| | | | | |
|---|---|---|---|---|
| **Prüfbericht-Nr.:** *Test Report No.:* | **10051279 001** | **Auftrags-Nr.:** *Order No.:* | 114033390 | Seite 1 von 35 *Page 1 of 35* |
| **Kunden-Referenz-Nr.:** *Client Reference No.:* | N/A | **Auftragsdatum:** *Order date:* | 25-Mar-2015 | |
| **Auftraggeber:** *Client:* | PRECASTER, No.204, Sec. 2, Fu-Hsing Rd., Taichung, Taiwan | | | |
| **Prüfgegenstand:** *Test item:* | Laser Distance Meter | | | |
| **Bezeichnung / Typ-Nr.:** *Identification / Type No.:* | CA7100,CA6100, CA670, CA650,CX100, CX70, CX50, CX40,DM100, DM70, DM50, DM40,EL100, EL70, EL50, EL40,KD7000 | | | |
| **Auftrags-Inhalt:** *Order content:* | FCC Part15C and IC RSS-210 Test report | | | |
| **Prüfgrundlage:** *Test specification:* | FCC 47CFR Part 15: Subpart C Section 15.247<br>RSS-210 (12-2010) A8 | | | |

| | |
|---|---|
| **Wareneingangsdatum:** *Date of receipt:* | 9-Apr-2015 |
| **Prüfmuster-Nr.:** *Test sample No.:* | A000183485-002<br>A000183485-002 |
| **Prüfzeitraum:** *Testing period:* | 18-May-2015 - 21-May-2015 |
| **Ort der Prüfung:** *Place of testing:* | EMC/RF Laboratory Taipei |
| **Prüflaboratorium:** *Testing laboratory:* | TUV Rheinland Taiwan Ltd. |
| **Prüfergebnis*:** *Test result*:* | Pass |


| **geprüft von** / *tested by:* | | | **kontrolliert von** / *reviewed by:* | | |
|---|---|---|---|---|---|
| 2015-06-30 | Ryan Chen/Project Engineer | | 2015-06-30 | Rene Charton/Senior Project Manager | |
| **Datum** *Date* | **Name / Stellung** *Name / Position* | **Unterschrift** *Signature* | **Datum** *Date* | **Name / Stellung** *Name / Position* | **Unterschrift** *Signature* |

**Sonstiges** / *Other:*

| | |
|---|---|
| **Zustand des Prüfgegenstandes bei Anlieferung:** *Condition of the test item at delivery:* | Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged* |

| | | | | | |
|---|---|---|---|---|---|
| * Legende: | 1 = sehr gut | 2 = gut | 3 = befriedigend | 4 = ausreichend | 5 = mangelhaft |
| | P(ass) = entspricht o.g. Prüfgrundlage(n) | | F(ail) = entspricht nicht o.g. Prüfgrundlage(n) | N/A = nicht anwendbar | N/T = nicht getestet |
| *Legend:* | *1 = very good* | *2 = good* | *3 = satisfactory* | *4 = sufficient* | *5 = poor* |
| | *P(ass) = passed a.m. test specification(s)* | | *F(ail) = failed a.m. test specification(s)* | *N/A = not applicable* | *N/T = not tested* |

# TEST SUMMARY

**5.1.1 ANTENNA REQUIREMENT**
*RESULT: Passed*

**5.1.2 PEAK OUTPUT POWER**
*RESULT: Passed*

**5.1.3 6DB BANDWIDTH**
*RESULT: Passed*

**5.1.4 POWER DENSITY**
*RESULT: Passed*

**5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100KHZ BANDWIDTH**
*RESULT: Passed*

**5.1.6 SPURIOUS EMISSION**
*RESULT: Passed*

**6.1.1 ELECTROMAGNETIC FIELDS**
*RESULT: Passed*

# Contents

# 1. General Remarks

## 1.1 Complementary Materials

These attachments are integral parts of this test report:

**Appendix P: Photo Documentation internal view**
**(File Name: 10051279APPENDIX P)**

**Appendix D: Test Result of Radiated Emissions**
**(File Name: 10051279APPENDIX D)**

Test Specifications

The following standards were applied.

### Table 1: Applied Standard and Test Levels

| **Radio** |
|---|
| NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2011)(100年6月28日) |
| FCC CFR47 Part 15: Subpart C Section 15.247 |
| RSS-210 Issue 8, December 2010 |
| RSS-Gen, Issue 4, November 2014 |
| ANSI C63.4:2009, ANSI C63.10:2009 (FCC Part 15) |
| ANSI C63.10:2013 (RSS-Gen) |
| KDB558074 D01 DTS Meas Guidance v02 |

# 2. Test Sites

## 2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taichung Branch Office

No.9, Lane 36, Minsheng Rd., Sec. 3, Daya District,
Taichung City 428
Taiwan (R.O.C.)

## 2.2 Test Facility

TUV Rheinland Taiwan Ltd.
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC RegistrationNo.: 365730
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2013-Jul-1st to 2016-Jun-30th

Testing Laboratory
0759

## 2.3 List of Test and Measurement Instruments

### Table 2: List of Test and Measurement Equipment

| Kind of Equipment | Manufacturer | Type | S/N | Last Calibration | Next Calibration |
|---|---|---|---|---|---|
| EMI Test Receiver | R&S | ESR7 | 101062 | 31-Aug-14 | 30-Aug-15 |
| Bilog Antenna | TESEQ | CBL6111D | 29802 | 4-Jul-14 | 3-Jul-16 |
| Spectrum Analyzer | R&S | FSV 40 | 100921 | 17-Dec-14 | 16-Dec-15 |
| Spectrum Analyzer | Agilent | N9010A | MY53470241 | 1-Apr-15 | 30-Mar-16 |
| Horn Antenna | ETS-Lindgren | 3117 | 138160 | 12-Jan-15 | 11-Jan-17 |
| Horn Antenna (18GHz~40GHz) | COM-POWER | AH840 | 101031 | 30-Oct-13 | 29-Oct-15 |
| Preamplifier (30MHz -1GHz) | HP | 8447F | 2805A03335 | 23-Aug-14 | 22-Aug-15 |
| Preamplifier (18 GHz -40 GHz) | COM-POWER | PAM-840 | 461257 | 26-Aug-14 | 25-Aug-15 |
| Pre-Amplifier (1GHz~18GHz) | EM Electronics | EM30180 | 60558 | 4-Nov-14 | 3-Nov-15 |
| Loop Antenna | Schwarzbeck | FMZB 1513 | 1513-076 | 22-Oct-14 | 21-Oct-15 |
| EMI Test Receiver | R&S | ESCI7 | 100797 | 28-Dec-14 | 27-Dec-15 |
| LISN (1 phase) | R&S | ENV216 | 101243 | 31-May-14 | 30-May-15 |
| LISN | Rolf Heine | NNB-2/16Z | 99080 | 26-Aug-14 | 25-Aug-15 |

## 2.4 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

## 2.5 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

## 2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements .

**Table 3: Emission Measurement Uncertainty**

| Parameter | Uncertainty |
|---|---|
| Radio Frequency | ± 1 x $10^{-7}$ |
| RF power, conducted | ± 1.5 dB |
| RF power density, conducted | ± 3 dB |
| spurious emissions, conducted | ± 3 dB |
| all emissions, radiated | ± 6 dB |
| Temperature | ± 1 ºC |
| Humidity | ± 5 % |
| DC and low frequency voltages | ±3 % |

# 3. General Product Information

## 3.1 Product Function and Intended Use

The EUT is a  Laser Distance Meter. It contains a Bluetooth 4.0 BLE compatible module enabling the user to communicate data through a Wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

## 3.2 System Details and Ratings

### Table 4: Basic Information of EUT

| Item | EUT information |
|---|---|
| Kind of Equipment | Laser Distance Meter |
| Type Designation | CA7100,CA6100, CA670, CA650,CX100, CX70, CX50, CX40,DM100, DM70, DM50, DM40,EL100, EL70, EL50, EL40,KD7000 |
| FCC ID | YWSLB113100000001 |
| Canada ID | 20299-LB113100001 |
| HVIN | 1.0 |

### Table 5: Technical Specification of EUT

| Technical Specification | Value |
|---|---|
| Operating Frequencies | 2402~2480 MHz |
| Channel Spacing | 2 MHz |
| Channel number | 40 |
| Operation Voltage | 3V |
| Modulation | GFSK |
| Antenna gain | 3.27 dBi |

## 3.3 Independent Operation Modes

Basic operation modes are:

A. Transmitting
    1. Low channel
    2. Middle channel
    3. High channel
B. Receiving
C. Standby
D. Off

## 3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

## 3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

# 4. Test Set-up and Operation Modes

## 4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

## 4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a modified firmware which makes it possible to control them through a keypad on device.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:
Conducted: A000183485-002
Radiation: A000183485-002

Full test was applied on all test modes, but only worst case was shown

### 4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

| Kind of Equipment | Manufacturer | S/N |
|---|---|---|
| Laptop | HP | CNF0339QBM |

