# FCC REPORT

| | |
|---|---|
| **Applicant:** | Shinwa Industries (China) Ltd. |
| **Address of Applicant:** | No.26, Huifeng West 2 Road, Zhongkai High-tech Park, Huizhou, Guangdong, China |

**Equipment Under Test (EUT)**

| | |
|---|---|
| Product Name: | Car Kit Bluetooth Module |
| Model No.: | BT-MC88-1X |
| **FCC ID:** | ZWY8811X |
| **Applicable standards:** | FCC CFR Title 47 Part 15 Subpart C Section 15.247:2014 |
| **Date of sample receipt:** | May 25, 2015 |
| **Date of Test:** | May 25-June 02, 2015 |
| **Date of report issued:** | June 02, 2015 |
| **Test Result :** | PASS * |

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

**Robinson Lo**
**Laboratory Manager**

## 2 Version

| Version No. | Date | Description |
|---|---|---|
| *00* | *June 02, 2015* | *Original* |
| | | |
| | | |
| | | |
| | | |

| | | | |
|---|---|---|---|
| ***Tested By:*** | Edward.pan | ***Date:*** | *June 02, 2015* |
| | ***Project Engineer*** | | |
| ***Check By:*** | hank.yan | ***Date:*** | *June 02, 2015* |
| | ***Reviewer*** | | |

# 3 Contents

# 4 Test Summary

| Test Item | Section in CFR 47 | Result |
|---|---|---|
| Antenna requirement | 15.203/15.247 (c) | Pass |
| AC Power Line Conducted Emission | 15.207 | Pass |
| Conducted Output Power | 15.247 (b)(3) | Pass |
| Channel Bandwidth | 15.247 (a)(2) | Pass |
| Power Spectral Density | 15.247 (e) | Pass |
| Band Edge | 15.247(d) | Pass |
| Spurious Emission | 15.205/15.209 | Pass |

*Pass: The EUT complies with the essential requirements in the standard.*

## 4.1 Measurement Uncertainty

| Test Item | Frequency Range | Measurement Uncertainty | Notes |
|---|---|---|---|
| Radiated Emission | 9kHz ~ 30MHz | ± 4.34dB | (1) |
| Radiated Emission | 30MHz ~ 1000MHz | ± 4.24dB | (1) |
| Radiated Emission | 1GHz ~ 26.5GHz | ± 4.68dB | (1) |
| AC Power Line Conducted Emission | 0.15MHz ~ 30MHz | ± 3.45dB | (1) |
| Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%. | | | |

*Remark: Test according to ANSI C63.4:2009*

# 5 General Information

## 5.1 Client Information

| | |
|---|---|
| Applicant: | Shinwa Industries (China) Ltd. |
| Address of Applicant: | No.26, Huifeng West 2 Road, Zhongkai High-tech Park, Huizhou, Guangdong, China |
| Manufacturer: | Shinwa Industries (China) Ltd. |
| Address of Manufacturer: | No.26, Huifeng West 2 Road, Zhongkai High-tech Park, Huizhou, Guangdong, China |

## 5.2 General Description of EUT

| | |
|---|---|
| Product Name: | Car Kit Bluetooth Module |
| Model No.: | BT-MC88-1X |
| Operation Frequency: | 2402MHz~2480MHz |
| Channel Numbers: | 40 |
| Channel Separation: | 2MHz |
| Modulation Type: | GFSK |
| Antenna Type: | PCB antenna |
| Antenna Gain: | 0.25dBi (declare by Applicant) |
| Power Supply: | DC 3.3V |

| Operation Frequency each of channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2402MHz | 11 | 2422MHz | 21 | 2442MHz | 31 | 2462MHz |
| 2 | 2404MHz | 12 | 2424MHz | 22 | 2444MHz | 32 | 2464MHz |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 9 | 2418MHz | 19 | 2438MHz | 29 | 2458MHz | 39 | 2478MHz |
| 10 | 2420MHz | 20 | 2440MHz | 30 | 2460MHz | 40 | 2480MHz |

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel | Frequency |
|---|---|
| The lowest channel | 2402MHz |
| The middle channel | 2440MHz |
| The Highest channel | 2480MHz |

## 5.3 Test mode

| | |
|---|---|
| Transmitting mode | Keep the EUT in continuously transmitting mode |
| *Remark: During the test, the dutycycle >98%, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.* | |

## 5.4 Description of Support Units

| Manufacturer | Description | Model | Serial Number | FCC ID/DoC |
|---|---|---|---|---|
| Apple | PC | A1278 | C1MN99ERDTY3 | DoC |

## 5.5 Test Facility

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

● **CNAS —Registration No.: CNAS L5775**

CNAS has accredited Global United Technology Services Co., Ltd. To ISO/IEC 17025 General Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

● **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fuly described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 28, 2013.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, June 26, 2013.

## 5.6 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Room 301-309, 3th Floor, Block A, Huafeng Jinyuan Business Building, No. 300 Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, China

Tel: 0755-27798480

Fax: 0755-27798960

# 6 Test Instruments list

| Radiated Emission: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | 3m Semi- Anechoic Chamber | ZhongYu Electron | 9.2(L)*6.2(W)* 6.4(H) | GTS250 | Mar. 28 2015 | Mar. 27 2016 |
| 2 | Control Room | ZhongYu Electron | 6.2(L)*2.5(W)* 2.4(H) | GTS251 | N/A | N/A |
| 3 | Spectrum Analyzer | Agilent | E4440A | GTS533 | Jul. 01 2014 | Jun 30 2015 |
| 4 | EMI Test Receiver | Rohde & Schwarz | ESU26 | GTS203 | Jul. 01 2014 | Jun 30 2015 |
| 5 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | Jul. 01 2014 | Jun 30 2015 |
| 6 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | 9120D-829 | GTS208 | June 27 2014 | June 26 2015 |
| 7 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | Mar. 27 2015 | Mar. 26 2016 |
| 8 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 9 | Coaxial Cable | GTS | N/A | GTS213 | Mar. 28 2015 | Mar. 27 2016 |
| 10 | Coaxial Cable | GTS | N/A | GTS211 | Mar. 28 2015 | Mar. 27 2016 |
| 11 | Coaxial cable | GTS | N/A | GTS210 | Mar. 28 2015 | Mar. 27 2016 |
| 12 | Coaxial Cable | GTS | N/A | GTS212 | Mar. 28 2015 | Mar. 27 2016 |
| 13 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | Jul. 01 2014 | Jun. 30, 2015 |
| 14 | Amplifier(2GHz-20GHz) | HP | 8349B | GTS206 | Jul. 01 2014 | Jun. 30, 2015 |
| 15 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June 27 2014 | June 26 2015 |
| 16 | Band filter | Amindeon | 82346 | GTS219 | Mar. 28 2015 | Mar. 27 2016 |
| 17 | Power Meter | Anritsu | ML2495A | GTS540 | July 01 2014 | June 30 2015 |
| 18 | Power Sensor | Anritsu | MA2411B | GTS541 | July 01 2014 | June 30 2015 |

| Conducted Emission: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Shielding Room | ZhongYu Electron | 7.0(L)x3.0(W)x3.0(H) | GTS264 | July 01 2014 | June 30 2015 |
| 2 | EMI Test Receiver | Rohde & Schwarz | ESCS30 | GTS223 | July 01 2014 | June 30 2015 |
| 3 | 10dB Pulse Limita | Rohde & Schwarz | N/A | GTS224 | July 01 2014 | June 30 2015 |
| 4 | Coaxial Switch | ANRITSU CORP | MP59B | GTS225 | July 01 2014 | June 30 2015 |
| 5 | LISN | SCHWARZBECK MESS-ELEKTRONIK | NSLK 8127 | GTS226 | July 01 2014 | June 30 2015 |
| 6 | Coaxial Cable | GTS | N/A | GTS227 | July 01 2014 | June 30 2015 |
| 7 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |

| General used equipment: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Barometer | ChangChun | DYM3 | GTS257 | July 08 2014 | July 07 2015 |

