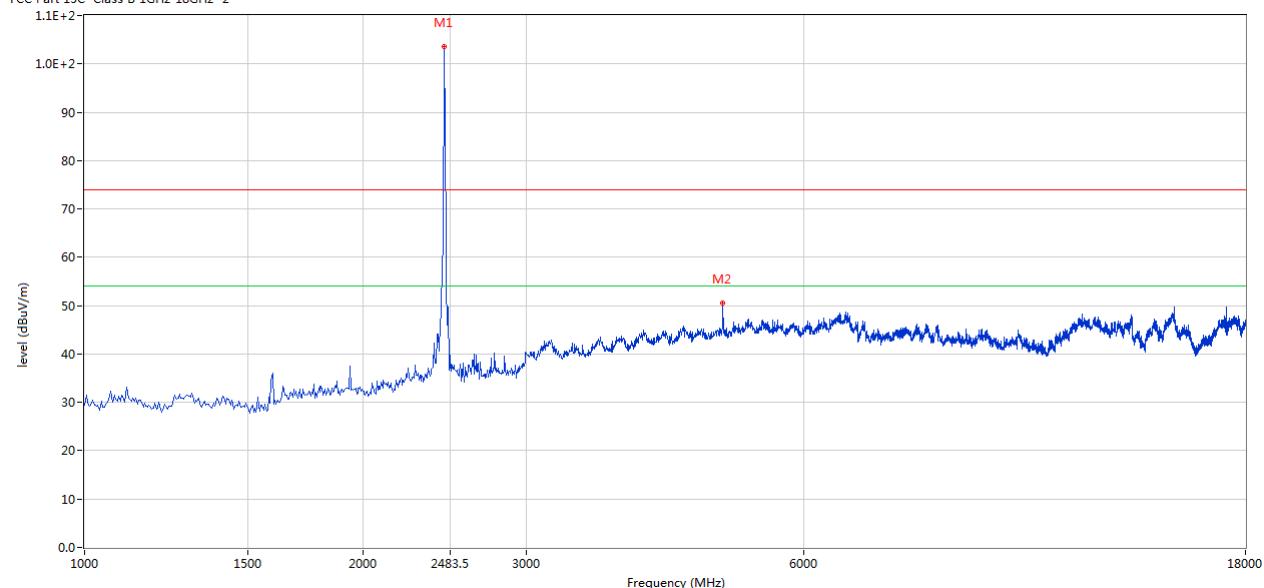
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### Middle Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 4901.500        | 50.46            | 3.22        | 74.0           | -23.54          | Peak     | 274.00    | 100         | Horizontal | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

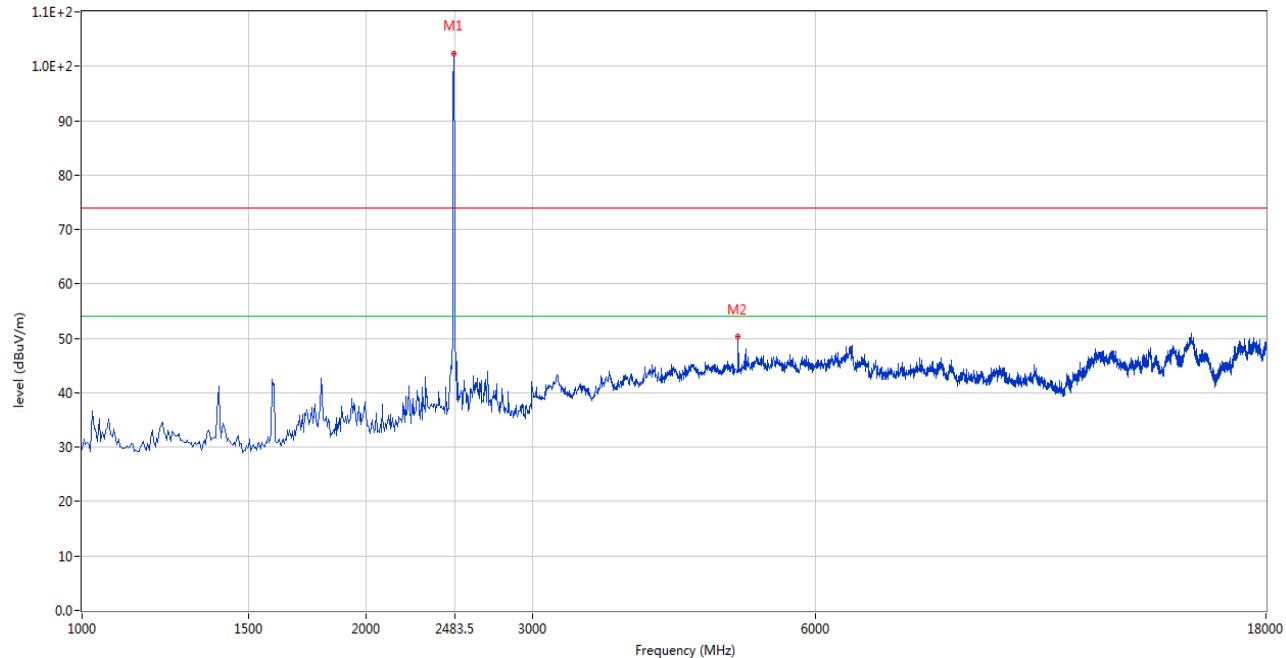
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### High Channel: Vertical

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 2   | 4961.000        | 50.28            | 3.36        | 74.0           | -23.72          | Peak     | 16.00     | 100         | Vertical | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

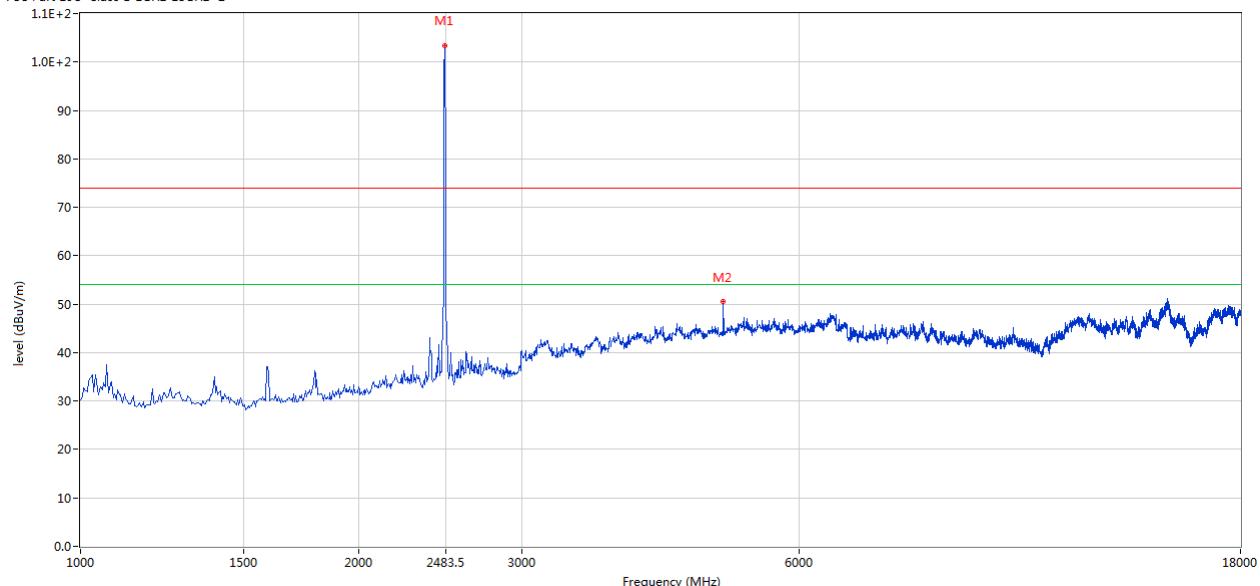
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### High Channel: Horizontal

FCC Part 15C Class B 1GHz-18GHz -2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 4961.000        | 51.49            | 3.36        | 74.0           | -22.51          | Peak     | 317.00    | 100         | Horizontal | Pass    |

Note: 1. Result Level = Reading + Factor  
2. Factor= AF + Cable Loss- Preamp  
3. Margin = Result- Limit  
4. For radiated Emissions from 18-25GHz and below 30MHz, it is only the floor noise.  
5. The peak value less than the AV limit, no necessary to take down the AV measurement result.

The report refers only to the sample tested and does not apply to the bulk.

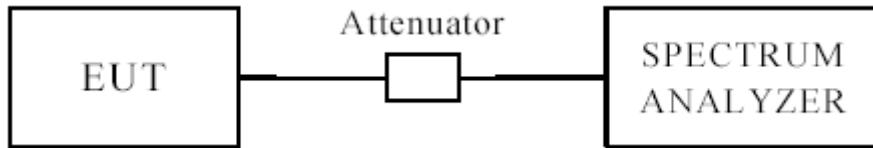
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## 7.0 6dB Bandwidth Measurement

### 7.1 Test Setup



### 7.2 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is >500 kHz

### 7.3 Test Procedure

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

### 7.4 Test Result

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### 6dB BW

| EUT         |                         | ZBEE3                | Model               | ZBEE3S2F8C |
|-------------|-------------------------|----------------------|---------------------|------------|
| Mode        |                         | Keep Transmitting    | Test Voltage        | DC3.3V     |
| Temperature |                         | 24 deg. C,           | Humidity            | 56% RH     |
| Channel     | Channel Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass/ Fail |
| Low         | 2405                    | 1.683                | 0.5                 | Pass       |
| Middle      | 2450                    | 1.683                | 0.5                 | Pass       |
| High        | 2480                    | 1.663                | 0.5                 | Pass       |

The report refers only to the sample tested and does not apply to the bulk.

