

# HONG KONG IPRO TECHNOLOGY CO., LIMITED

## Smart Mobile Phone

Main Model: WAVE 3.5

Serial Model: N/A

September 04, 2014

Report No.: 14070434-FCC-R4

(This report supersedes none)



Modifications made to the product : None

This Test Report is Issued Under the Authority of:

|                                                                                     |                                                                                     |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |
| Hank Li<br>Compliance Engineer                                                      | Alex Liu<br>Technical Manager                                                       |                                                                                       |

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# RF Test Report

To: FCC Part 15.247: 2013, ANSI C63.4: 2009

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| Australia      | EMC, RF, Telecom , Safety      |
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| Europe         | EMC, RF, Telecom , Safety      |

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## 1 Executive Summary & EUT information

The purpose of this test programme was to demonstrate compliance of the HONG KONG IPRO TECHNOLOGY CO., LIMITED, Smart Mobile Phone and model: WAVE 3.5 against the current Stipulated Standards. The Smart Mobile Phone has demonstrated compliance with the FCC Part 15.247: 2013, ANSI C63.4: 2009.

### EUT Information

|                                     |                                                                                                                                                                                      |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EUT Description</b>              | : Smart Mobile Phone                                                                                                                                                                 |
| <b>Main Model</b>                   | : WAVE 3.5                                                                                                                                                                           |
| <b>Serial Model</b>                 | : N/A                                                                                                                                                                                |
| <b>Antenna Gain</b>                 | :<br>GSM850: 0.7 dBi<br>PCS1900: 1.5 dBi<br>Bluetooth/BLE: 2 dBi<br>WIFI: 2 dBi                                                                                                      |
| <b>Input Power</b>                  | :<br>Battery:<br>Model: 454841AR<br>Spec: 3.7V 1000mAh<br>Limited charger voltage: 4.2V<br>Adapter:<br>Model: NTR-S01<br>Input: AC 100-240V; 50/60Hz 150mA<br>Output: DC 5.0V; 700mA |
| <b>Classification</b>               |                                                                                                                                                                                      |
| <b>Per Stipulated Test Standard</b> | : FCC Part 15.247: 2013, ANSI C63.4: 2009                                                                                                                                            |

## 2 TECHNICAL DETAILS

|                                        |                                                                                                                                                                                                                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>                         | <b>Compliance testing of Smart Mobile Phone with stipulated standard</b>                                                                                                                                                                                                                   |
| <b>Applicant / Client</b>              | <b>HONG KONG IPRO TECHNOLOGY CO., LIMITED<br/>FLAT/RM A3, 9/F SILVERCORP INT TOWER 707-713 NATHAN RD<br/>MONGKOK, HONGKONG</b>                                                                                                                                                             |
| <b>Manufacturer</b>                    | <b>SHENZHEN ZHIKE COMMUNICATION CO., LTD<br/>8th Floor, B Bldg. Dianzi Fuhua Jidi, Taojindi, Longsheng community,<br/>Longhua District, Shenzhen, China</b>                                                                                                                                |
| <b>Laboratory performing the tests</b> | <b>SIEMIC (Shenzhen - China) Laboratories<br/>Zone A, Floor 1, Building 2, Wan Ye Long Technology Park, South Side of Zhoushi Road, Bao'an District, Shenzhen, Guangdong, China<br/>Tel: +86-0755-2601 4629 / 2601 4953<br/>Fax: +86-0755-2601 4953-810<br/>Email: China@siemic.com.cn</b> |
| <b>Test report reference number</b>    | <b>14070434-FCC-R4</b>                                                                                                                                                                                                                                                                     |
| <b>Date EUT received</b>               | <b>August 13, 2014</b>                                                                                                                                                                                                                                                                     |
| <b>Standard applied</b>                | <b>FCC Part 15.247: 2013, ANSI C63.4: 2009</b>                                                                                                                                                                                                                                             |
| <b>Dates of test (from – to)</b>       | <b>August 15 to September 04, 2014</b>                                                                                                                                                                                                                                                     |
| <b>No of Units :</b>                   | <b>#1</b>                                                                                                                                                                                                                                                                                  |
| <b>Equipment Category :</b>            | <b>DTS</b>                                                                                                                                                                                                                                                                                 |
| <b>Trade Name :</b>                    | <b>IPRO</b>                                                                                                                                                                                                                                                                                |
| <b>RF Operating Frequency (ies)</b>    | <b>GSM850 TX : 824.2 ~ 848.8 MHz; RX : 869.2 ~ 893.8 MHz<br/>PCS1900 TX : 1850.2 ~ 1909.8 MHz; RX : 1930.2 ~ 1989.8 MHz<br/>802.11b/g/n: 2412-2462 MHz<br/>Bluetooth&amp; BLE: 2402-2480 MHz</b>                                                                                           |
| <b>Number of Channels</b>              | <b>299CH (PCS1900) and 124CH (GSM850)<br/>Bluetooth: 79CH<br/>802.11b/g/n: 11CH<br/>BLE: 40CH</b>                                                                                                                                                                                          |
| <b>Modulation</b>                      | <b>GSM /PCS: GMSK<br/>802.11b/g/n: DSSS/OFDM<br/>Bluetooth: GFSK&amp; <math>\pi/4</math>DQPSK&amp;8DPSK<br/>BLE: GFSK</b>                                                                                                                                                                  |
| <b>GPRS Multi-slot class</b>           | <b>8/10/12</b>                                                                                                                                                                                                                                                                             |
| <b>FCC ID</b>                          | <b>PQ4IPROWAVE35</b>                                                                                                                                                                                                                                                                       |

