Shenzhen CTL Electromagnetic Technology Co., Ltd.
Tel: +86-755-89486194 Fax: +86-755-89486194-805

# FCC PART 15 SUBPART C TEST REPORT

## FCC Part 15.247

| | |
|---|---|
| **Report Reference No**.....: | **CTL130407507-WF** |
| Compiled by ( position+printed name+signature) .: | File administrators Jacky Chen |
| Name of the organization performing the tests ( position+printed name+signature) .: | Test Engineer Tracy Qi |
| Approved by ( position+printed name+signature) .: | Manager Tracy Qi |
| Date of issue.....: | May 05, 2013 |
| **Representative Laboratory Name** .: | **Shenzhen CTL Electromagnetic Technology Co., Ltd.** |
| Address .....: | Zone B, 4/F, Block 20, Guangqian Industrial Park, Longzhu Road, Nanshan, Shenzhen 518055 China. |
| **Test Firm** .....: | **Bontek Compliance Testing Laboratory Ltd** |
| Address .....: | 1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China |
| **Applicant's name**.....: | **Shenzhen 3Geyes Technology Co., Ltd.** |
| Address .....: | Rm22I, Block B, Fortune Plaza, 7002 Shennan Road, Futian District, Shenzhen, P.R.China |
| **Test specification:** | |
| Standard .....: | FCC Part 15.247: Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz. |
| TRF Originator.....: | Shenzhen CTL Electromagnetic Technology Co., Ltd. |
| Master TRF.....: | Dated 2011-01 |



| | |
|---|---|
| **Test item description .....:** | **Wireless DMX Transceiver** |
| **FCC ID……..:** | **SZKLC-512XF** |
| Trade Mark .....: | 3Geyes |
| Model/Type reference .....: | LC-512X/F, LC-512X/M, LC-512M |
| Transmit .....: | 2403~2480MHz |
| Type of modulation.....: | GFSK |
| Antenna Gain .....: | 2.0 dBi |
| Antenna type .....: | RP-SMA isotropic antenna |
| Result .....: | **Positive** |

# TEST REPORT

| Test Report No. : | CTL130407507-WF | May 05, 2013<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| **Equipment under Test** | : | Wireless DMX Transceiver |
| **Model /Type** | : | LC-512X/F |
| **Listed Models** | : | LC-512X/M, LC-512M (only model's name difference with LC-512X/F for marketing requirement, all of the models have same electrical design.) |
| **Applicant** | : | **Shenzhen 3Geyes Technology Co., Ltd.** |
| **Address** | : | Rm22I, Block B, Fortune Plaza, 7002 Shennan Road, Futian District, Shenzhen, P.R.China |
| **Manufacturer** | : | **Shenzhen 3Geyes Technology Co., Ltd.** |
| **Address** | : | Rm22I, Block B, Fortune Plaza, 7002 Shennan Road, Futian District, Shenzhen, P.R.China |

| | |
|---|---|
| **Test Result** according to the standards on page 4: | **Positive** |

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

# Contents

# 1. TEST STANDARDS

The tests were performed according to following standards:

**FCC Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

**ANSI C63.10-2009:** American National Standard for Testing Unlicensed Wireless Devices.

**ANSI C63.4-2003**

**KDB Publication No. 558074 Guidance on Measurements for Digital Transmission Systems**

# 2. SUMMARY

## 2.1. General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | April 17, 2013 |
| | | |
| | | |
| Testing commenced on | : | April 18, 2013 |
| | | |
| | | |
| Testing concluded on | : | April 24, 2013 |

## 2.2. Equipment Under Test

### Power supply system utilised

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ● | 120V / 60 Hz | ○ | 115V / 60Hz |
| | | ○ | 12 V DC | ○ | 24 V DC |
| | | ● | Other (specified in blank below) | | |

DC 5V from adapter

### Description of the test mode

78 channels are provided to the EUT
Channels list:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 01 | 2403 | 28 | 2430 | 55 | 2457 |
| 02 | 2404 | 29 | 2431 | 56 | 2458 |
| 03 | 2405 | 30 | 2432 | 57 | 2459 |
| 04 | 2406 | 31 | 2433 | 58 | 2460 |
| 05 | 2407 | 32 | 2434 | 59 | 2461 |
| 06 | 2408 | 33 | 2435 | 60 | 2462 |
| 07 | 2409 | 34 | 2436 | 61 | 2463 |
| 08 | 2410 | 35 | 2437 | 62 | 2464 |
| 09 | 2411 | 36 | 2438 | 63 | 2465 |
| 10 | 2412 | 37 | 2439 | 64 | 2466 |
| 11 | 2413 | 38 | 2440 | 65 | 2467 |
| 12 | 2414 | 39 | 2441 | 66 | 2468 |
| 13 | 2415 | 40 | 2442 | 67 | 2469 |
| 14 | 2416 | 41 | 2443 | 68 | 2470 |
| 15 | 2417 | 42 | 2444 | 69 | 2471 |
| 16 | 2418 | 43 | 2445 | 70 | 2472 |
| 17 | 2419 | 44 | 2446 | 71 | 2473 |
| 18 | 2420 | 45 | 2447 | 72 | 2474 |
| 19 | 2421 | 46 | 2448 | 73 | 2475 |
| 20 | 2422 | 47 | 2449 | 74 | 2476 |
| 21 | 2423 | 48 | 2450 | 75 | 2477 |
| 22 | 2424 | 49 | 2451 | 76 | 2478 |
| 23 | 2425 | 50 | 2452 | 77 | 2479 |
| 24 | 2426 | 51 | 2453 | 78 | 2480 |
| 25 | 2427 | 52 | 2454 | | |
| 26 | 2428 | 53 | 2455 | | |
| 27 | 2429 | 54 | 2456 | | |

## 2.3. Short description of the Equipment under Test (EUT)

A Wireless DMX Transceiver (LC-512X/F ) work from 2403MHz to 2480MHz.

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

## 2.4. EUT operation mode

Test Mode:
1. The EUT has been tested under normal operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel low (2403MHz), mid (2441MHz) and high (2480MHz) with highest data rate are chosen for full testing.
3. Test Mode:

| Test Mode(TM) | Description | Remark |
|---|---|---|
| TM1 | Bottom Channel Transmitting | / |
| TM2 | Middle Channel Transmitting | / |
| TM3 | Top Channel Transmitting | / |

## 2.5. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

○ - supplied by the manufacturer
○ - supplied by the lab

Manufacturer :
Model No. :

## 2.6. NOTE

1. The EUT is an 2.4GHz Wireless DMX Transceiver,The functions of the EUT listed as below:

| | Test Standards | Reference Report |
|---|---|---|
| Wireless DMX Transceiver | FCC Part 15 Subpart C (Section15.247) | CTL130407507-WF |
| Wireless DMX Transceiver | FCC Per 47 CFR 2.1091(b) | CTL130407507-MPE |

2. The frequency bands used in this EUT are listed as follows:

| Frequency Band(MHz) | 2400-2483.5 | 5150-5350 | 5470-5725 | 5725-5850 |
|---|---|---|---|---|
| 2403-2480 | √ | — | — | — |
| — | — | — | — | — |
| — | — | — | — | — |
| — | — | — | — | — |

3. The EUT incorporates a SISO function,Physically,the EUT provides two completed transmitter and two completed receivers.

| Modulation Mode | TX Function |
|---|---|
| GFSK | 1TX |

## 2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **SZKLC-512XF** filing to comply with of the FCC Part 15.247 Rules.

## 2.8. Modifications

No modifications were implemented to meet testing criteria.

# 3. TEST ENVIRONMENT

## 3.1. Address of the test laboratory

Bontek Compliance Testing Laboratory Ltd
1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

## 3.2. Test Facility

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

### IC Registration No.: 7631A

The 3m alternate test site of Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 7631A on March, 2011.

### FCC-Registration No.: 338263

Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 338263, March 24, 2008.

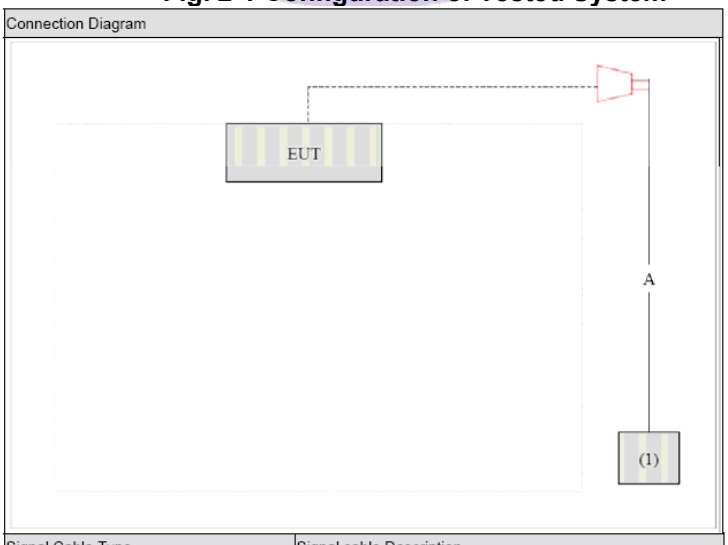
## 3.3. Environmental conditions

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

| | |
|---|---|
| Temperature: | 15-35 ° C |
| Humidity: | 30-60 % |
| Atmospheric pressure: | 950-1050mbar |

## 3.4. Configuration of Tested System

**Fig. 2-1 Configuration of Tested System**




| Signal Cable Type | | Signal cable Description |
|---|---|---|
| A | Coaxial Cable | Shielded, >5m |

## 3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Bontek Compliance Testing Laboratory Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Bontek laboratory is reported:

| Test | Range | Measurement Uncertainty | Notes |
|---|---|---|---|
| Radiated Emission | 30~1000MHz | 4.10dB | (1) |
| Radiated Emission | Above 1GHz | 4.32dB | (1) |
| Conducted Disturbance | 0.15~30MHz | 3.20dB | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 3.6. Equipments Used during the Test

| No. | Equipment | Manufacturer | Model No. | S/N | Calibration date | Calibration due date |
|---|---|---|---|---|---|---|
| 1 | EMI Test Receiver | R&S | ESCI | 100687 | 2013-4-5 | 2014-4-4 |
| 3 | Amplifier | HP | 8447D | 1937A02492 | 2013-4-5 | 2014-4-4 |
| 4 | Single Power Conductor Module | FCC | FCC-LISN-5-50-1-01-CISPR25 | 07101 | 2013-4-5 | 2014-4-4 |
| 5 | Single Power Conductor Module | FCC | FCC-LISN-5-50-1-01-CISPR25 | 07102 | 2013-4-5 | 2014-4-4 |
| 6 | Positioning Controller | C&C | CC-C-1F | MF7802113 | N/A | N/A |
| 7 | Signal generator | Rhode & Schwarz | SMIQ 03HD + option SM-B1, SMIQB11, SMIQB12, SMIQB14, SMIQB17, SMIQB20 | 1125.5555.46 | 2013-4-5 | 2014-4-4 |
| 8 | Spectrum Analyzer | Agilent | E4404B | US41192833 | 2013-4-5 | 2014-4-4 |
| 9 | 6dB Attenuator | Atten | Attenuator | DC-4GHz | 2013-4-5 | 2014-4-4 |
| 10 | Digital Multimeter | Fluke | 15B | 91280239 | 2013-4-5 | 2014-4-4 |
| 11 | TRILOG Broadband Test-Antenna | SCHWARZBECK | VULB9163 | 9163-324 | 2013-4-9 | 2014-4-8 |
| 12 | Horn Antenna | SCHWARZBECK | BBHA9120A | 0499 | 2012-11-27 | 2013-11-26 |
| 13 | Horn Antenna | SCHWARZBECK | BBHA9170 | 1562 | 2012-11-27 | 2013-11-26 |
| 14 | Active Loop Antenna | DAZE | ZN30900A | 1200 | 2013-4-5 | 2014-4-4 |
| 15 | 9kHz-2.4GHz signal generator 2024 | MARCONI | 10S/6625-99-457-8730 | 112260/042 | 2013-4-5 | 2014-4-4 |
| 16 | 10dB attenuator | ELECTRO-METRICS | EM-7600 | 836 | 2013-4-5 | 2014-4-4 |
| 17 | Spectrum Analyzer | R&S | FSP | 100397 | 2012-11-2 | 2013-11-1 |
| 18 | Broadband preamplifier | SCH WARZBECK | BBV9718 | 9718-182 | 2013-4-5 | 2014-4-4 |
| 19 | Temperature & Humidity Chamber | TOPSTAT | TOS-831A | 3438A05208 | 2013-4-5 | 2014-4-4 |
| 20 | Wideband Peak Power Meter | Anritsu | ML2495A | 0905011 | 2013-4-5 | 2014-4-4 |