## 4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

## 4.5 Test Setup Diagram

**Diagram of Measurement Configuration for Radiation Test**

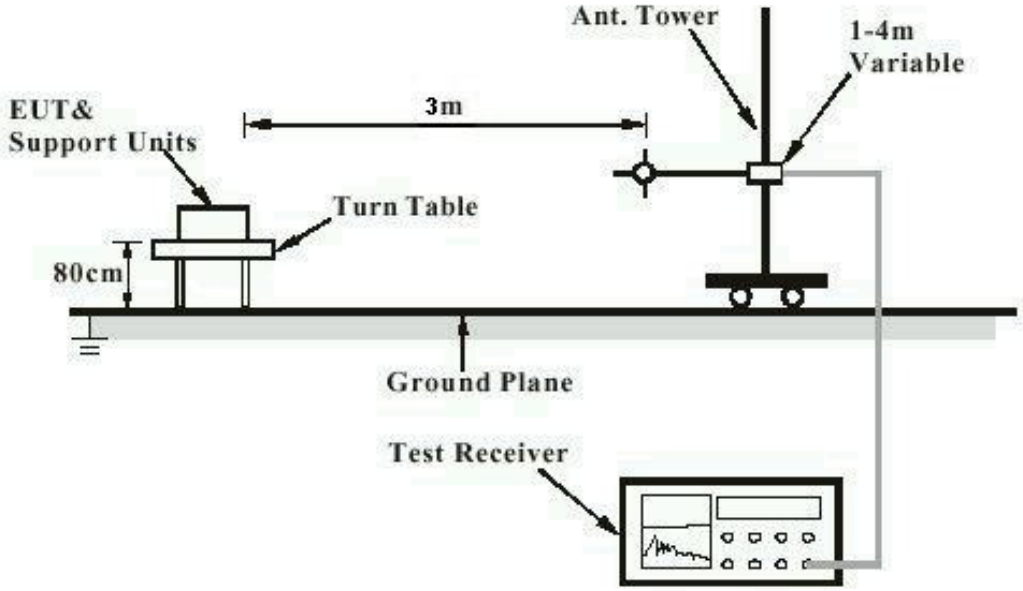


**Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)**

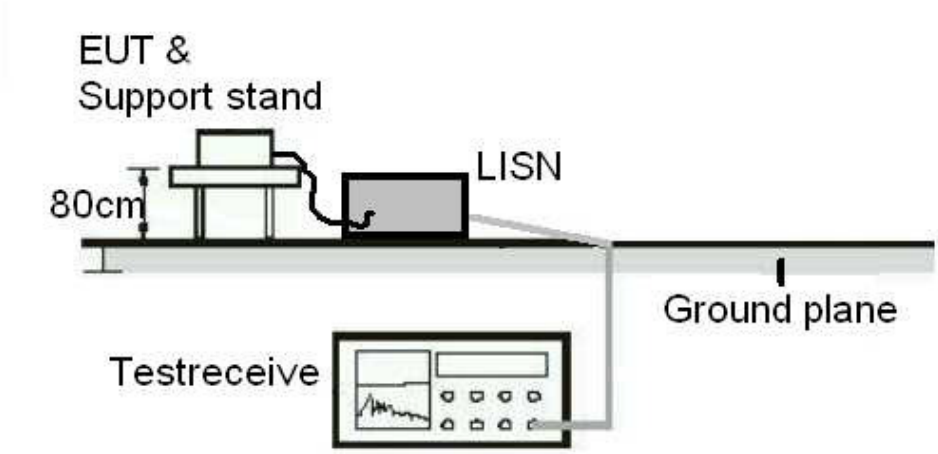
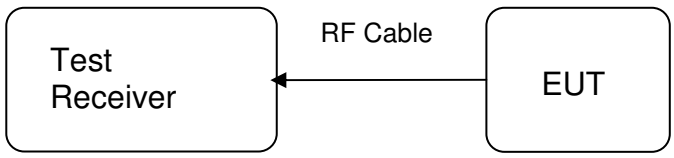



**Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement**



# 5. Test Results

## 5.1 Transmitter Requirement & Test Suites

### 5.1.1 Antenna Requirement

**RESULT:** **Passed**

| | | |
|---|---|---|
| Test standard | : | LP0002(2011): 2.2, 3.10.1, (3)<br>FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 8.3 |
| Requirement | : | use of approved antennas only with directional gains that do not exceed 6 dBi |

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 3.27 dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

## 5.1.2 Peak Output Power

**RESULT:** **Passed**

| | | |
|---|---|---|
| Test standard | : | LP0002(2011): 3.10.1, (2)<br>FCC Part 15.247(b)(3), RSS-210 A8.4(4) |
| Basic standard | : | ANSI C63.10:2009, KDB558074 |
| Limit | : | 1 Watt |
| Kind of test site | : | Shielded room |

**Test setup**

| | | |
|---|---|---|
| Test Channel | : | Low/ Middle/ High |
| Operation Mode | : | A |
| Ambient temperature | : | 20-24 °C |
| Relative humidity | : | 50-65 % |
| Atmospheric pressure | : | 100-103 kPa |

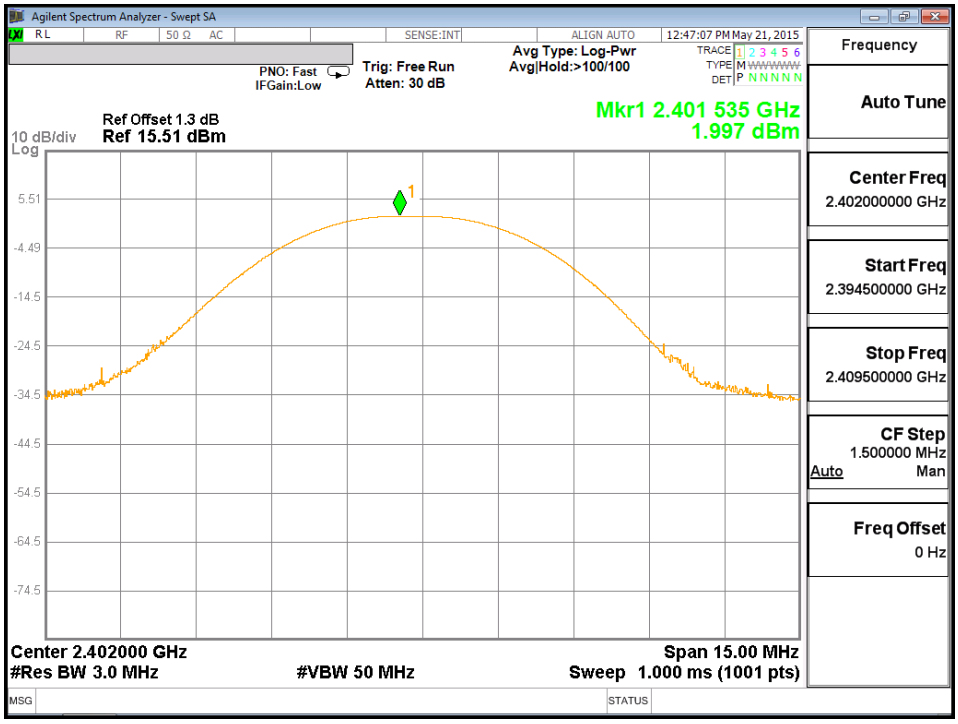
**Table 6: Test result of Peak Output Power**

| Channel | Channel Frequency (MHz) | Output Power | | Limit |
|---|---|---|---|---|
| | | (dBm) | (W) | (W) |
| Low Channel | 2402 | 2.00 | 0.00158 | 1 |
| Middle Channel | 2442 | 1.43 | 0.00139 | 1 |
| High Channel | 2480 | 0.40 | 0.00110 | 1 |