### 3 MODIFICATION

NONE

## 4 TEST SUMMARY

The product was tested in accordance with the following specifications.  
All testing has been performed according to below product classification:

### Test Results Summary

| FCC Rules                       | Description of Test                                                                    | Result     |
|---------------------------------|----------------------------------------------------------------------------------------|------------|
| §15.247 (i), §2.1091            | RF Exposure                                                                            | Compliance |
| §15.203                         | Antenna Requirement                                                                    | Compliance |
| §15.247 (a)(2)                  | DTS (6 dB) CHANNEL BANDWIDTH                                                           | Compliance |
| §15.247(b)(3)                   | Conducted Maximum Output Power                                                         | Compliance |
| §15.247(e)                      | Power Spectral Density                                                                 | Compliance |
| §15.247(d)                      | Band-Edge                                                                              | Compliance |
| §15.207 (a),                    | AC Power Line Conducted Emissions                                                      | Compliance |
| §15.205, §15.209,<br>§15.247(d) | Radiated Spurious Emissions &<br>Unwanted Emissions into Restricted Frequency<br>Bands | Compliance |



## **5 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS**

### **5.1 §15.247 (i) and §2.1093 – RF Exposure**

#### **Standard Requirement:**

According to §15.247 (i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances*  $\leq 50$  mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{GHz}}}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR,}^{16} \text{ where}$$

- $f_{\text{GHz}}$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation<sup>17</sup>
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum *test separation distance* is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

Two antennas are available for the EUT (GSM antenna, Bluetooth/BLE/WIFI antenna).

The maximum average output power(turn-up power) in low channel of BLE is -1.286 dBm= 0.74 mW

The calculation results=  $0.74 / 5 * \sqrt{2.402} = 0.23 < 3$

The maximum average output power(turn-up power) in middle channel of BLE is -1.111 dBm= 0.77 mW

The calculation results=  $0.77 / 5 * \sqrt{2.440} = 0.24 < 3$

The maximum average output power(turn-up power) in high channel of BLE is -1.492 dBm= 0.71 mW

The calculation results=  $0.71 / 5 * \sqrt{2.480} = 0.22 < 3$

According to KDB 447498, no stand-alone required for BLE antenna, and no simultaneous SAR measurement is required, please refer to SAR report.

**Test Result: Pass**

## **5.2 §15.203 - ANTENNA REQUIREMENT**

### **Applicable Standard**

According to § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the 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 6 dBi.

### **Antenna Connector Construction**

The EUT has 2 antennas: a PIFA antenna for WIFI/Bluetooth/BLE, the gain is 2 dBi for Bluetooth/ BLE/WIFI.  
a PIFA antenna for GSM850 and 0.7 dBi PCS1900 and 1.5 dBi  
which in accordance to section 15.203, please refer to the internal photos.