# 7 Test results and Measurement Data

## 7.1 Antenna requirement

| | |
|---|---|
| **Standard requirement:** | FCC Part15 C Section 15.203 /247(c) |

**15.203 requirement:**

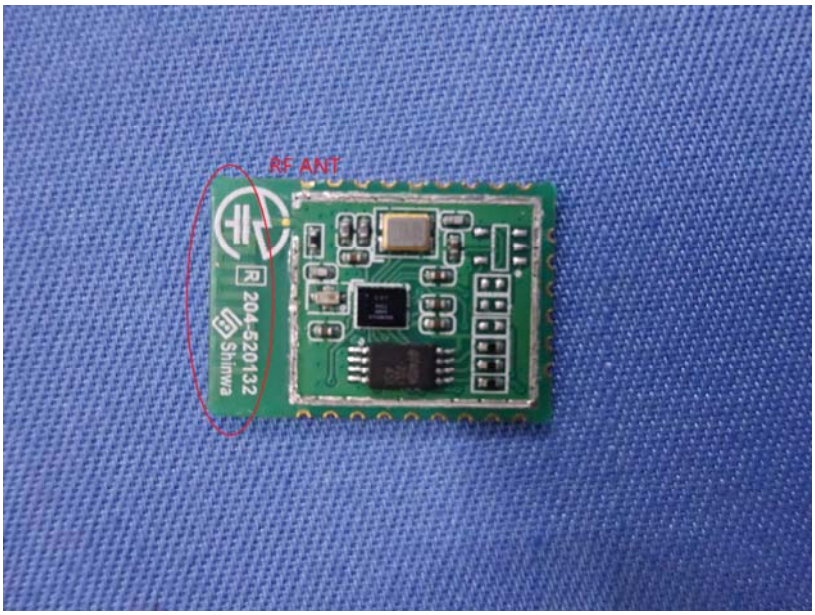
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

**15.247(c) (1)(i) requirement:**

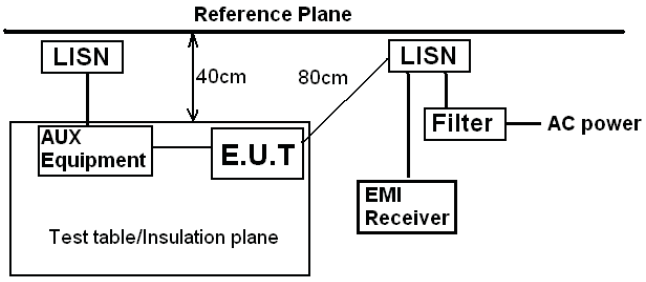
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

**EUT Antenna:**

*The antenna is PCB antenna, the best case gain of the antenna is 0.25dBi*

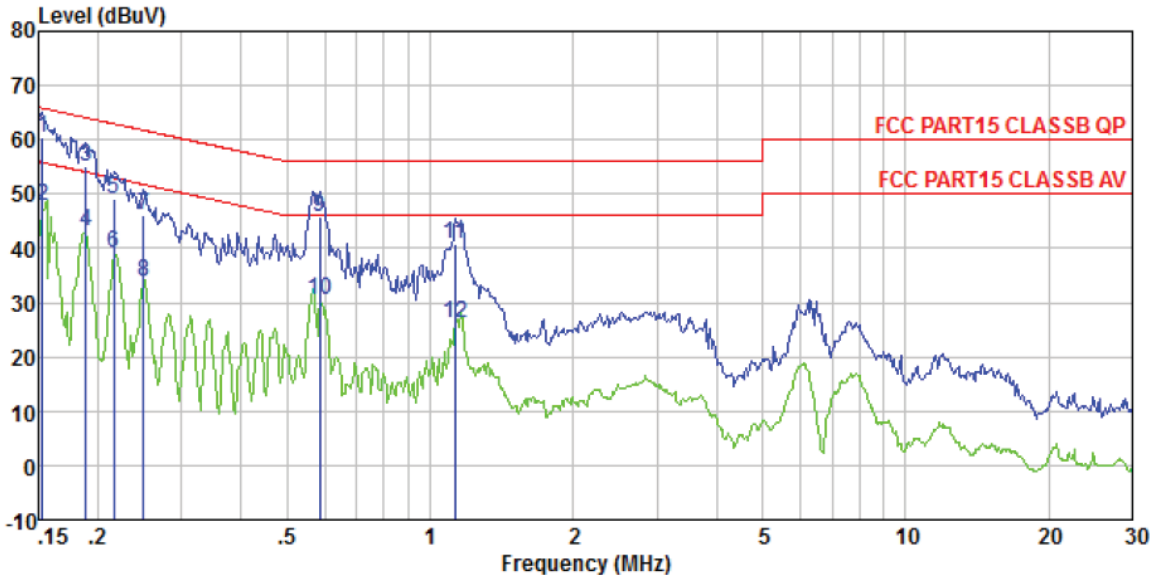


## 7.2 Conducted Emissions

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.207 |
| Test Method: | ANSI C63.4:2009 |
| Test Frequency Range: | 150KHz to 30MHz |
| Class / Severity: | Class B |
| Receiver setup: | RBW=9KHz, VBW=30KHz, Sweep time=auto |
| Limit: | Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average<br>0.15-0.5: 66 to 56* / 56 to 46*<br>0.5-5: 56 / 46<br>5-30: 60 / 50<br>* Decreases with the logarithm of the frequency. |
| Test setup: |  <br>*Remark:*<br>*E.U.T: Equipment Under Test*<br>*LISN: Line Impedence Stabilization Network*<br>*Test table height=0.8m* |
| Test procedure: | 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.<br>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).<br>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2009 on conducted measurement. |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

**Measurement data**

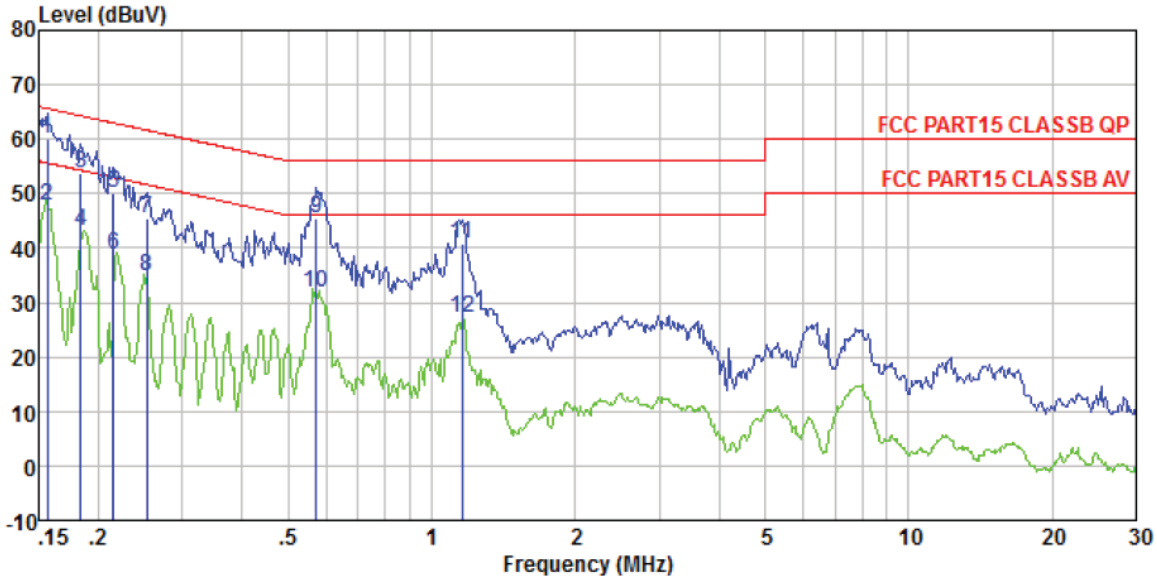
Line:




Site : Shielded room
Condition : FCC PART15 CLASSB QP LISN-2013 LINE
Job No. : 0795RF
Test mode : Bluetooth 4.0 mode
Test Engineer: Qing

| | Freq | Read Level | LISN Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 1 | 0.153 | 60.16 | 0.15 | 0.12 | 60.43 | 65.82 | -5.39 | QP |
| 2 | 0.153 | 47.65 | 0.15 | 0.12 | 47.92 | 55.82 | -7.90 | Average |
| 3 | 0.188 | 54.72 | 0.14 | 0.13 | 54.99 | 64.11 | -9.12 | QP |
| 4 | 0.188 | 43.01 | 0.14 | 0.13 | 43.28 | 54.11 | -10.83 | Average |
| 5 | 0.216 | 48.95 | 0.13 | 0.13 | 49.21 | 62.96 | -13.75 | QP |
| 6 | 0.216 | 38.85 | 0.13 | 0.13 | 39.11 | 52.96 | -13.85 | Average |
| 7 | 0.249 | 45.82 | 0.12 | 0.11 | 46.05 | 61.78 | -15.73 | QP |
| 8 | 0.249 | 33.59 | 0.12 | 0.11 | 33.82 | 51.78 | -17.96 | Average |
| 9 | 0.585 | 45.65 | 0.13 | 0.12 | 45.90 | 56.00 | -10.10 | QP |
| 10 | 0.585 | 30.25 | 0.13 | 0.12 | 30.50 | 46.00 | -15.50 | Average |
| 11 | 1.129 | 40.65 | 0.13 | 0.13 | 40.91 | 56.00 | -15.09 | QP |
| 12 | 1.129 | 26.10 | 0.13 | 0.13 | 26.36 | 46.00 | -19.64 | Average |

Neutral:



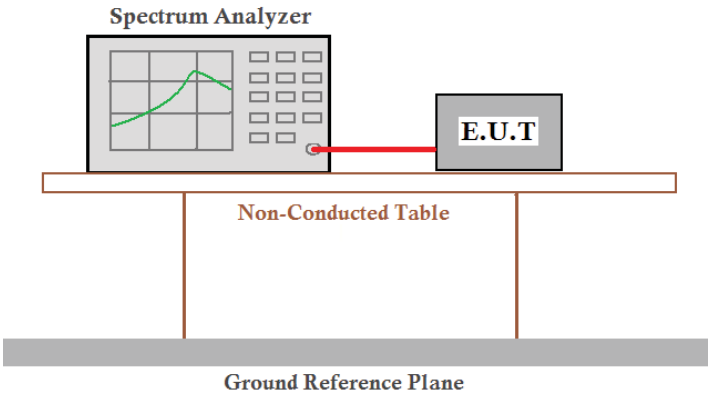

Site : Shielded room
Condition : FCC PART15 CLASSB QP LISN-2013 NEUTRAL
Job No. : 0795RF
Test mode : Bluetooth 4.0 mode
Test Engineer: Qing

| | Freq | Read Level | LISN Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 1 | 0.156 | 59.73 | 0.07 | 0.12 | 59.92 | 65.65 | -5.73 | QP |
| 2 | 0.156 | 47.69 | 0.07 | 0.12 | 47.88 | 55.65 | -7.77 | Average |
| 3 | 0.183 | 53.64 | 0.07 | 0.13 | 53.84 | 64.33 | -10.49 | QP |
| 4 | 0.183 | 42.87 | 0.07 | 0.13 | 43.07 | 54.33 | -11.26 | Average |
| 5 | 0.215 | 49.79 | 0.06 | 0.13 | 49.98 | 63.01 | -13.03 | QP |
| 6 | 0.215 | 38.49 | 0.06 | 0.13 | 38.68 | 53.01 | -14.33 | Average |
| 7 | 0.253 | 45.17 | 0.06 | 0.11 | 45.34 | 61.64 | -16.30 | QP |
| 8 | 0.253 | 34.80 | 0.06 | 0.11 | 34.97 | 51.64 | -16.67 | Average |
| 9 | 0.573 | 45.16 | 0.07 | 0.12 | 45.35 | 56.00 | -10.65 | QP |
| 10 | 0.573 | 31.80 | 0.07 | 0.12 | 31.99 | 46.00 | -14.01 | Average |
| 11 | 1.160 | 40.55 | 0.08 | 0.13 | 40.76 | 56.00 | -15.24 | QP |
| 12 | 1.160 | 27.03 | 0.08 | 0.13 | 27.24 | 46.00 | -18.76 | Average |

*Notes:*

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

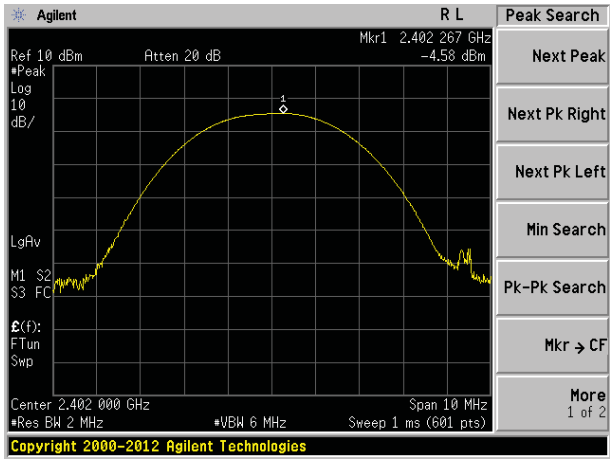
## 7.3 Conducted Output Power

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (b)(3) |
| Test Method: | ANSI C63.4:2009 and KDB558074 D01 DTS Meas Guidance V03 |
| Limit: | 30dBm |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

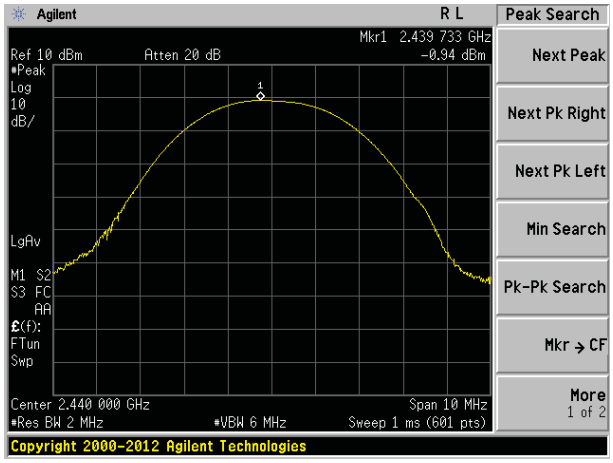
**Measurement Data**

| Test channel | Peak Output Power (dBm) | Limit(dBm) | Result |
|---|---|---|---|
| Lowest | -4.58 | 30.00 | Pass |
| Middle | -0.94 | | |
| Highest | 0.07 | | |

