



Neutron Engineering Inc.

# FCC Radio TEST Report

## FCC ID: P5A-CL0019

This report concerns (check one):  Original Grant  Class II Change

Issued Date : Jan. 18, 2011  
Project No. : 1012C223  
Equipment : Wireless Laser Mouse  
Model Name : L281  
Applicant : Areson Technology Corporation  
Address : 11F,NO.646, SEC.5,CHONGSIN RD., SAN CHONG  
241, TAIPEI COUNTY, TAIWAN (R.O.C.)

**Tested by:**

Neutron Engineering Inc. EMC Laboratory

Date of Receipt: Dec. 31, 2010

**Date of Test:**

Dec. 31, 2010 ~ Jan. 17, 2011

Testing Engineer :

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### **Declaration**

**Neutron** represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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### **Limitation**

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.



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## 1. CERTIFICATION

Equipment : Wireless Laser Mouse

Brand Name : ARESON

Model Name. : L281

Applicant : Areson Technology Corporation

Factory : Dong Guan Hong Sheng Electronic Corp.

Address : No.28,Sha-Wu S.Ave., Sha-Wu, Tang-Xia, Dong-Guan, Guan-Dong, China

Date of Test : Dec. 31, 2010 ~ Jan. 17, 2011

Test Item : ENGINEERING SAMPLE

Standards : FCC Part15, Subpart C(15.249)/ ANSI C63.4 : 2003

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCP-1-1012C223) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP and TAF according to the ISO-17025 quality assessment standard and technical standard(s).



## 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| FCC Part15, Subpart C (15.249) |                            |          |         |
|--------------------------------|----------------------------|----------|---------|
| Standard Section               | Test Item                  | Judgment | Remark  |
| 15.207                         | Conducted Emission         | -        | Note(1) |
| 15.209                         | Radiated Emission          | PASS     |         |
| 15.249                         | Radiated Spurious Emission | PASS     |         |

**NOTE:**

- (1) "N/A" denotes test is not applicable in this Test Report
- (2) The EUT used new battery.



**2.1 TEST FACILITY**

The test facilities used to collect the test data in this report is **DG-C02/DG-CB03** at the location of No.3, Jinshagang 1st Road, ShiXia, Dalang Town, Dong Guan, China.523792  
 Neutron's test firm number is 319330

**2.2 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:

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95 %**.

**A. Conducted Measurement :**

| Test Site | Method | Measurement Frequency Range | U , (dB) | NOTE |
|-----------|--------|-----------------------------|----------|------|
| DG-C02    | CISPR  | 150 KHz ~ 30MHz             | 1.94     |      |

**B. Radiated Measurement :**

| Test Site | Method | Measurement Frequency Range | Ant. H / V | U , (dB) | NOTE |
|-----------|--------|-----------------------------|------------|----------|------|
| DG-CB03   | CISPR  | 30MHz ~ 200MHz              | V          | 2.48     |      |
|           |        | 30MHz ~ 200MHz              | H          | 2.16     |      |
|           |        | 200MHz ~ 1,000MHz           | V          | 2.50     |      |
|           |        | 200MHz ~ 1,000MHz           | H          | 2.66     |      |



**3. GENERAL INFORMATION**

**3.1 GENERAL DESCRIPTION OF EUT**

|  |  |                                |
|--|--|--------------------------------|
| Equipment  | Wireless Laser Mouse                         |                                |
| Brand Name   | ARESON                                       |                                |
| Model Name.  | L281   |                                |
| OEM Brand/Model Name   | N/A  |                                |
| Model Difference   | N/A  |                                |
| Product Description  | The EUT is a Wireless Laser Mouse .          |                                |
|  | Product Type                                 | Low Power Communication Device |
|  | Operation Frequency:                         | 2402~2472 MHz                  |
|  | Modulation Type:                             | GFSK                           |
|  | Date rate:                                   | 1Mbps                          |
|  | Number of Channel                            | 16CH .Please see note 2.       |
|  | Antenna Designation:                         | Printed antenna                |
|  | Antenna Gain(Peak)                           | 1.8 dBi                        |
|  | Output Power:                                | 81.71dBuV/m (AV Max.)          |
| Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification. Please refer to the User's Manual. |  |                                |
| Channel List   | Please refer to the Note 2.                  |                                |
| Power Source   | DC Voltage supplied from 2*AAA size Battery. |                                |
| Power Rating   | DC 3V  |                                |
| Connecting I/O Port(s)   | Please refer to the User's Manual            |                                |

**Note:**

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





2.

| Frequency Band | Channel No. | Frequency |
|----------------|-------------|-----------|
| 2400~2483.5MHz | 01          | 2402 MHz  |
|                | 02          | 2405 MHz  |
|                | 03          | 2408 MHz  |
|                | 04          | 2411 MHz  |
|                | 05          | 2425 MHz  |
|                | 06          | 2432 MHz  |
|                | 07          | 2435 MHz  |
|                | 08          | 2439 MHz  |
|                | 09          | 2447 MHz  |
|                | 10          | 2450 MHz  |
|                | 11          | 2462 MHz  |
|                | 12          | 2465 MHz  |
|                | 13          | 2468 MHz  |
|                | 14          | 2470 MHz  |
|                | 15          | 2471 MHz  |
|                | 16          | 2472 MHz  |

3. Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type    | Connector | Gain (dBi) |
|------|-------|------------|-----------------|-----------|------------|
| 1    | N/A   | N/A        | Printed Antenna | N/A       | 1.8        |



### 3.2 DESCRIPTION OF TEST MODES

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

| Pretest Mode | Description         |
|--------------|---------------------|
| Mode 1       | CH Lower – 2402MHz  |
| Mode 2       | CH Middle – 2432MHz |
| Mode 3       | CH Highest -2472MHz |

| For Conducted Test |   |
|--------------------|---|
| Final Test Mode    | Description   |
|                    | " N/A" denotes test is not applicable in this Test Report |

| For Radiated Test |                     |
|-------------------|---------------------|
| Final Test Mode   | Description         |
| Mode 1            | CH Lower - 2402MHz  |
| Mode 2            | CH Middle - 2432MHz |
| Mode 3            | CH Highest -2472MHz |

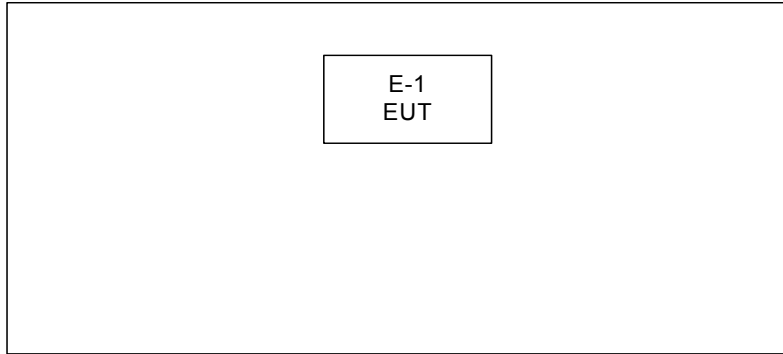
Note:

- (1) The EUT used the new battery



**3.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED**

**Mouse Sample:**





**3.4 DESCRIPTION OF SUPPORT UNITS**

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment            | Mfr/Brand | Model/Type No. | FCC ID     | Series No. | Note |
|------|----------------------|-----------|----------------|------------|------------|------|
| E-1  | Wireless Laser Mouse | ARESON    | L281           | P5A-CL0019 | N/A        | EUT  |
|      |                      |           |                |            |            |      |
|      |                      |           |                |            |            |      |
|      |                      |           |                |            |            |      |
|      |                      |           |                |            |            |      |
|      |                      |           |                |            |            |      |

| Item | Shielded Type | Ferrite Core | Length | Note |
|------|---------------|--------------|--------|------|
|      |               |              |        |      |
|      |               |              |        |      |
|      |               |              |        |      |
|      |               |              |        |      |
|      |               |              |        |      |

**Note:**

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in m in 『Length』 column.



**4. EMC EMISSION TEST**

**4.1 CONDUCTED EMISSION MEASUREMENT**

**4.1.1 POWER LINE CONDUCTED EMISSION LIMITS (Frequency Range 150KHz-30MHz)**

| FREQUENCY (MHz) | Class A (dBuV) |         | Class B (dBuV) |           | Standard |
|-----------------|----------------|---------|----------------|-----------|----------|
|                 | Quasi-peak     | Average | Quasi-peak     | Average   |          |
| 0.15 -0.5       | 79.00          | 66.00   | 66 - 56 *      | 56 - 46 * | CISPR    |
| 0.50 -5.0       | 73.00          | 60.00   | 56.00          | 46.00     | CISPR    |
| 5.0 -30.0       | 73.00          | 60.00   | 60.00          | 50.00     | CISPR    |

|           |       |       |           |           |     |
|-----------|-------|-------|-----------|-----------|-----|
| 0.15 -0.5 | 79.00 | 66.00 | 66 - 56 * | 56 - 46 * | FCC |
| 0.50 -5.0 | 73.00 | 60.00 | 56.00     | 46.00     | FCC |
| 5.0 -30.0 | 73.00 | 60.00 | 60.00     | 50.00     | FCC |

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

**4.1.2 MEASUREMENT INSTRUMENTS LIST**

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
|------|-------------------|--------------|----------|------------|------------------|
| 1    | LISN              | EMCO         | 3816/2   | 00052765   | May.26.2011      |
| 2    | LISN              | R&S          | ENV216   | 100087     | May.26.2011      |
| 3    | Test Cable        | N/A          | C_17     | N/A        | Mar.31.2011      |
| 4    | EMI TEST RECEIVER | R&S          | ESCS30   | 8333641017 | May.27.2011      |
| 5    | 50Ω Terminator    | SHX          | TF2-3G-A | 08122902   | May.26.2011      |

Remark: " N/A" denotes No Model Name. , Serial No. or No Calibration specified.

The following table is the setting of the receiver

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 kHz    |

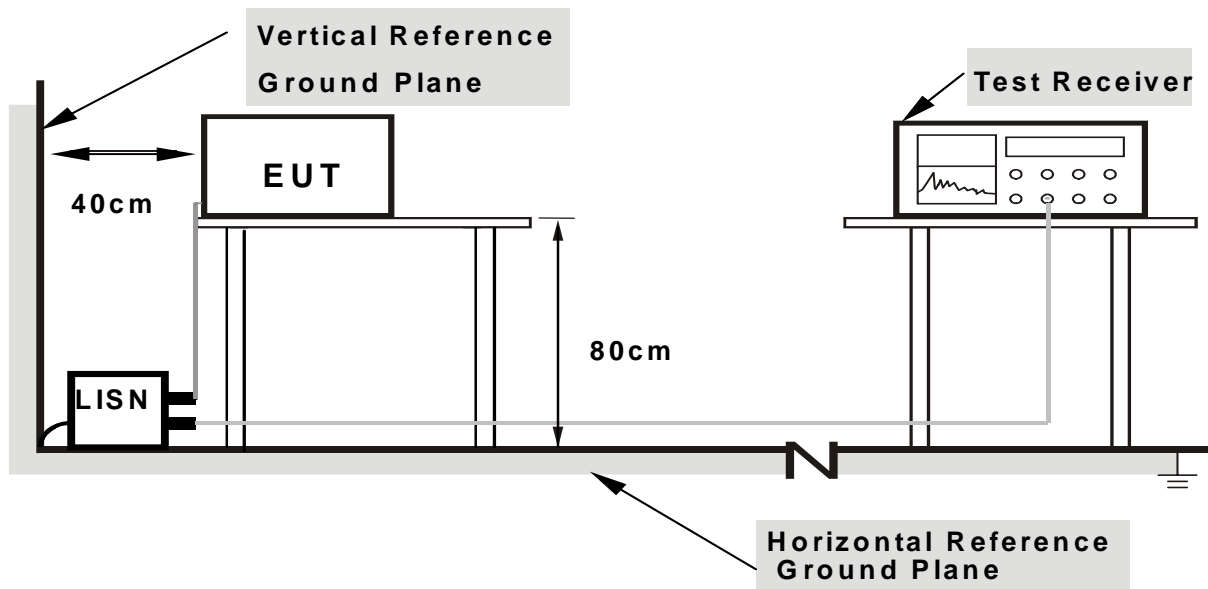
**4.1.3 TEST PROCEDURE**

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

**4.1.4 DEVIATION FROM TEST STANDARD**

No deviation

**4.1.5 TEST SETUP**



**Note: 1.Support units were connected to second LISN.**

**2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes**

**4.1.6 EUT OPERATING CONDITIONS**

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

The EUT was programmed to be in continuously transmitting mode.



4.1.7 TEST RESULTS

|               |   |                     |      |
|---------------|---|---------------------|------|
| EUT :         | Wireless Laser Mouse                                      | Model Name. :       | L281 |
| Temperature : | ---   | Relative Humidity : | ---  |
| Pressure :    | ---   | Test Power :        | ---  |
| Test Mode :   | " N/A" denotes test is not applicable in this Test Report |                     |      |

Remark

- (1) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a " \* " marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150KHz to 30MHz.
- (3) " N/A" denotes test is not applicable in this Test Report.