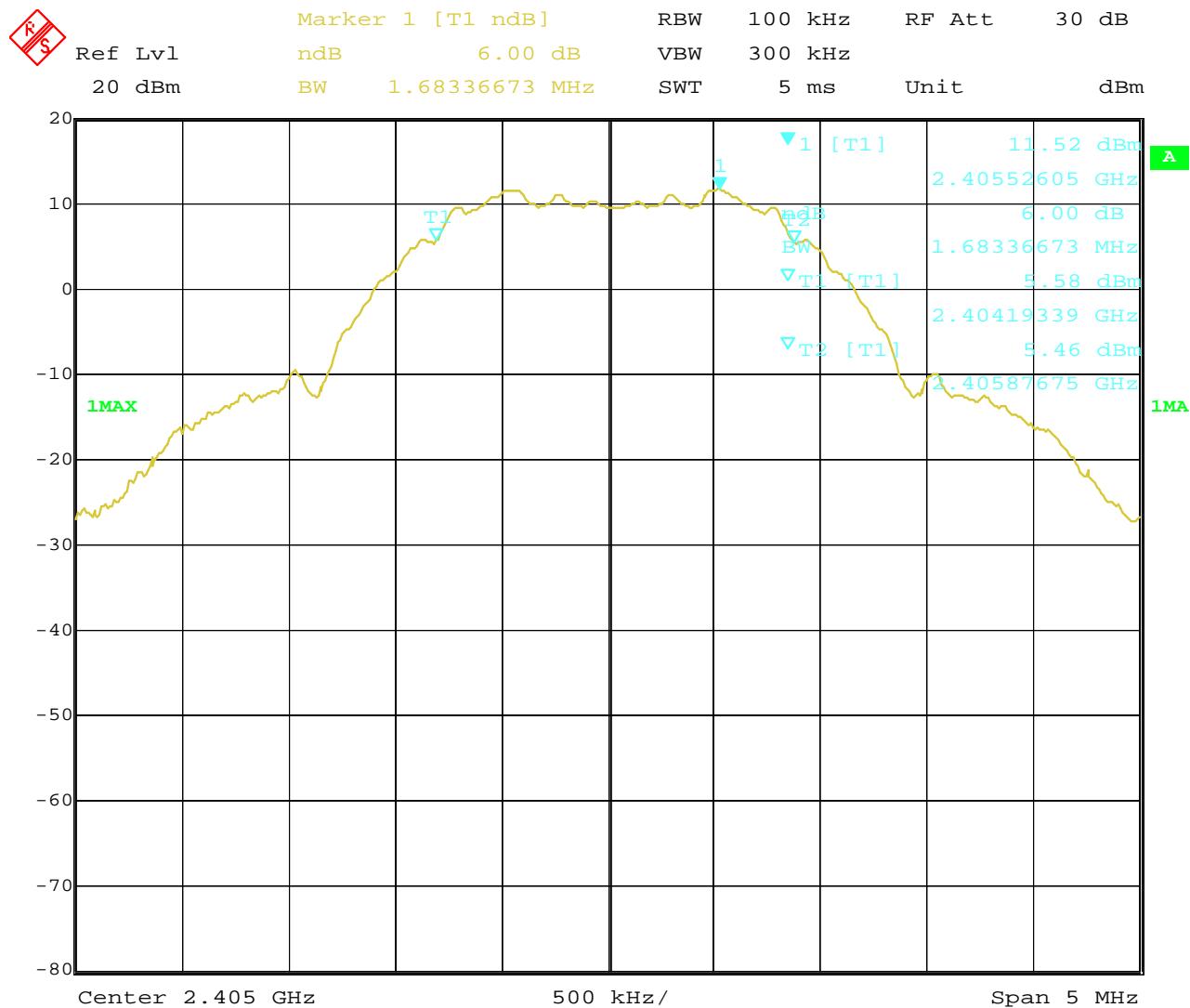
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## Test Figure:

## 1. Condition: Low Channel



Date: 25.MAR.2021 13:10:05

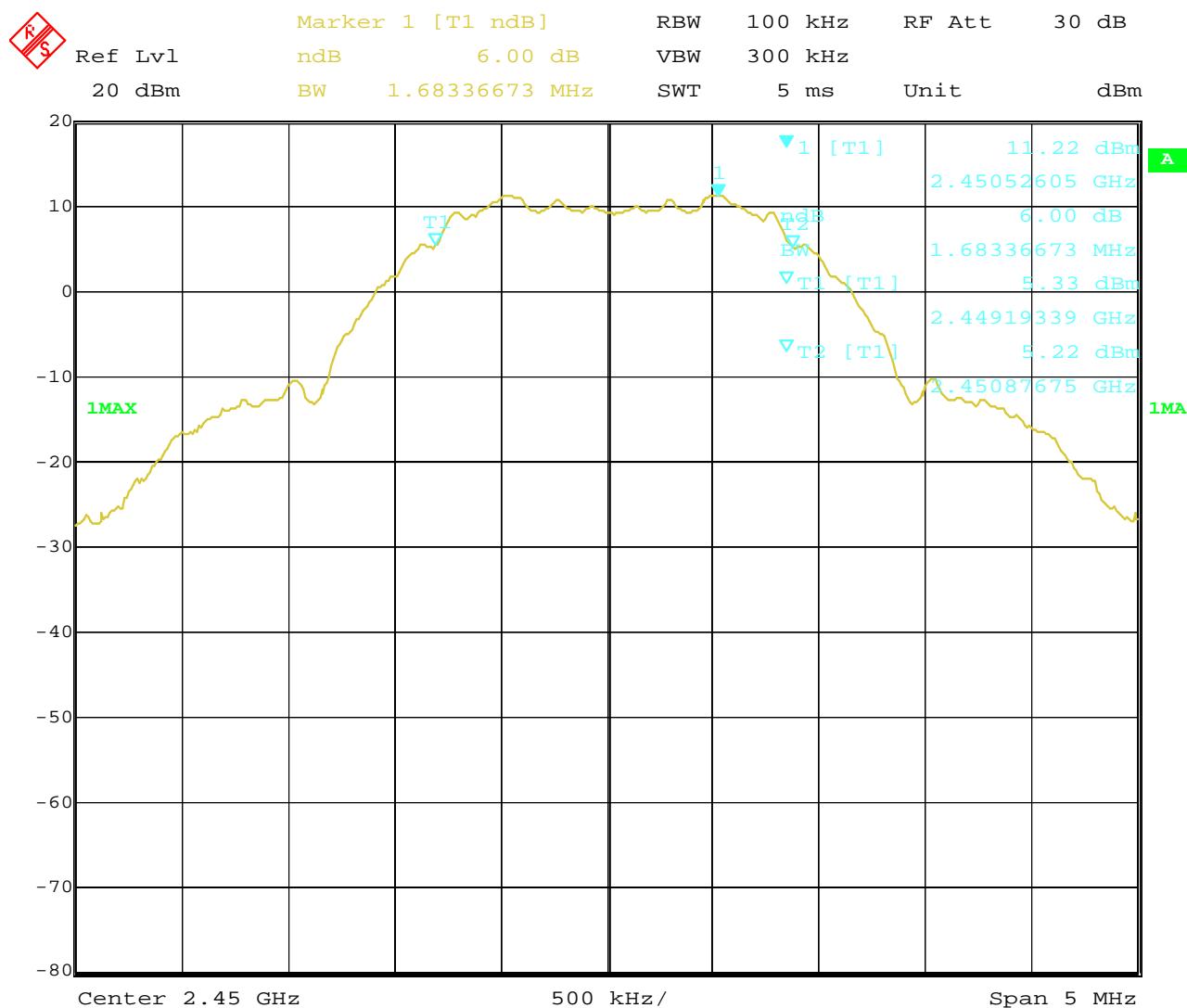
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## 2. Condition: Middle Channel



Date: 25.MAR.2021 13:39:01

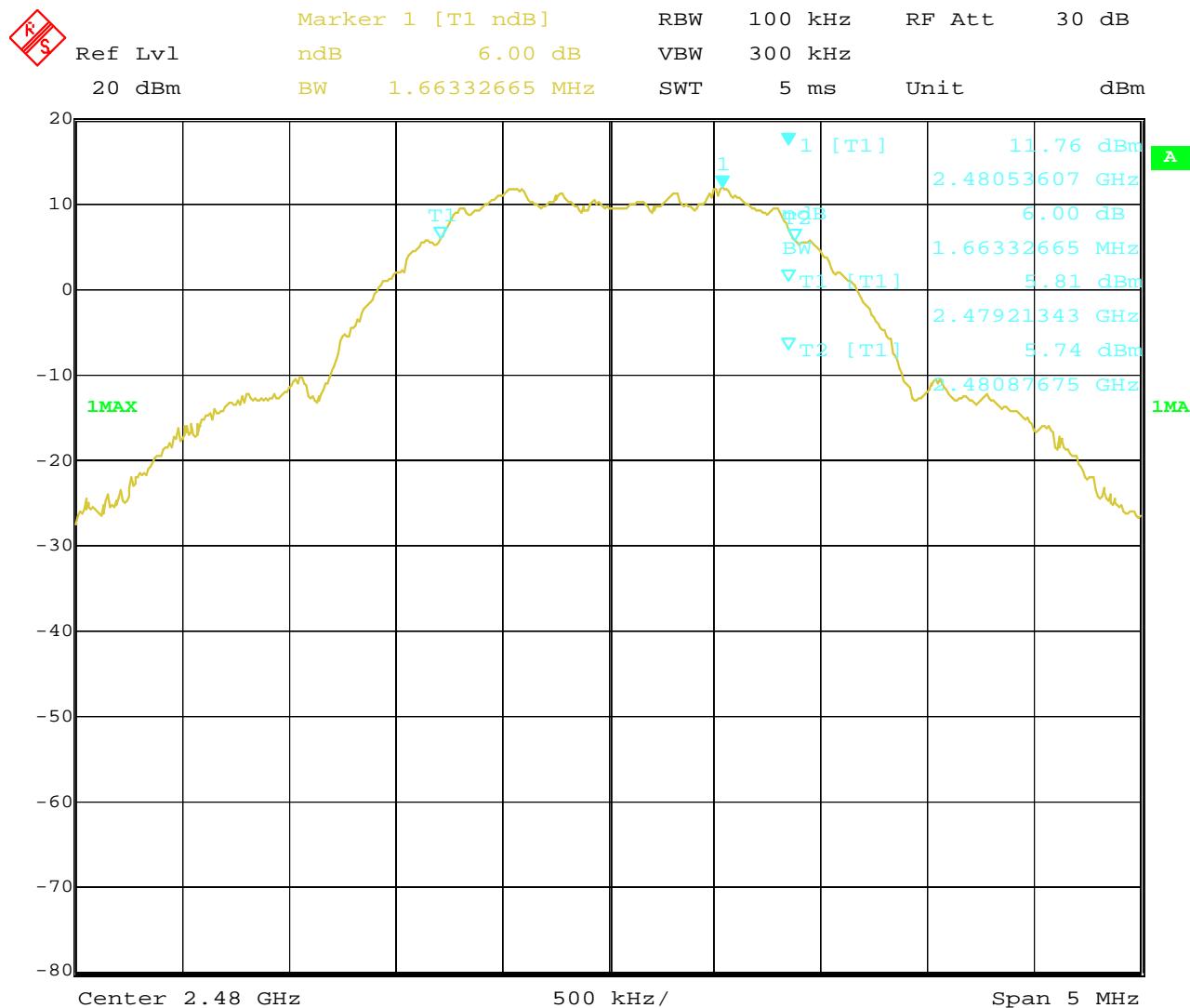
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### 3. High Channel



Date: 16.APR.2021 11:53:49

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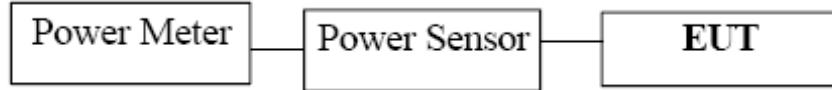
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## 8. Maximum Output Power

### 8.1 Test Setup



### 8.2 Limits of Maximum Output Power

The Maximum Output Power Measurement is 30dBm.