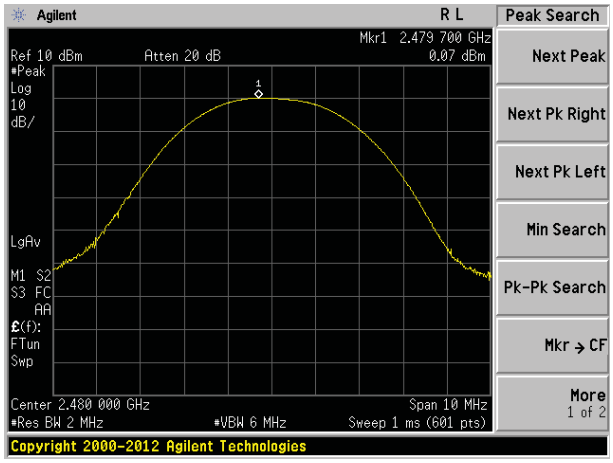
**Test plot as follows:**




Lowest channel

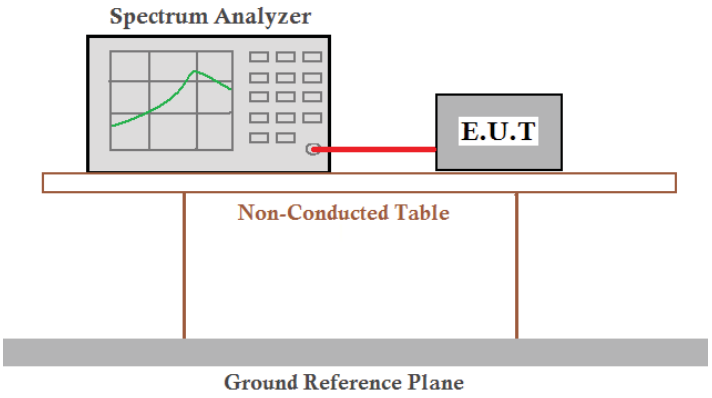



Middle channel




Highest channel

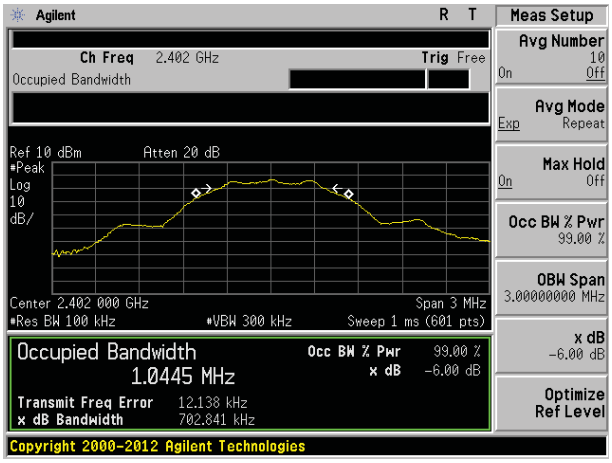
## 7.4 Channel Bandwidth

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(2) |
| Test Method: | ANSI C63.4:2009 and KDB558074 D01 DTS Meas Guidance V03 |
| Limit: | >500KHz |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

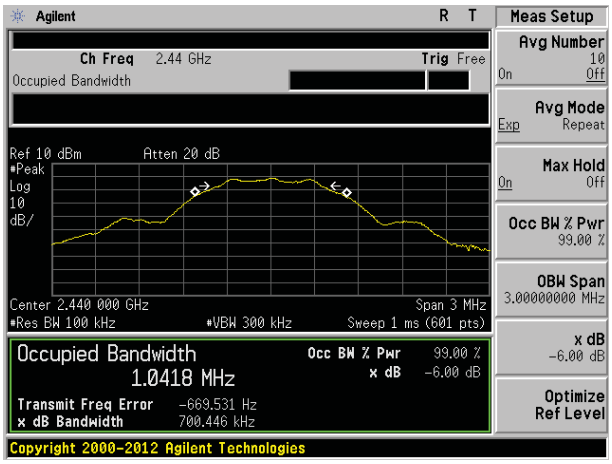
**Measurement Data**

| Test channel | Channel Bandwidth (KHz) | Limit(KHz) | Result |
|---|---|---|---|
| Lowest | 702.841 | >500 | Pass |
| Middle | 700.446 | | |
| Highest | 698.810 | | |

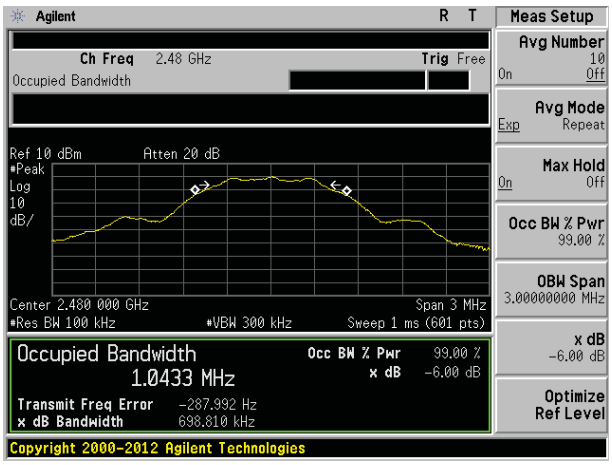
**Test plot as follows:**




Lowest channel

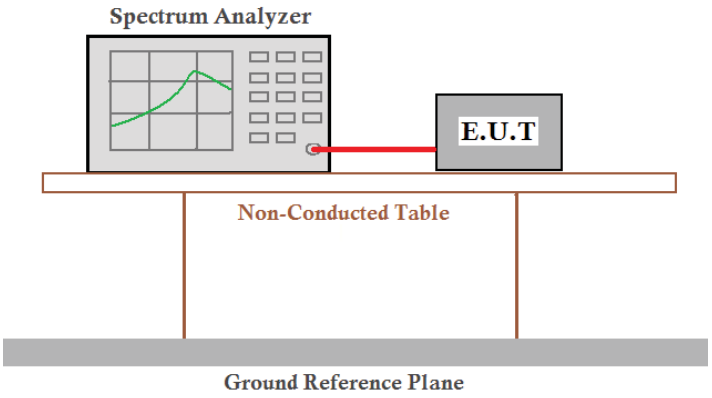



Middle channel




Highest channel

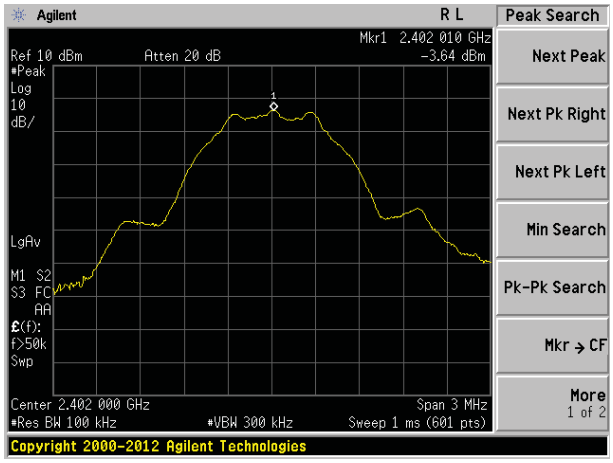
## 7.5 Power Spectral Density

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (e) |
| Test Method: | ANSI C63.4:2009 and KDB558074 D01 DTS Meas Guidance V03 |
| Limit: | 8dBm/3kHz |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