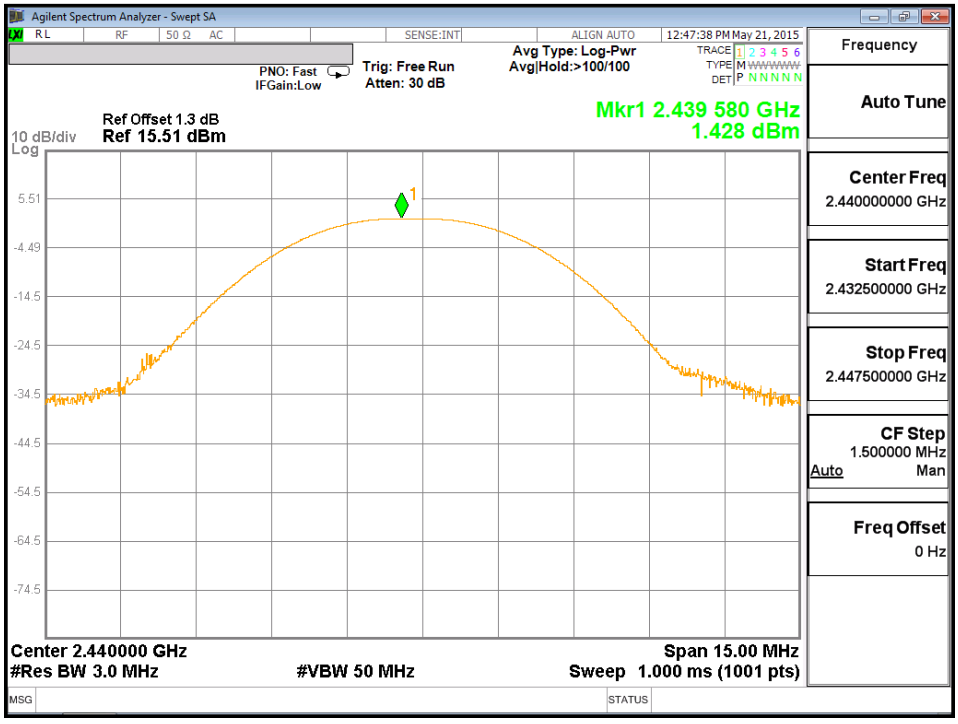
Pmax: 1.5838 mW

# Test Plot of Output Power

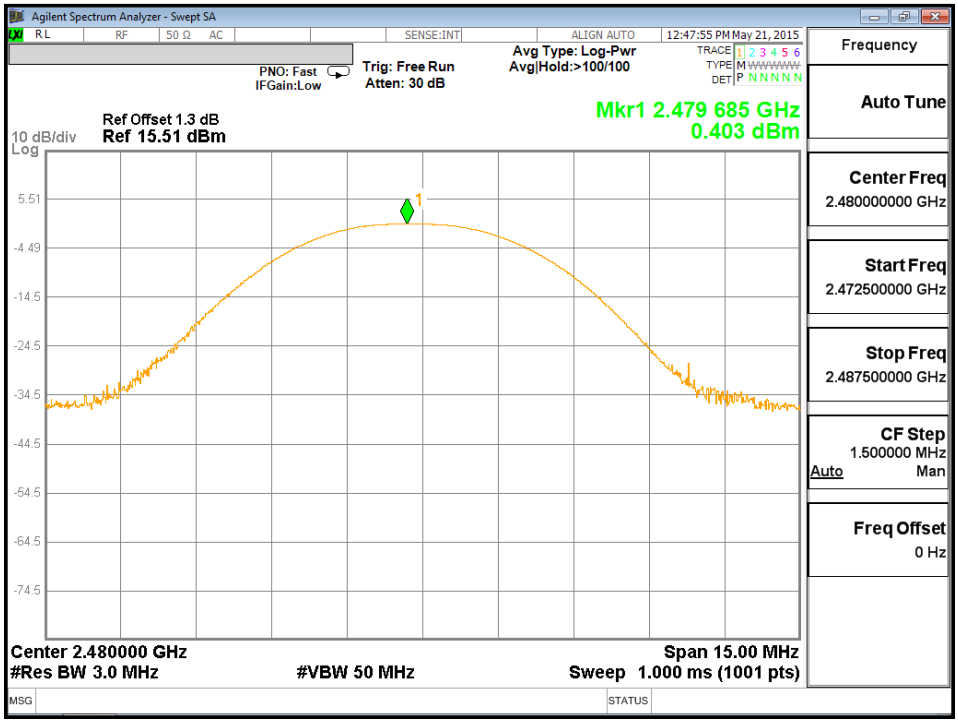
## Low Channel




## Middle Channel



## High Channel



## 5.1.3 6dB Bandwidth

**RESULT:** **Passed**

| | | |
|---|---|---|
| Test standard | : | LP0002(2011): 3.10.1, (5)<br>FCC Part 15.247(a)(2), RSS-210 A8.2(1) |
| Basic standard | : | ANSI C63.10:2009, KDB558074 |
| Kind of test site | : | Shielded room |

**Test setup**

| | | |
|---|---|---|
| Test Channel | : | Low/ Middle/ High |
| Operation Mode | : | A |

| | | |
|---|---|---|
| Ambient temperature | : | 20-24°C |
| Relative humidity | : | 50-65% |
| Atmospheric pressure | : | 100-103 kPa |

### Table 7: Test result of 6dB Bandwidth

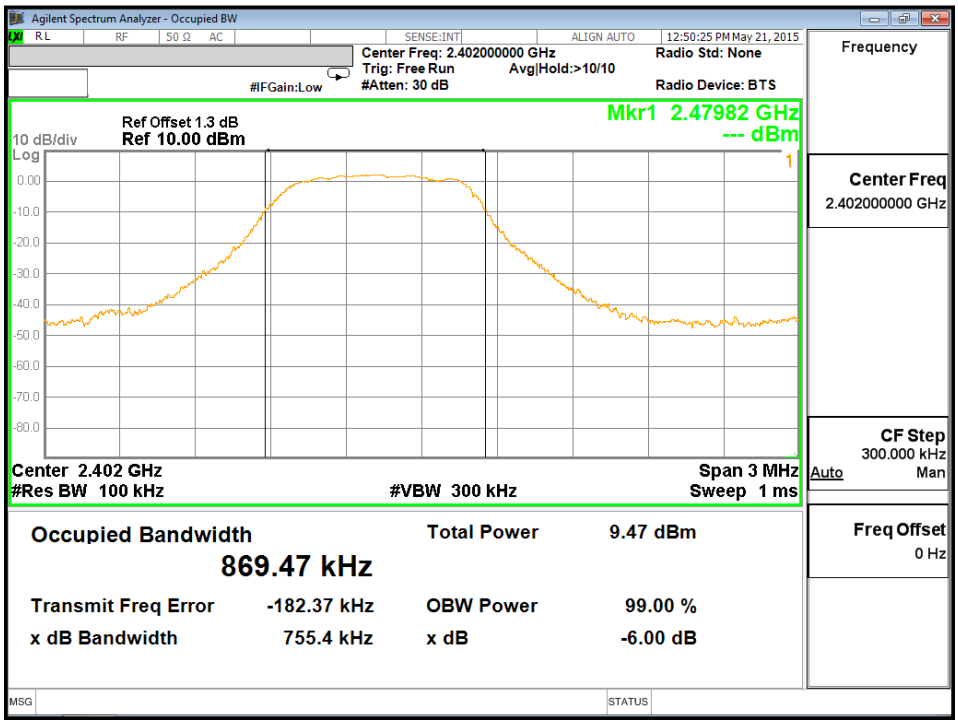
| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|---|
| Low Channel | 2402 | 755.4 | >500 | Pass |
| Mid Channel | 2440 | 769.6 | >500 | Pass |
| High Channel | 2480 | 781.1 | >500 | Pass |

### Table 8: Test result of 99% Bandwidth, GFSK modulation

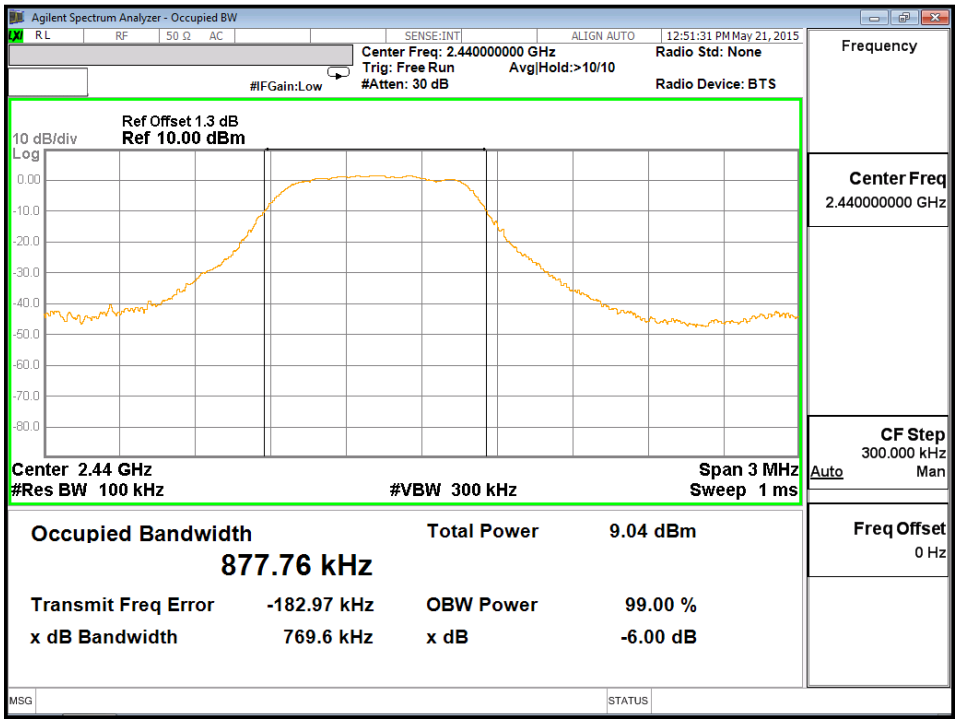
| Channel | Channel Frequency (MHz) | 99% Bandwidth (kHz) |
|---|---|---|
| Low Channel | 2402 | 871.97 |
| Mid Channel | 2440 | 878.88 |
| High Channel | 2480 | 878.4 |

