



# RF TEST REPORT

**Applicant** ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD  
**FCC ID** 2AC7Z-ESPWROOM32D  
**Product** Wi-Fi & Bluetooth Internet of Things Module  
**Brand** WROOM  
**Model** ESP-WROOM-32D  
**Report No.** RXA1710-0352RF01R1  
**Issue Date** December 18, 2017

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2017)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Xianqing Li

Approved by: Kai Xu

## TA Technology (Shanghai) Co., Ltd.

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## Summary of measurement results

| Number                                               | Summary of measurements of results               | Clause in FCC rules     | Verdict |
|------------------------------------------------------|--------------------------------------------------|-------------------------|---------|
| 1                                                    | Maximum Average conducted output power           | 15.247(b)(3)            | PASS    |
| 2                                                    | 6 dB bandwidth                                   | 15.247(a)(2)            | PASS    |
| 3                                                    | Power spectral density                           | 15.247(e)               | PASS    |
| 4                                                    | Band Edge                                        | 15.247(d)               | PASS    |
| 5                                                    | Spurious RF Conducted Emissions                  | 15.247(d)               | PASS    |
| 6                                                    | Radiated Emissions in restricted frequency bands | 15.247(d),15.205,15.209 | PASS    |
| 7                                                    | Radiated Emissions                               | 15.247(d),15.205,15.209 | PASS    |
| 8                                                    | Conducted Emissions                              | 15.207                  | PASS    |
| Date of Testing: November 1, 2017~ December 13, 2017 |                                                  |                         |         |



## 1. Test Laboratory

### 1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

### 1.2. Test facility

#### **CNAS (accreditation number: L2264)**

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

#### **FCC (Designation number: CN1179, Test Firm Registration Number: 446626)**

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

#### **IC (recognition number is 8510A)**

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

#### **VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)**

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

#### **A2LA (Certificate Number: 3857.01)**

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



### 1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.  
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong  
City: Shanghai  
Post code: 201201  
Country: P. R. China  
Contact: Xu Kai  
Telephone: +86-021-50791141/2/3  
Fax: +86-021-50791141/2/3-8000  
Website: <http://www.ta-shanghai.com>  
E-mail: [xukai@ta-shanghai.com](mailto:xukai@ta-shanghai.com)

## 2. General Description of Equipment under Test

### Client Information

|                      |                                                                         |
|----------------------|-------------------------------------------------------------------------|
| Applicant            | ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD                                    |
| Applicant address    | Room204,Building2,690Bibo Road,Zhangjiang Hi-Teck Park, Shanghai, China |
| Manufacturer         | ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD                                    |
| Manufacturer address | Room204,Building2,690Bibo Road,Zhangjiang Hi-Teck Park, Shanghai, China |

### General information

| EUT Description                                                   |                                                                                             |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Model                                                             | ESP-WROOM-32D                                                                               |
| SN                                                                | /                                                                                           |
| Hardware Version                                                  | V2.1                                                                                        |
| Software Version                                                  | V1.0                                                                                        |
| Power Supply                                                      | External Power Supply                                                                       |
| Antenna Type                                                      | Internal Antenna                                                                            |
| Antenna Connector                                                 | A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)         |
| Antenna Gain                                                      | 3.7 dBi                                                                                     |
| additional beamforming gain                                       | 0 dB                                                                                        |
| Test Mode                                                         | Bluetooth(Low Energy)<br>802.11b<br>802.11g, 802.11n(HT20/HT40);                            |
| Modulation Type                                                   | BLE :GFSK<br>802.11b: DSSS;<br>802.11g/n(HT20/HT40): OFDM                                   |
| Max. Conducted Power                                              | Wi-Fi 2.4G: 18.01dBm<br>BLE: -0.05 dBm                                                      |
| Operating Frequency Range(s)                                      | 802.11b/g/n(HT20): 2412 ~ 2462 MHz<br>802.11n(HT40): 2422 ~ 2452 MHz<br>BLE: 2402 ~2480 MHz |
| Note: The information of the EUT is declared by the manufacturer. |                                                                                             |



### 3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

#### Test standards

- **FCC CFR47 Part 15C (2017) Radio Frequency Devices**
- **ANSI C63.10 (2013)**
- **KDB 558074 D01 DTS Meas Guidance v04**

## 4. Test Configuration

### Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

| Band                  | Data Rate |
|-----------------------|-----------|
| Bluetooth(Low Energy) | 1Mbps     |
| 802.11b               | 1Mbps     |
| 802.11g               | 6 Mbps    |
| 802.11n HT20          | MCS0      |
| 802.11n HT40          | MCS0      |

## 5. Test Case Results

### 5.1. Average Power Output –Conducted

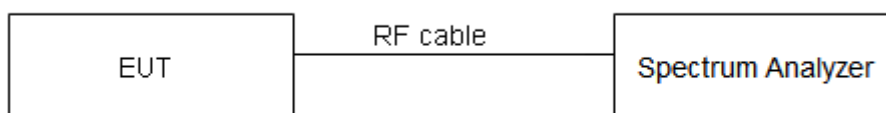
#### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

#### Methods of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. The Average detector is used. We use Maximum Average Conducted Output Power Level Method AVGSA-2 in KDB 558074 D01 for this test.

#### Test Setup



#### Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

|                      |                   |
|----------------------|-------------------|
| Average Output Power | $\leq 1W$ (30dBm) |
|----------------------|-------------------|

#### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 0.44$  dB.

## Test Results

| Band         | T <sub>on</sub> (ms) | T <sub>(on+off)</sub> (ms) | Duty cycle | Duty cycle correction Factor(dB) |
|--------------|----------------------|----------------------------|------------|----------------------------------|
| 802.11b      | 0.59                 | 0.67                       | 0.88       | 0.55                             |
| 802.11g      | 0.58                 | 0.67                       | 0.87       | 0.58                             |
| 802.11n HT20 | 0.58                 | 0.66                       | 0.88       | 0.58                             |
| 802.11n HT40 | 0.58                 | 0.66                       | 0.88       | 0.56                             |
| BLE          | 2.10                 | 2.51                       | 0.83       | 0.79                             |

| Network Standards                                         | Carrier frequency (MHz) | Read Value (dBm) | Average Output Power(dBm) | Limit (dBm) | Conclusion |
|-----------------------------------------------------------|-------------------------|------------------|---------------------------|-------------|------------|
| 802.11b                                                   | 2412                    | 17.09            | 17.64                     | 30          | PASS       |
|                                                           | 2437                    | 17.46            | 18.01                     | 30          | PASS       |
|                                                           | 2462                    | 17.44            | 17.99                     | 30          | PASS       |
| 802.11g                                                   | 2412                    | 17.27            | 17.85                     | 30          | PASS       |
|                                                           | 2437                    | 17.09            | 17.67                     | 30          | PASS       |
|                                                           | 2462                    | 17.19            | 17.77                     | 30          | PASS       |
| 802.11n HT20                                              | 2412                    | 16.21            | 16.77                     | 30          | PASS       |
|                                                           | 2437                    | 17.44            | 18.00                     | 30          | PASS       |
|                                                           | 2462                    | 17.20            | 17.76                     | 30          | PASS       |
| 802.11n HT40                                              | 2422                    | 15.50            | 16.06                     | 30          | PASS       |
|                                                           | 2437                    | 17.10            | 17.66                     | 30          | PASS       |
|                                                           | 2452                    | 16.63            | 17.19                     | 30          | PASS       |
| Bluetooth (Low Energy)                                    | 2402                    | -1.44            | -0.65                     | 30          | PASS       |
|                                                           | 2440                    | -0.84            | -0.05                     | 30          | PASS       |
|                                                           | 2480                    | -0.84            | -0.05                     | 30          | PASS       |
| Note:Output Power=Read Value+Duty cycle correction factor |                         |                  |                           |             |            |

## 5.2. 6dB Bandwidth

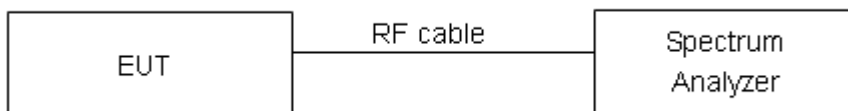
### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

### Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer. Dector=Peak, Trace mode=max hold.

### Test Setup



### Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

|                        |           |
|------------------------|-----------|
| minimum 6 dB bandwidth | ≥ 500 kHz |
|------------------------|-----------|

### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 936$  Hz.

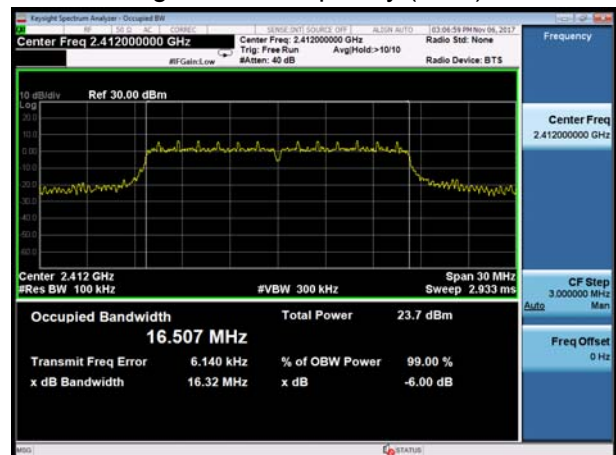
**Test Results:**

| Network Standards         | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 6 dB bandwidth (MHz) | Limit (kHz) | Conclusion |
|---------------------------|-------------------------|---------------------|------------------------------|-------------|------------|
| 802.11b                   | 2412                    | 11.304              | 8.759                        | 500         | PASS       |
|                           | 2437                    | 11.308              | 8.751                        | 500         | PASS       |
|                           | 2462                    | 11.324              | 8.759                        | 500         | PASS       |
| 802.11g                   | 2412                    | 16.507              | 16.320                       | 500         | PASS       |
|                           | 2437                    | 16.512              | 16.310                       | 500         | PASS       |
|                           | 2462                    | 16.548              | 16.310                       | 500         | PASS       |
| 802.11n<br>HT20           | 2412                    | 17.534              | 16.830                       | 500         | PASS       |
|                           | 2437                    | 17.541              | 16.820                       | 500         | PASS       |
|                           | 2462                    | 17.556              | 16.820                       | 500         | PASS       |
| 802.11n<br>HT40           | 2422                    | 36.218              | 35.790                       | 500         | PASS       |
|                           | 2437                    | 36.291              | 35.760                       | 500         | PASS       |
|                           | 2452                    | 36.302              | 35.910                       | 500         | PASS       |
| Bluetooth<br>(Low Energy) | 2402                    | 1.0234              | 0.6458                       | 500         | PASS       |
|                           | 2440                    | 1.0229              | 0.6460                       | 500         | PASS       |
|                           | 2480                    | 1.0227              | 0.6461                       | 500         | PASS       |

802.11b, Carrier frequency (MHz): 2412



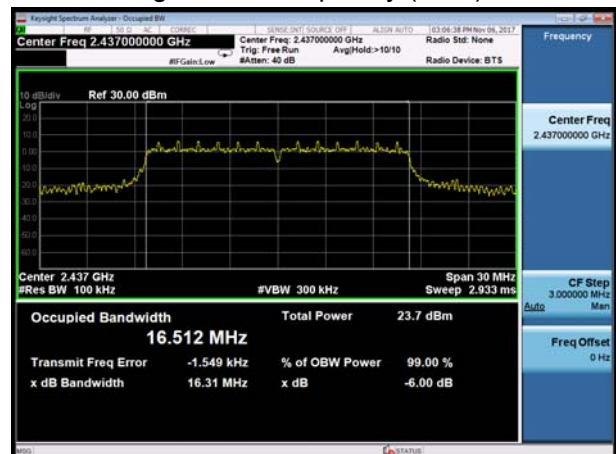
802.11g, Carrier frequency (MHz): 2412



802.11b, Carrier frequency (MHz): 2437



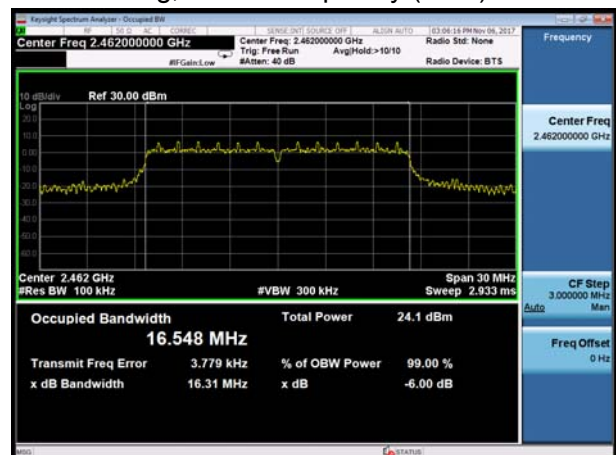
802.11g, Carrier frequency (MHz): 2437



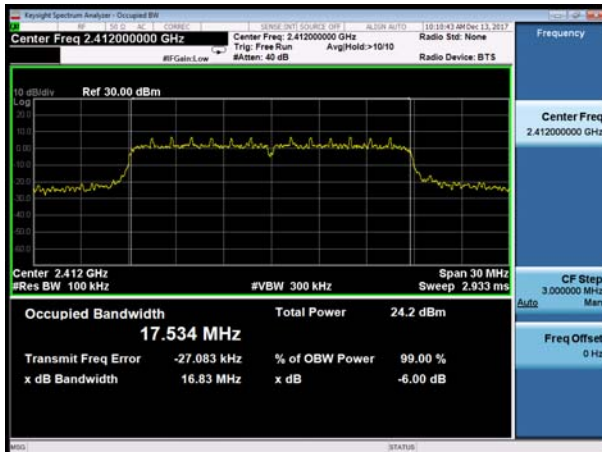
802.11b, Carrier frequency (MHz): 2462



802.11g, Carrier frequency (MHz): 2462



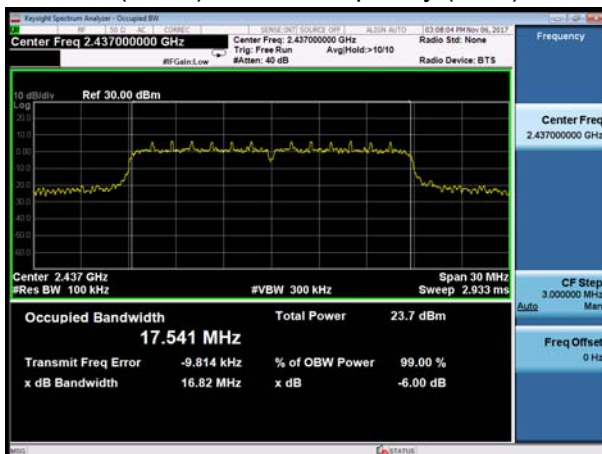
802.11n(HT20), Carrier frequency (MHz): 2412



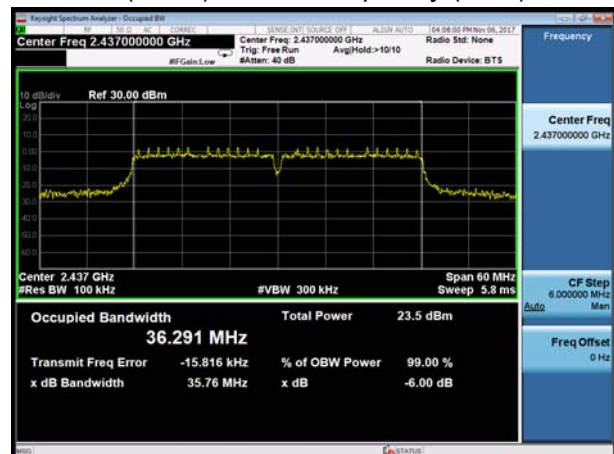
802.11n(HT40), Carrier frequency (MHz): 2422



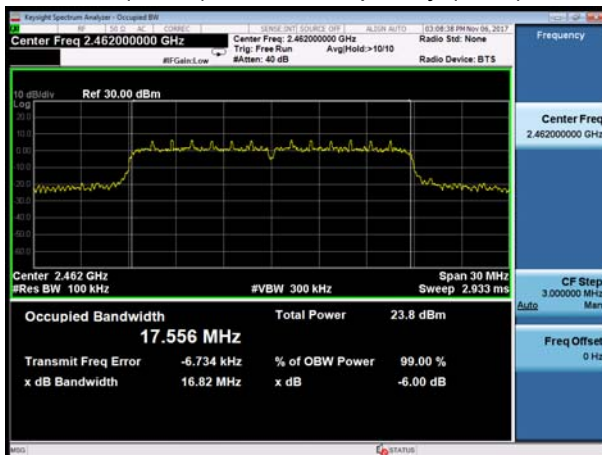
802.11n(HT20), Carrier frequency (MHz): 2437



802.11n(HT40), Carrier frequency (MHz): 2437



802.11n(HT20), Carrier frequency (MHz): 2462



802.11n(HT40), Carrier frequency (MHz): 2452



### BLE Carrier frequency (MHz): 2402



### BLE Carrier frequency (MHz): 2440



### BLE Carrier frequency (MHz): 2480



### 5.3. Band Edge

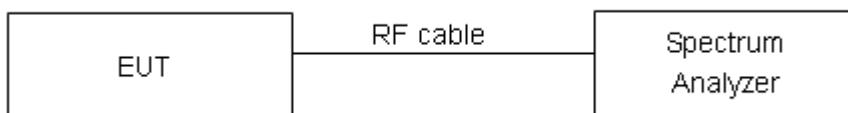
#### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

#### Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

#### Test Setup



#### Limits

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.”

#### Measurement Uncertainty

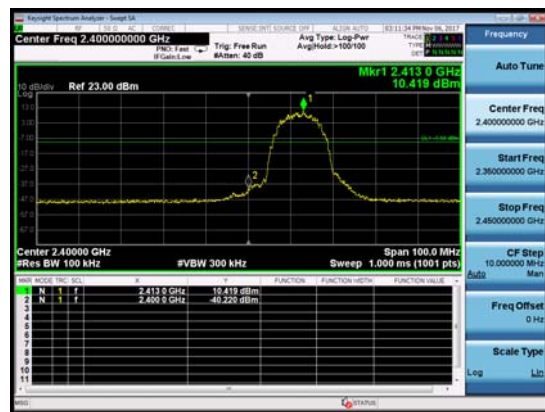
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

| Frequency | Uncertainty |
|-----------|-------------|
| 2GHz-3GHz | 1.407 dB    |

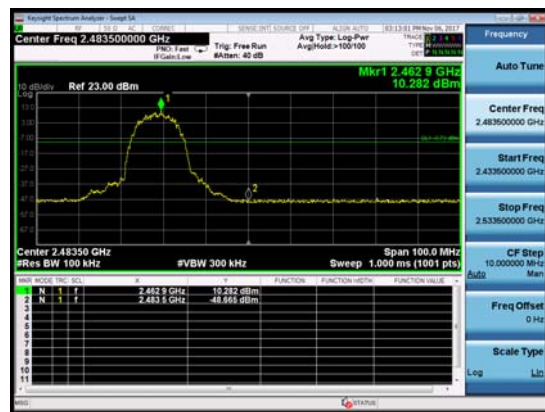


## Test Results: PASS

802.11b, Channel No.: 1



802.11b, Channel No.: 11



802.11g, Channel No.: 1



802.11g, Channel No.: 11



802.11n(HT20), Channel No.: 1



802.11n(HT20), Channel No.: 11

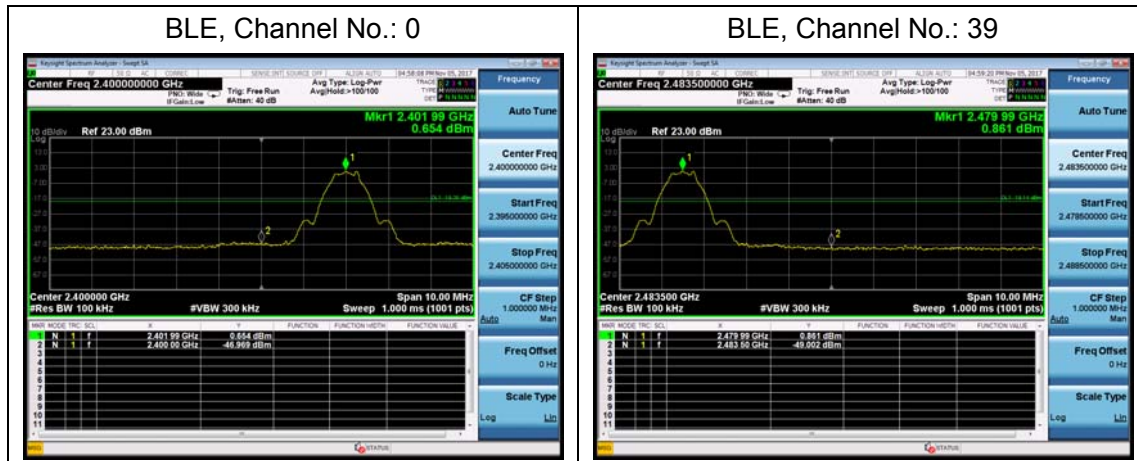


802.11n(HT40), Channel No.: 3



802.11n(HT40), Channel No.: 9





## 5.4. Power Spectral Density

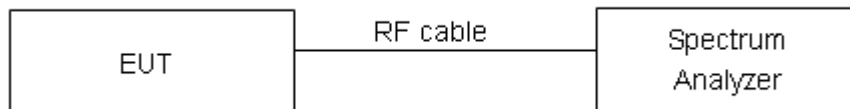
### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

### Method of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. The Average detector is used. We use Method AVGPSD-2 in KDB 558074 D01 for this test.

### Test setup



### Limits

Rule Part 15.247(e) specifies that” For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. ”

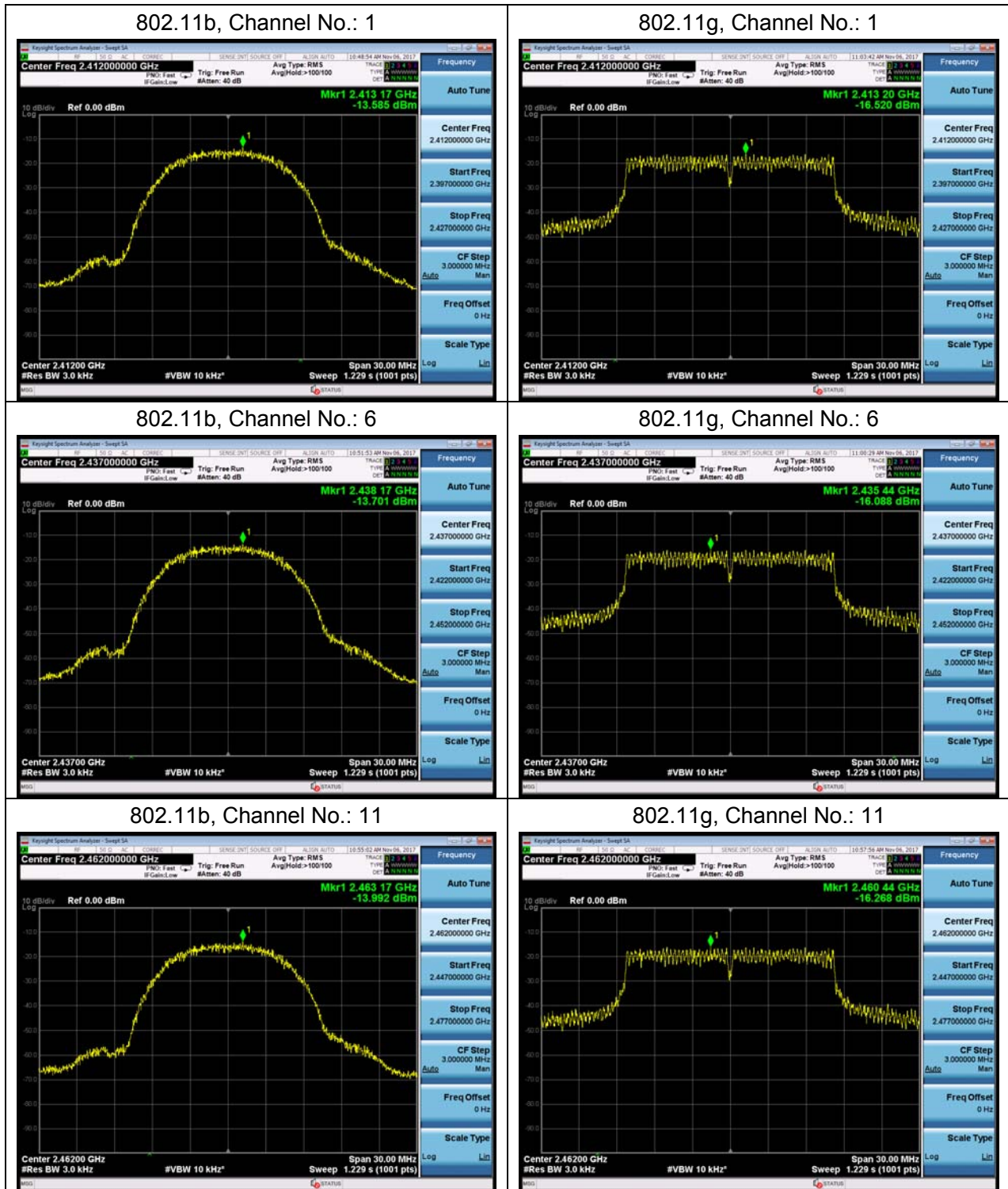
| Limits | $\leq 8 \text{ dBm} / 3\text{kHz}$ |
|--------|------------------------------------|
|--------|------------------------------------|

### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 0.75\text{dB}$ .