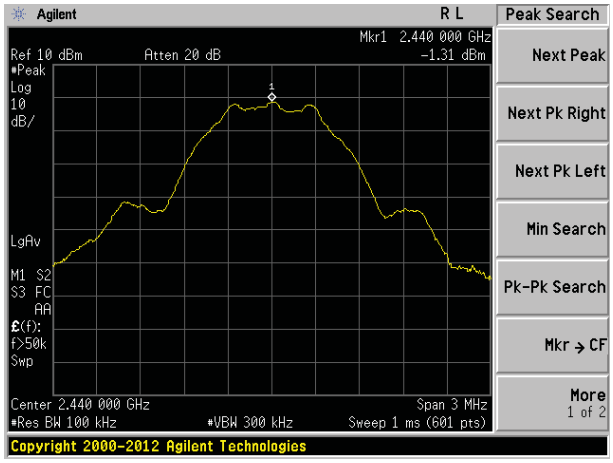
**Measurement Data**

| Test channel | Power Spectral Density (dBm) | Limit(dBm/3kHz) | Result |
|---|---|---|---|
| Lowest | -3.64 | 8.00 | Pass |
| Middle | -1.31 | | |
| Highest | -0.36 | | |

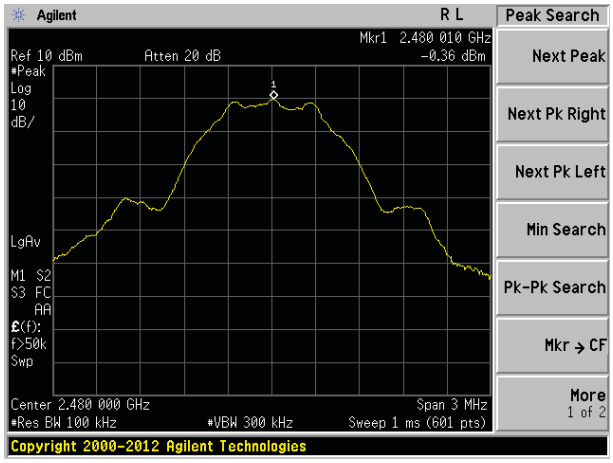
**Test plot as follows:**




Lowest channel



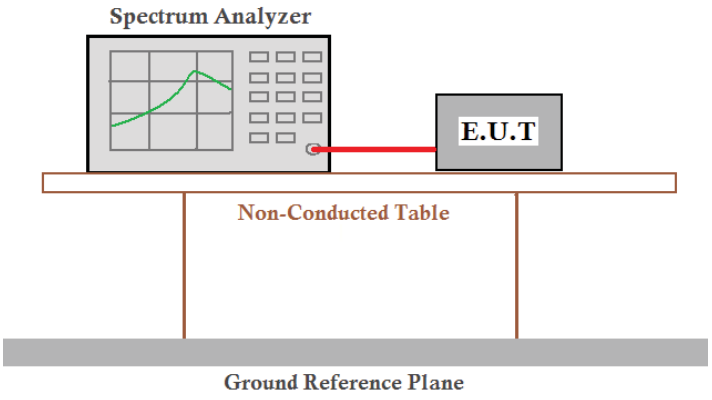

Middle channel



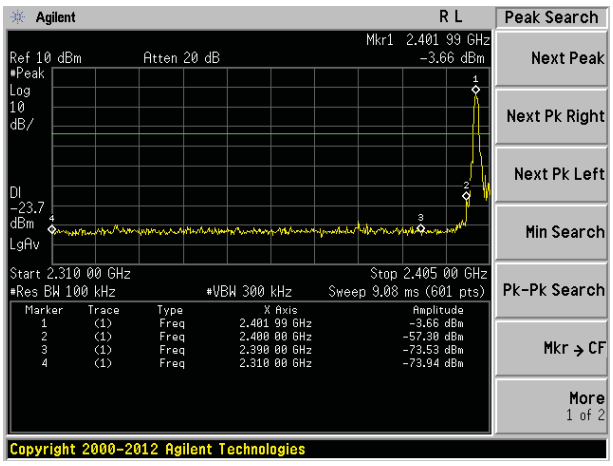

Highest channel

## 7.6 Band edges

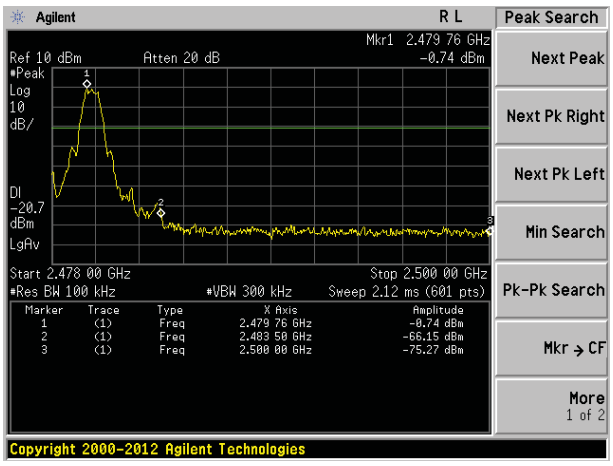
### 7.6.1 Conducted Emission Method

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (d) |
| Test Method: | ANSI C63.4:2009 and KDB558074 D01 DTS Meas Guidance V03 |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

**Test plot as follows:**

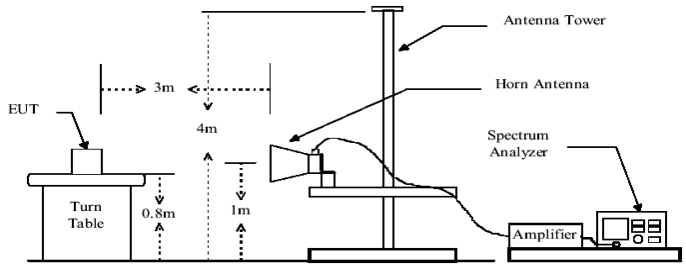



Lowest channel




Highest channel

### 7.6.2 Radiated Emission Method

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.209 and 15.205 |
| Test Method: | ANSI C63.4: 2009 |
| Test Frequency Range: | All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed. |
| Test site: | Measurement Distance: 3m |
| Receiver setup: | <table><tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Value</td></tr><tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr><tr><td>RMS</td><td>1MHz</td><td>3MHz</td><td>Average</td></tr></table> |
| Limit: | <table><tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Value</td></tr><tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average</td></tr><tr><td>74.00</td><td>Peak</td></tr></table> |
| Test setup: |  |
| Test Procedure: | 1. The EUT was placed on the top of a rotating table 0.8m above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.<br>7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report. |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

Measurement data:

*Remark: The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.*

| Test channel: | Lowest |
|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 42.71 | 27.59 | 5.38 | 30.18 | 45.50 | 74.00 | -28.50 | Vertical |
| 2400.00 | 60.89 | 27.58 | 5.39 | 30.18 | 63.68 | 74.00 | -10.32 | Vertical |
| 2390.00 | 42.23 | 27.59 | 5.38 | 30.18 | 45.02 | 74.00 | -28.98 | Horizontal |
| 2400.00 | 58.92 | 27.58 | 5.39 | 30.18 | 61.71 | 74.00 | -12.29 | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 32.82 | 27.59 | 5.38 | 30.18 | 35.61 | 54.00 | -18.39 | Vertical |
| 2400.00 | 45.71 | 27.58 | 5.39 | 30.18 | 48.50 | 54.00 | -5.50 | Vertical |
| 2390.00 | 32.92 | 27.59 | 5.38 | 30.18 | 35.71 | 54.00 | -18.29 | Horizontal |
| 2400.00 | 44.12 | 27.58 | 5.39 | 30.18 | 46.91 | 54.00 | -7.09 | Horizontal |

| Test channel: | Highest |
|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 44.99 | 27.53 | 5.47 | 29.93 | 48.06 | 74.00 | -25.94 | Vertical |
| 2500.00 | 44.49 | 27.55 | 5.49 | 29.93 | 47.60 | 74.00 | -26.40 | Vertical |
| 2483.50 | 44.25 | 27.53 | 5.47 | 29.93 | 47.32 | 74.00 | -26.68 | Horizontal |
| 2500.00 | 43.55 | 27.55 | 5.49 | 29.93 | 46.66 | 74.00 | -27.34 | Horizontal |