**Test Result: Pass**

### 5.3 §15.247(a) (2) –DTS (6 dB) CHANNEL BANDWIDTH

1. Conducted Measurement  
EUT was set for low, mid, high channel with modulated mode and highest RF output power.  
The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions
 

|                      |          |
|----------------------|----------|
| Temperature          | 20°C     |
| Relative Humidity    | 50%      |
| Atmospheric Pressure | 1001mbar |
3. Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is  $\pm 1.5\text{dB}$ .
4. Test date : September 01, 2014  
Tested By : Hank Li

**Requirement(s):** The minimum 6 dB bandwidth of a DTS transmission shall be at least 500 kHz. Within this document, this bandwidth is referred to as the DTS bandwidth. The procedures provided herein for measuring the maximum peak conducted output power assume the use of the DTS bandwidth.

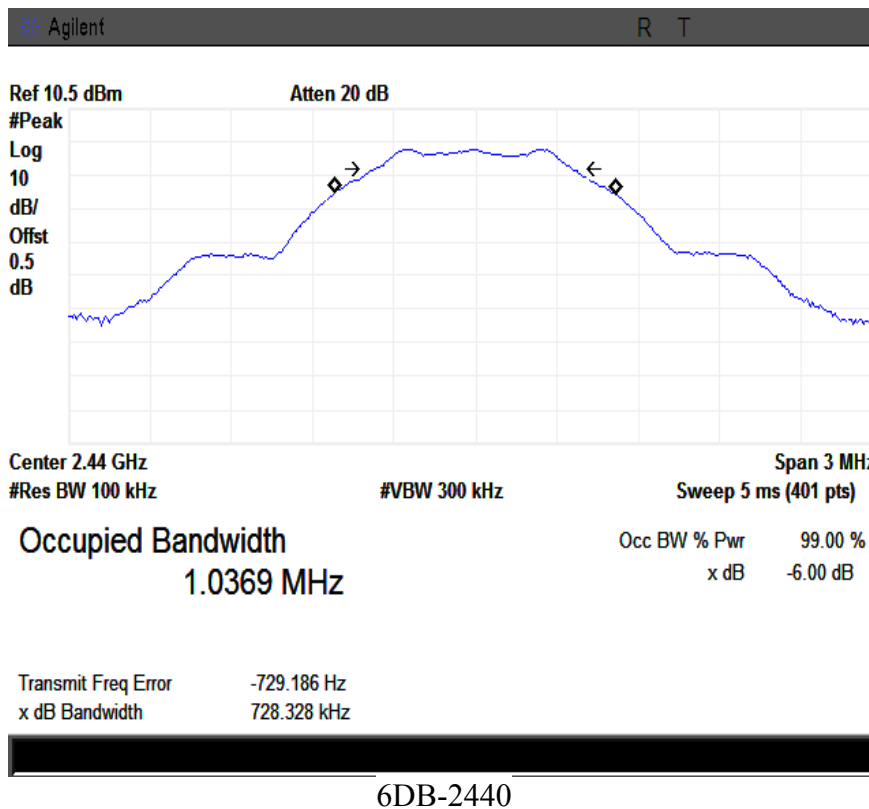
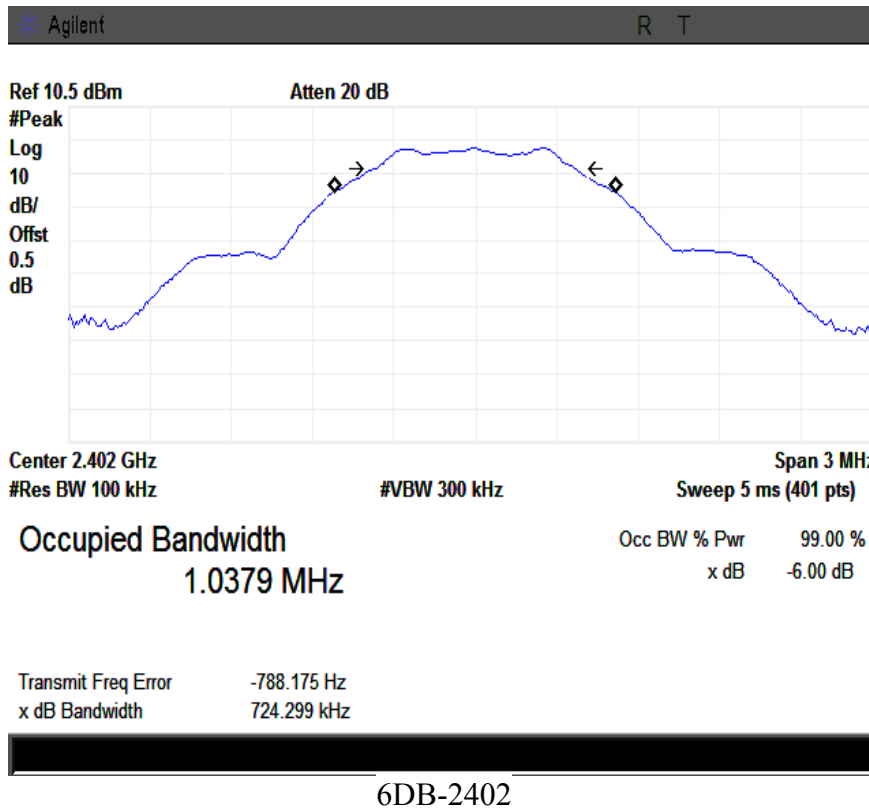
**Procedures:**