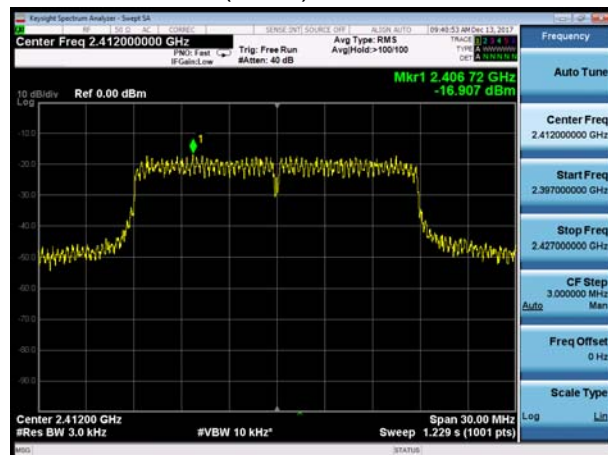
**Test Results:**

| Network Standards                                                     | Channel Number | Read Value (dBm) | Power Spectral Density (dBm / 3kHz) | Limit (dBm / 3kHz) | Conclusion |
|-----------------------------------------------------------------------|----------------|------------------|-------------------------------------|--------------------|------------|
| 802.11b                                                               | 1              | -13.59           | -13.03                              | 8                  | PASS       |
|                                                                       | 6              | -13.70           | -13.15                              | 8                  | PASS       |
|                                                                       | 11             | -13.99           | -13.44                              | 8                  | PASS       |
| 802.11g                                                               | 1              | -16.52           | -15.94                              | 8                  | PASS       |
|                                                                       | 6              | -16.09           | -15.50                              | 8                  | PASS       |
|                                                                       | 11             | -16.27           | -15.68                              | 8                  | PASS       |
| 802.11n HT20                                                          | 1              | -16.91           | -16.35                              | 8                  | PASS       |
|                                                                       | 6              | -16.31           | -15.75                              | 8                  | PASS       |
|                                                                       | 11             | -16.69           | -16.13                              | 8                  | PASS       |
| 802.11n HT40                                                          | 3              | -22.22           | -21.66                              | 8                  | PASS       |
|                                                                       | 6              | -18.98           | -18.41                              | 8                  | PASS       |
|                                                                       | 9              | -21.08           | -20.52                              | 8                  | PASS       |
| Bluetooth (Low Energy)                                                | 0              | -20.83           | -20.05                              | 8                  | PASS       |
|                                                                       | 19             | -20.71           | -19.93                              | 8                  | PASS       |
|                                                                       | 39             | -21.39           | -20.60                              | 8                  | PASS       |
| Note: Power Spectral Density =Read Value+Duty cycle correction factor |                |                  |                                     |                    |            |

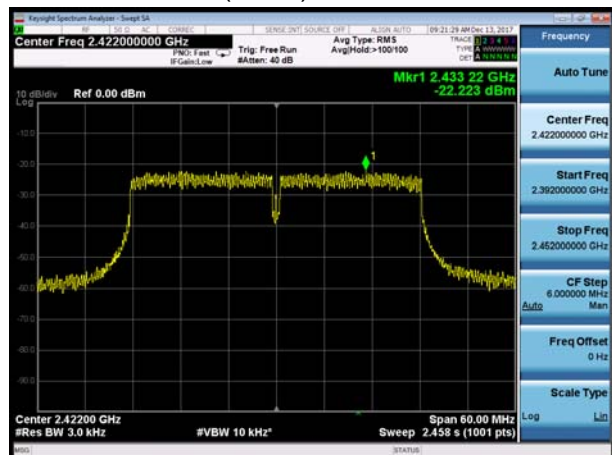




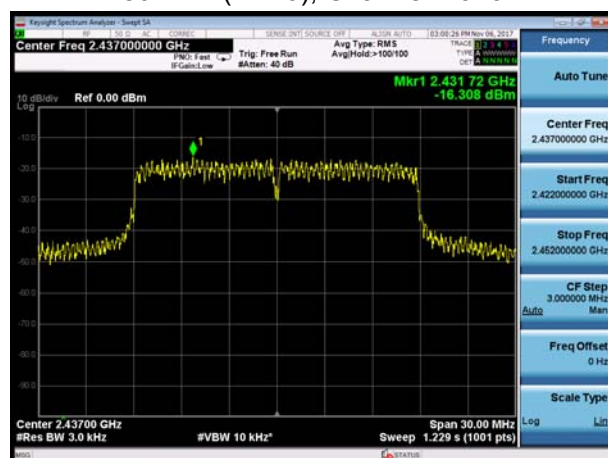
802.11n(HT20), Channel No. 1



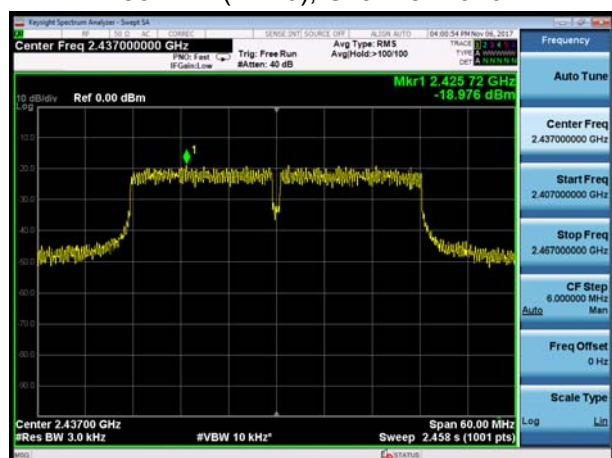
802.11n(HT40), Channel No. 3



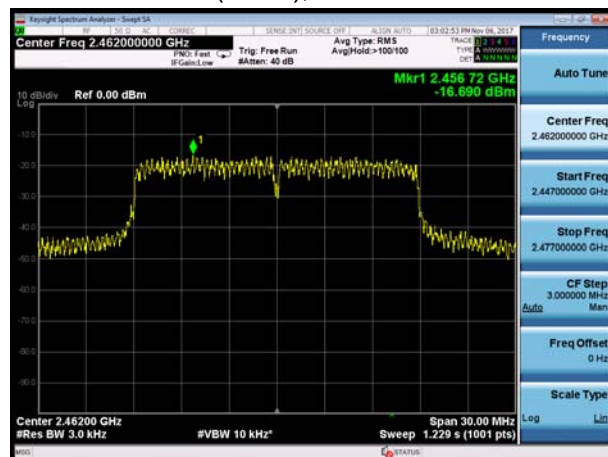
802.11n(HT20), Channel No. 6



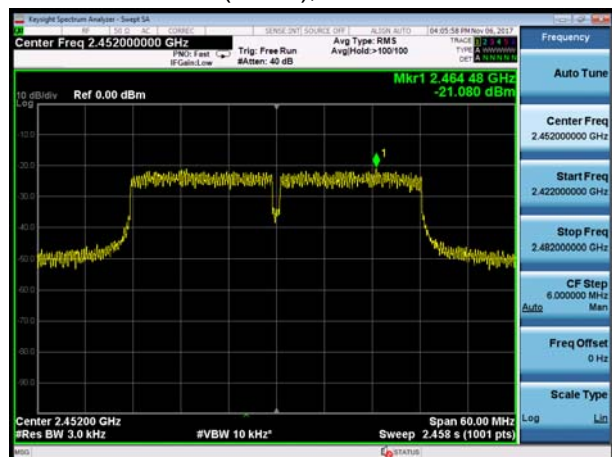
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



802.11n(HT40), Channel No. 9





BLE, Channel No.: 0



BLE, Channel No.: 19



BLE, Channel No.: 39



## 5.5. Spurious RF Conducted Emissions

### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

### Method of Measurement

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100kHz and VBW to 300 kHz, Sweep is set to ATUO.

The test is in transmitting mode.

### Test setup



### Limits

Rule Part 15.247(d) specifies that "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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power."

| Network Standards      | Carrier frequency (MHz) | Reference value (dBm) | Limit  |
|------------------------|-------------------------|-----------------------|--------|
| 802.11b                | 2412                    | 1.64                  | -18.36 |
|                        | 2437                    | 1.40                  | -18.60 |
|                        | 2462                    | 4.00                  | -16.00 |
| 802.11g                | 2412                    | 0.24                  | -19.76 |
|                        | 2437                    | -2.29                 | -22.29 |
|                        | 2462                    | -5.60                 | -25.60 |
| 802.11n HT20           | 2412                    | 1.54                  | -18.46 |
|                        | 2437                    | -0.11                 | -20.11 |
|                        | 2462                    | -0.26                 | -20.26 |
| 802.11n HT40           | 2422                    | -2.16                 | -22.16 |
|                        | 2437                    | -3.76                 | -23.76 |
|                        | 2452                    | -3.31                 | -23.31 |
| Bluetooth (Low Energy) | 2402                    | -9.96                 | -29.96 |
|                        | 2440                    | -9.10                 | -29.10 |
|                        | 2480                    | -8.57                 | -28.57 |

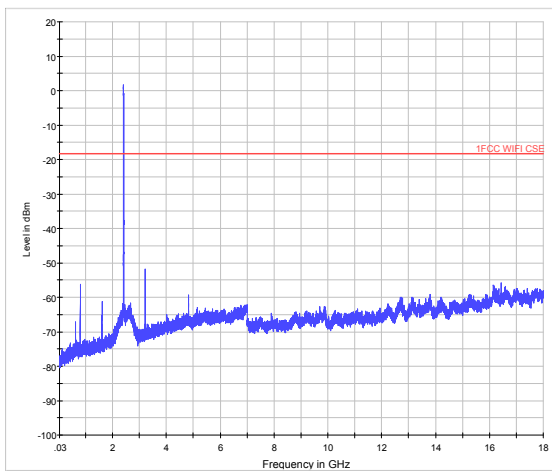
### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

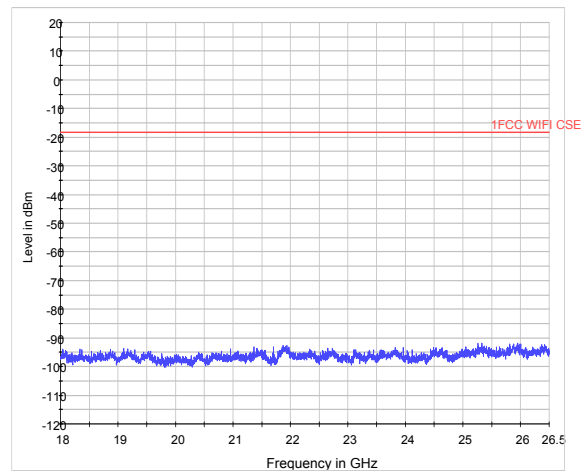
| Frequency   | Uncertainty |
|-------------|-------------|
| 100kHz-2GHz | 0.684 dB    |
| 2GHz-26GHz  | 1.407 dB    |

**Test Results:**

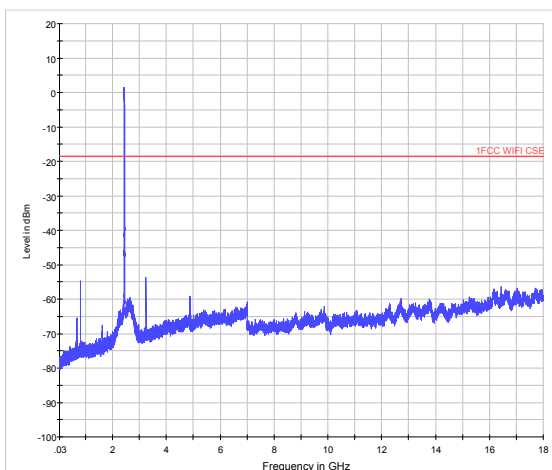
The signal beyond the limit is carrier.