# Test Plot of 6dB Bandwidth

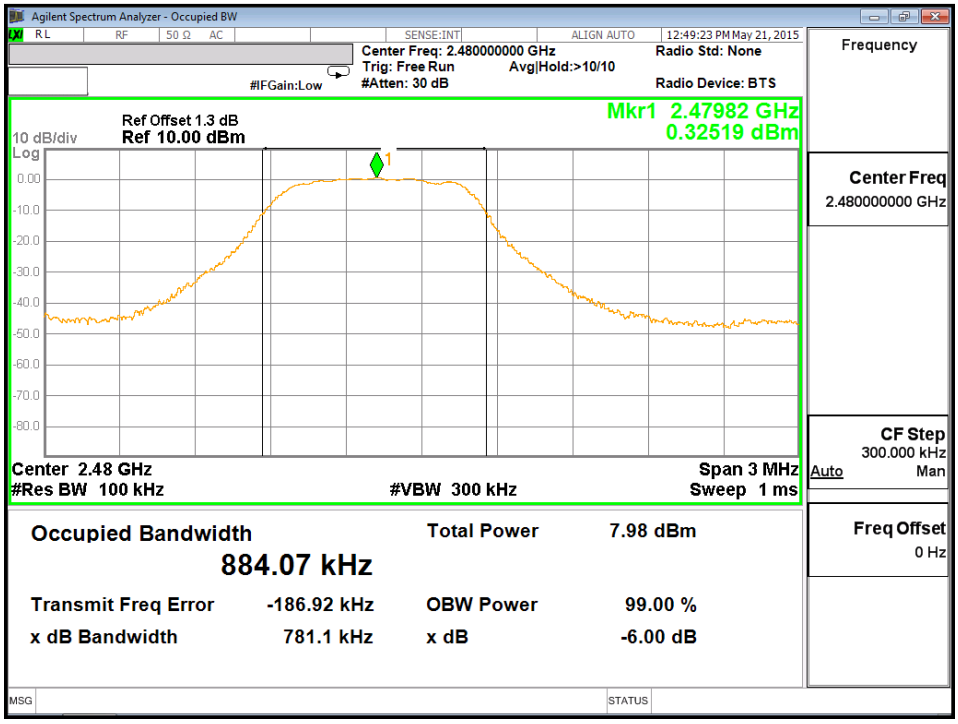
## Low Channel




## Middle Channel

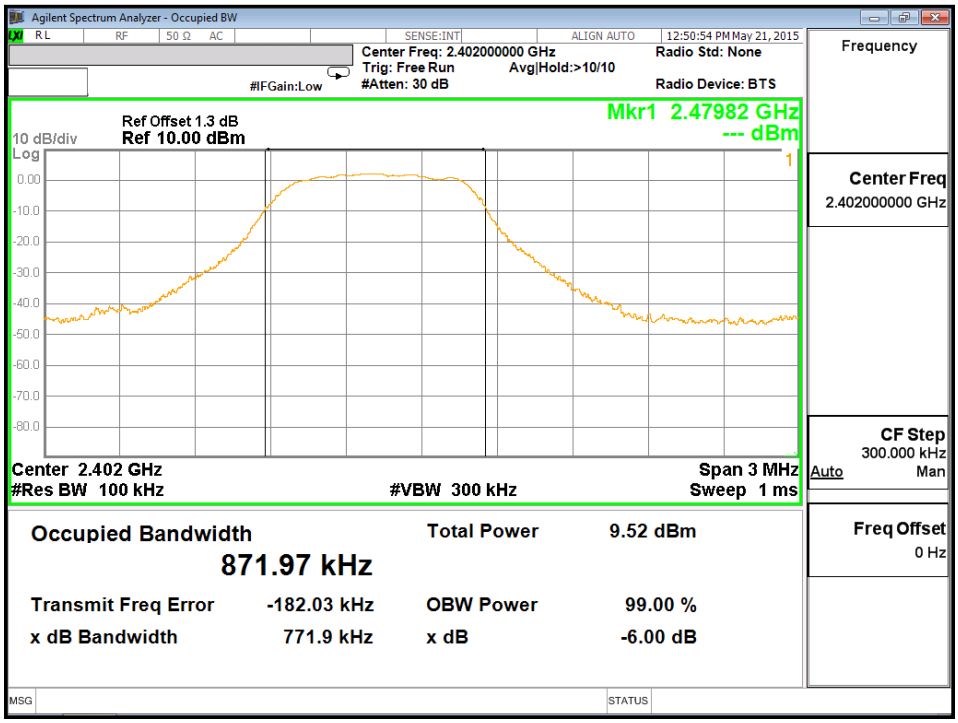


## High Channel

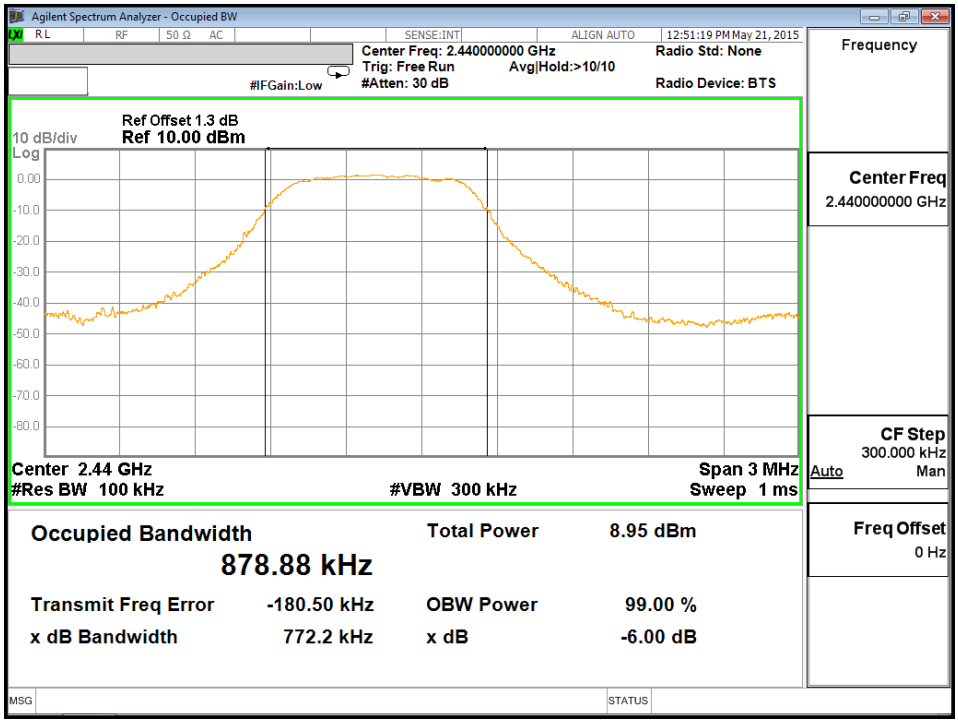


# Test Plot of 99% Bandwidth

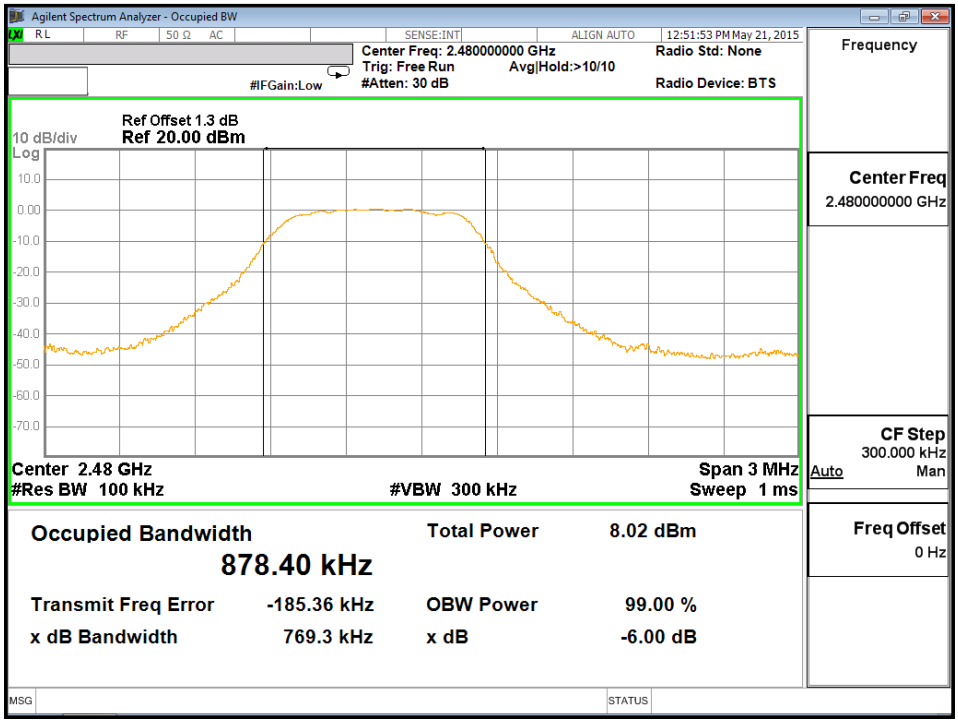
## Low Channel




## Middle Channel



## High Channel



## 5.1.4 Power Density

**RESULT:** **Passed**

| | | |
|---|---|---|
| Test standard | : | LP0002(2011): 3.10.1, (6.2.2)<br>FCC Part 15.247(e) , RSS-210 A8.2(2) |
| Basic standard | : | ANSI C63.10:2009, KDB558074 |
| Kind of test site | : | Shielded room |