**4.2 RADIATED EMISSION MEASUREMENT**

**4.2.1 RADIATED EMISSION LIMITS ( FCC 15.209 )**

| <b>Frequencies (MHz)</b> | <b>Field Strength (micorvolts/meter)</b> | <b>Measurement Distance (meters)</b> |
|--------------------------|--|--------------------------------------|
| 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                                    |

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).

**LIMITS OF RADIATED EMISSION MEASUREMENT ( FCC 15.209 )**

| <b>FREQUENCY (MHz)</b> | <b>(dBuV/m) (at 3m)</b> |                |
|------------------------|-------------------------|----------------|
|                        | <b>PEAK</b>             | <b>AVERAGE</b> |
| Above 1000             | 74                      | 54             |

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

**LIMITS OF RADIATED EMISSION MEASUREMENT (FCC Part 15.249)**

| <b>FCC Part15 (15.249) , Subpart C</b>                        |                              |
|---|------------------------------|
| <b>Limit</b>  | <b>Frequency Range (MHz)</b> |
| Field strength of fundamental<br>50000 μV/m (94 dBμV/m) @ 3 m | 2400-2483.5                  |
| Field strength of harmonics<br>500 μV/m (54 dBμV/m) @ 3 m     | Above 2483.5                 |





4.2.2 MEASUREMENT INSTRUMENTS LIST

| Item | Kind of Equipment | Manufacturer     | Type No.    | Serial No. | Calibrated until |
|------|-------------------|------------------|-------------|------------|------------------|
| 1    | Antenna           | Schwarbec<br>k   | VULB9160    | 9160-3232  | Jun .08.2011     |
| 2    | Amplifier         | HP               | 8447D       | 2944A09673 | May.26.2011      |
| 3    | Test Receiver     | R&S              | ESCI        | 100382     | May.26.2011      |
| 4    | Test Cable        | N/A              | C-01_CB03   | N/A        | Jul.06.2011      |
| 5    | Controller        | CT               | SC100       | N/A        | N/A              |
| 6    | Antenna           | ETS              | 3115        | 00075789   | May.27.2011      |
| 7    | Amplifier         | Agilent          | 8449B       | 3008A02274 | May.26.2011      |
| 8    | Spectrum          | Agilent          | E4408B      | US39240143 | Nov.26.2011      |
| 9    | Test Cable        | HUBER+S<br>UHNER | SUCOFLEX_8m | 313794/4   | Apr.12.2011      |
| 10   | Controller        | CT               | SC100       | N/A        | N/A              |

Remark: " N/A" denotes No Model Name. / Serial No. and No Calibration specified.

| Spectrum Parameter                    | Setting                                       |
|---------------------------------------|---|
| Attenuation                           | Auto  |
| Start Frequency                       | 1000 MHz                                      |
| Stop Frequency                        | 10th carrier harmonic                         |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, Average=PK-duty cycle |

| Receiver Parameter     | Setting                          |
|------------------------|----------------------------------|
| Attenuation            | Auto                             |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP    |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |



# Neutron Engineering Inc.

DUTY CYCLE: TX 2432MHz (1Mbps)

Dwell time=ON/ON+OFF

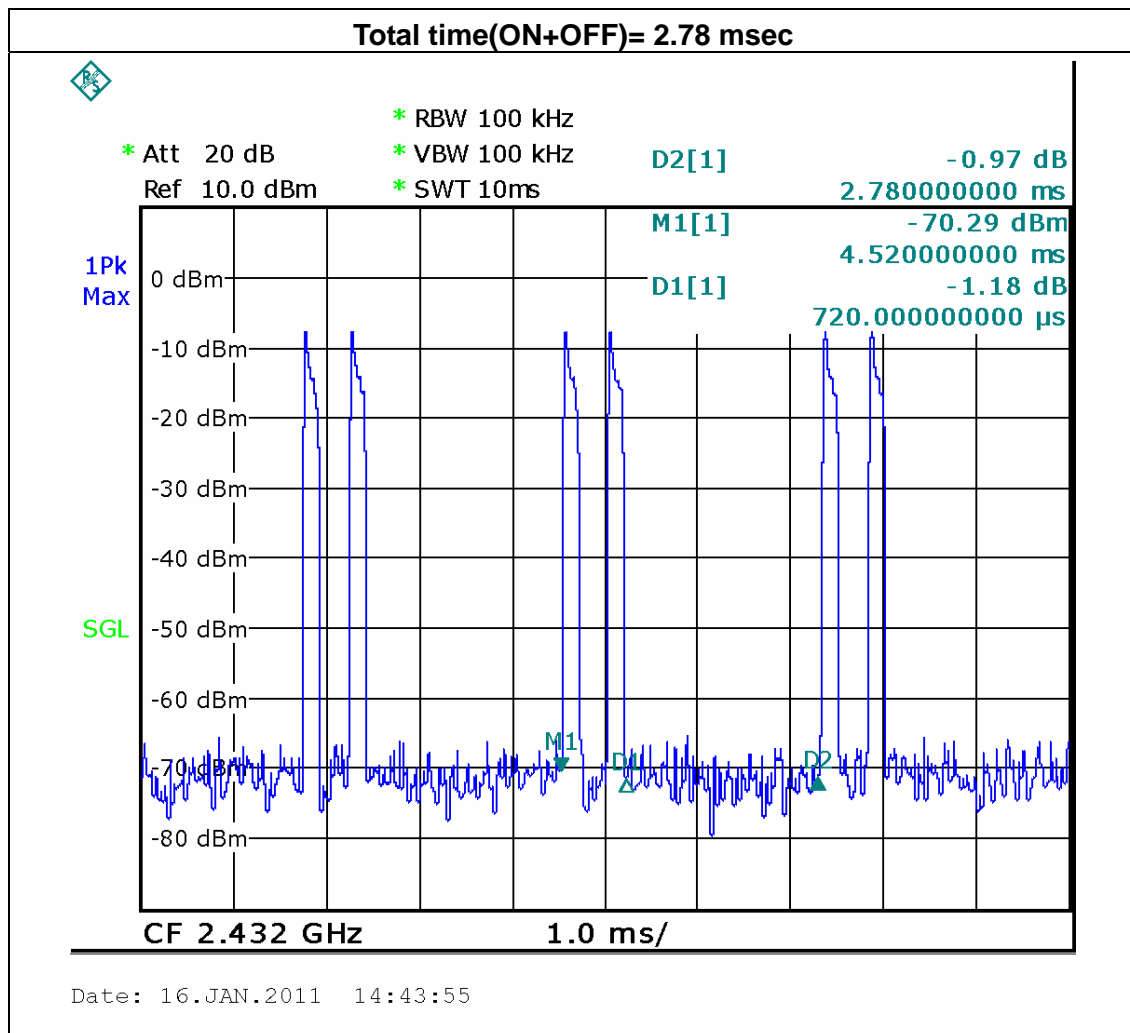
ON: 0.44msec

ON+OFF: (total time):2.78msec

Dwell time: 15.8%

AV=PK+20 log(Dwell time)

AV=PK-16.01







#### 4.2.3 TEST PROCEDURE

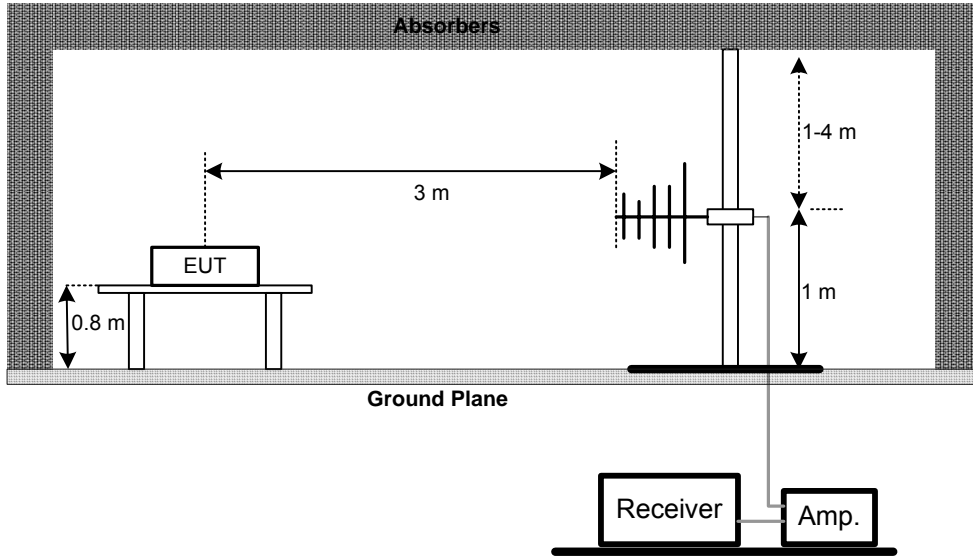
- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

#### 4.2.4 DEVIATION FROM TEST STANDARD

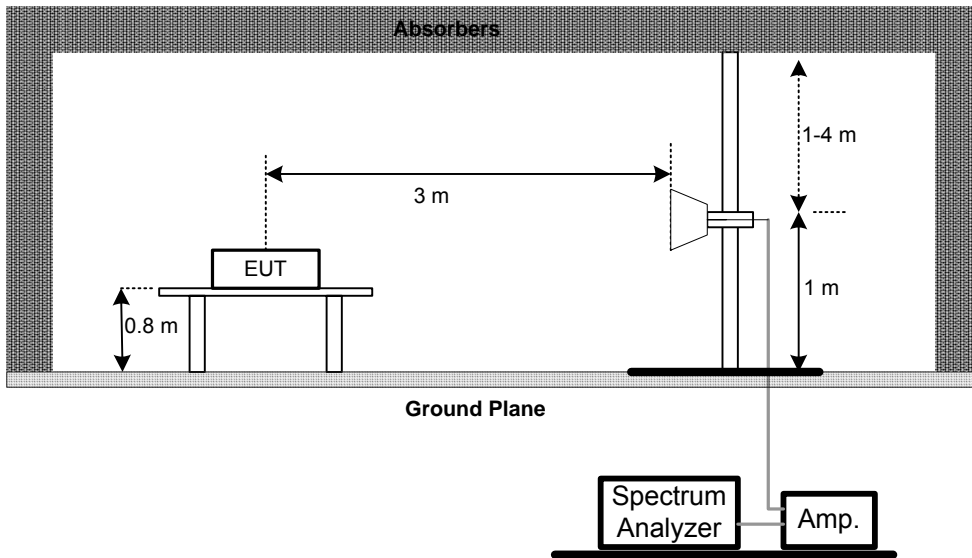
No deviation

4.2.5 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



4.2.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.



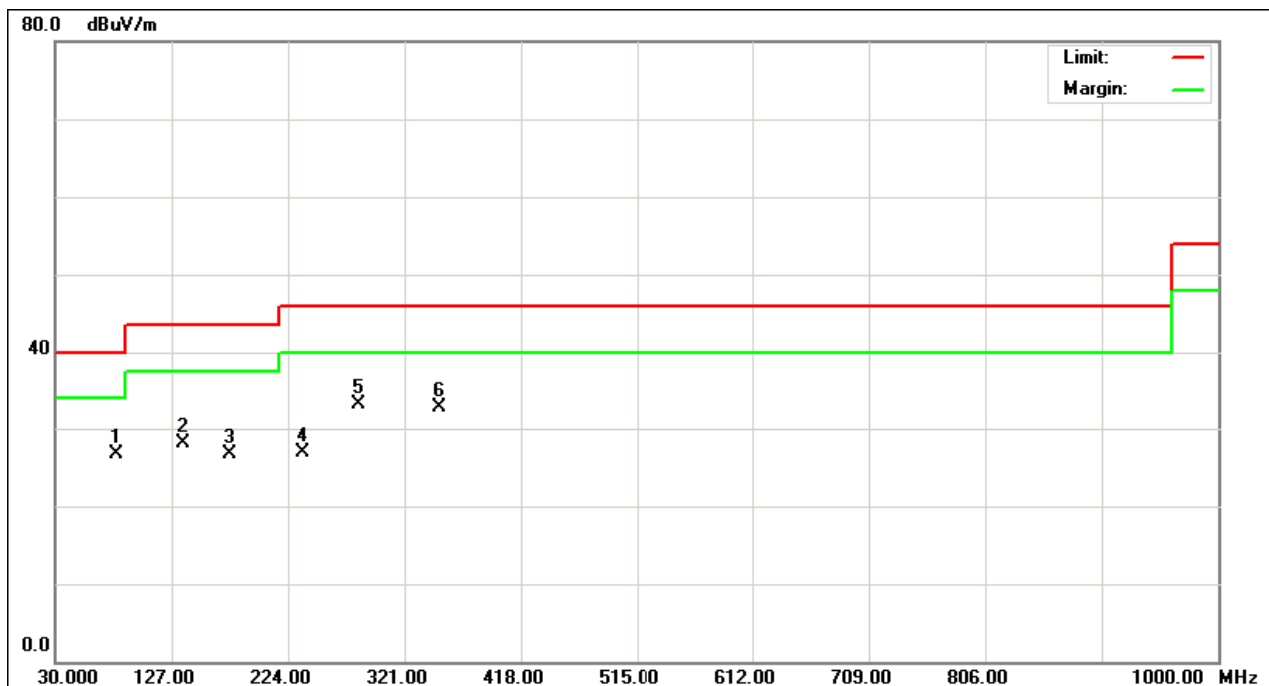
4.2.7 TEST RESULTS (BETWEEN 30 – 1000 MHz)

|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 45 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX Mode              |                     |       |

| Freq. (MHz) | Ant. H/V | Reading(RA) (dBuV) | Corr.Factor(CF) (dB) | Measured(FS) (dBuV/m) | Limits(QP) (dBuV/m) | Margin (dB) | Note |
|-------------|----------|--------------------|----------------------|-----------------------|---------------------|-------------|------|
| 78.62       | V        | 45.64              | -19.00               | 26.64                 | 40.00               | - 13.36     |      |
| 135.28      | V        | 46.00              | -17.91               | 28.09                 | 43.50               | - 15.41     |      |
| 173.92      | V        | 43.85              | -17.14               | 26.71                 | 43.50               | - 16.79     |      |
| 234.33      | V        | 42.23              | -15.42               | 26.81                 | 46.00               | - 19.19     |      |
| 281.47      | V        | 45.76              | -12.56               | 33.20                 | 46.00               | - 12.80     |      |
| 349.27      | V        | 43.57              | -10.85               | 32.72                 | 46.00               | - 13.28     |      |

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform .
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency . “F” denotes fundamental frequency; “ H” denotes spurious frequency. “E” denotes band edge frequency.
- (3) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode or QP detector mode of the emission .
- (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.



