Certificate Number: 2861.01

# TEST REPORT

| | | | |
|---|---|---|---|
| **Report No.:** | **E20190319559202-1** | **Application No.:** | **E20190319559202** |
| **Applicant:** | GEMMY INDUSTRIES (HK)LIMITED BVI | | |
| **Address:** | No.301 on 3rd Floor, East Ocean Centre,No.98 Granville Road,Kowloon,Hong Kong | | |
| **Sample Description:** | Wireless Remote Controller | | |
| **Model:** | 5002019 | | |
| **Adding Model:** | / | | |
| **FCC ID:** | GPO5002019 | | |
| **Test Specification:** | FCC 47 CFR Part 15 Subpart C | | |
| **Test Date:** | 2019-03-28 to 2019-04-01 | | |
| **Issue Date:** | 2019-04-15 | | |
| **Test Result:** | **PASS** | | |

| **Prepared By:** | **Reviewed By:** | **Approved By:** |
|---|---|---|
| Darry Wu / Test Engineer | Eve Wang /Technical Manager | Tony Han / Manager |
| Date: 2019-04-15 | Date: 2019-04-15 | Date: 2019-04-15 |

| **Other Aspects:** |
|---|
| / |
| **Abbreviations:** *ok / P = passed; fail / F = failed; n.a. / N = not applicable* |

**The test result in this test report refers exclusively to the presented test sample. This report shall not be reproduced except in full, without the written approval of GRGT.**

# DIRECTIONS OF TEST

1. This company carries out test task according to the national regulation of verifications which can be traced to National Primary Standards and BIPM.

2. The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

3. If there is any objection concerning the test, the client should inform the laboratory within 15 days from the date of receiving the test report.

# TABLE OF CONTENTS

# 1. TEST RESULT SUMMARY

| FCC Part 15.249 | | | |
|---|---|---|---|
| **Standard** | **Item** | **Limit / Severity** | **Result** |
| FCC Part 15,Subpart C (15.249) | Antenna Requirement | §15.203 | PASS |
| | Conducted Emissions | §15.207 (a) | N/A[1)] |
| | Radiated Spurious Emission | §15.249(d) | PASS |
| | 20 dB Bandwidth | N/A | PASS |
| | Duty Cycle | N/A | PASS |
| | Restricted bands of operation | §15.205 | PASS |

Note 1): The EUT power is DC 3V.

# 2. GENERAL DESCRIPTION OF EUT

## 2.1 APPLICANT

| | |
|---|---|
| Name: | GEMMY INDUSTRIES (HK)LIMITED BVI |
| Address: | No.301 on 3rd Floor, East Ocean Centre, No.98 Granville Road, Kowloon, Hong Kong |

## 2.2 MANUFACTURER

| | |
|---|---|
| Name: | GEMMY INDUSTRIES (HK)LIMITED BVI |
| Address: | No.301 on 3rd Floor, East Ocean Centre, No.98 Granville Road, Kowloon, Hong Kong |

## 2.3 FACTORY

| | |
|---|---|
| Factory 1 | |
| Name : | ZAIXING ELECTRONIC (SHENZHEN)CO., LTD. |
| Address : | 3#, 1st Road Yang Yong, Shapu Community, Songgang, Baoan District, Shenzhen City, Guangdong Province, China. |
| Factory 2 | |
| Name : | DynaTech Co. Ltd |
| Address : | 259-261 Xincheng Road, Qiaotou Town, Dongguan, Guangdong, China |
| Factory 3 | |
| Name : | YUAN HONG CO., LTD |
| Address : | No. 3, meichun A industrial zone, meichun fang, fumei city, Ba Ria Vung Tau Province, Vietnam. |

## 2.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

| | |
|---|---|
| Equipment: | Wireless Remote Controller |
| Model No.: | 5002019 |
| Adding Model | / |
| Trade Name: | / |
| Power supply | DC 3V Supply by the Cell |
| Frequency Range | 2407MHz~2477MHz |
| Antenna Specification: | PCB antenna with 0dBi gain (Max) |
| Modulation type: | GFSK |
| Temperature Range: | -20~70℃ |
| Hardware Version: | 115000-USA（V1） |
| Software | 115000-USA（V1） |

Version:

Note: /

## 2.5 TEST OPERATION MODE

| Test Item | Mode No. | Description of the modes |
|---|---|---|
| Conducted Emission | 1 | / |
| Radiated Emission | 1 | Continuously Transmitting |

## 2.6 LOCAL SUPPORTIVE

| Name of Equipment | Manufacturer | Model | Serial Number | Note |
|---|---|---|---|---|
| / | / | / | / | / |
| **Cable** | | | | |
| / | / | / | / | / |

Test software:

| Software version | Test level |
|---|---|
| / | 3 |

# 3. LABORATORY AND ACCREDITATIONS

## 3.1 LABORATORY

The tests and measurements refer to this report were performed by EMC Laboratory of GRG METROLOGY & TEST (SHENZHEN) CO., LTD

Add. : No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China

Telephone : +86-755-61180008

Fax : /

## 3.2 ACCREDITATIONS

| | |
|---|---|
| A2LA | Certificate Number 2861.01 |

## 3.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | | Frequency | Uncertainty |
|---|---|---|---|
| Radiated Emission | Horizontal | 30MHz～1000MHz | 4.8dB |
| | | 1GHz～26.5GHz | 5.8dB |
| | Vertical | 30MHz～1000MHz | 4.8dB |
| | | 1GHz～26.5GHz | 5.9dB |

This uncertainty represents an expanded uncertainty factor of *k*=2.

# 4. LIST OF USED TEST EQUIPMENT AT GRGT

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| **Radiated Spurious Emission& Restricted bands of operation** | | | | |
| ESPI Test Receiver | ROHDE&SCHWARZ | ESPI | 101026 | 2020-01-09 |
| EXA signal analyzer | Agilent | N9010A | MY52221469 | 2020-01-10 |
| Bilog Antenna | Schwarzbeck | VULB 9160 | 9160-3401 | 2019-12-21 |
| Horn Antenna | Schwarzbeck | BBHA9120 | D286 | 2019-12-21 |
| Active Loop Antenna | COM-POWER | AL-130 | 121044 | 2019-12-27 |
| Amplifier | EM Electronics Corporation | EM330 | 060661 | 2019-12-21 |
| High Noise Amplifier | Agilent | 8449B | 3008A02060 | 2019-12-21 |
| Hygrothermograph | VICTOR | HTC-1 | NA | 2019-12-24 |
| Test SW | FARAD | EZ-EMC/ CCS-3A1-CE | | |
| **20 dB Bandwidth** | | | | |
| EXA signal analyzer | Agilent | N9010A | MY52221469 | 2020-01-10 |
| **Duty cycle** | | | | |
| EXA signal analyzer | Agilent | N9010A | MY52221469 | 2020-01-10 |

# 5. ANTENNA REQUIREMENT

The EUT has two antennas. The antennas are PCB antennas.
The max gain of antenna is 0 dBi.which accordance 15.203.is considered sufficient to comply with the provisions of this section

# 6. RADIATED SPURIOUS EMISSIONS

## 6.1 LIMITS

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency | Field Strength of Fundamental Field Strength (mV/m) | Field Strength of Harmonics (μV/m) |
|---|---|---|
| 902-928 MHz | 50 | 500 |
| 2400 - 2483.5 MHz | 50 | 500 |
| 5725 - 5875 MHz | 50 | 500 |
| 24.0 - 24.25 GHz | 250 | 2500 |

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 (μV/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 |

## 6.2 TEST PROCEDURES (please refer to measurement standard)

**1) Sequence of testing 9 kHz to 30 MHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

**Pre measurement:**

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

**Final measurement:**

--- Identified emissions during the pre measurement the software maximizes by rotating the turntable position (0 °to 360 °) and by rotating the elevation axes (0 °to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

**2) Sequence of testing 30 MHz to 1 GHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

**Pre measurement:**

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement:**

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**3) Sequence of testing 1 GHz to 18 GHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

**Pre measurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

**Final measurement:**

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

**4) Sequence of testing above 18 GHz**
**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

**Pre measurement:**

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

**Final measurement:**

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

NOTE: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).