**Test setup**

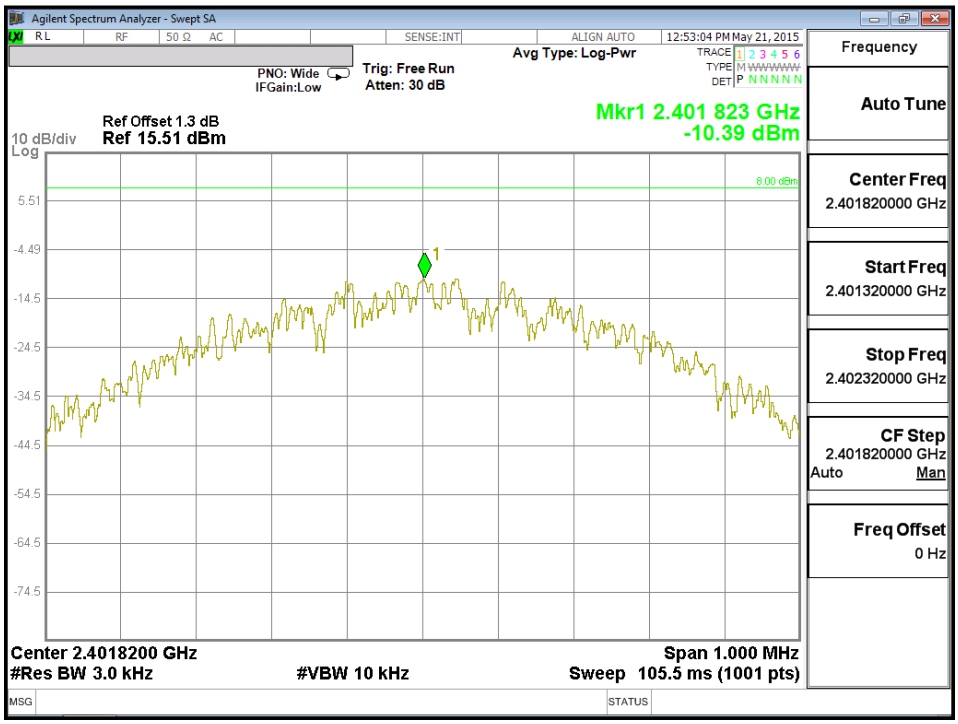
| | | |
|---|---|---|
| Test Channel | : | Low/ Middle/ High |
| Operation Mode | : | A |
| Ambient temperature | : | 20-24°C |
| Relative humidity | : | 50-65% |
| Atmospheric pressure | : | 100-103 kPa |

**Table 9: Test result of Power Density**

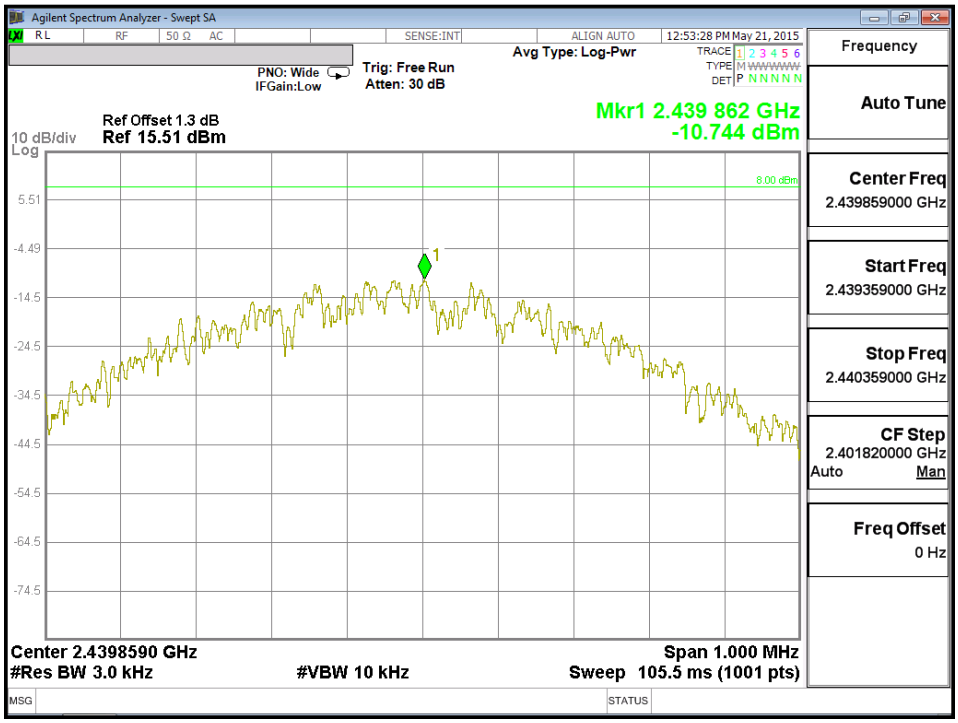
| Channel | Channel Frequency (MHz) | Power Density | Limit |
|---|---|---|---|
| | | (dBm) | (dBm) |
| Low Channel | 2402 | -10.39 | 8 |
| Middle Channel | 2440 | -10.744 | 8 |
| High Channel | 2480 | -10.901 | 8 |

# Test Plot of Power Density

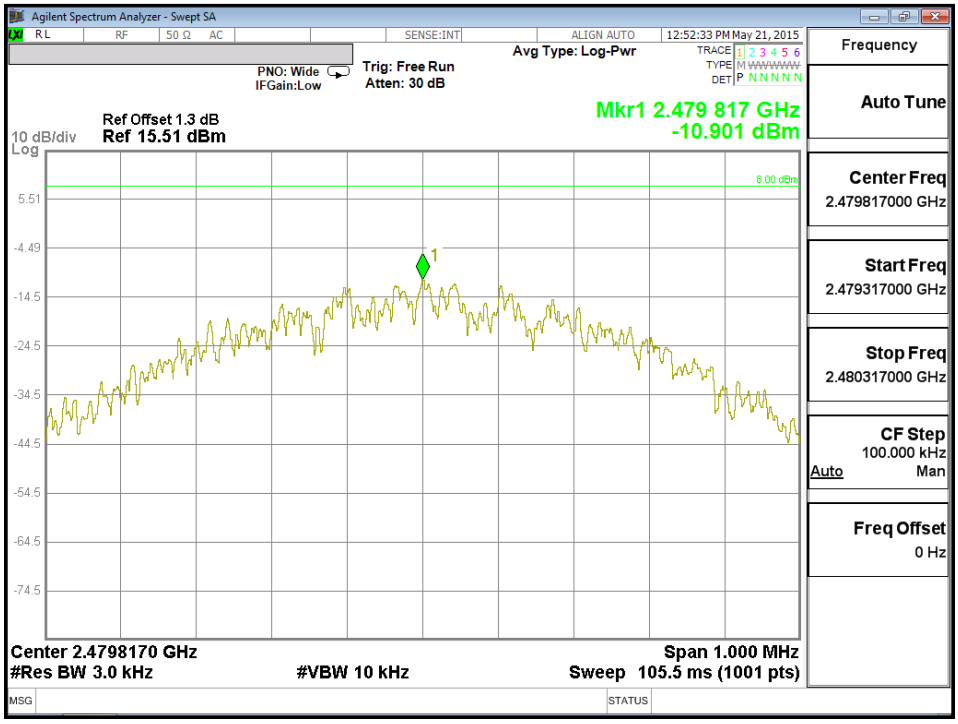
## Low Channel




## Middle Channel



## High Channel



## 5.1.5 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

**RESULT:** **Passed**

| | | |
|---|---|---|
| Test standard | : | LP0002(2011): 3.10.1, (5)<br>FCC part 15.247(d), RSS-210 A8.5 |
| Basic standard | : | ANSI C63.10:2009, KDB558074 |
| Limit | : | 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power) |
| Kind of test site | : | Shielded room |

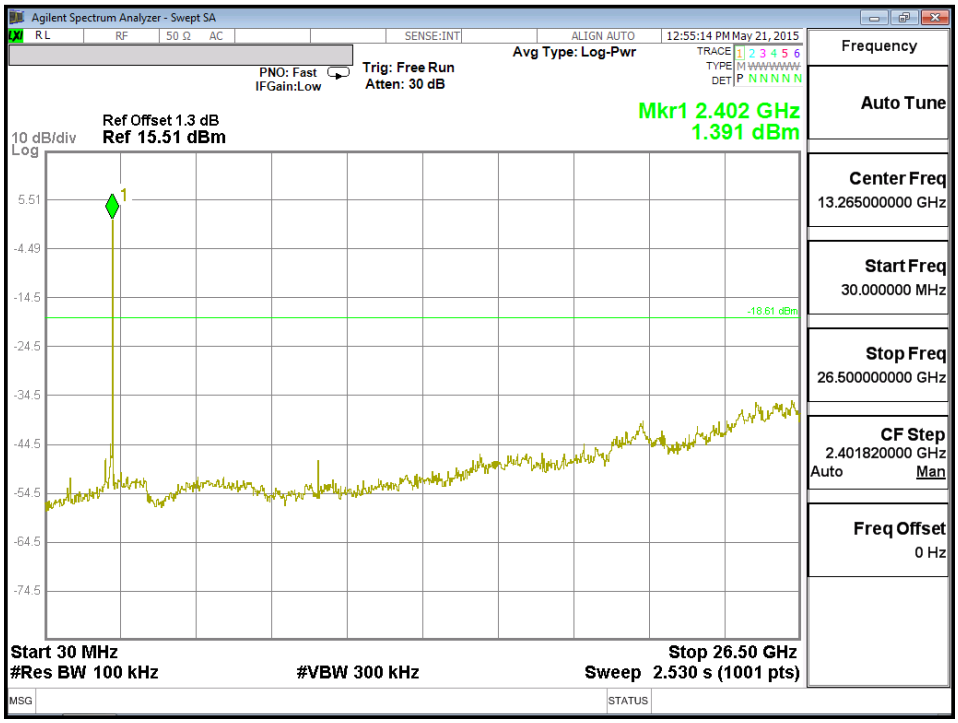
**Test setup**

| | | |
|---|---|---|
| Test Channel | : | Low/ High |
| Operation mode | : | A |
| Ambient temperature | : | 20-24°C |
| Relative humidity | : | 50-65% |
| Atmospheric pressure | : | 100-103 kPa |