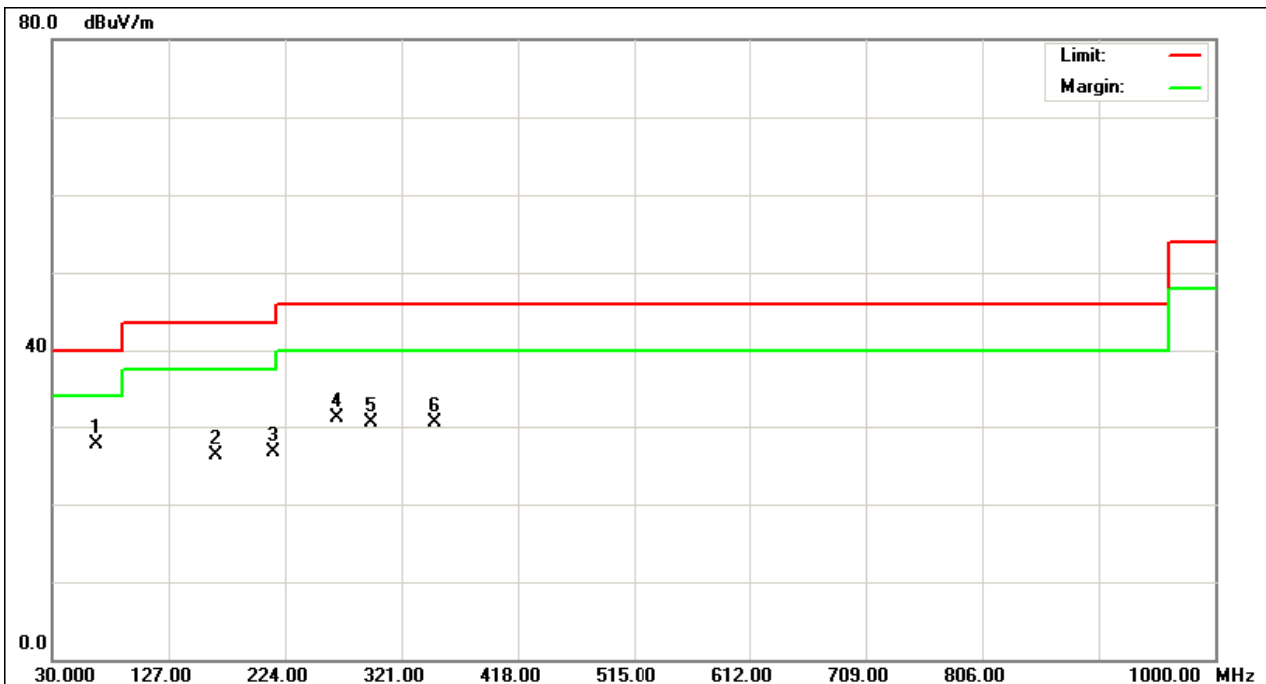


|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 45 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX Mode              |                     |       |

| Freq. (MHz) | Ant. H/V | Reading(RA) (dBUV) | Corr.Factor(CF) (dB) | Measured(FS) (dBUV/m) | Limits(QP) (dBUV/m) | Margin (dB) | Note |
|-------------|----------|--------------------|----------------------|-----------------------|---------------------|-------------|------|
| 65.35       | H        | 45.38              | -17.66               | 27.72                 | 40.00               | - 12.28     |      |
| 165.35      | H        | 43.76              | -17.46               | 26.30                 | 43.50               | - 17.20     |      |
| 213.62      | H        | 42.82              | -16.15               | 26.67                 | 43.50               | - 16.83     |      |
| 266.55      | H        | 44.65              | -13.47               | 31.18                 | 46.00               | - 14.82     |      |
| 294.81      | H        | 42.58              | -12.07               | 30.51                 | 46.00               | - 15.49     |      |
| 346.25      | H        | 41.43              | -10.93               | 30.50                 | 46.00               | - 15.50     |      |

**Remark :**

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform .
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency . "F" denotes fundamental frequency; " H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode or QP detector mode of the emission .
- (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.





4.2.8 TEST RESULTS (ABOVE 1000 MHz)

|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX 2402MHz           |                     |       |

| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant./CF<br>CF(dB) | Act.             |                | Limit            |                | Note       |
|----------------|-----------------|----------------|--------------|-------------------|------------------|----------------|------------------|----------------|------------|
|                |                 | Peak<br>(dBuV) | AV<br>(dBuV) |                   | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |            |
| 2390.00        | V               | 25.39          | 9.38         | 31.91             | 57.30            | 41.29          | 74.00            | 54.00          | X/E        |
| <b>2402.40</b> | <b>V</b>        | <b>58.85</b>   | <b>42.84</b> | <b>31.90</b>      | <b>91.75</b>     | <b>74.74</b>   | <b>114.00</b>    | <b>94.00</b>   | <b>X/F</b> |
| 4805.00        | V               | 46.68          | 30.67        | 5.21              | 51.89            | 35.88          | 74.00            | 54.00          | X/H        |

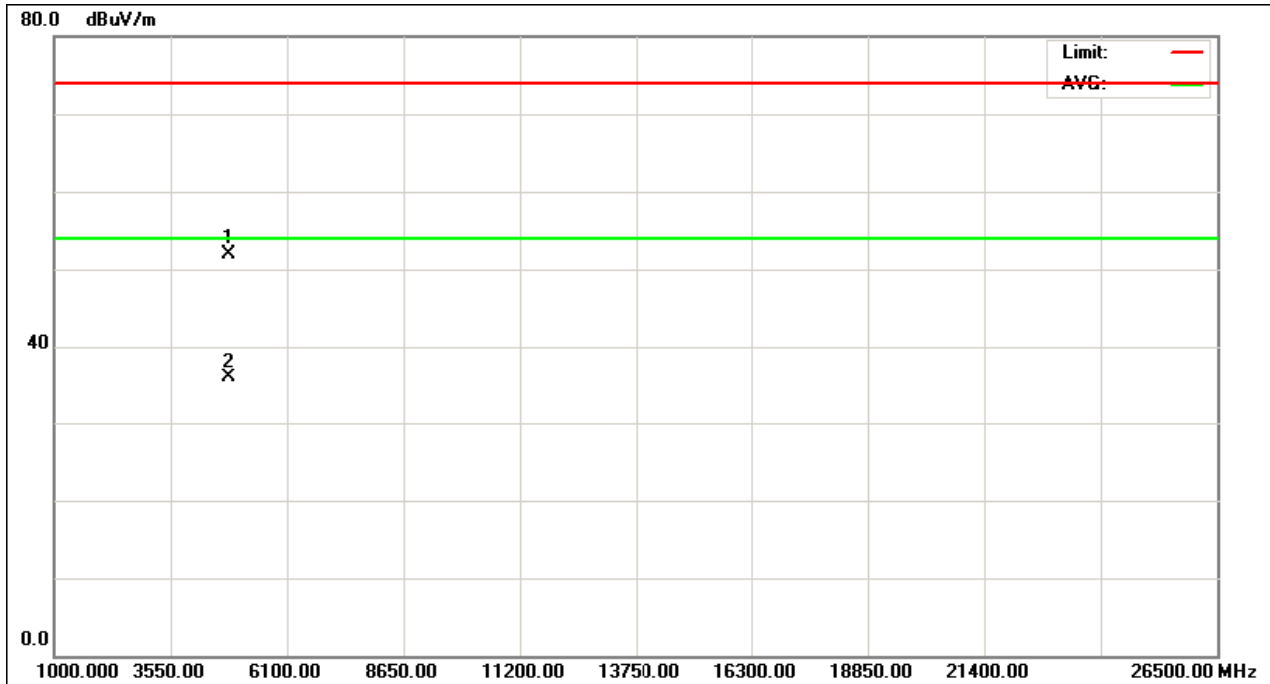
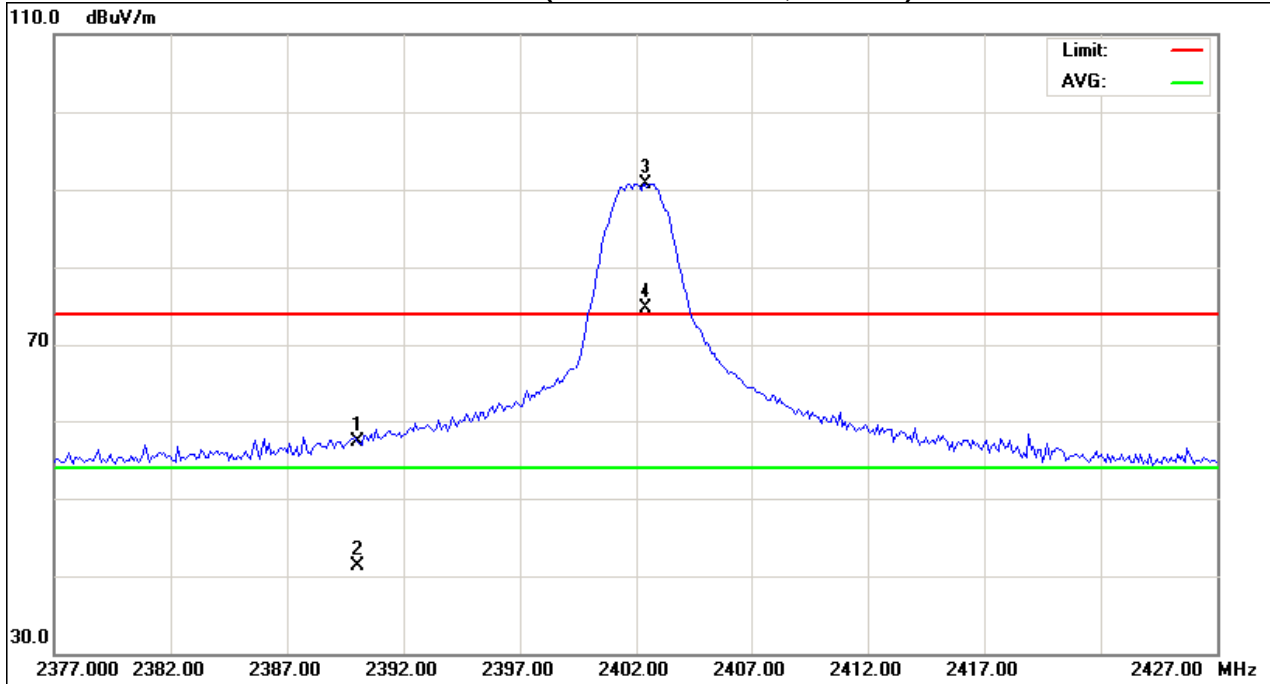
Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency. "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission.
- (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) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axis :  
"X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand
- (7) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (8) The average value of fundamental frequency is:  
Average = Peak value + 20log(Duty cycle) · Final AV=PK-16.01





Orthogonal Axis : X  
TX 2402MHz (Above 1000 MHz, Vertical)





|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX 2402MHz           |                     |       |

