



# TEST REPORT

**APPLICANT** : BDE Technology Co., Ltd

**PRODUCT NAME** : BDE Low Power, Long Range Sub-1G Module

**MODEL NAME** : BDE-RFM216

**BRAND NAME** : BDE

**FCC ID** : 2ABRUBDRFM216

**STANDARD(S)** : 47 CFR Part 15 Subpart C

**RECEIPT DATE** : 2019-11-27

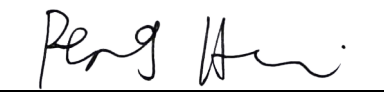
**TEST DATE** : 2019-12-04 to 2019-12-05

**ISSUE DATE** : 2019-12-16

Edited by:

  
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Approved by:

  
Peng Huarui ( Supervisor )

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## DIRECTORY

|                                                          |           |
|----------------------------------------------------------|-----------|
| <b>1. Technical Information .....</b>                    | <b>4</b>  |
| <b>1.1. Applicant and Manufacturer Information .....</b> | <b>4</b>  |
| <b>1.2. Equipment Under Test (EUT) Description .....</b> | <b>4</b>  |
| <b>1.3. Host Information .....</b>                       | <b>5</b>  |
| <b>1.4. The Channel Number and Frequency .....</b>       | <b>6</b>  |
| <b>1.5. Test Standards and Results .....</b>             | <b>8</b>  |
| <b>1.6. Environmental Conditions .....</b>               | <b>9</b>  |
| <b>2. 47 CFR Part 15C Requirements .....</b>             | <b>10</b> |
| <b>2.1. Conducted Emission .....</b>                     | <b>10</b> |
| <b>2.2. Radiated Emission .....</b>                      | <b>14</b> |
| <b>Annex A Test Uncertainty .....</b>                    | <b>27</b> |
| <b>Annex B Testing Laboratory Information .....</b>      | <b>28</b> |



REPORT No.: SZ19100195W02

| Change History |            |                   |
|----------------|------------|-------------------|
| Version        | Date       | Reason for change |
| 1.0            | 2019-12-16 | First edition     |
|                |            |                   |



# 1. Technical Information

**Note:** Provide by applicant.

## 1.1. Applicant and Manufacturer Information

|                              |                                                                              |
|------------------------------|------------------------------------------------------------------------------|
| <b>Applicant:</b>            | BDE Technology Co., Ltd                                                      |
| <b>Applicant Address:</b>    | Innovation Building C1-1105, 182 Science Ave, Science City, Guangzhou, China |
| <b>Manufacturer:</b>         | BDE Technology Co., Ltd                                                      |
| <b>Manufacturer Address:</b> | Innovation Building C1-1105, 182 Science Ave, Science City, Guangzhou, China |

## 1.2. Equipment Under Test (EUT) Description

|                                   |                                                                    |
|-----------------------------------|--------------------------------------------------------------------|
| <b>Product Name:</b>              | BDE Low Power, Long Range Sub-1G Module                            |
| <b>Serial No:</b>                 | (N/A, marked #1 by test site)                                      |
| <b>Equipment Type:</b>            | FHSS                                                               |
| <b>Modulation Type:</b>           | 2-GFSK                                                             |
| <b>Data Rate:</b>                 | 5kbps, 50kbps 200kbps                                              |
| <b>Operating Frequency Range:</b> | 5kbps, 50kbps: 902.2MHz - 927.8MHz<br>200kbps: 902.4MHz - 927.6MHz |

**Note 1:** This is a Class II permissive change report for FCC ID: 2ABRUBDRFM216, we tested and recorded the test results for below test items.

1. Conducted Emission
2. Radiated Emission

**Note 2:** For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



### 1.3.Host Information

|                          |                                             |
|--------------------------|---------------------------------------------|
| <b>Product Name:</b>     | BDE Low Power, Long Range Sub-1G USB Dongle |
| <b>Model Name:</b>       | BDE-USB216                                  |
| <b>Brand Name:</b>       | BDE                                         |
| <b>Hardware Version:</b> | 2.2                                         |
| <b>Software Version:</b> | 1.0                                         |
| <b>Antenna Type:</b>     | Helical Antenna                             |
| <b>Antenna Gain:</b>     | 4.37dBi                                     |



## 1.4.The Channel Number and Frequency

| Channel | Frequency (MHz) | Channel   | Frequency (MHz) | Channel | Frequency (MHz) | Channel    | Frequency (MHz) |
|---------|-----------------|-----------|-----------------|---------|-----------------|------------|-----------------|
| 0       | <b>902.2</b>    | 33        | 908.8           | 66      | 915.4           | 99         | 922.0           |
| 1       | 902.4           | 34        | 909.0           | 67      | 915.6           | 100        | 922.2           |
| 2       | 902.6           | 35        | 909.2           | 68      | 915.8           | 101        | 922.4           |
| 3       | 902.8           | 36        | 909.4           | 69      | 916.0           | 102        | 922.6           |
| 4       | 903.0           | 37        | 909.6           | 70      | 916.2           | 103        | 922.8           |
| 5       | 903.2           | 38        | 909.8           | 71      | 916.4           | 104        | 923             |
| 6       | 903.4           | 39        | 910.0           | 72      | 916.6           | 105        | 923.2           |
| 7       | 903.6           | 40        | 910.2           | 73      | 916.8           | 106        | 923.4           |
| 8       | 903.8           | 41        | 910.4           | 74      | 917.0           | 107        | 923.6           |
| 9       | 904.0           | 42        | 910.6           | 75      | 917.2           | 108        | 923.8           |
| 10      | 904.2           | 43        | 910.8           | 76      | 917.4           | 109        | 924.0           |
| 11      | 904.4           | 44        | 911.0           | 77      | 917.6           | 110        | 924.2           |
| 12      | 904.6           | 45        | 911.2           | 78      | 917.8           | 111        | 924.4           |
| 13      | 904.8           | 46        | 911.4           | 79      | 918.0           | 112        | 924.6           |
| 14      | 905.0           | 47        | 911.6           | 80      | 918.2           | 113        | 924.8           |
| 15      | 905.2           | 48        | 911.8           | 81      | 918.4           | 114        | 925.0           |
| 16      | 905.4           | 49        | 912.0           | 82      | 918.6           | 115        | 925.2           |
| 17      | 905.6           | 50        | 912.2           | 83      | 918.8           | 116        | 925.4           |
| 18      | 905.8           | 51        | 912.4           | 84      | 919.0           | 117        | 925.6           |
| 19      | 906.0           | 52        | 912.6           | 85      | 919.2           | 118        | 925.8           |
| 20      | 906.2           | 53        | 912.8           | 86      | 919.4           | 119        | 926.0           |
| 21      | 906.4           | 54        | 913.0           | 87      | 919.6           | 120        | 926.2           |
| 22      | 906.6           | 55        | 913.2           | 88      | 919.8           | 121        | 926.4           |
| 23      | 906.8           | 56        | 913.4           | 89      | 920.0           | 122        | 926.6           |
| 24      | 907.0           | 57        | 913.6           | 90      | 920.2           | 123        | 926.8           |
| 25      | 907.2           | 58        | 913.8           | 91      | 920.4           | 124        | 927.0           |
| 26      | 907.4           | 59        | 914.0           | 92      | 920.6           | 125        | 927.2           |
| 27      | 907.6           | 60        | 914.2           | 93      | 920.8           | 126        | 927.4           |
| 28      | 907.8           | 61        | 914.4           | 94      | 921             | 127        | 927.6           |
| 29      | 908.0           | 62        | 914.6           | 95      | 921.2           | <b>128</b> | <b>927.8</b>    |
| 30      | 908.2           | 63        | 914.8           | 96      | 921.4           |            |                 |
| 31      | 908.4           | <b>64</b> | <b>915.0</b>    | 97      | 921.6           |            |                 |
| 32      | 908.6           | 65        | 915.2           | 98      | 921.8           |            |                 |