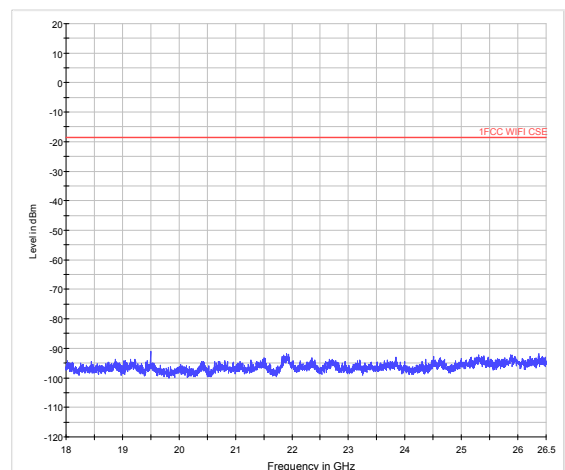
802.11b CH1 30MHz to 18GHz



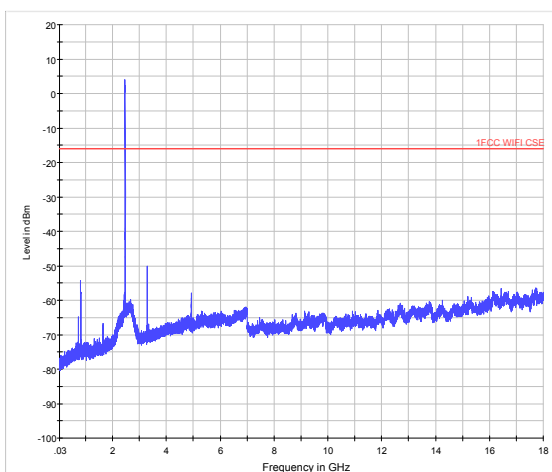
802.11b CH1 18GHz to 26.5GHz



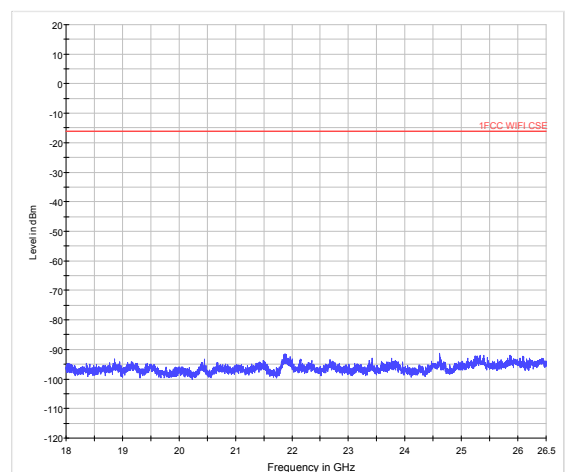
802.11b CH6 30MHz to 18GHz



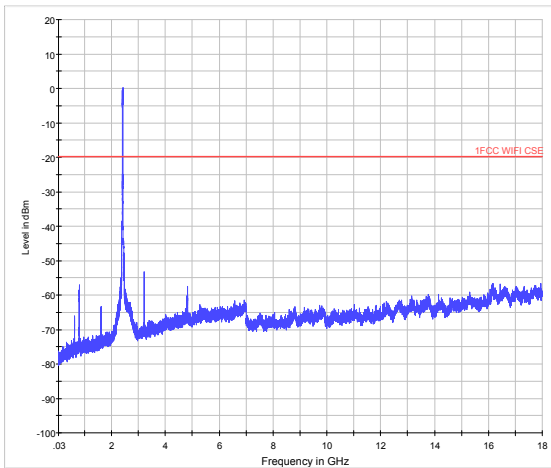
802.11b CH6 18GHz to 26.5GHz



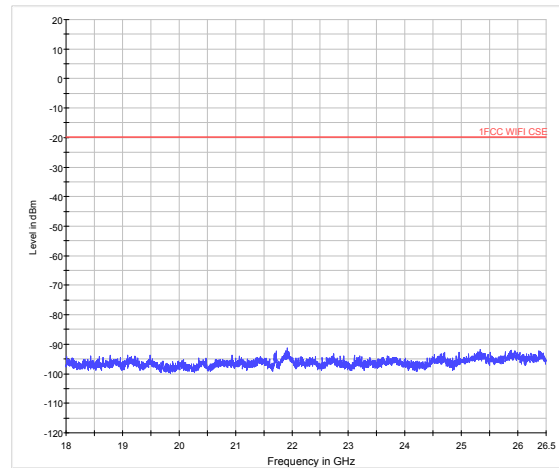
802.11b CH11 30MHz to 18GHz



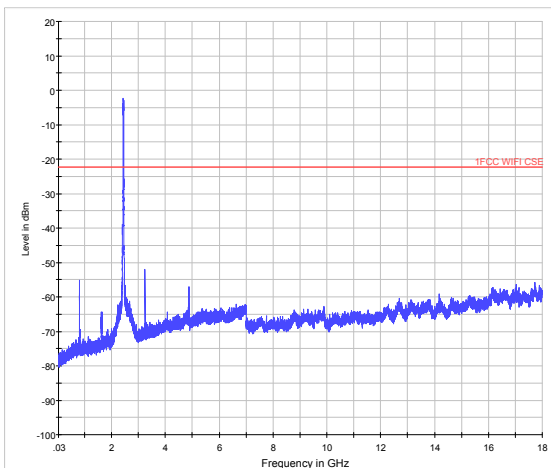
802.11b CH11 18GHz to 26.5GHz



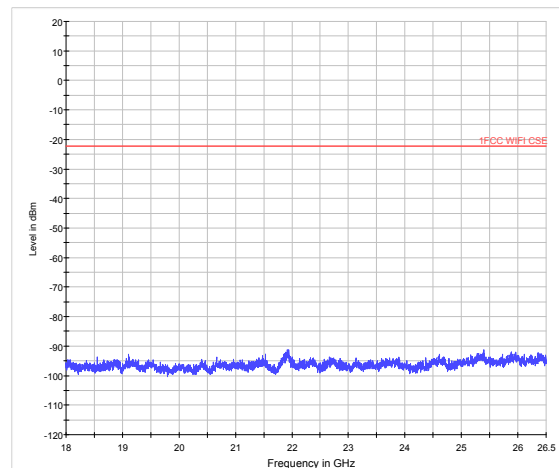
802.11g CH1 30MHz to 18GHz



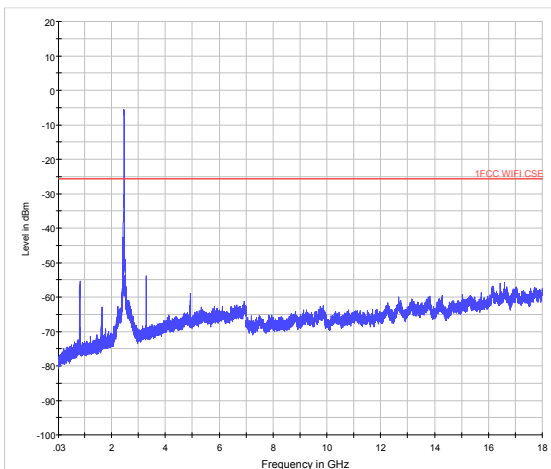
802.11g CH1 18GHz to 26.5GHz



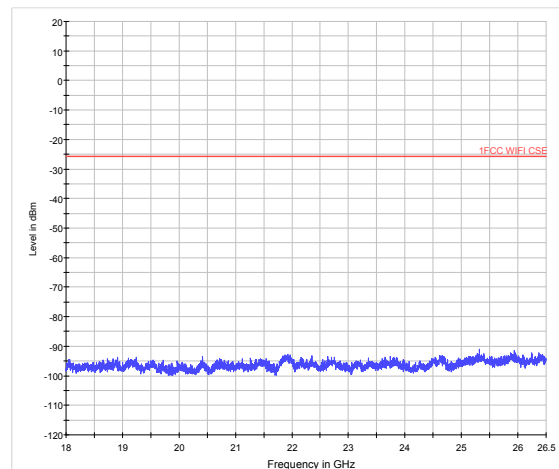
802.11g CH6 30MHz to 18GHz



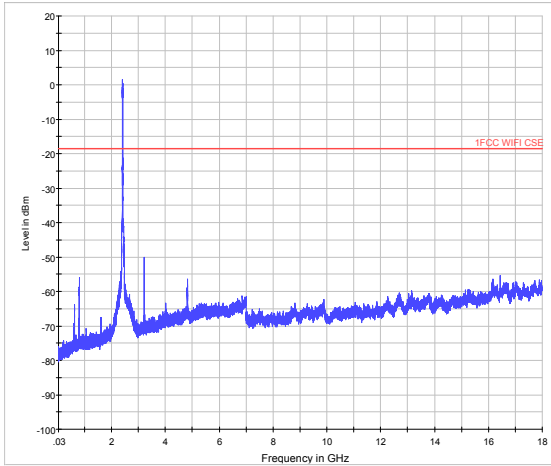
802.11g CH6 18GHz to 26.5GHz



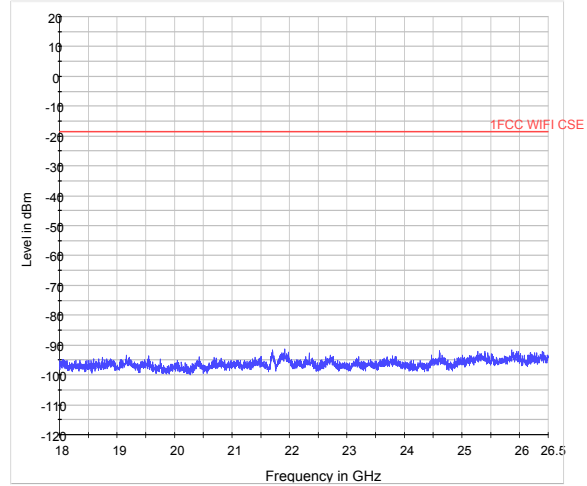
802.11g CH11 30MHz to 18GHz



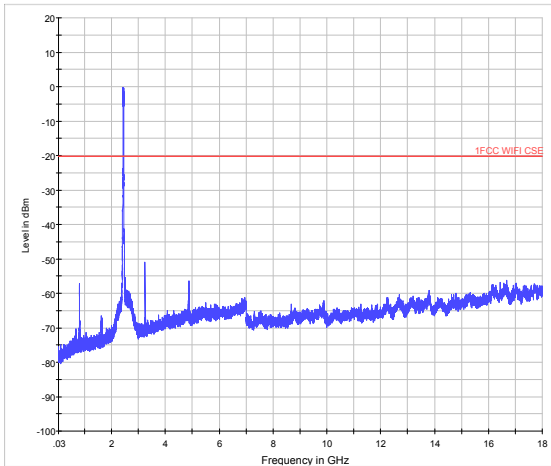
802.11g CH11 18GHz to 26.5GHz



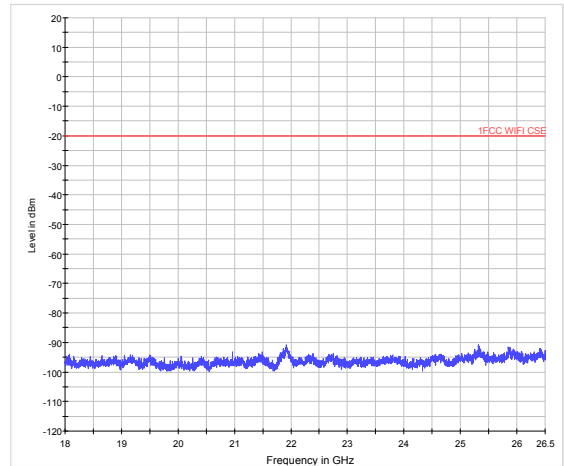
802.11n (HT20) CH1 30MHz to 18GHz



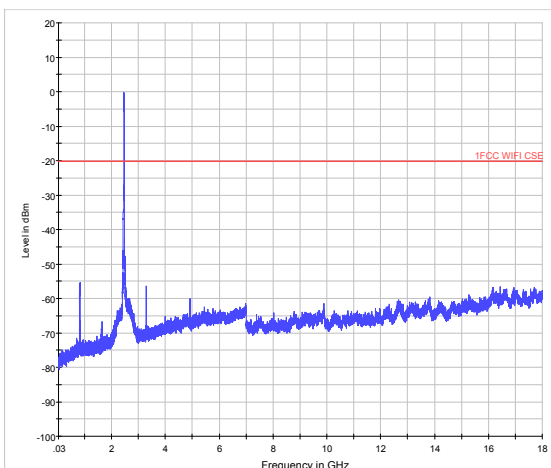
802.11n (HT20) CH1 18GHz to 26.5GHz



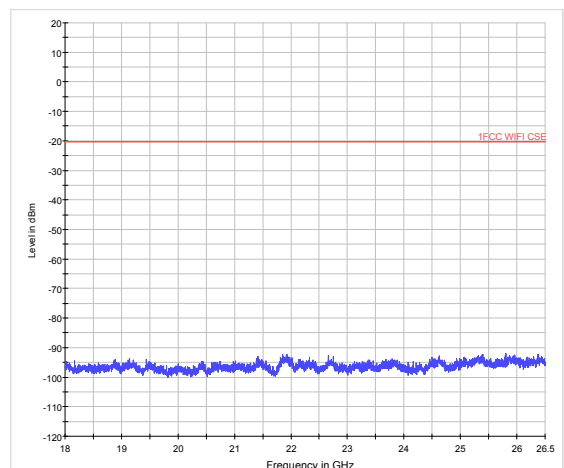
802.11n (HT20) CH6 30MHz to 18GHz



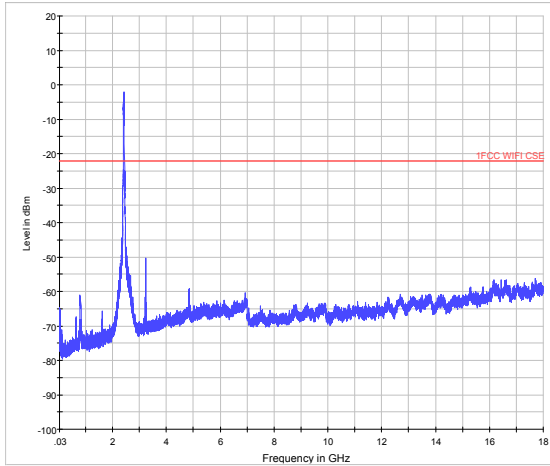
802.11n (HT20) CH6 18GHz to 26.5GHz



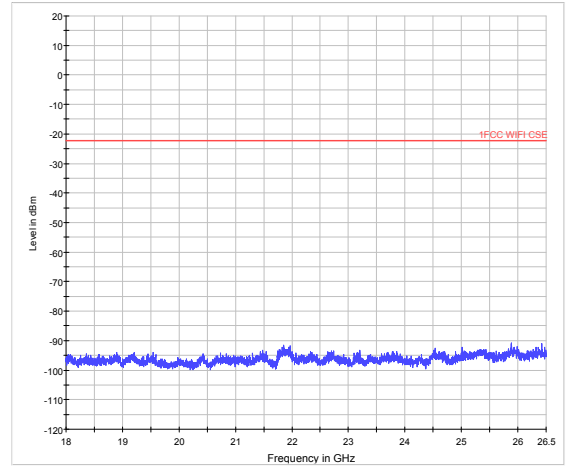
802.11n (HT20) CH11 30MHz to 18GHz



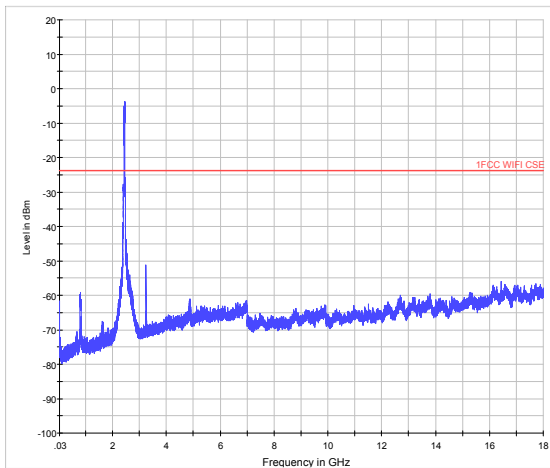
802.11n (HT20) CH11 18GHz to 26.5GHz



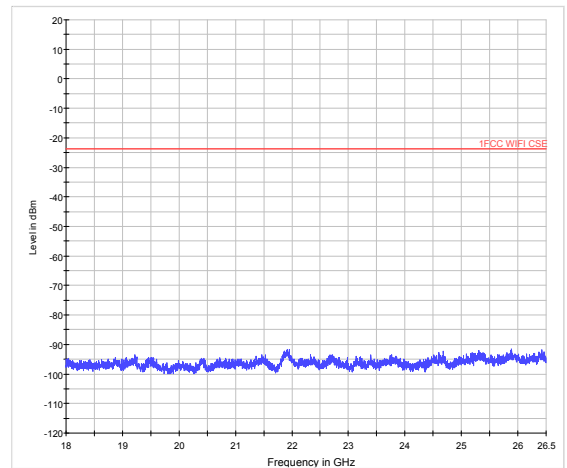
802.11n (HT40) CH3 30MHz to 18GHz



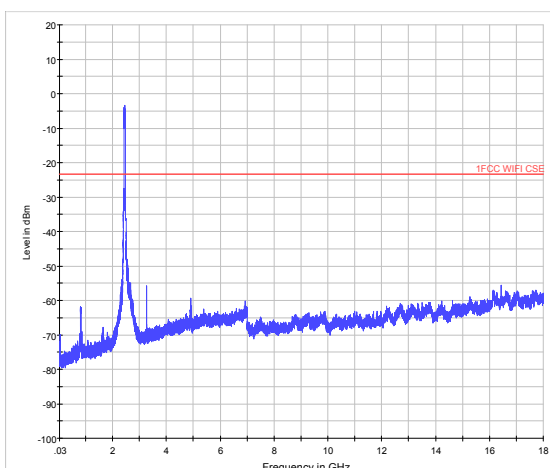
802.11n (HT40) CH3 18GHz to 26.5GHz



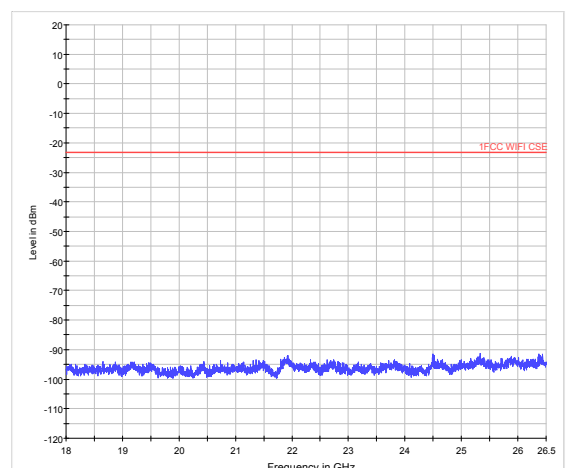
802.11n (HT40) CH6 30MHz to 18GHz



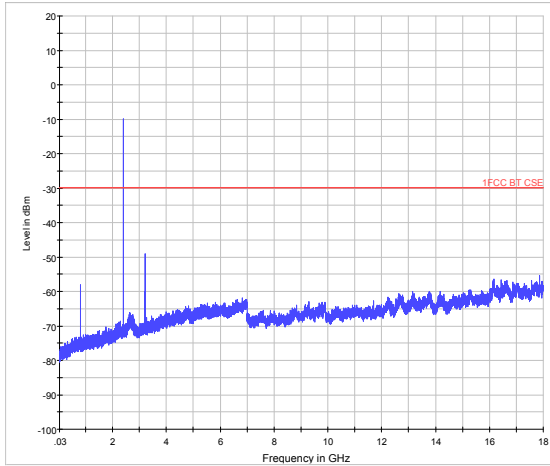
802.11n (HT40) CH6 18GHz to 26.5GHz



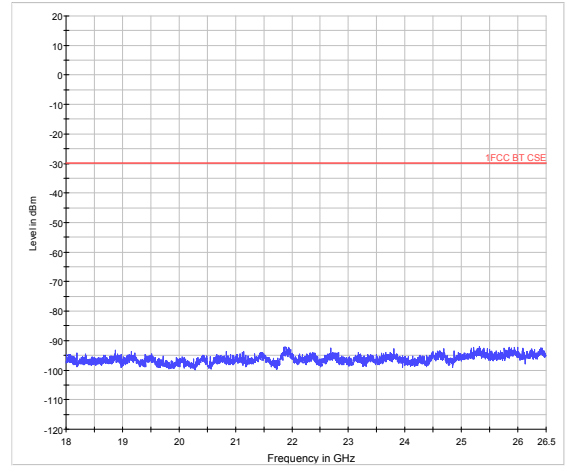
802.11n (HT40) CH9 30MHz to 18GHz



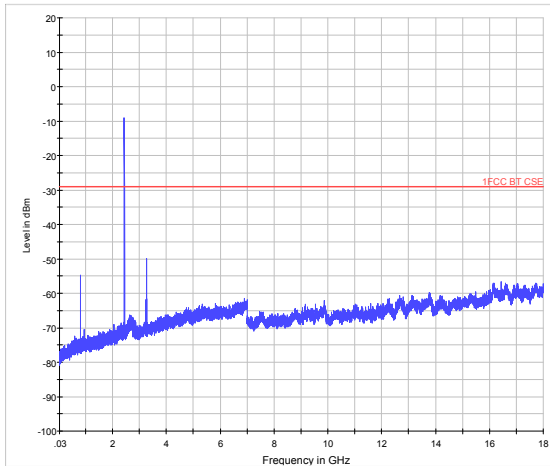
802.11n (HT40) CH9 18GHz to 26.5GHz



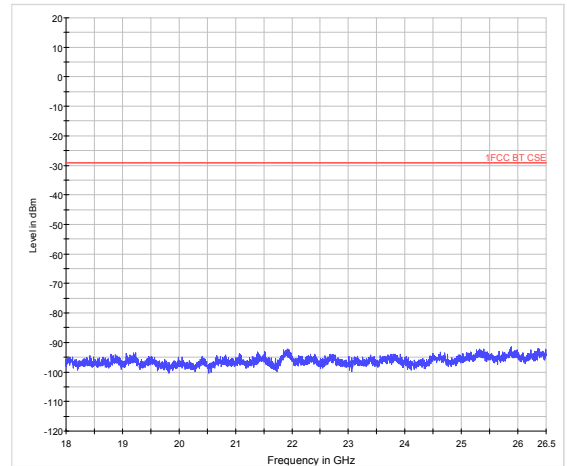
BLE CH0 30MHz to 18GHz



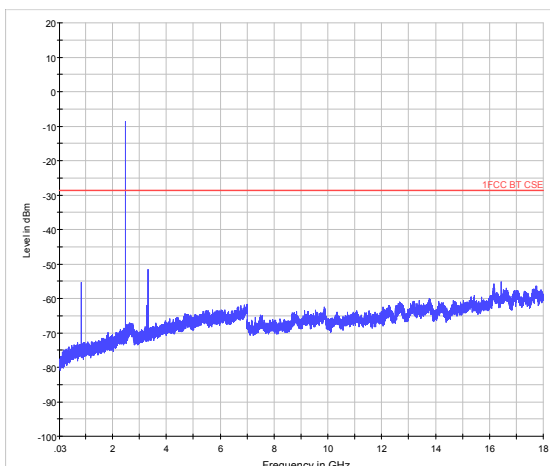
BLE CH0 18GHz to 26.5GHz



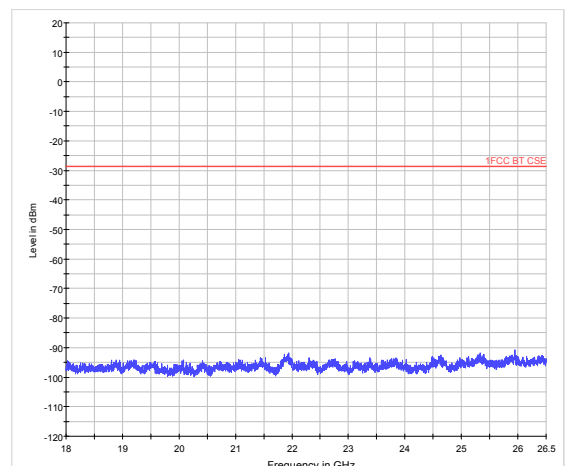
BLE CH19 30MHz to 18GHz



BLE CH19 18GHz to 26.5GHz



BLE CH39 30MHz to 18GHz



BLE CH39 18GHz to 26.5GHz



If disturbances were found more than 20dB below limit line, the mark is not required for the EUT.

The signal beyond the limit is carrier.

| Test Data File Name    | Frequency<br>(MHz) | Peak<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|------------------------|--------------------|---------------|----------------|----------------|
| CSE_BLE CH0_0.03-18GHz | 3202.5             | -49.1         | -30.0          | 19.1           |

## 5.6. Radiated Emissions in the Restricted Band

### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

### Method of Measurement

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. RBW is set to 100kHz. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

Set the spectrum analyzer in the following:

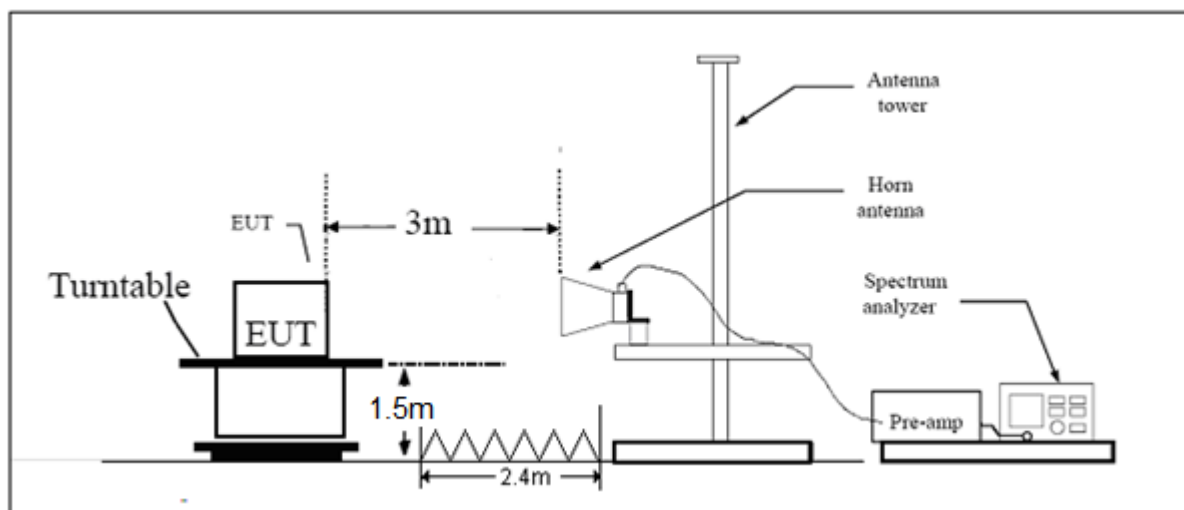
- (a) PEAK: RBW=1MHz /VBW=3MHz / Sweep=AUTO
- (b) AVERAGE: RBW=1MHz /VBW=3MHz / Sweep=AUTO

This setting method can refer to **KDB 558074**.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Y axis) and the antenna is vertical.

The test is in transmitting mode.

### Test setup



Note: Area side: 2.4mX3.6m

## Limits

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

| MHz                        | MHz                   | MHz             | GHz              |
|----------------------------|-----------------------|-----------------|------------------|
| 0.090 - 0.110              | 16.42 - 16.423        | 399.9 - 410     | 4.5 - 5.15       |
| <sup>1</sup> 0.495 - 0.505 | 16.69475 - 16.69525   | 608 - 614       | 5.35 - 5.46      |
| 2.1735 - 2.1905            | 16.80425 - 16.80475   | 960 - 1240      | 7.25 - 7.75      |
| 4.125 - 4.128              | 25.5 - 25.67          | 1300 - 1427     | 8.025 - 8.5      |
| 4.17725 - 4.17775          | 37.5 - 38.25          | 1435 - 1626.5   | 9.0 - 9.2        |
| 4.20725 - 4.20775          | 73 - 74.6             | 1645.5 - 1646.5 | 9.3 - 9.5        |
| 6.215 - 6.218              | 74.8 - 75.2           | 1660 - 1710     | 10.6 - 12.7      |
| 6.26775 - 6.26825          | 108 - 121.94          | 1718.8 - 1722.2 | 13.25 - 13.4     |
| 6.31175 - 6.31225          | 123 - 138             | 2200 - 2300     | 14.47 - 14.5     |
| 8.291 - 8.294              | 149.9 - 150.05        | 2310 - 2390     | 15.35 - 16.2     |
| 8.362 - 8.366              | 156.52475 - 156.52525 | 2483.5 - 2500   | 17.7 - 21.4      |
| 8.37625 - 8.38675          | 156.7 - 156.9         | 2690 - 2900     | 22.01 - 23.12    |
| 8.41425 - 8.41475          | 162.0125 - 167.17     | 3260 - 3267     | 23.6 - 24.0      |
| 12.29 - 12.293             | 167.72 - 173.2        | 3332 - 3339     | 31.2 - 31.8      |
| 12.51975 - 12.52025        | 240 - 285             | 3345.8 - 3358   | 36.43 - 36.5     |
| 12.57675 - 12.57725        | 322 - 335.4           | 3600 - 4400     | ( <sup>2</sup> ) |
| 13.36 - 13.41              |                       |                 |                  |

Limit in restricted band

| Frequency of emission (MHz) | Field strength(uV/m) | Field strength(dBuV/m) |
|-----------------------------|----------------------|------------------------|
| 30-88                       | 100                  | 40                     |
| 88-216                      | 150                  | 43.5                   |
| 216-960                     | 200                  | 46                     |
| Above960                    | 500                  | 54                     |

## §15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74 dBuV/m

Average Limit=54 dBuV/m

## Measurement Uncertainty

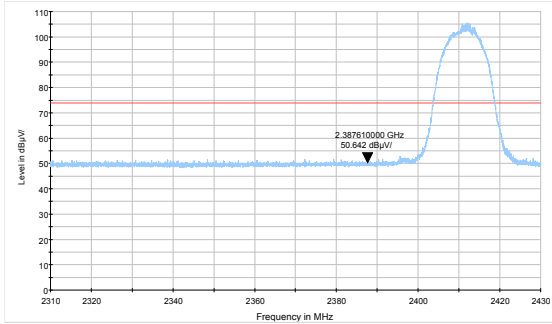
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ ,  $U = 3.55$  dB.

## Test Results:

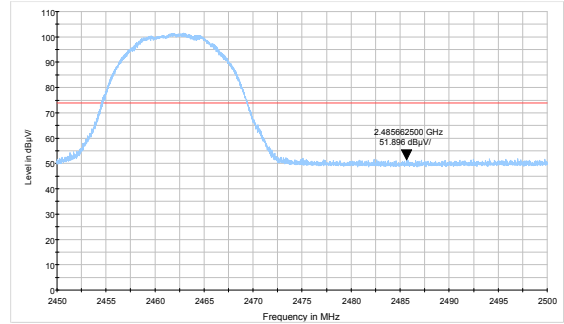
**PASS**

The signal beyond the limit is carrier.

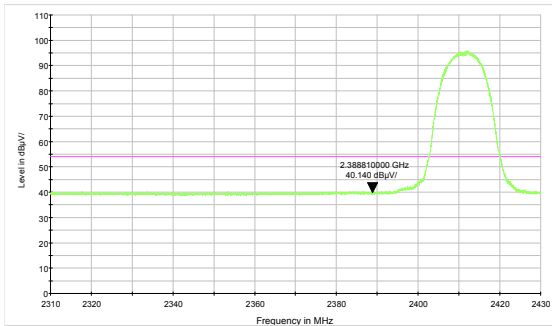
**802.11b-Channel 1: Peak**



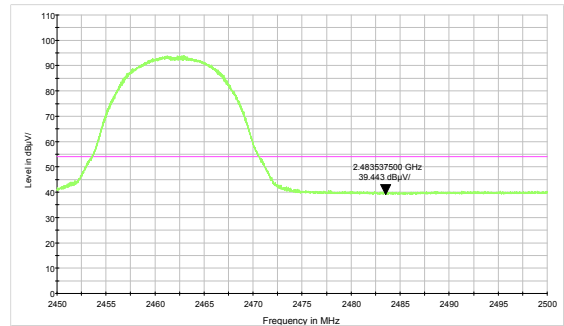
**802.11b-Channel 11: Peak**



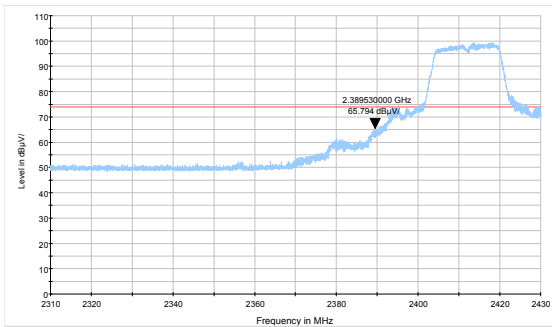
**802.11b-Channel 1: Average**



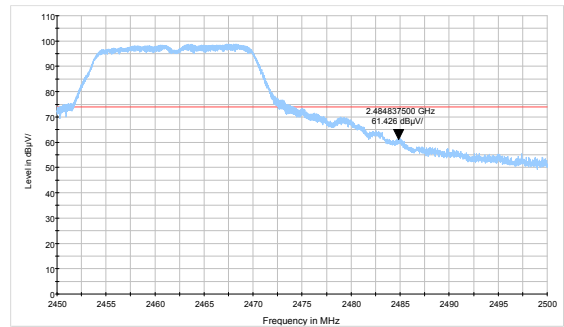
**802.11b-Channel 11: Average**



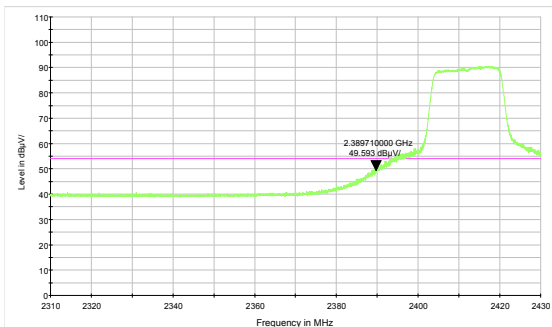
**802.11g-Channel 1: Peak**



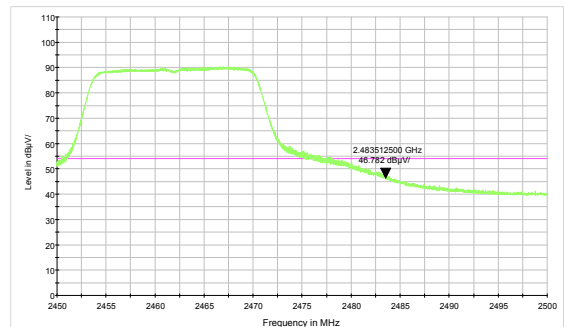
**802.11g-Channel 11: Peak**



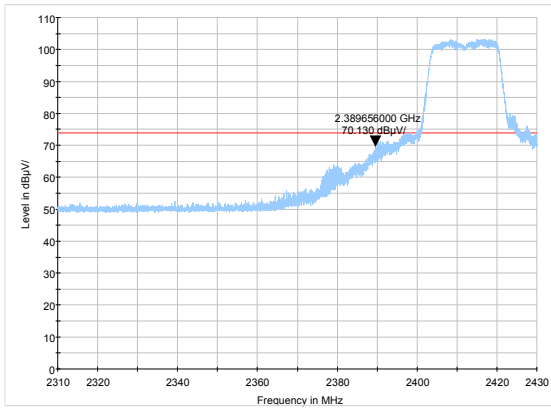
**802.11g-Channel 1: Average**



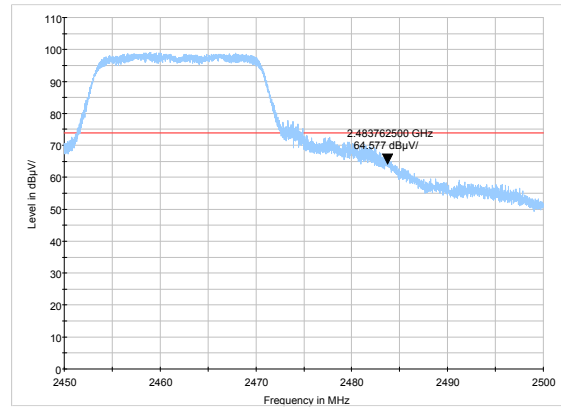
**802.11g-Channel 11: Average**



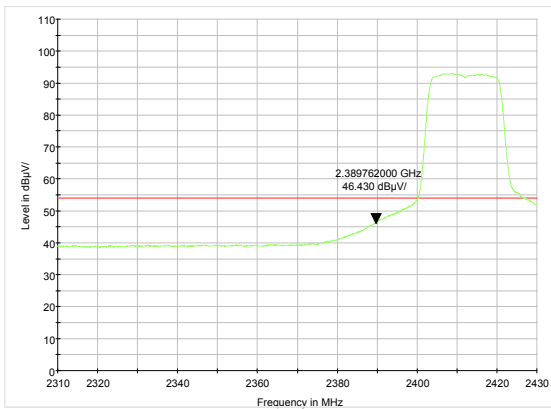
**802.11n HT20 -Channel 1: Peak**



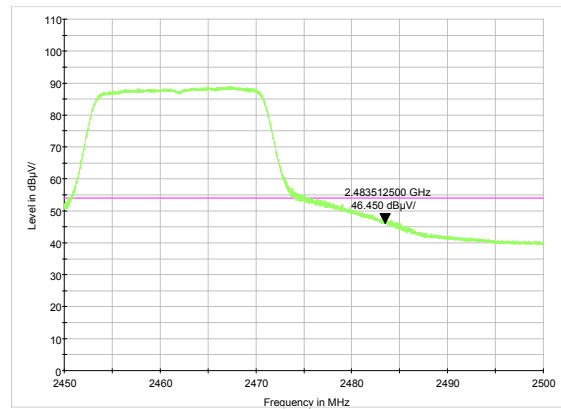
**802.11n HT20-Channel 11: Peak**



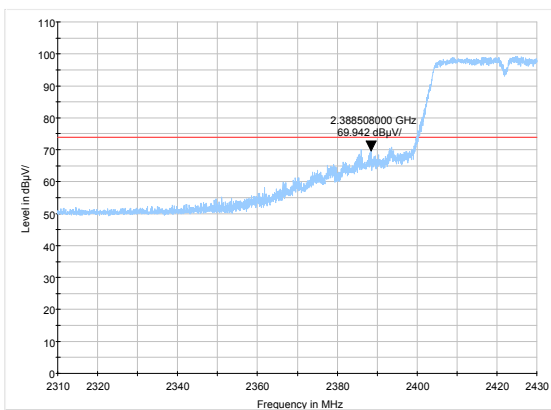
**802.11n HT20-Channel 1: Average**



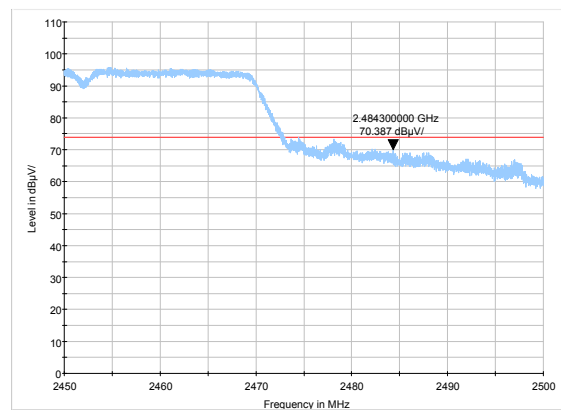
**802.11n HT20-Channel 11: Average**



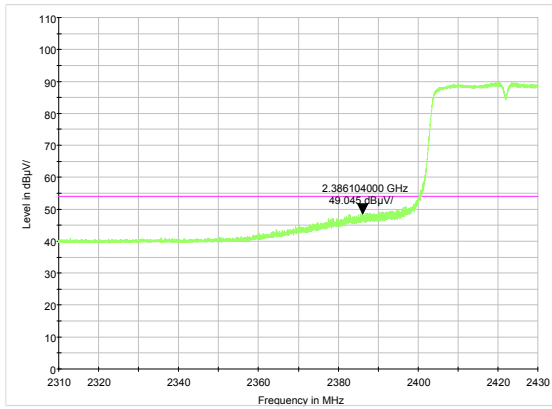
**802.11n HT40 -Channel 3: Peak**



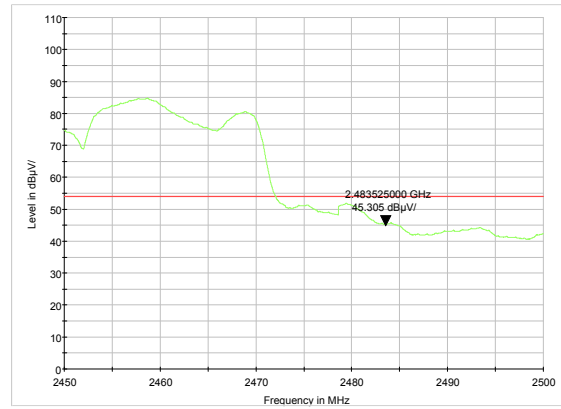
**802.11n HT40-Channel 9: Peak**



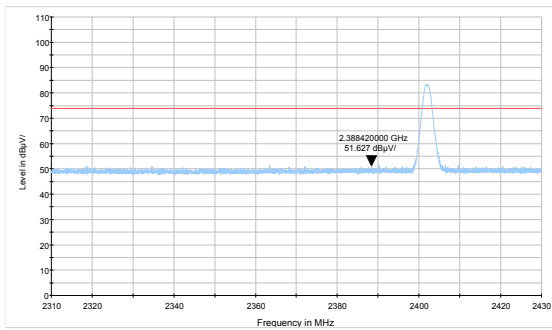
**802.11n HT40-Channel 3: Average**



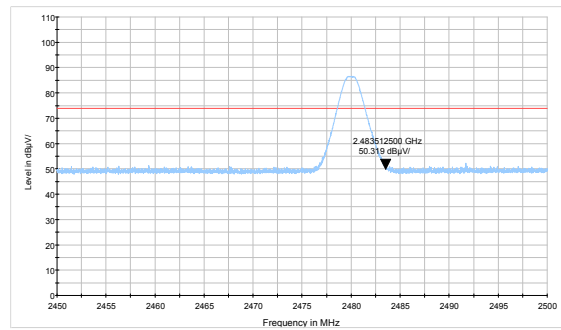
**802.11n HT40-Channel 9: Average**



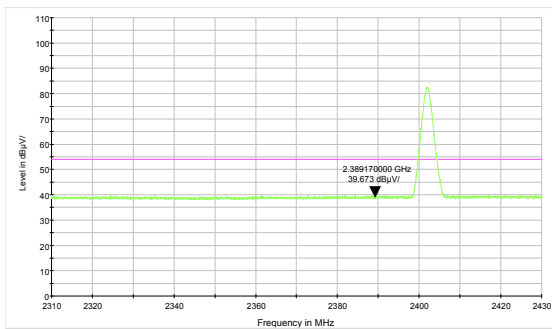
**BLE -Channel 0: Peak**



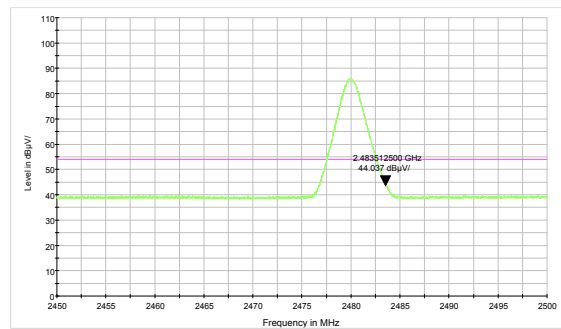
**BLE -Channel 39: Peak**



**BLE -Channel 0: Average**



**BLE -Channel 39: Average**



## 5.7. Radiates Emission

### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 102.5kPa |

### Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration. Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, below 30MHz, the center of the loop shall be 1 meters; above 30MHz, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