## 3.7. Summary of Test Result

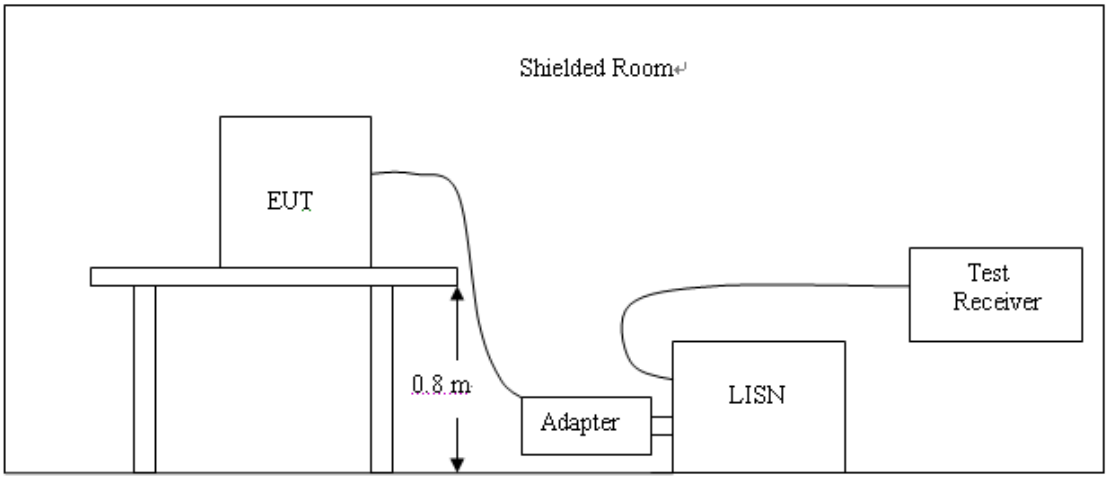
| FCC PART 15 | | |
|---|---|---|
| FCC Part 15.207 | AC Power Conducted Emission | PASS |
| FCC Part 15.247(a)(2) | 6dB Bandwidth | PASS |
| FCC Part 15.247(d) | Spurious RF Conducted Emission | PASS |
| FCC Part 15.247(b) | Maximum Peak Output Power | PASS |
| FCC Part 15.247(e) | Power Spectral Density | PASS |
| FCC Part 15.109/ 15.205/ 15.209 | Radiated Emissions | PASS |
| FCC Part 15.247(d) | Band Edge Compliance of RF Emission | PASS |
| FCC Part 15.203/15.247 (b) | Antenna Requirement | PASS |
| FCC Per 47 CFR 2.1091(b) | MPE Evaluation | PASS |

Remark: The measurement uncertainty is not included in the test result.

# 4. TEST CONDITIONS AND RESULTS

## 4.1. Conducted Emissions Test

**TEST CONFIGURATION**




**TEST PROCEDURE**

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following：

| Frequency (MHz) | Maximum RF Line Voltage (dBμv) | | | |
|---|---|---|---|---|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15 - 0.50 | 79 | 66 | 66-56* | 56-46* |
| 0.50 - 5.00 | 73 | 60 | 56 | 46 |
| 5.00 - 30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

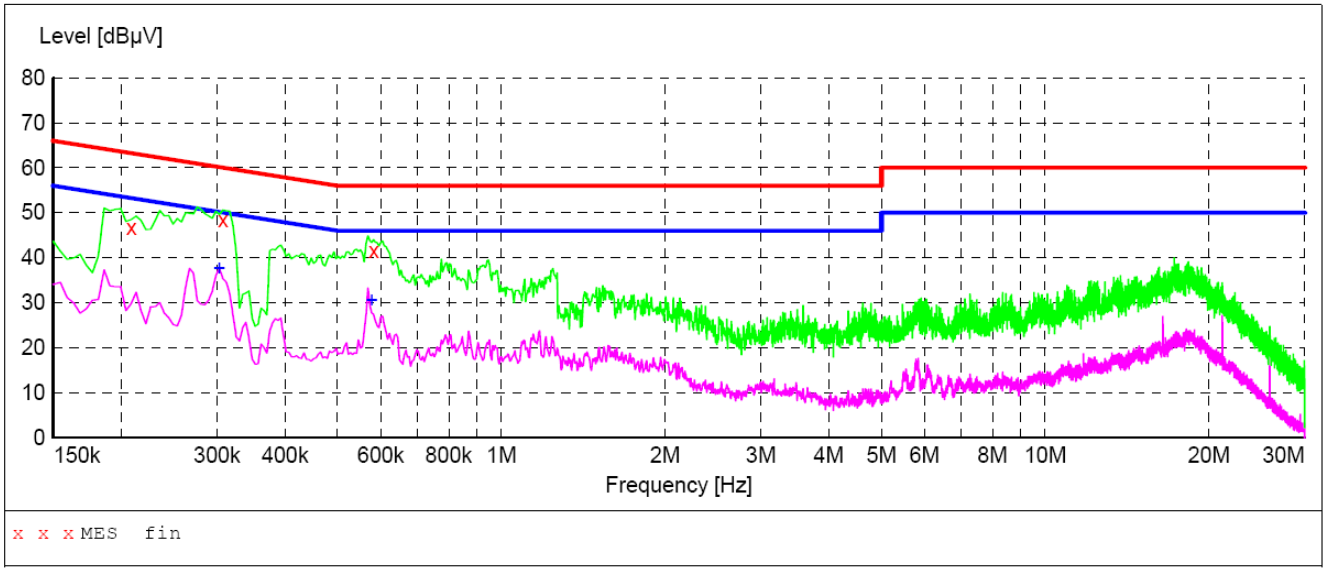
1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 kHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

**The RBW/VBW for 150KHz to 30MHz: 9KHz**

**TEST RESULTS**

***SCAN TABLE: "Voltage (9K-30M)FIN"***

Short Description: 150K-30M Voltage




***MEASUREMENT RESULT:***

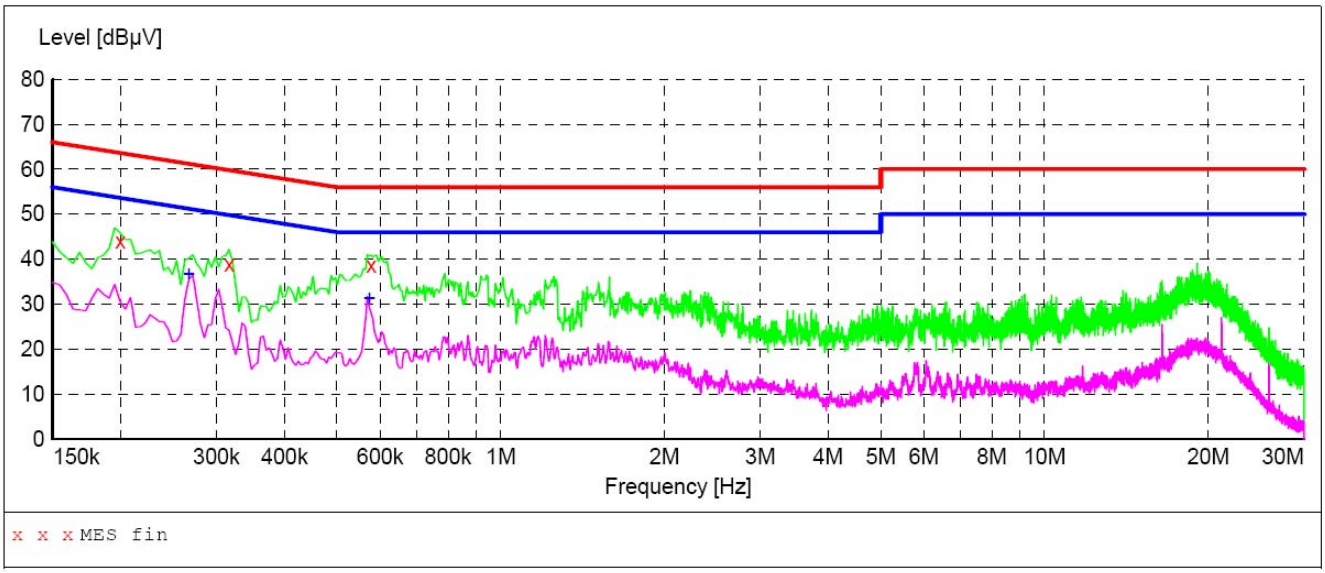
| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.208500 | 46.80 | 10.2 | 63 | 16.5 | QP | L1 | GND |
| 0.307500 | 48.40 | 10.2 | 60 | 11.6 | QP | L1 | GND |
| 0.582000 | 41.50 | 10.2 | 56 | 14.5 | QP | L1 | GND |

***MEASUREMENT RESULT:***

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.303000 | 37.70 | 10.2 | 50 | 12.5 | AV | L1 | GND |
| 0.577500 | 30.40 | 10.2 | 46 | 15.6 | AV | L1 | GND |

***SCAN TABLE: "Voltage (9K-30M)FIN"***

Short Description: 150K-30M Voltage




***MEASUREMENT RESULT:***

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.199500 | 43.90 | 10.2 | 64 | 19.7 | QP | N | GND |
| 0.316500 | 38.80 | 10.2 | 60 | 21.0 | QP | N | GND |
| 0.577500 | 38.60 | 10.2 | 56 | 17.4 | QP | N | GND |