**Note:** The black bold channels were selected for 5kbps and 50kbps test.



| Channel  | Frequency (MHz) | Channel | Frequency (MHz) | Channel   | Frequency (MHz) | Channel   | Frequency (MHz) |
|----------|-----------------|---------|-----------------|-----------|-----------------|-----------|-----------------|
| <b>0</b> | <b>902.4</b>    | 16      | 908.8           | <b>32</b> | <b>915.2</b>    | 48        | 921.6           |
| 1        | 902.8           | 17      | 909.2           | 33        | 915.6           | 49        | 922.0           |
| 2        | 903.2           | 18      | 909.6           | 34        | 916.0           | 50        | 922.4           |
| 3        | 903.6           | 19      | 910.0           | 35        | 916.4           | 51        | 922.8           |
| 4        | 904.0           | 20      | 910.4           | 36        | 916.8           | 52        | 923.2           |
| 5        | 904.4           | 21      | 910.8           | 37        | 917.2           | 53        | 923.6           |
| 6        | 904.8           | 22      | 911.2           | 38        | 917.6           | 54        | 924.0           |
| 7        | 905.2           | 23      | 911.6           | 39        | 918.0           | 55        | 924.4           |
| 8        | 905.6           | 24      | 912.0           | 40        | 918.4           | 56        | 924.8           |
| 9        | 906.0           | 25      | 912.4           | 41        | 918.8           | 57        | 925.2           |
| 10       | 906.4           | 26      | 912.8           | 42        | 919.2           | 58        | 925.6           |
| 11       | 906.8           | 27      | 913.2           | 43        | 919.6           | 59        | 926.0           |
| 12       | 907.2           | 28      | 913.6           | 44        | 920.0           | 60        | 926.4           |
| 13       | 907.6           | 29      | 914.0           | 45        | 920.4           | 61        | 926.8           |
| 14       | 908.0           | 30      | 914.4           | 46        | 920.8           | 62        | 927.2           |
| 15       | 908.4           | 31      | 914.8           | 47        | 921.2           | <b>63</b> | <b>927.6</b>    |

**Note:** The black bold channels were selected for 200kbps test.



## 1.5. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

| No. | Identity       | Document Title          |
|-----|----------------|-------------------------|
| 1   | 47 CFR Part 15 | Radio Frequency Devices |

Test detailed items/section required by FCC rules and results are as below:

| No. | Section                 | Description                            | Test Date    | Test Engineer | Result | Method determination /Remark |
|-----|-------------------------|----------------------------------------|--------------|---------------|--------|------------------------------|
| 1   | 15.203                  | Antenna Requirement                    | N/A          | N/A           | N/A    | N/A                          |
| 2   | 15.247(a)1<br>15.247(h) | Hopping Mechanism                      | N/A          | N/A           | N/A    | N/A                          |
| 3   | 15.247(a)               | Number of Hopping Frequency            | N/A          | N/A           | N/A    | N/A                          |
| 4   | N/A                     | Duty Cycle                             | N/A          | N/A           | N/A    | N/A                          |
| 5   | 15.247(b)               | Maximum Peak Conducted Output Power    | N/A          | N/A           | N/A    | N/A                          |
| 6   | 15.247(b)               | Maximum Average Conducted Output Power | N/A          | N/A           | N/A    | N/A                          |
| 7   | 15.247(a)               | 20dB Bandwidth                         | N/A          | N/A           | N/A    | N/A                          |
| 8   | 15.247(a)               | Carrier Frequency Separation           | N/A          | N/A           | N/A    | N/A                          |
| 9   | 15.247(a)               | Time of Occupancy (Dwell time)         | N/A          | N/A           | N/A    | N/A                          |
| 10  | 15.247(d)               | Conducted Spurious Emission            | N/A          | N/A           | N/A    | N/A                          |
| 11  | 15.207                  | Conducted Emission                     | Dec 04, 2019 | Lin Jiayong   | PASS   | No deviation                 |
| 12  | 15.209,<br>15.247(d)    | Radiated Emission                      | Dec 05, 2019 | Gao Jianrou   | PASS   | No deviation                 |



**Note 1:** The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013.

**Note 2:** Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

## 1.6. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

|                             |        |
|-----------------------------|--------|
| Temperature (°C):           | 15-35  |
| Relative Humidity (%):      | 30-60  |
| Atmospheric Pressure (kPa): | 86-106 |

## 2.47 CFR Part 15C Requirements

### 2.1. Conducted Emission

#### 2.1.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

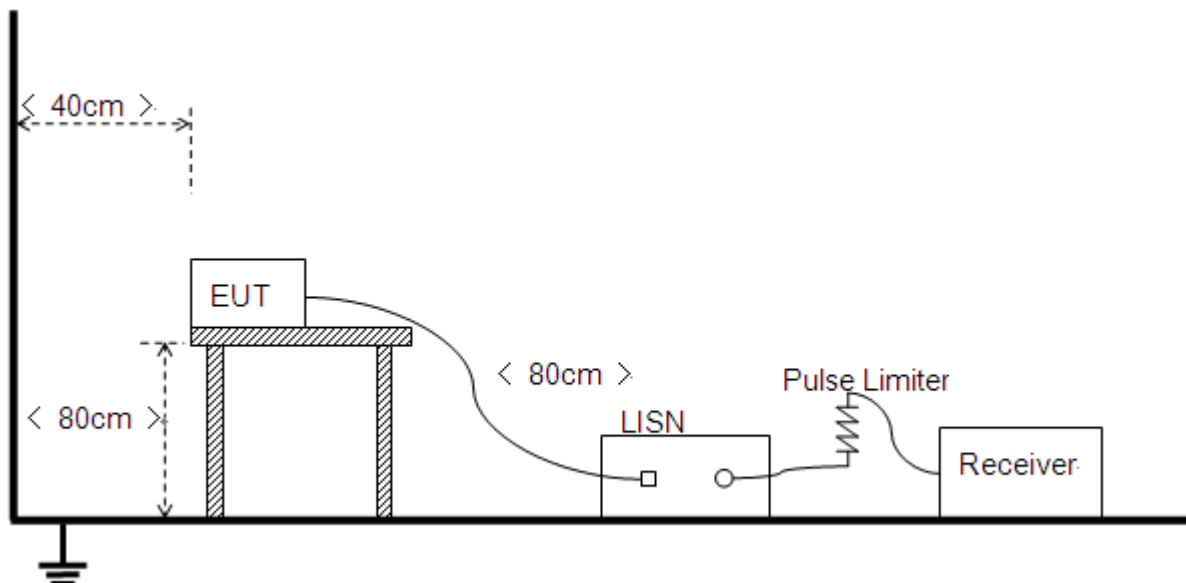
| Frequency range (MHz) | Conducted Limit (dB $\mu$ V) |          |
|-----------------------|------------------------------|----------|
|                       | Quai-peak                    | Average  |
| 0.15 - 0.50           | 66 to 56                     | 56 to 46 |
| 0.50 - 5              | 56                           | 46       |
| 5- 30                 | 60                           | 50       |