Set the spectrum analyzer in the following:

Below 1GHz (detector: Peak and Quasi-Peak)

RBW=100 kHz / VBW=300 kHz / Sweep=AUTO

Above 1GHz (detector: Peak):

(a) PEAK: RBW=1MHz / VBW=3MHz/ Sweep=AUTO

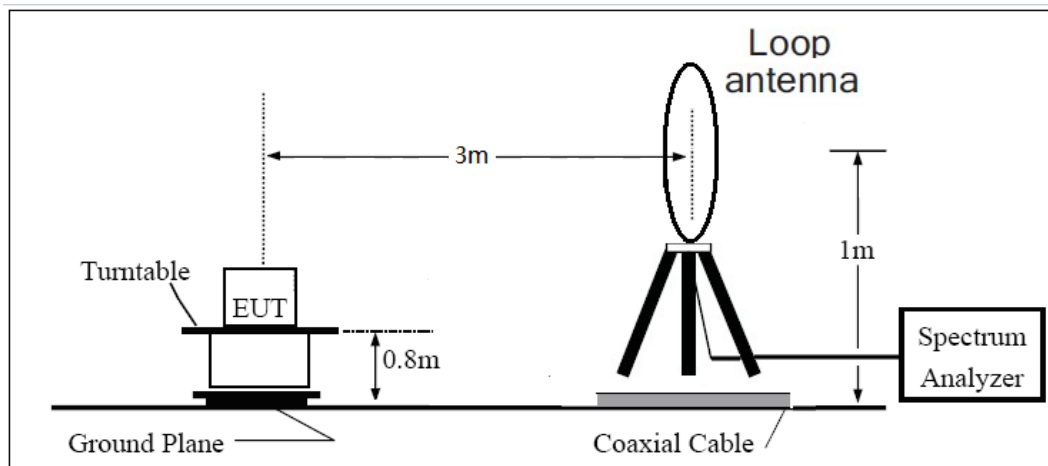
(b) AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

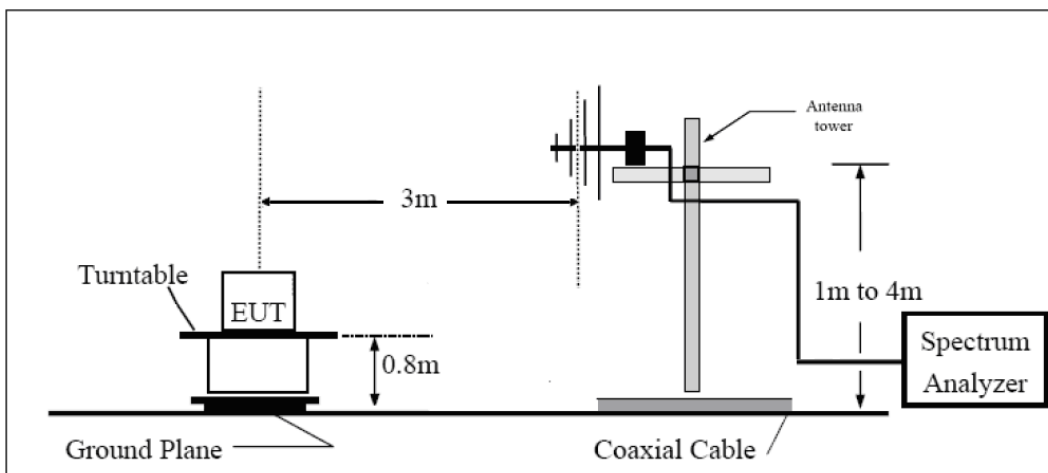
The test is in transmitting mode.

## Test setup

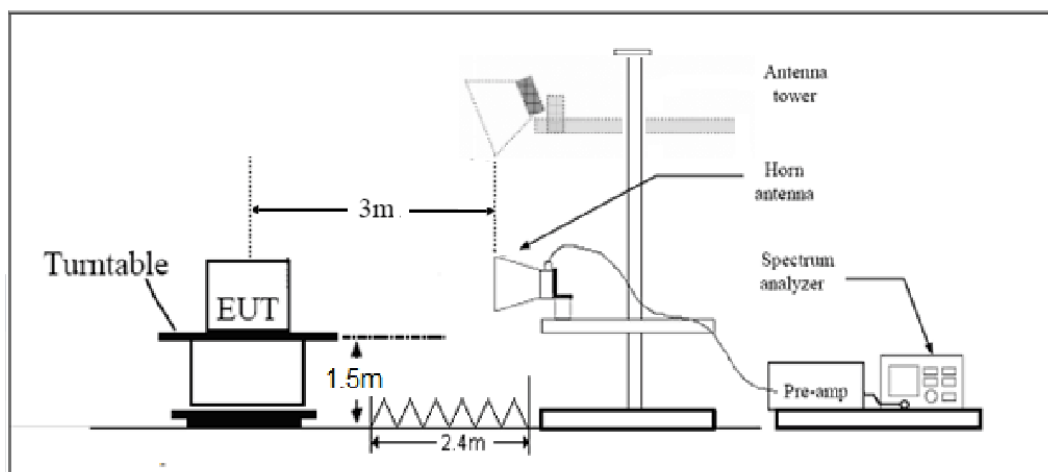
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

## Limits

Rule Part 15.247(d) specifies that “In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).”

Limit in restricted band

| Frequency of emission (MHz) | Field strength(uV/m) | Field strength(dBuV/m) |
|-----------------------------|----------------------|------------------------|
| 0.009–0.490                 | 2400/F(kHz)          | /                      |
| 0.490–1.705                 | 24000/F(kHz)         | /                      |
| 1.705–30.0                  | 30                   | /                      |
| 30-88                       | 100                  | 40                     |
| 88-216                      | 150                  | 43.5                   |
| 216-960                     | 200                  | 46                     |
| Above960                    | 500                  | 54                     |

## §15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

## Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

| Frequency    | Uncertainty |
|--------------|-------------|
| 9KHz-30MHz   | 3.55 dB     |
| 30MHz-200MHz | 4.19 dB     |
| 200MHz-1GHz  | 3.63 dB     |
| Above 1GHz   | 3.68 dB     |

## Test result

Sweep from 9 kHz to 30MHz, and the emissions more than 20 dB below the permissible value are not reported.

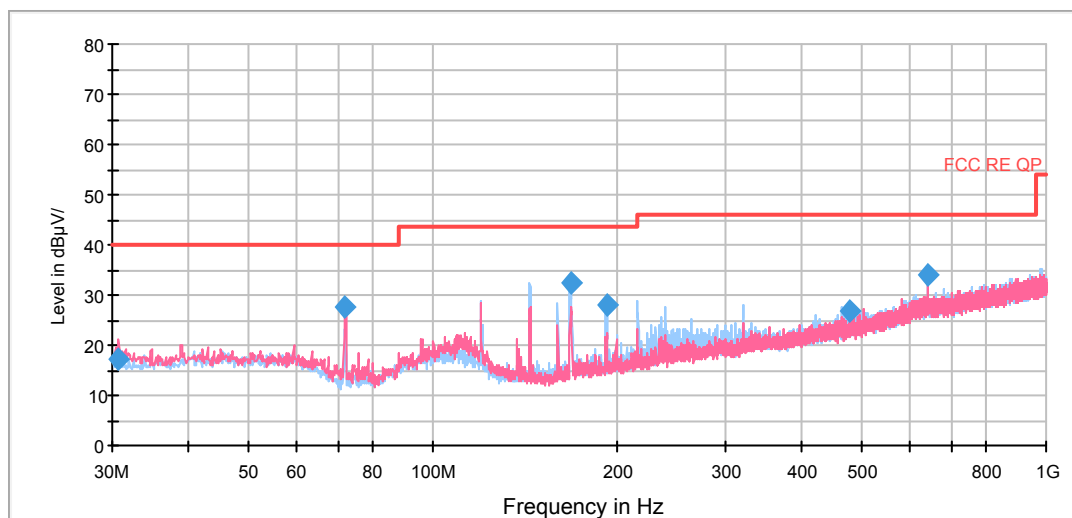
The following graphs display the maximum values of horizontal and vertical by software.

For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, 802.11n(HT20), Channel 6 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

## Continuous TX mode:

FCC RE 0.03-1GHz QP Class B



Radiates Emission from 30MHz to 1GHz

| Frequency (MHz) | Quasi-Peak (dBuV/m) | Reading value (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------------|------------------------|-------------|--------------|---------------|---------------------|-------------|----------------|
| 30.727500       | 17.2                | 5.1                    | 100.0       | V            | 69.0          | 12.1                | 22.8        | 40.0           |
| 71.992500       | 27.6                | 19.0                   | 100.0       | V            | 343.0         | 8.6                 | 12.4        | 40.0           |
| 167.983750      | 32.5                | 22.1                   | 225.0       | H            | 199.0         | 10.4                | 11.0        | 43.5           |
| 191.990000      | 27.9                | 16.1                   | 100.0       | H            | 196.0         | 11.8                | 15.6        | 43.5           |
| 479.998750      | 26.8                | 6.6                    | 125.0       | V            | 168.0         | 20.2                | 19.2        | 46.0           |
| 639.968750      | 33.8                | 10.5                   | 100.0       | V            | 231.0         | 23.3                | 12.2        | 46.0           |

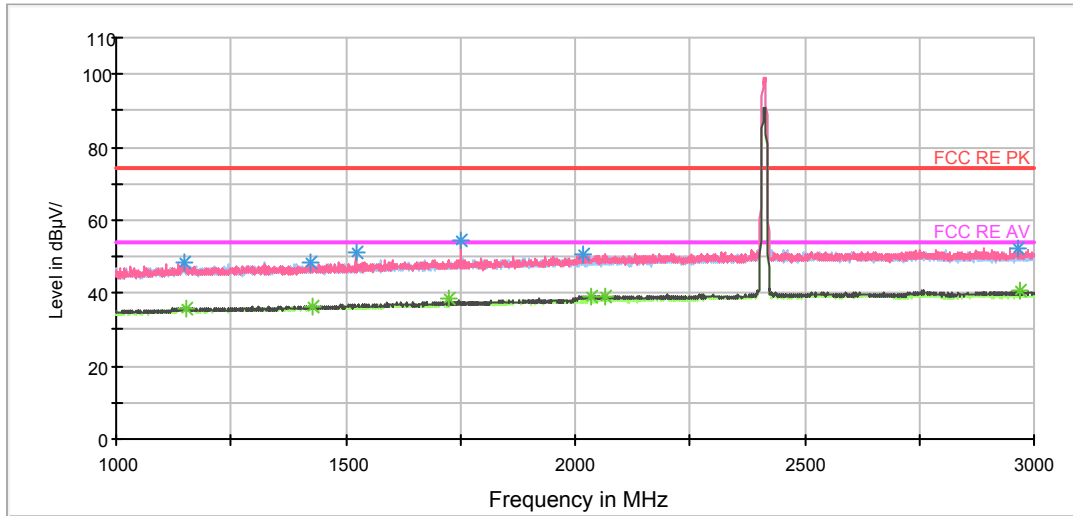
Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

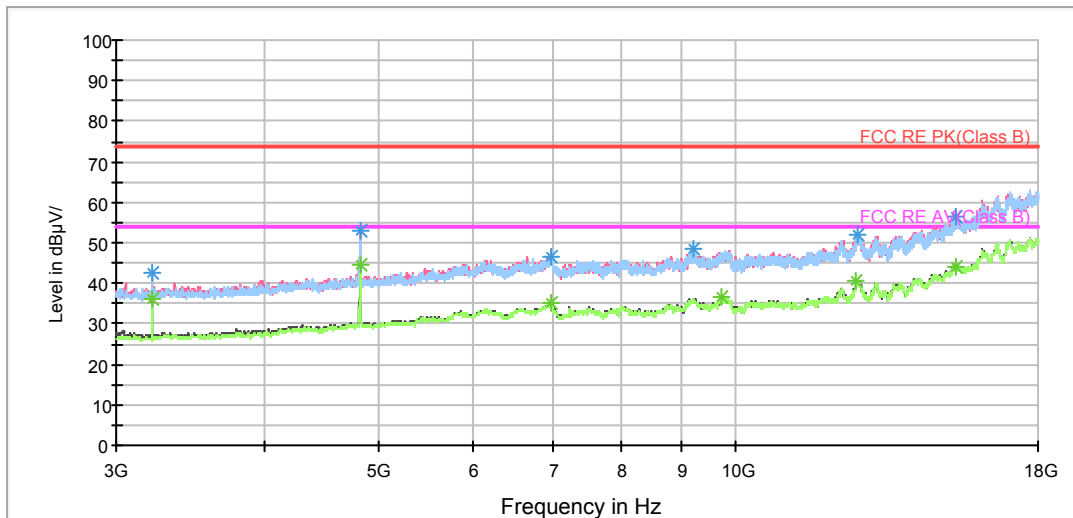
802.11b CH1

FCC RE 1G-3GHz PK+AV Class B



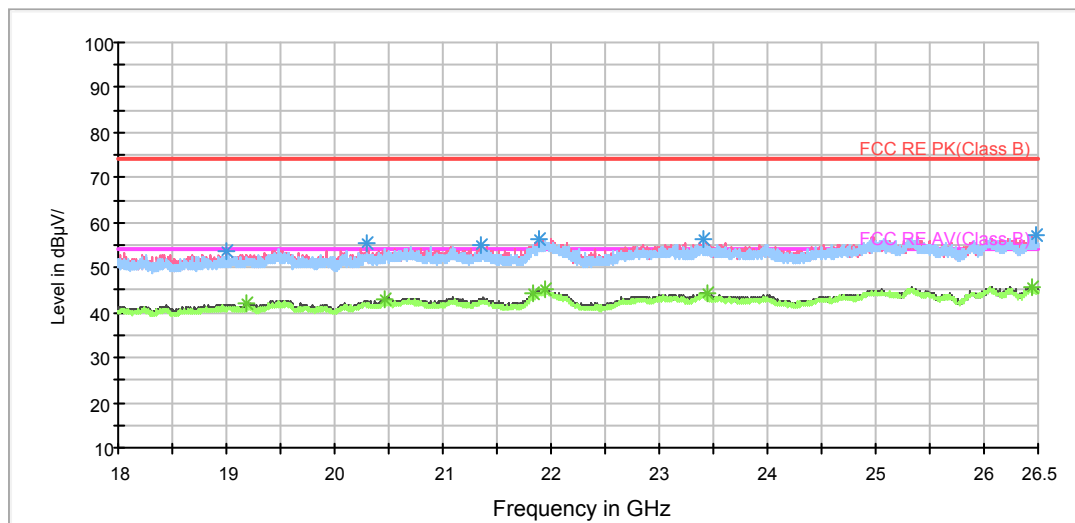
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1148.500000     | 48.5          | 100.0       | V            | 7.0           | 46.2                   | 2.3                 | 25.5        | 74             |
| 1425.500000     | 48.6          | 100.0       | V            | 56.0          | 45.5                   | 3.1                 | 25.4        | 74             |
| 1522.000000     | 51.0          | 100.0       | V            | 10.0          | 47.6                   | 3.4                 | 23.0        | 74             |
| 1751.000000     | 54.2          | 100.0       | V            | 31.0          | 49.9                   | 4.3                 | 19.8        | 74             |
| 2016.500000     | 50.8          | 100.0       | V            | 150.0         | 45.5                   | 5.3                 | 23.2        | 74             |
| 2964.000000     | 52.1          | 100.0       | V            | 7.0           | 44.6                   | 7.5                 | 21.9        | 74             |

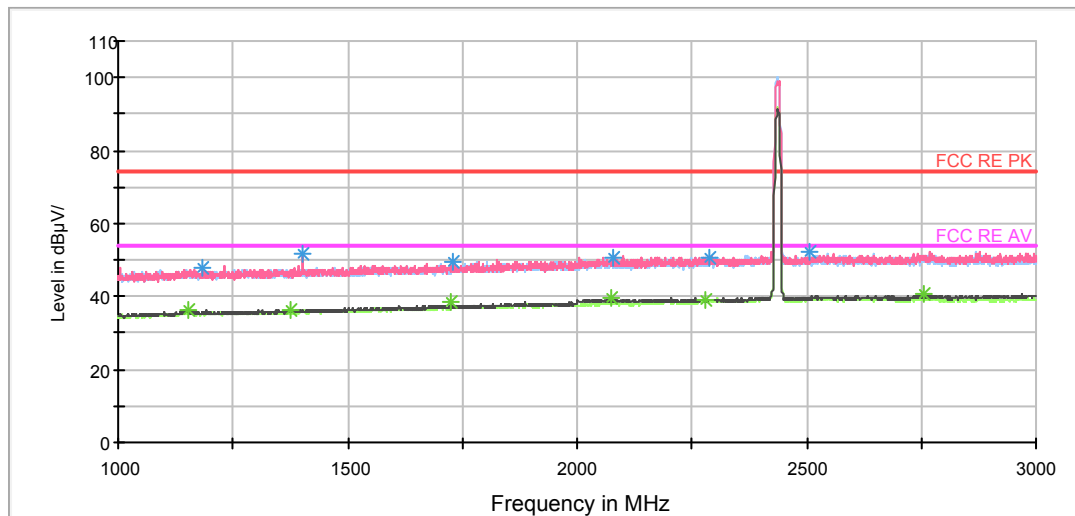
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1152.500000     | 36.0             | 100.0       | V            | 105.0         | 33.7                   | 2.3                 | 18.0        | 54             |
| 1426.500000     | 36.5             | 100.0       | V            | 0.0           | 33.4                   | 3.1                 | 17.5        | 54             |
| 1725.000000     | 38.2             | 100.0       | V            | 7.0           | 34.0                   | 4.2                 | 15.8        | 54             |
| 2034.500000     | 39.1             | 100.0       | V            | 5.0           | 33.8                   | 5.3                 | 14.9        | 54             |
| 2063.500000     | 39.1             | 100.0       | V            | 3.0           | 33.6                   | 5.5                 | 14.9        | 54             |
| 2970.500000     | 40.6             | 100.0       | V            | 3.0           | 33.1                   | 7.5                 | 13.4        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

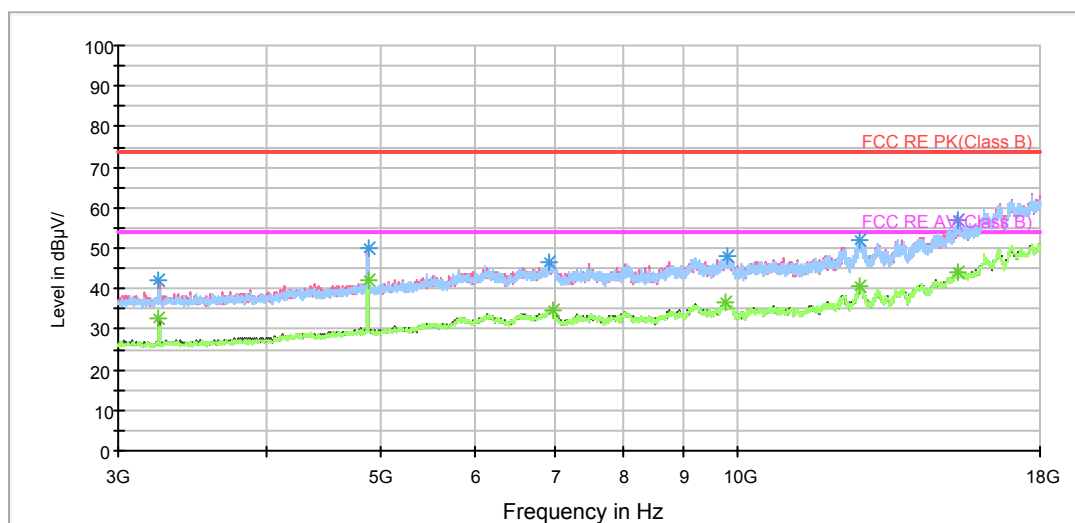
802.11b CH6

FCC RE 1G-3GHz PK+AV Class B



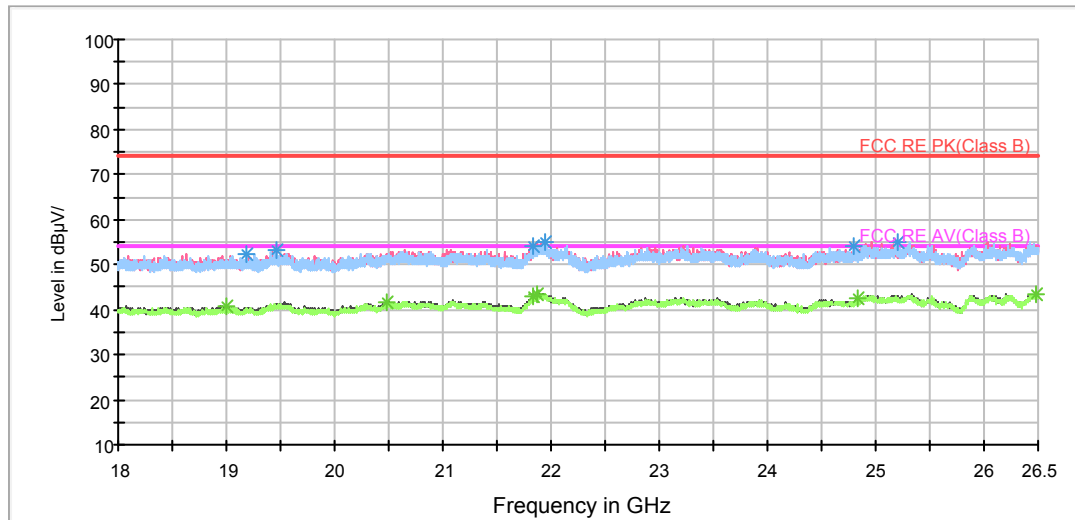
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1183.500000     | 47.8          | 100.0       | V            | 0.0           | 45.4                   | 2.4                 | 26.2        | 74             |
| 1401.500000     | 51.7          | 100.0       | V            | 72.0          | 48.6                   | 3.1                 | 22.3        | 74             |
| 1730.500000     | 49.3          | 100.0       | V            | 47.0          | 45.1                   | 4.2                 | 24.7        | 74             |
| 2078.500000     | 50.8          | 100.0       | V            | 24.0          | 45.3                   | 5.5                 | 23.2        | 74             |
| 2287.000000     | 50.6          | 100.0       | H            | 213.0         | 44.2                   | 6.4                 | 23.4        | 74             |
| 2504.500000     | 52.1          | 100.0       | H            | 297.0         | 44.9                   | 7.2                 | 21.9        | 74             |

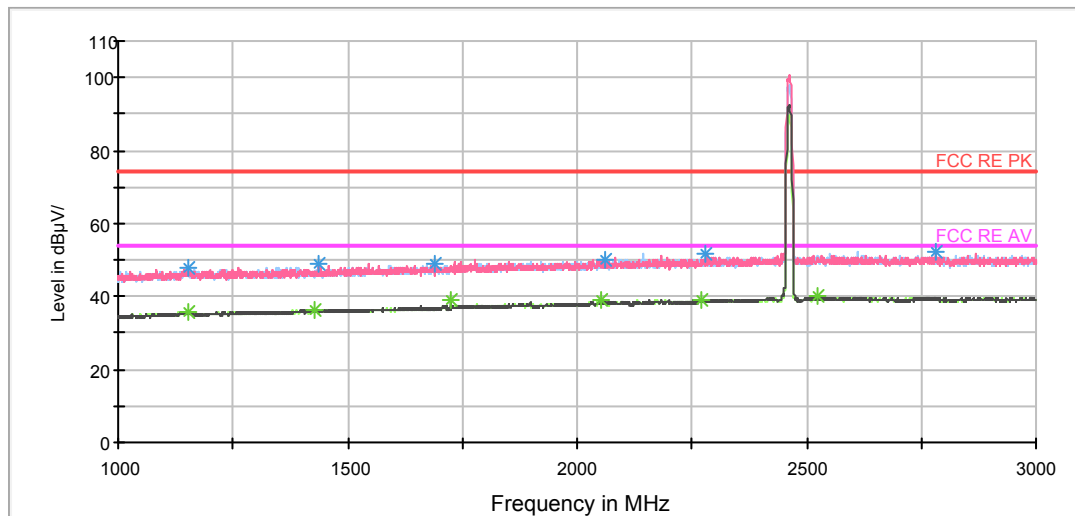
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1153.500000     | 36.1             | 100.0       | V            | 0.0           | 33.8                   | 2.3                 | 17.9        | 54             |
| 1375.000000     | 36.4             | 100.0       | V            | 55.0          | 33.4                   | 3.0                 | 17.6        | 54             |
| 1725.000000     | 38.5             | 100.0       | V            | 24.0          | 34.3                   | 4.2                 | 15.5        | 54             |
| 2076.000000     | 39.4             | 100.0       | V            | 13.0          | 33.9                   | 5.5                 | 14.6        | 54             |
| 2281.500000     | 39.1             | 100.0       | V            | 147.0         | 32.8                   | 6.3                 | 14.9        | 54             |
| 2756.000000     | 40.7             | 100.0       | V            | 64.0          | 33.3                   | 7.4                 | 13.3        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