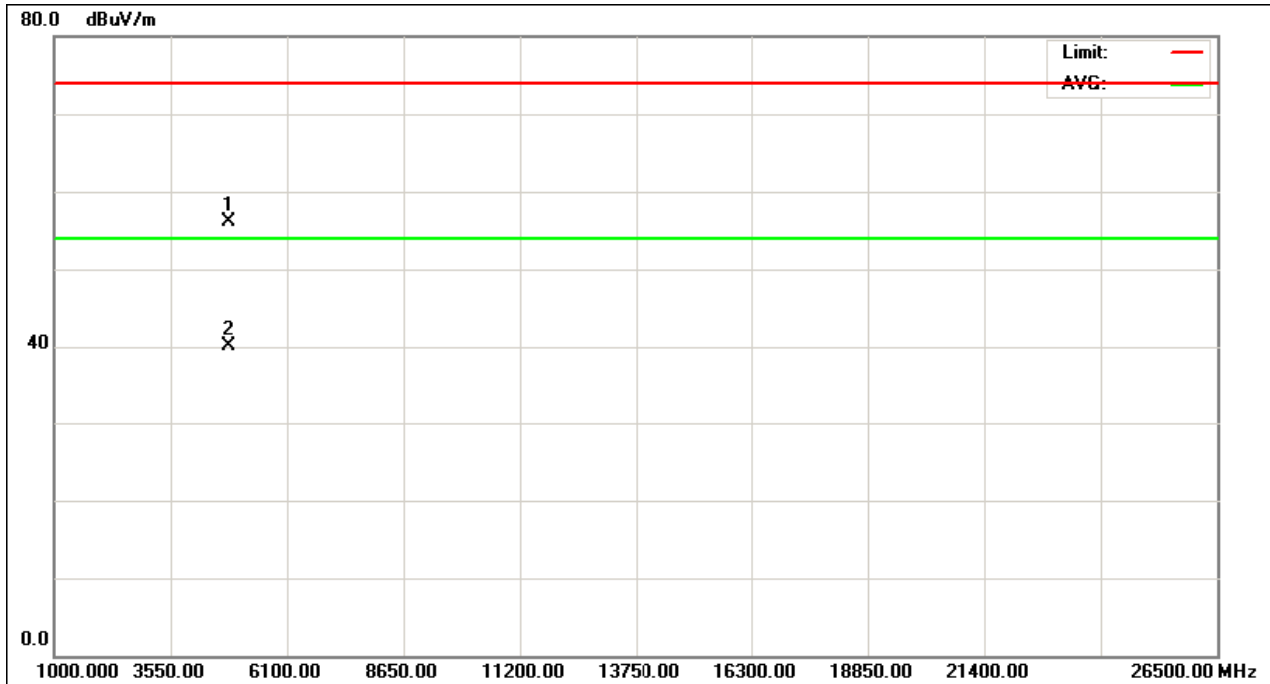
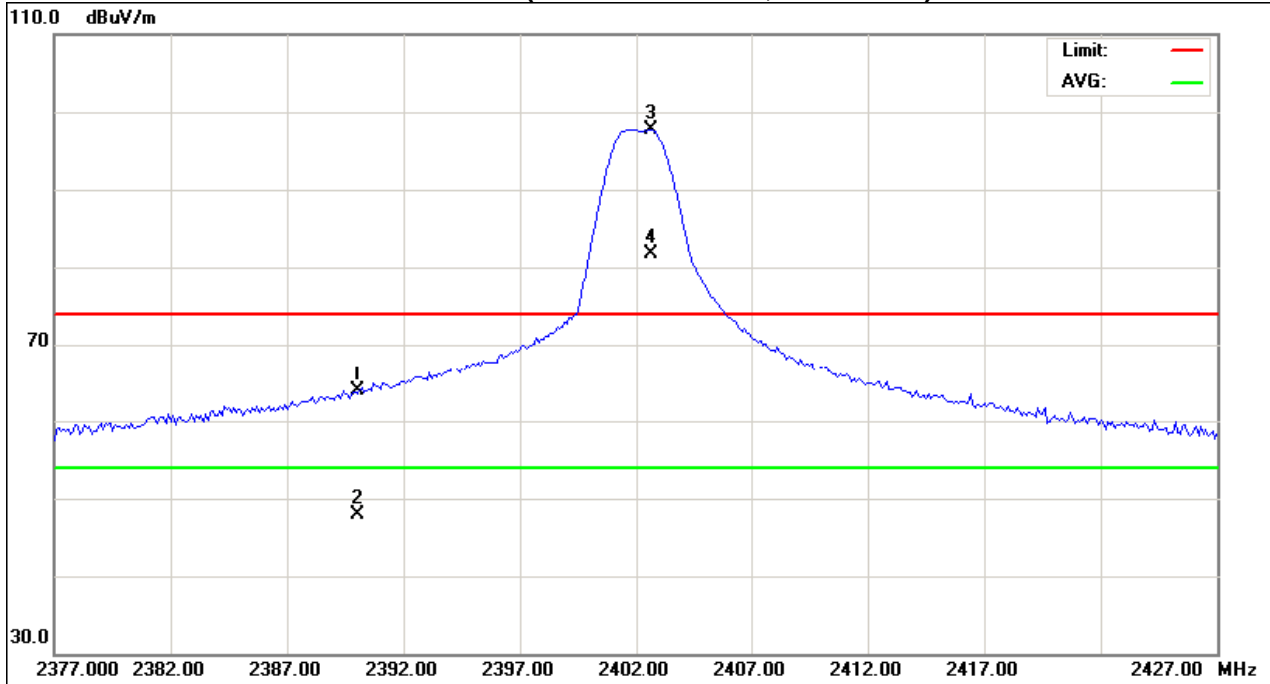
| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant./CF<br>CF(dB) | Act.             |                | Limit            |                | Note       |
|----------------|-----------------|----------------|--------------|-------------------|------------------|----------------|------------------|----------------|------------|
|                |                 | Peak<br>(dBuV) | AV<br>(dBuV) |                   | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |            |
| 2390.00        | H               | 32.02          | 16.01        | 31.91             | 63.93            | 47.92          | 74.00            | 54.00          | X/E        |
| <b>2402.70</b> | <b>H</b>        | <b>65.83</b>   | <b>49.82</b> | <b>31.89</b>      | <b>97.72</b>     | <b>81.71</b>   | <b>114.00</b>    | <b>94.00</b>   | <b>X/F</b> |
| 4805.40        | H               | 50.89          | 34.88        | 5.22              | 56.11            | 40.10          | 74.00            | 54.00          | X/H        |

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency. "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission.
- (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) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axis :  
"X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand
- (7) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (8) The average value of fundamental frequency is:  
Average = Peak value + 20log(Duty cycle) · Final AV=PK-16.01



Orthogonal Axis : X  
TX 2402MHz (Above 1000 MHz, Horizontal)





## Neutron Engineering Inc.

|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX 2432MHz           |                     |       |

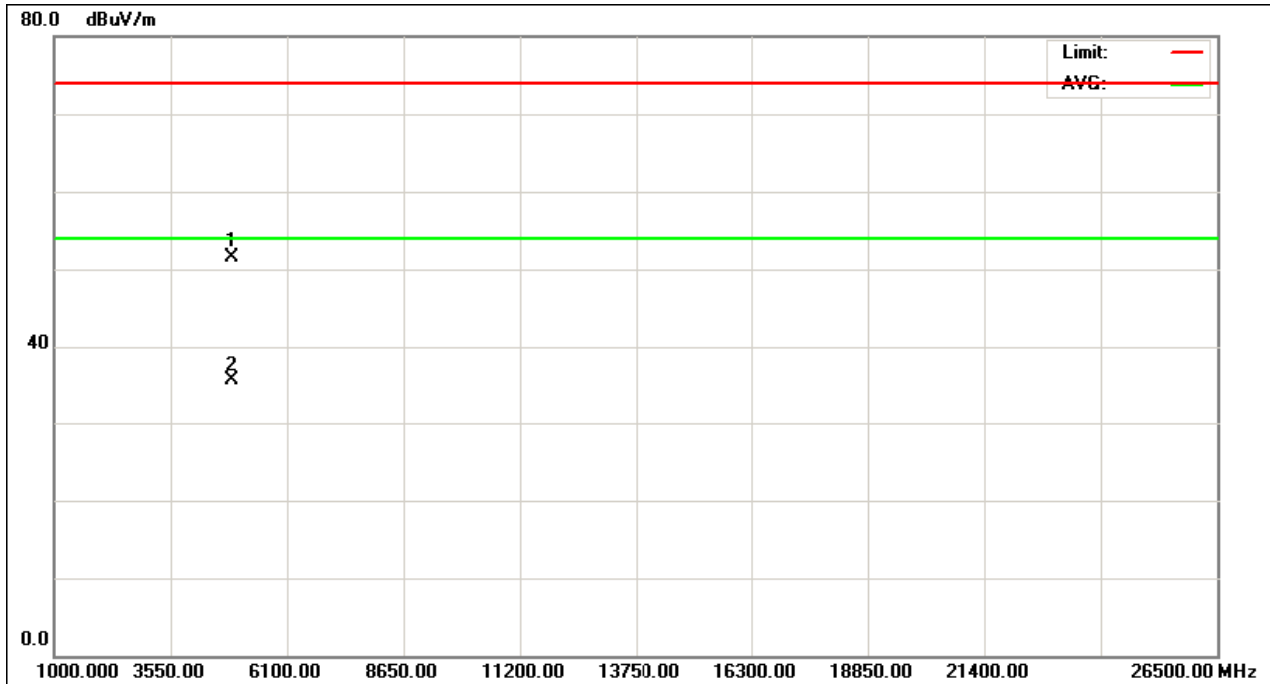
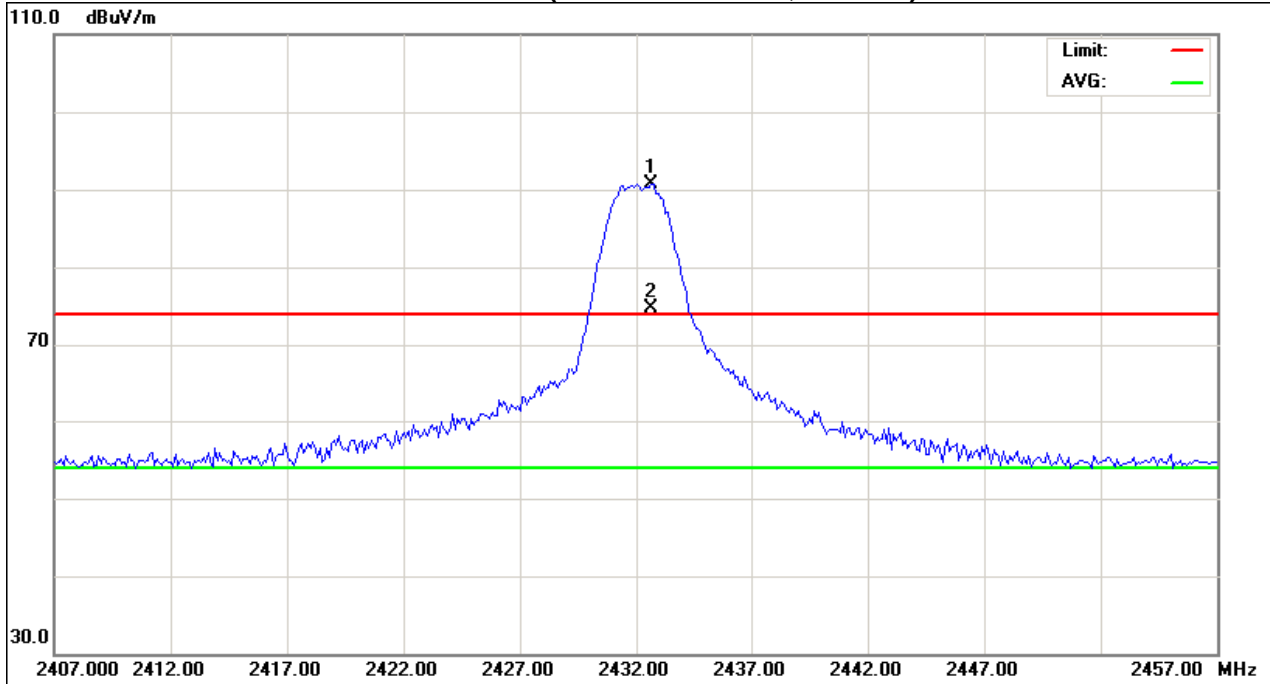
| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant./CF<br>CF(dB) | Act.             |                | Limit            |                | Note       |
|----------------|-----------------|----------------|--------------|-------------------|------------------|----------------|------------------|----------------|------------|
|                |                 | Peak<br>(dBuV) | AV<br>(dBuV) |                   | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |            |
| <b>2432.70</b> | <b>V</b>        | <b>58.92</b>   | <b>42.91</b> | <b>31.86</b>      | <b>90.78</b>     | <b>74.77</b>   | <b>114.00</b>    | <b>94.00</b>   | <b>X/F</b> |
| 4865.20        | V               | 46.15          | 30.14        | 5.45              | 51.60            | 35.59          | 74.00            | 54.00          | X/H        |

### Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency. "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission.
- (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) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axis :  
"X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand
- (7) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (8) The average value of fundamental frequency is:  
Average = Peak value + 20log(Duty cycle) · Final AV=PK-16.01



Orthogonal Axis : X  
TX 2432 MHz (Above 1000 MHz, Vertical)





|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX 2432MHz           |                     |       |