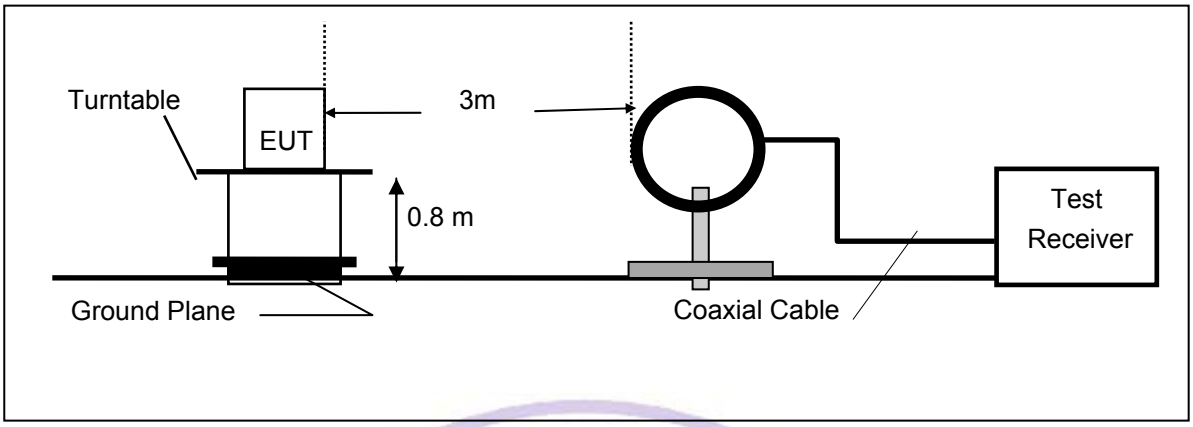
***MEASUREMENT RESULT:***

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.267000 | 36.70 | 10.2 | 51 | 14.5 | AV | N | GND |
| 0.573000 | 31.30 | 10.2 | 46 | 14.7 | AV | N | GND |

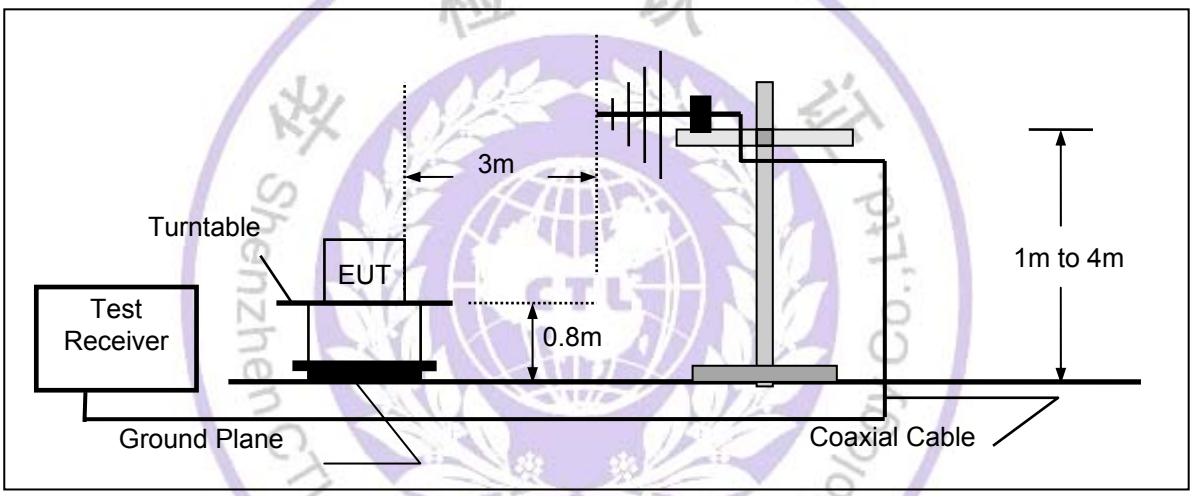
## 4.2. Radiated Emission Test

**TEST CONFIGURATION**

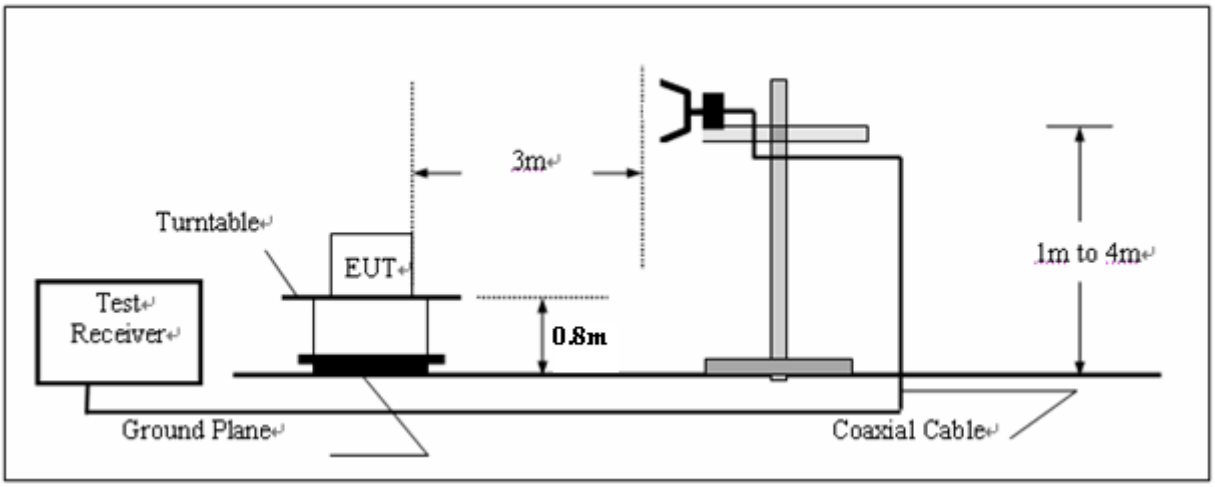
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz




(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz




(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



## FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

**FS = RA + AF + CL - AG**

| | |
|---|---|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude | AG = Amplifier Gain |
| AF = Antenna Factor | |

## TEST PROCEDURE

1. The testing follows FCC KDB Publication No. 558074 (Measurement Guidelines of DTS), the EUT was setup according to ANSI C63.4: and tested according to ANSI C63.10 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for f >1 GHz, 120 kHz for f < 1 GHz; VBW ≧RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Repeat above procedures until all frequency measurements have been completed.

Note:
When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 60 degrees for H-plane and 90 degrees for E-plane.

## LIMIT

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m) | Radiated (μV/m) |
|---|---|---|---|
| 30-88 | 3 | 40.0 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

**TEST RESULTS**

| CH | Antenna | Frequency (MHz) | Reading Level (dBuV/m) | Factor (dB) | Measure Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 01 | H | 2402.8 | 56.5 | 35.7 | 92.2 | Fundamental | / | PK |
| | V | 354.0 | 6.6 | 16.4 | 23.0 | 46 | -23.0 | QP |
| | V | 539.3 | 4.4 | 20.9 | 25.3 | 46 | -20.7 | QP |
| | H | 3122.5 | 43.5 | -1.7 | 41.8 | 54(Note) | -12.2 | PK |
| | V | 4804.0 | 41.9 | 2.3 | 44.2 | 54(Note) | -9.8 | PK |
| | V | 7213.5 | 55.2 | 8.8 | 64.0 | 72.2 | -8.2 | PK |
| | V | 7209.1 | 47.1 | 8.7 | 55.8 | 62.2 | -6.4 | AV |
| | H | 24000.0 | 59.1 | -8.9 | 50.2 | 54(Note) | -3.8 | PK |
| 39 | H | 2440.9 | 59.3 | 36.1 | 95.4 | Fundamental | / | PK |
| | V | 365.1 | 1.8 | 16.7 | 18.5 | 46 | -27.5 | QP |
| | V | 539.3 | 4.7 | 21.0 | 25.7 | 46 | -20.3 | QP |
| | H | 3122.5 | 44.1 | -1.7 | 42.4 | 54(Note) | -11.6 | PK |
| | H | 4882.0 | 41.8 | 2.5 | 44.3 | 54(Note) | -9.7 | PK |
| | V | 7324.0 | 54.1 | 8.7 | 62.8 | 74 | -11.2 | PK |
| | V | 7326.0 | 44.2 | 8.7 | 52.9 | 54 | -1.1 | AV |
| | H | 24000.0 | 59.1 | -8.9 | 50.2 | 54(Note) | -3.8 | PK |
| 78 | H | 2480.0 | 62.6 | 37.1 | 99.7 | Fundamental | / | PK |
| | V | 439.8 | 3.0 | 18.5 | 21.5 | 46 | -24.5 | QP |
| | V | 539.3 | 3.8 | 20.9 | 24.7 | 46 | -21.3 | QP |
| | H | 3122.5 | 43.5 | -1.7 | 41.8 | 54(Note) | -12.2 | PK |
| | H | 4944.0 | 44.8 | 2.9 | 47.7 | 54(Note) | -6.3 | PK |
| | V | 7434.5 | 52.1 | 8.7 | 60.8 | 74 | -13.2 | PK |
| | V | 7437.0 | 44.3 | 8.6 | 52.9 | 54 | -1.1 | AV |
| | H | 24000.0 | 59.1 | -8.9 | 50.2 | 54(Note) | -3.8 | PK |

Note

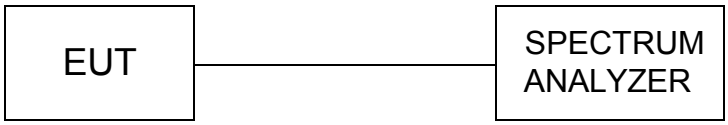
1: The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz, therefore no data appear in the report.

2: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn’ t be performed.

3: According to FCC Part15.247(d). Radiated emission which don't fall in the restricted bands, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

## 4.3. 6dB Bandwidth Measurement

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The testing follows FCC KDB Publication No. 558074 (Measurement Guidelines of DTS).
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.
4. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

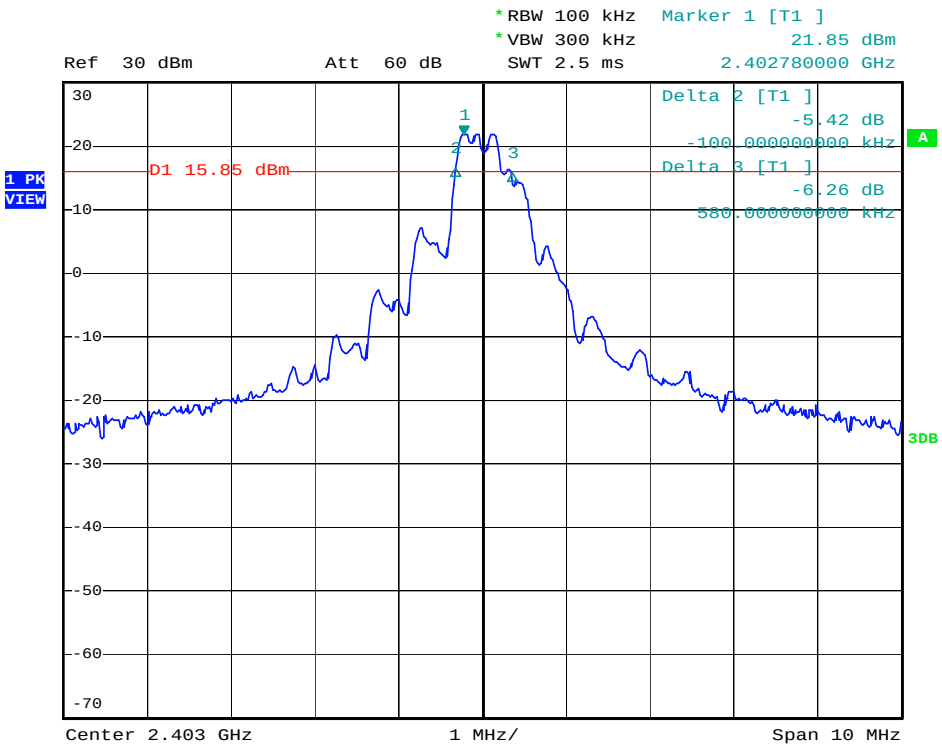
**LIMIT**

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

**TEST RESULTS**

| CHANNEL | 6 dB BANDWIDTH (MHz) | MINIMUM LIMIT (MHz) | PASS/FAIL |
|---|---|---|---|
| 01 | 0.68 | 0.5 | PASS |
| 39 | 0.70 | 0.5 | PASS |
| 78 | 0.70 | 0.5 | PASS |