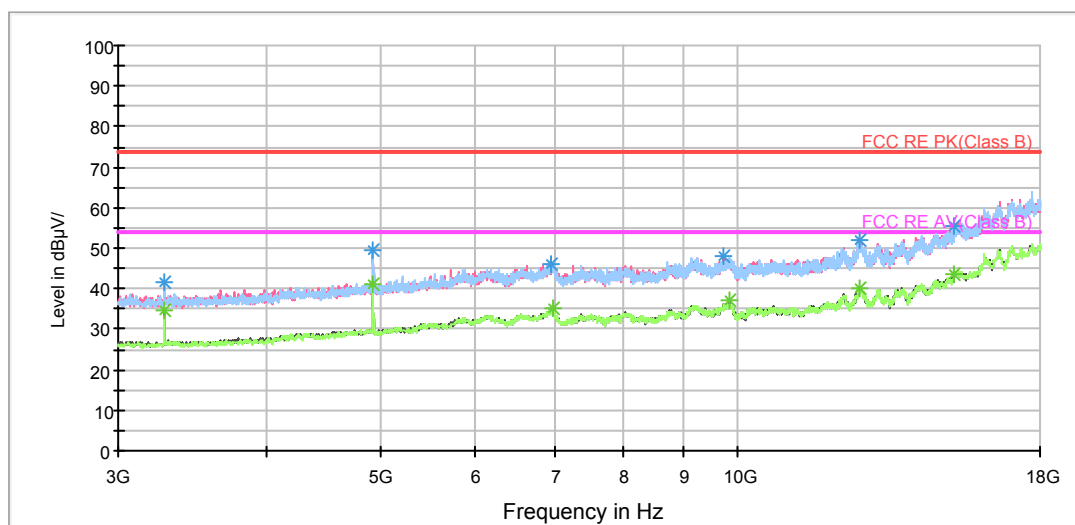
802.11b CH11

FCC RE 1G-3GHz PK+AV Class B



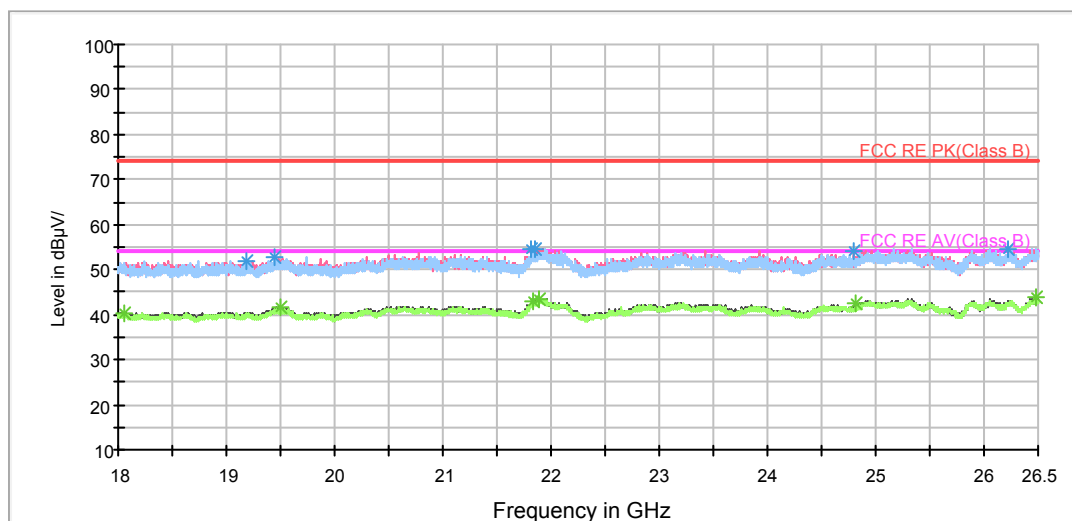
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1151.000000     | 47.6          | 100.0       | V            | 108.0         | 45.3                   | 2.3                 | 26.4        | 74             |
| 1435.000000     | 48.8          | 100.0       | V            | 22.0          | 45.6                   | 3.2                 | 25.2        | 74             |
| 1688.000000     | 48.8          | 100.0       | H            | 310.0         | 44.7                   | 4.1                 | 25.2        | 74             |
| 2059.000000     | 50.2          | 100.0       | V            | 12.0          | 44.8                   | 5.4                 | 23.8        | 74             |
| 2281.500000     | 51.7          | 100.0       | H            | 311.0         | 45.4                   | 6.3                 | 22.3        | 74             |
| 2780.500000     | 52.3          | 100.0       | V            | 5.0           | 44.9                   | 7.4                 | 21.7        | 74             |

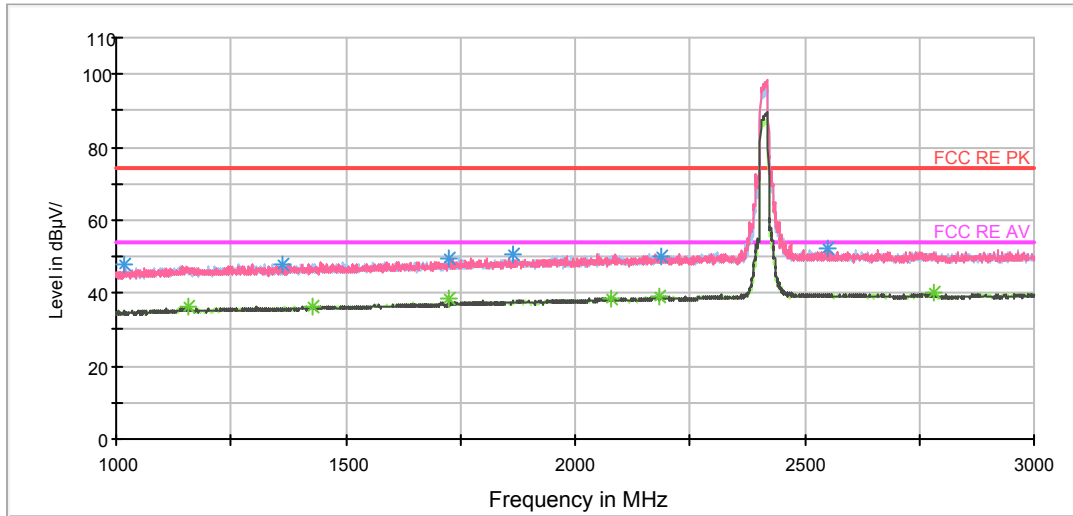
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1155.000000     | 36.0             | 100.0       | V            | 43.0          | 33.7                   | 2.3                 | 18.0        | 54             |
| 1427.500000     | 36.4             | 100.0       | V            | 2.0           | 33.3                   | 3.1                 | 17.6        | 54             |
| 1725.000000     | 38.8             | 100.0       | V            | 0.0           | 34.6                   | 4.2                 | 15.2        | 54             |
| 2054.000000     | 38.8             | 100.0       | V            | 133.0         | 33.4                   | 5.4                 | 15.2        | 54             |
| 2270.000000     | 38.9             | 100.0       | V            | 1.0           | 32.6                   | 6.3                 | 15.1        | 54             |
| 2523.500000     | 39.9             | 100.0       | H            | 254.0         | 32.7                   | 7.2                 | 14.1        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

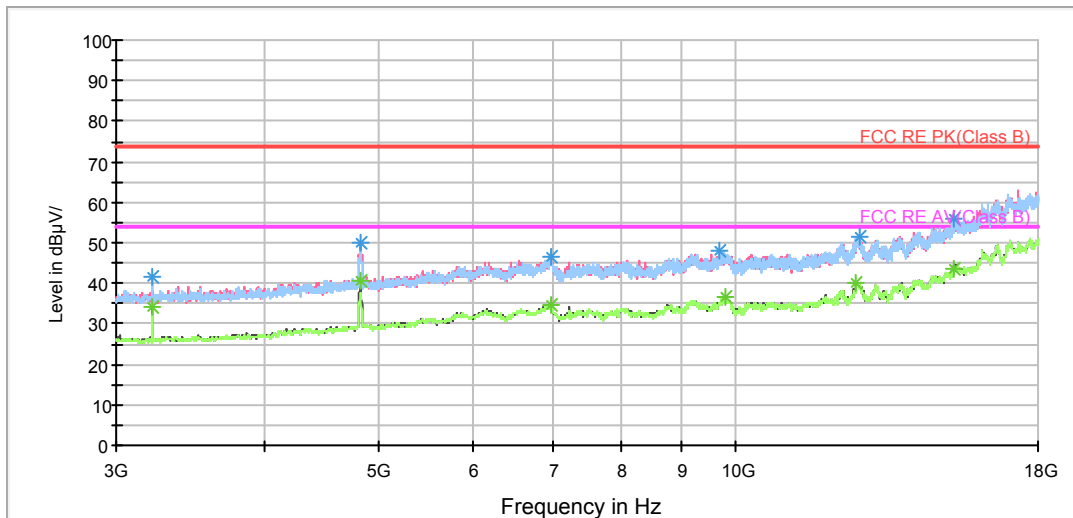
802.11g CH1

FCC RE 1G-3GHz PK+AV Class B



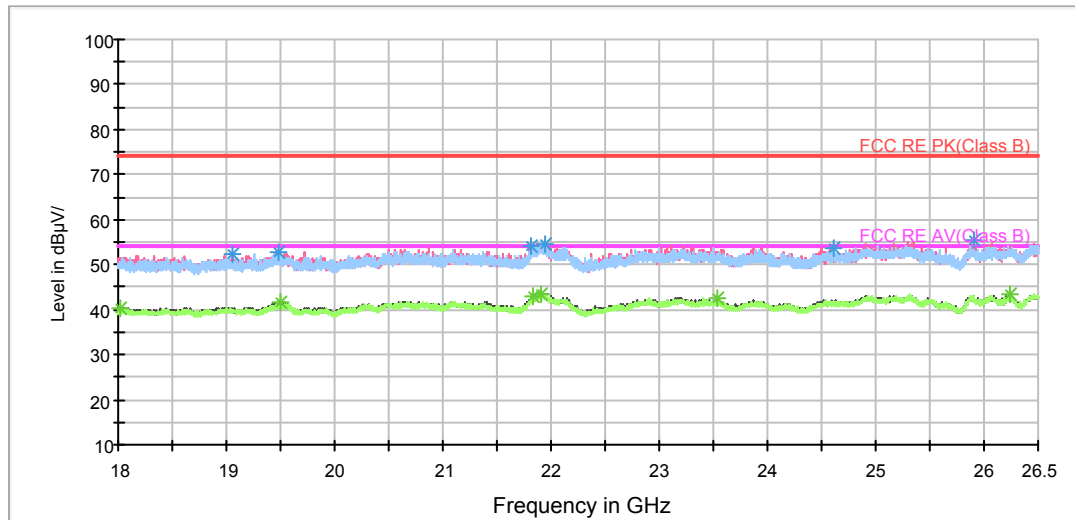
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1019.500000     | 47.8          | 100.0       | H            | 215.0         | 45.9                   | 1.9                 | 26.2        | 74             |
| 1360.500000     | 48.1          | 100.0       | V            | 0.0           | 45.2                   | 2.9                 | 25.9        | 74             |
| 1727.000000     | 49.4          | 100.0       | H            | 313.0         | 45.2                   | 4.2                 | 24.6        | 74             |
| 1864.500000     | 50.7          | 100.0       | V            | 190.0         | 46.0                   | 4.7                 | 23.3        | 74             |
| 2189.500000     | 49.9          | 100.0       | V            | 58.0          | 43.9                   | 6.0                 | 24.1        | 74             |
| 2551.000000     | 52.5          | 100.0       | V            | 165.0         | 45.3                   | 7.2                 | 21.5        | 74             |

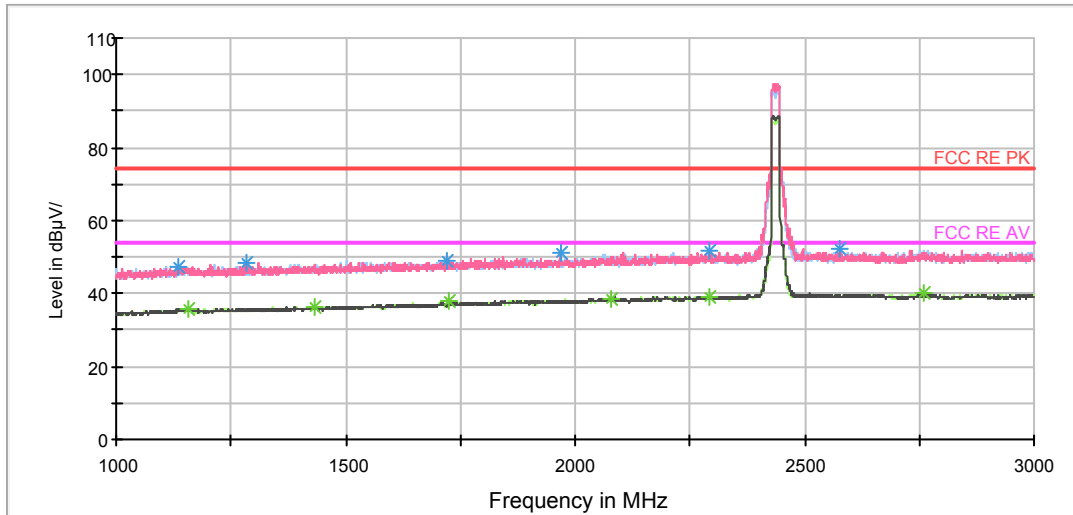
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1155.500000     | 36.1             | 100.0       | V            | 1.0           | 33.8                   | 2.3                 | 17.9        | 54             |
| 1428.500000     | 36.4             | 100.0       | V            | 67.0          | 33.3                   | 3.1                 | 17.6        | 54             |
| 1725.000000     | 38.5             | 100.0       | V            | 9.0           | 34.3                   | 4.2                 | 15.5        | 54             |
| 2080.000000     | 38.6             | 100.0       | V            | 0.0           | 33.1                   | 5.5                 | 15.4        | 54             |
| 2185.000000     | 39.1             | 100.0       | H            | 248.0         | 33.1                   | 6.0                 | 14.9        | 54             |
| 2780.500000     | 39.9             | 100.0       | V            | 2.0           | 32.5                   | 7.4                 | 14.1        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

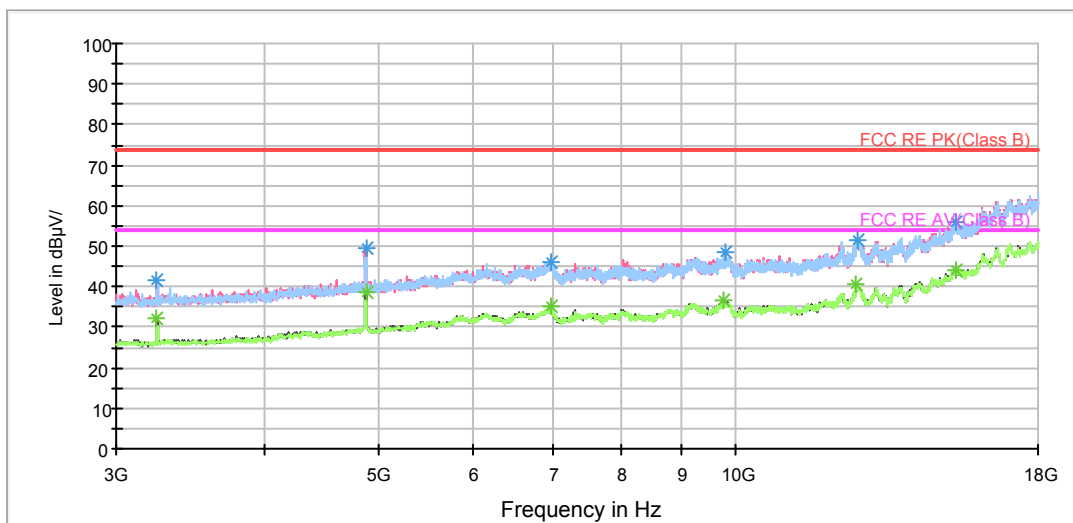
802.11g CH6

FCC RE 1G-3GHz PK+AV Class B



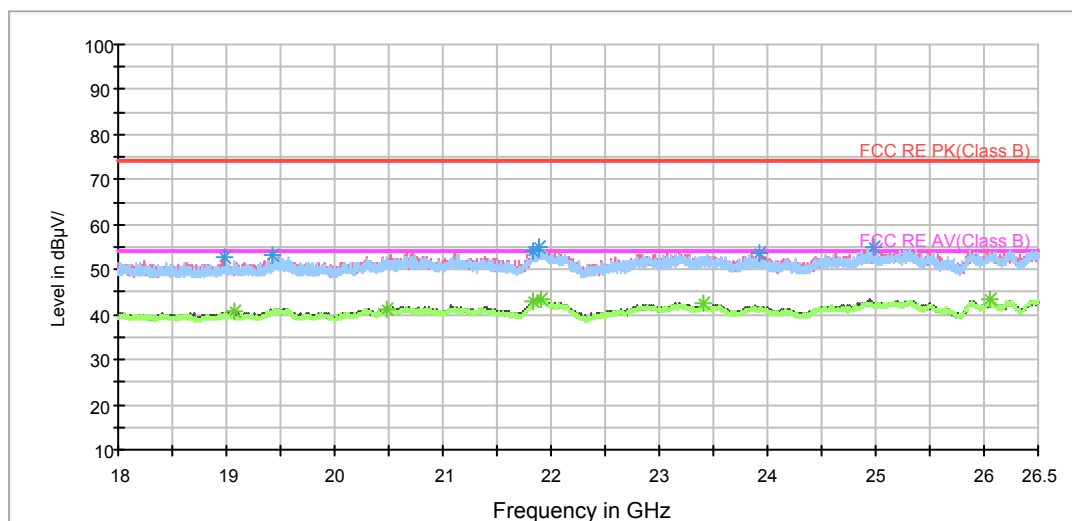
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1135.500000     | 47.4          | 100.0       | V            | 4.0           | 45.2                   | 2.2                 | 26.6        | 74             |
| 1283.500000     | 48.4          | 100.0       | H            | 0.0           | 45.7                   | 2.7                 | 25.6        | 74             |
| 1721.500000     | 49.2          | 100.0       | H            | 220.0         | 45.0                   | 4.2                 | 24.8        | 74             |
| 1967.500000     | 51.3          | 100.0       | V            | 10.0          | 46.2                   | 5.1                 | 22.7        | 74             |
| 2294.000000     | 51.6          | 100.0       | V            | 13.0          | 45.2                   | 6.4                 | 22.4        | 74             |
| 2578.500000     | 52.4          | 100.0       | V            | 225.0         | 45.2                   | 7.2                 | 21.6        | 74             |

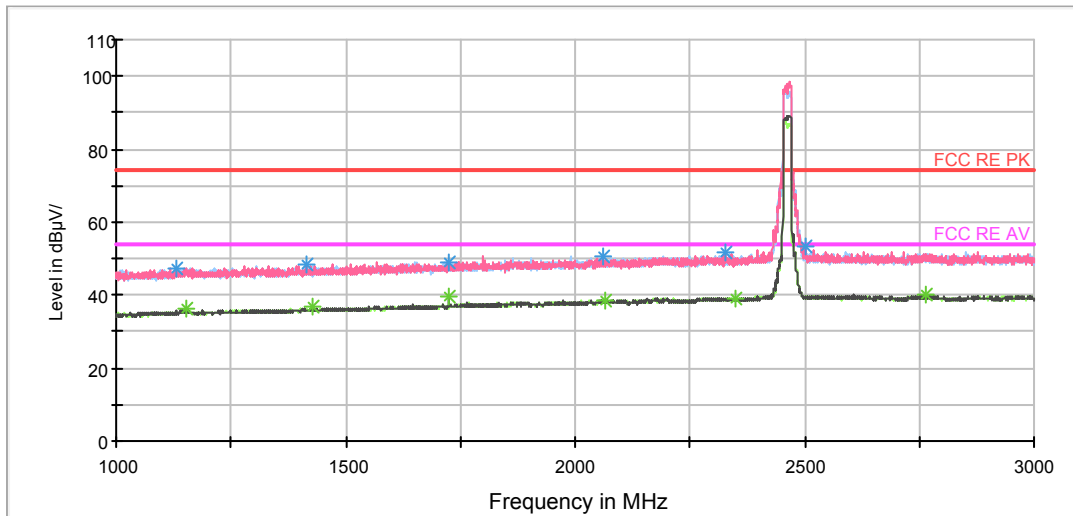
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1156.000000     | 36.0             | 100.0       | V            | 0.0           | 33.7                   | 2.3                 | 18.0        | 54             |
| 1432.000000     | 36.2             | 100.0       | V            | 0.0           | 33.0                   | 3.2                 | 17.8        | 54             |
| 1725.000000     | 38.2             | 100.0       | V            | 10.0          | 34.0                   | 4.2                 | 15.8        | 54             |
| 2078.500000     | 38.7             | 100.0       | V            | 53.0          | 33.2                   | 5.5                 | 15.3        | 54             |
| 2290.500000     | 39.1             | 100.0       | V            | 259.0         | 32.7                   | 6.4                 | 14.9        | 54             |
| 2760.000000     | 39.9             | 100.0       | V            | 86.0          | 32.5                   | 7.4                 | 14.1        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

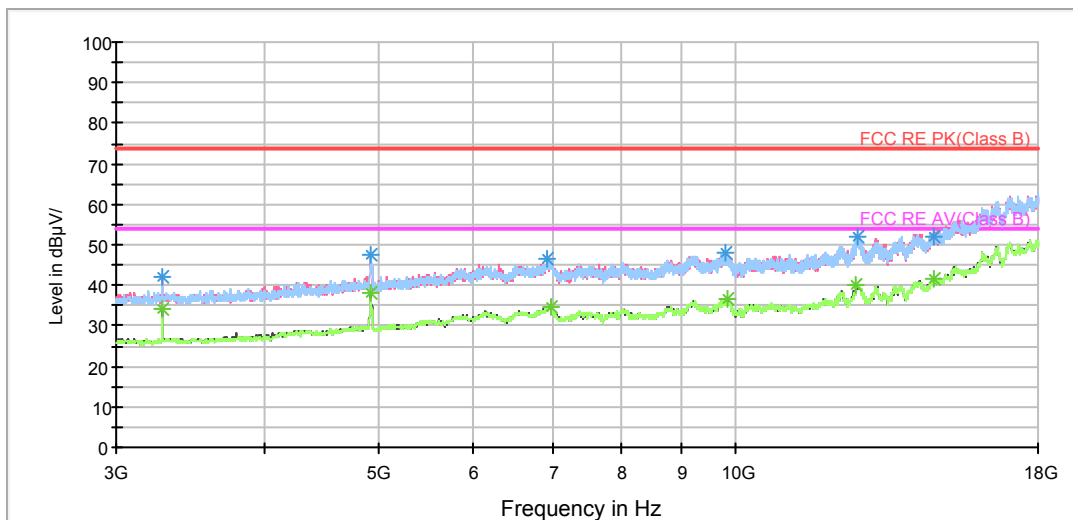
802.11g CH11

FCC RE 1G-3GHz PK+AV Class B



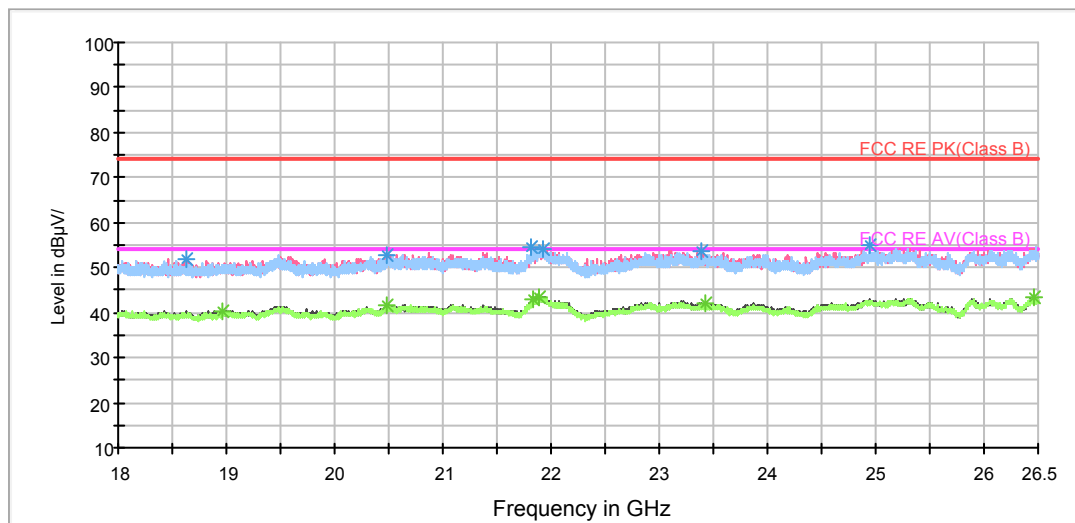
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1131.500000     | 47.4          | 100.0       | V            | 6.0           | 45.2                   | 2.2                 | 26.6        | 74             |
| 1415.500000     | 48.1          | 100.0       | V            | 206.0         | 45.0                   | 3.1                 | 25.9        | 74             |
| 1725.000000     | 49.1          | 100.0       | H            | 315.0         | 44.9                   | 4.2                 | 24.9        | 74             |
| 2061.000000     | 50.6          | 100.0       | V            | 16.0          | 45.1                   | 5.5                 | 23.4        | 74             |
| 2327.000000     | 51.6          | 100.0       | V            | 50.0          | 45.1                   | 6.5                 | 22.4        | 74             |
| 2501.500000     | 53.6          | 100.0       | V            | 174.0         | 46.4                   | 7.2                 | 20.4        | 74             |

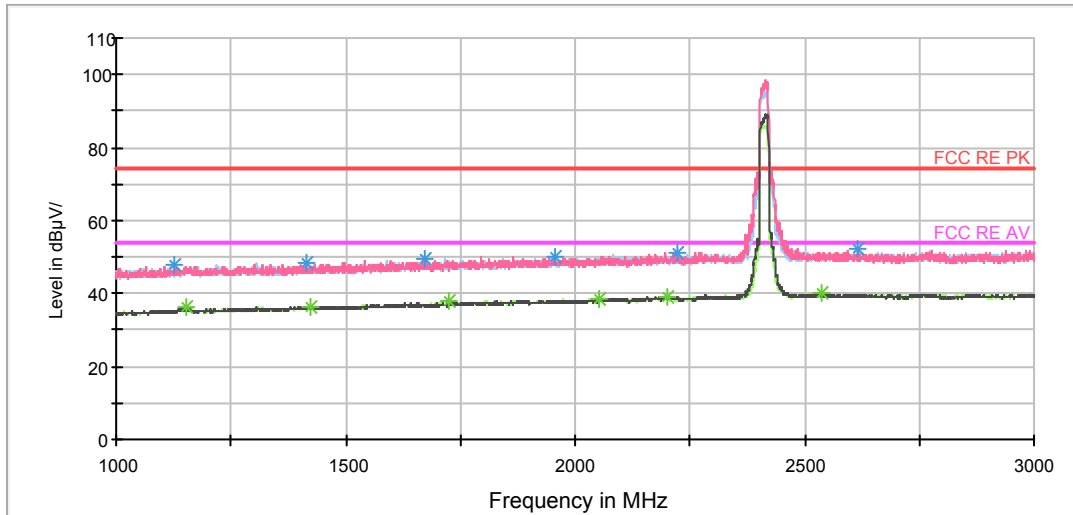
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1151.500000     | 36.2             | 100.0       | H            | 12.0          | 33.9                   | 2.3                 | 17.8        | 54             |
| 1427.500000     | 36.6             | 100.0       | V            | 2.0           | 33.5                   | 3.1                 | 17.4        | 54             |
| 1725.000000     | 39.9             | 100.0       | V            | 0.0           | 35.7                   | 4.2                 | 14.1        | 54             |
| 2064.000000     | 38.6             | 100.0       | H            | 297.0         | 33.1                   | 5.5                 | 15.4        | 54             |
| 2348.000000     | 38.9             | 100.0       | V            | 6.0           | 32.3                   | 6.6                 | 15.1        | 54             |
| 2765.500000     | 40.0             | 100.0       | H            | 229.0         | 32.6                   | 7.4                 | 14.0        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