## 6.3 TEST SETUP

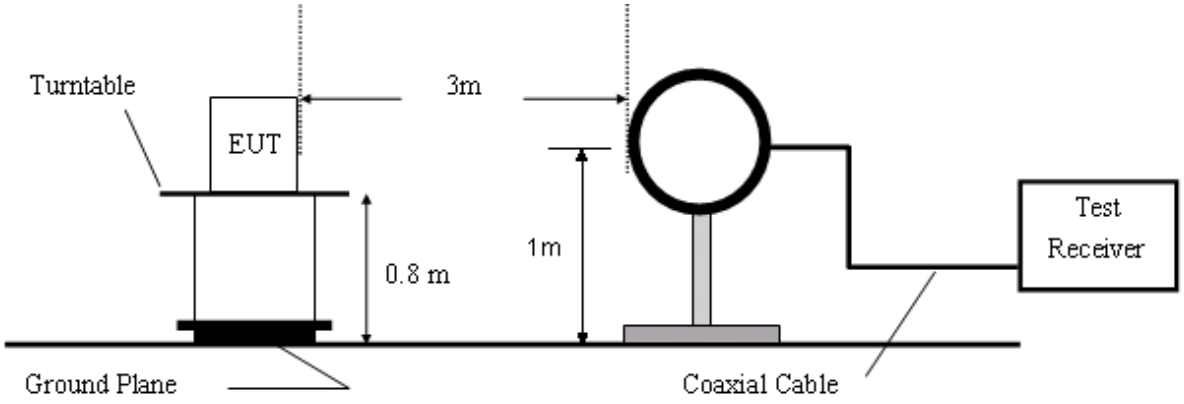



**Figure 1. 9KHz to 30MHz radiated emissions test configuration**

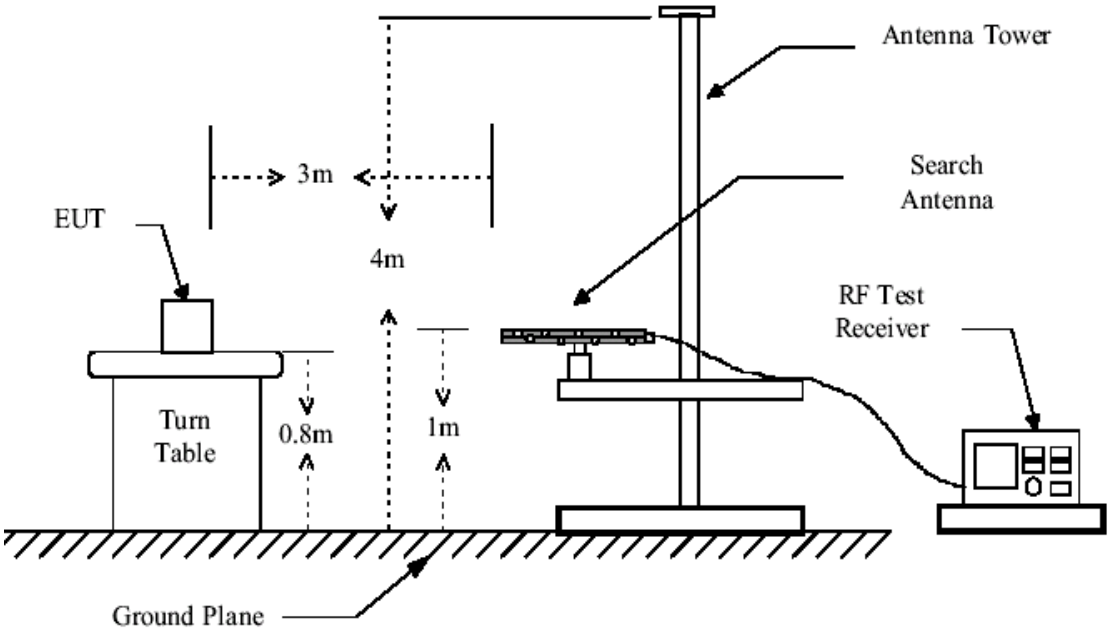



**Figure 2. 30MHz to 1GHz radiated emissions test configuration**

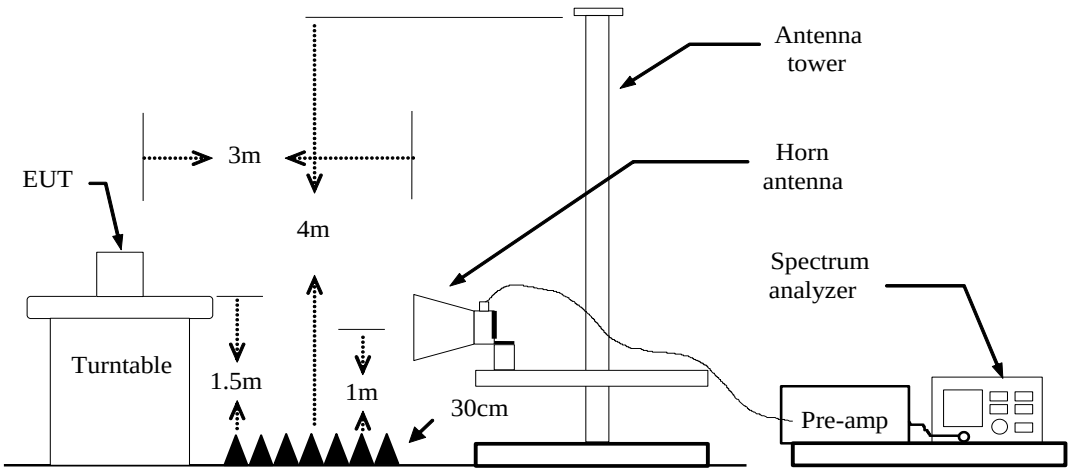



**Figure 3. Above 1GHz radiated emissions test configuration**

# 6.4 DATA SAMPLE

## 30MHz to 1GHz

| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| xxx | xxx | 37.06 | -15.48 | 21.58 | 40.00 | -18.42 | QP | Vertical |

## Above 1 GHz

| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| xxx | xxx | 65.45 | -11.12 | 54.33 | 74.00 | -19.67 | peak | Vertical |
| xxx | xxx | 63.00 | -11.12 | 51.88 | 54.00 | -2.12 | AVG | Vertical |

| | |
|---|---|
| Frequency (MHz) | = Emission frequency in MHz |
| Ant.Pol. (H/V) | = Antenna polarization |
| Reading (dBuV) | = Uncorrected Analyzer / Receiver reading |
| Correction Factor (dB/m) | = Antenna factor + Cable loss – Amplifier gain |
| Result (dBuV/m) | = Reading (dBuV) + Correction Factor (dB/m) |
| Limit (dBuV/m) | = Limit stated in standard |
| Margin (dB) | = Remark Result (dBuV/m) – Limit (dBuV/m) |
| Peak | = Peak Reading |
| QP | = Quasi-peak Reading |
| AVG | = Average Reading |

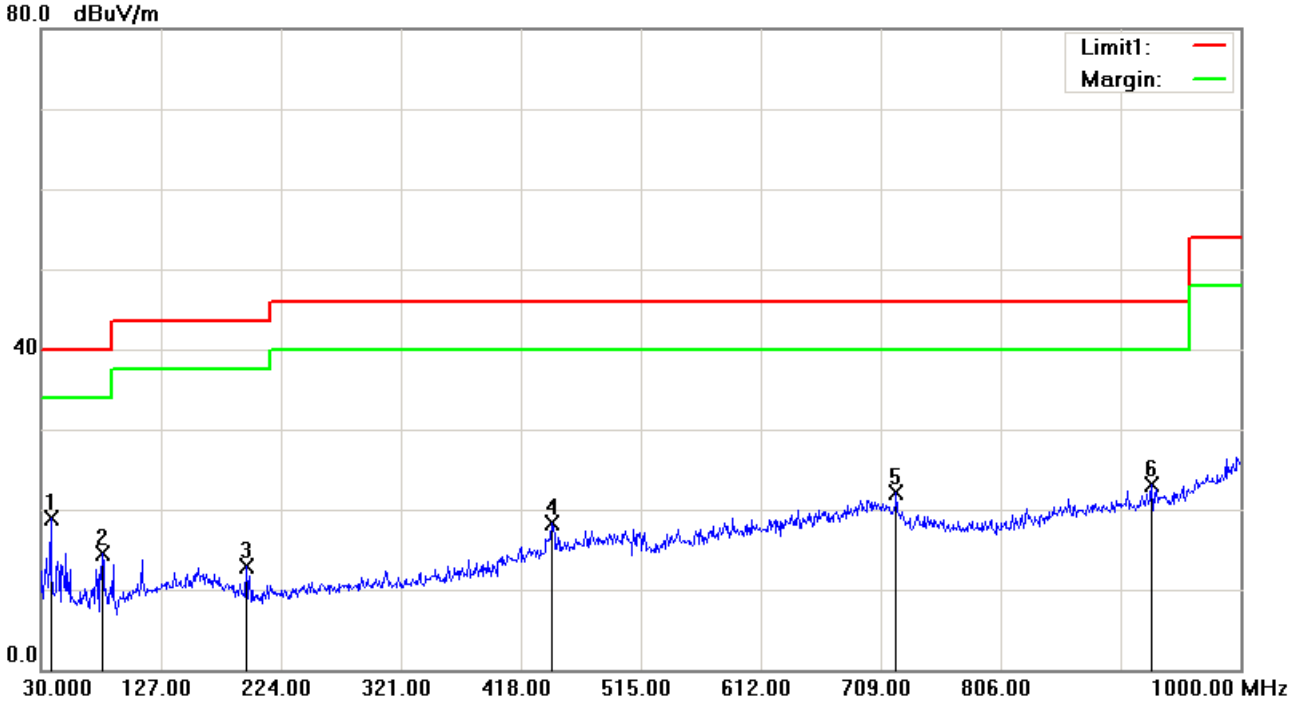
## 6.5 TEST RESULTS

**. 30MHz to 1GHz:**

Pre-scan all modes and recorded the worst case results in this report (Low Channel)