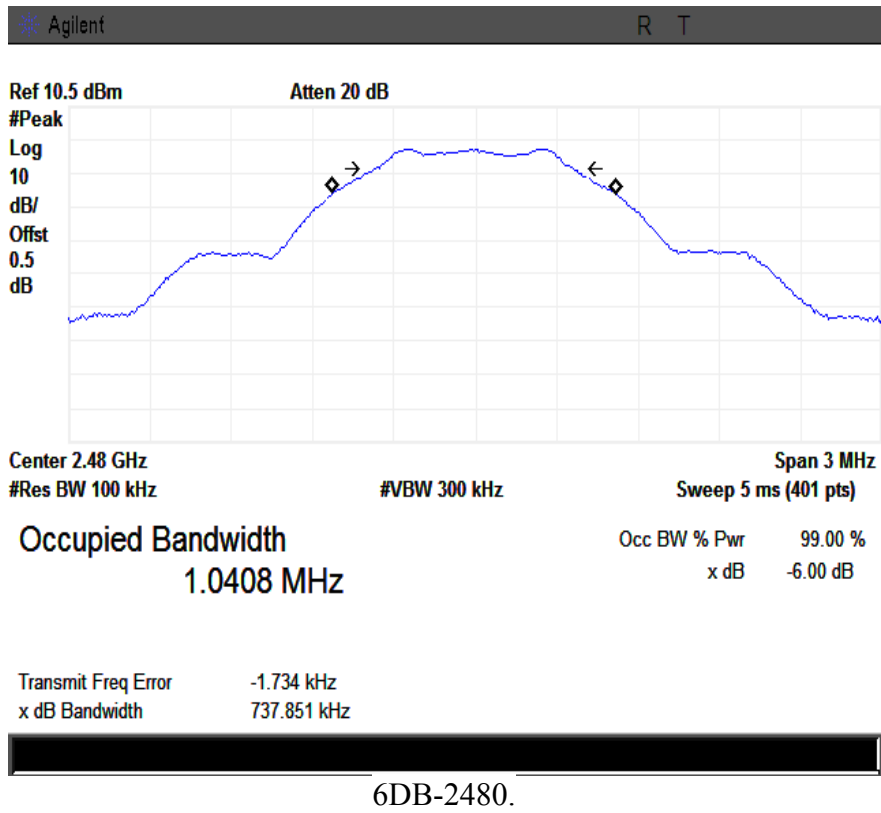
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times \text{RBW}$ .
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**Test Result: Pass.**

Please refer to the following tables and plots.

| Channel | Channel Frequency (MHz) | Measured 6dB Bandwidth (kHz) | FCC Part 15.247 Limit (kHz) |
|---------|-------------------------|------------------------------|-----------------------------|
| Low     | 2402                    | 724.299                      | > 500                       |
| Middle  | 2440                    | 728.328                      | > 500                       |
| High    | 2480                    | 737.851                      | > 500                       |





## 5.4 §15.247(b) (3) - Conducted Maximum Output Power

1. Conducted Measurement  
EUT was set for low, mid, high channel with modulated mode and highest RF output power.  
The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is  $\pm 1.5\text{dB}$ .
3. Environmental Conditions
 

|                      |          |
|----------------------|----------|
| Temperature          | 21°C     |
| Relative Humidity    | 51%      |
| Atmospheric Pressure | 1002mbar |
4. Test date : September 02, 2014  
Tested By : Hank Li