CH01

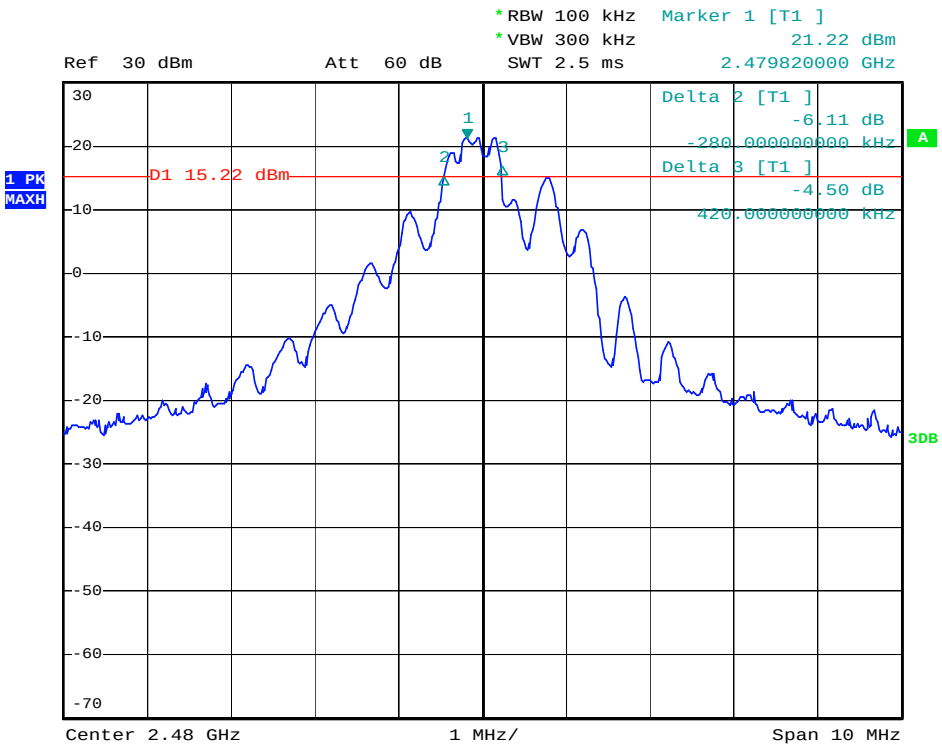



Date: 18.APR.2013 17:33:32

CH39


Date: 18.APR.2013 18:22:04

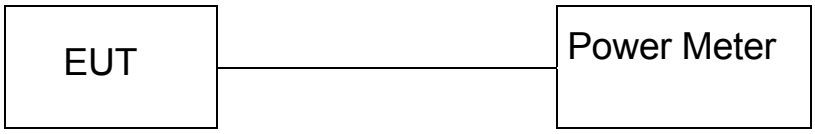
CH78




Date: 18.APR.2013 18:24:09

## 4.4. Maximum Peak Output Power

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to C63.10 -2009 and KDB558074,The EUT was directly connected to the power meter / spectrum analyzer and antenna output port as show in the block diagram as TEST CONFIGURATION shows.

Use the wideband power meter to test peak power and record the result.

**LIMIT**

The Peak Output Power Measurement limits are 30dBm.

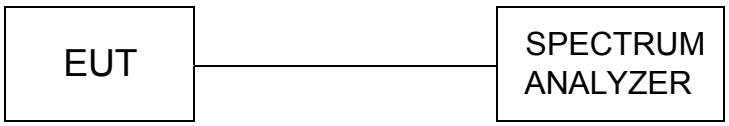
**TEST RESULTS**

| Test Mode | Frequency (MHz) | Channel | Peak Power (dBm) |
|---|---|---|---|
| TM1 | 2403 | 01 | 21.87 |
| TM2 | 2441 | 39 | 21.66 |
| TM3 | 2480 | 78 | 21.20 |

*Note: The test results including the cable lose.*

## 4.5. Band Edge Measurement

**TEST CONFIGURATION**




**TEST PROCEDURE**

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 and FCC KDB Publication No. 558074 (Measurement Guidelines of DTS) with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBM= 300KHz to measure the peak field strength and set RBW to 1MHz and VBW to 10Hz to measure the average radiated field strength.

The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW and VBW to 100 kHz, to measure the conducted peak band edge.

Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described below (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).

- Span: Set Span for minimum 50 MHz - Reference Level: 110 dBμV (corrected for gains and losses of test antenna factor, preamp gain and cable loss) - Attenuation: 10 dB

- Sweep Time: Coupled - Resolution Bandwidth: Up to and including 1 GHz = ≥ 100 kHz

- Resolution Bandwidth: Above 1 GHz = 1 MHz - Video Bandwidth: Below 1 GHz = 300 kHz

- Video Bandwidth: Up to and including 1 GHz =≥ 3 MHz for peak and10 Hz for average

- Detector: Peak

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel.

**LIMIT**

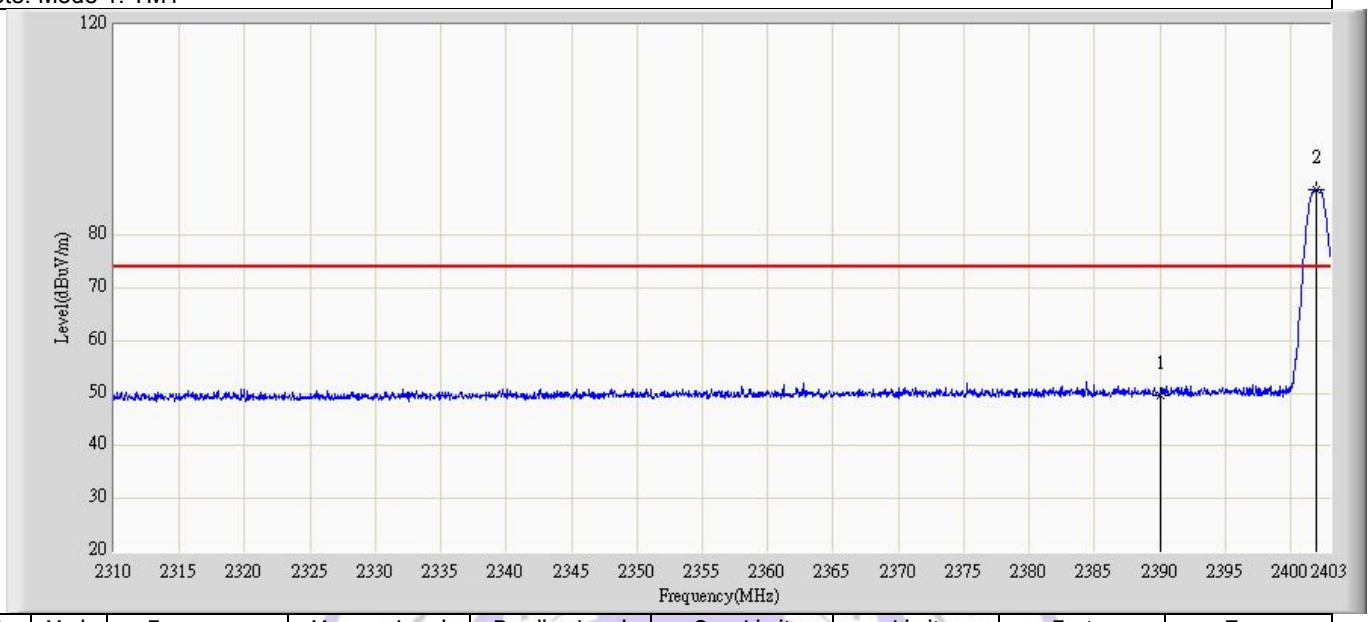
1. Below -20dB of the highest emission level in operating band.

2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209(see Section 15.205(c)).

| Frequency (MHz) | Limit Average (dBuv/m) | Limit Peak (dBuv/m) |
|---|---|---|
| Below 2390 or Above 2483.5 | 54 | 74 |

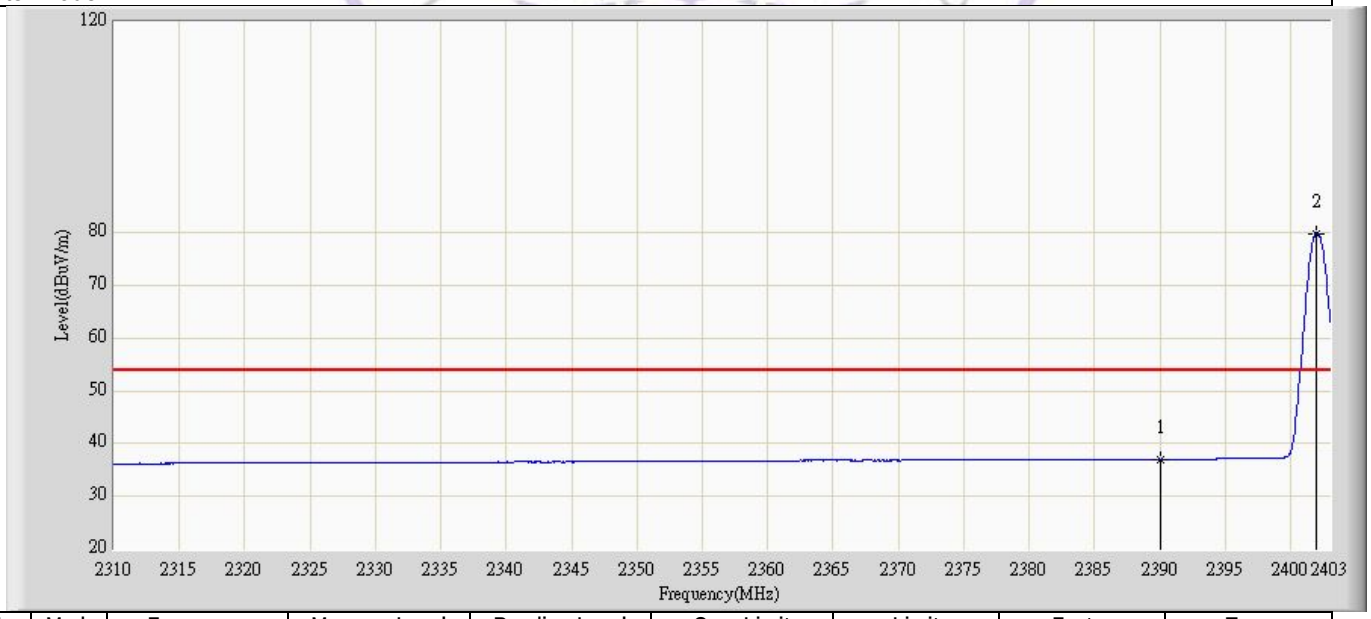
**TEST RESULTS**

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:14 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Horizontal |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM1 | |