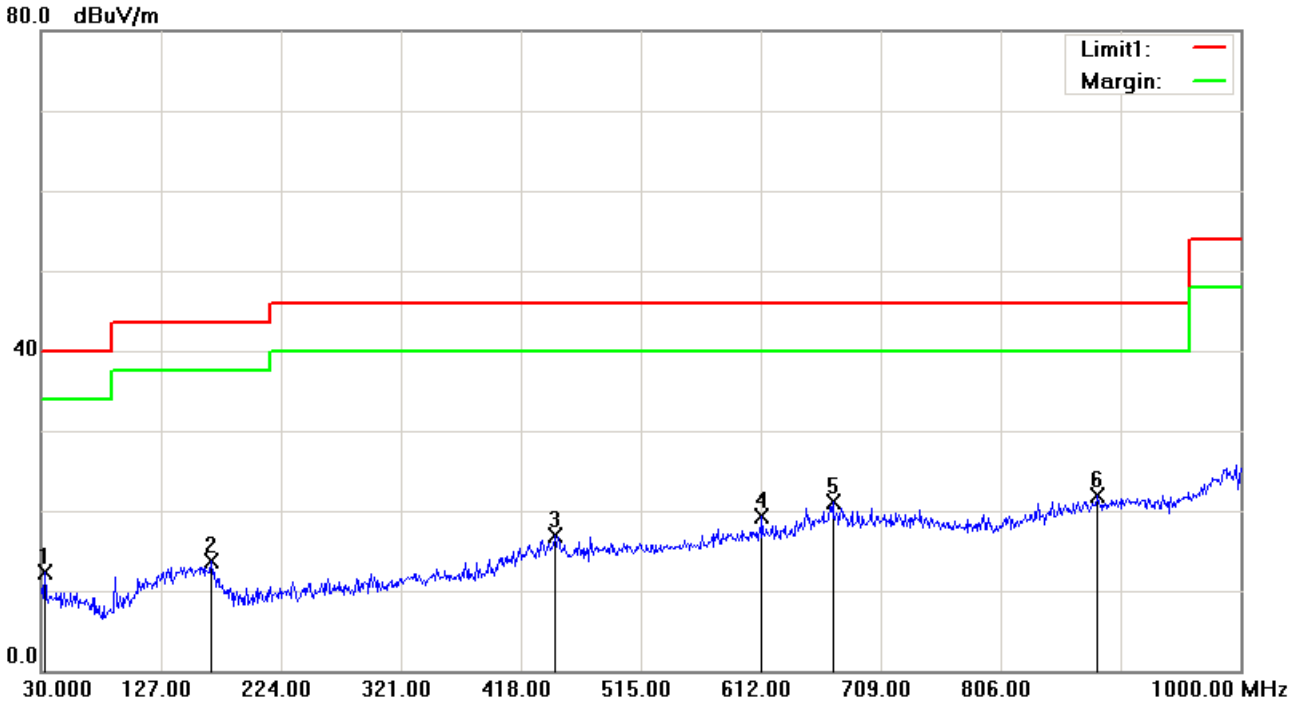
Mode: TX

Low channel (2407MHz) Date: Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 37.7600 | 36.61 | -17.61 | 19.00 | 40.00 | -21.00 | QP | Vertical |
| 2 | 79.4700 | 34.96 | -20.47 | 14.49 | 40.00 | -25.51 | QP | Vertical |
| 3 | 195.8700 | 30.92 | -18.02 | 12.90 | 43.50 | -30.60 | QP | Vertical |
| 4 | 443.2200 | 29.77 | -11.46 | 18.31 | 46.00 | -27.69 | QP | Vertical |
| 5 | 721.6100 | 28.75 | -6.61 | 22.14 | 46.00 | -23.86 | QP | Vertical |
| 6 | 928.2200 | 27.13 | -4.10 | 23.03 | 46.00 | -22.97 | QP | Vertical |

Mode: TX
Low channel (2407MHz) Date: Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 32.9100 | 29.90 | -17.53 | 12.37 | 40.00 | -27.63 | QP | Horizontal |
| 2 | 167.7400 | 29.11 | -15.39 | 13.72 | 43.50 | -29.78 | QP | Horizontal |
| 3 | 446.1300 | 28.21 | -11.33 | 16.88 | 46.00 | -29.12 | QP | Horizontal |
| 4 | 612.9700 | 27.52 | -8.22 | 19.30 | 46.00 | -26.70 | QP | Horizontal |
| 5 | 670.2000 | 28.15 | -7.09 | 21.06 | 46.00 | -24.94 | QP | Horizontal |
| 6 | 884.5700 | 26.37 | -4.52 | 21.85 | 46.00 | -24.15 | QP | Horizontal |

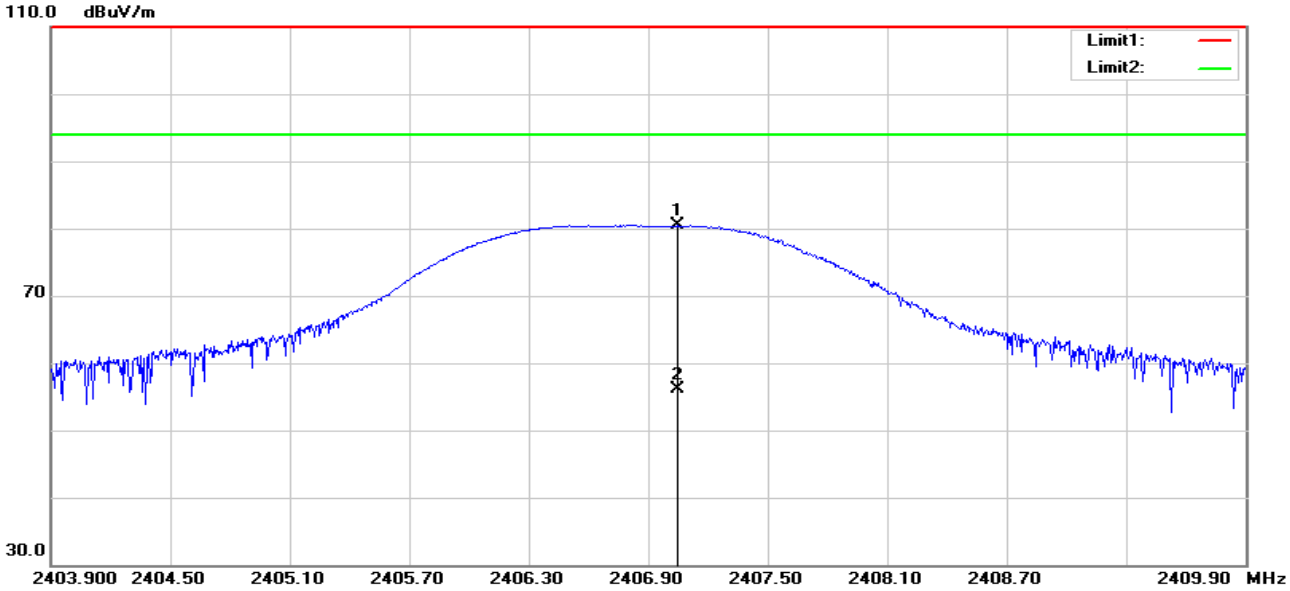
***Remark:***

1 No emission found between lowest internal used/generated frequency to 30MHz.
2 Only worst case recorded for radiated emissions below 1GHz.
3 Radiated emissions measured in frequency range from 9kHz to 1GHz were made with an instrument using peak/quasi-peak detector mode.
4 Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
5 Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

**Above 1GHz:**

Mode: TX

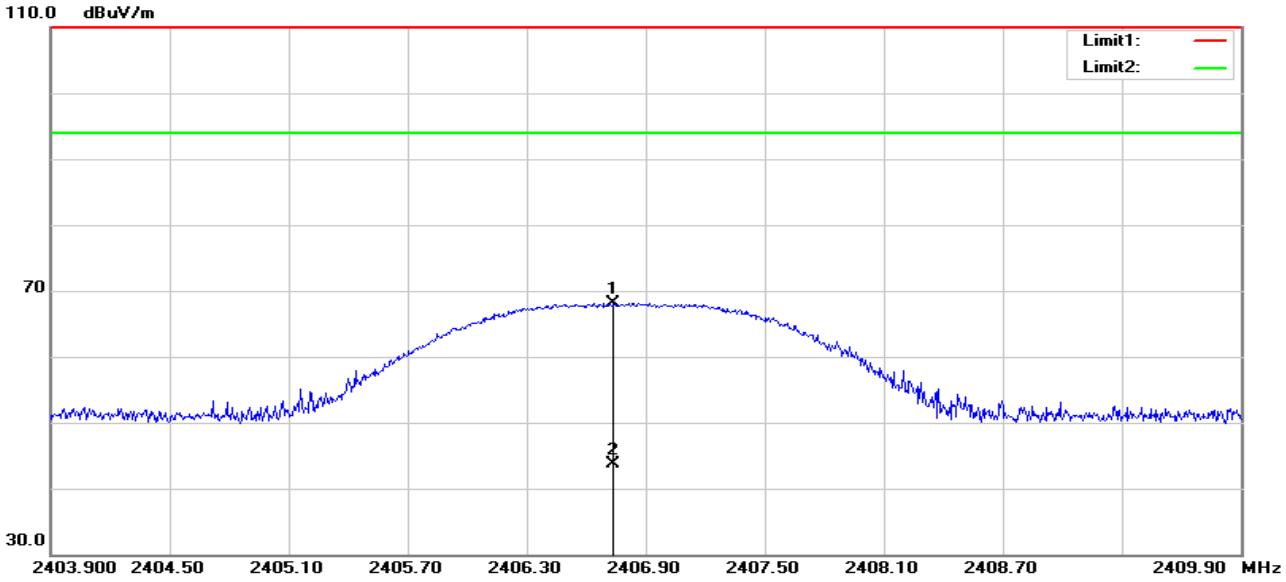
Lowest channel (2407MHz) Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2407.050 | 81.90 | -1.44 | 80.46 | 114.00 | -33.54 | peak | Vertical |
| 2 | 2407.050 | 57.46 | -1.44 | 56.02 | 94.00 | -37.98 | AVG | Vertical |

Mode: TX

Lowest channel (2407MHz) Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2406.738 | 69.51 | -1.44 | 68.07 | 114.00 | -45.93 | peak | Horizontal |
| 2 | 2406.738 | 45.07 | -1.44 | 43.63 | 94.00 | -50.37 | AVG | Horizontal |