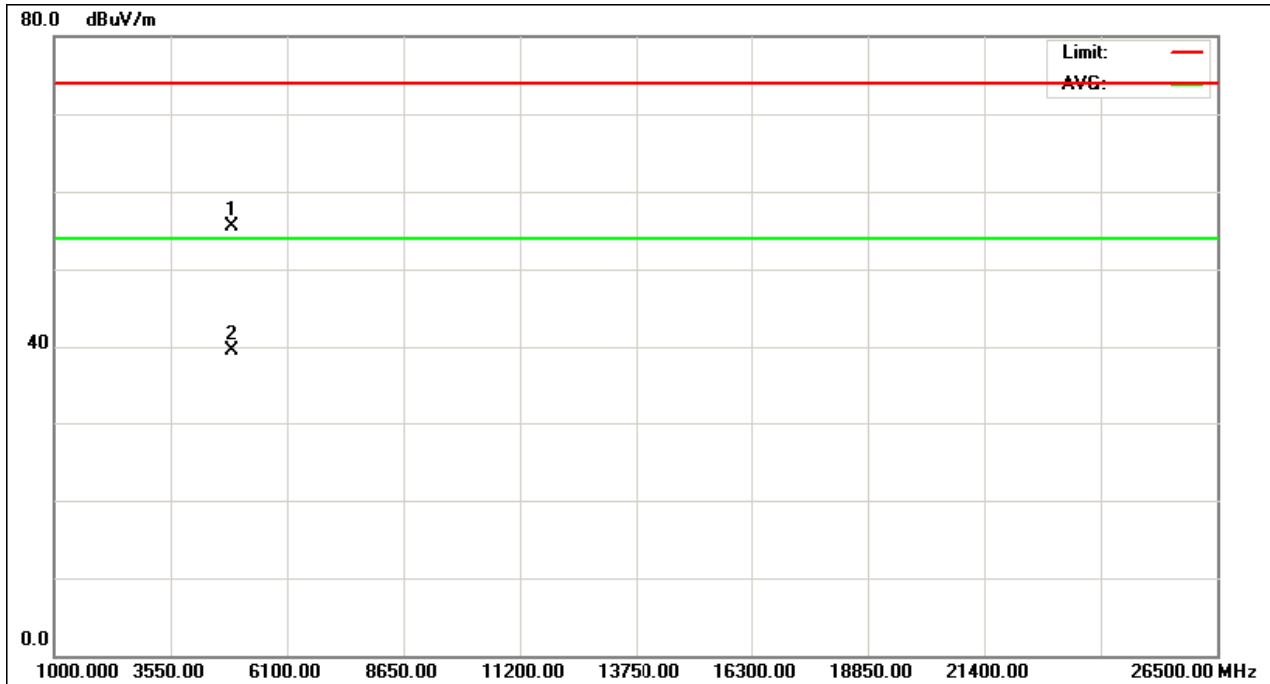
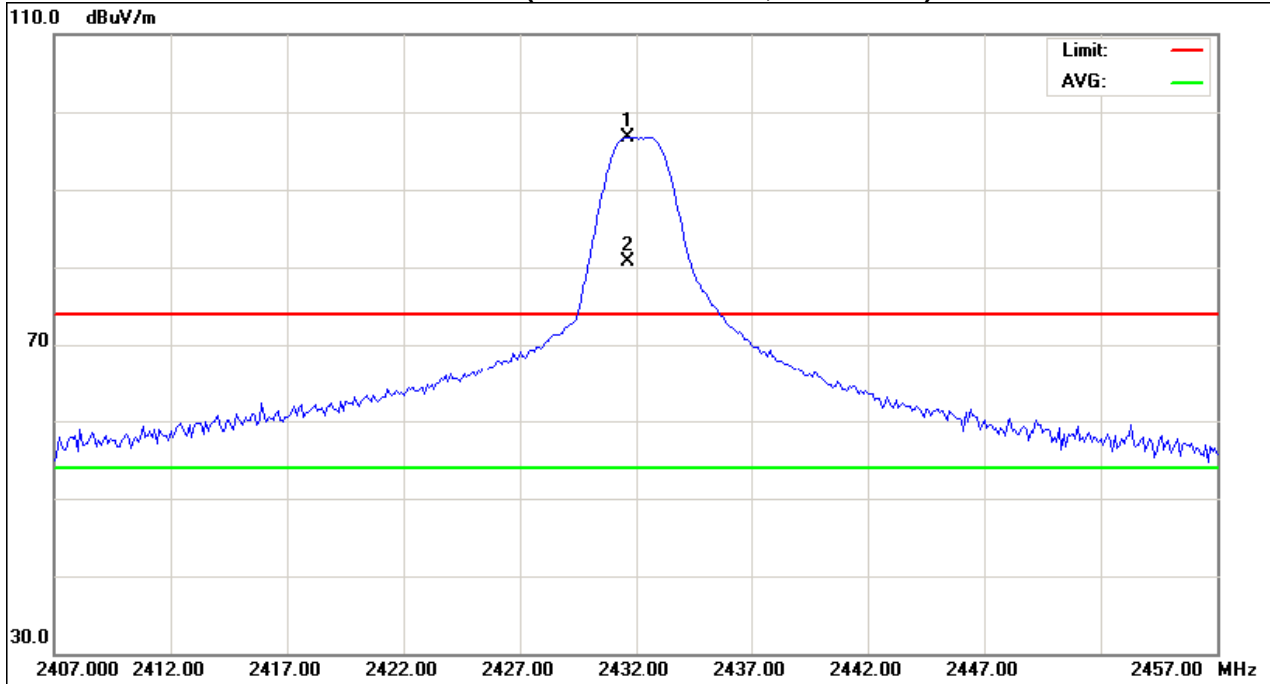
| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant./CF<br>CF(dB) | Act.             |                | Limit            |                | Note       |
|----------------|-----------------|----------------|--------------|-------------------|------------------|----------------|------------------|----------------|------------|
|                |                 | Peak<br>(dBuV) | AV<br>(dBuV) |                   | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |            |
| <b>2431.60</b> | <b>H</b>        | <b>64.87</b>   | <b>48.86</b> | <b>31.87</b>      | <b>96.74</b>     | <b>80.73</b>   | <b>114.00</b>    | <b>94.00</b>   | <b>X/F</b> |
| 4863.80        | H               | 50.10          | 34.09        | 5.43              | 55.53            | 39.52          | 74.00            | 54.00          | X/H        |

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『 Note 』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform .
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission .
- (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) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axis :  
"X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand
- (7) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (8) The average value of fundamental frequency is:  
Average = Peak value + 20log(Duty cycle) · Final AV=PK-16.01



Orthogonal Axis : X  
TX 2432MHz (Above 1000 MHz, Horizontal)





|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX 2472MHz           |                     |       |

| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant./CF<br>CF(dB) | Act.             |                | Limit            |                | Note       |
|----------------|-----------------|----------------|--------------|-------------------|------------------|----------------|------------------|----------------|------------|
|                |                 | Peak<br>(dBuV) | AV<br>(dBuV) |                   | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |            |
| <b>2471.80</b> | <b>V</b>        | <b>58.34</b>   | <b>42.33</b> | <b>31.82</b>      | <b>90.16</b>     | <b>74.15</b>   | <b>114.00</b>    | <b>94.00</b>   | <b>X/F</b> |
| 2483.50        | V               | 24.82          | 8.81         | 31.80             | 56.62            | 40.61          | 74.00            | 54.00          | X/E        |
| 4943.80        | V               | 45.70          | 29.69        | 5.73              | 51.43            | 35.42          | 74.00            | 54.00          | X/H        |

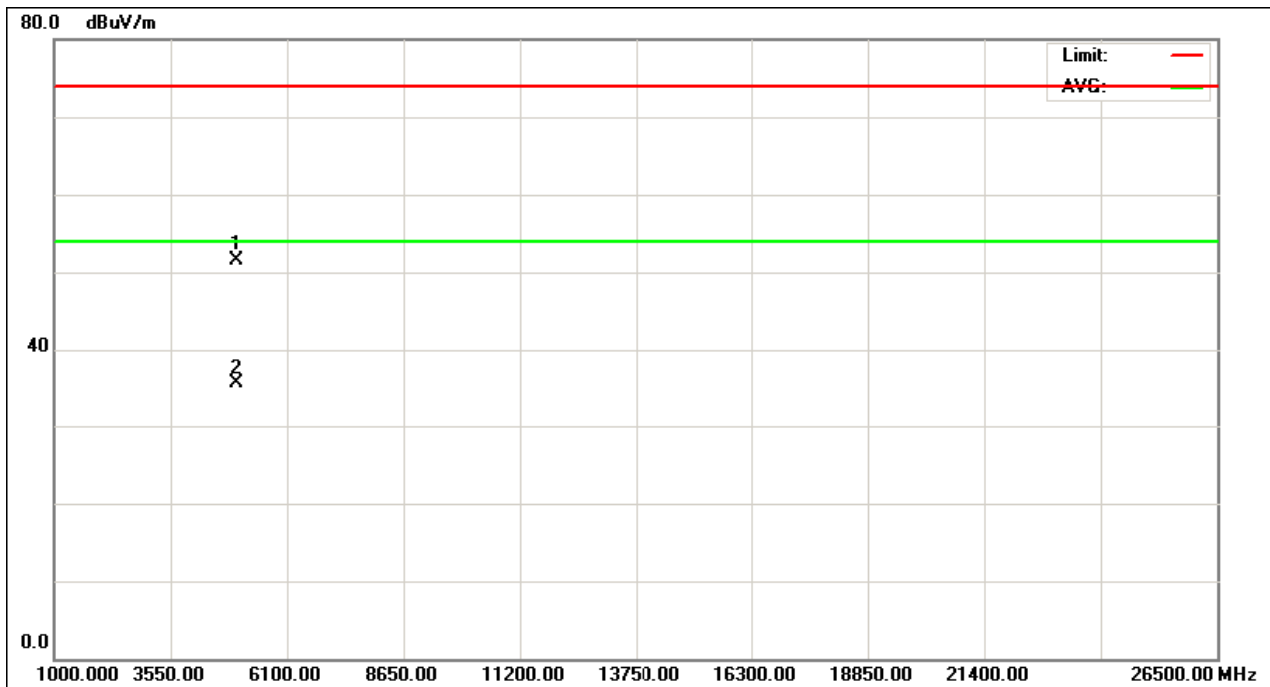
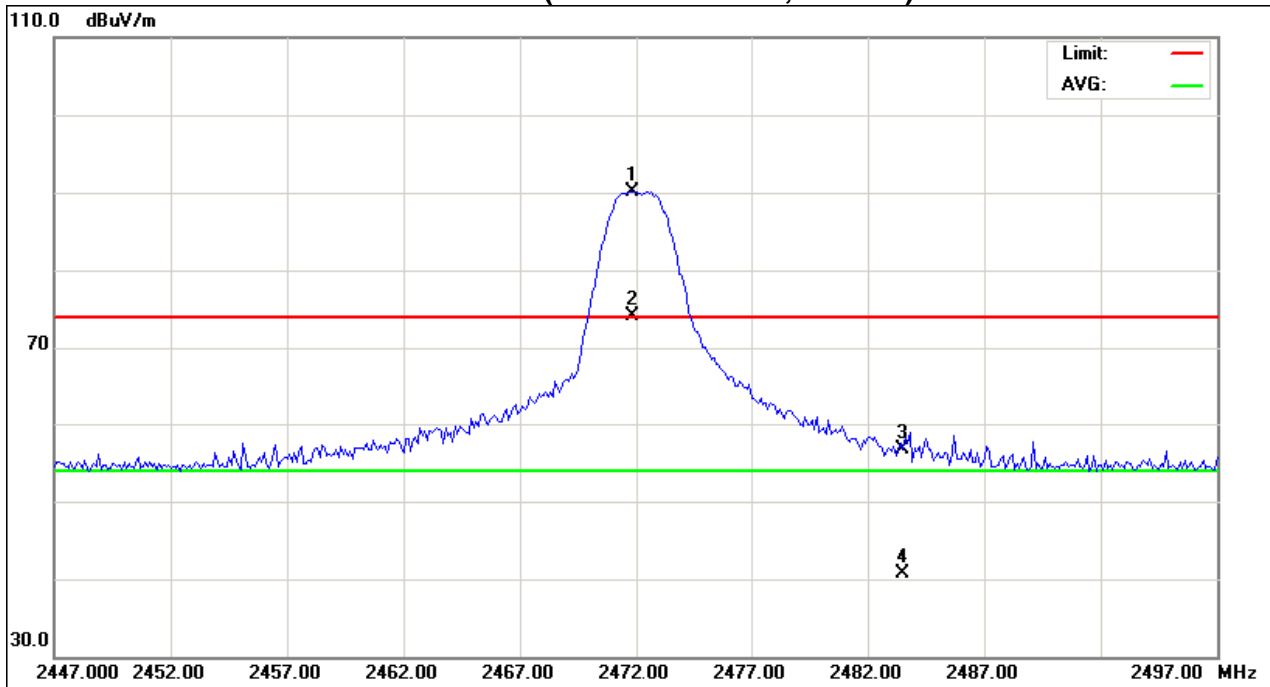
Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform .
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency .“F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission .
- (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) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axis :  
“X” - denotes Laid on Table ; “Y” - denotes Vertical Stand ; “Z” - denotes Side Stand
- (7) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (8) The average value of fundamental frequency is:  
Average = Peak value + 20log(Duty cycle) · Final AV=PK-16.01





Orthogonal Axis : X  
TX 2472MHz (Above 1000 MHz, Vertical)





|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 22°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX 2472MHz           |                     |       |