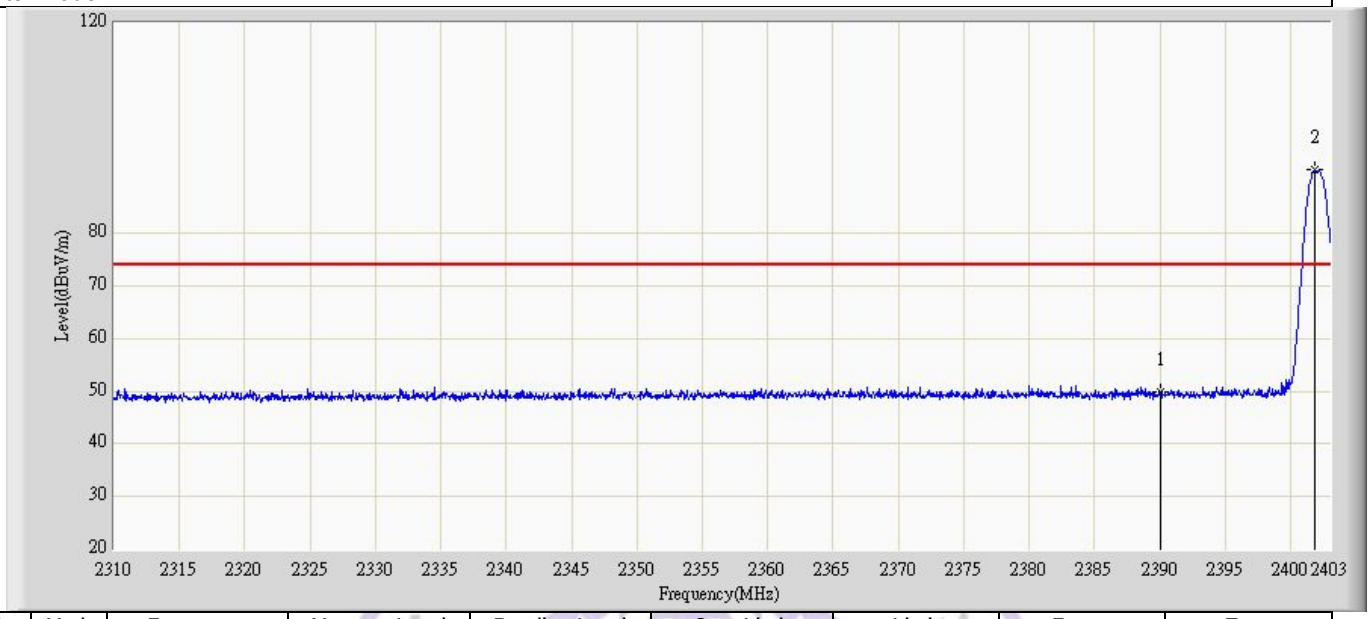

| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 2390.000 | 49.517 | 13.216 | -24.483 | 74.000 | 36.302 | PK |
| 2 | * | 2402.930 | 88.628 | 52.229 | N/A | N/A | 36.400 | PK |

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:28 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Horizontal |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM1 | |



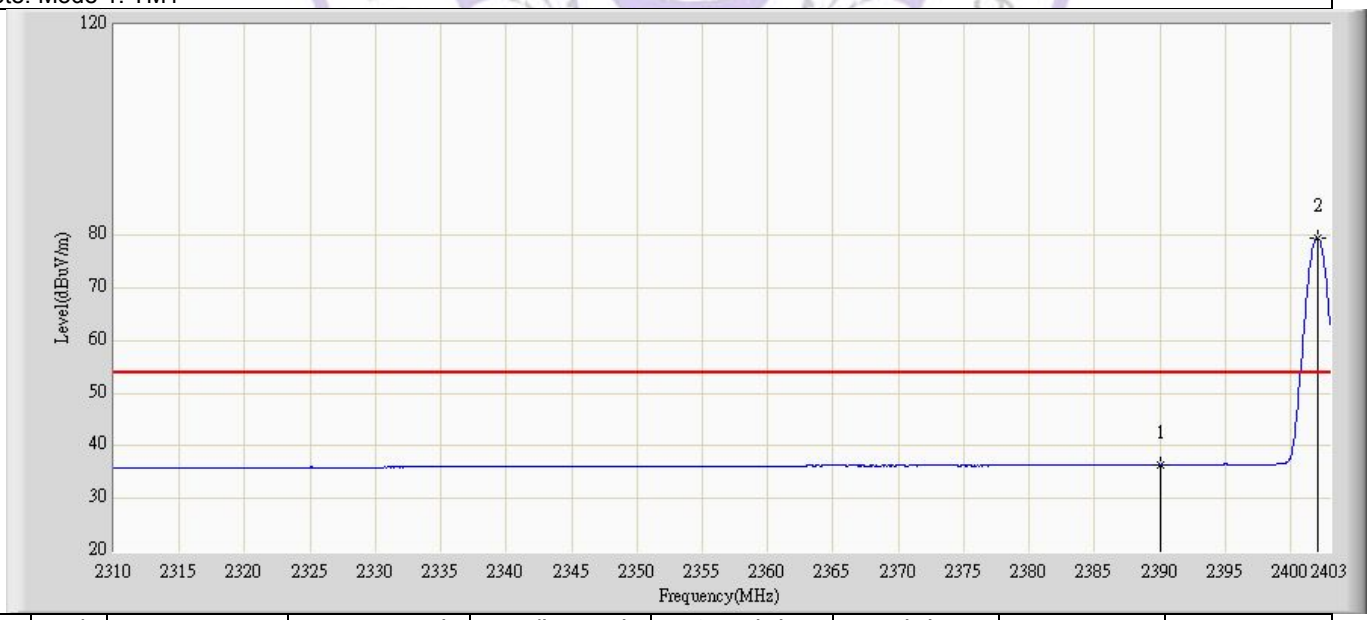

| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 2390.000 | 37.000 | 0.699 | -17.000 | 54.000 | 36.302 | AV |
| 2 | * | 2402.930 | 79.837 | 43.438 | N/A | N/A | 36.400 | AV |

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:29 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Vertical |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM1 | |



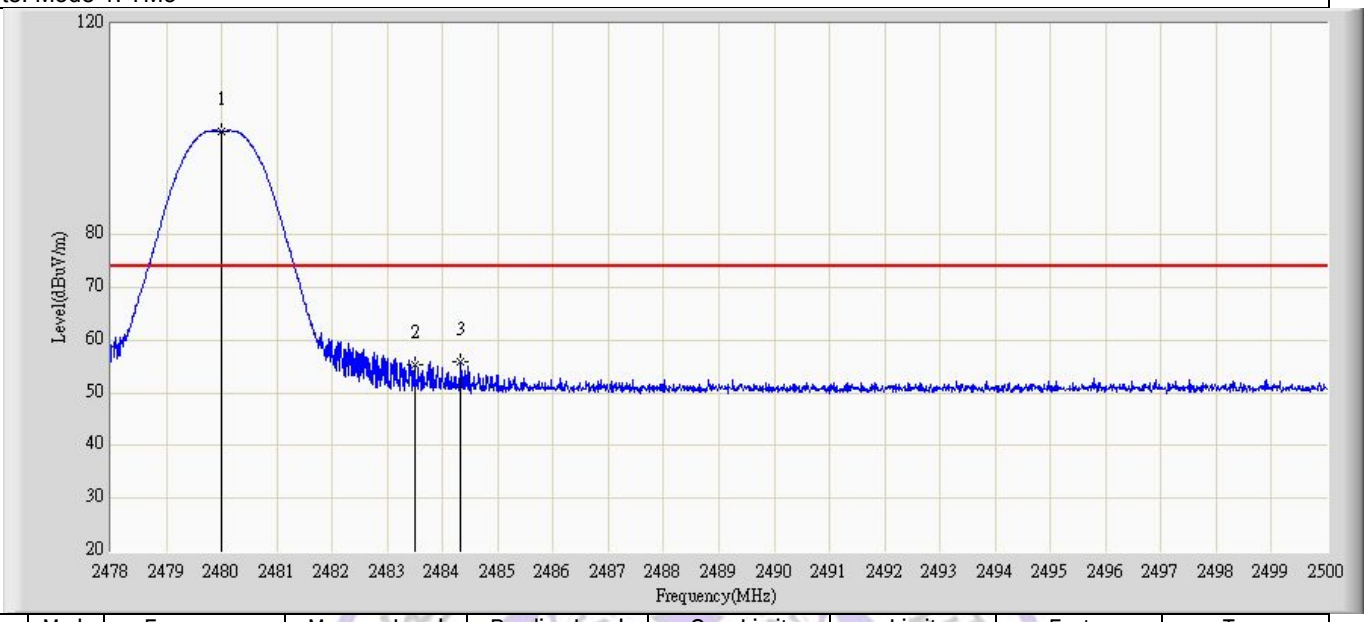

| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 2390.000 | 49.771 | 14.130 | -24.229 | 74.000 | 35.642 | PK |
| 2 | * | 2402.837 | 92.187 | 56.496 | N/A | N/A | 35.692 | PK |

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:32 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Vertical |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM1 | |



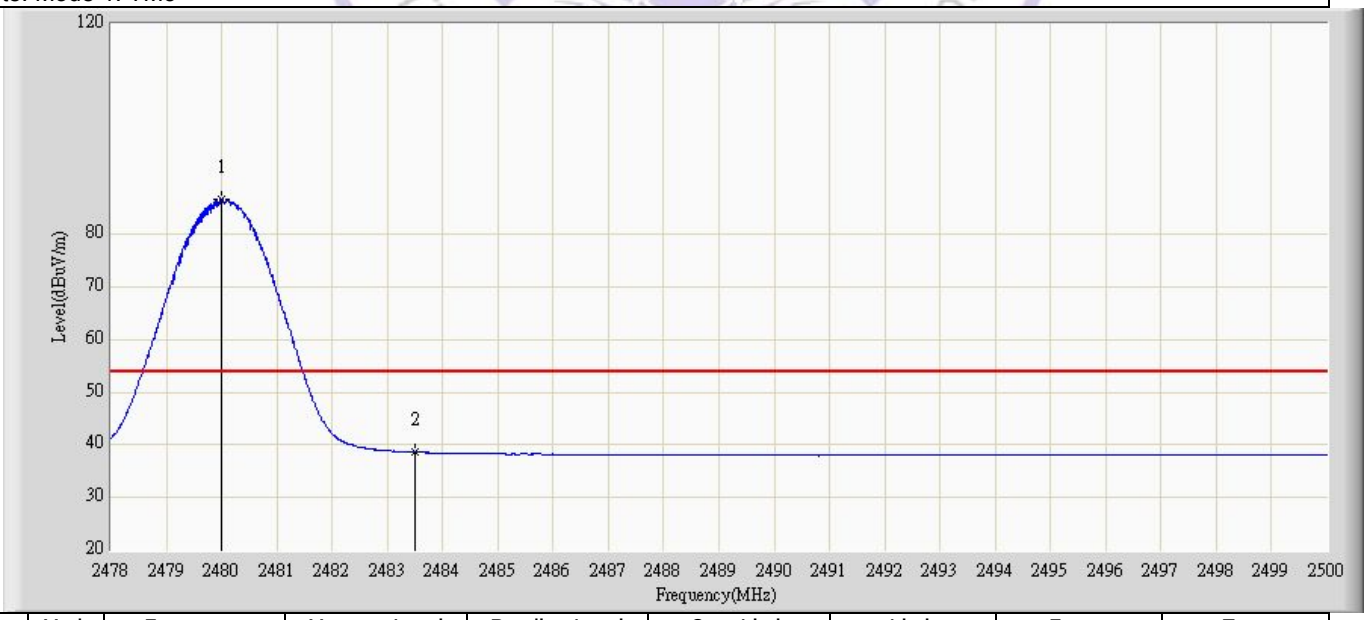

| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 2390.000 | 36.335 | 0.694 | -17.665 | 54.000 | 35.642 | AV |
| 2 | * | 2403.070 | 79.603 | 43.911 | N/A | N/A | 35.692 | AV |