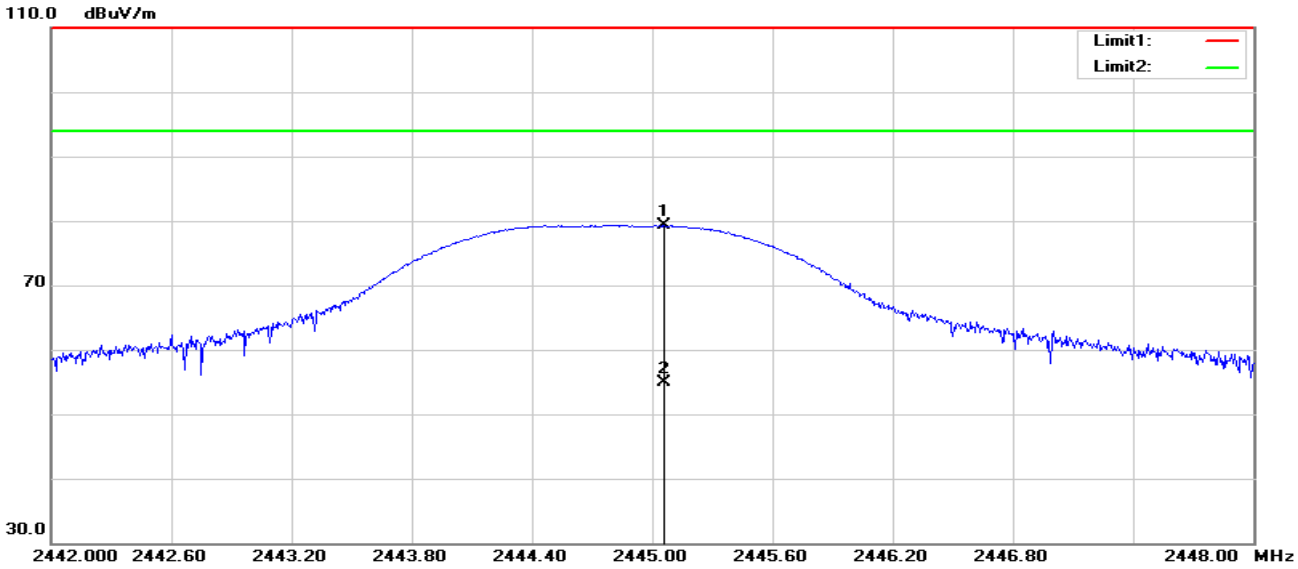
Remark: AVG result=Peak result-duty cycle

Mode: TX

Low channel (2407 MHz) Date: 2019-03-28

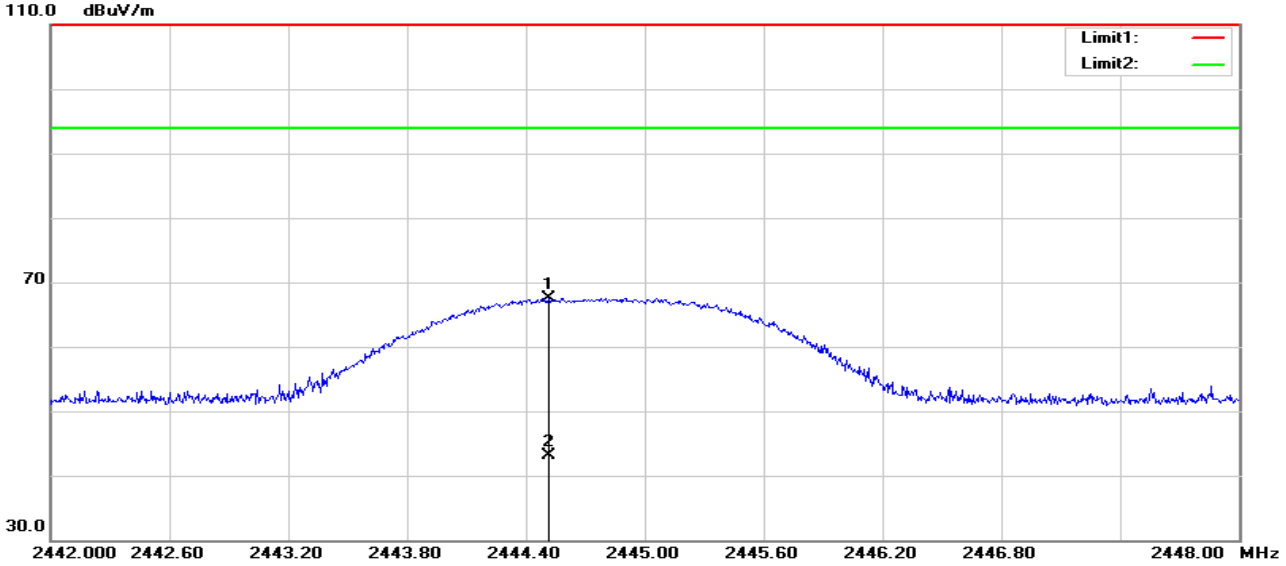
| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 1783.000 | 46.45 | -3.65 | 42.80 | 74.00 | -31.20 | peak | Vertical |
| 2 | 2539.000 | 45.65 | -1.07 | 44.58 | 74.00 | -29.42 | peak | Vertical |
| 3 | 3367.000 | 44.53 | 0.91 | 45.44 | 74.00 | -28.56 | peak | Vertical |
| 4 | 4600.000 | 42.63 | 2.48 | 45.11 | 74.00 | -28.89 | peak | Vertical |
| 5 | 7345.000 | 41.69 | 7.90 | 49.59 | 74.00 | -24.41 | peak | Vertical |
| 6 | 8173.000 | 42.07 | 9.09 | 51.16 | 74.00 | -22.84 | peak | Vertical |
| 7 | 2836.000 | 44.04 | 0.21 | 44.25 | 74.00 | -29.75 | peak | Horizontal |
| 8 | 3817.000 | 43.06 | 1.35 | 44.41 | 74.00 | -29.59 | peak | Horizontal |
| 9 | 4816.000 | 44.94 | 2.35 | 47.29 | 74.00 | -26.71 | peak | Horizontal |
| 10 | 5698.000 | 41.59 | 4.30 | 45.89 | 74.00 | -28.11 | peak | Horizontal |
| 11 | 6580.000 | 42.11 | 6.18 | 48.29 | 74.00 | -25.71 | peak | Horizontal |
| 12 | 7669.000 | 41.11 | 8.58 | 49.69 | 74.00 | -24.31 | peak | Horizontal |

Mode: TX
Middle channel (2445MHz) Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2445.060 | 80.66 | -1.36 | 79.30 | 114.00 | -34.70 | peak | Vertical |
| 2 | 2445.060 | 56.22 | -1.36 | 54.86 | 94.00 | -39.14 | AVG | Vertical |

Mode: TX
Middle channel (2445MHz) Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2444.514 | 68.89 | -1.36 | 67.53 | 114.00 | -46.47 | peak | Horizontal |
| 2 | 2444.514 | 44.45 | -1.36 | 43.09 | 94.00 | -50.91 | AVG | Horizontal |

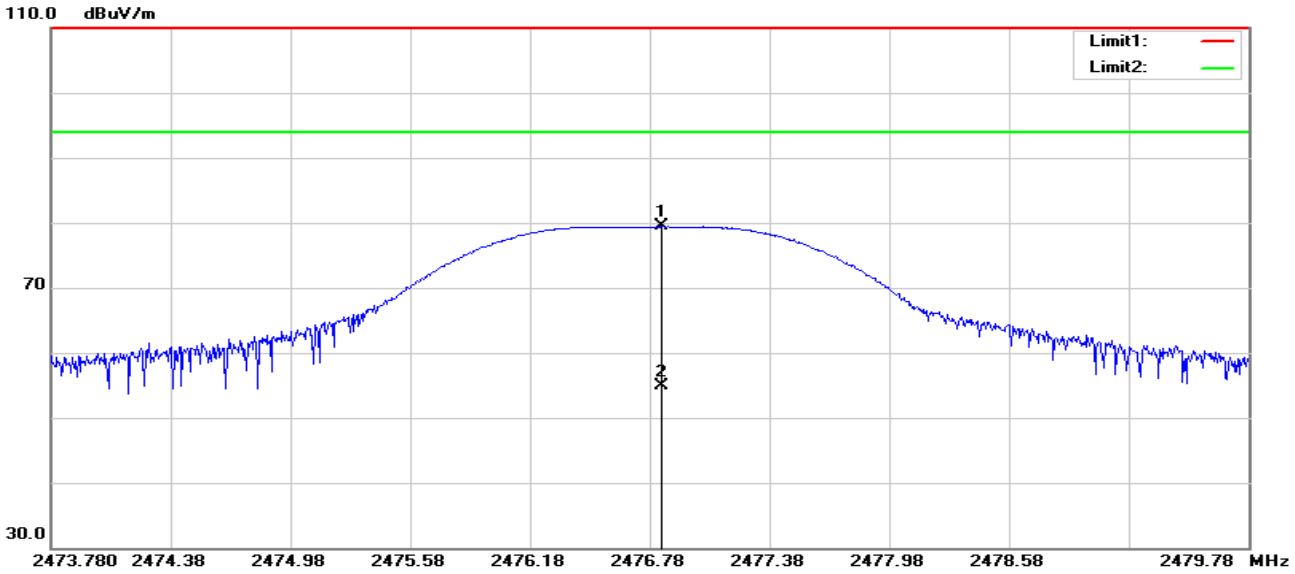
Remark: AVG result=Peak result-duty cycle