### 8.3 Test Procedure

The RF power output was measured with a Power meter connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate centre frequency.

**Note: the Peak power were measured.**

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#### 8.4 Test Results

| EUT         |                            | ZBEE3                   | Model        | ZBEE3S2F8C                   |            |
|-------------|----------------------------|-------------------------|--------------|------------------------------|------------|
| Mode        |                            | Keep Transmitting       | Test Voltage | DC3.3V                       |            |
| Temperature |                            | 24 deg. C,              | Humidity     | 56% RH                       |            |
| Channel     | Channel Frequency<br>(MHz) | Max. Power Output (dBm) |              | Peak Power<br>Limit<br>(dBm) | Pass/ Fail |
|             |                            | Peak                    |              |                              |            |
| Low         | 2405                       | 17.90                   |              | 30                           | Pass       |
| Middle      | 2450                       | 17.58                   |              | 30                           | Pass       |
| High        | 2480                       | 17.70                   |              | 30                           | Pass       |

Note: 1. the result basic equation calculation as follow:

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

The report refers only to the sample tested and does not apply to the bulk.

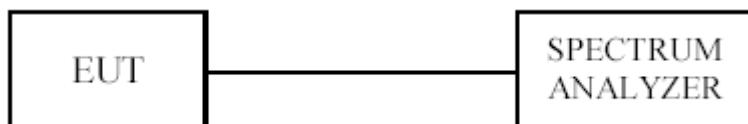
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## 9. Power Spectral Density Measurement

### 9.1 Test Setup



### 9.2 Limits of Power Spectral Density Measurement

The Maximum Power Spectral Density Measurement is 8dBm/3kHz.

### 9.3 Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 10 kHz.
3. Set the VBW  $\geq$  30 kHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be  $\leq$  8 dBm/3kHz.

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#### 9.4 Test Result

| EUT         |                          | ZBEE3             |  | Model                    |            |
|-------------|--------------------------|-------------------|--|--------------------------|------------|
| Mode        |                          | Keep Transmitting |  | Test Voltage             |            |
| Temperature |                          | 24 deg. C,        |  | Humidity                 |            |
| Channel     | Peak Power Reading (dBm) | Cable Loss (dB)   | Final Power Spectral Density (dBm/10kHz) | Maximum Limit (dBm/3kHz) | Pass/ Fail |
| <hr/>       |                          |                   |  |                          |            |
| Low         | 3.69                     | 0.2               | 3.89                                     | 8                        | Pass       |
| Middle      | 3.16                     | 0.2               | 3.36                                     | 8                        | Pass       |
| High        | 3.96                     | 0.2               | 4.16                                     | 8                        | Pass       |

Note: The result basic equation calculation as follow:

Peak Power Output = Peak Power Reading + Cable loss

The report refers only to the sample tested and does not apply to the bulk.

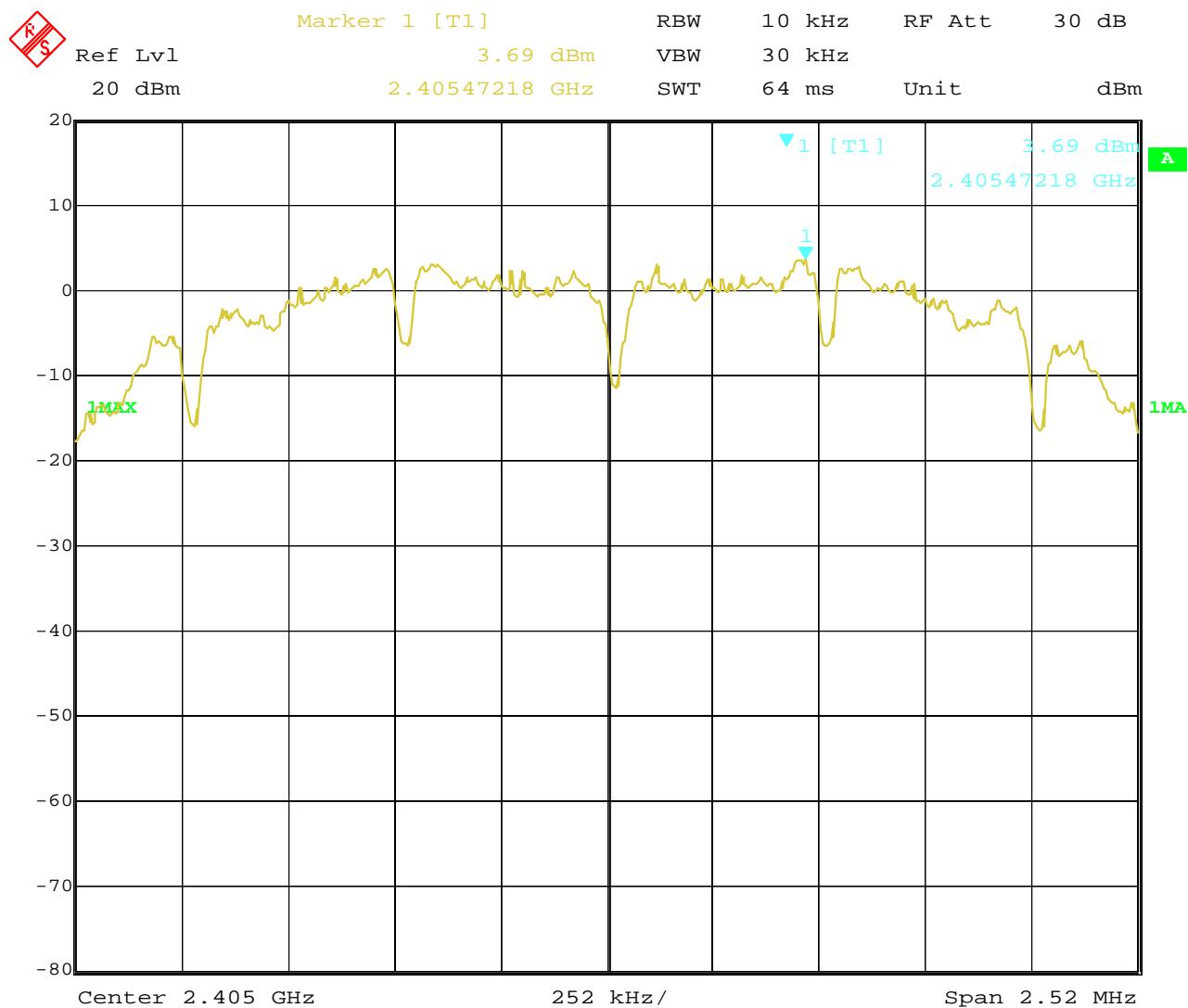
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Test Figure:

### 1. Condition: Low Channel



Date: 25.MAR.2021 14:41:52

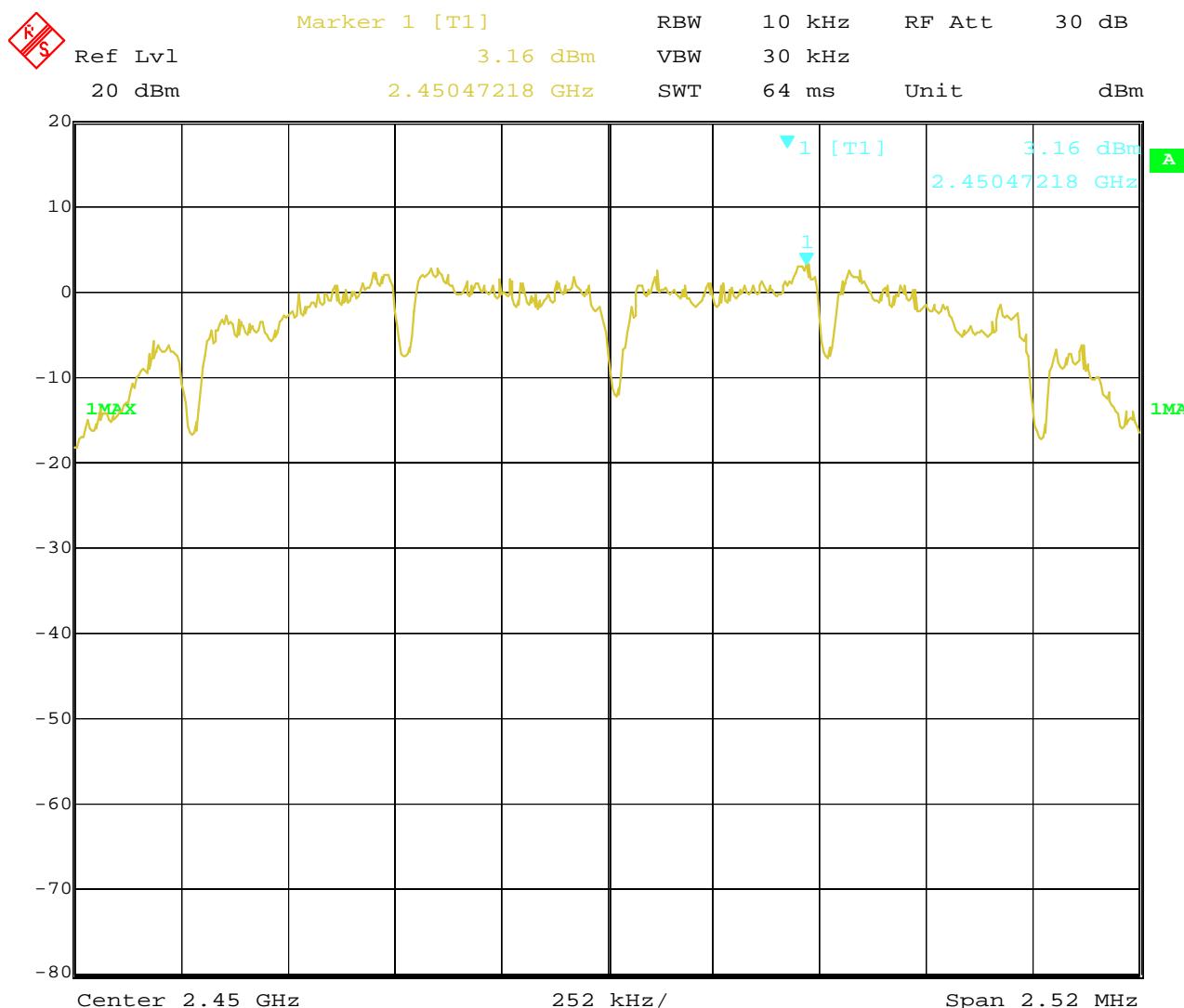
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## 2. Condition: Middle Channel