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:33 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Horizontal |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM3 | |



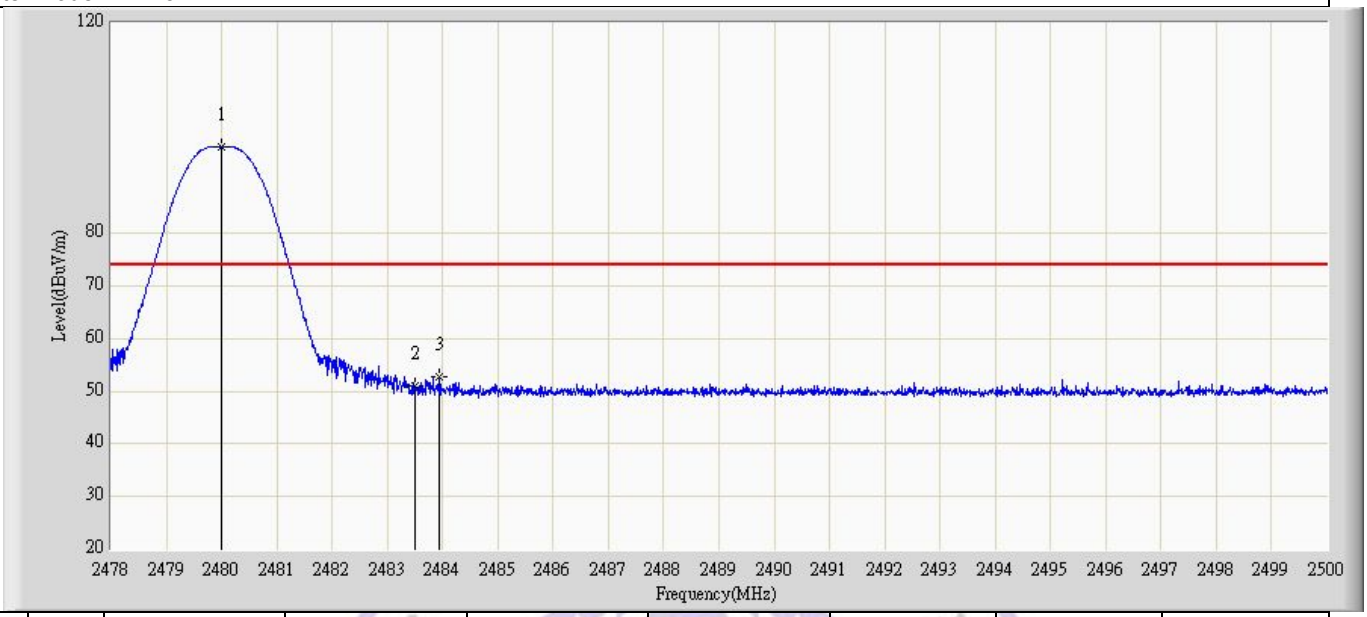

| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 2480.002 | 99.672 | 62.613 | N/A | N/A | 37.059 | PK |
| 2 | | 2483.500 | 55.339 | 18.249 | -18.661 | 74.000 | 37.089 | PK |
| 3 | | 2484.325 | 55.989 | 18.892 | -18.011 | 74.000 | 37.097 | PK |

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:39 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Horizontal |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM3 | |



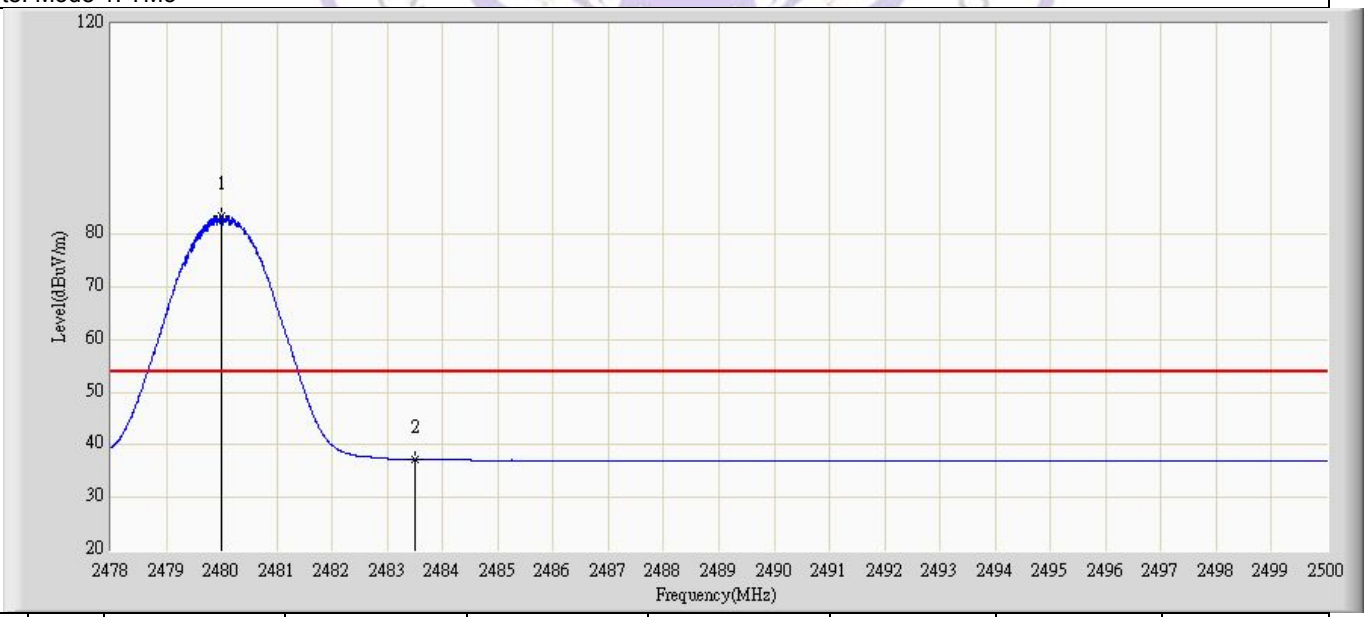

| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 2480.002 | 86.632 | 49.573 | N/A | N/A | 37.059 | AV |
| 2 | | 2483.500 | 38.634 | 1.544 | -15.366 | 54.000 | 37.089 | AV |

| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:39 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Vertical |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM3 | |




| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 2480.002 | 96.342 | 60.303 | N/A | N/A | 36.039 | PK |
| 2 | | 2483.500 | 50.899 | 14.843 | -23.101 | 74.000 | 36.055 | PK |
| 3 | | 2483.929 | 52.848 | 16.790 | -21.152 | 74.000 | 36.058 | PK |

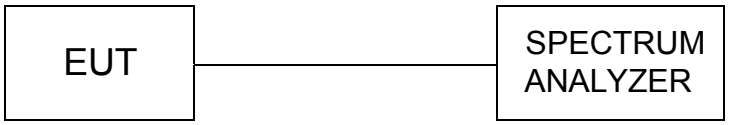
| | |
|---|---|
| Engineer: Brgant | |
| Site: AC5 | Time: 2013/04/22 - 17:43 |
| Limit: FCC_Part15.209_RE(3m) | Margin: 0 |
| Probe: BBHA 9120D_499(1-18GHz) | Polarity: Vertical |
| EUT: Wireless DMX Transceiver | Power: By adapter |
| Note: Mode 1: TM3 | |




| No | Mark | Frequency (MHz) | Measure Level (dBuV/m) | Reading Level (dBuV) | Over Limit (dB) | Limit (dBuV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 2480.002 | 83.554 | 47.515 | N/A | N/A | 36.039 | AV |
| 2 | | 2483.500 | 37.203 | 1.147 | -16.797 | 54.000 | 36.055 | AV |

## 4.6. Power Spectral Density Measurement

**TEST CONFIGURATION**




**TEST PROCEDURE**

The EUT was tested according to KDB558074 D01 V02 10/04/2012 for compliance to FCC 47CFR 15.247 requirements.

Set RBW= 3 kHz, VBW≥10KHz, SPAN to 1.5 times greater than the EBW,.

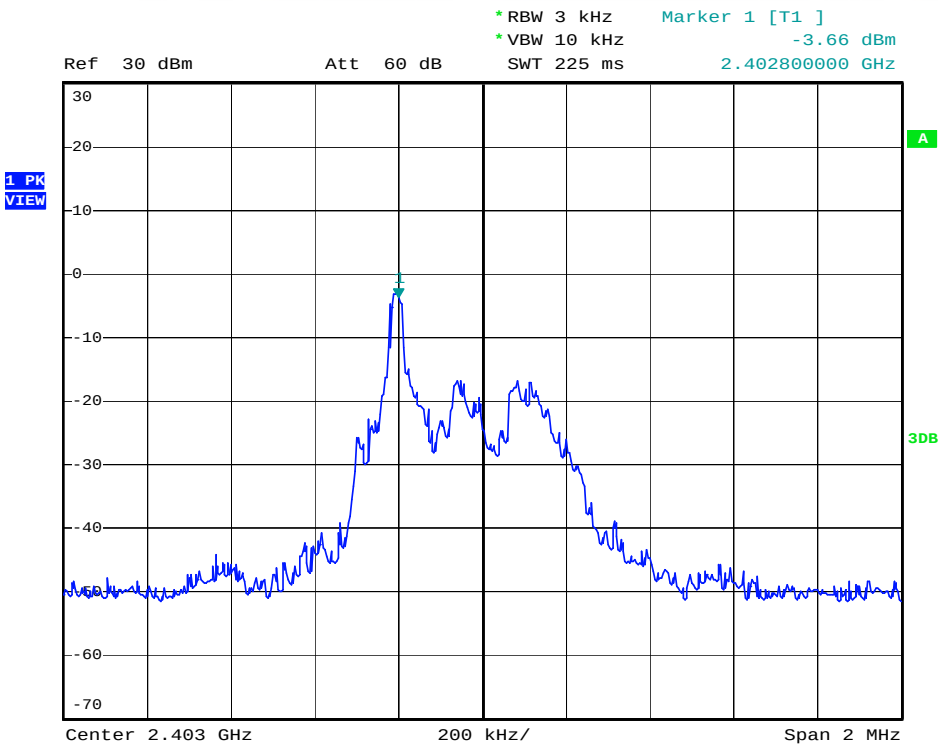
**LIMIT**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