Mode: TX

Mid channel (2445 MHz) Date: 2019-03-28

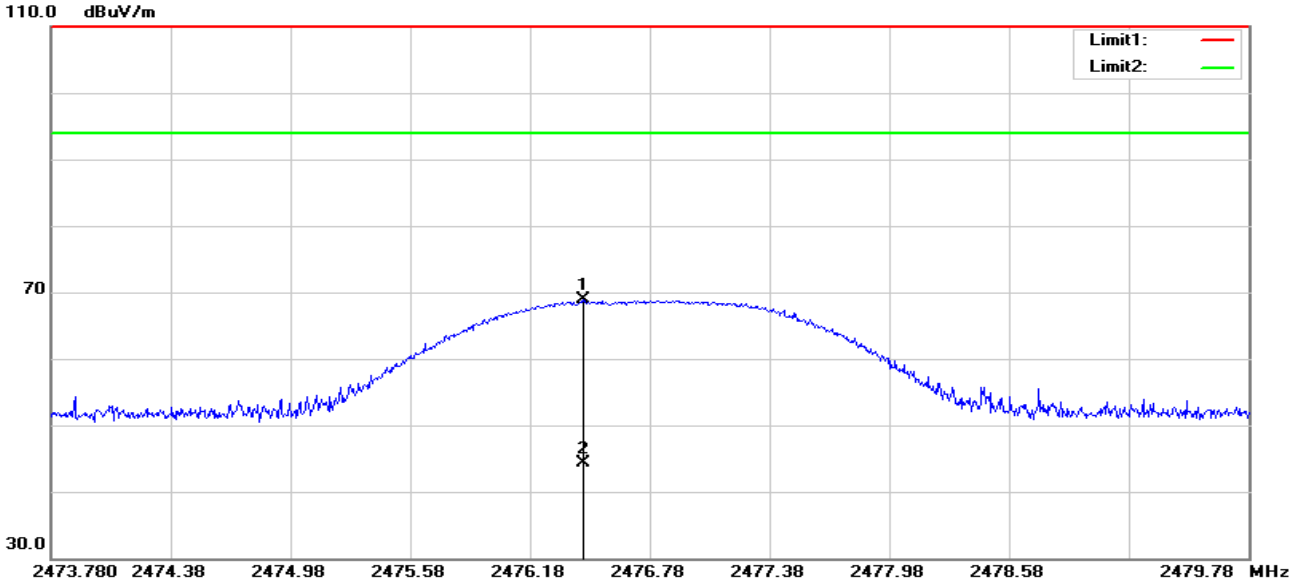
| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 1342.000 | 47.01 | -5.76 | 41.25 | 74.00 | -32.75 | peak | Vertical |
| 2 | 2107.000 | 45.87 | -2.10 | 43.77 | 74.00 | -30.23 | peak | Vertical |
| 3 | 2827.000 | 44.25 | 0.16 | 44.41 | 74.00 | -29.59 | peak | Vertical |
| 4 | 4204.000 | 42.24 | 1.98 | 44.22 | 74.00 | -29.78 | peak | Vertical |
| 5 | 6247.000 | 41.14 | 5.63 | 46.77 | 74.00 | -27.23 | peak | Vertical |
| 6 | 7489.000 | 40.98 | 8.25 | 49.23 | 74.00 | -24.77 | peak | Vertical |
| 7 | 1297.000 | 47.58 | -5.88 | 41.70 | 74.00 | -32.30 | peak | Horizontal |
| 8 | 2107.000 | 45.87 | -2.10 | 43.77 | 74.00 | -30.23 | peak | Horizontal |
| 9 | 2593.000 | 45.52 | -0.85 | 44.67 | 74.00 | -29.33 | peak | Horizontal |
| 10 | 3376.000 | 44.06 | 0.92 | 44.98 | 74.00 | -29.02 | peak | Horizontal |
| 11 | 4888.000 | 43.38 | 2.30 | 45.68 | 74.00 | -28.32 | peak | Horizontal |
| 12 | 8380.000 | 42.13 | 8.97 | 51.10 | 74.00 | -22.90 | peak | Horizontal |

Mode: TX
Highest channel (2477MHz) Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2476.840 | 80.73 | -1.30 | 79.43 | 114.00 | -34.57 | peak | Vertical |
| 2 | 2476.840 | 56.29 | -1.30 | 54.99 | 94.00 | -39.01 | AVG | Vertical |

Mode: TX
Highest channel (2477MHz) Date: 2019-03-28




| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2476.444 | 70.13 | -1.30 | 68.83 | 114.00 | -45.17 | peak | Horizontal |
| 2 | 2476.444 | 45.69 | -1.30 | 44.39 | 94.00 | -49.61 | AVG | Horizontal |

Remark: AVG result=Peak result-duty cycle

Mode: TX

High channel (2477 MHz) Date: 2019-03-28

| No. | Frequency (MHz) | Reading (dBuV/m) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2116.000 | 45.70 | -2.09 | 43.61 | 74.00 | -30.39 | peak | Vertical |
| 2 | 3079.000 | 43.92 | 0.91 | 44.83 | 74.00 | -29.17 | peak | Vertical |
| 3 | 3367.000 | 43.37 | 0.91 | 44.28 | 74.00 | -29.72 | peak | Vertical |
| 4 | 4591.000 | 42.32 | 2.49 | 44.81 | 74.00 | -29.19 | peak | Vertical |
| 5 | 6589.000 | 41.39 | 6.20 | 47.59 | 74.00 | -26.41 | peak | Vertical |
| 6 | 7948.000 | 41.47 | 9.10 | 50.57 | 74.00 | -23.43 | peak | Vertical |
| 7 | 1981.000 | 45.16 | -2.47 | 42.69 | 74.00 | -31.31 | peak | Horizontal |
| 8 | 3079.000 | 44.66 | 0.91 | 45.57 | 74.00 | -28.43 | peak | Horizontal |
| 9 | 4663.000 | 42.96 | 2.44 | 45.40 | 74.00 | -28.60 | peak | Horizontal |
| 10 | 4951.000 | 42.84 | 2.26 | 45.10 | 74.00 | -28.90 | peak | Horizontal |
| 11 | 7660.000 | 40.69 | 8.58 | 49.27 | 74.00 | -24.73 | peak | Horizontal |
| 12 | 9037.000 | 41.26 | 9.38 | 50.64 | 74.00 | -23.36 | peak | Horizontal |

***Remark:***

1 Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

2 Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.

3 Average test would be performed if the peak result were greater than the average limit or as required by the applicant.

4 Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5 Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

# 7. 20DB BANDWIDTH

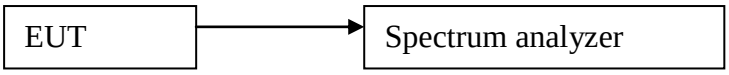
## 7.1 LIMITS

None: for reporting purpose only.

## 7.2 TEST PROCEDURES

1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer**.**
2) Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Span=6MHz, Sweep = auto.
3) Mark the peak frequency and 20dB (upper and lower) frequency.
4) Repeat above procedures until all frequencies measured were complete.

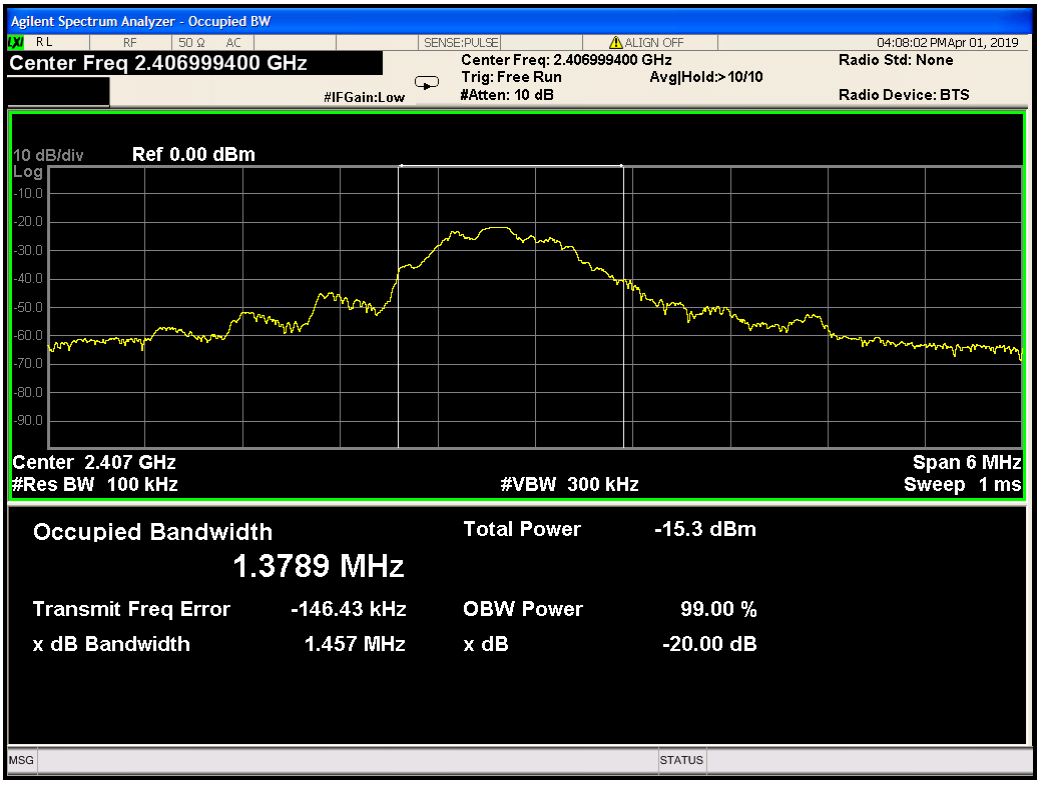
## 7.3 TEST SETUP



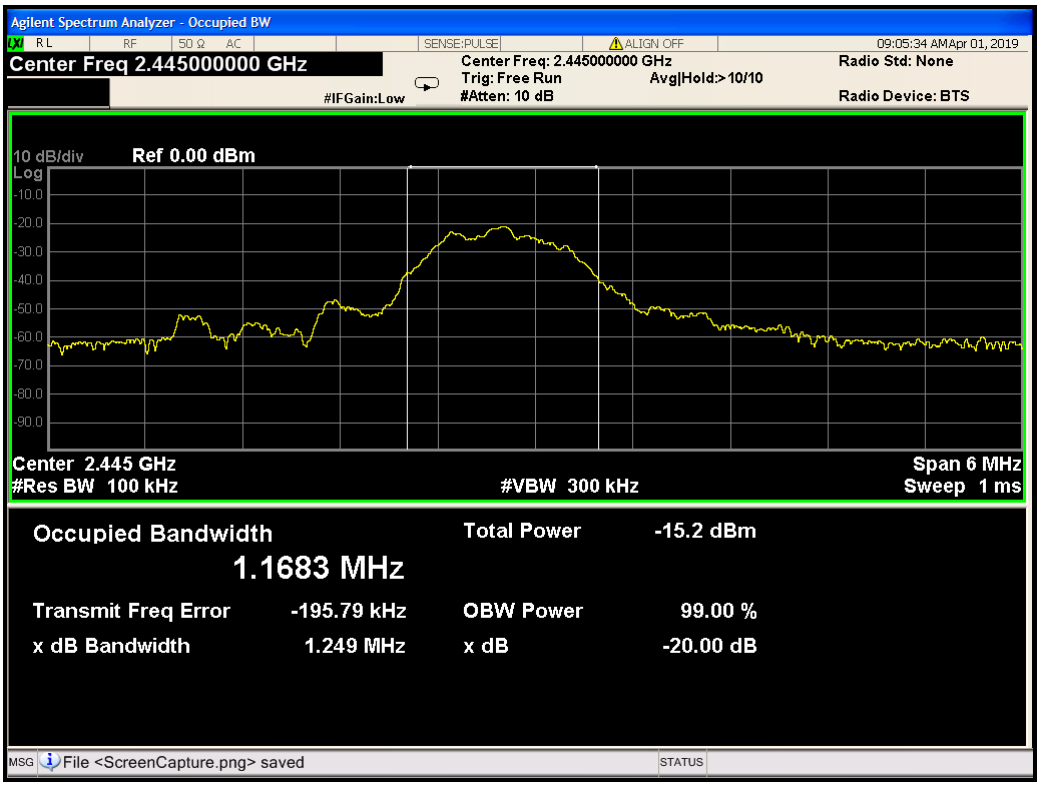

## 7.4 TEST RESULTS

| Channel | Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Test Result |
|---|---|---|---|---|
| Low | 2407 | 1457 | >500 | PASS |
| Mid | 2445 | 1249 | | PASS |
| High | 2477 | 1180 | | PASS |