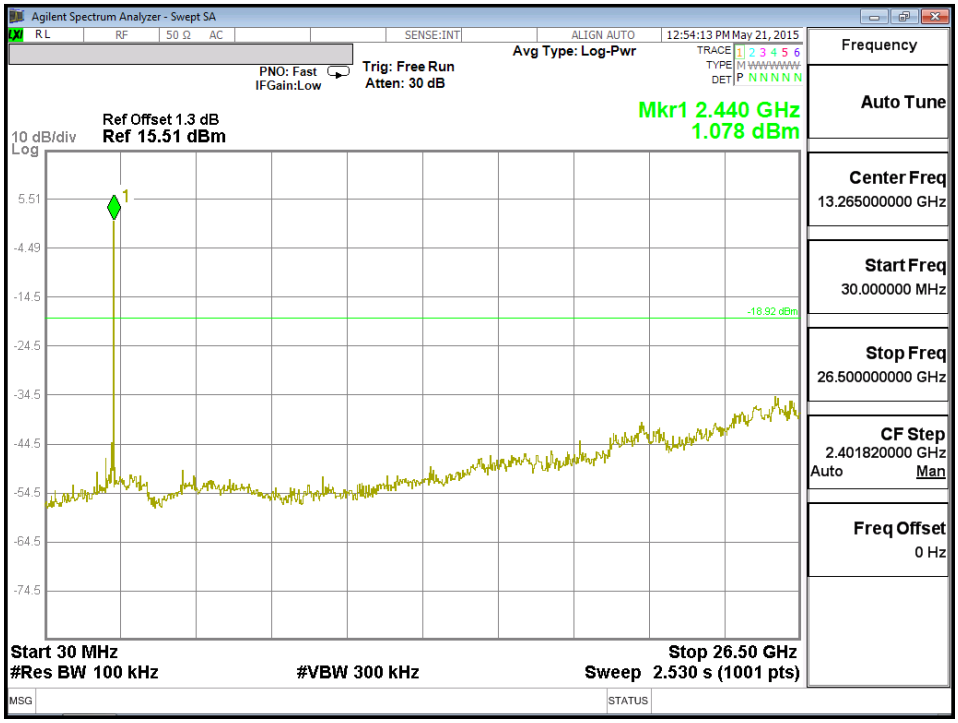
All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