**Standard Requirement:** One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

### Procedures:

#### RBW $\geq$ DTS bandwidth:

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

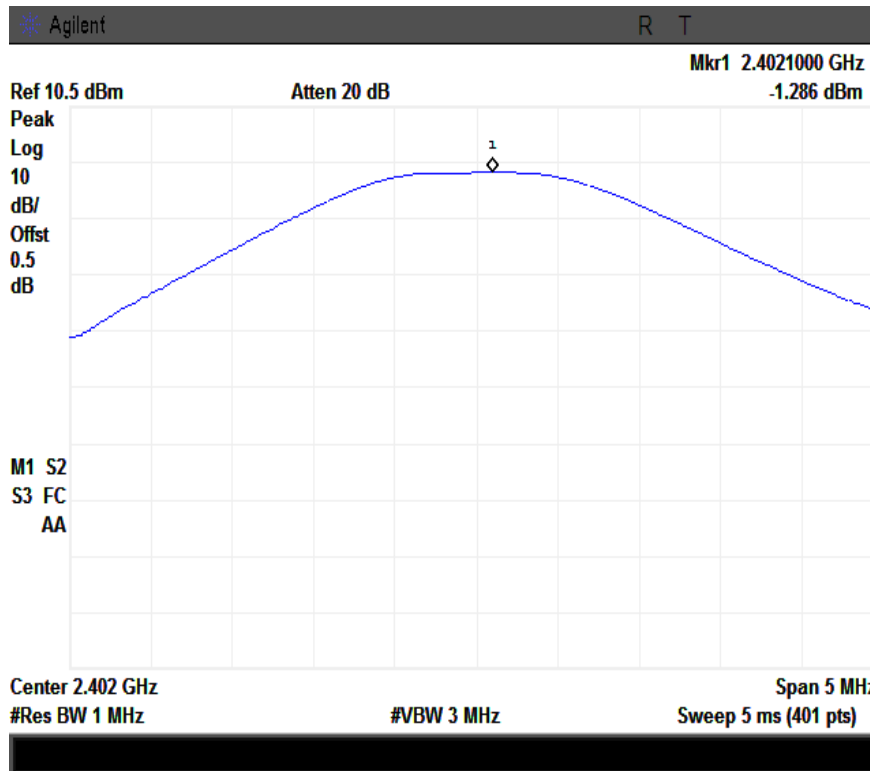
1. Set the RBW  $\geq$  DTS bandwidth.
2. Set VBW  $\geq 3$  RBW.
3. Set span  $\geq 3 \times$  RBW
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.

**Test Result: Pass.**

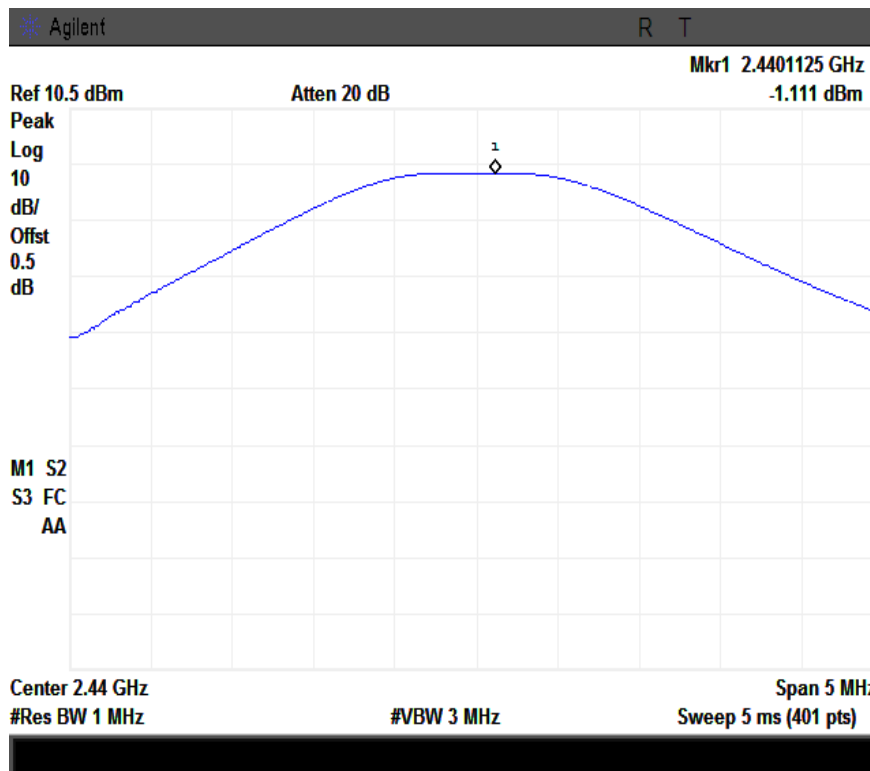
Please refer to the following tables and plots.