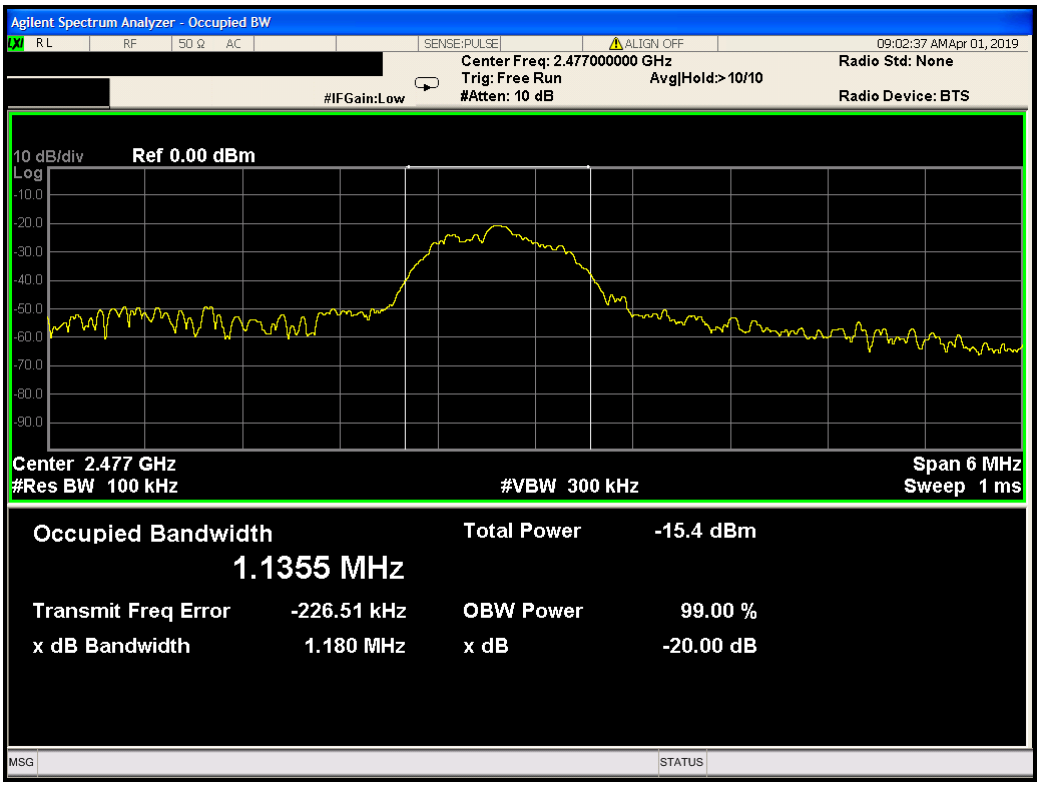
Channel 2407MHz




Channel 2445MHz



Channel 2477MHz



# 8. DUTY CYCLE

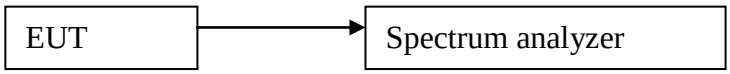
## 8.1 LIMITS

None: for reporting purpose only.

## 8.2 TEST PROCEDURES

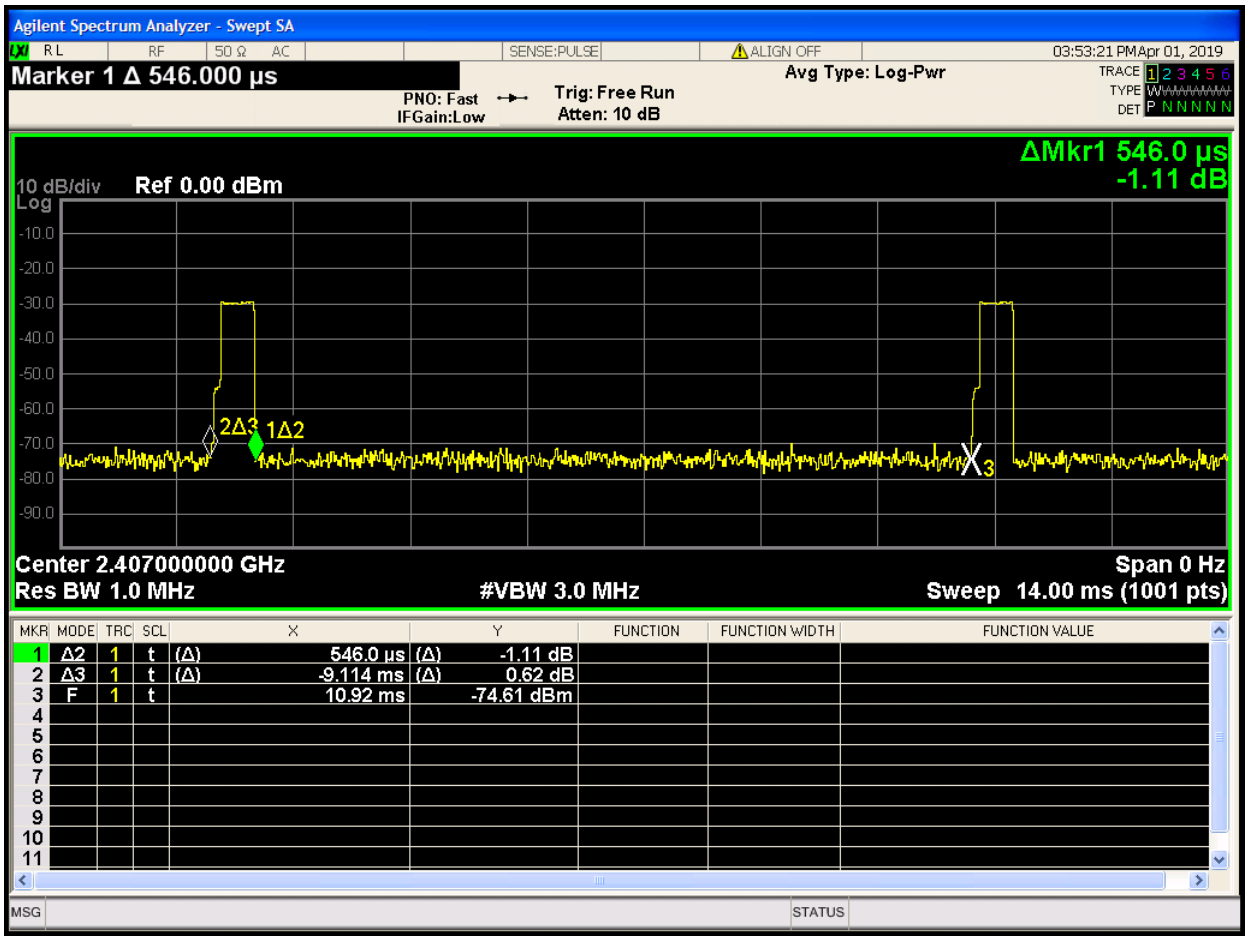
1) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an EMI Test Receiver.
2) Set center frequency of spectrum analyzer = operating frequency.
3) Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Adjust Sweep = 20ms
4) Only need to test one channel and record data

## 8.3 TEST SETUP




## 8.4 TEST RESULTS

20Log {1/[on/(on+off)]}= 20Log [1/(0.546/9.114)]=24.44dB



# 9. RESTRICTED BANDS OF OPERATION

## 9.1 LIMITS

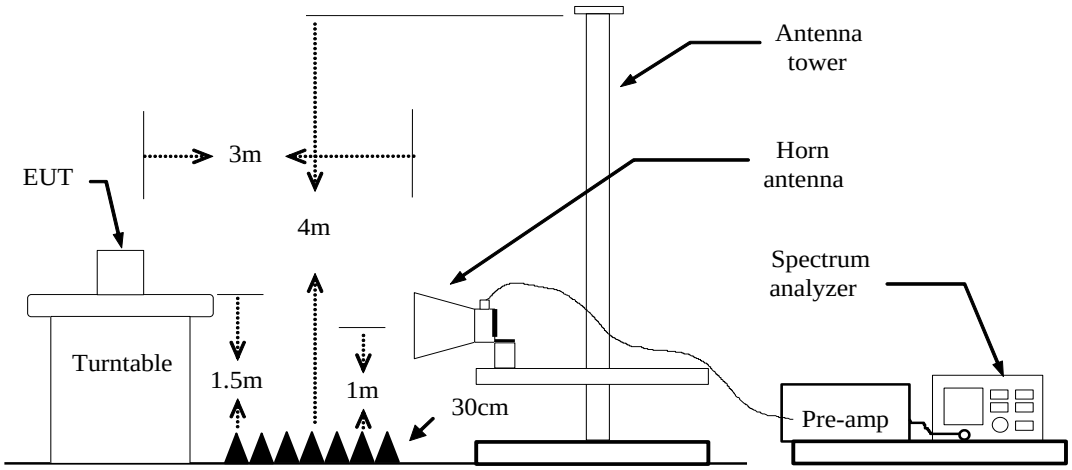
§15.205(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.69525 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 16.80425 - | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 16.80475 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 25.5 - 25.67 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 37.5 - 38.25 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 73 - 74.6 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 74.8 - 75.2 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 108 - 121.94 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 123 - 138 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 149.9 - 150.05 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 156.52475 - | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 156.52525 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - | 156.7 - 156.9 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.52025 | 162.0125 - 167.17 | 3600 - 4400 | |
| 12.57675 - | 167.72 - 173.2 | | |
| 12.57725 | 240 - 285 | | |
| 13.36 - 13.41 | 322 - 335.4 | | |