# Test Plot 100kHz Conducted Emissions

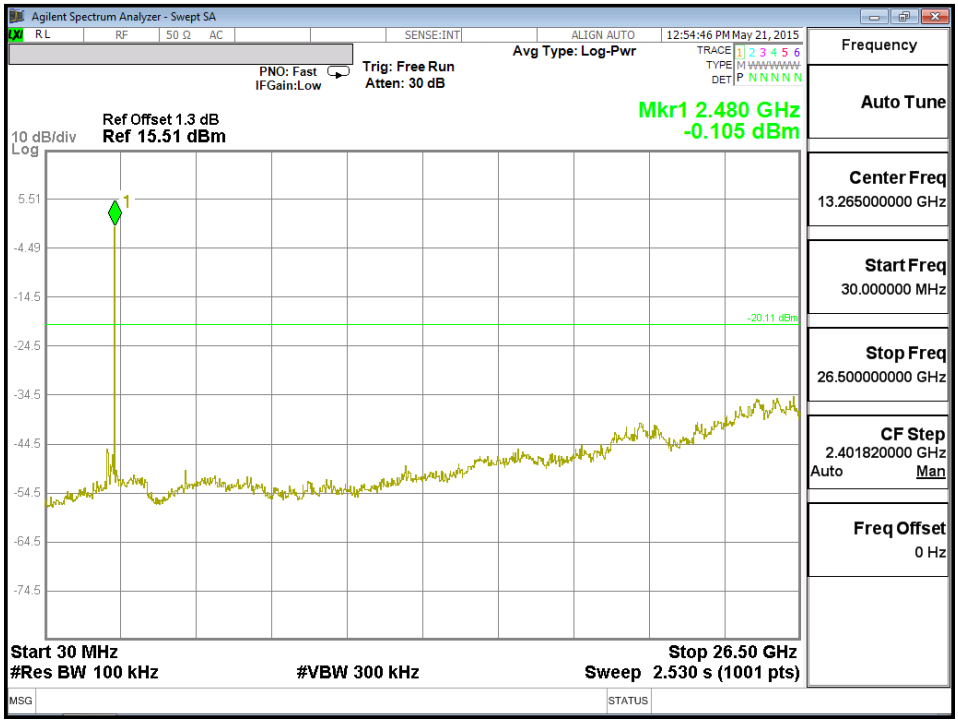
## Low Channel




## Middle Channel

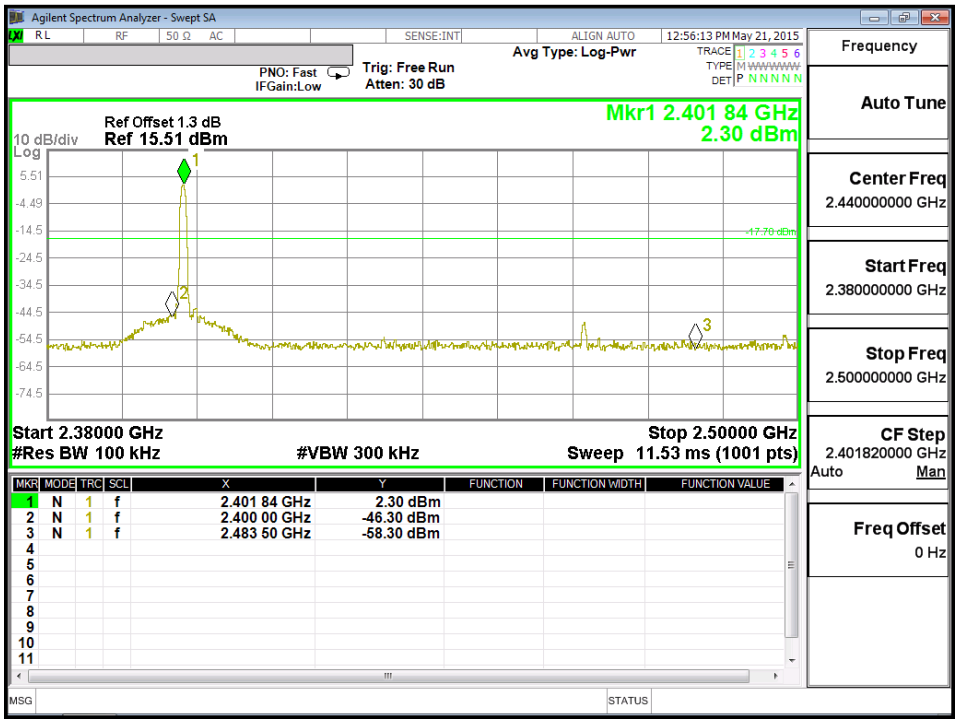


## High Channel

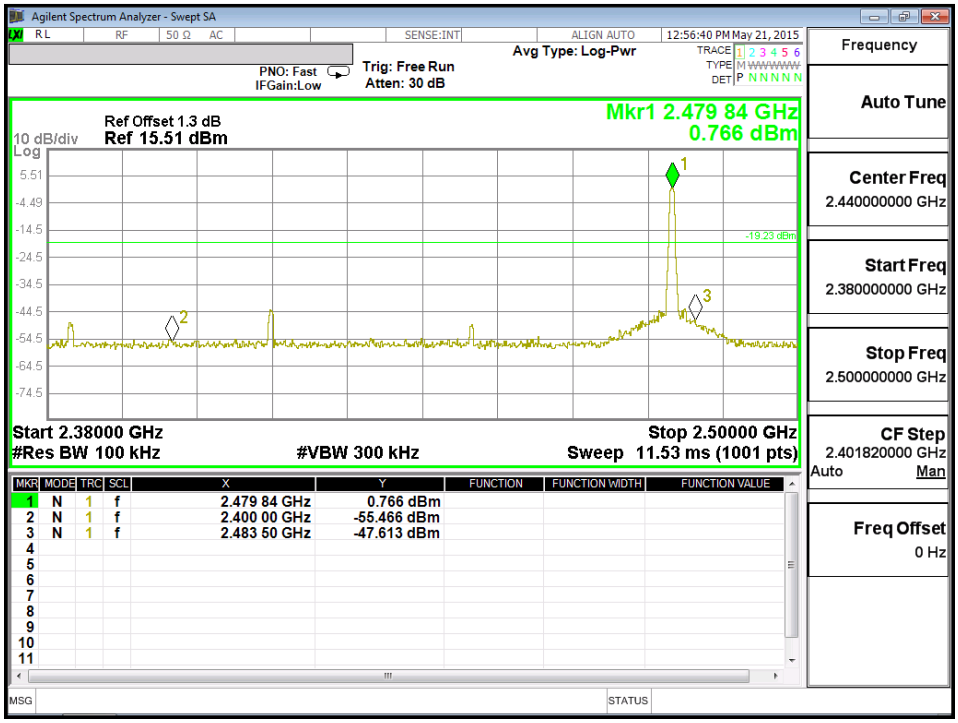


# Test Plot 100kHz RBW of Band Edge

## Low Channel




## High Channel



## 5.1.6 Spurious Emission

**RESULT:** **Passed**

| | | |
|---|---|---|
| Test standard | : | FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-210 A8.5 and RSS-Gen 8.9<br>LP0002(2011): 3.10.1, (5) |
| Basic standard | : | ANSI C63.10: 2009 |
| Limits | : | Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-210 2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 2.7 (Table 2 and 3).<br>Radiated emissions which fall in the restricted bands, as defined in LP0002(2011): 2.7 , must comply with the radiated emission limits specified in LP0002(2011): 2.8<br>Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a), RSS-210 2.7 (Table 2 and 3) and RSS-210 A2.9(a).<br>Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in LP0002(2011): 2.8 |
| Kind of test site | : | 3m Semi-Anechoic Chamber |

**Test setup**

| | | |
|---|---|---|
| Test Channel | : | Low/ Middle/ High |
| Operation mode | : | A, B |

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic.

For details refer to Appendix D.

Testing was carried out within frequency range 30MHz to the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

# 6. Safety Human exposure

## 6.1 Radio Frequency Exposure Compliance

### 6.1.1 Electromagnetic Fields

**RESULT:** **Passed**

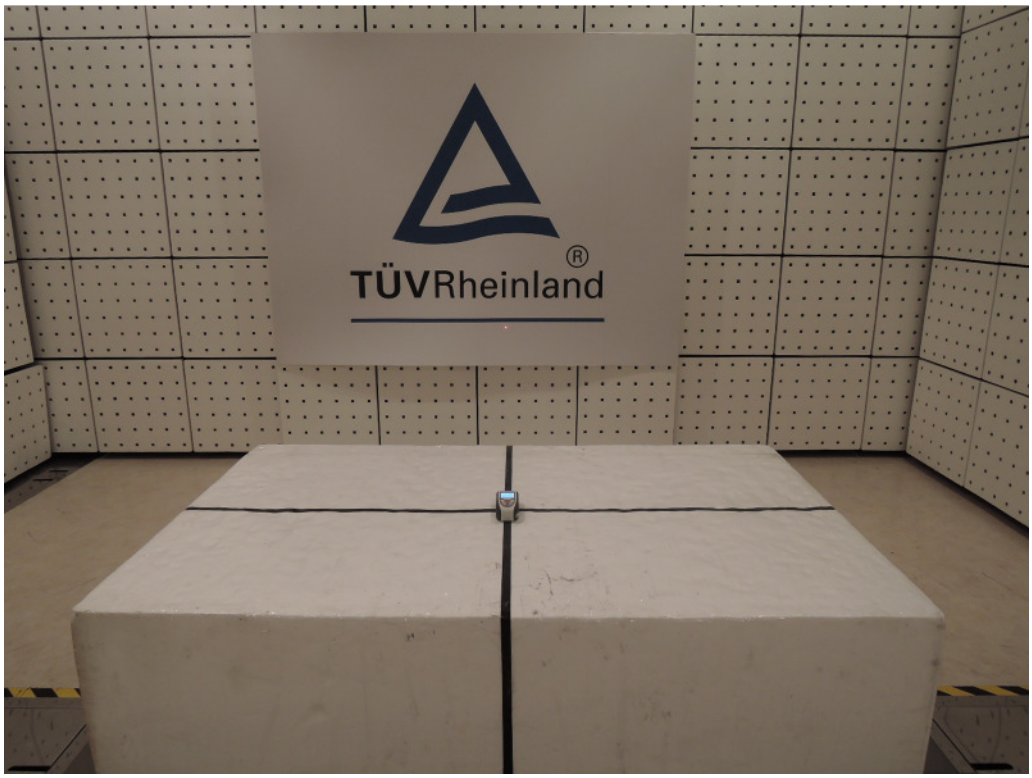
Test standard : FCC KDB Publication 447498 D01 v05

The maximum peak output power of the transmitter is 1.58 mW.

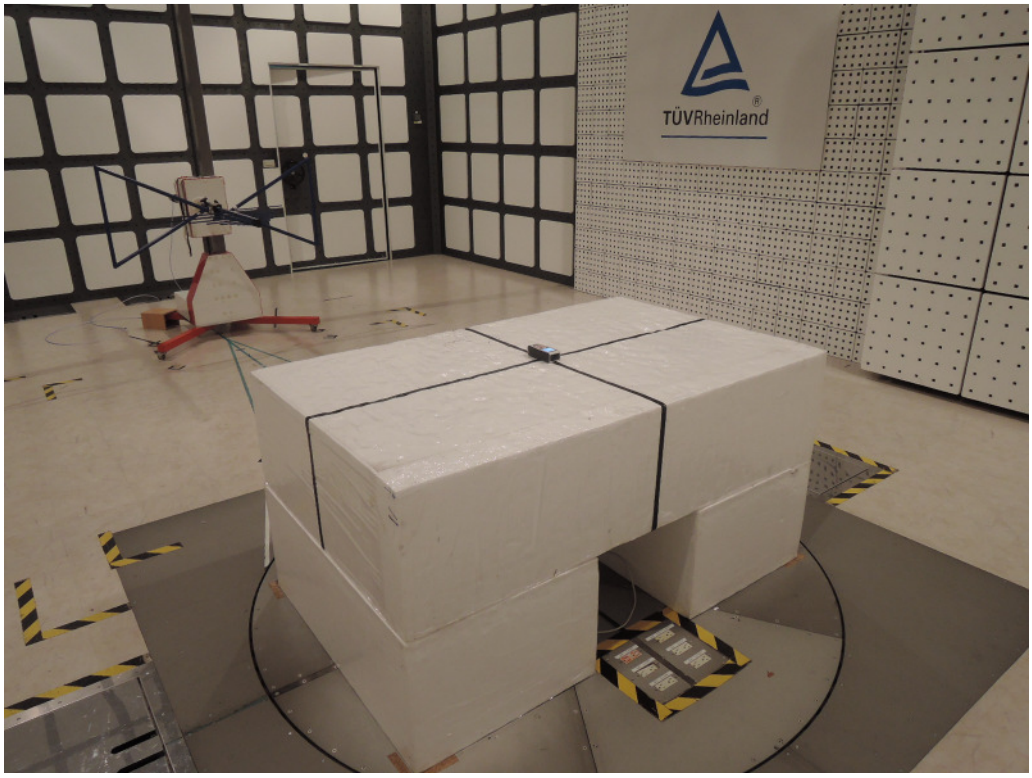
Hence the EUT is excluded from SAR evaluation.
Please also refer to FCC KDB publication 447498 D01 v05: Mobile Portable RF Exposure

# 7. Photographs of the Test Set-Up

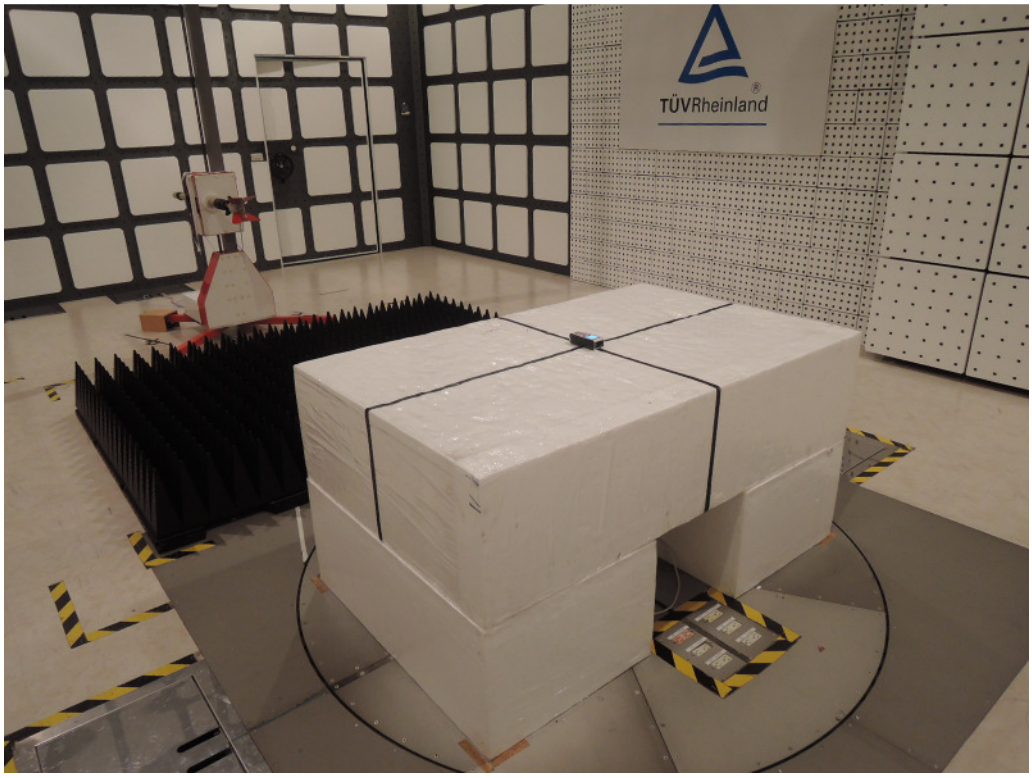
**Photograph 1: Set-up for Spurious Emissions (Front View)**