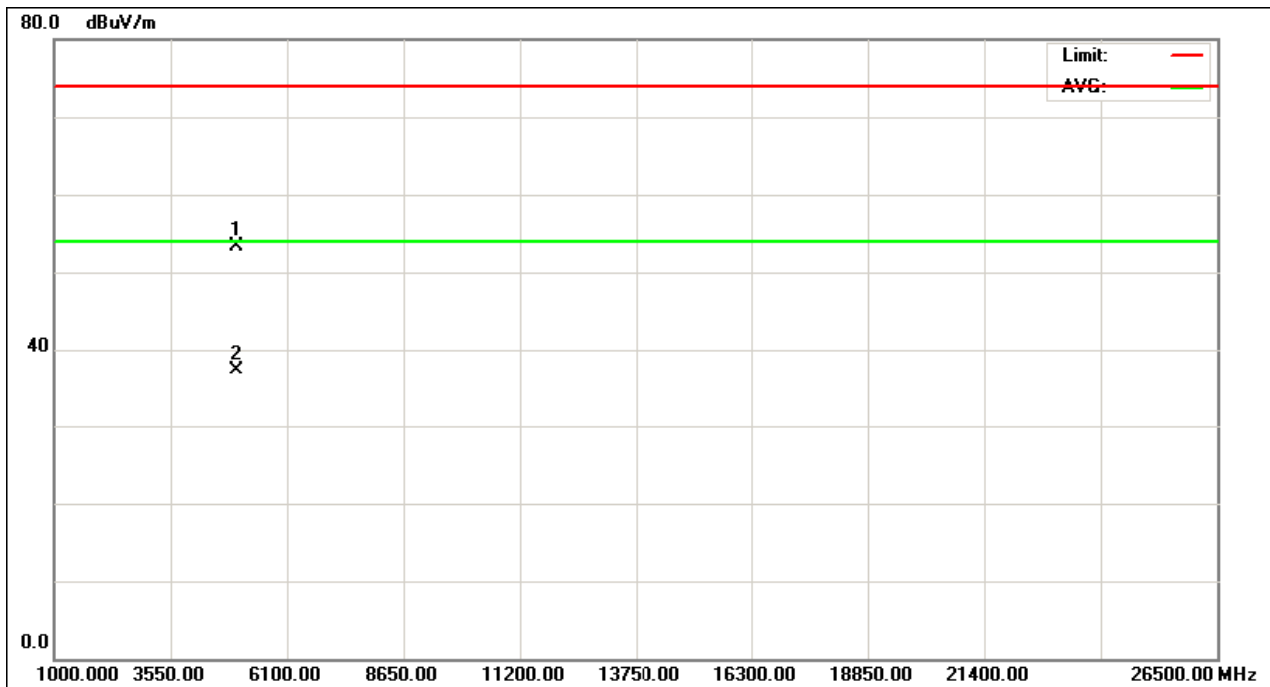
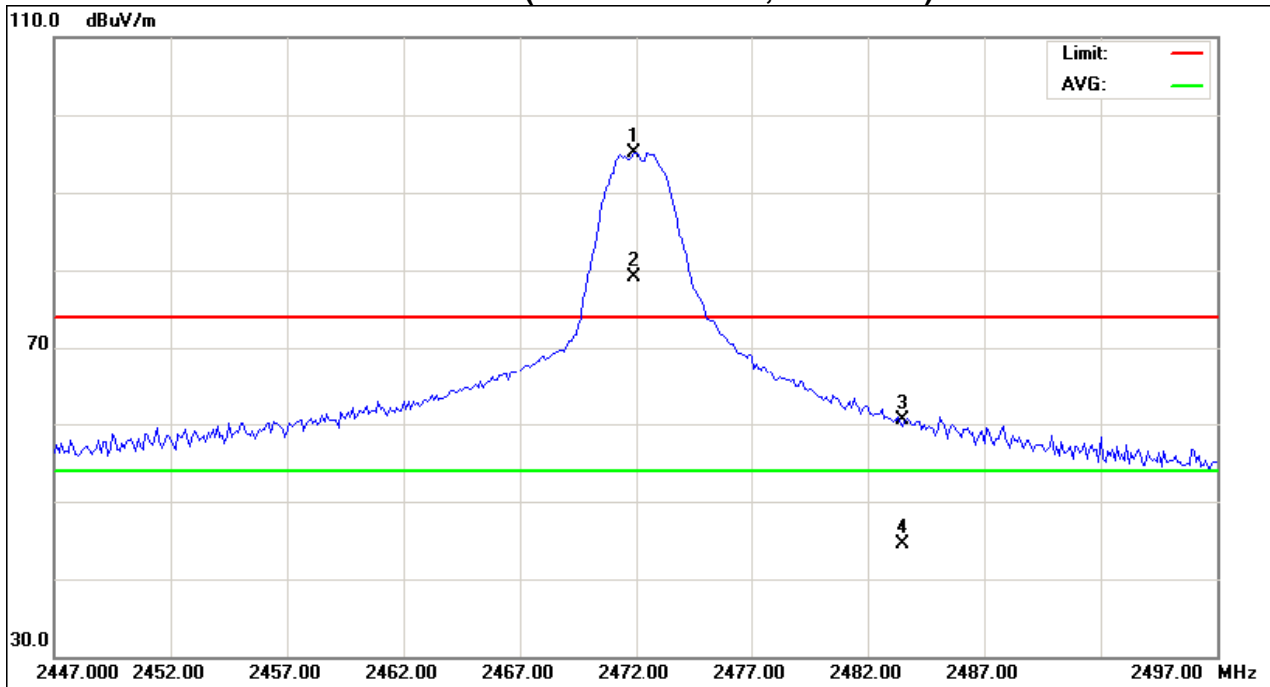
| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant./CF<br>CF(dB) | Act.             |                | Limit            |                | Note       |
|----------------|-----------------|----------------|--------------|-------------------|------------------|----------------|------------------|----------------|------------|
|                |                 | Peak<br>(dBuV) | AV<br>(dBuV) |                   | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |            |
| <b>2471.90</b> | <b>H</b>        | <b>63.32</b>   | <b>47.31</b> | <b>31.82</b>      | <b>95.14</b>     | <b>79.13</b>   | <b>114.00</b>    | <b>94.00</b>   | <b>X/F</b> |
| 2483.50        | H               | 28.75          | 12.74        | 31.80             | 60.55            | 44.54          | 74.00            | 54.00          | X/E        |
| 4943.60        | H               | 47.68          | 31.67        | 5.72              | 53.40            | 37.39          | 74.00            | 54.00          | X/H        |

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform .
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency . "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission .
- (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) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axis :  
"X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand
- (7) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (8) The average value of fundamental frequency is:  
Average = Peak value + 20log(Duty cycle) · Final AV=PK-16.01



Orthogonal Axis : X  
TX 2472MHz (Above 1000 MHz, Horizontal)





4.2.9 TEST RESULTS (2400 – 2483.5 MHz)

|               |                               |                     |       |
|---------------|-------------------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse          | Model Name. :       | L281  |
| Temperature : | 22°C                          | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa                      | Test Power :        | DC 3V |
| Test Mode :   | TX CH 2402MHz/2432MHz/2472MHz |                     |       |

| Freq.<br>(MHz) | Ant.Pol.<br>(H/V) | Peak AV           |        | Ant./CL/<br>CF(dB) | Peak AV               |          | Peak AV             |          | NOTE |
|----------------|-------------------|-------------------|--------|--------------------|-----------------------|----------|---------------------|----------|------|
|                |                   | Reading<br>(dBuV) | (dBuV) |                    | Actual FS<br>(dBuV/m) | (dBuV/m) | Limit3m<br>(dBuV/m) | (dBuV/m) |      |
| 2402.40        | V                 | 58.85             | 42.84  | 31.90              | 90.75                 | 74.74    | 114.00              | 94.00    | CH01 |
| 2402.70        | H                 | 65.83             | 49.82  | 31.89              | 97.72                 | 81.71    | 114.00              | 94.00    | CH01 |
| 2432.70        | V                 | 58.92             | 42.91  | 31.86              | 90.78                 | 74.77    | 114.00              | 94.00    | CH06 |
| 2431.60        | H                 | 64.87             | 48.86  | 31.87              | 96.74                 | 80.73    | 114.00              | 94.00    | CH06 |
| 2471.80        | V                 | 58.34             | 42.33  | 31.82              | 90.16                 | 74.15    | 114.00              | 94.00    | CH16 |
| 2471.90        | H                 | 63.32             | 47.31  | 31.82              | 95.14                 | 79.13    | 114.00              | 94.00    | CH16 |

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform .
- (2) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission .
- (3) 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.
- (4) EUT Orthogonal Axis :  
 “X” - denotes Laid on Table ; “Y” - denotes Vertical Stand ; “Z” - denotes Side Stand



## 5. BANDWIDTH TEST

### 5.1 MEASUREMENT INSTRUMENTS LIST

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
|------|-------------------|--------------|----------|------------|------------------|
| 1    | Spectrum Analyzer | R&S          | FSP 40   | 100185     | Nov.26.2011      |

Remark: " N/A" denotes No Model Name. , Serial No. or No Calibration specified.

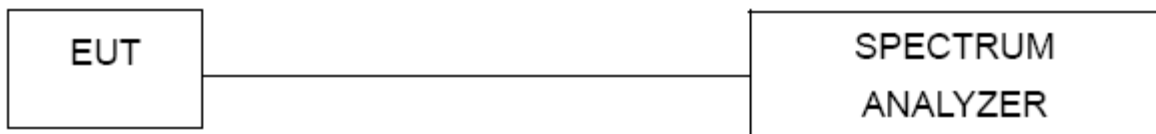
### 5.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW= 100KHz, VBW=100KHz, Sweep time = 20 ms.

### 5.3 DEVIATION FROM STANDARD

No deviation.

### 5.4 TEST SETUP



### 5.5 EUT OPERATION CONDITIONS

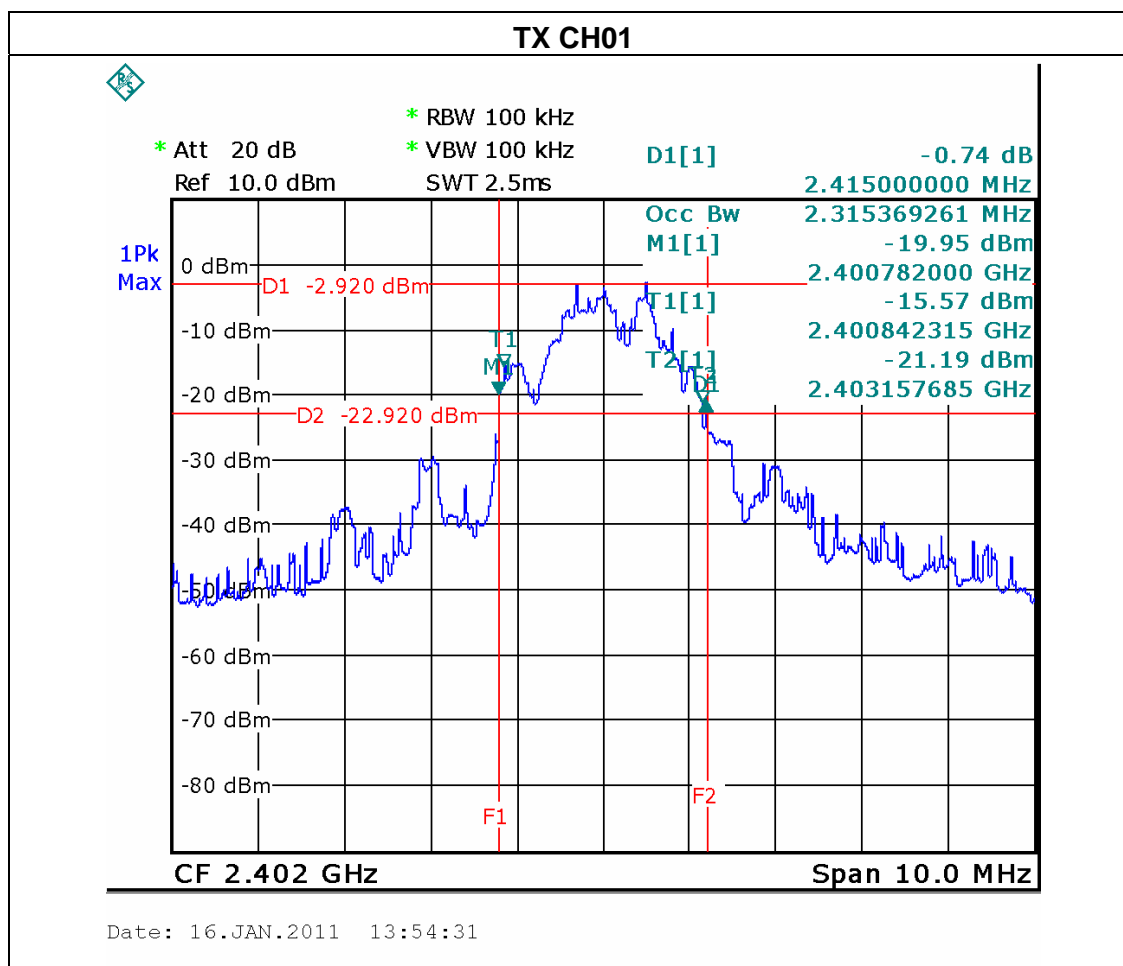
The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