#### NOTE:

- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

#### 2.1.2. Test Description

##### Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference



Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

### 2.1.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

**Note:** Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

#### Test Setup:

Test Mode: EUT+PC+ + Adapter+915M TX

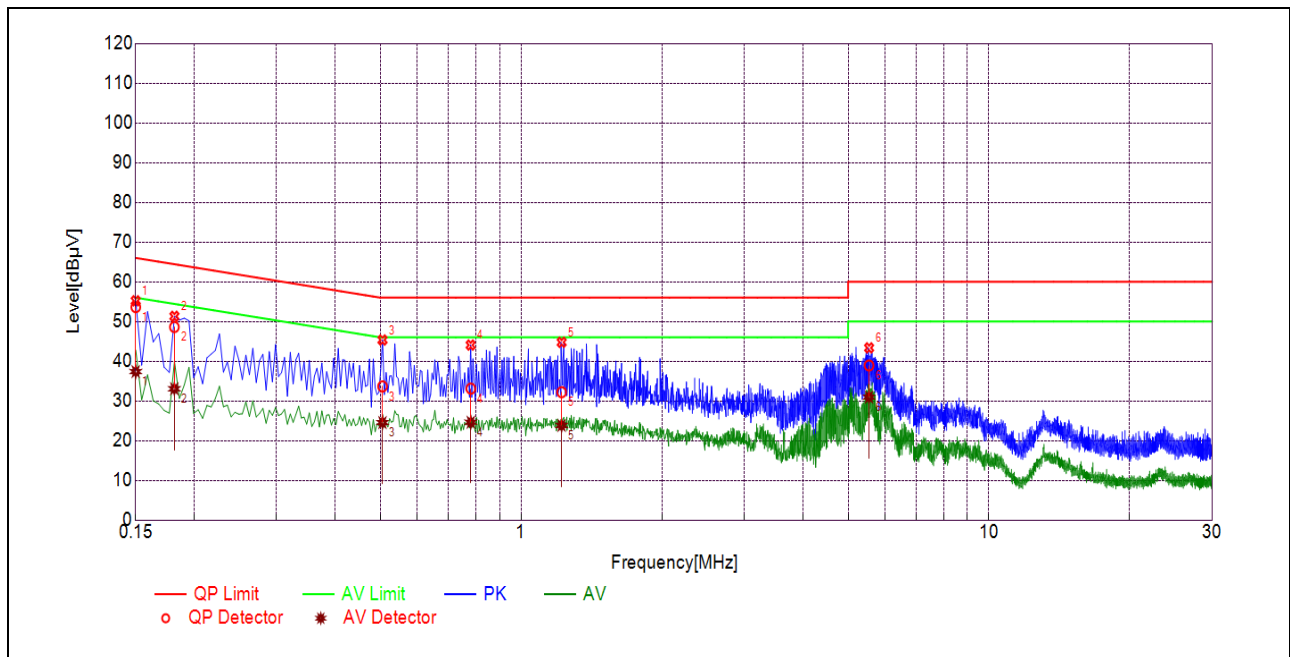
Test voltage: AC 120V/60Hz

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V]} = U_R + L_{\text{Cable loss [dB]} + A_{\text{Factor}}$$

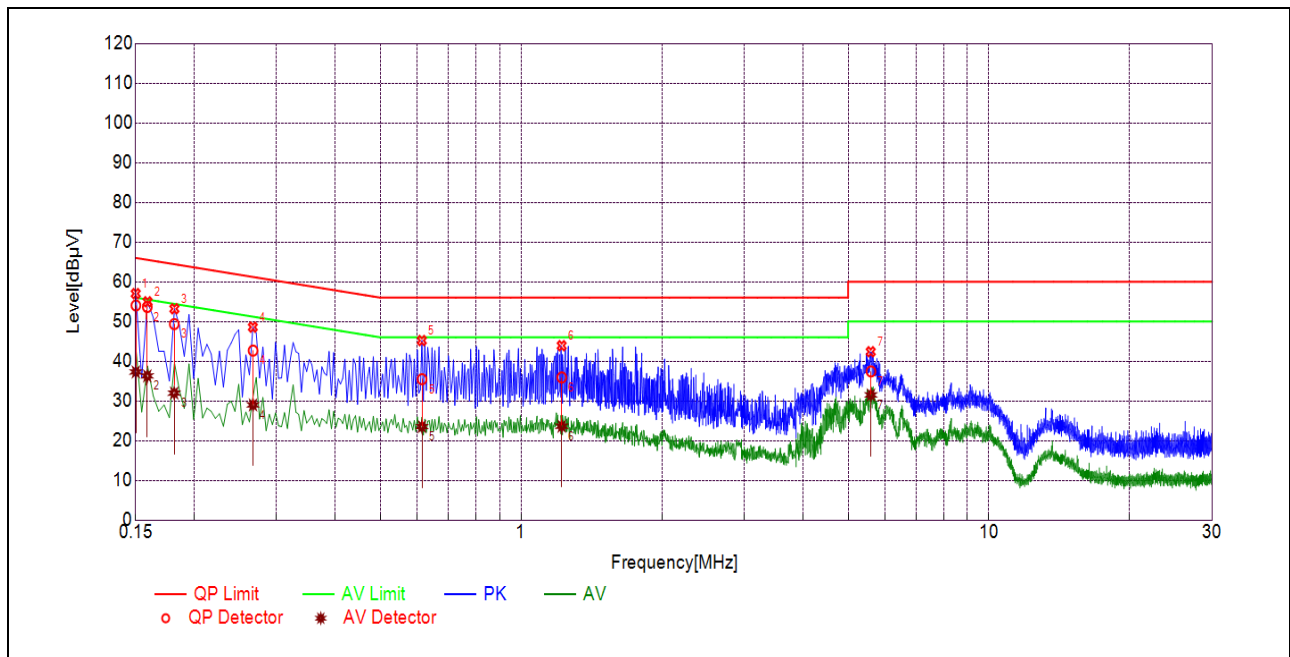
$U_R$ : Receiver Reading

$A_{\text{Factor}}$ : Voltage division factor of LISN



(L Phase)

| NO. | Fre.<br>(MHz) | Emission Level (dBμV) |         | Limit (dBμV) |         | Power-line | Verdict |
|-----|---------------|-----------------------|---------|--------------|---------|------------|---------|
|     |               | Quai-peak             | Average | Quai-peak    | Average |            |         |
| 1   | 0.1500        | 53.62                 | 37.38   | 66.00        | 56.00   | Line       | PASS    |
| 2   | 0.1814        | 48.61                 | 33.05   | 64.42        | 54.42   |            | PASS    |
| 3   | 0.5054        | 33.65                 | 24.55   | 56.00        | 46.00   |            | PASS    |
| 4   | 0.7806        | 33.09                 | 24.63   | 56.00        | 46.00   |            | PASS    |
| 5   | 1.2205        | 32.20                 | 23.82   | 56.00        | 46.00   |            | PASS    |
| 6   | 5.5426        | 38.93                 | 30.96   | 60.00        | 50.00   |            | PASS    |



(N Phase)

| NO. | Fre.<br>(MHz) | Emission Level (dBμV) |         | Limit (dBμV) |         | Power-line | Verdict |
|-----|---------------|-----------------------|---------|--------------|---------|------------|---------|
|     |               | Quai-peak             | Average | Quai-peak    | Average |            |         |
| 1   | 0.1501        | 54.04                 | 37.29   | 66.00        | 56.00   | Neutral    | PASS    |
| 2   | 0.1588        | 53.65                 | 36.29   | 65.52        | 55.52   |            | PASS    |
| 3   | 0.1813        | 49.35                 | 31.97   | 64.42        | 54.42   |            | PASS    |
| 4   | 0.2672        | 42.68                 | 29.00   | 61.21        | 51.21   |            | PASS    |
| 5   | 0.6139        | 35.46                 | 23.53   | 56.00        | 46.00   |            | PASS    |
| 6   | 1.2213        | 35.91                 | 23.62   | 56.00        | 46.00   |            | PASS    |
| 7   | 5.5961        | 37.42                 | 31.50   | 60.00        | 50.00   |            | PASS    |

## 2.2. Radiated Emission

### 2.2.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ ) | Measurement Distance (m) |
|-----------------|------------------------------------|--------------------------|
| 0.009 - 0.490   | 2400/F(kHz)                        | 300                      |
| 0.490 - 1.705   | 24000/F(kHz)                       | 30                       |
| 1.705 - 30.0    | 30                                 | 30                       |
| 30 - 88         | 100                                | 3                        |
| 88 - 216        | 150                                | 3                        |
| 216 - 960       | 200                                | 3                        |
| Above 960       | 500                                | 3                        |