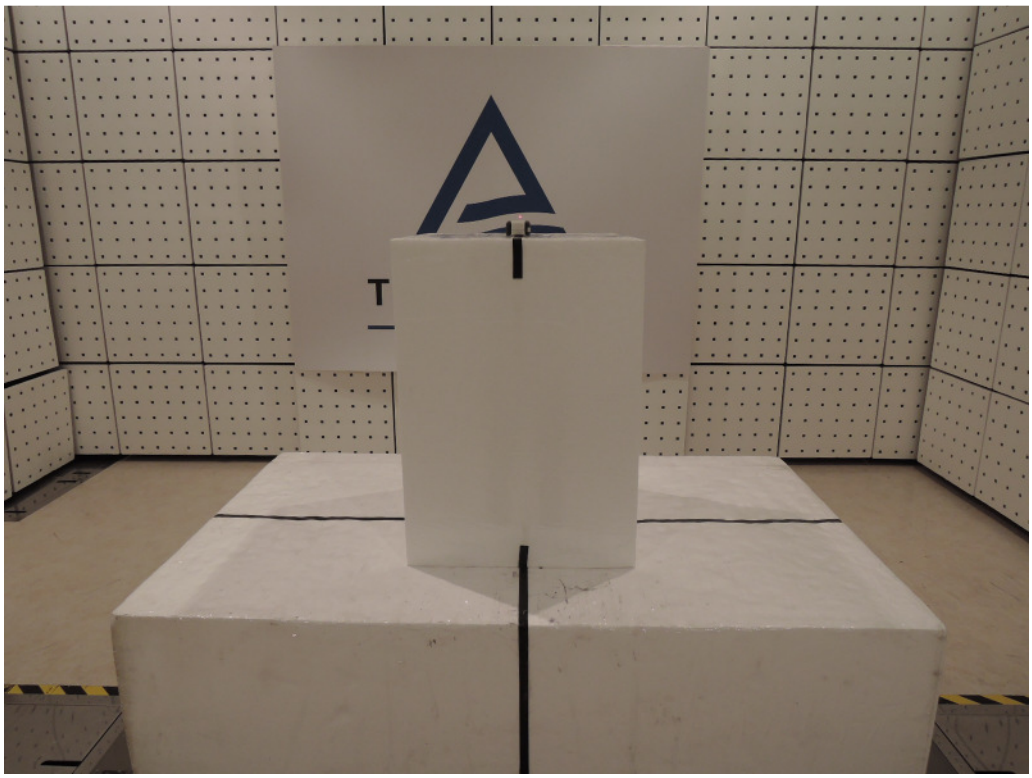
## Photograph 2: Set-up for Spurious Emissions (Back View 1)



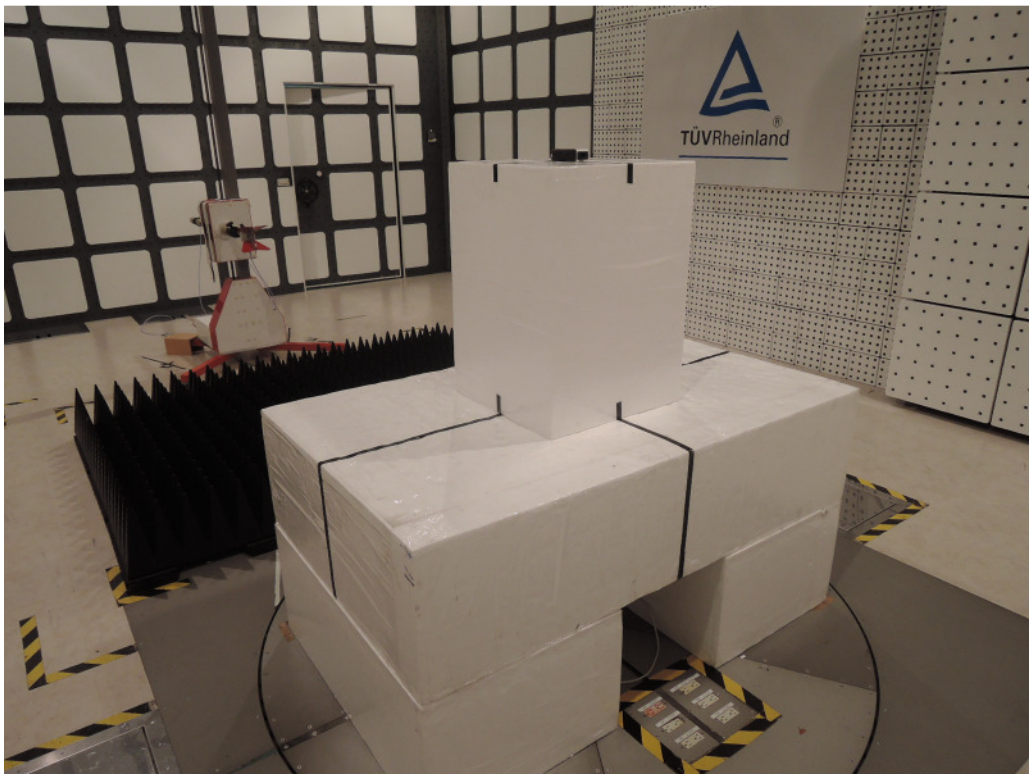

## Photograph 3: Set-up for Spurious Emissions (Back View 2)



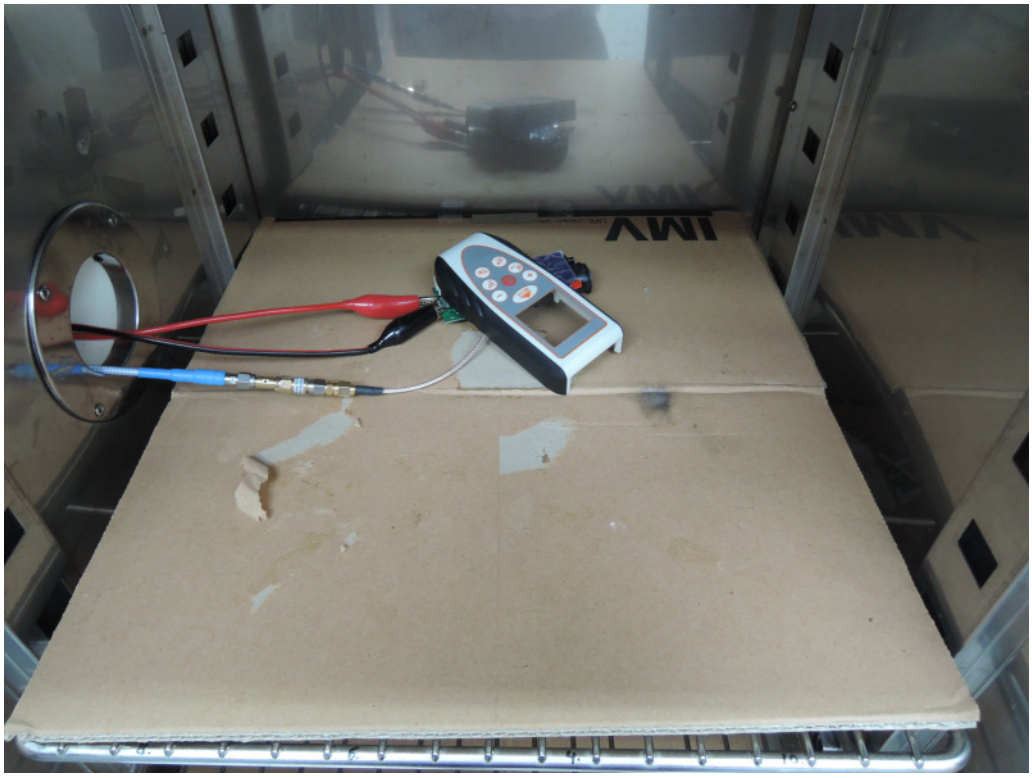
**Photograph 4: Set-up for Spurious Emissions - For IC (Front)**



**Photograph 5: Set-up for Spurious Emissions – For IC (Back)**



## Photograph 6: Set-up for Conducted testing



# 8. List of Tables



# 9. List of Photographs