Date: 25.MAR.2021 15:02:14

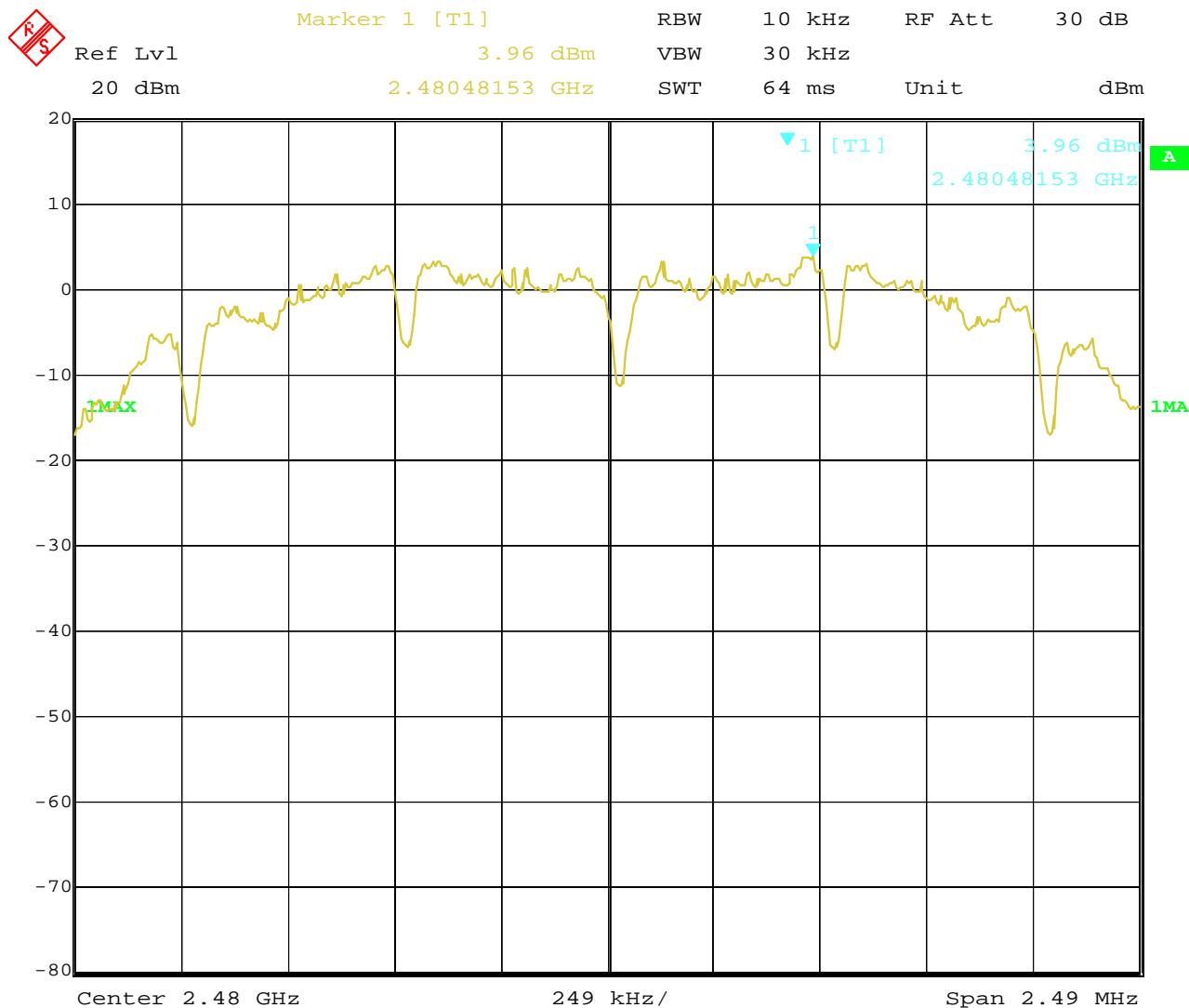
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### 3. High Channel



Date: 16.APR.2021 12:14:12

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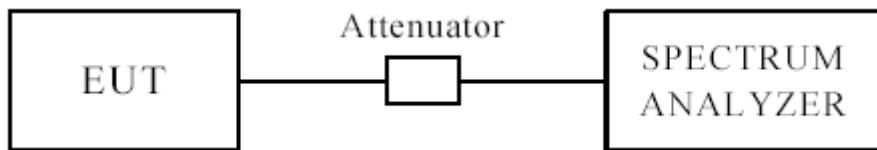
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## 10 Out of Band Measurement

### 10.1 Test Setup for band edge



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

### 10.2 Limits of Out of Band Emissions Measurement

1. Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

### 10.3 Test Procedure

For signals in the restricted bands above and below the 2.400-2.483GHz allocated band a measurement was made of Radiated emission test. (Peak values with RBW=1MHz, VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector)

For bandage test, the spectrum set as follows: RBW=100 kHz, VBW=300 kHz. A conducted measurement used

### 10.4 Test Result

Please see next pages

Note: 1. For band-edge measurement, the frequency from 30MHz-25GHz was tested. And It met the FCC rule.

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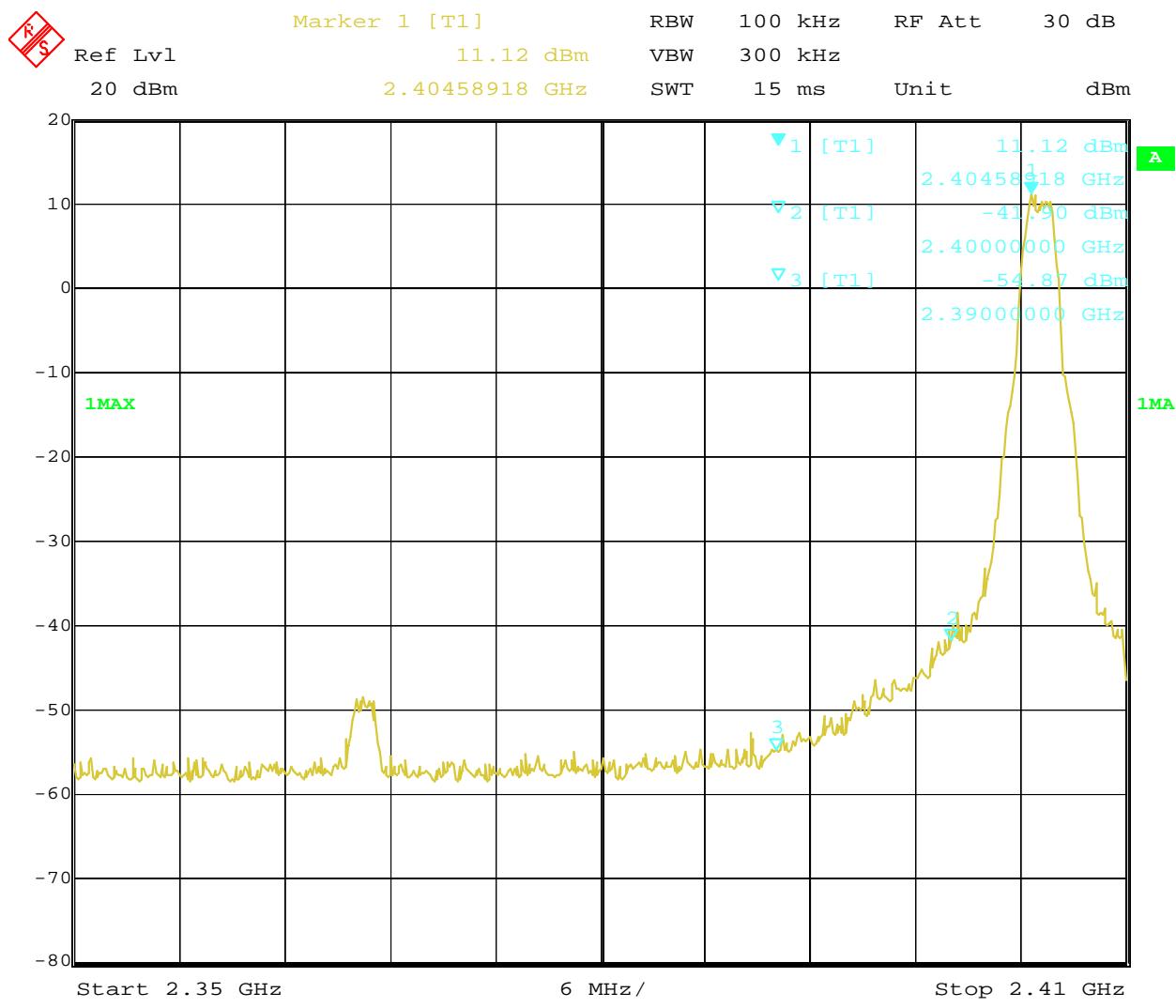
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#### 10.4 Band-edge Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              | Detector     | PK         |