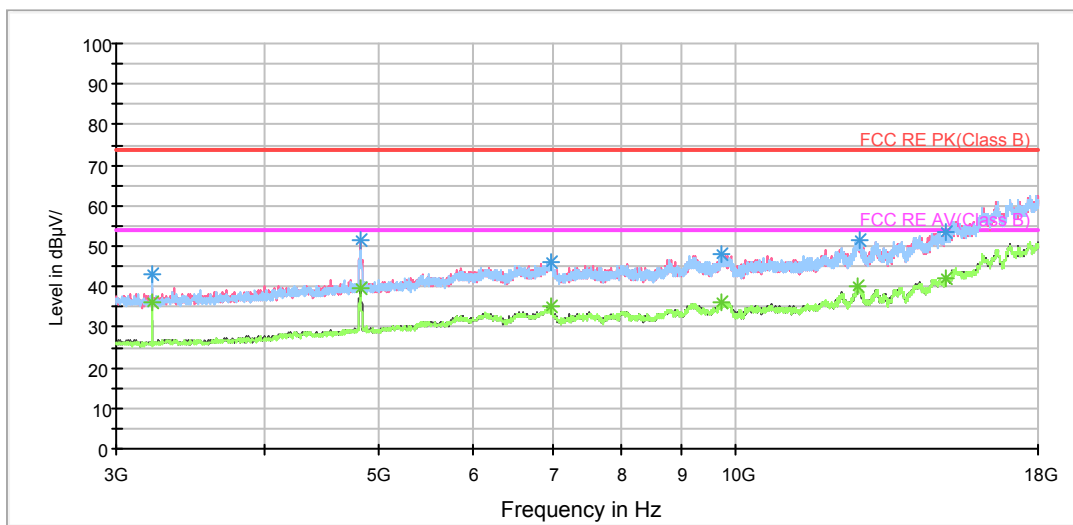
# 802.11n (HT20) CH1

FCC RE 1G-3GHz PK+AV Class B



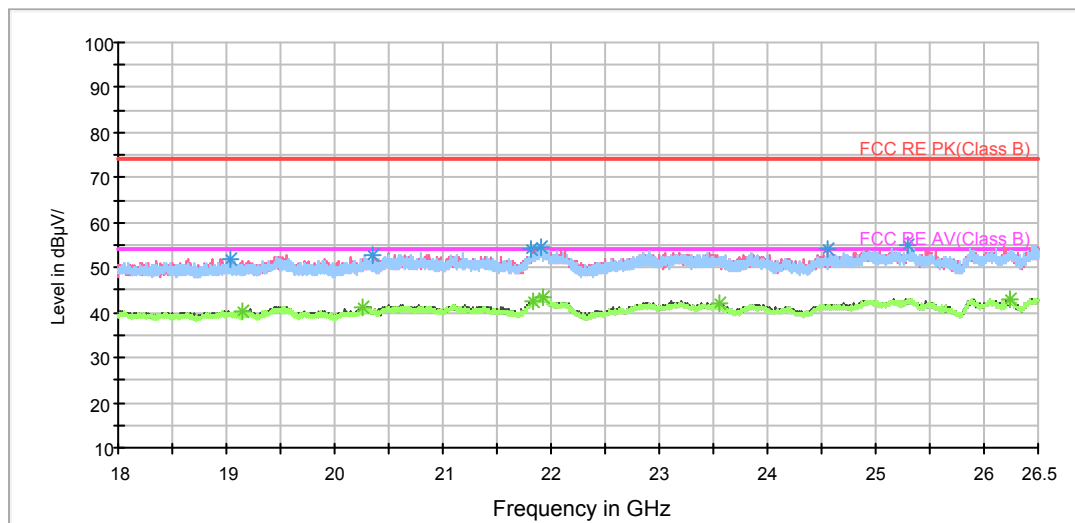
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1127.000000     | 47.9          | 100.0       | V            | 141.0         | 45.7                   | 2.2                 | 26.1        | 74             |
| 1415.000000     | 48.6          | 100.0       | H            | 147.0         | 45.5                   | 3.1                 | 25.4        | 74             |
| 1671.000000     | 49.5          | 100.0       | V            | 117.0         | 45.5                   | 4.0                 | 24.5        | 74             |
| 1955.000000     | 50.3          | 100.0       | H            | 313.0         | 45.3                   | 5.0                 | 23.7        | 74             |
| 2221.000000     | 51.4          | 100.0       | V            | 18.0          | 45.3                   | 6.1                 | 22.6        | 74             |
| 2617.500000     | 52.1          | 100.0       | V            | 199.0         | 44.8                   | 7.3                 | 21.9        | 74             |

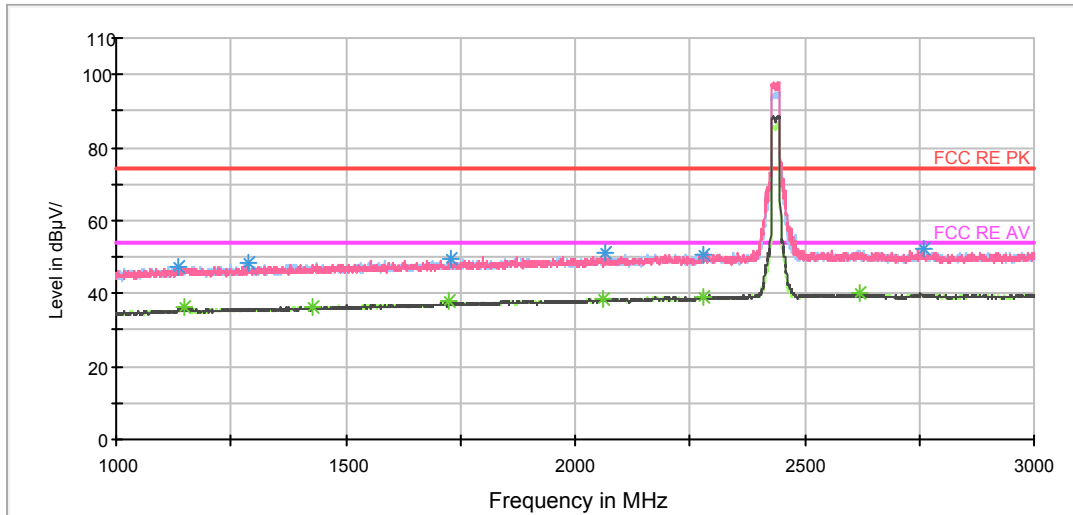
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1151.500000     | 36.0             | 100.0       | H            | 155.0         | 33.7                   | 2.3                 | 18.0        | 54             |
| 1422.500000     | 36.4             | 100.0       | H            | 180.0         | 33.3                   | 3.1                 | 17.6        | 54             |
| 1725.000000     | 38.2             | 100.0       | V            | 2.0           | 34.0                   | 4.2                 | 15.8        | 54             |
| 2052.500000     | 38.7             | 100.0       | H            | 314.0         | 33.3                   | 5.4                 | 15.3        | 54             |
| 2201.000000     | 39.0             | 100.0       | V            | 4.0           | 33.0                   | 6.0                 | 15.0        | 54             |
| 2535.000000     | 40.0             | 100.0       | V            | 36.0          | 32.8                   | 7.2                 | 14.0        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

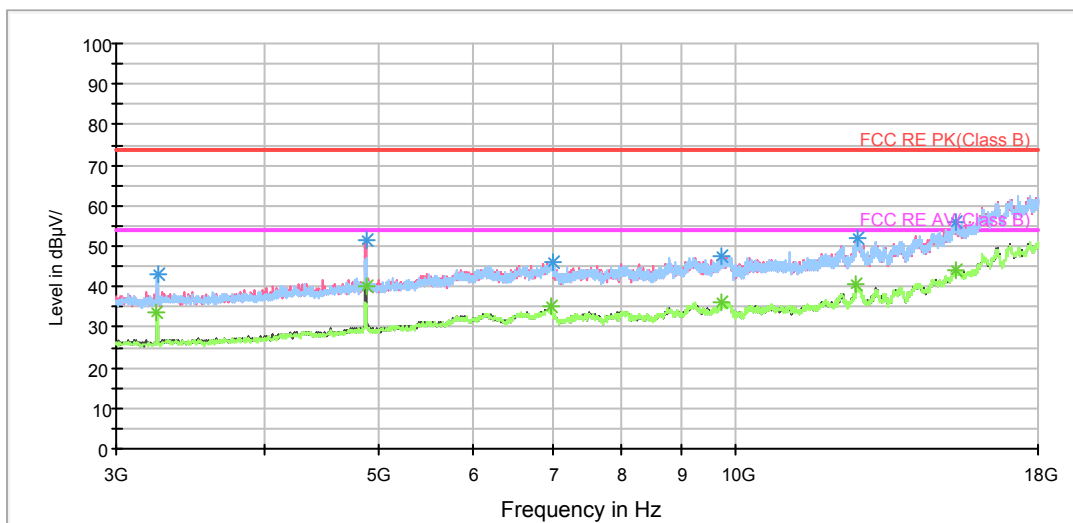
802.11n (HT20) CH6

FCC RE 1G-3GHz PK+AV Class B



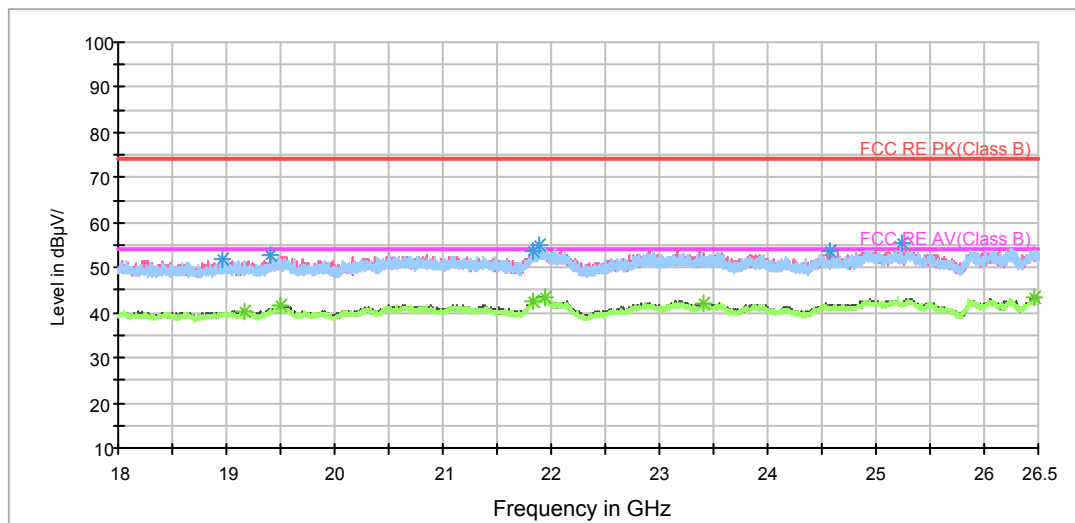
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1136.500000     | 47.5          | 100.0       | H            | 89.0          | 45.3                   | 2.2                 | 26.5        | 74             |
| 1288.500000     | 48.6          | 100.0       | V            | 0.0           | 45.9                   | 2.7                 | 25.4        | 74             |
| 1730.500000     | 49.3          | 100.0       | V            | 35.0          | 45.1                   | 4.2                 | 24.7        | 74             |
| 2065.000000     | 51.1          | 100.0       | V            | 208.0         | 45.6                   | 5.5                 | 22.9        | 74             |
| 2279.500000     | 50.8          | 100.0       | V            | 9.0           | 44.5                   | 6.3                 | 23.2        | 74             |
| 2761.500000     | 52.1          | 100.0       | V            | 9.0           | 44.7                   | 7.4                 | 21.9        | 74             |

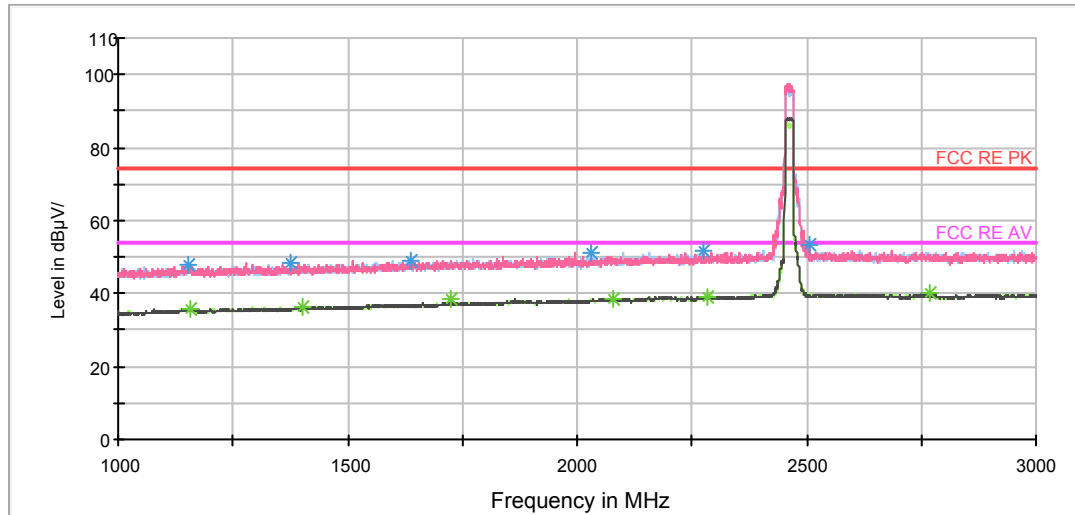
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1150.000000     | 36.5             | 100.0       | H            | 154.0         | 34.2                   | 2.3                 | 17.5        | 54             |
| 1429.000000     | 36.4             | 100.0       | H            | 252.0         | 33.3                   | 3.1                 | 17.6        | 54             |
| 1725.000000     | 38.2             | 100.0       | V            | 0.0           | 34.0                   | 4.2                 | 15.8        | 54             |
| 2061.500000     | 38.6             | 100.0       | H            | 146.0         | 33.1                   | 5.5                 | 15.4        | 54             |
| 2279.500000     | 39.0             | 100.0       | V            | 9.0           | 32.7                   | 6.3                 | 15.0        | 54             |
| 2622.000000     | 40.0             | 100.0       | V            | 0.0           | 32.7                   | 7.3                 | 14.0        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

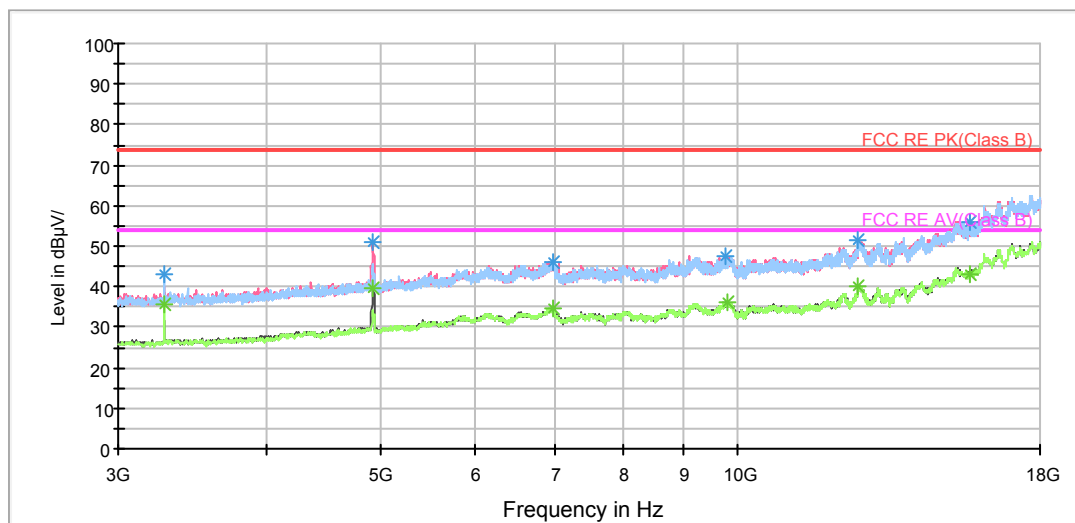
802.11n (HT20) CH11

FCC RE 1G-3GHz PK+AV Class B



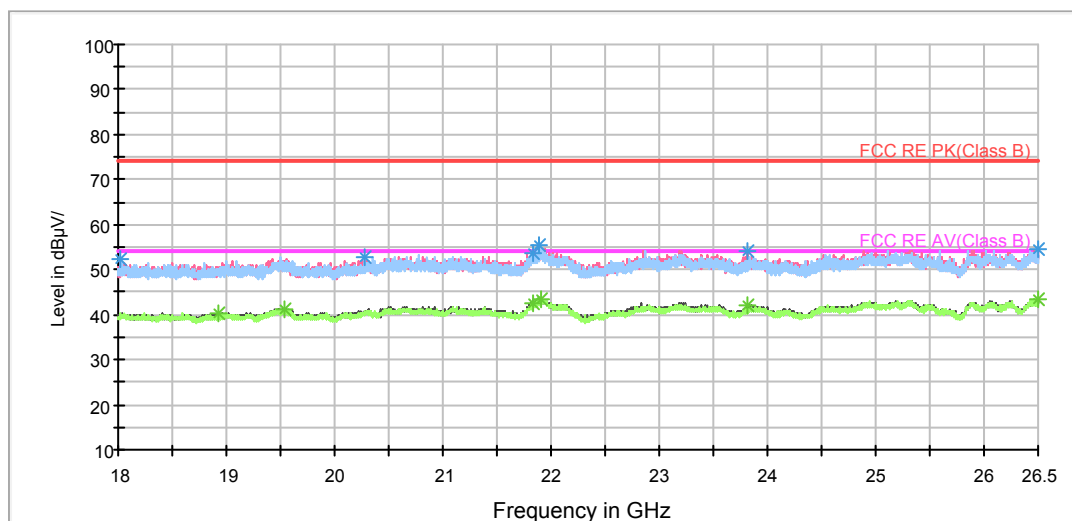
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1151.500000     | 47.9          | 100.0       | H            | 311.0         | 45.6                   | 2.3                 | 26.1        | 74             |
| 1375.000000     | 48.2          | 100.0       | V            | 128.0         | 45.2                   | 3.0                 | 25.8        | 74             |
| 1636.500000     | 49.1          | 100.0       | V            | 236.0         | 45.2                   | 3.9                 | 24.9        | 74             |
| 2031.500000     | 51.1          | 100.0       | H            | 315.0         | 45.8                   | 5.3                 | 22.9        | 74             |
| 2274.000000     | 51.5          | 100.0       | V            | 0.0           | 45.2                   | 6.3                 | 22.5        | 74             |
| 2505.500000     | 53.5          | 100.0       | H            | 11.0          | 46.3                   | 7.2                 | 20.5        | 74             |

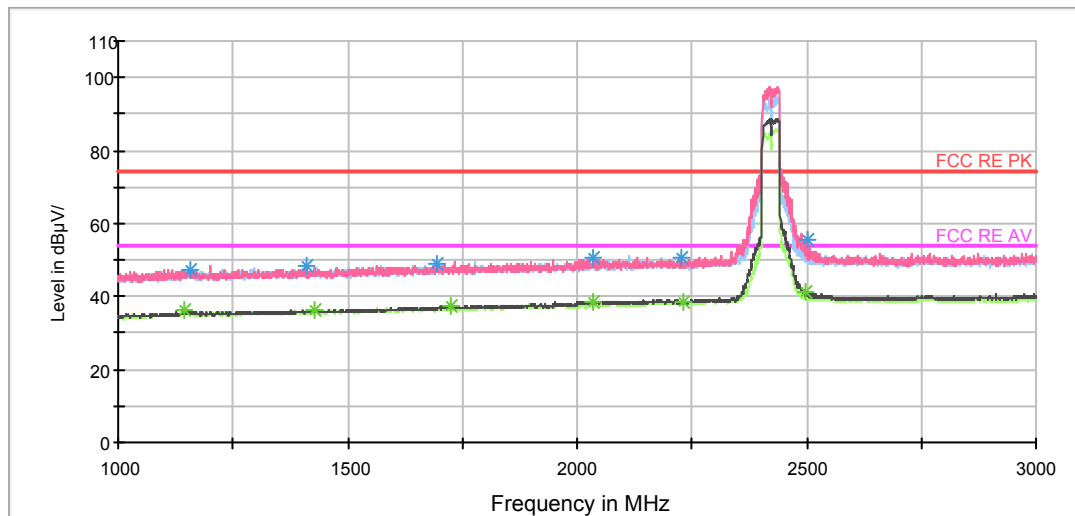
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1155.500000     | 36.0             | 100.0       | V            | 19.0          | 33.7                   | 2.3                 | 18.0        | 54             |
| 1403.000000     | 36.4             | 100.0       | V            | 194.0         | 33.3                   | 3.1                 | 17.6        | 54             |
| 1725.000000     | 38.3             | 100.0       | V            | 1.0           | 34.1                   | 4.2                 | 15.7        | 54             |
| 2079.500000     | 38.5             | 100.0       | H            | 270.0         | 33.0                   | 5.5                 | 15.5        | 54             |
| 2283.000000     | 39.0             | 100.0       | H            | 315.0         | 32.6                   | 6.4                 | 15.0        | 54             |
| 2770.500000     | 40.1             | 100.0       | V            | 62.0          | 32.7                   | 7.4                 | 13.9        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

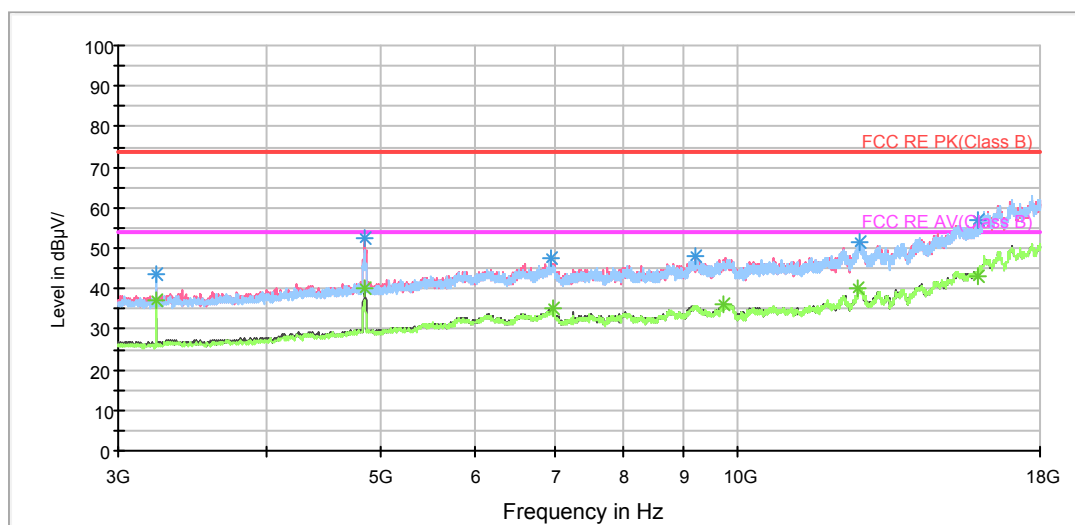
# 802.11n (HT40) CH3

FCC RE 1G-3GHz PK+AV Class B



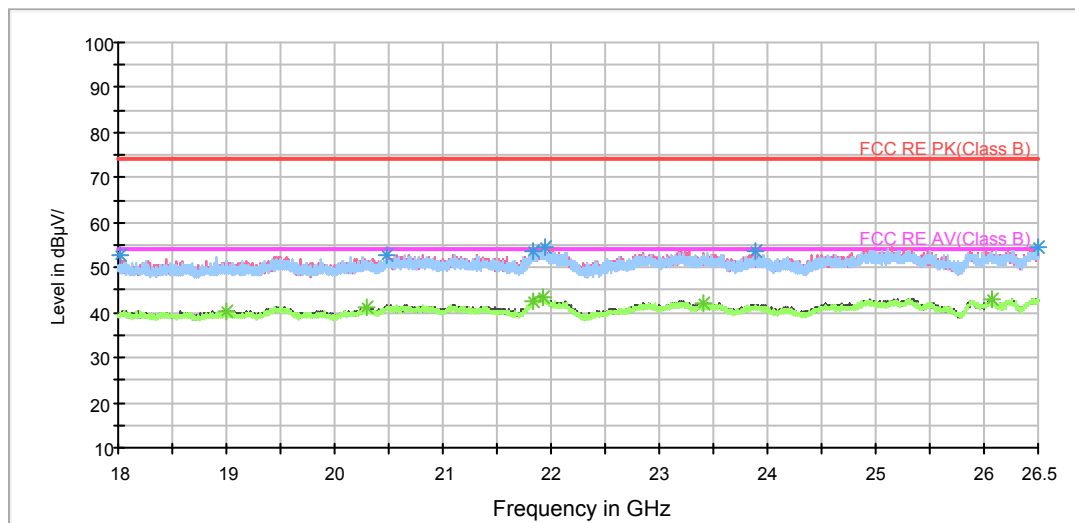
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1159.000000     | 47.5          | 100.0       | V            | 0.0           | 45.2                   | 2.3                 | 26.5        | 74             |
| 1410.500000     | 48.6          | 100.0       | V            | 0.0           | 45.5                   | 3.1                 | 25.4        | 74             |
| 1696.500000     | 49.0          | 100.0       | V            | 0.0           | 44.9                   | 4.1                 | 25.0        | 74             |
| 2035.000000     | 50.4          | 100.0       | V            | 0.0           | 45.1                   | 5.3                 | 23.6        | 74             |
| 2228.000000     | 50.7          | 100.0       | V            | 4.0           | 44.6                   | 6.1                 | 23.3        | 74             |
| 2502.500000     | 55.4          | 100.0       | V            | 26.0          | 48.2                   | 7.2                 | 18.6        | 74             |