**Average value:**

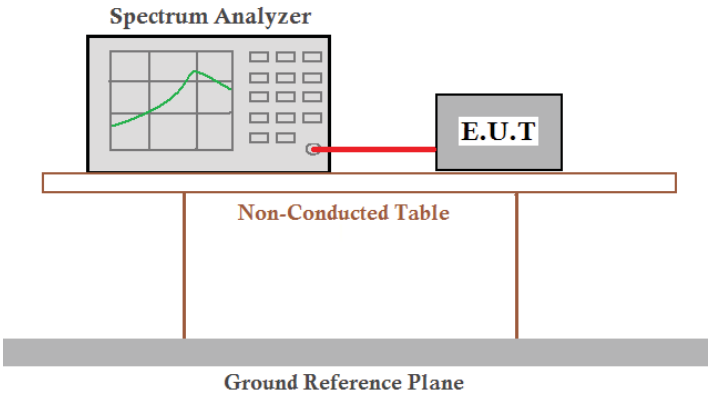
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 36.90 | 27.53 | 5.47 | 29.93 | 39.97 | 54.00 | -14.03 | Vertical |
| 2500.00 | 33.71 | 27.55 | 5.49 | 29.93 | 36.82 | 54.00 | -17.18 | Vertical |
| 2483.50 | 35.74 | 27.53 | 5.47 | 29.93 | 38.81 | 54.00 | -15.19 | Horizontal |
| 2500.00 | 33.84 | 27.55 | 5.49 | 29.93 | 36.95 | 54.00 | -17.05 | Horizontal |

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

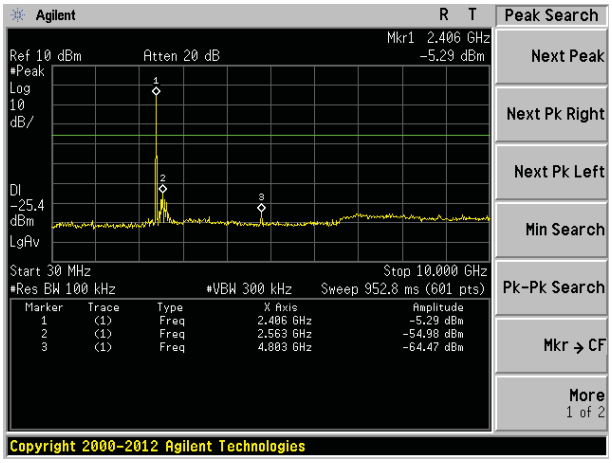
## 7.7 Spurious Emission

### 7.7.1 Conducted Emission Method

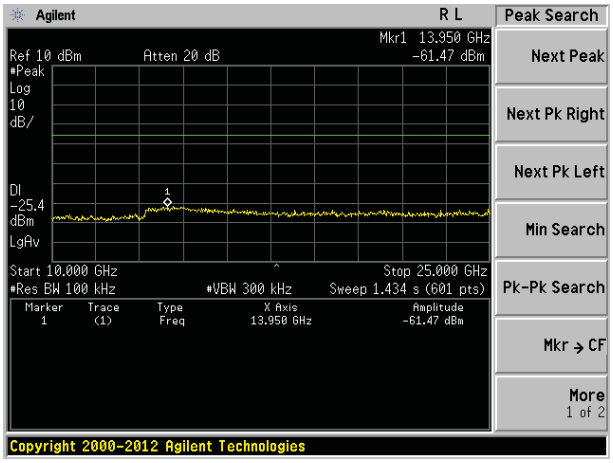
| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (d) |
| Test Method: | ANSI C63.4:2009 and KDB558074 D01 DTS Meas Guidance V03 |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

**Test plot as follows:**

Lowest channel

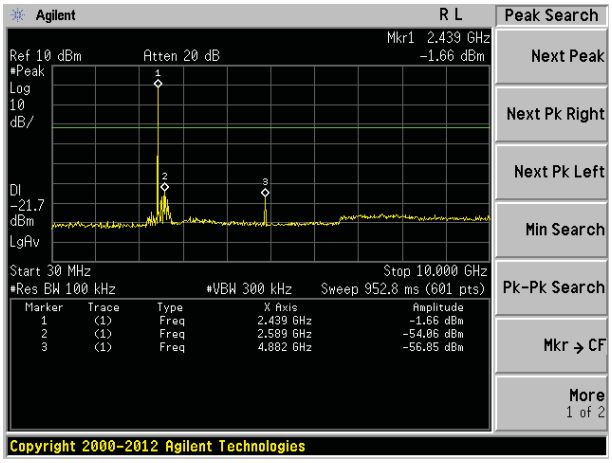



30MHz~10GHz

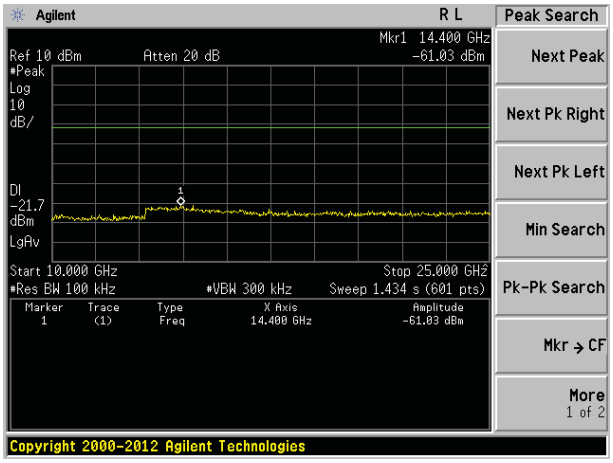



10GHz~25GHz

Middle channel

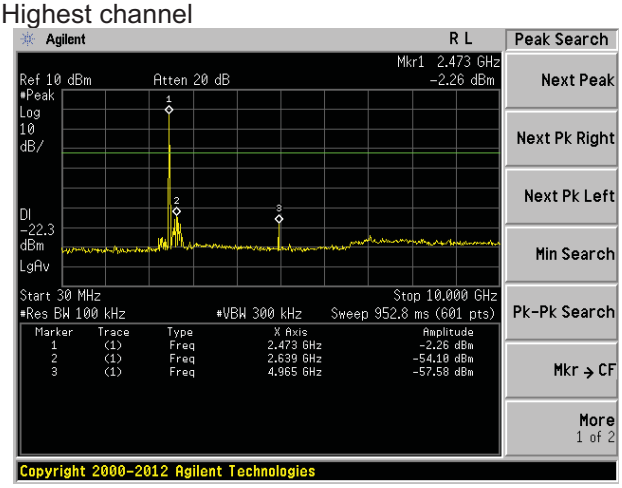



30MHz~10GHz

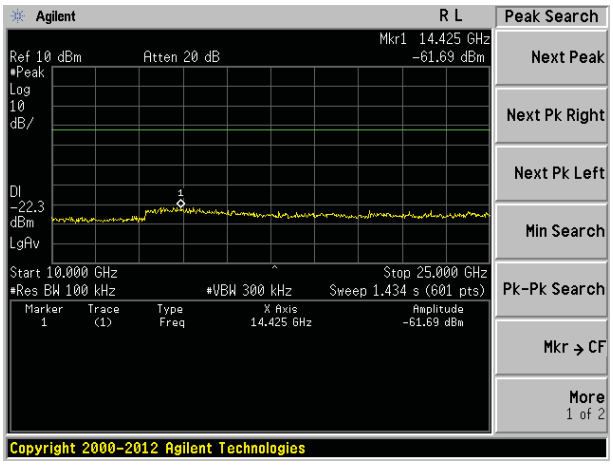



10GHz~25GHz

Highest channel




30MHz~10GHz




10GHz~25GHz

### 7.7.2 Radiated Emission Method

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.209 |
| Test Method: | ANSI C63.4: 2009 |
| Test Frequency Range: | 30MHz to 25GHz |
| Test site: | Measurement Distance: 3m |