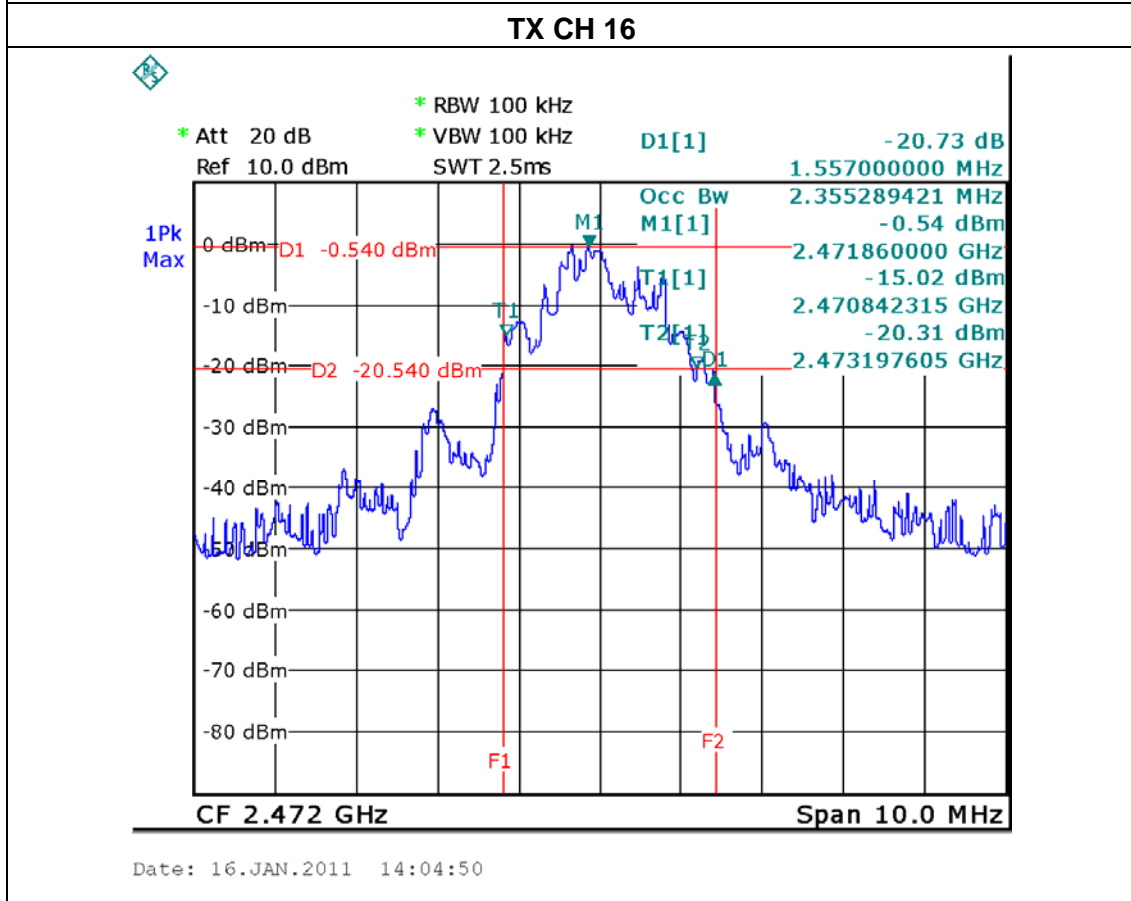
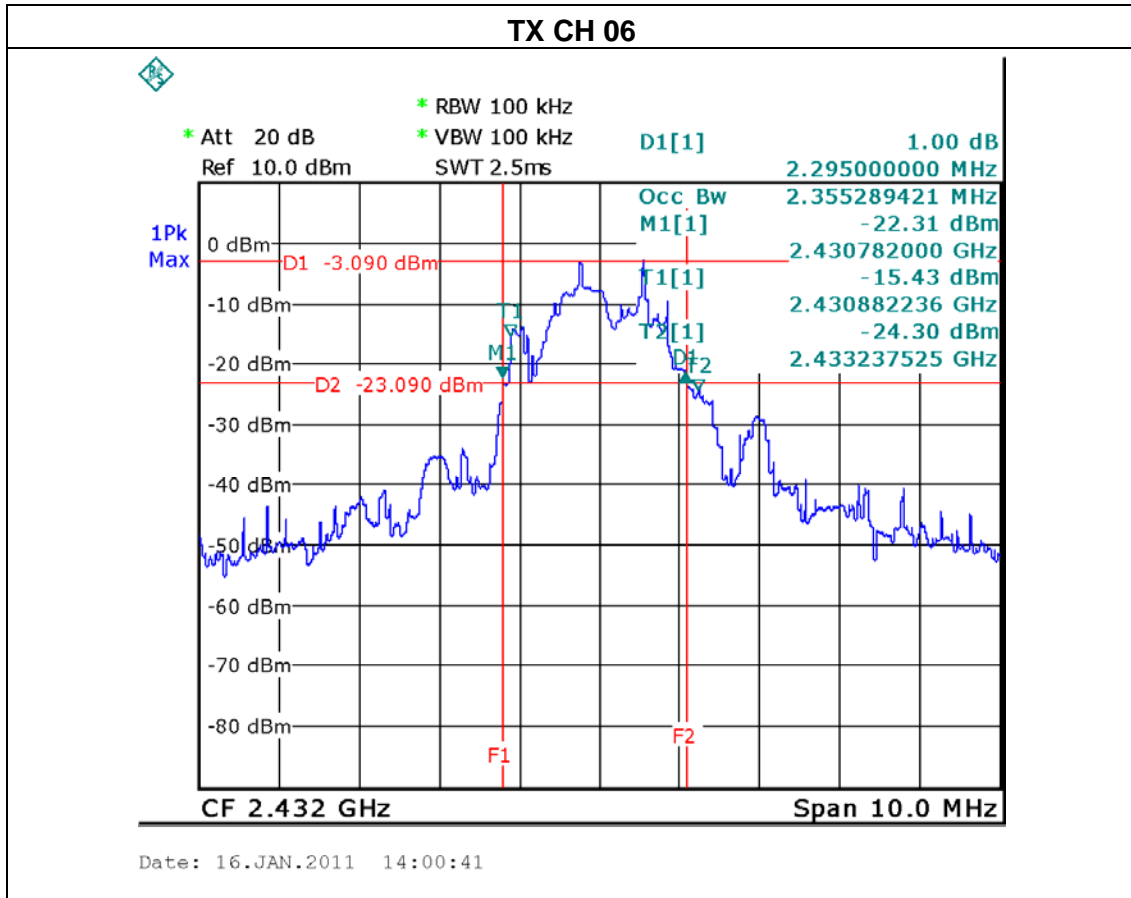


**5.6 TEST RESULTS**

|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 20°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX CH 01/09/16       |                     |       |

| Test Channel | Frequency (MHz) | 20 dBc Bandwidth (MHz) | 99% occupied Bandwidth(MHz) |
|--------------|-----------------|------------------------|-----------------------------|
| CH01         | 2402            | 2.415                  | 2.315                       |
| CH06         | 2432            | 2.295                  | 2.355                       |
| CH16         | 2472            | 1.557                  | 2.355                       |







**6. ANTENNA CONDUCTED SPURIOUS EMISSION**

**6.1 APPLIED PROCEDURES / LIMIT**

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| <b>Frequencies (MHz)</b> | <b>Field Strength (micorvolts/meter)</b> | <b>Measurement Distance (meters)</b> |
|--------------------------|--|--------------------------------------|
| 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                                    |

**6.1.1 MEASUREMENT INSTRUMENTS LIST**

| <b>Item</b> | <b>Kind of Equipment</b> | <b>Manufacturer</b> | <b>Type No.</b> | <b>Serial No.</b> | <b>Calibrated until</b> |
|-------------|--------------------------|---------------------|-----------------|-------------------|-------------------------|
| 1           | Spectrum Analyzer        | R&S                 | FSP 40          | 100185            | Nov.26.2011             |

Remark: " N/A" denotes No Model Name. , Serial No. or No Calibration specified.

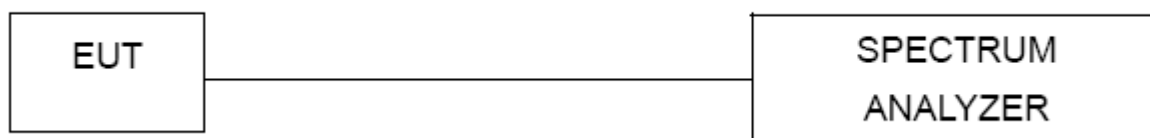
**6.1.2 TEST PROCEDURE**

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms.

**6.1.3 DEVIATION FROM STANDARD**

No deviation.

**6.1.4 TEST SETUP**



**6.1.5 EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.



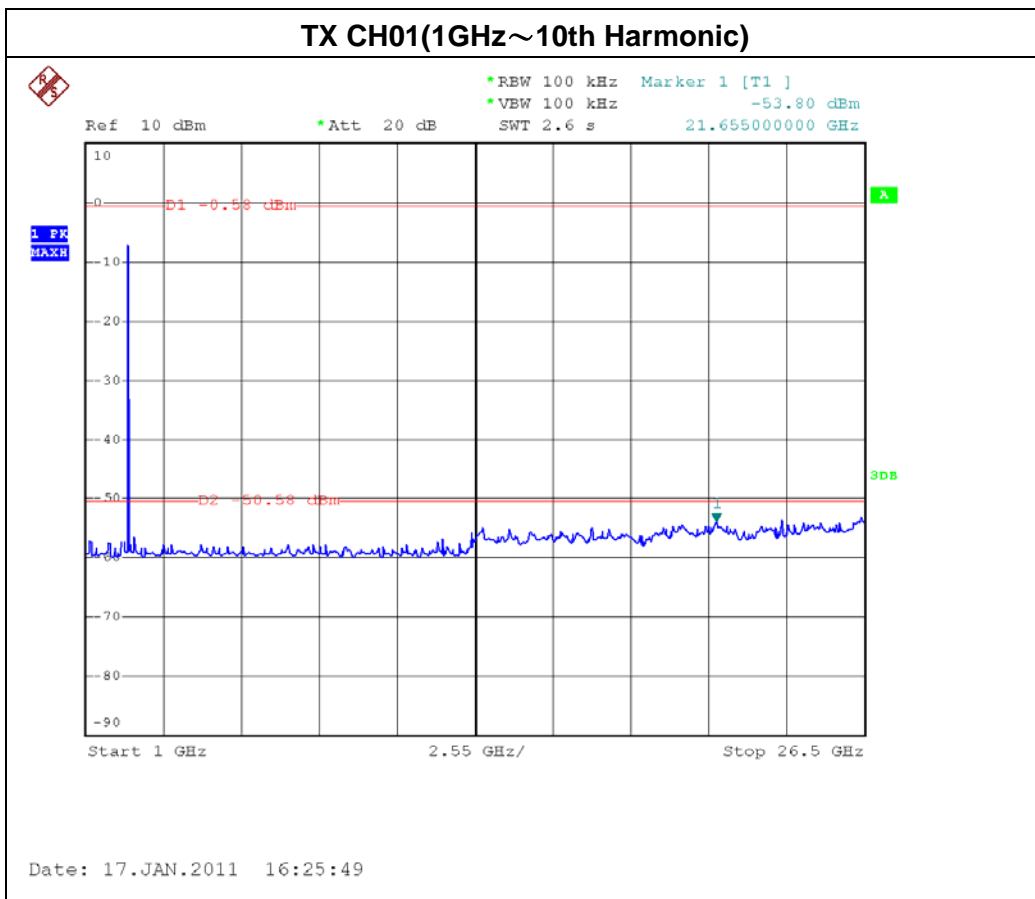
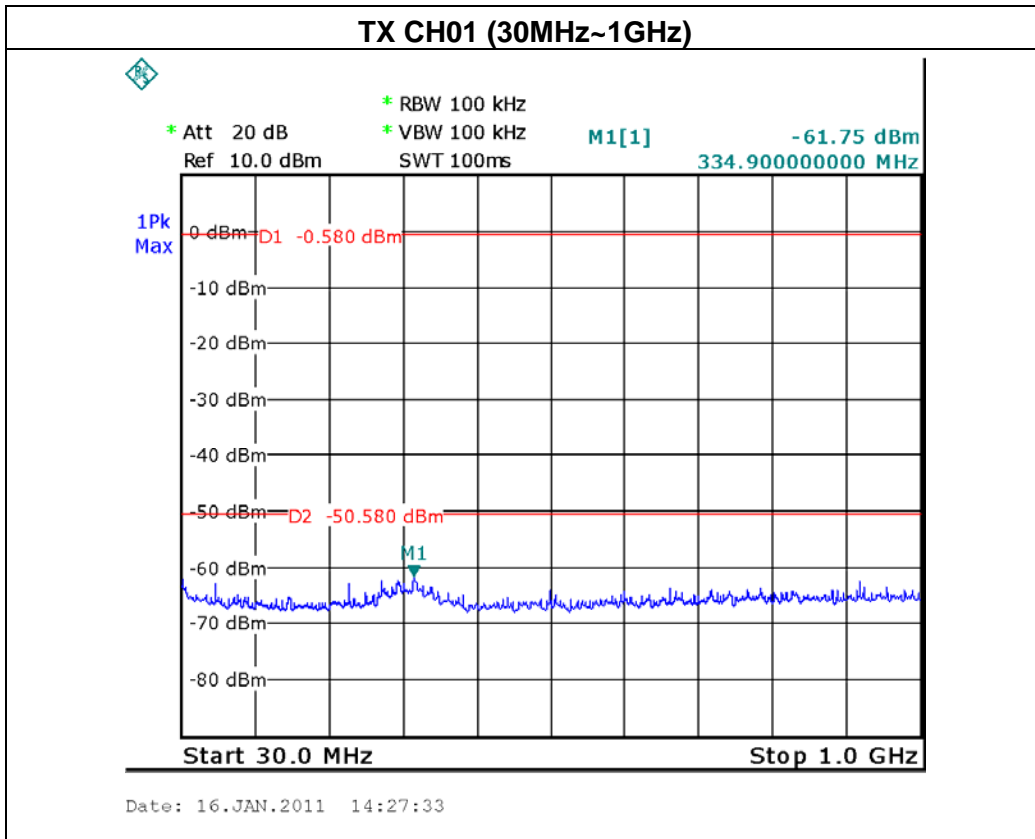