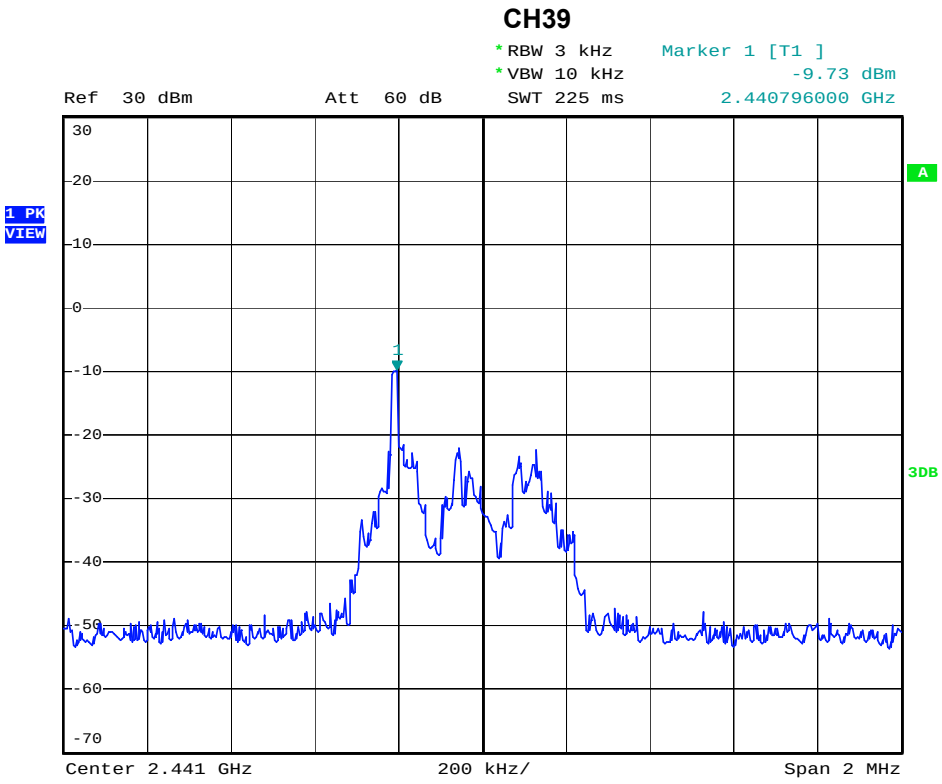
**TEST RESULTS**

| Channel | Channel Frequency (MHz) | PSD (dBm/3KHz) | Maximum limit (dBm/3KHz) | PASS / FAIL |
|---|---|---|---|---|
| 01 | 2403 | -3.66 | 8 | PASS |
| 39 | 2441 | -9.73 | 8 | PASS |
| 78 | 2480 | -4.70 | 8 | PASS |

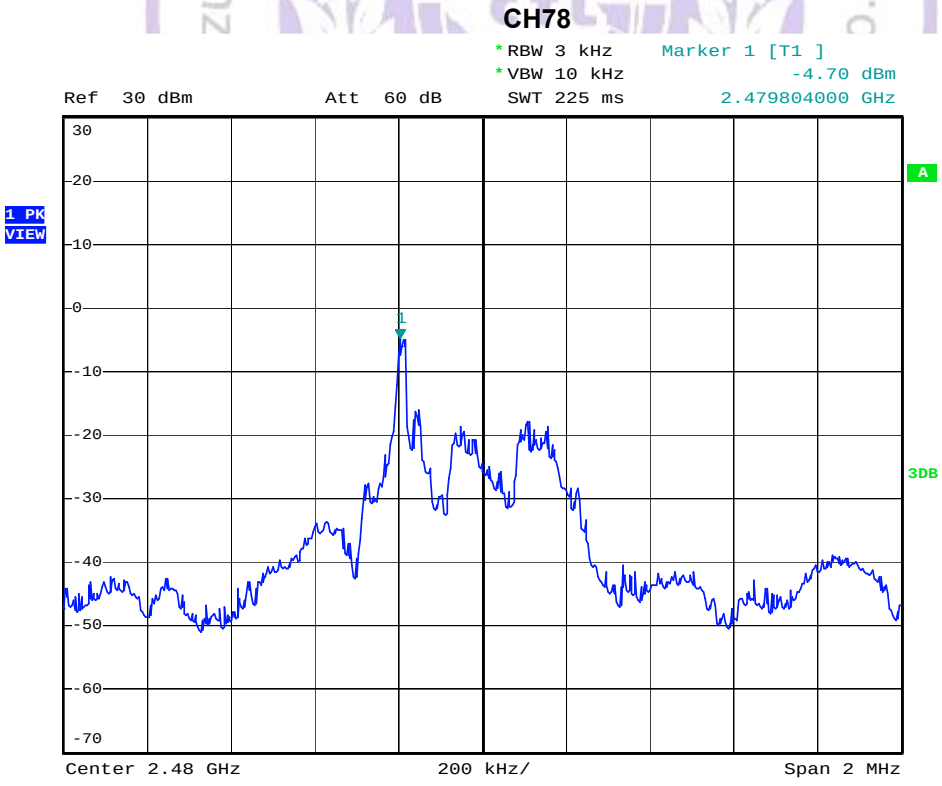
**CH01**




Date: 18.APR.2013 17:40:19



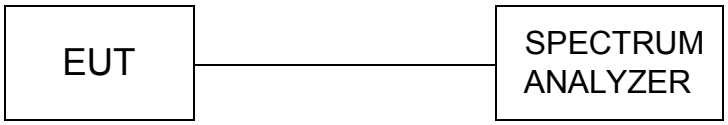

Date: 18.APR.2013 18:02:53




Date: 18.APR.2013 18:28:06

## 4.7. Spurious RF Conducted Emission

**TEST CONFIGURATION**




**TEST PROCEDURE**

The EUT was tested according to KDB558074 D01 V02 10/04/2012 for compliance to FCC 47CFR 15.247 requirements.
The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2009 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBM= 300KHz to measure the peak field strength , and measure frequeny range from 30MHz to 26.5GHz.

**LIMIT**

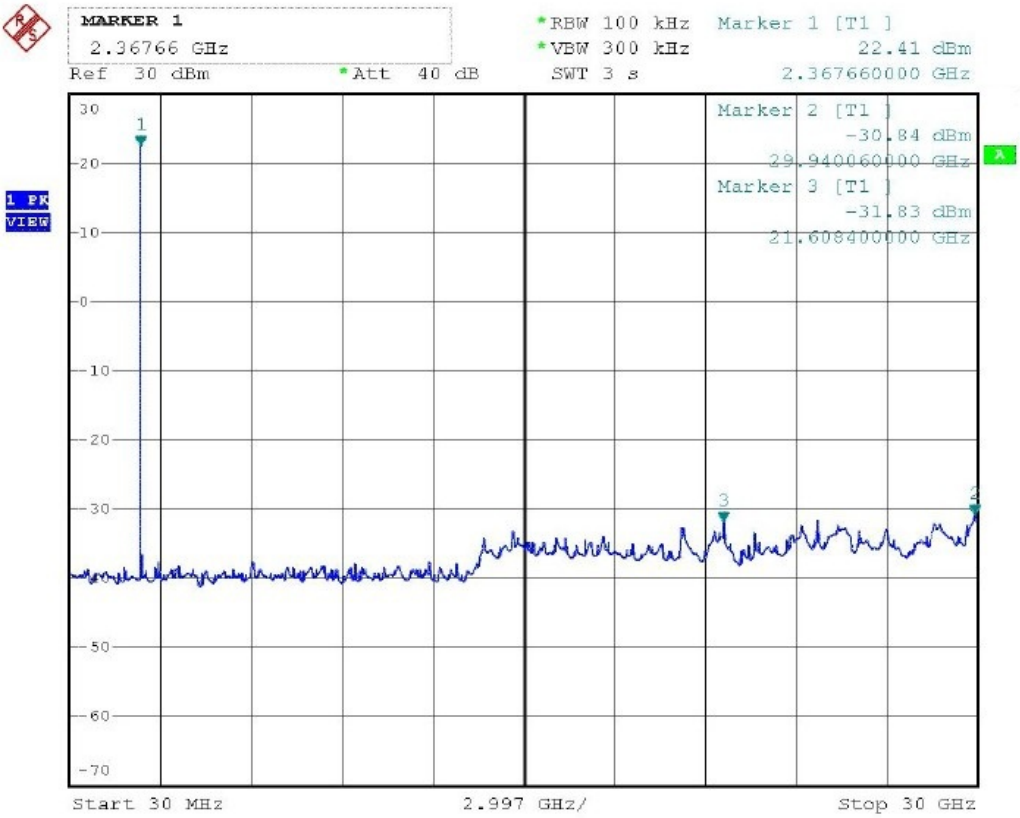
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

**TEST RESULTS**

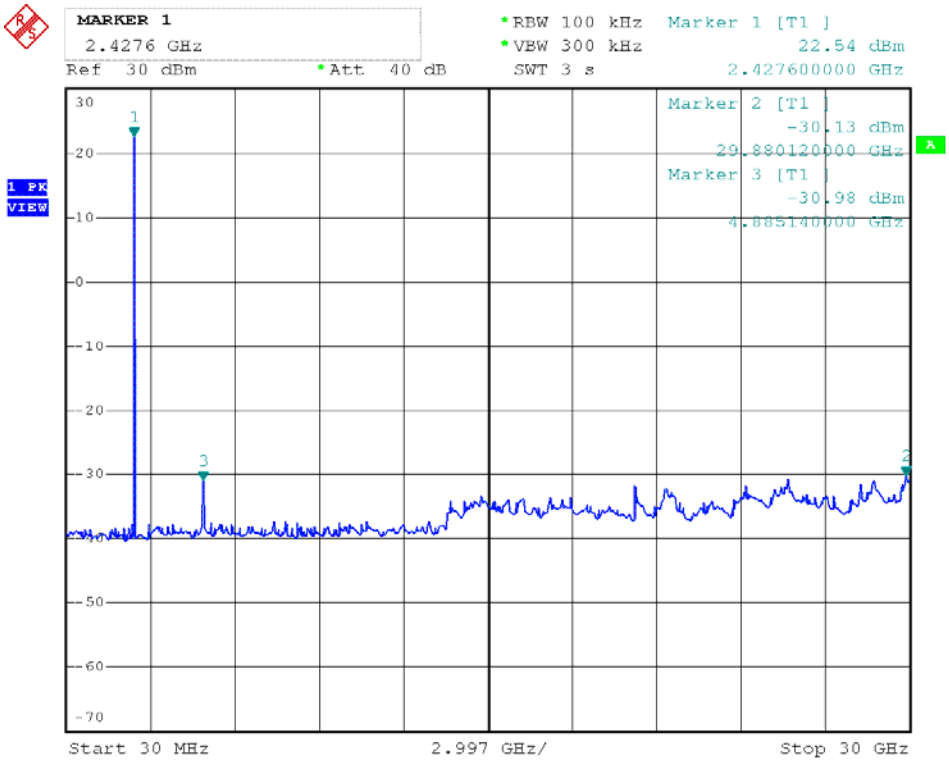
Photos of Spurious RF Conducted Emission Measurement