Receiver setup:

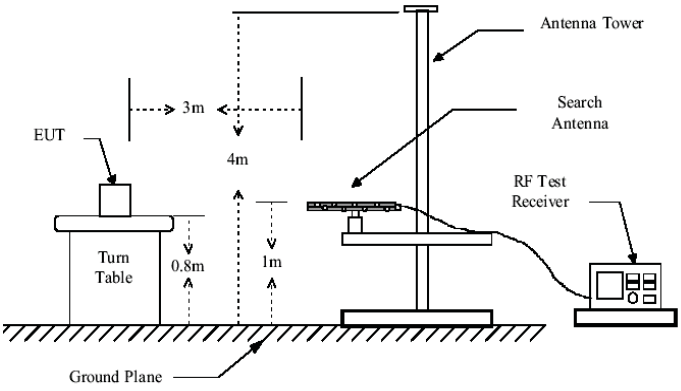
| Frequency | Detector | RBW | VBW | Value |
|---|---|---|---|---|
| 30MHz-1GHz | Quasi-peak | 120KHz | 300KHz | Quasi-peak |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | RMS | 1MHz | 3MHz | Average |

Limit:

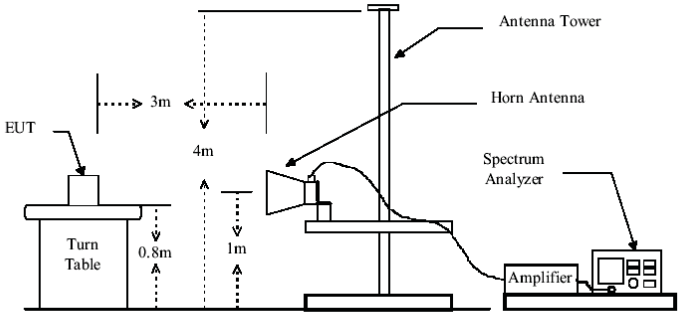
| Frequency | Limit (dBuV/m @3m) | Value |
|---|---|---|
| 30MHz-88MHz | 40.00 | Quasi-peak |
| 88MHz-216MHz | 43.50 | Quasi-peak |
| 216MHz-960MHz | 46.00 | Quasi-peak |
| 960MHz-1GHz | 54.00 | Quasi-peak |
| Above 1GHz | 54.00 | Average |
| | 74.00 | Peak |

Test setup:

Below 1GHz




Above 1GHz



| | |
|---|---|
| Test Procedure: | 1. The EUT was placed on the top of a rotating table 0.8m meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.<br>7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report. |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

*Remark:*

*Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis which it is worse case.*

**Measurement Data**

■ **Below 1GHz**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 40.28 | 26.16 | 15.58 | 0.66 | 30.04 | 12.36 | 40.00 | -27.64 | Vertical |
| 98.49 | 25.19 | 15.06 | 1.18 | 29.71 | 11.72 | 43.50 | -31.78 | Vertical |
| 241.68 | 25.19 | 14.09 | 2.08 | 29.57 | 11.79 | 46.00 | -34.21 | Vertical |
| 356.68 | 27.31 | 16.38 | 2.65 | 29.70 | 16.64 | 46.00 | -29.36 | Vertical |
| 508.26 | 25.12 | 18.74 | 3.34 | 29.30 | 17.90 | 46.00 | -28.10 | Vertical |
| 750.11 | 24.99 | 21.43 | 4.28 | 29.20 | 21.50 | 46.00 | -24.50 | Vertical |
| 35.38 | 27.40 | 14.39 | 0.61 | 30.07 | 12.33 | 40.00 | -27.67 | Horizontal |
| 100.23 | 25.65 | 15.11 | 1.19 | 29.70 | 12.25 | 43.50 | -31.25 | Horizontal |
| 230.10 | 25.34 | 13.62 | 2.02 | 29.48 | 11.50 | 46.00 | -34.50 | Horizontal |
| 419.11 | 25.73 | 17.43 | 2.94 | 29.46 | 16.64 | 46.00 | -29.36 | Horizontal |
| 622.89 | 24.84 | 20.54 | 3.81 | 29.28 | 19.91 | 46.00 | -26.09 | Horizontal |
| 912.86 | 25.10 | 23.18 | 4.90 | 29.10 | 24.08 | 46.00 | -21.92 | Horizontal |

■ **Above 1GHz**

| Test channel: | Lowest |
|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4804.00 | 37.79 | 31.78 | 8.60 | 32.09 | 46.08 | 74.00 | -27.92 | Vertical |
| 7206.00 | 32.15 | 36.15 | 11.65 | 32.00 | 47.95 | 74.00 | -26.05 | Vertical |
| 9608.00 | 31.76 | 37.95 | 14.14 | 31.62 | 52.23 | 74.00 | -21.77 | Vertical |
| 12010.00 | * | | | | | 74.00 | | Vertical |
| 14412.00 | * | | | | | 74.00 | | Vertical |
| 4804.00 | 42.18 | 31.78 | 8.60 | 32.09 | 50.47 | 74.00 | -23.53 | Horizontal |
| 7206.00 | 33.95 | 36.15 | 11.65 | 32.00 | 49.75 | 74.00 | -24.25 | Horizontal |
| 9608.00 | 31.22 | 37.95 | 14.14 | 31.62 | 51.69 | 74.00 | -22.31 | Horizontal |
| 12010.00 | * | | | | | 74.00 | | Horizontal |
| 14412.00 | * | | | | | 74.00 | | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4804.00 | 26.51 | 31.78 | 8.60 | 32.09 | 34.80 | 54.00 | -19.20 | Vertical |
| 7206.00 | 20.78 | 36.15 | 11.65 | 32.00 | 36.58 | 54.00 | -17.42 | Vertical |
| 9608.00 | 19.83 | 37.95 | 14.14 | 31.62 | 40.30 | 54.00 | -13.70 | Vertical |
| 12010.00 | * | | | | | 54.00 | | Vertical |
| 14412.00 | * | | | | | 54.00 | | Vertical |
| 4804.00 | 30.79 | 31.78 | 8.60 | 32.09 | 39.08 | 54.00 | -14.92 | Horizontal |
| 7206.00 | 22.99 | 36.15 | 11.65 | 32.00 | 38.79 | 54.00 | -15.21 | Horizontal |
| 9608.00 | 19.60 | 37.95 | 14.14 | 31.62 | 40.07 | 54.00 | -13.93 | Horizontal |
| 12010.00 | * | | | | | 54.00 | | Horizontal |
| 14412.00 | * | | | | | 54.00 | | Horizontal |