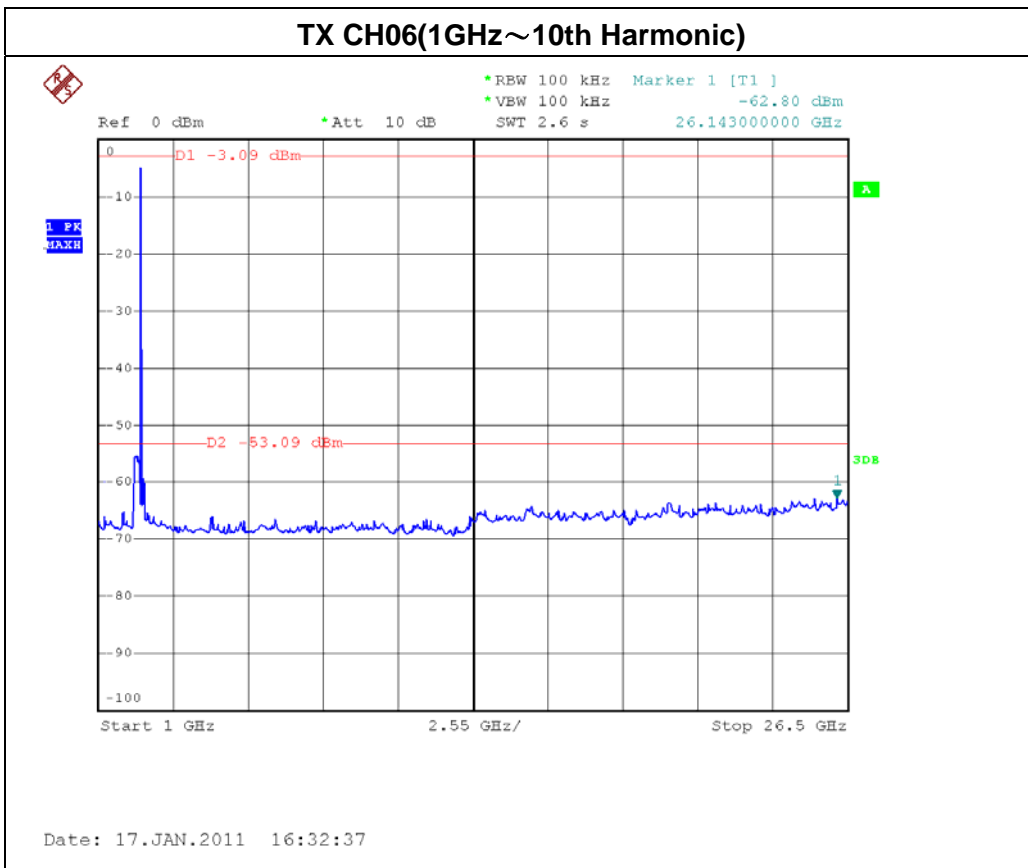
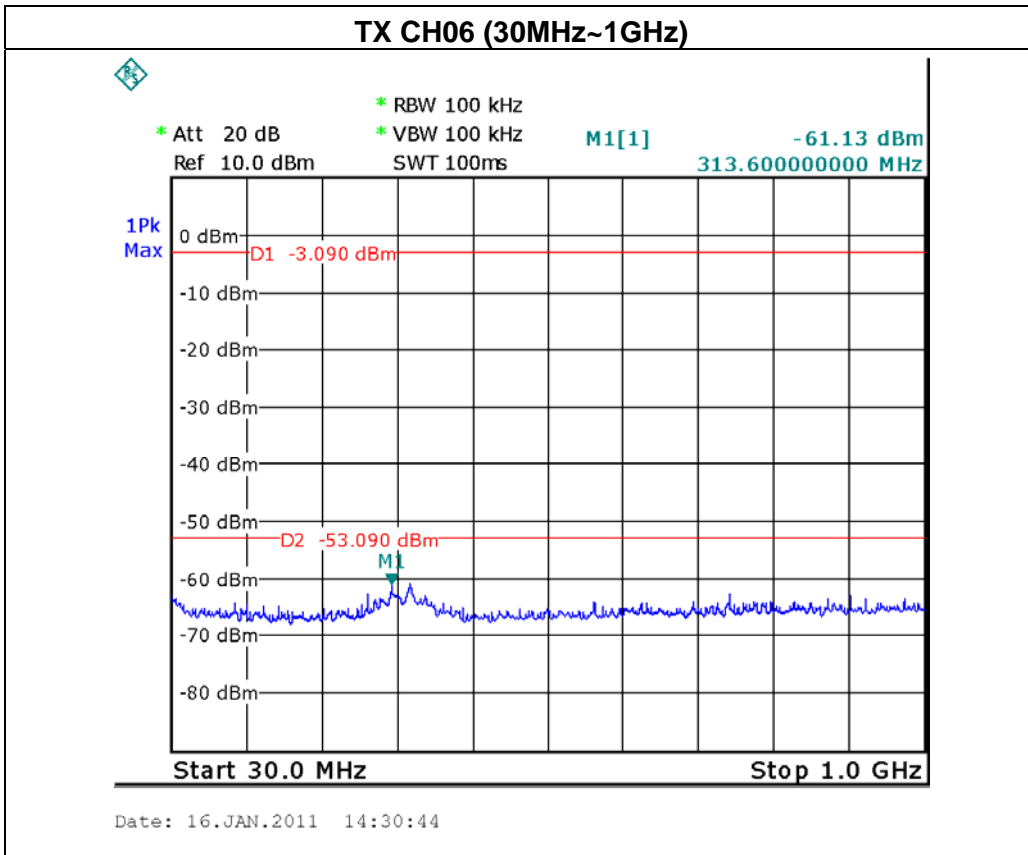
6.1.6 TEST RESULTS

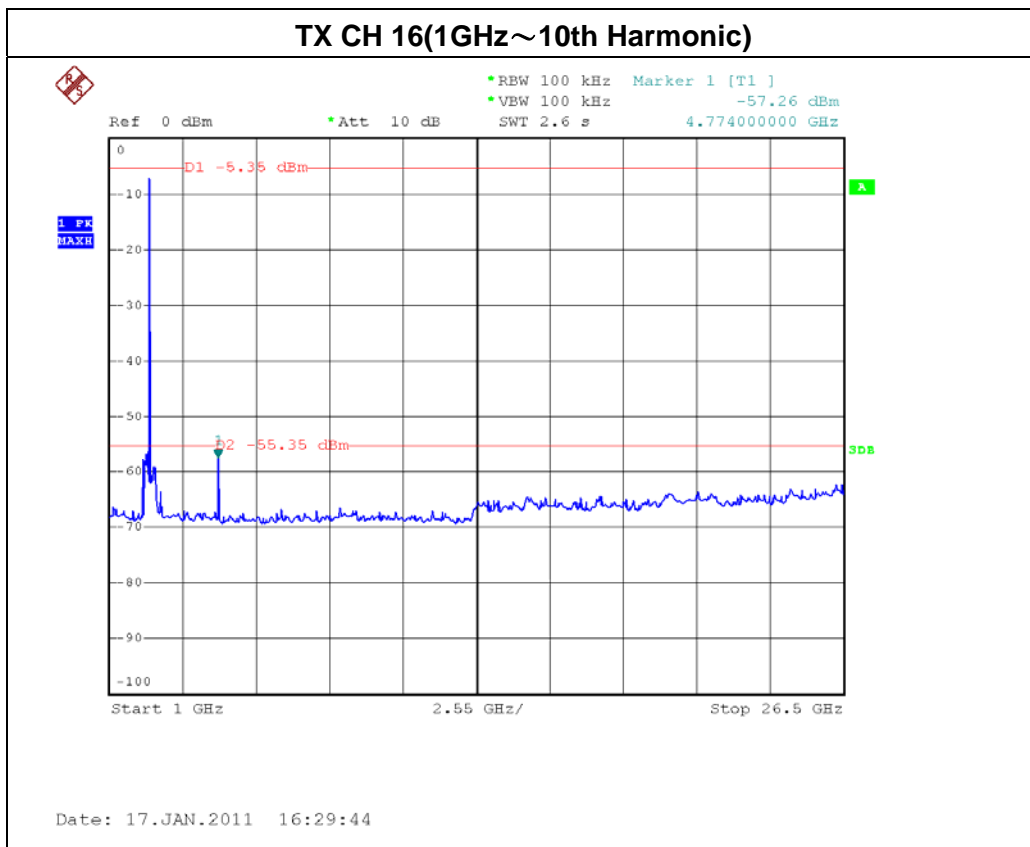
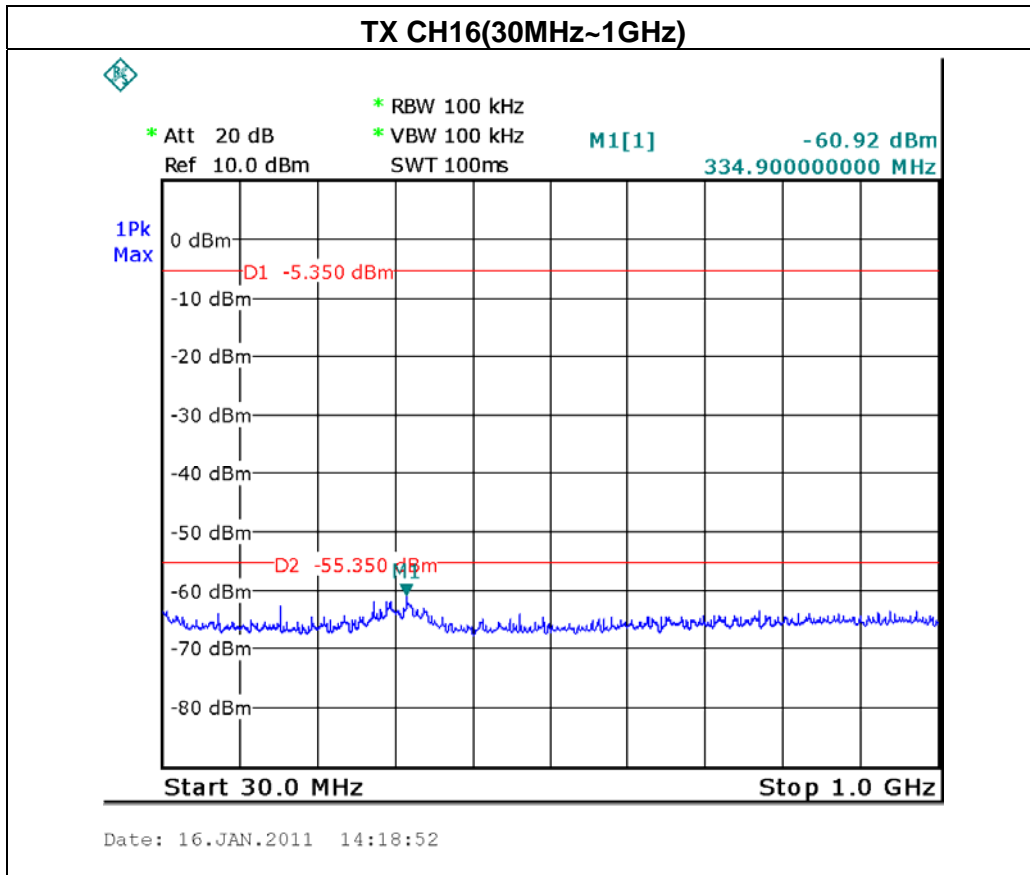
|               |                      |                     |       |
|---------------|----------------------|---------------------|-------|
| EUT :         | Wireless Laser Mouse | Model Name. :       | L281  |
| Temperature : | 20°C                 | Relative Humidity : | 60 %  |
| Pressure :    | 1001 hPa             | Test Power :        | DC 3V |
| Test Mode :   | TX CH01, CH16        |                     |       |

| Channel of Worst Data: CH01   |            |  |            |
|---|------------|--|------------|
| The max. radio frequency power in any 100kHz bandwidth outside the frequency band   |            | The max. radio frequency power in any 100 kHz bandwidth within the frequency band. |            |
| FREQUENCY(MHz)  | POWER(dBm) | FREQUENCY(MHz)   | POWER(dBm) |
| 2341.84   | -56.49     | 2483.50  | -55.67     |
| Result  |            |  |            |
| In any 100kHz bandwidth outside the frequency band, the radio frequency power is at least 50dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. |            |  |            |











7. EUT TEST PHOTO

**Radiated Measurement Photos**