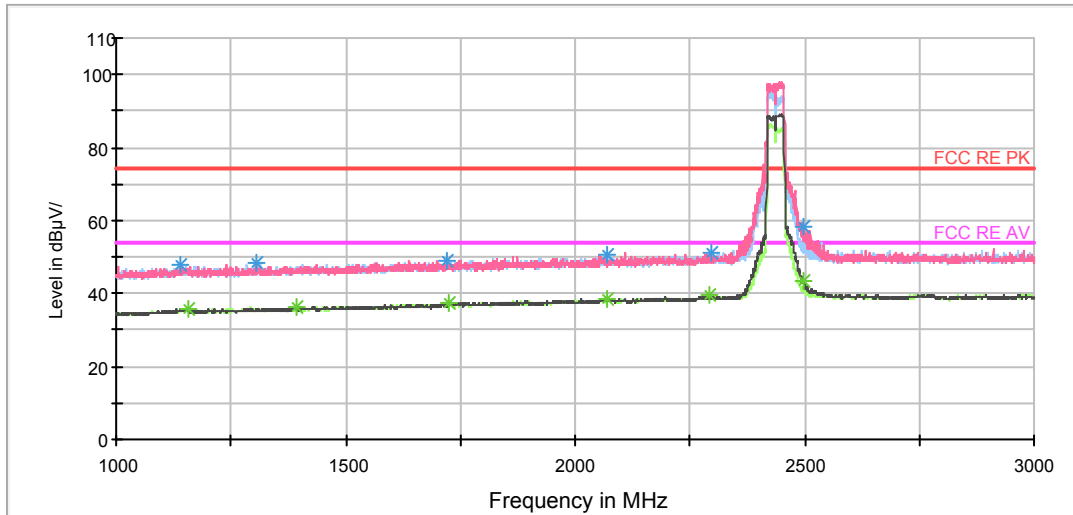
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1142.500000     | 36.1             | 100.0       | V            | 26.0          | 33.8                   | 2.3                 | 17.9        | 54             |
| 1428.000000     | 36.4             | 100.0       | V            | 0.0           | 33.3                   | 3.1                 | 17.6        | 54             |
| 1725.000000     | 37.3             | 100.0       | V            | 15.0          | 33.1                   | 4.2                 | 16.7        | 54             |
| 2034.000000     | 38.8             | 100.0       | V            | 2.0           | 33.5                   | 5.3                 | 15.2        | 54             |
| 2232.500000     | 38.7             | 100.0       | V            | 0.0           | 32.5                   | 6.2                 | 15.3        | 54             |
| 2498.500000     | 41.5             | 100.0       | V            | 26.0          | 34.4                   | 7.1                 | 12.5        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

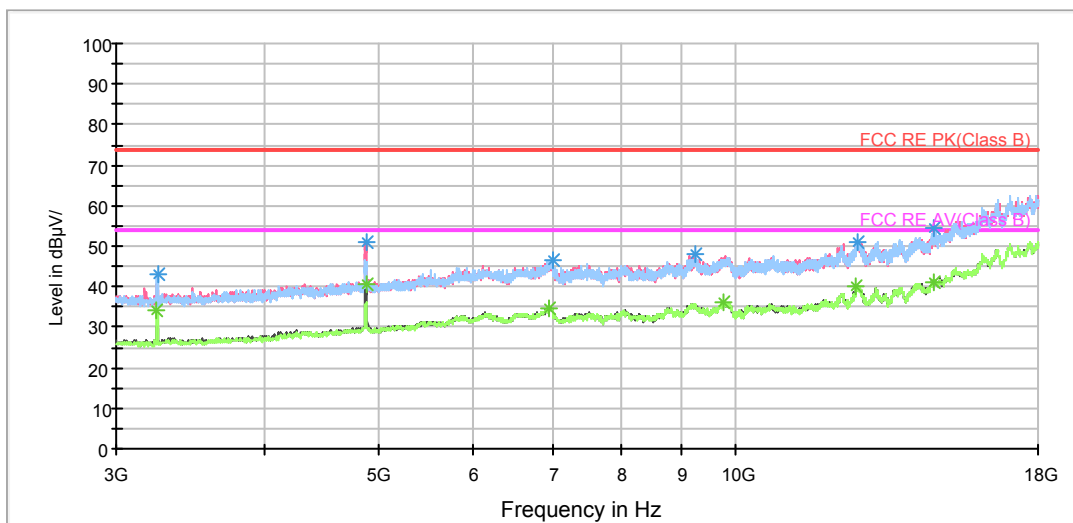
# 802.11n (HT40) CH6

## FCC RE 1G-3GHz PK+AV Class B



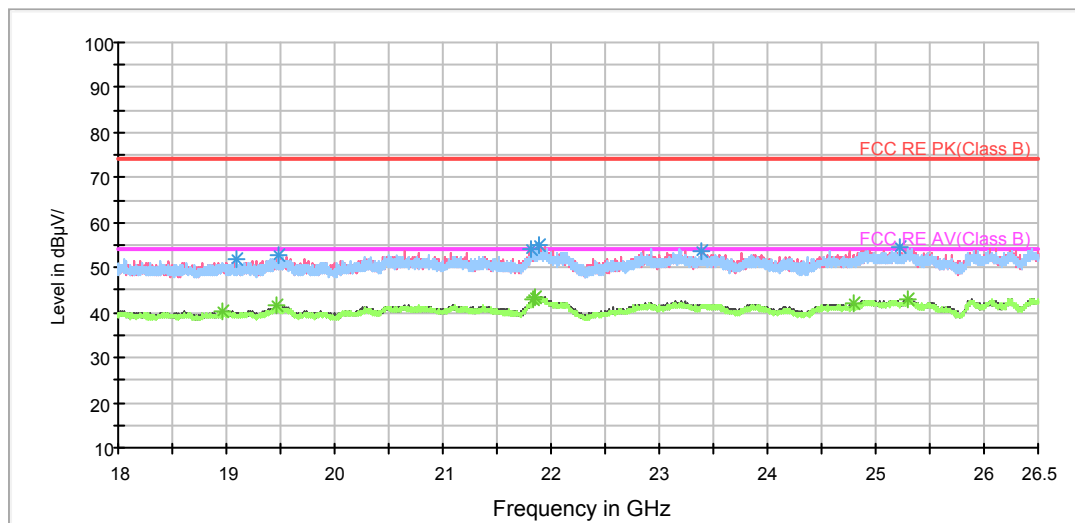
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

## RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1140.500000     | 47.9          | 100.0       | V            | 169.0         | 45.6                   | 2.3                 | 26.1        | 74             |
| 1307.000000     | 48.6          | 100.0       | V            | 55.0          | 45.8                   | 2.8                 | 25.4        | 74             |
| 1719.000000     | 49.1          | 100.0       | V            | 304.0         | 44.9                   | 4.2                 | 24.9        | 74             |
| 2070.500000     | 50.5          | 100.0       | H            | 304.0         | 45.0                   | 5.5                 | 23.5        | 74             |
| 2295.000000     | 51.0          | 100.0       | V            | 31.0          | 44.6                   | 6.4                 | 23.0        | 74             |
| 2499.500000     | 58.2          | 100.0       | V            | 39.0          | 51.1                   | 7.1                 | 15.8        | 74             |

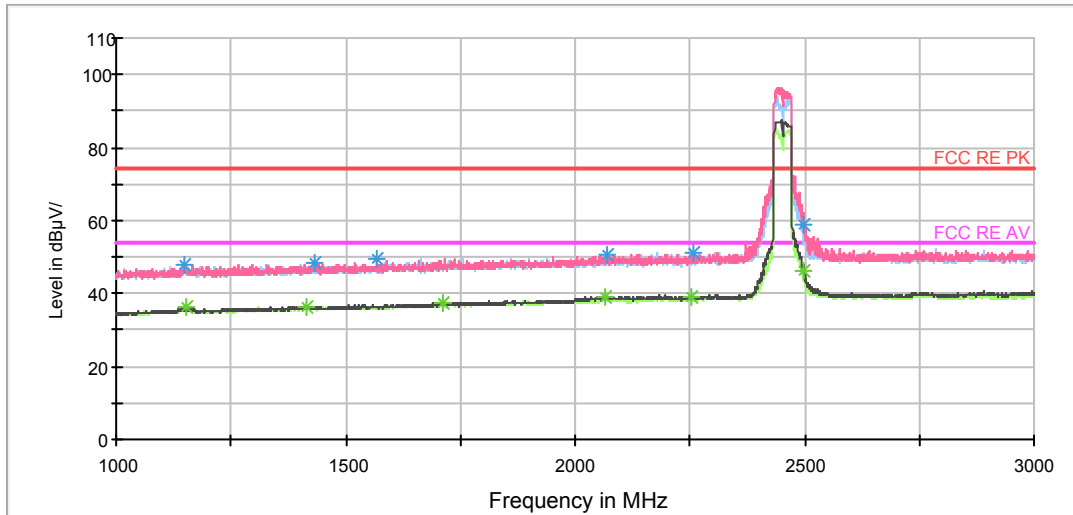
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1156.000000     | 35.8             | 100.0       | V            | 63.0          | 33.5                   | 2.3                 | 18.2        | 54             |
| 1395.000000     | 36.2             | 100.0       | V            | 39.0          | 33.2                   | 3.0                 | 17.8        | 54             |
| 1725.500000     | 37.2             | 100.0       | V            | 2.0           | 33.0                   | 4.2                 | 16.8        | 54             |
| 2069.500000     | 38.4             | 100.0       | V            | 55.0          | 32.9                   | 5.5                 | 15.6        | 54             |
| 2294.500000     | 39.4             | 100.0       | V            | 55.0          | 33.0                   | 6.4                 | 14.6        | 54             |
| 2498.500000     | 43.6             | 100.0       | V            | 39.0          | 36.5                   | 7.1                 | 10.4        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

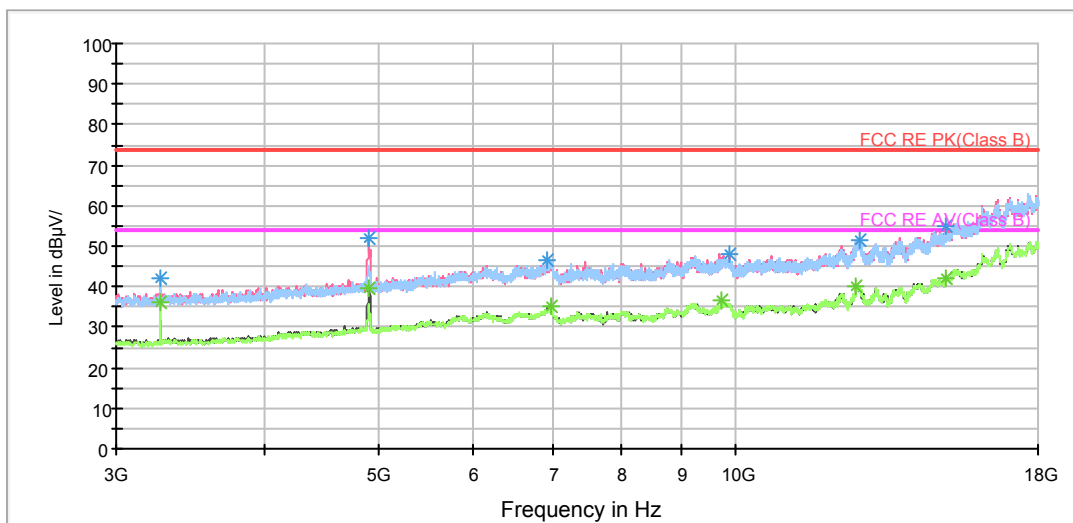
802.11n (HT40) CH9

FCC RE 1G-3GHz PK+AV Class B



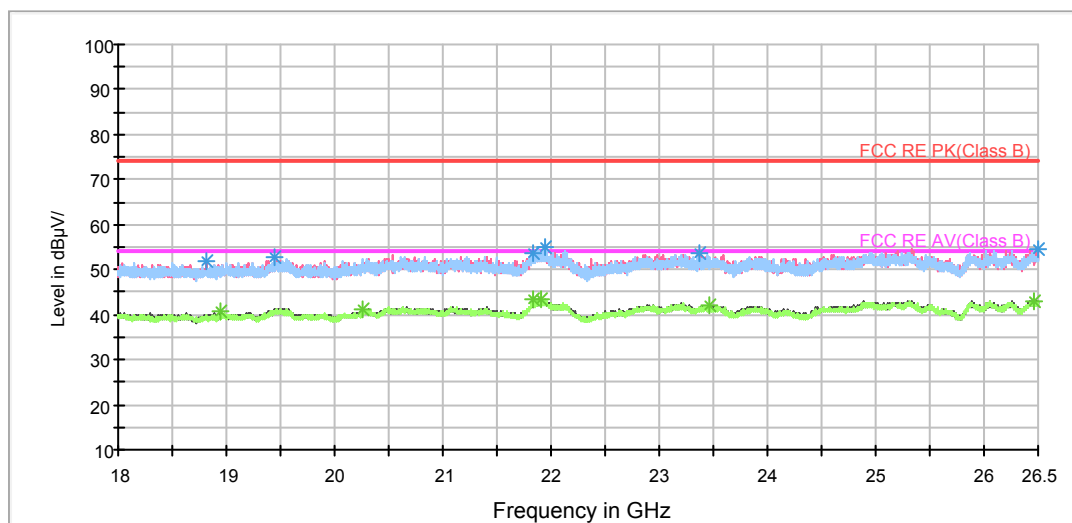
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1147.500000     | 48.1          | 100.0       | V            | 0.0           | 45.8                   | 2.3                 | 25.9        | 74             |
| 1434.000000     | 48.5          | 100.0       | V            | 4.0           | 45.3                   | 3.2                 | 25.5        | 74             |
| 1568.500000     | 49.6          | 100.0       | H            | 315.0         | 46.0                   | 3.6                 | 24.4        | 74             |
| 2068.500000     | 50.6          | 100.0       | H            | 314.0         | 45.1                   | 5.5                 | 23.4        | 74             |
| 2258.500000     | 51.1          | 100.0       | V            | 2.0           | 44.8                   | 6.3                 | 22.9        | 74             |
| 2498.500000     | 58.7          | 100.0       | V            | 56.0          | 51.6                   | 7.1                 | 15.3        | 74             |

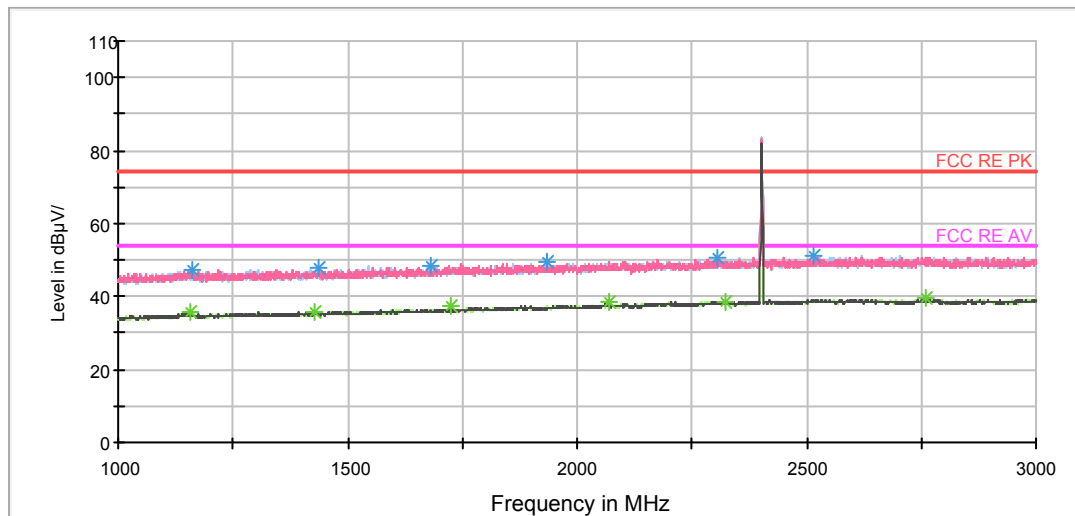
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1153.500000     | 36.1             | 100.0       | V            | 0.0           | 33.8                   | 2.3                 | 17.9        | 54             |
| 1415.000000     | 36.4             | 100.0       | V            | 21.0          | 33.3                   | 3.1                 | 17.6        | 54             |
| 1710.500000     | 37.4             | 100.0       | V            | 145.0         | 33.2                   | 4.2                 | 16.6        | 54             |
| 2064.000000     | 39.1             | 100.0       | V            | 0.0           | 33.6                   | 5.5                 | 14.9        | 54             |
| 2253.500000     | 39.1             | 100.0       | V            | 0.0           | 32.9                   | 6.2                 | 14.9        | 54             |
| 2498.500000     | 46.1             | 100.0       | V            | 56.0          | 39.0                   | 7.1                 | 7.9         | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

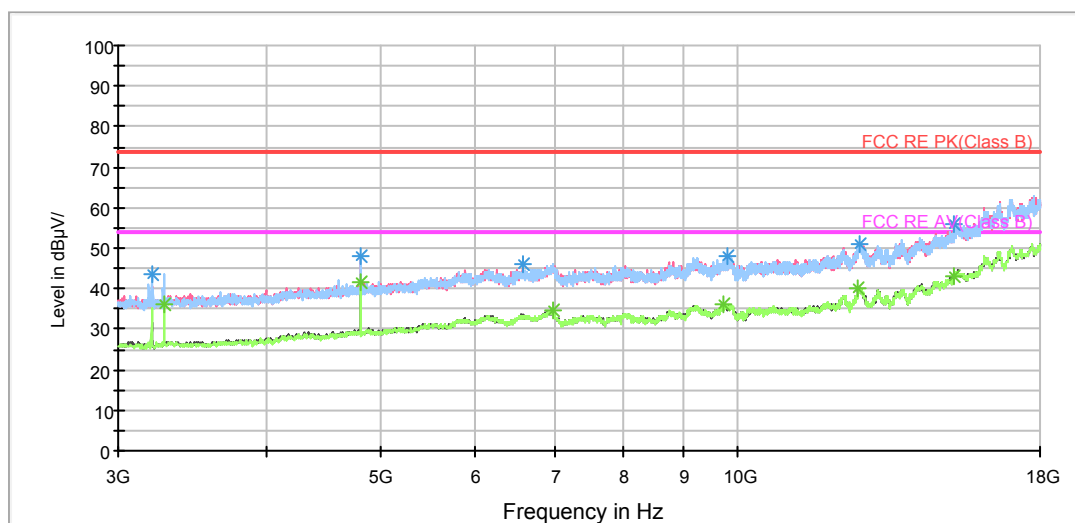
# BLE-Channel 0

FCC RE 1G-3GHz PK+AV Class B



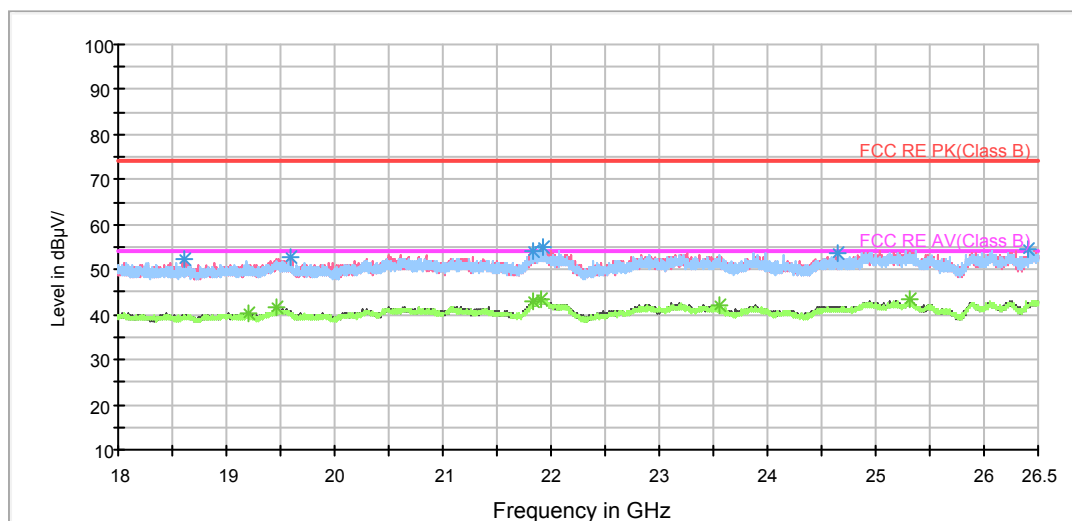
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1159.500000     | 47.2          | 100.0       | V            | 277.0         | 44.9                   | 2.3                 | 26.8        | 74             |
| 1438.500000     | 47.7          | 100.0       | V            | 67.0          | 44.5                   | 3.2                 | 26.3        | 74             |
| 1682.500000     | 48.5          | 100.0       | V            | 0.0           | 44.5                   | 4.0                 | 25.5        | 74             |
| 1933.000000     | 49.7          | 100.0       | H            | 202.0         | 44.7                   | 5.0                 | 24.3        | 74             |
| 2304.500000     | 50.6          | 100.0       | V            | 36.0          | 44.2                   | 6.4                 | 23.4        | 74             |
| 2516.500000     | 51.1          | 100.0       | H            | 312.0         | 43.9                   | 7.2                 | 22.9        | 74             |

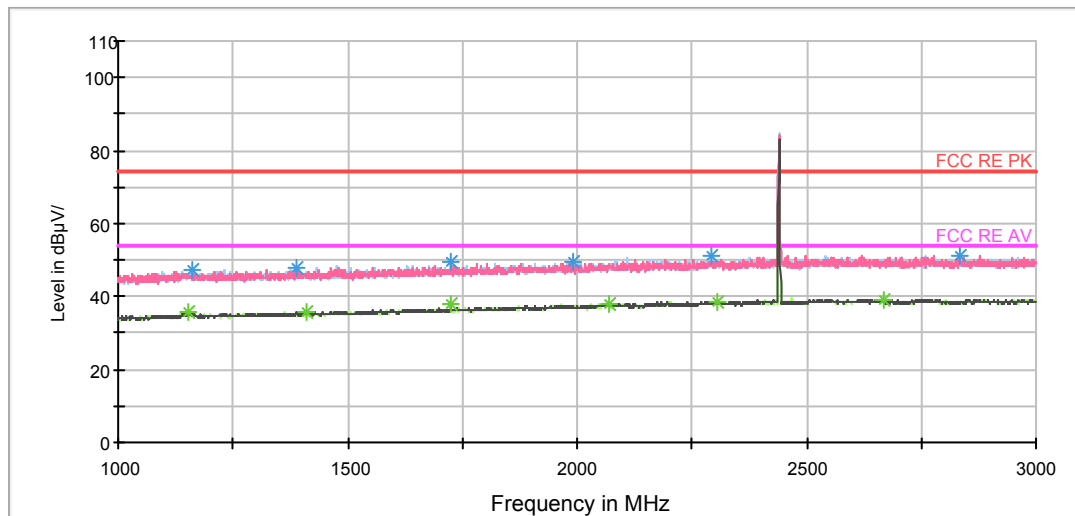
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1158.000000     | 35.7             | 100.0       | V            | 135.0         | 33.4                   | 2.3                 | 18.3        | 54             |
| 1430.000000     | 35.7             | 100.0       | H            | 259.0         | 32.5                   | 3.2                 | 18.3        | 54             |
| 1725.000000     | 37.5             | 100.0       | V            | 4.0           | 33.3                   | 4.2                 | 16.5        | 54             |
| 2070.000000     | 38.5             | 100.0       | V            | 67.0          | 33.0                   | 5.5                 | 15.5        | 54             |
| 2321.500000     | 38.7             | 100.0       | H            | 314.0         | 32.2                   | 6.5                 | 15.3        | 54             |
| 2758.000000     | 39.4             | 100.0       | V            | 1.0           | 32.0                   | 7.4                 | 14.6        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

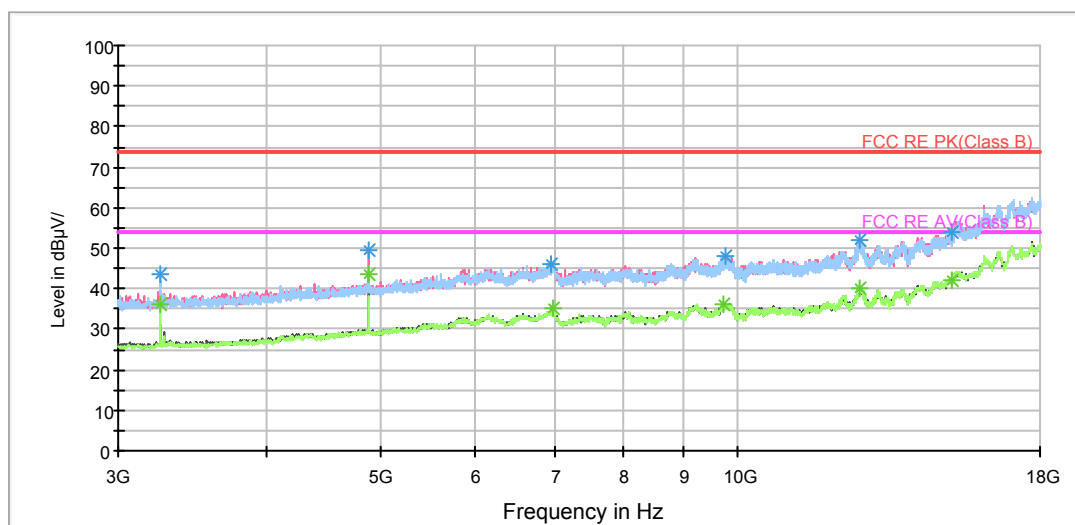
## BLE-Channel 19

FCC RE 1G-3GHz PK+AV Class B



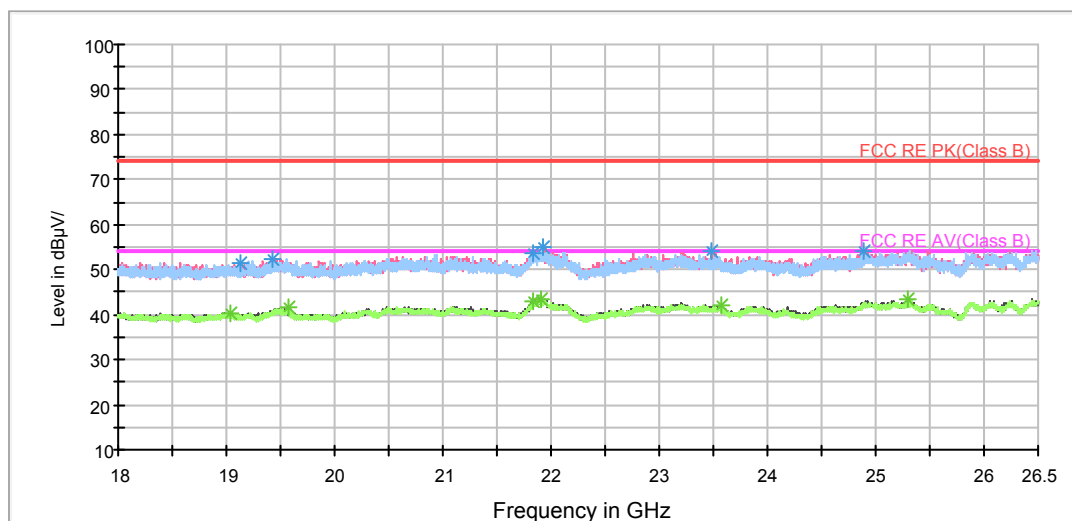
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1161.000000     | 47.4          | 100.0       | H            | 315.0         | 45.1                   | 2.3                 | 26.6        | 74             |
| 1388.000000     | 47.8          | 100.0       | V            | 4.0           | 44.8                   | 3.0                 | 26.2        | 74             |
| 1724.500000     | 49.5          | 100.0       | V            | 2.0           | 45.3                   | 4.2                 | 24.5        | 74             |
| 1990.000000     | 49.2          | 100.0       | H            | 228.0         | 44.0                   | 5.2                 | 24.8        | 74             |
| 2294.000000     | 51.2          | 100.0       | H            | 296.0         | 44.8                   | 6.4                 | 22.8        | 74             |
| 2835.000000     | 51.4          | 100.0       | V            | 37.0          | 44.0                   | 7.4                 | 22.6        | 74             |