*Remark:*

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*

| Test channel: | Middle |
|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4880.00 | 37.25 | 31.85 | 8.67 | 32.12 | 45.65 | 74.00 | -28.35 | Vertical |
| 7320.00 | 31.79 | 36.37 | 11.72 | 31.89 | 47.99 | 74.00 | -26.01 | Vertical |
| 9760.00 | 31.43 | 38.35 | 14.25 | 31.62 | 52.41 | 74.00 | -21.59 | Vertical |
| 12200.00 | * | | | | | 74.00 | | Vertical |
| 14652.00 | * | | | | | 74.00 | | Vertical |
| 4880.00 | 41.52 | 31.85 | 8.67 | 32.12 | 49.92 | 74.00 | -24.08 | Horizontal |
| 7320.00 | 33.54 | 36.37 | 11.72 | 31.89 | 49.74 | 74.00 | -24.26 | Horizontal |
| 9760.00 | 30.85 | 38.35 | 14.25 | 31.62 | 51.83 | 74.00 | -22.17 | Horizontal |
| 12200.00 | * | | | | | 74.00 | | Horizontal |
| 14652.00 | * | | | | | 74.00 | | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4880.00 | 26.09 | 31.85 | 8.67 | 32.12 | 34.49 | 54.00 | -19.51 | Vertical |
| 7320.00 | 20.49 | 36.37 | 11.72 | 31.89 | 36.69 | 54.00 | -17.31 | Vertical |
| 9760.00 | 19.57 | 38.35 | 14.25 | 31.62 | 40.55 | 54.00 | -13.45 | Vertical |
| 12200.00 | * | | | | | 54.00 | | Vertical |
| 14652.00 | * | | | | | 54.00 | | Vertical |
| 4880.00 | 30.31 | 31.85 | 8.67 | 32.12 | 38.71 | 54.00 | -15.29 | Horizontal |
| 7320.00 | 22.66 | 36.37 | 11.72 | 31.89 | 38.86 | 54.00 | -15.14 | Horizontal |
| 9760.00 | 19.30 | 38.35 | 14.25 | 31.62 | 40.28 | 54.00 | -13.72 | Horizontal |
| 12200.00 | * | | | | | 54.00 | | Horizontal |
| 14652.00 | * | | | | | 54.00 | | Horizontal |

*Remark:*

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*

| Test channel: | Highest |
|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4960.00 | 36.09 | 31.93 | 8.73 | 32.16 | 44.59 | 74.00 | -29.41 | Vertical |
| 7440.00 | 31.02 | 36.59 | 11.79 | 31.78 | 47.62 | 74.00 | -26.38 | Vertical |
| 9920.00 | 30.75 | 38.81 | 14.38 | 31.88 | 52.06 | 74.00 | -21.94 | Vertical |
| 12400.00 | * | | | | | 74.00 | | Vertical |
| 14880.00 | * | | | | | 74.00 | | Vertical |
| 4960.00 | 40.12 | 31.93 | 8.73 | 32.16 | 48.62 | 74.00 | -25.38 | Horizontal |
| 7440.00 | 32.67 | 36.59 | 11.79 | 31.78 | 49.27 | 74.00 | -24.73 | Horizontal |
| 9920.00 | 30.06 | 38.81 | 14.38 | 31.88 | 51.37 | 74.00 | -22.63 | Horizontal |
| 12400.00 | * | | | | | 74.00 | | Horizontal |
| 14880.00 | * | | | | | 74.00 | | Horizontal |

**Average value:**

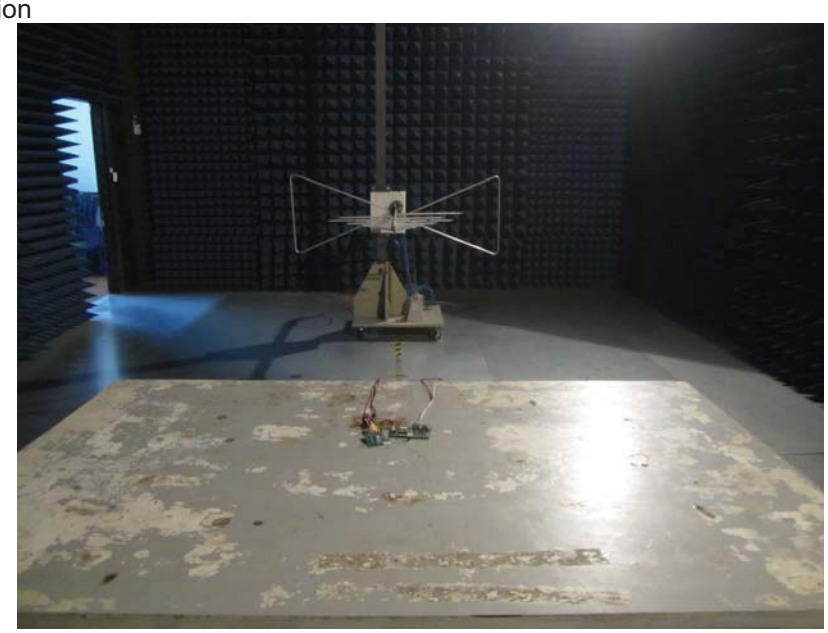
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4960.00 | 25.18 | 31.93 | 8.73 | 32.16 | 33.68 | 54.00 | -20.32 | Vertical |
| 7440.00 | 19.88 | 36.59 | 11.79 | 31.78 | 36.48 | 54.00 | -17.52 | Vertical |
| 9920.00 | 19.03 | 38.81 | 14.38 | 31.88 | 40.34 | 54.00 | -13.66 | Vertical |
| 12400.00 | * | | | | | 54.00 | | Vertical |
| 14880.00 | * | | | | | 54.00 | | Vertical |
| 4960.00 | 29.28 | 31.93 | 8.73 | 32.16 | 37.78 | 54.00 | -16.22 | Horizontal |
| 7440.00 | 21.98 | 36.59 | 11.79 | 31.78 | 38.58 | 54.00 | -15.42 | Horizontal |
| 9920.00 | 18.66 | 38.81 | 14.38 | 31.88 | 39.97 | 54.00 | -14.03 | Horizontal |
| 12400.00 | * | | | | | 54.00 | | Horizontal |
| 14880.00 | * | | | | | 54.00 | | Horizontal |

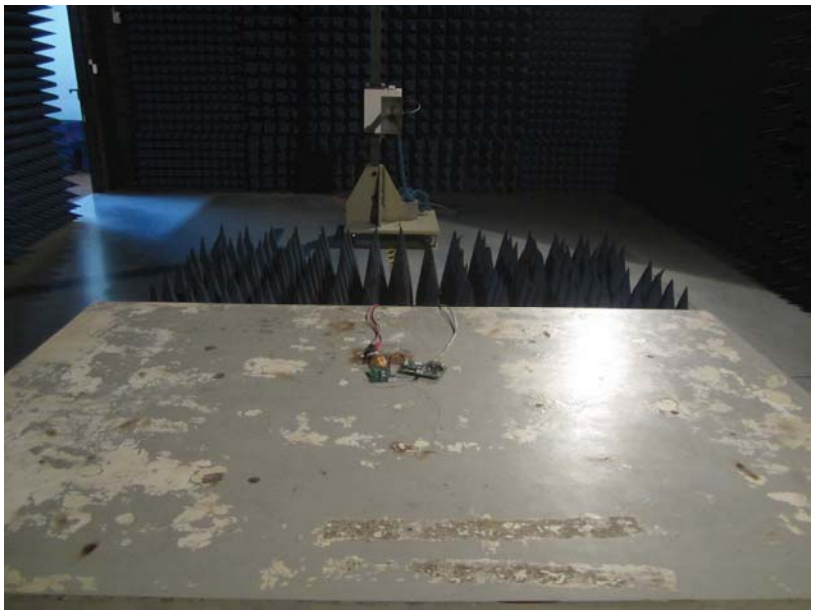
*Remark:*

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*

# 8 Test Setup Photo

Radiated Emission





Conducted Emission

# 9 EUT Constructional Details

Reference to the test report No. GTSE15050079501

------End------