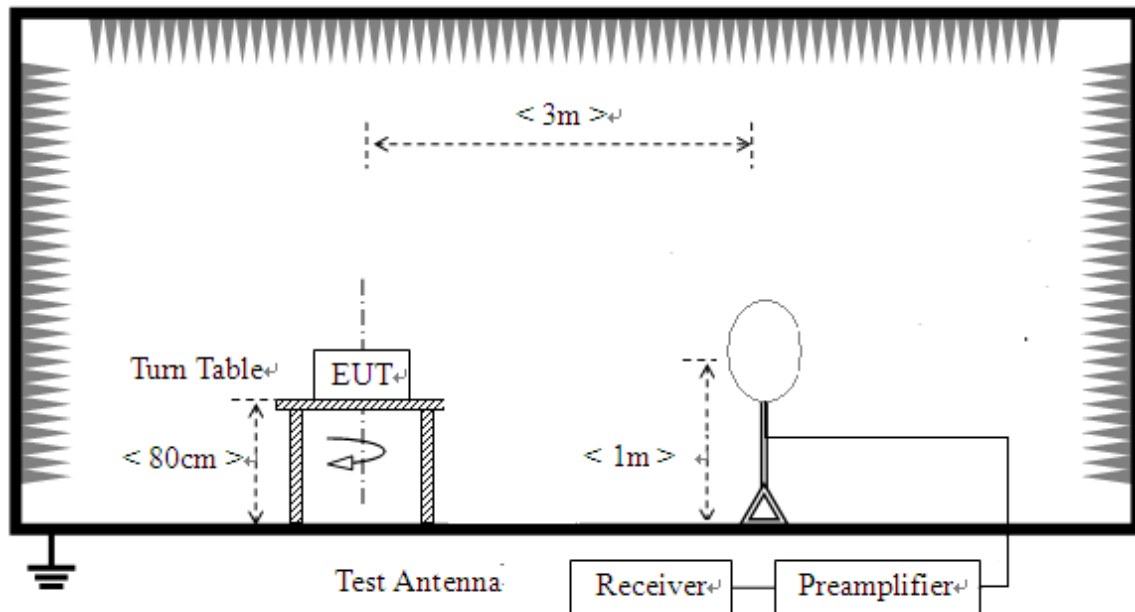
**Note 1:** For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

**Note 2:** For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK). In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

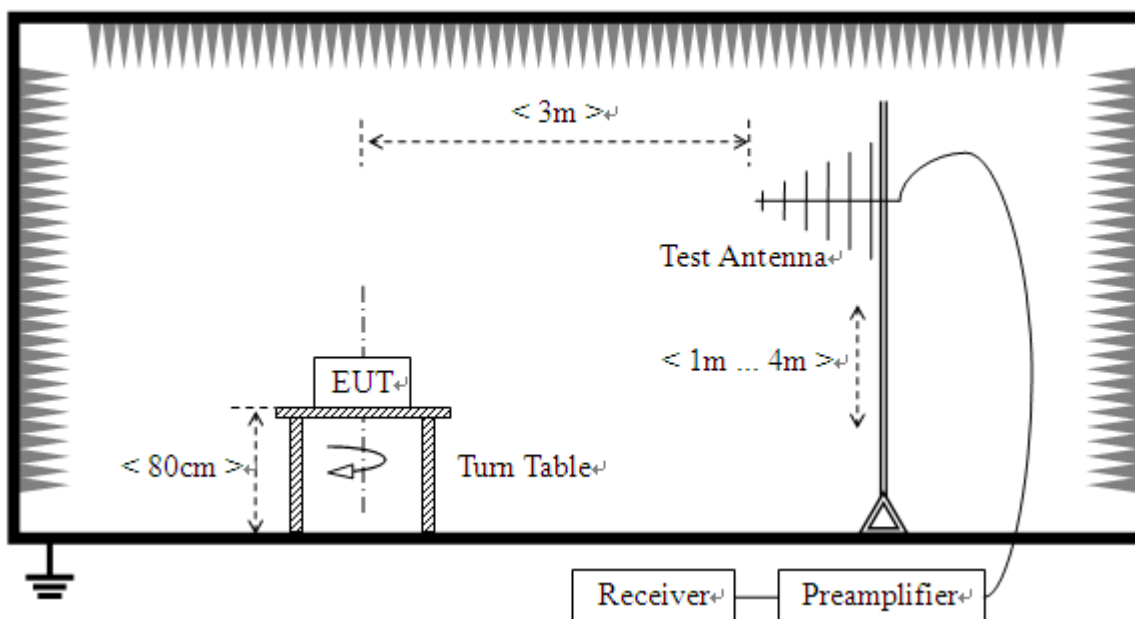
### 2.2.2. Test Description

#### Test Setup:

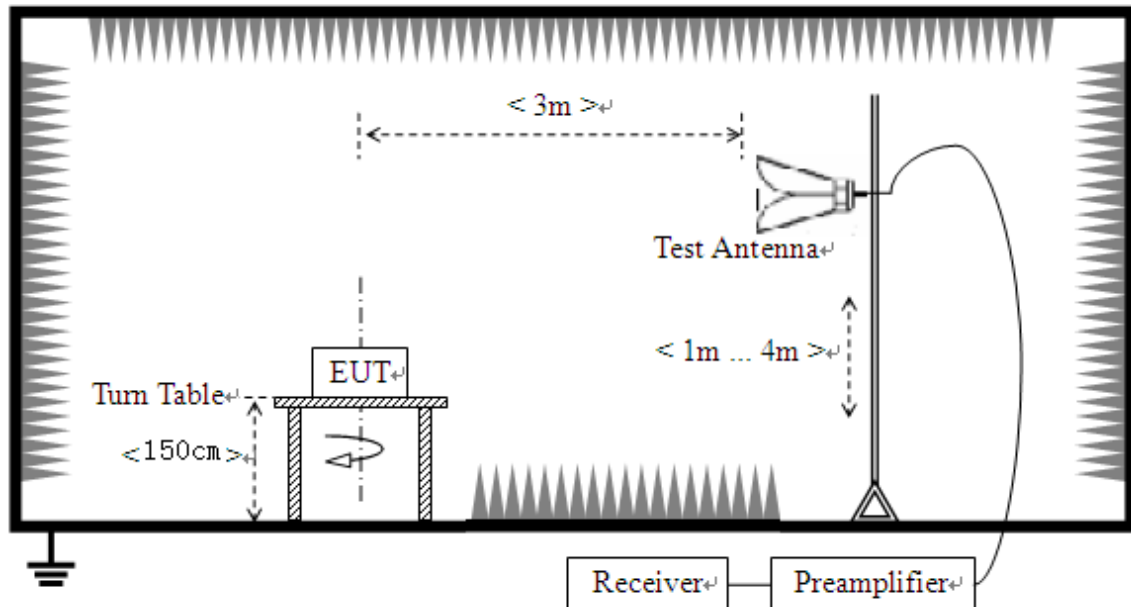
- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



### 3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10:2013. For radiated emissions below or equal to 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane, for radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2013.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

- In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test antenna may have to be



higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

### 2.2.3. Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V/m]} = U_R + A_T + A_{\text{Factor}} \text{ [dB]}; A_T = L_{\text{Cable loss}} \text{ [dB]} - G_{\text{preamp}} \text{ [dB]}$$

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : Antenna Factor at 3m

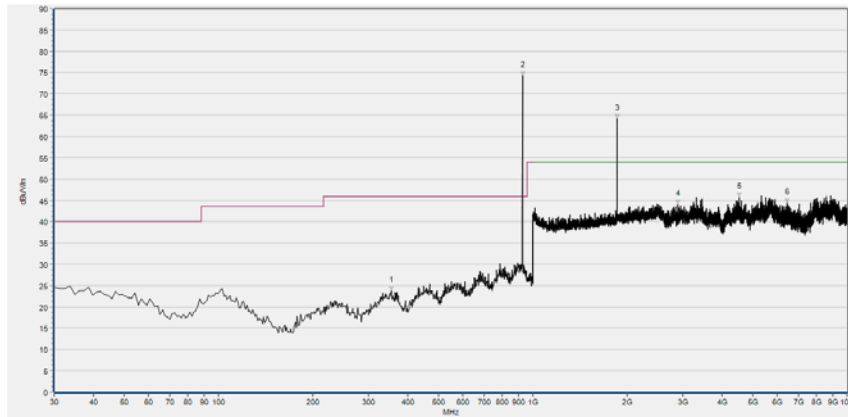
During the test, the total correction Factor  $A_T$  and  $A_{\text{Factor}}$  were built in test software.