##### Test Figure:



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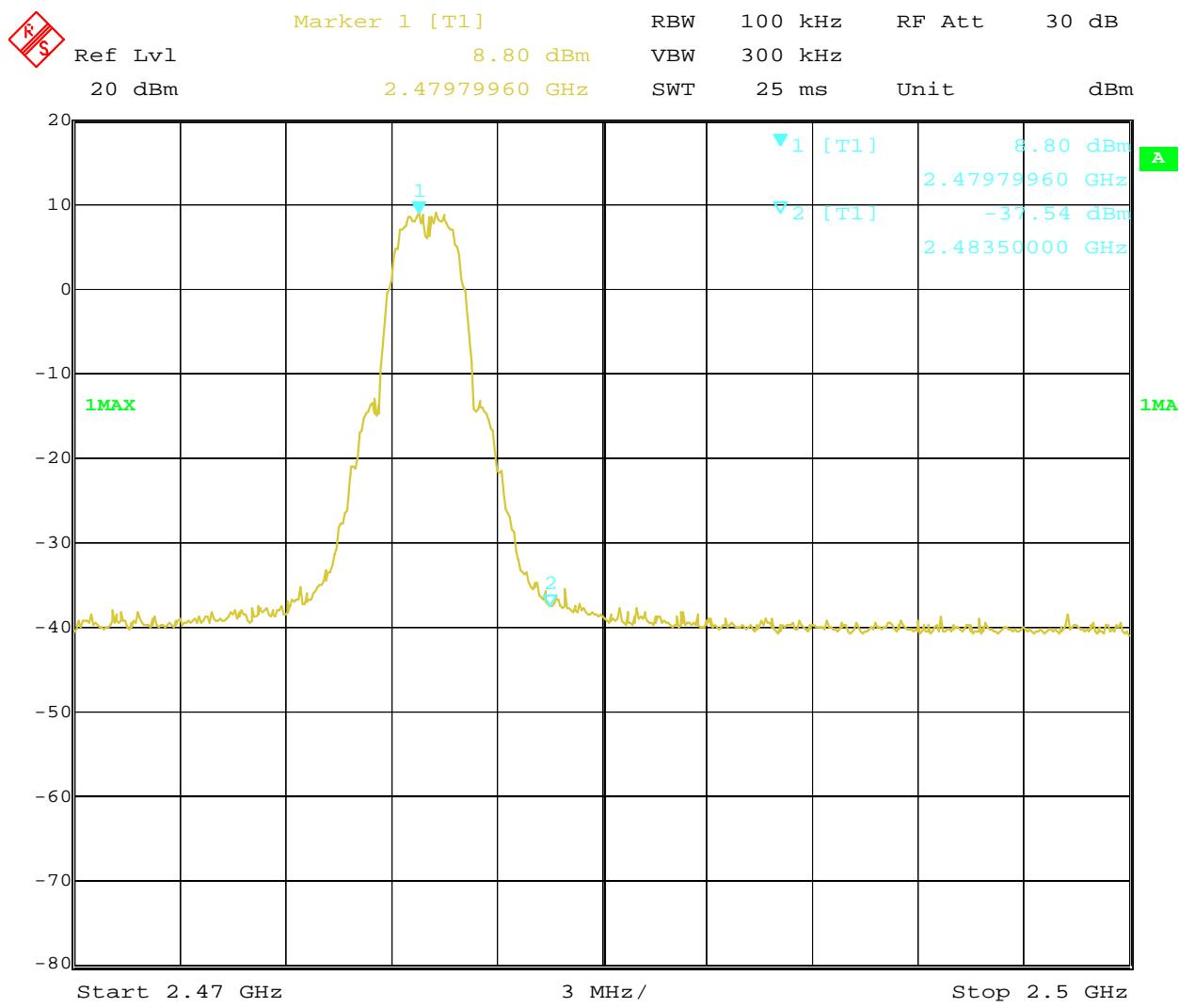
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#### 10.4 Band-edge Measurement

|              |                      |              |            |
|--------------|----------------------|--------------|------------|
| EUT          | ZBEE3                | Model        | ZBEE3S2F8C |
| Mode         | Keeping Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,           | Humidity     | 56% RH     |
| Test Result: | Pass                 | Detector     | PK         |

#### Test Figure:



Date: 16.APR.2021 12:16:07

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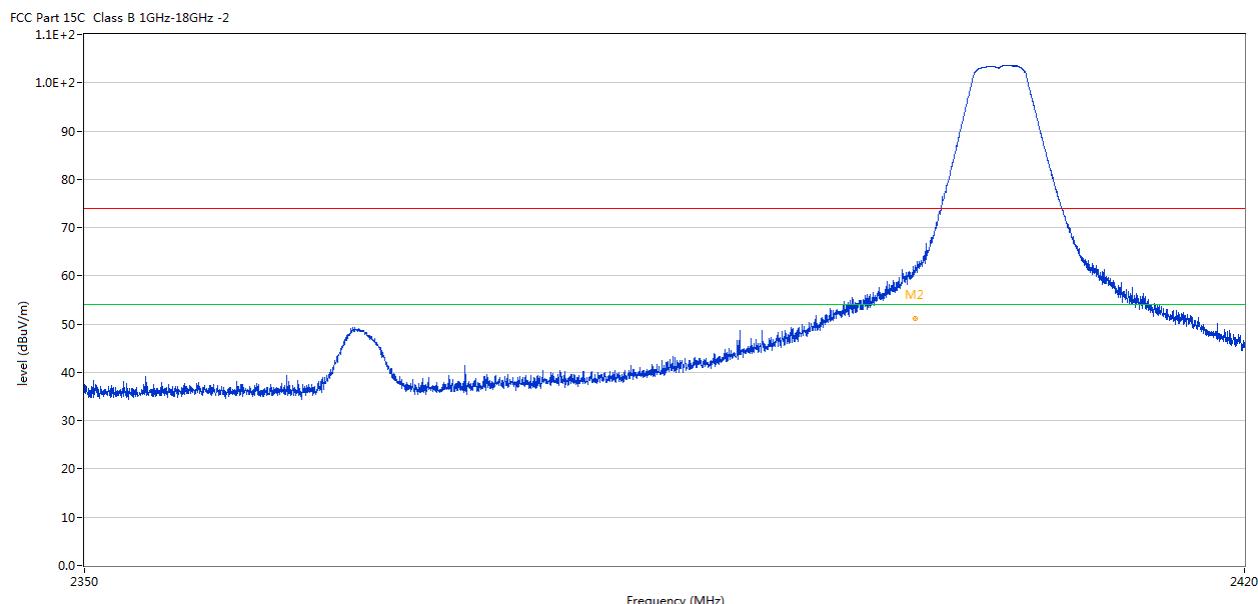
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### Test data with Chip antenna from page 46-49

#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 3   | 2390.288        | 48.70            | -3.53       | 74.0           | -25.30          | Peak     | 158.00    | 100         | Horizontal | Pass    |
|     |                 |                  |             |                |                 |          |           |             |            |         |

The report refers only to the sample tested and does not apply to the bulk.

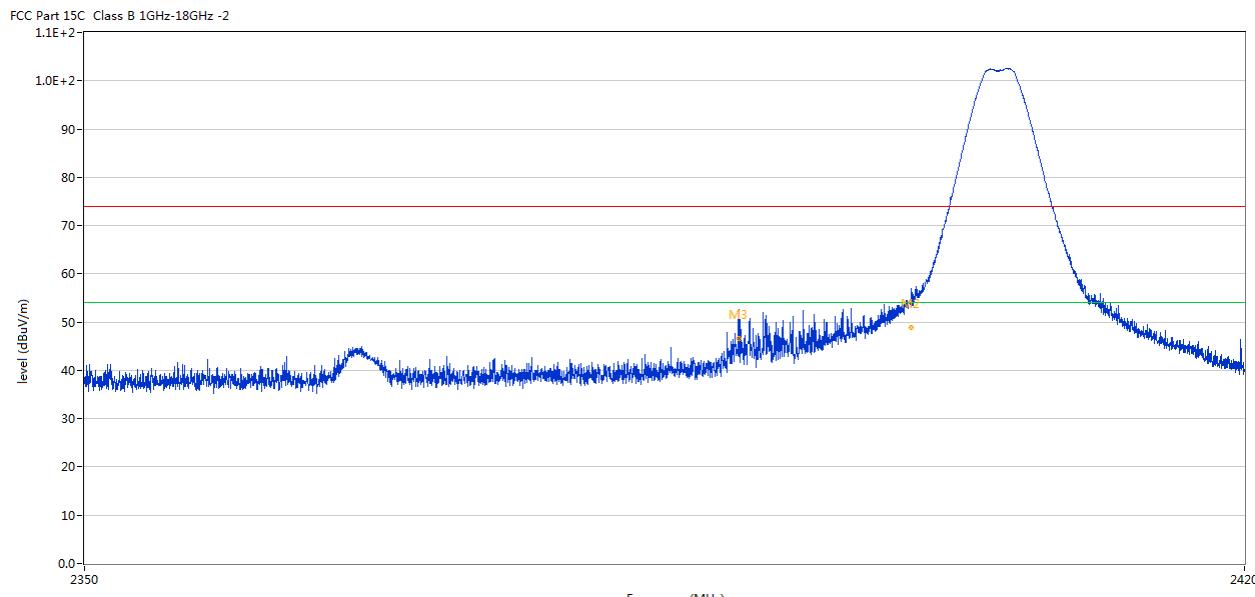
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#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 3   | 2390.218        | 52.57            | -3.53       | 74.0           | -21.43          | Peak     | 110.00    | 100         | Vertical | Pass    |
| 3** | 2390.218        | 46.70            | -3.53       | 54.0           | -7.30           | AV       | 110.00    | 100         | Vertical | Pass    |

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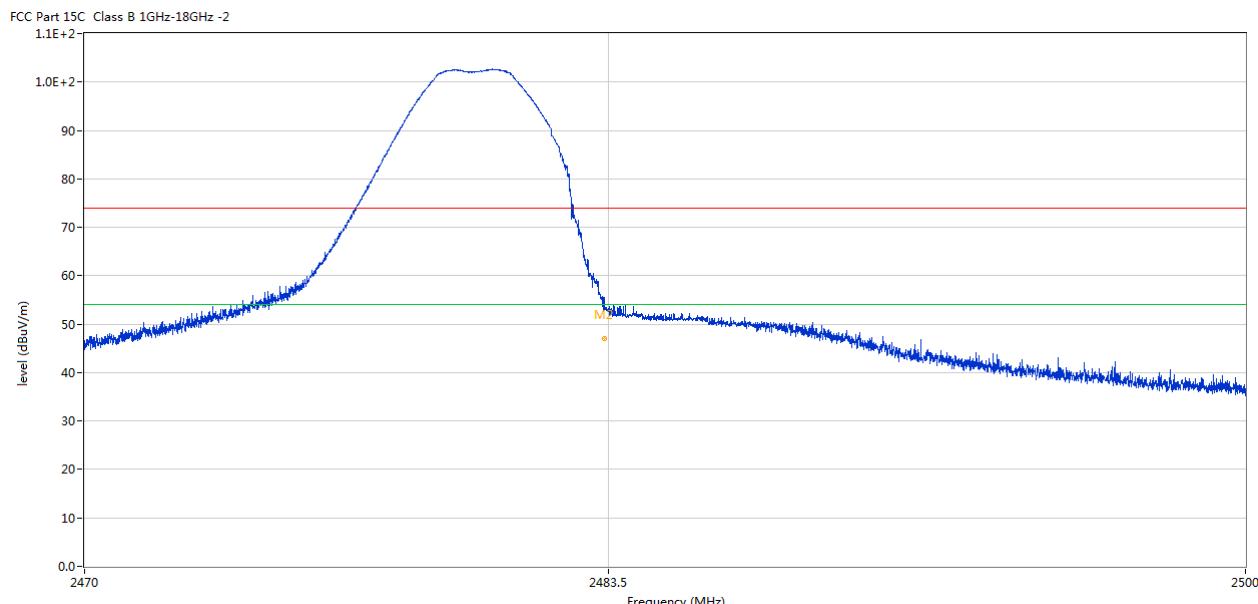
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#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 2483.380        | 53.06            | -3.57       | 74.0           | -20.94          | Peak     | 311.00    | 100         | Horizontal | Pass    |
| 2** | 2483.380        | 46.98            | -3.57       | 54.0           | -7.02           | AV       | 311.00    | 100         | Horizontal | Pass    |