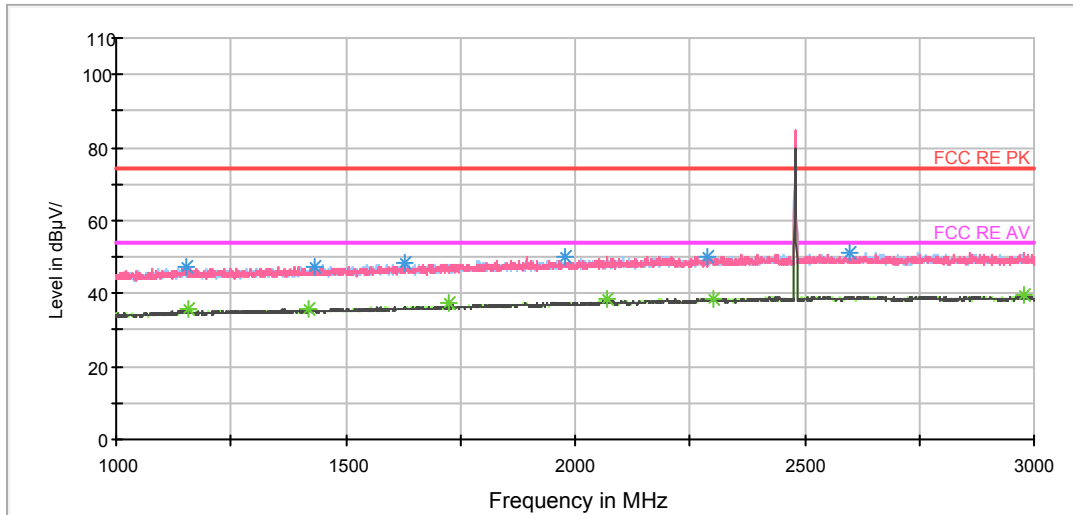
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1153.500000     | 35.5             | 100.0       | H            | 130.0         | 33.2                   | 2.3                 | 18.5        | 54             |
| 1412.500000     | 35.7             | 100.0       | V            | 0.0           | 32.6                   | 3.1                 | 18.3        | 54             |
| 1725.000000     | 37.8             | 100.0       | V            | 2.0           | 33.6                   | 4.2                 | 16.2        | 54             |
| 2070.000000     | 38.0             | 100.0       | V            | 95.0          | 32.5                   | 5.5                 | 16.0        | 54             |
| 2304.000000     | 38.4             | 100.0       | H            | 171.0         | 32.0                   | 6.4                 | 15.6        | 54             |
| 2666.500000     | 39.2             | 100.0       | V            | 5.0           | 31.9                   | 7.3                 | 14.8        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

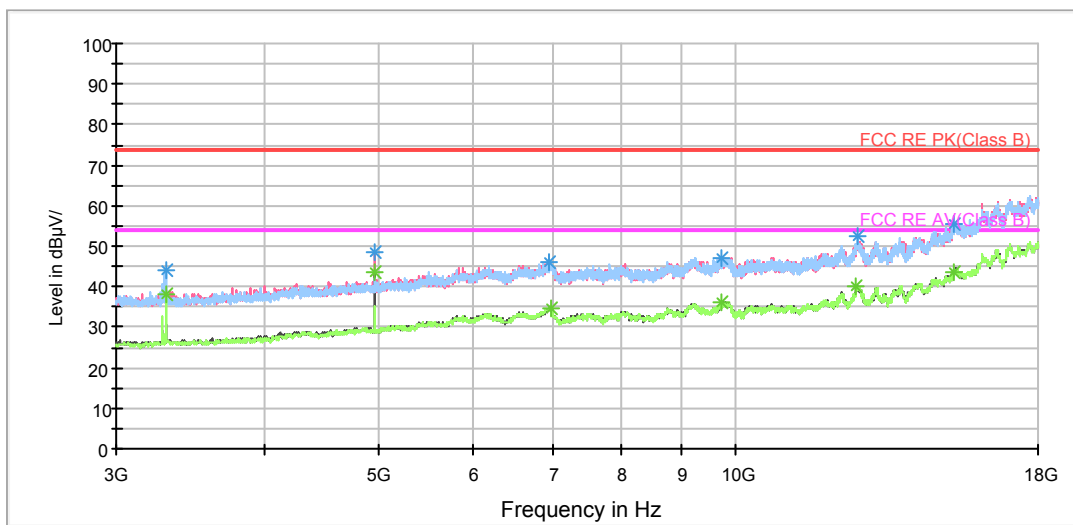
## BLE-Channel 39

FCC RE 1G-3GHz PK+AV Class B



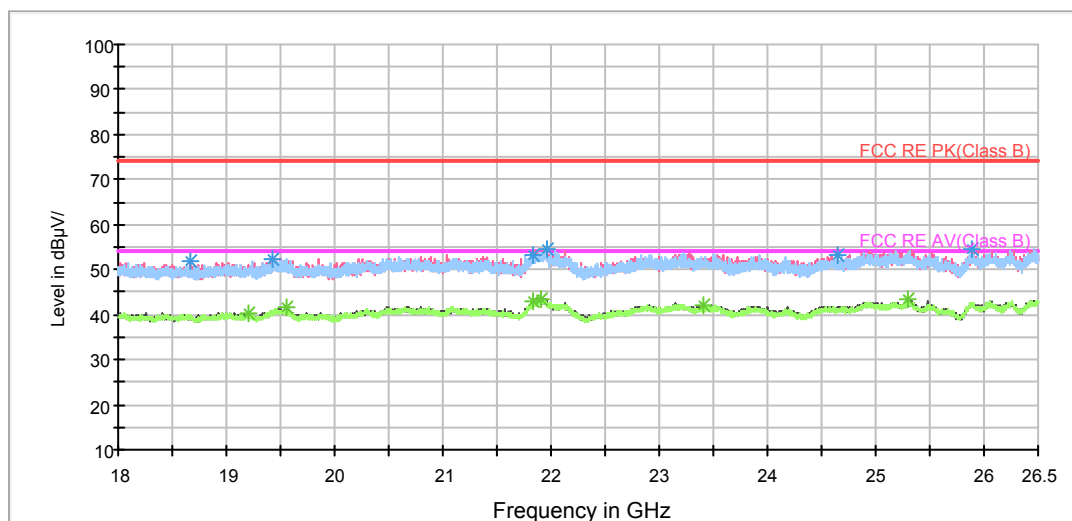
Note: The signal beyond the limit is carrier.  
Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

## BELL\_RE 18-26.5GHz PK+AV



## Radiates Emission from 18GHz to 26.5GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1153.500000     | 47.5          | 100.0       | V            | 135.0         | 45.2                   | 2.3                 | 26.5        | 74             |
| 1433.500000     | 47.3          | 100.0       | V            | 151.0         | 44.1                   | 3.2                 | 26.7        | 74             |
| 1629.500000     | 48.6          | 100.0       | V            | 55.0          | 44.7                   | 3.9                 | 25.4        | 74             |
| 1978.000000     | 50.1          | 100.0       | H            | 132.0         | 45.0                   | 5.1                 | 23.9        | 74             |
| 2289.000000     | 50.2          | 100.0       | V            | 87.0          | 43.8                   | 6.4                 | 23.8        | 74             |
| 2598.000000     | 51.3          | 100.0       | H            | 315.0         | 44.1                   | 7.2                 | 22.7        | 74             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------------------|---------------------|-------------|----------------|
| 1155.500000     | 35.8             | 100.0       | H            | 311.0         | 33.5                   | 2.3                 | 18.1        | 54             |
| 1417.500000     | 35.9             | 100.0       | H            | 313.0         | 32.8                   | 3.1                 | 16.5        | 54             |
| 1725.000000     | 37.5             | 100.0       | V            | 4.0           | 33.3                   | 4.2                 | 15.8        | 54             |
| 2070.000000     | 38.2             | 100.0       | V            | 87.0          | 32.7                   | 5.5                 | 15.7        | 54             |
| 2299.500000     | 38.3             | 100.0       | H            | 305.0         | 31.9                   | 6.4                 | 14.7        | 54             |
| 2979.000000     | 39.3             | 100.0       | H            | 205.0         | 31.8                   | 7.5                 | 18.1        | 54             |

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

## 5.8. Conducted Emission

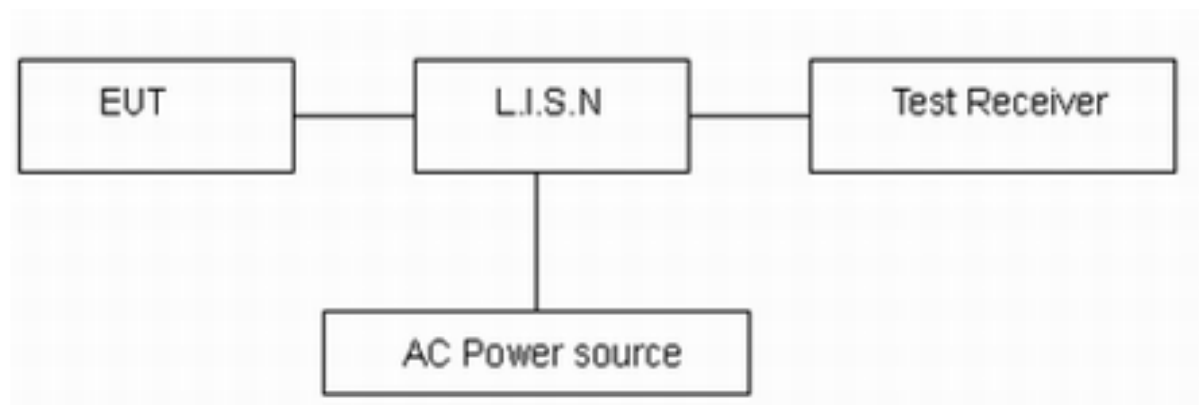
### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

### Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10-2013. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.  
The test is in transmitting mode.

### Test Setup



Note: AC Power source is used to change the voltage 110V/60Hz.

### Limits

| Frequency<br>(MHz) | Conducted Limits(dBμV) |            |
|--------------------|------------------------|------------|
|                    | Quasi-peak             | Average    |
| 0.15 - 0.5         | 66 to 56 *             | 56 to 46 * |
| 0.5 - 5            | 56                     | 46         |
| 5 - 30             | 60                     | 50         |

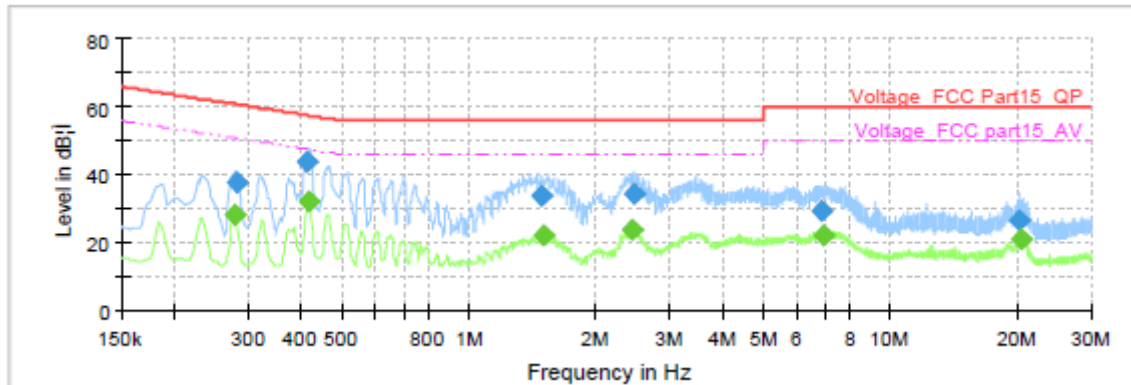
\*: Decreases with the logarithm of the frequency.

### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ ,  $U = 2.69$  dB.

## Test Results:

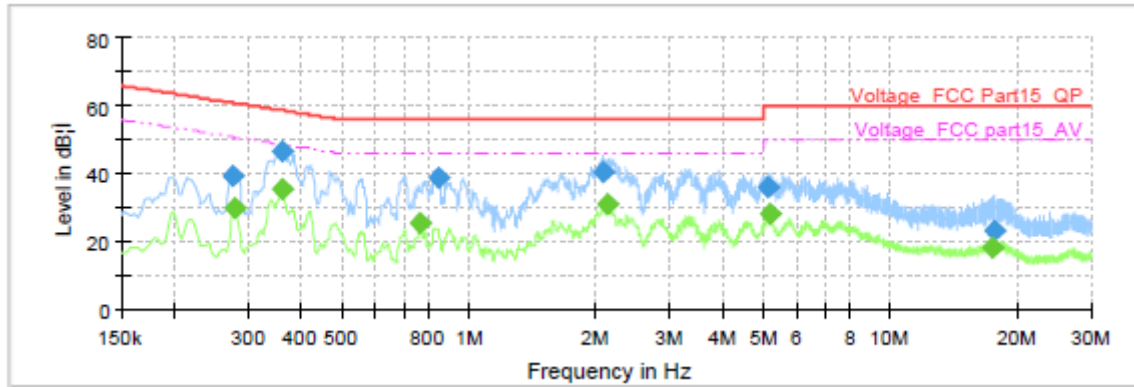
Following plots, Blue trace uses the peak detection and Green trace uses the average detection. During the test, the Conducted Emission was performed in all modes with all channels, 802.11n (HT20), Channel 6 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



## Final Result

| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter | Corr. (dB) |
|-----------------|------------------|----------------|--------------|-------------|-----------------|-----------------|------|--------|------------|
| 0.278250        | ---              | 28.18          | 50.87        | 22.69       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 0.280500        | 38.03            | ---            | 60.80        | 22.78       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 0.411000        | 43.88            | ---            | 57.63        | 13.75       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 0.415500        | ---              | 32.36          | 47.54        | 15.18       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 1.484250        | 33.69            | ---            | 56.00        | 22.31       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 1.504500        | ---              | 22.05          | 46.00        | 23.95       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 2.431500        | ---              | 23.79          | 46.00        | 22.21       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 2.478750        | 34.33            | ---            | 56.00        | 21.67       | 1000.0          | 9.000           | L1   | ON     | 19.5       |
| 6.895500        | 29.50            | ---            | 60.00        | 30.50       | 1000.0          | 9.000           | L1   | ON     | 19.6       |
| 6.967500        | ---              | 22.33          | 50.00        | 27.67       | 1000.0          | 9.000           | L1   | ON     | 19.6       |
| 20.330250       | 26.69            | ---            | 60.00        | 33.31       | 1000.0          | 9.000           | L1   | ON     | 19.9       |
| 20.530500       | ---              | 21.28          | 50.00        | 28.72       | 1000.0          | 9.000           | L1   | ON     | 19.9       |

L Line



## Final Result

| Frequency (MHz) | QuasiPeak (dB <sub>i</sub> / V) | Average (dB <sub>i</sub> / V) | Limit (dB <sub>i</sub> / V) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter |
|-----------------|---------------------------------|-------------------------------|-----------------------------|-------------|-----------------|-----------------|------|--------|
| 0.276000        | 39.48                           | ---                           | 60.94                       | 21.46       | 1000.0          | 9.000           | N    | ON     |
| 0.278250        | ---                             | 29.93                         | 50.87                       | 20.94       | 1000.0          | 9.000           | N    | ON     |
| 0.361500        | ---                             | 35.66                         | 48.69                       | 13.04       | 1000.0          | 9.000           | N    | ON     |
| 0.361500        | 46.40                           | ---                           | 58.69                       | 12.30       | 1000.0          | 9.000           | N    | ON     |
| 0.764250        | ---                             | 25.67                         | 46.00                       | 20.33       | 1000.0          | 9.000           | N    | ON     |
| 0.845250        | 38.85                           | ---                           | 56.00                       | 17.15       | 1000.0          | 9.000           | N    | ON     |
| 2.094000        | 40.81                           | ---                           | 56.00                       | 15.19       | 1000.0          | 9.000           | N    | ON     |
| 2.132250        | ---                             | 30.97                         | 46.00                       | 15.03       | 1000.0          | 9.000           | N    | ON     |
| 5.106750        | 35.84                           | ---                           | 60.00                       | 24.16       | 1000.0          | 9.000           | N    | ON     |
| 5.163000        | ---                             | 28.26                         | 50.00                       | 21.74       | 1000.0          | 9.000           | N    | ON     |
| 17.567250       | ---                             | 18.56                         | 50.00                       | 31.44       | 1000.0          | 9.000           | N    | ON     |
| 17.607750       | 23.32                           | ---                           | 60.00                       | 36.68       | 1000.0          | 9.000           | N    | ON     |

N Line

## 6. Main Test Instruments

| Name                                 | Manufacturer      | Type      | Serial Number | Calibration Date | Expiration Date |
|--------------------------------------|-------------------|-----------|---------------|------------------|-----------------|
| Spectrum Analyzer                    | R&S               | FSV30     | 100815        | 2016-12-16       | 2017-12-15      |
| EMI Test Receiver                    | R&S               | ESCI      | 100948        | 2017-05-20       | 2018-05-19      |
| TRILOG Broadband Antenna             | Schwarzbeck       | VULB 9163 | 9163-201      | 2014-12-06       | 2017-12-05      |
| TRILOG Broadband Antenna             | Schwarzbeck       | VULB 9163 | 9163-201      | 2017-11-18       | 2020-11-17      |
| Double Ridged Waveguide Horn Antenna | R&S               | HF907     | 100126        | 2014-12-06       | 2019-12-05      |
| Loop Antenna                         | SCHWARZBECK       | FMZB1519  | 1519-047      | 2017-02-18       | 2020-02-17      |
| Standard Gain Horn                   | ETS-Lindgren      | 3160-09   | 00102644      | 2015-01-30       | 2018-01-29      |
| EMI Test Receiver                    | R&S               | ESCS30    | 100138        | 2016-12-16       | 2017-12-15      |
| LISN                                 | R&S               | ENV216    | 101171        | 2016-12-16       | 2019-12-15      |
| Spectrum Analyzer                    | Agilent           | N9010A    | MY47191109    | 2017-05-20       | 2018-05-19      |
| RF Cable                             | Agilent           | SMA 15cm  | 0001          | 2017-08-04       | 2018-02-03      |
| Software (CE)                        | ROHDE&SCHW<br>ARZ | EMC32     | 9.26.0        | /                | /               |
| Software (RE/RSE)                    | ROHDE&SCHW<br>ARZ | EMC32     | 8.52.0        | /                | /               |

\*\*\*\*\*END OF REPORT \*\*\*\*\*

## ANNEX A: EUT Appearance and Test Setup

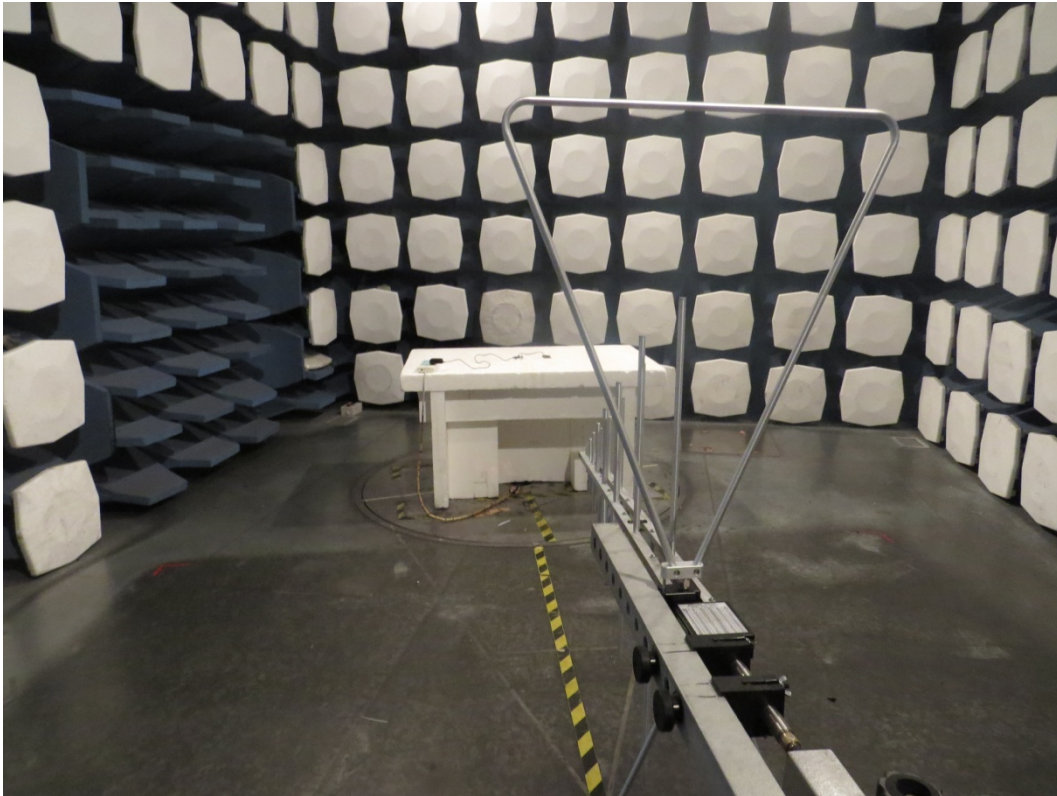
### A.1 EUT Appearance



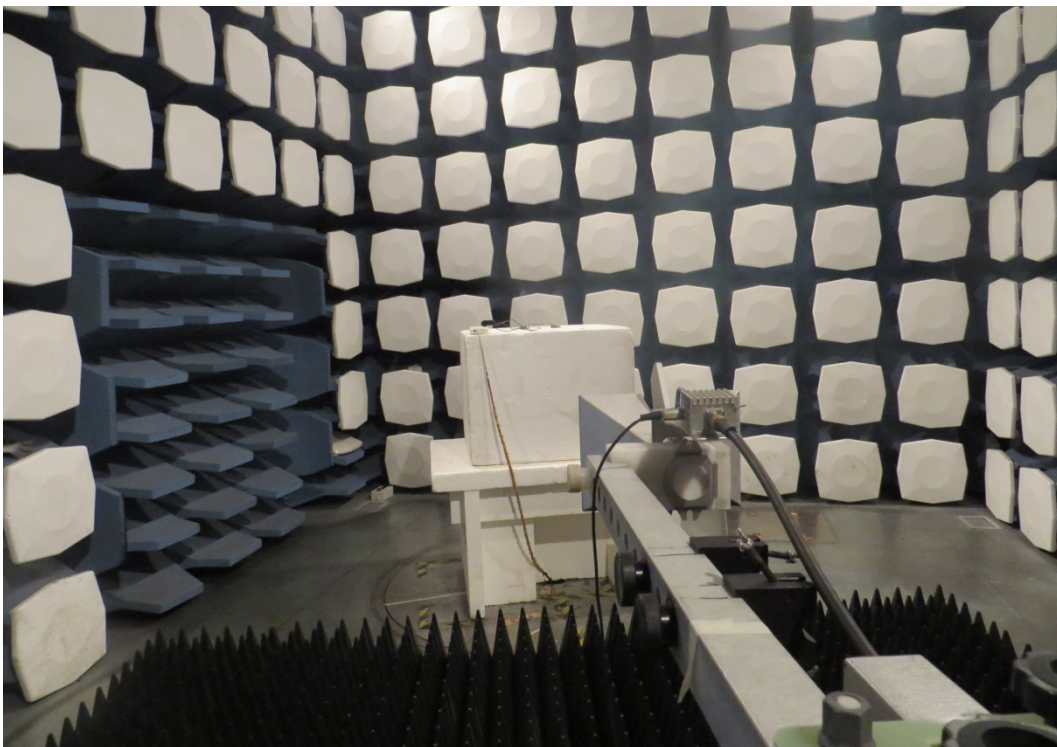
a: EUT

Picture 1 EUT and Accessory

## A.2 Test Setup

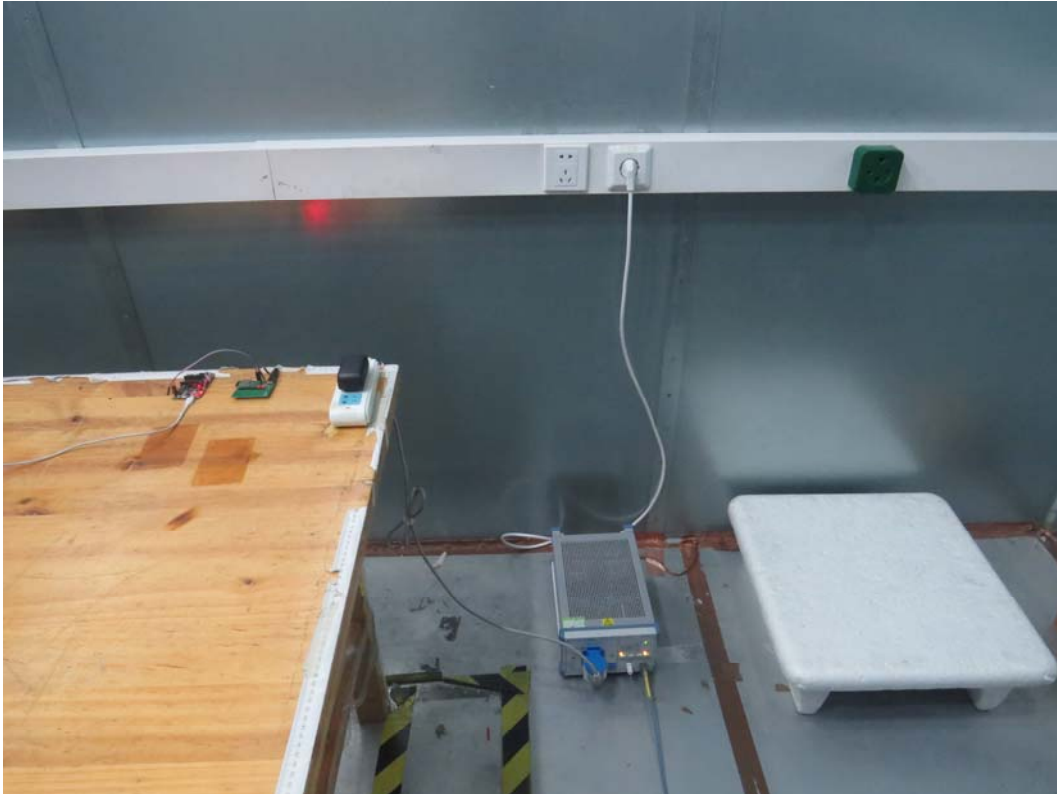


30M Hz-1GHz



Above 1GHz

**Picture 2 Radiated Emission Test Setup**



**Picture 3 Conducted Emission Test Setup**