**Note1:** All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

**Note2:** For the frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

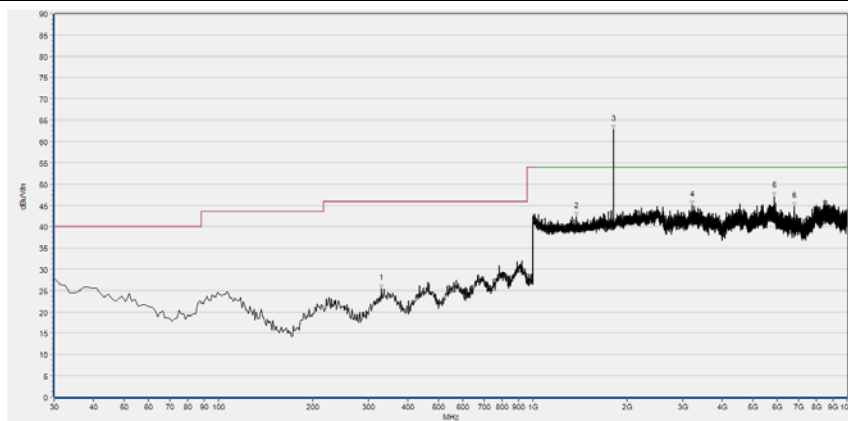


5kbps

**Plot for Channel = 0**

| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 355.357    | 23.84       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 902.159    | 74.19       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1805.700   | 64.54       | N/A         | 35.65       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2897.400   | 44.07       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 4545.881   | 45.74       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 6447.354   | 44.47       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

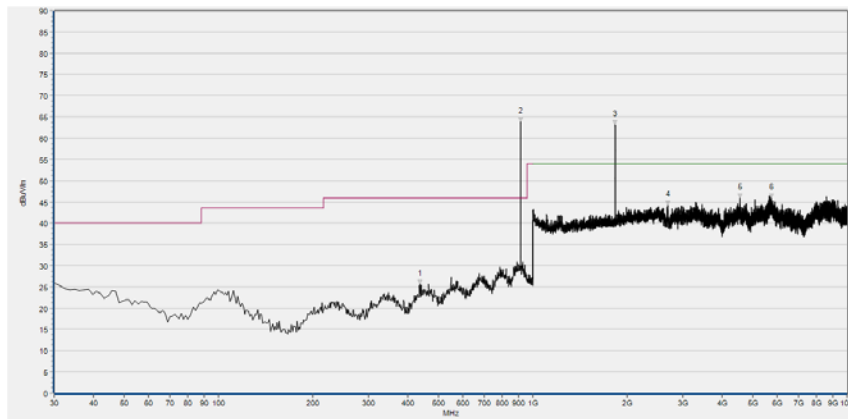
(30MHz to 10GHz, Antenna Horizontal, 5kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 329.862    | 25.52       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 1372.629   | 42.34       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 1805.700   | 62.73       | N/A         | 34.98       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 3220.367   | 45.04       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 5863.321   | 47.07       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 6791.853   | 44.83       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

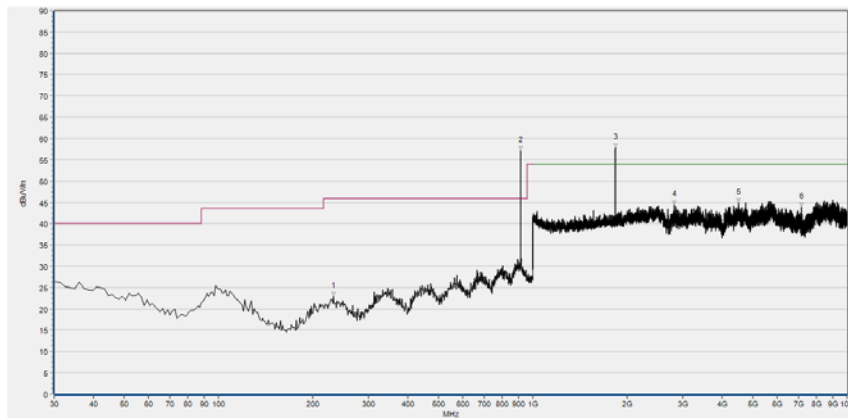
(30MHz to 10GHz, Antenna Vertical, 5kbps)

### Plot for Channel = 64



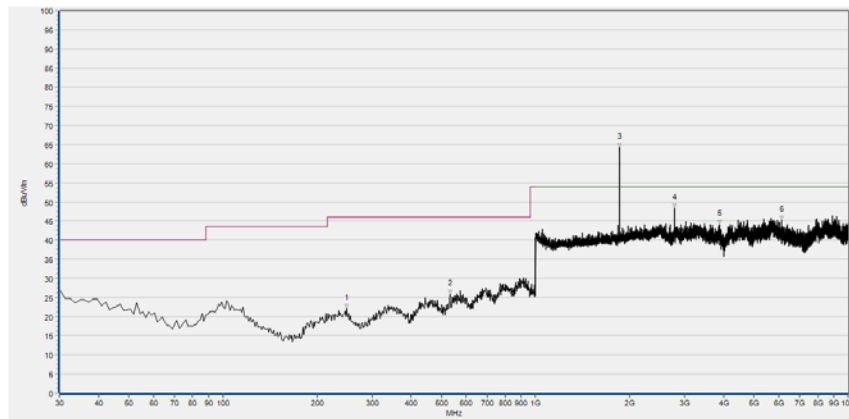
| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 437.910    | 25.63       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 915.019    | 63.89       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1829.600   | 63.35       | N/A         | 34.54       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2687.470   | 44.29       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 4555.301   | 45.87       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 5752.973   | 45.90       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

(30MHz to 10GHz, Antenna Horizontal, 5kbps)



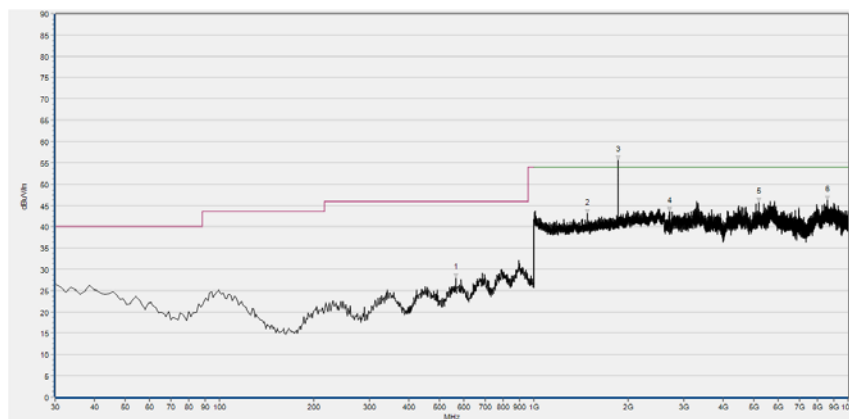
| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 232.741    | 22.88       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 915.019    | 57.14       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | N/A     |
| 1830.200   | 57.19       | N/A         | 34.25       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 2818.003   | 44.41       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 4524.350   | 44.86       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 7153.846   | 43.97       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