## 9.2 TEST PROCEDURES

1) The EUT is placed on a turntable, which is 1.5m above the ground plane.
2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4) Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   a) PEAK: RBW=1MHz / VBW=1MHz / Sweep=AUTO
   b) AVERAGE: RBW=1MHz / VBW=1/T / Sweep=AUTO
5) Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

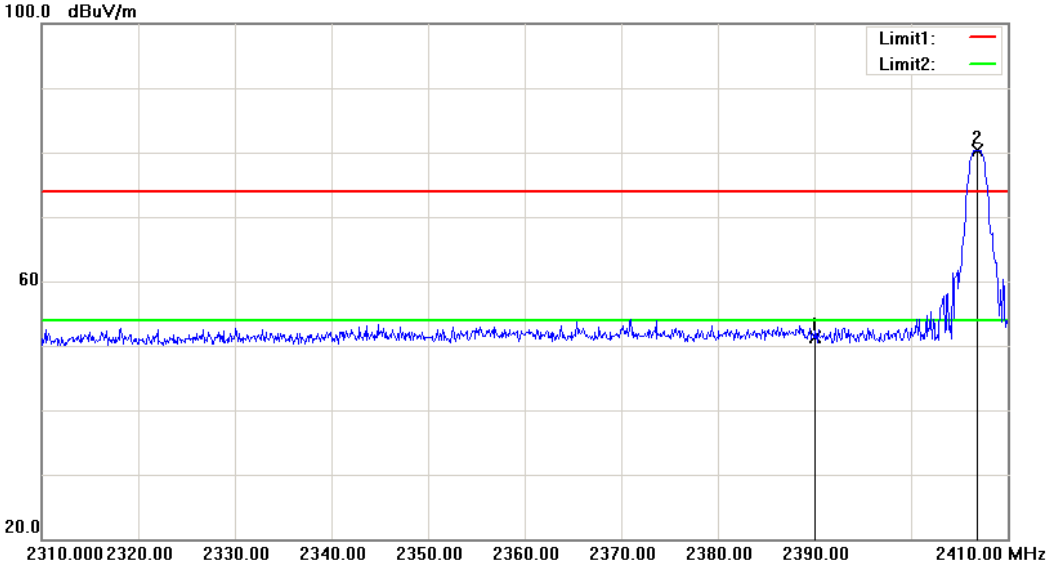
## 9.3 TEST SETUP



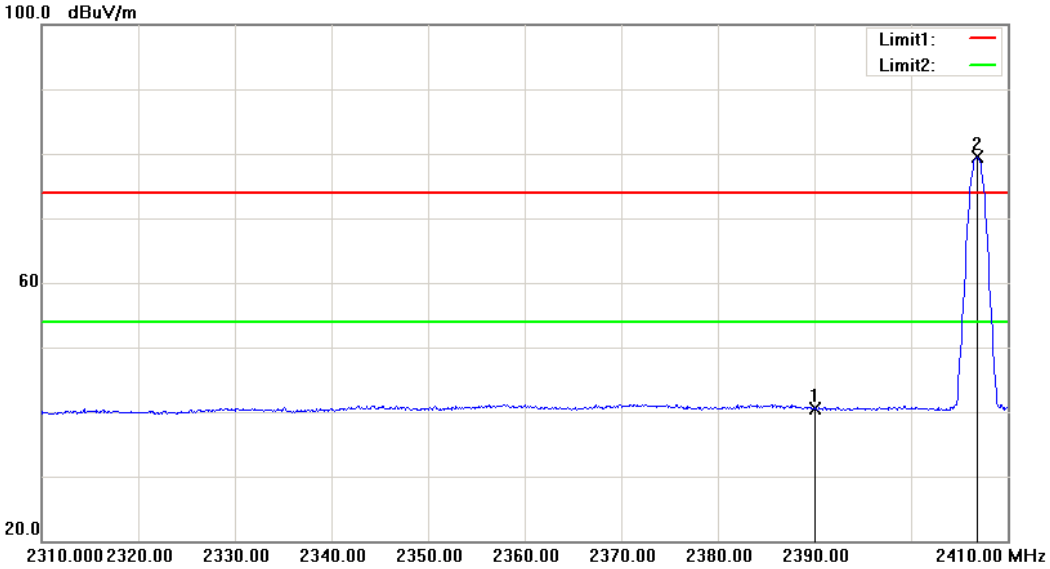
# 9.4 TEST RESULTS

## Channel Low

Detector mode: Peak Polarity: Vertical



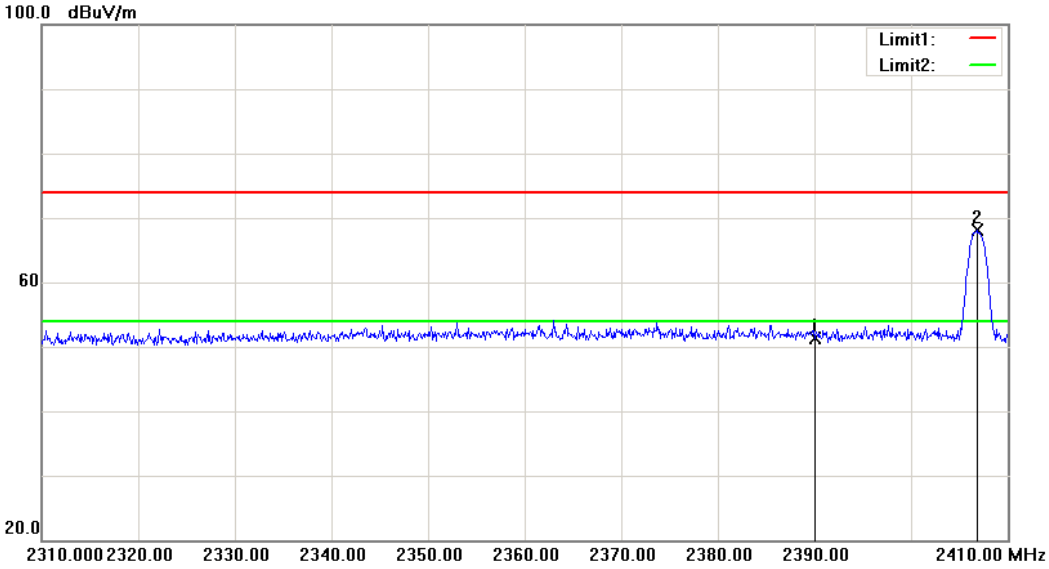

Detector mode: Average Polarity: Vertical



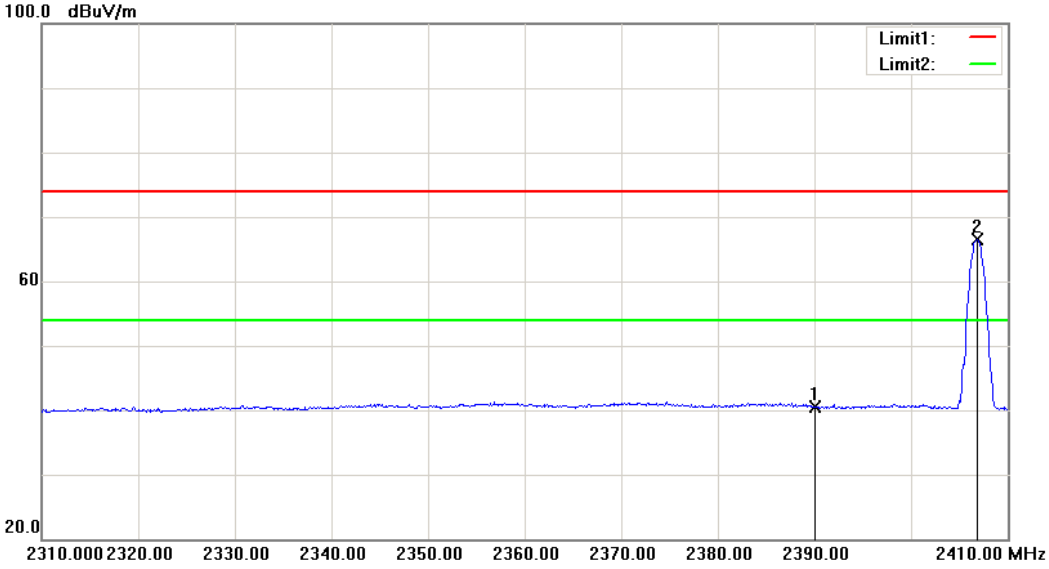

| No. | Frequency MHz | Reading dBuV | Factor dB | Result dBuV/m | Limit dBuV/m | Margin dB | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 52.82 | -1.48 | 51.34 | 74.00 | -22.66 | Peak | Vertical |
| 2 | 2406.800 | 81.81 | -1.44 | --- | 74.00 | --- | Peak | Vertical |
| 1 | 2390.000 | 41.89 | -1.48 | 40.41 | 54.00 | -13.59 | Average | Vertical |
| 2 | 2406.800 | 80.90 | -1.44 | --- | 54.00 | --- | Average | Vertical |