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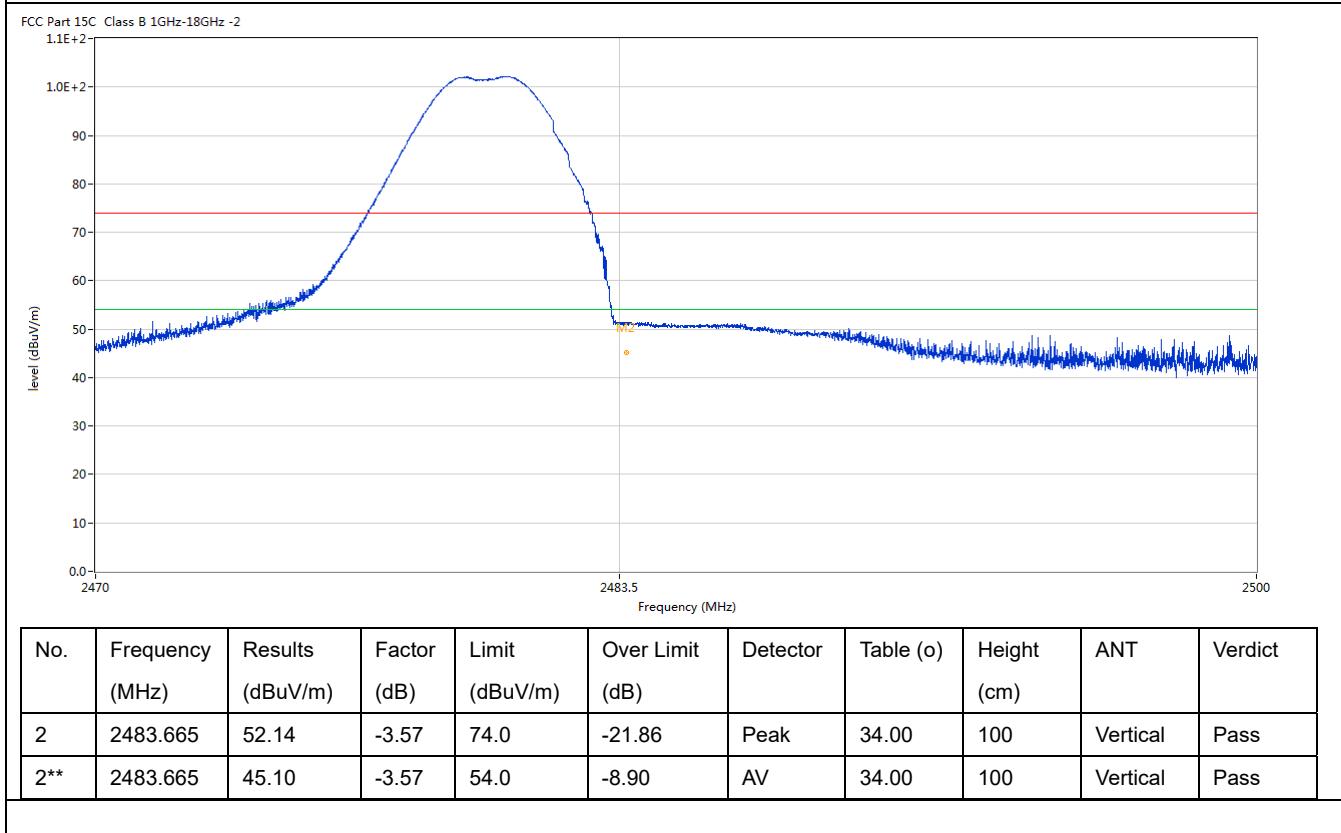
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#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



The report refers only to the sample tested and does not apply to the bulk.

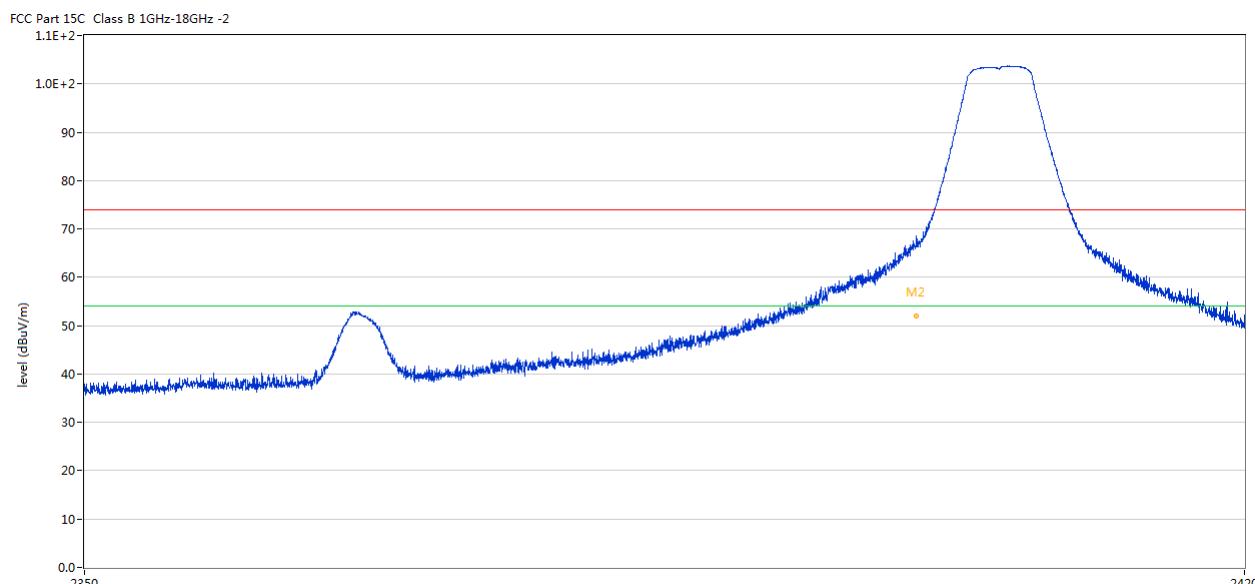
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### Test data with UFL antenna from page 50-53

#### 10.4 Restrict Band Measurement

| EUT   | ZBEE3             | Model            | ZBEE3S2F8C  |                |                 |          |           |             |            |         |
|---|-------------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| Mode  | Keep Transmitting | Test Voltage     | DC3.3V      |                |                 |          |           |             |            |         |
| Temperature   | 24 deg. C,        | Humidity         | 56% RH      |                |                 |          |           |             |            |         |
| Test Result:  | Pass              |                  |             |                |                 |          |           |             |            |         |
| <hr/>   |                   |                  |             |                |                 |          |           |             |            |         |
| FCC Part 15C Class B 1GHz-18GHz -2  |                   |                  |             |                |                 |          |           |             |            |         |
|  |                   |                  |             |                |                 |          |           |             |            |         |
| No.   | Frequency (MHz)   | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
| 3   | 2389.865          | 51.40            | -3.53       | 74.0           | -22.60          | Peak     | 275.00    | 100         | Horizontal | Pass    |
| <hr/>   |                   |                  |             |                |                 |          |           |             |            |         |

The report refers only to the sample tested and does not apply to the bulk.

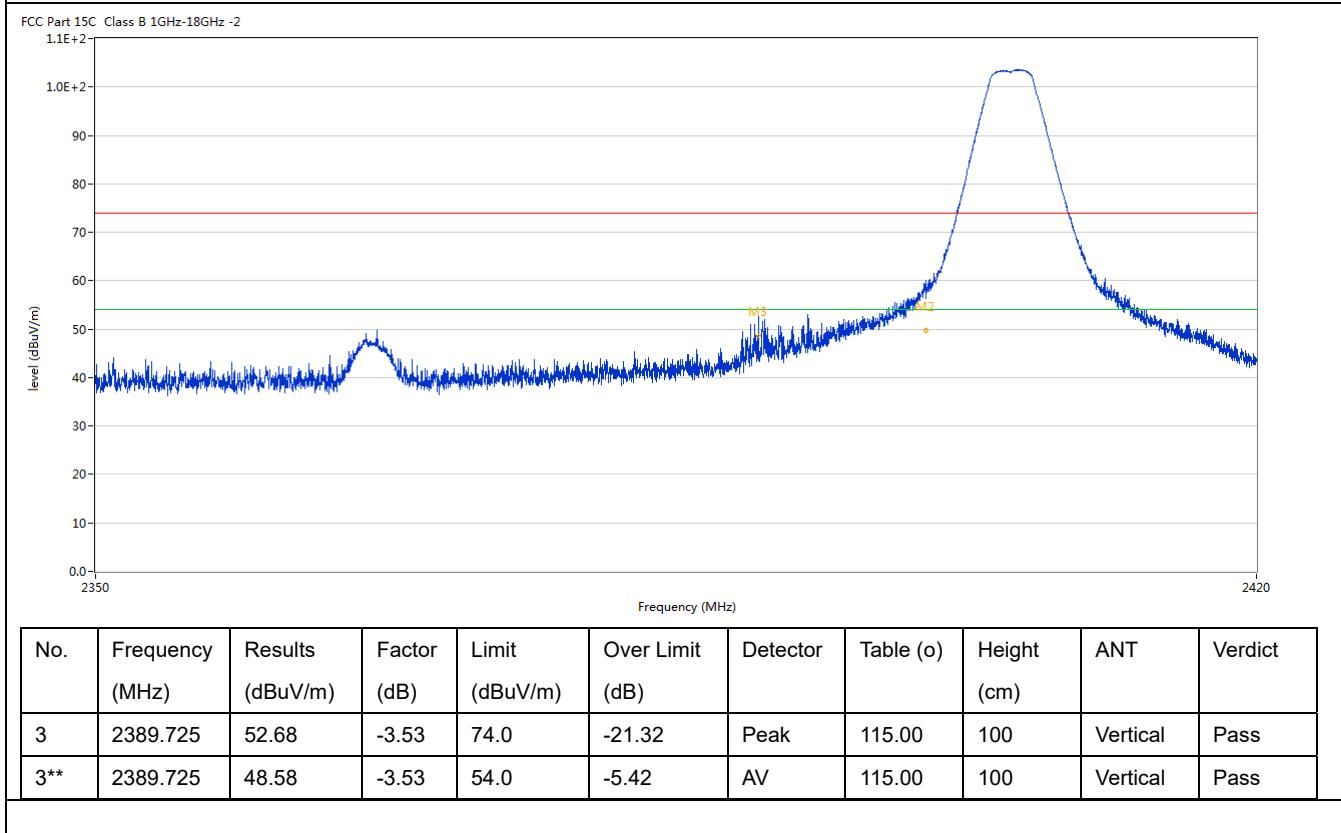
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#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



The report refers only to the sample tested and does not apply to the bulk.