(30MHz to 10GHz, Antenna Vertical, 5kbps)

**Plot for Channel = 128**

| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 248.523    | 22.12       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 532.603    | 25.82       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 1853.700   | 64.66       | N/A         | 35.70       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2780.324   | 48.45       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 3877.069   | 44.21       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 6114.966   | 45.21       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

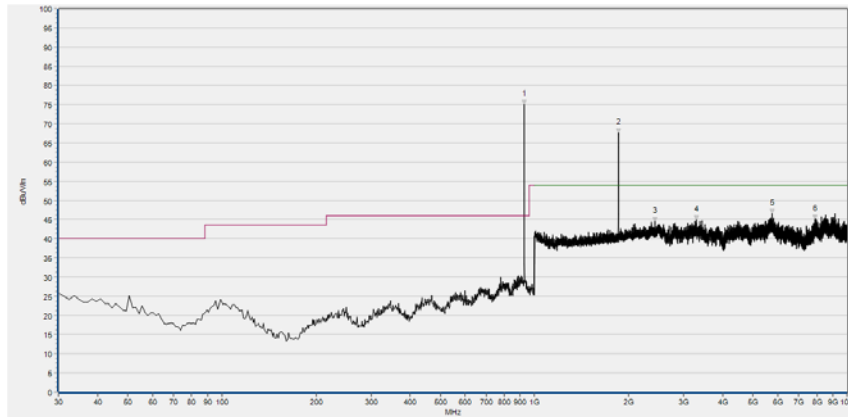
(30MHz to 10GHz, Antenna Horizontal, 5kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 565.382    | 27.93       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 1481.473   | 43.05       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 1853.800   | 55.84       | N/A         | 32.18       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 2707.656   | 43.51       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 5189.125   | 45.75       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 8601.819   | 46.26       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

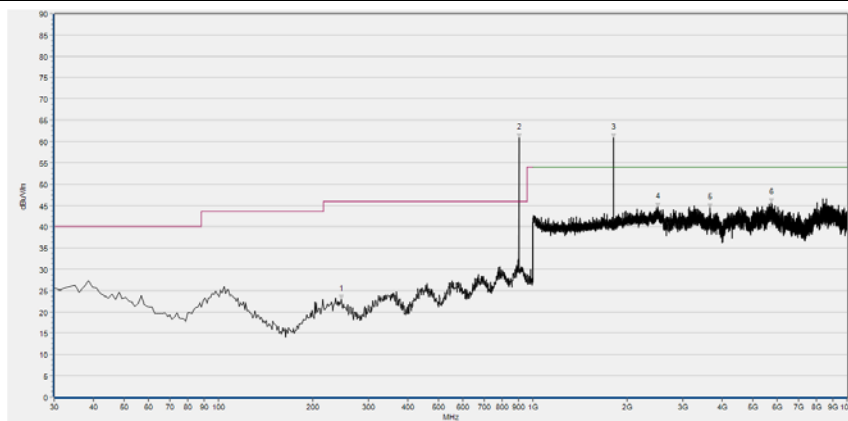
(30MHz to 10GHz, Antenna Vertical, 5kbps)

50kbps

**Plot for Channel = 0**


| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 903.159    | 75.09       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1806.600   | 67.82       | N/A         | 37.35       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2425.210   | 44.50       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 3288.998   | 44.96       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 5743.553   | 46.48       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 7892.635   | 45.05       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

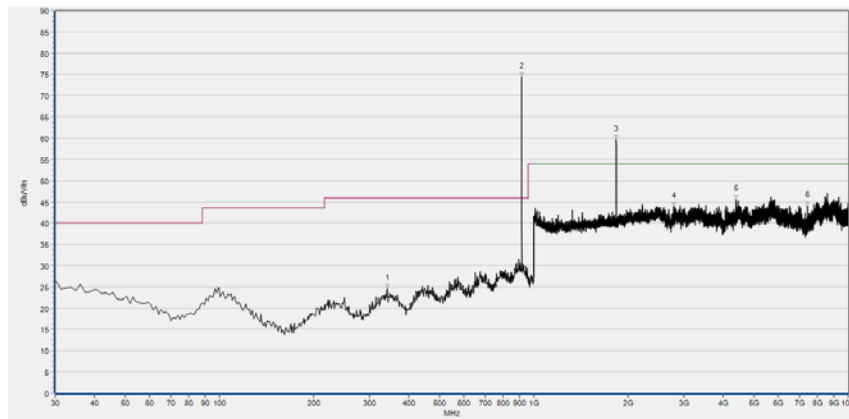
(30MHz to 10GHz, Antenna Horizontal, 5kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 246.095    | 22.96       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 902.879    | 60.83       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | N/A     |
| 1805.600   | 60.27       | N/A         | 33.46       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 2504.602   | 44.62       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 3656.374   | 44.35       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 5757.010   | 45.61       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

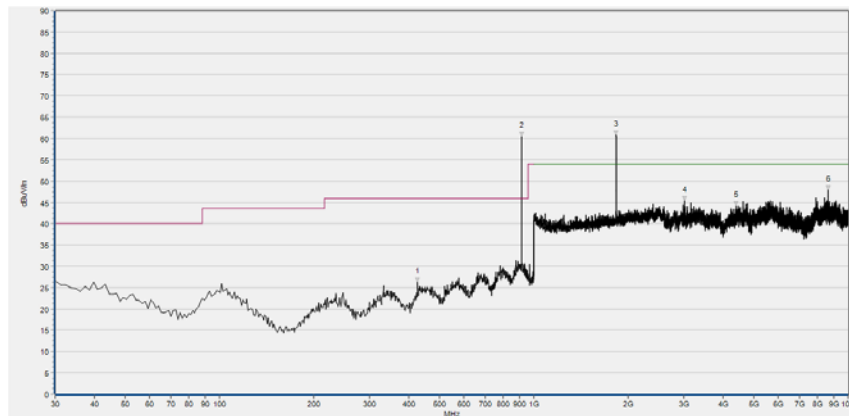
(30MHz to 10GHz, Antenna Vertical, 5kbps)

### Plot for Channel = 64



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 342.003    | 24.60       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 915.019    | 74.42       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1829.700   | 59.20       | N/A         | 34.54       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2785.706   | 43.87       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 4403.237   | 45.65       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 7405.492   | 44.10       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

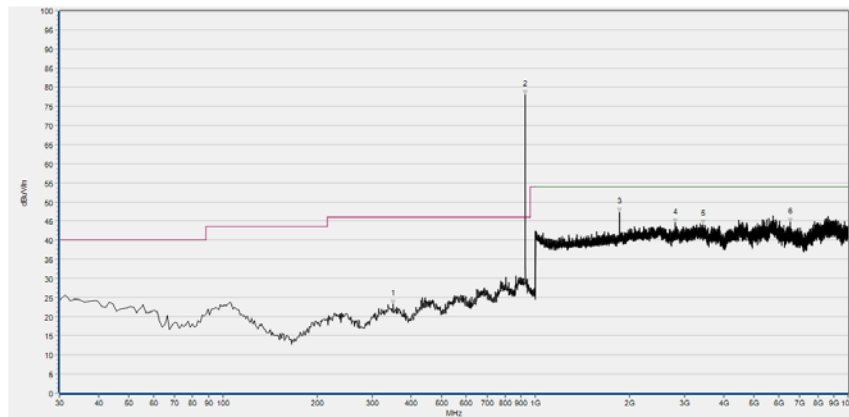
(30MHz to 10GHz, Antenna Horizontal, 5kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 426.984    | 26.36       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 915.019    | 60.57       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | N/A     |
| 1829.800   | 61.20       | N/A         | 34.20       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 3014.475   | 45.34       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 4407.274   | 44.21       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 8627.387   | 48.01       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