**For 802.11b Mode:**

**CH01**

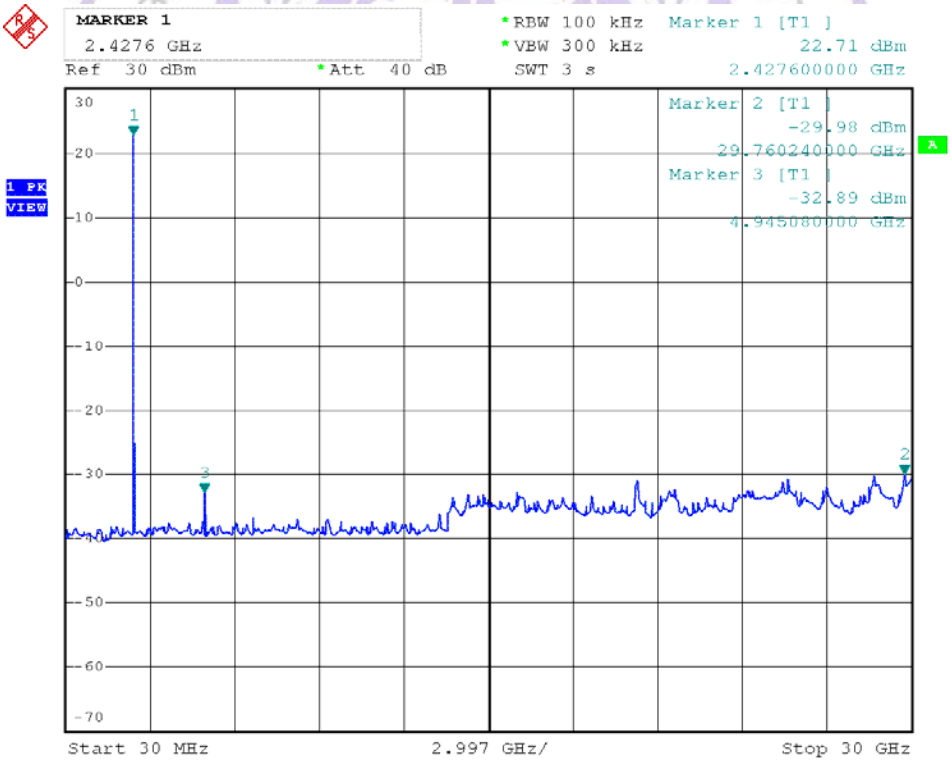


**CH39**




Date: 24.APR.2013 10:52:57

**CH78**




Date: 24.APR.2013 10:54:41

## 4.8. Antenna Requirement

**STANDARD APPLICABLE**

For intentional device, according to FCC 47 CFR Section 15.203, 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.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

**Refer to statement below for compliance.**

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

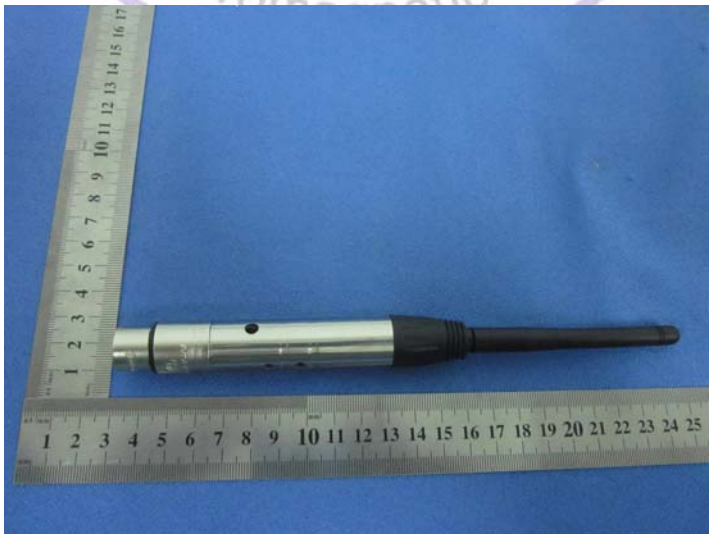
**ANTENNA CONNECTED CONSTRUCTION**

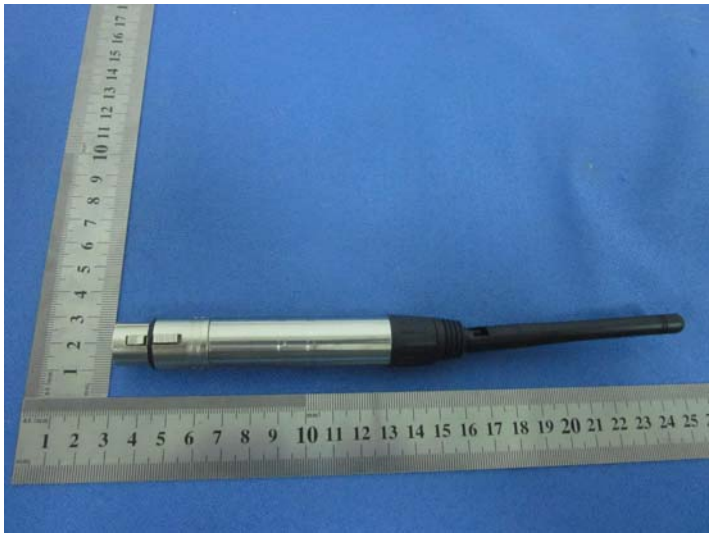
The directional gains of antenna used for transmitting is 2 dBi, and the antenna connector is designed as RP-SMA isotropic antenna and no consideration of replacement. Please see EUT photo for details.

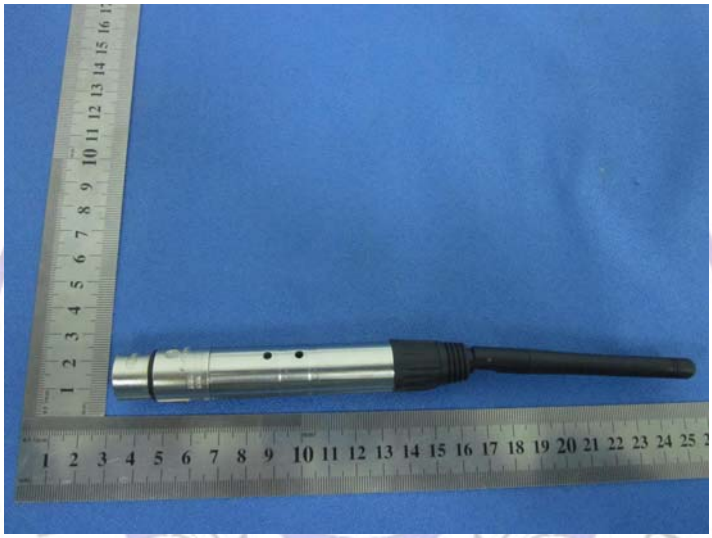
# 5. Test Setup Photos of the EUT

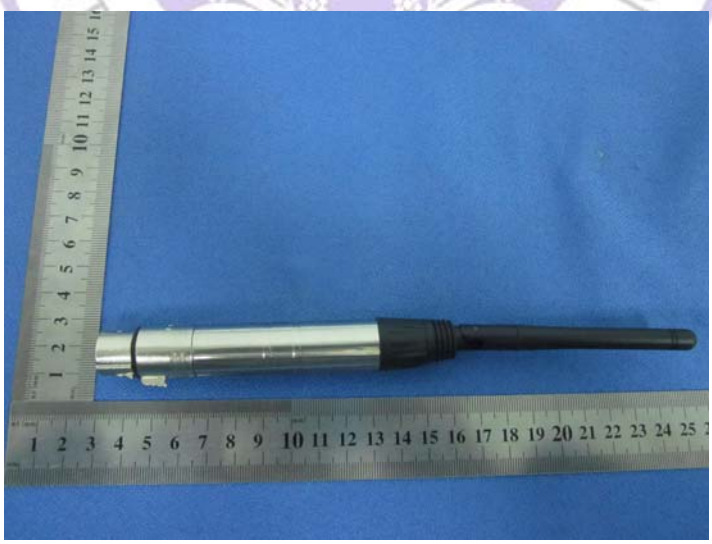
# 6. External and Internal Photos of the EUT

**External Photos of EUT**

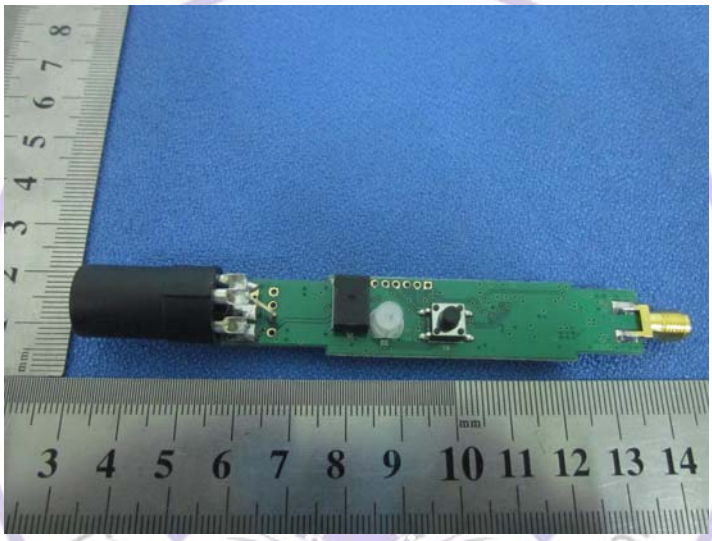


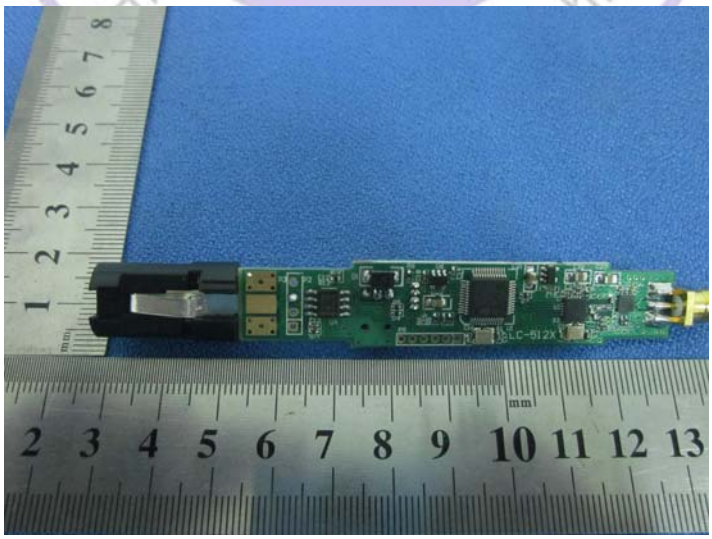






**Internal Photos of EUT**





**.....End of Report.....**