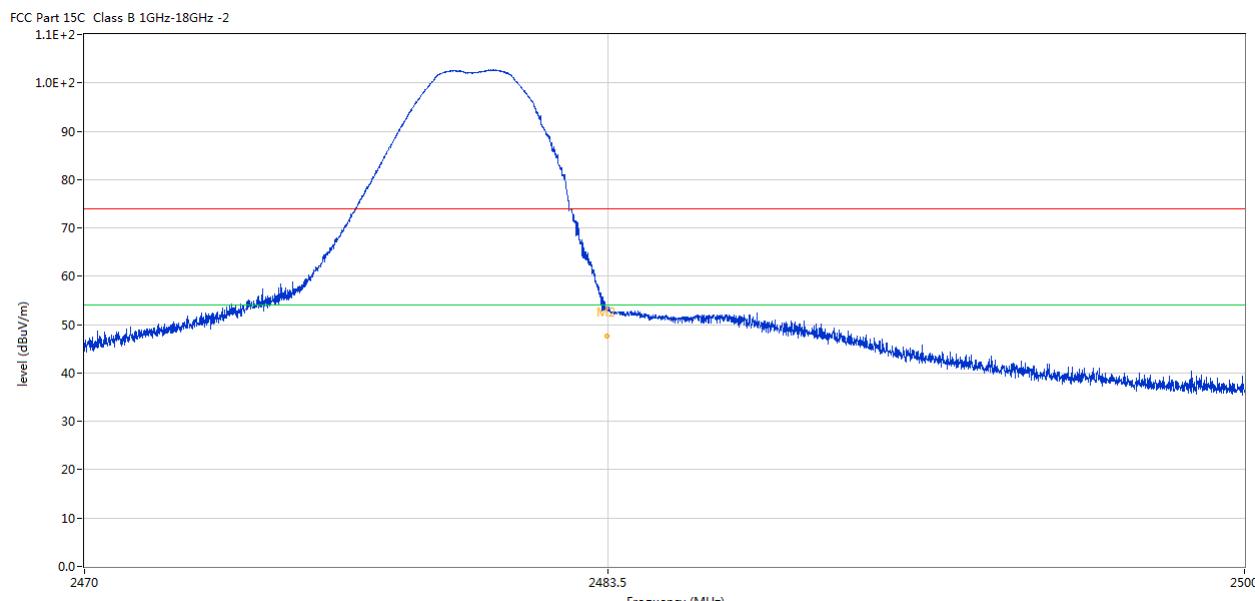
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#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 2   | 2483.455        | 53.80            | -3.57       | 74.0           | -20.20          | Peak     | 312.00    | 100         | Horizontal | Pass    |
| 2** | 2483.455        | 47.67            | -3.57       | 54.0           | -6.33           | AV       | 312.00    | 100         | Horizontal | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

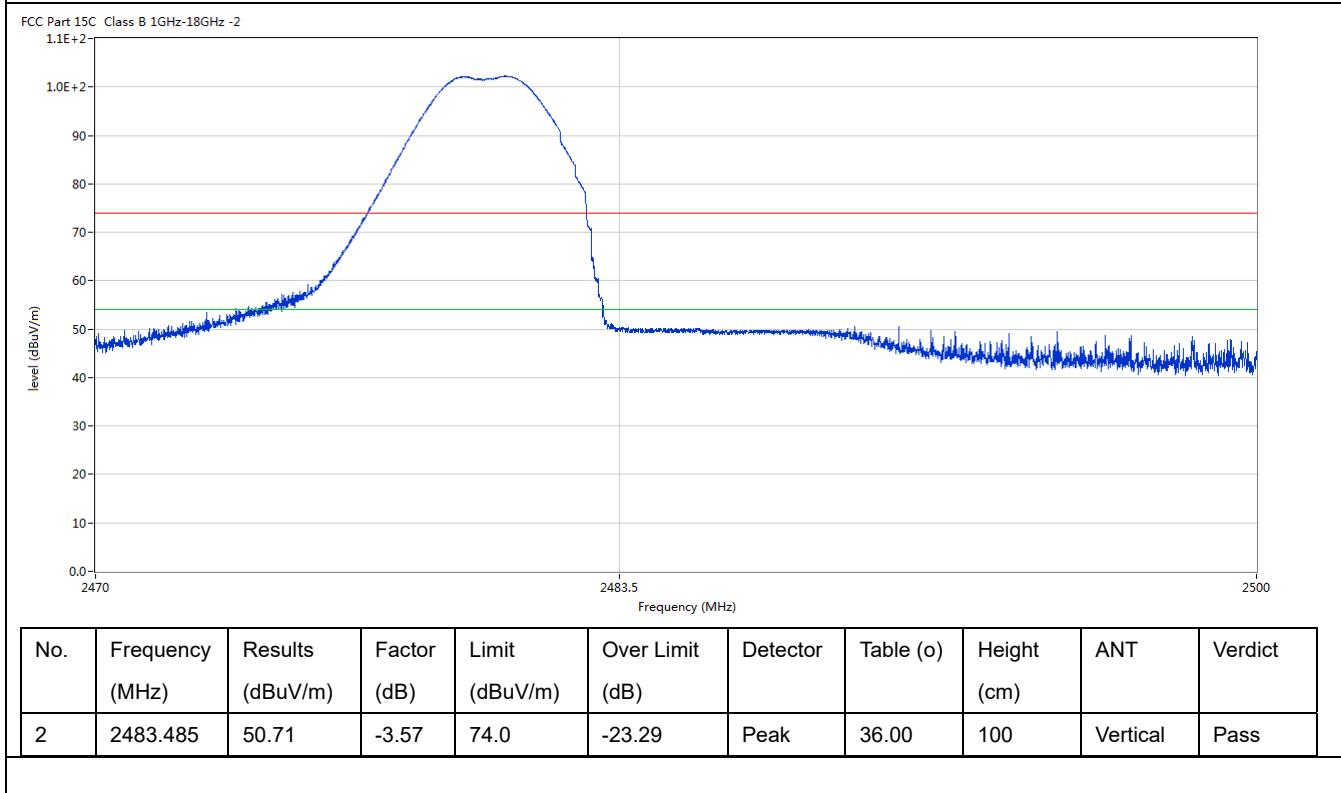
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#### 10.4 Restrict Band Measurement

|              |                   |              |            |
|--------------|-------------------|--------------|------------|
| EUT          | ZBEE3             | Model        | ZBEE3S2F8C |
| Mode         | Keep Transmitting | Test Voltage | DC3.3V     |
| Temperature  | 24 deg. C,        | Humidity     | 56% RH     |
| Test Result: | Pass              |              |            |



Note: The peak value less than the AV limit, no necessary to take down the AV measurement result.

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## 11.0 Antenna Requirement

### 11.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the mount in dB that the directional gain of the antenna exceeds 6 dBi.

### 11.2 Antenna Connected construction

Two types of antenna used. One is the chip antenna and the other is UFL antenna. The gain of the antennas is 2.0dBi. (for each type, declared by the applicant)

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## 12.0 FCC ID Label

**FCC ID: 2AZEG-ZBEE3S2F8C**

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

**Mark Location:**



**Label Location**

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### 13.0 Photo of testing

Conducted Emission Test Setup:



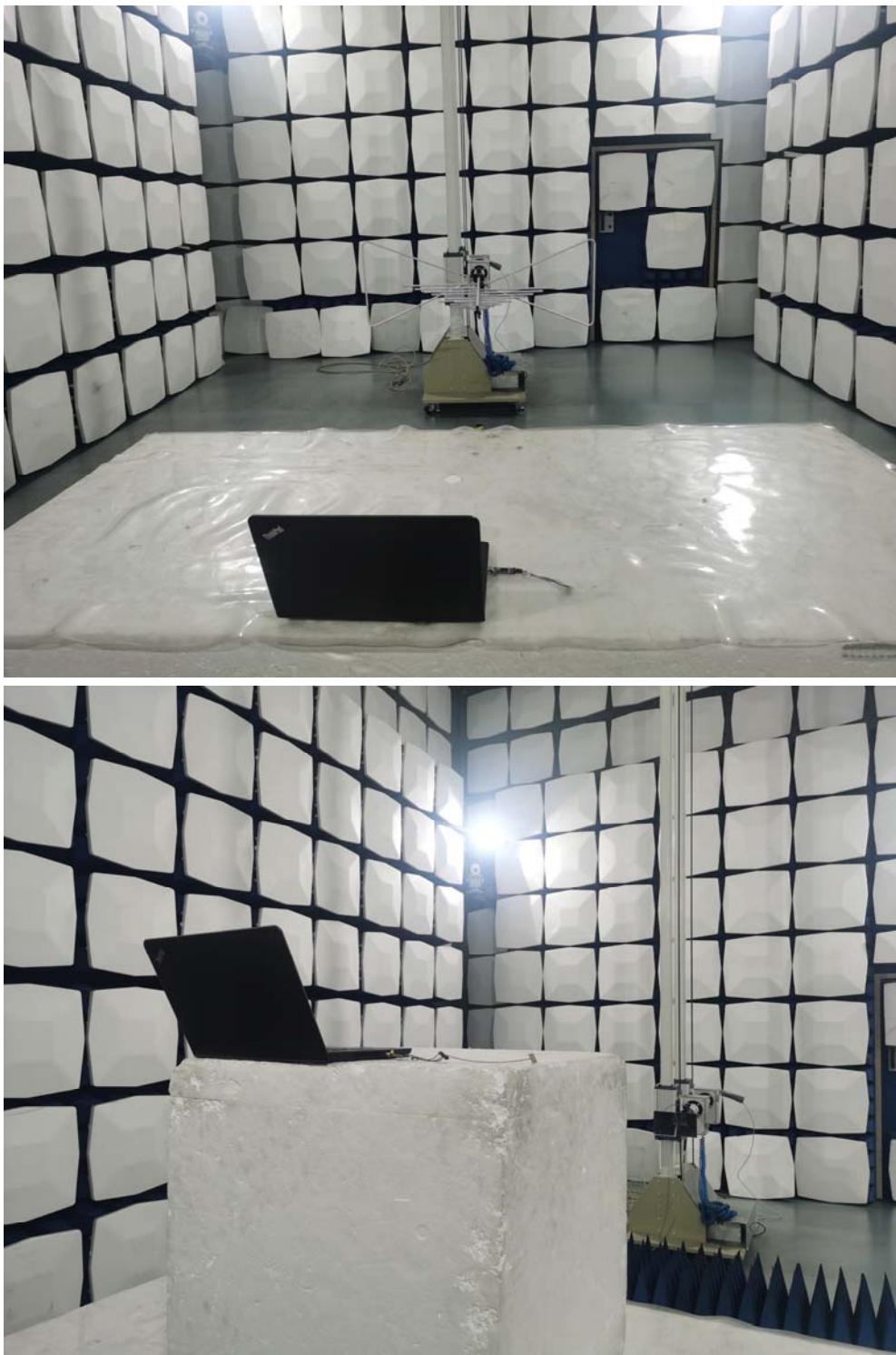
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Radiated Emission Test Setup:



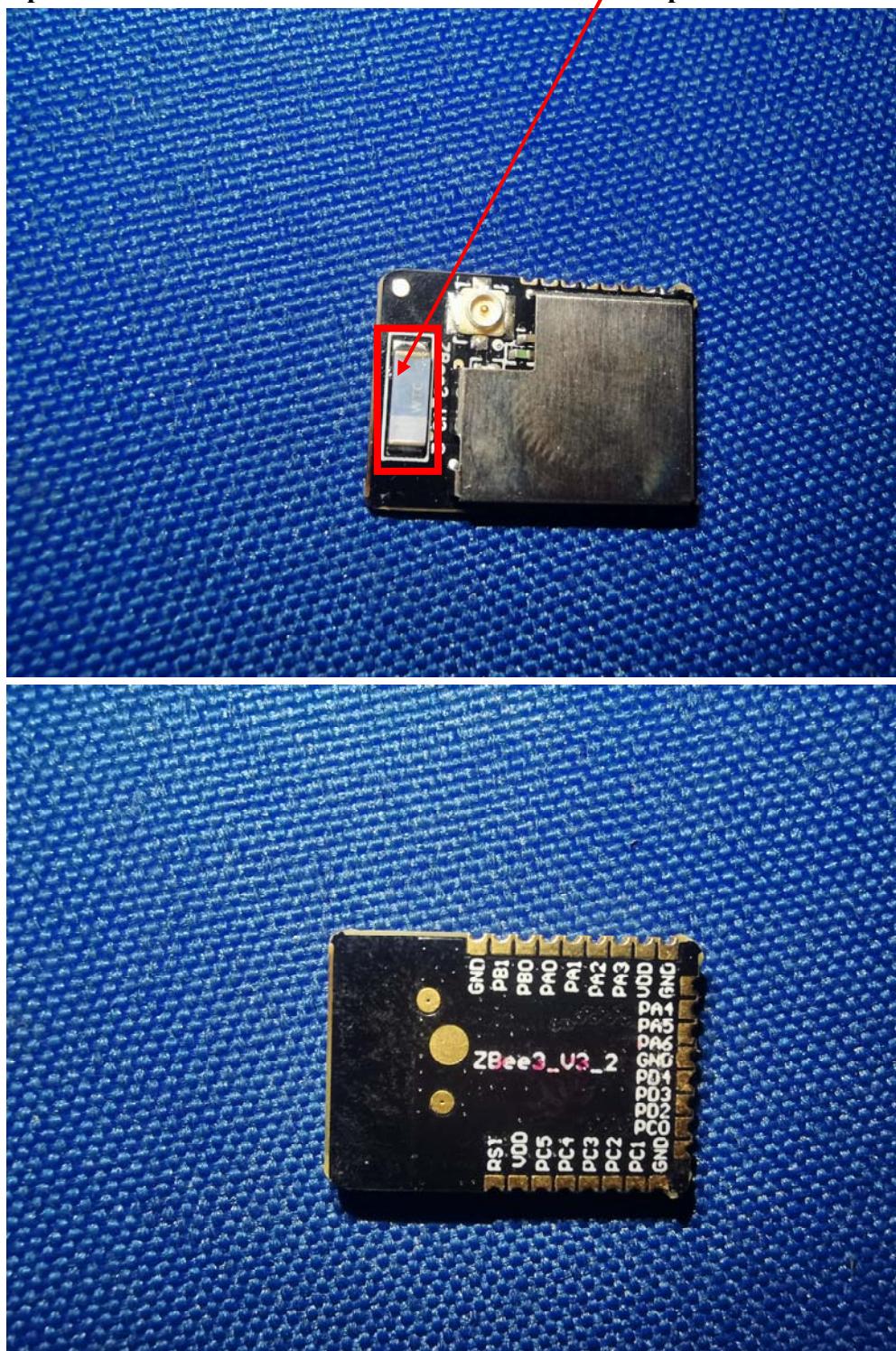
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**Photographs – EUT**



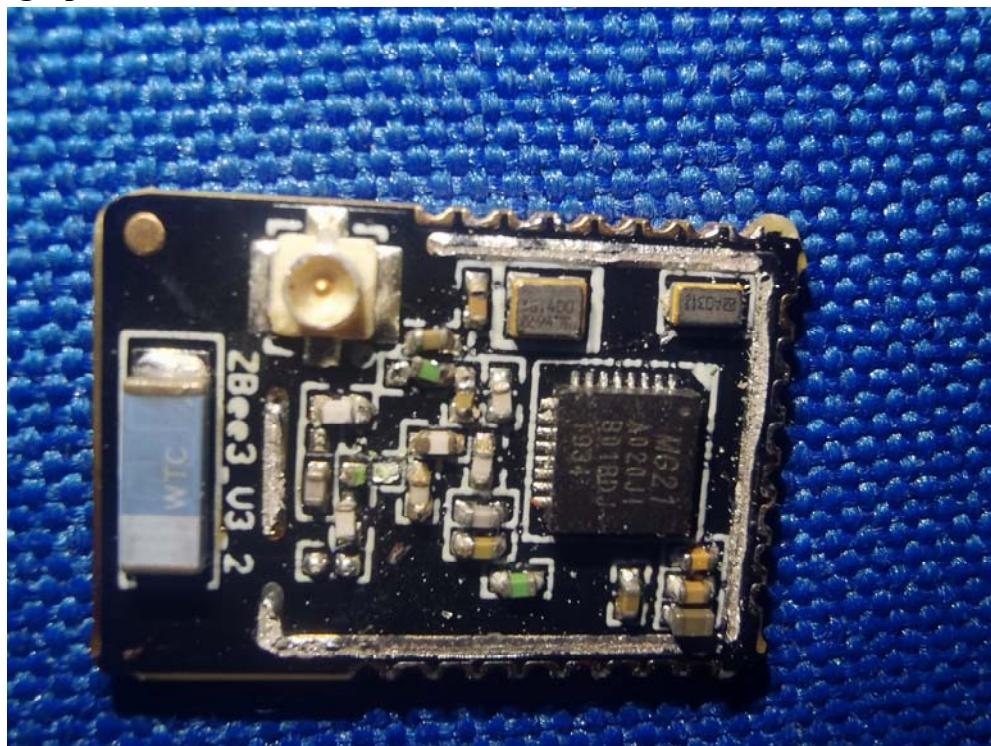
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### Photographs – EUT



**UFL Antenna**



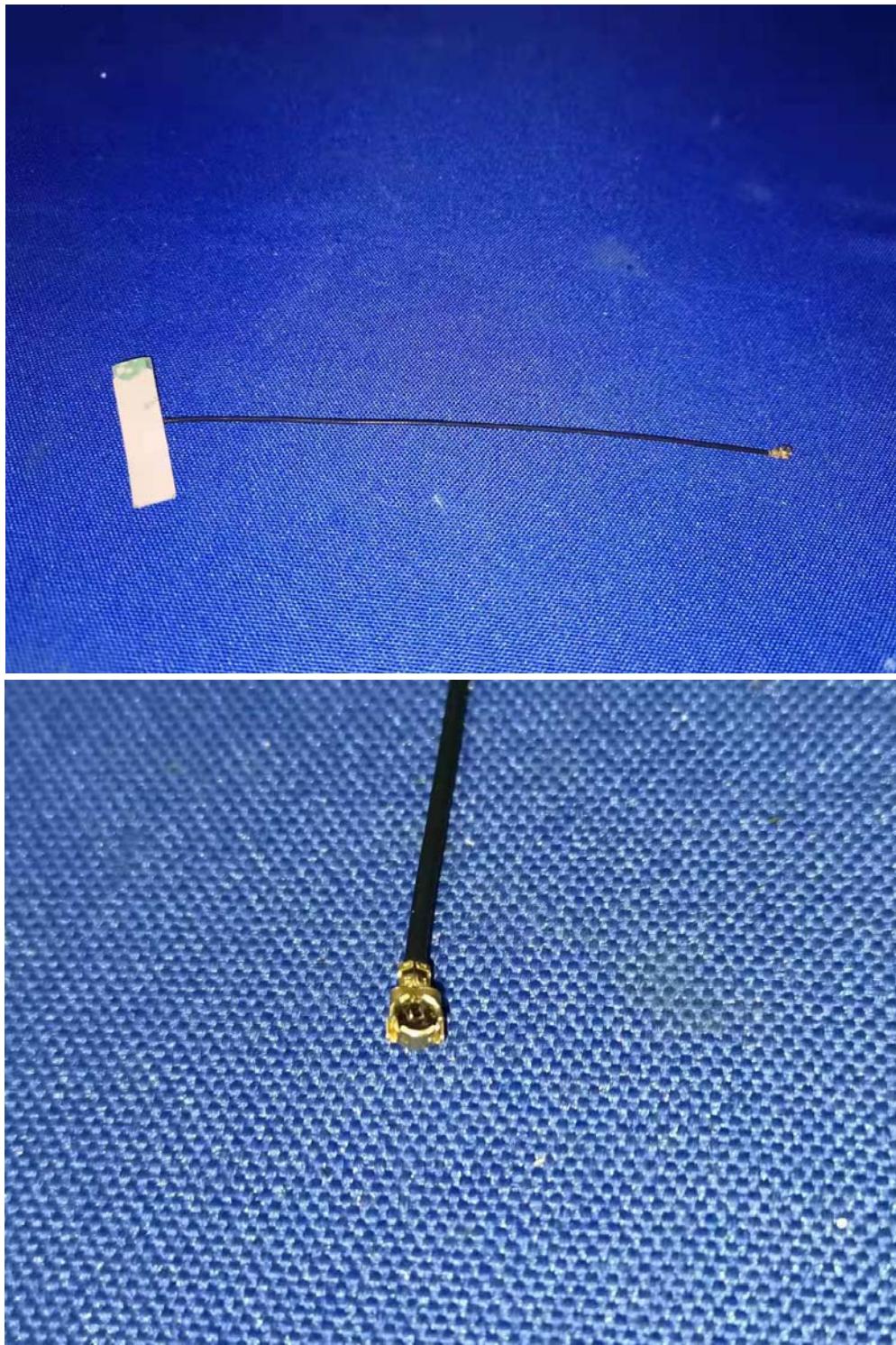
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### Photographs – EUT



### End of the report

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