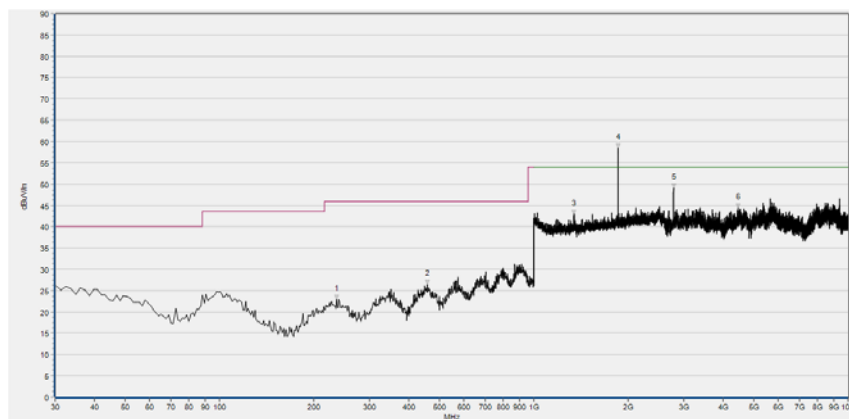
(30MHz to 10GHz, Antenna Vertical, 5kbps)

### Plot for Channel = 128



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 350.501    | 23.29       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 927.159    | 77.96       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1854.102   | 47.32       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2800.509   | 44.56       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 3435.679   | 44.14       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 6534.825   | 44.73       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

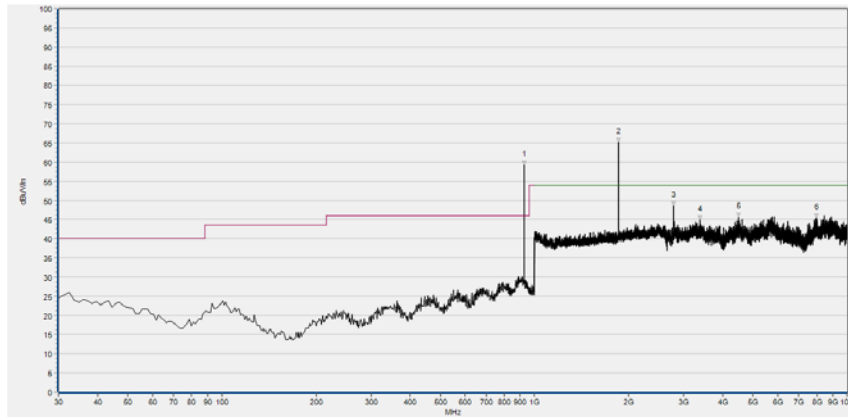
(30MHz to 10GHz, Antenna Horizontal, 5kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 236.383    | 22.96       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 457.334    | 26.47       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 1343.818   | 42.96       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 1853.600   | 57.11       | N/A         | 32.77       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 2781.669   | 49.03       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 4458.411   | 44.39       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

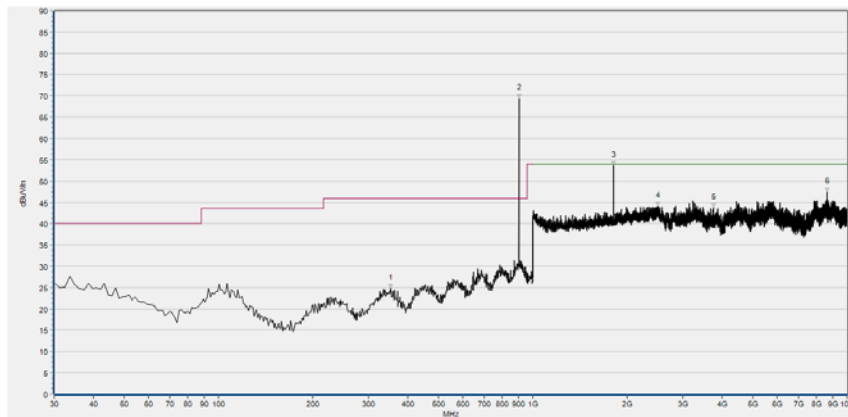
(30MHz to 10GHz, Antenna Vertical, 5kbps)

200kbps

**Plot for Channel = 0**


| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 903.159    | 59.28       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1805.700   | 70.18       | N/A         | 34.76       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2781.669   | 48.65       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 3375.123   | 44.84       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 4489.362   | 45.60       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 7967.994   | 45.41       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

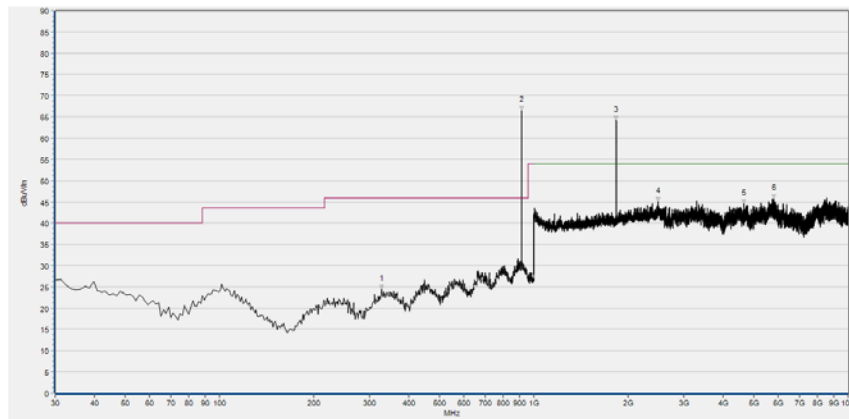
(30MHz to 10GHz, Antenna Horizontal, 200kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 352.929    | 24.80       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | N/A     |
| 902.879    | 69.36       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 1805.700   | 54.69       | N/A         | 32.94       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 2496.279   | 44.04       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 3762.684   | 43.76       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 8615.276   | 47.48       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

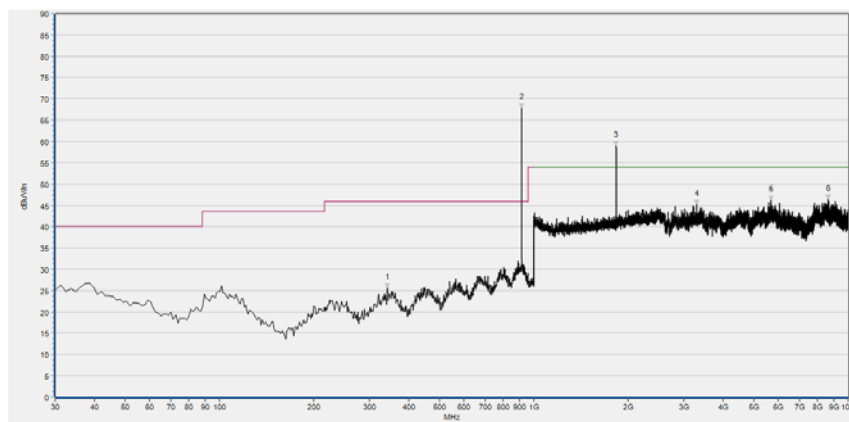
(30MHz to 10GHz, Antenna Vertical, 200kbps)

### Plot for Channel = 32



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 328.648    | 24.45       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | PASS    |
| 915.019    | 66.49       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1829.700   | 64.32       | N/A         | 35.56       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2483.473   | 45.03       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 4653.537   | 44.55       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 5794.690   | 45.80       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