## Channel Low

Detector mode: Peak Polarity: Horizontal



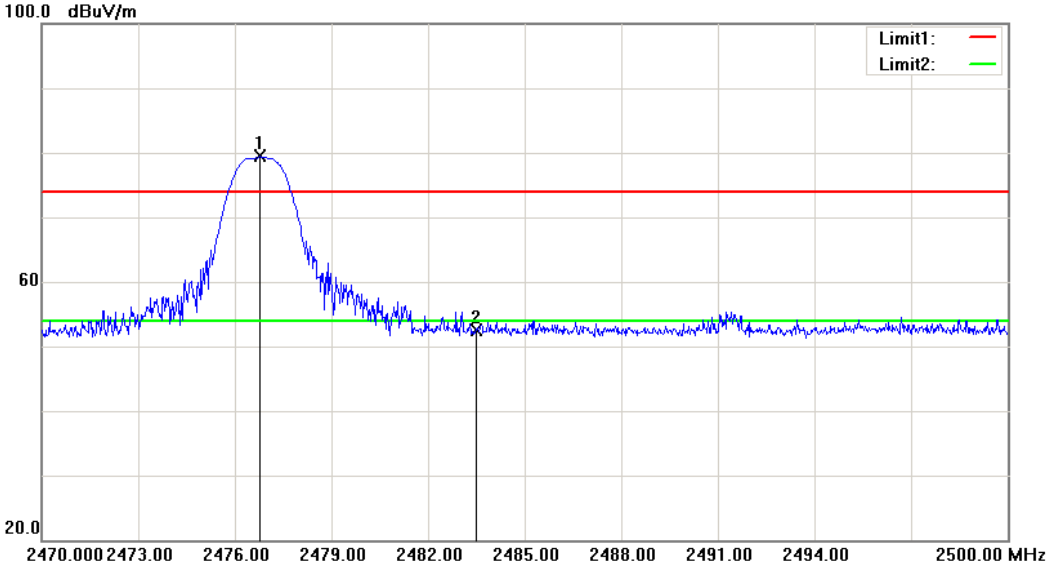

Detector mode: Average Polarity: Horizontal



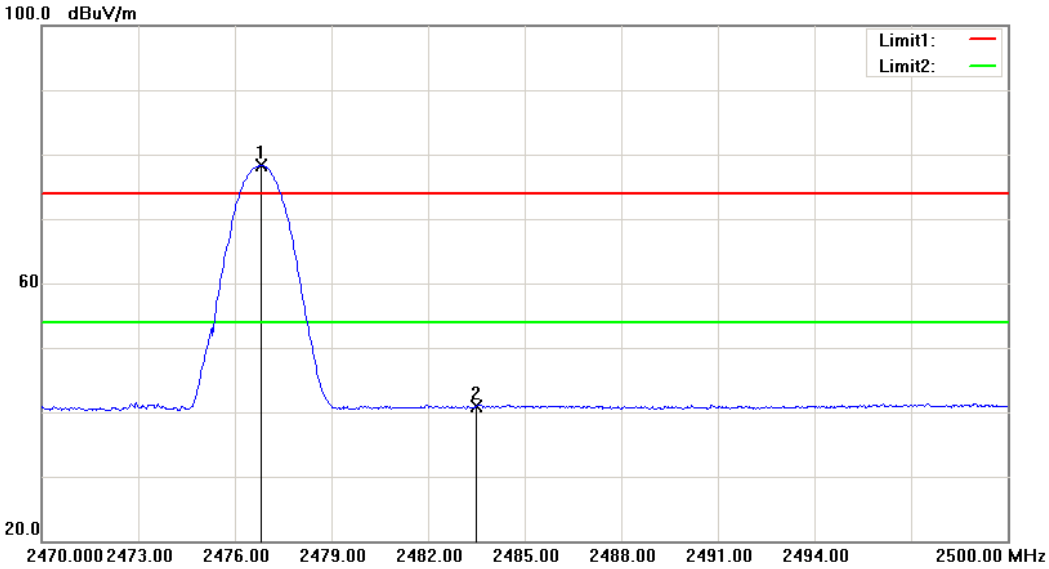

| No. | Frequency MHz | Reading dBuV | Factor dB | Result dBuV/m | Limit dBuV/m | Margin dB | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 52.69 | -1.48 | 51.21 | 74.00 | -22.79 | Peak | Horizontal |
| 2 | 2406.800 | 69.60 | -1.44 | 68.16 | 74.00 | -5.84 | Peak | Horizontal |
| 1 | 2390.000 | 42.06 | -1.48 | 40.58 | 54.00 | -13.42 | Average | Horizontal |
| 2 | 2406.800 | 67.89 | -1.44 | --- | 54.00 | --- | Average | Horizontal |

**Channel High**

Detector mode: Peak Polarity: Vertical



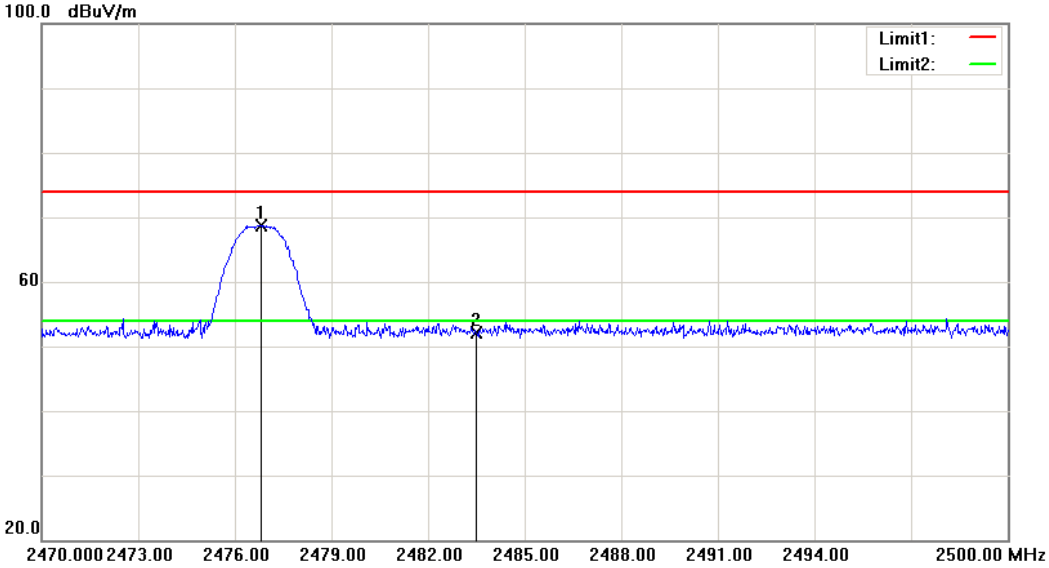

Detector mode: Average Polarity: Vertical



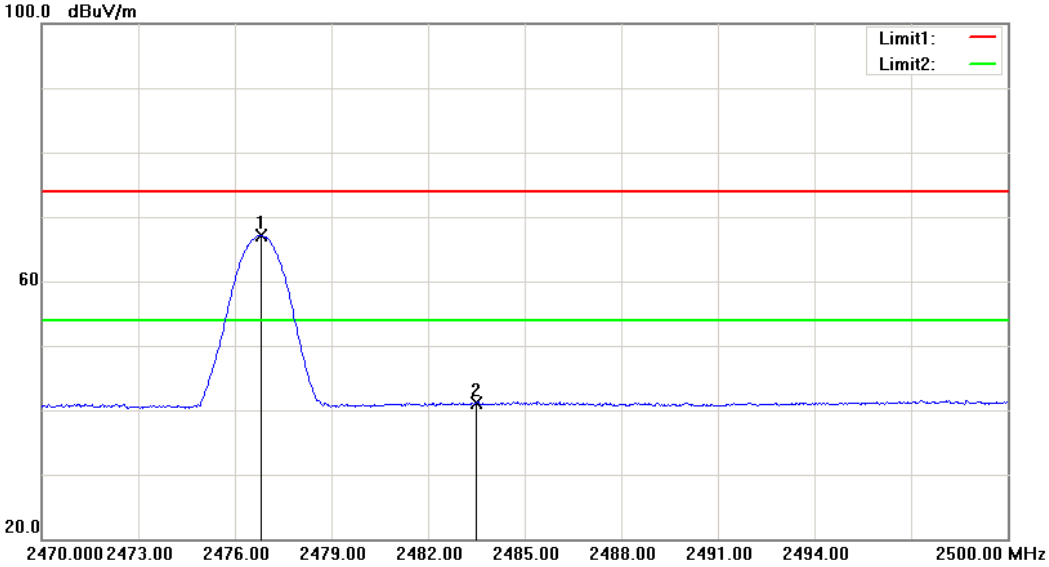

| No. | Frequency MHz | Reading dBuV | Factor dB | Result dBuV/m | Limit dBuV/m | Margin dB | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2476.780 | 80.71 | -1.30 | --- | 74.00 | --- | Peak | Vertical |
| 2 | 2483.500 | 53.72 | -1.27 | 52.45 | 74.00 | -21.55 | Peak | Vertical |
| 1 | 2476.810 | 79.60 | -1.30 | --- | 54.00 | --- | Average | Vertical |
| 2 | 2483.500 | 42.27 | -1.27 | 41.00 | 54.00 | -13.00 | Average | Vertical |

**Channel High**

Detector mode: Peak Polarity: Horizontal




Detector mode: Average Polarity: Horizontal




| No. | Frequency MHz | Reading dBuV | Factor dB | Result dBuV/m | Limit dBuV/m | Margin dB | Remark | Pole |
|---|---|---|---|---|---|---|---|---|
| 1 | 2476.810 | 70.09 | -1.30 | 68.79 | 74.00 | -5.21 | Peak | Horizontal |
| 2 | 2483.500 | 53.30 | -1.27 | 52.03 | 74.00 | -21.97 | Peak | Horizontal |
| 1 | 2476.810 | 68.39 | -1.30 | --- | 54.00 | --- | Average | Horizontal |
| 2 | 2483.500 | 42.36 | -1.27 | 41.09 | 54.00 | -12.91 | Average | Horizontal |

Remark: Max field strength in 3m distance. No any other emission which falls in restricted bands can be detected and be reported.