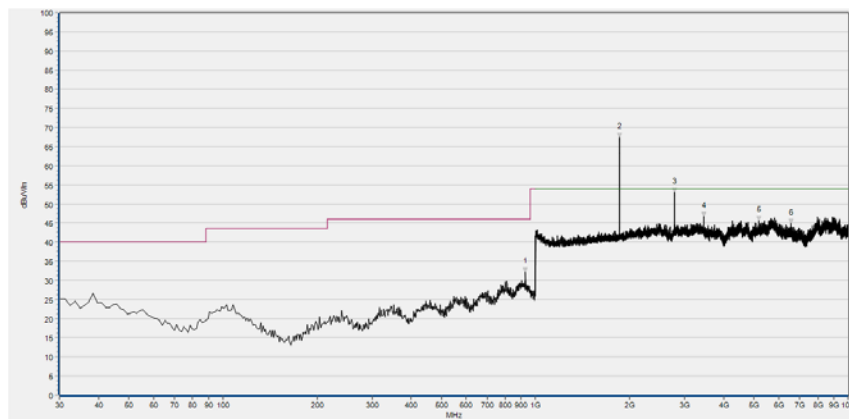
(30MHz to 10GHz, Antenna Horizontal, 200kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 342.003    | 25.68       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 915.019    | 67.93       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | N/A     |
| 1830.400   | 57.67       | N/A         | 33.74       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 3297.072   | 45.26       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 5687.034   | 46.23       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 8623.350   | 46.50       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

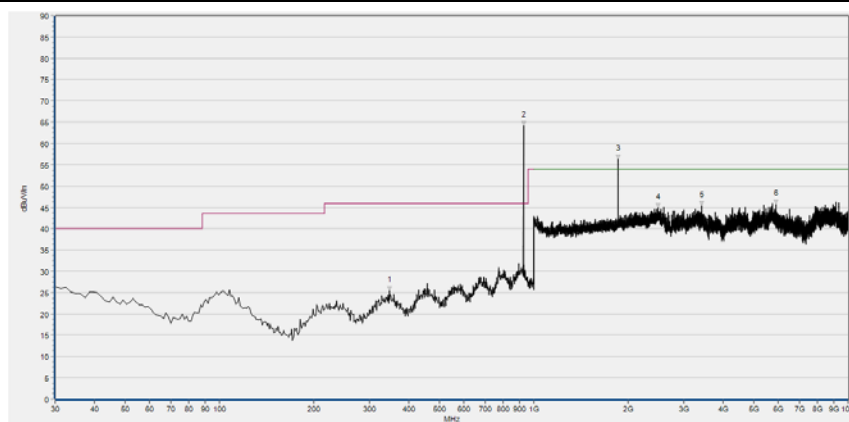
(30MHz to 10GHz, Antenna Vertical, 200kbps)

### Plot for Channel = 63



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna    | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|------------|---------|
| 928.373    | 32.25       | N/A         | N/A         | N/A               | 46.00             | N/A               | Horizontal | N/A     |
| 1853.600   | 67.87       | N/A         | 37.17       | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 2780.324   | 52.98       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 3455.865   | 46.74       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 5181.051   | 45.70       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |
| 6557.701   | 44.88       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Horizontal | PASS    |

(30MHz to 10GHz, Antenna Horizontal, 200kbps)



| Fre. (MHz) | Pk (dBμV/m) | QP (dBμV/m) | AV (dBμV/m) | Limit-PK (dBμV/m) | Limit-QP (dBμV/m) | Limit-AV (dBμV/m) | Antenna  | Verdict |
|------------|-------------|-------------|-------------|-------------------|-------------------|-------------------|----------|---------|
| 346.859    | 25.46       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | PASS    |
| 927.159    | 64.20       | N/A         | N/A         | N/A               | 46.00             | N/A               | Vertical | N/A     |
| 1853.600   | 55.90       | N/A         | 32.49       | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 2482.193   | 44.89       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 3426.259   | 45.40       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |
| 5879.469   | 45.81       | N/A         | N/A         | 74.00             | N/A               | 54.00             | Vertical | PASS    |

(30MHz to 10GHz, Antenna Vertical, 200kbps)

## Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

| Test items         | Uncertainty         |
|--------------------|---------------------|
| Radiated Emission  | $\pm 2.95\text{dB}$ |
| Conducted Emission | $\pm 2.44\text{dB}$ |

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$



## Annex B Testing Laboratory Information

### 1. Identification of the Responsible Testing Laboratory

|                            |                                                                                                                                  |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Laboratory Name:</b>    | Shenzhen Morlab Communications Technology Co., Ltd.<br>Morlab Laboratory                                                         |
| <b>Laboratory Address:</b> | FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China |
| <b>Telephone:</b>          | +86 755 36698555                                                                                                                 |
| <b>Facsimile:</b>          | +86 755 36698525                                                                                                                 |

### 2. Identification of the Responsible Testing Location

|                 |                                                                                                                                  |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Name:</b>    | Shenzhen Morlab Communications Technology Co., Ltd.<br>Morlab Laboratory                                                         |
| <b>Address:</b> | FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China |

### 3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.



#### 4. Test Equipments Utilized

##### 4.1 Conducted Emission Test Equipments

| Equipment Name                      | Serial No. | Type            | Manufacturer | Cal. Date  | Cal. Due   |
|-------------------------------------|------------|-----------------|--------------|------------|------------|
| Receiver                            | MY56400093 | N9038A          | KEYSIGHT     | 2019.05.08 | 2020.05.09 |
| LISN                                | 812744     | NSLK<br>8127    | Schwarzbeck  | 2019.05.08 | 2020.05.09 |
| Pulse Limiter<br>(20dB)             | 9391       | VTSD<br>9561-D  | Schwarzbeck  | 2019.05.08 | 2020.05.09 |
| Coaxial cable(BNC)<br>(30MHz-26GHz) | CB01       | EMC01           | Morlab       | N/A        | N/A        |
| PC                                  | OB68192 JS | T430i           | Lenovo       | NA         | NA         |
| Adapter                             | NA         | ADLX90N<br>CT3A | Lenovo       | NA         | NA         |

##### 4.2 List of Software Used

| Description      | Manufacturer | Software Version |
|------------------|--------------|------------------|
| MORLAB EMCR V1.2 | MORLAB       | V1.0             |

**4.3 Radiated Test Equipments**

| <b>Equipment Name</b>                | <b>Serial No.</b> | <b>Type</b>           | <b>Manufacturer</b> | <b>Cal. Date</b> | <b>Cal. Due</b> |
|--------------------------------------|-------------------|-----------------------|---------------------|------------------|-----------------|
| Receiver                             | MY54130016        | N9038A                | Agilent             | 2019.07.26       | 2020.07.25      |
| Test Antenna - Bi-Log                | 9163-520          | VULB 9163             | Schwarzbeck         | 2019.05.08       | 2020.05.09      |
| Test Antenna - Loop                  | 1520-022          | FMZB1520              | Schwarzbeck         | 2019.02.15       | 2020.02.14      |
| Test Antenna – Horn                  | 01774             | BBHA 9120D            | Schwarzbeck         | 2019.07.26       | 2020.07.25      |
| Test Antenna – Horn                  | BBHA9170 #774     | BBHA9170              | Schwarzbeck         | 2019.07.26       | 2020.07.25      |
| Coaxial cable (N male) (9KHz-30MHz)  | CB04              | EMC04                 | Morlab              | N/A              | N/A             |
| Coaxial cable (N male) (30MHz-26GHz) | CB02              | EMC02                 | Morlab              | N/A              | N/A             |
| Coaxial cable (N male) (30MHz-26GHz) | CB03              | EMC03                 | Morlab              | N/A              | N/A             |
| 1-18GHz pre-Amplifier                | MA02              | TS-PR18               | Rohde& Schwarz      | 2019.05.08       | 2020.05.09      |
| 18-26.5GHz pre-Amplifier             | MA03              | TS-PR18               | Rohde& Schwarz      | 2019.05.08       | 2020.05.09      |
| Notch Filter                         | N/A               | WRCG-2400-2483.5-60SS | Wainwright          | 2018.12.01       | 2019.11.30      |
| Anechoic Chamber                     | N/A               | 9m*6m*6m              | CRT                 | 2017.11.19       | 2020.11.18      |

————— END OF REPORT —————