**The Maximum peak conducted output power:**

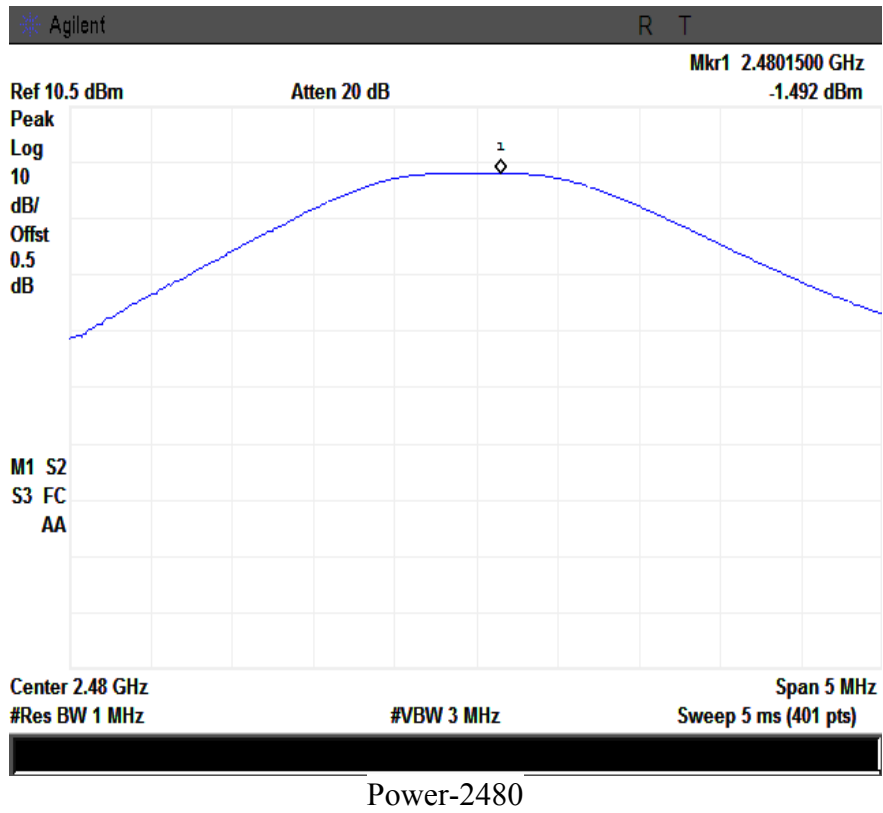
| Channel | Channel Frequency (MHz) | PK Output Power (dBm) | Limit (dBm) |
|---------|-------------------------|-----------------------|-------------|
| Low     | 2402                    | -1.286                | 30          |
| Middle  | 2440                    | -1.111                | 30          |
| High    | 2480                    | -1.492                | 30          |



Power-2402



Power-2440.





## 5.5 §15.247(e) - Power Spectral Density

- Conducted Measurement  
EUT was set for low, mid, high channel with modulated mode and highest RF output power.  
The spectrum analyzer was connected to the antenna terminal.
- Environmental Conditions
 

|                      |          |
|----------------------|----------|
| Temperature          | 22 °C    |
| Relative Humidity    | 52%      |
| Atmospheric Pressure | 1003mbar |
- Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is  $\pm 1.5$ dB.
- Test date : September 03, 2014  
Tested By : Hank Li

### Requirement(s):

The DTS rules specify a conducted PSD limit within the DTS bandwidth during any time interval of continuous transmission. Such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. Therefore, if maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option)

### Procedures:

#### Method PKPSD (peak PSD):

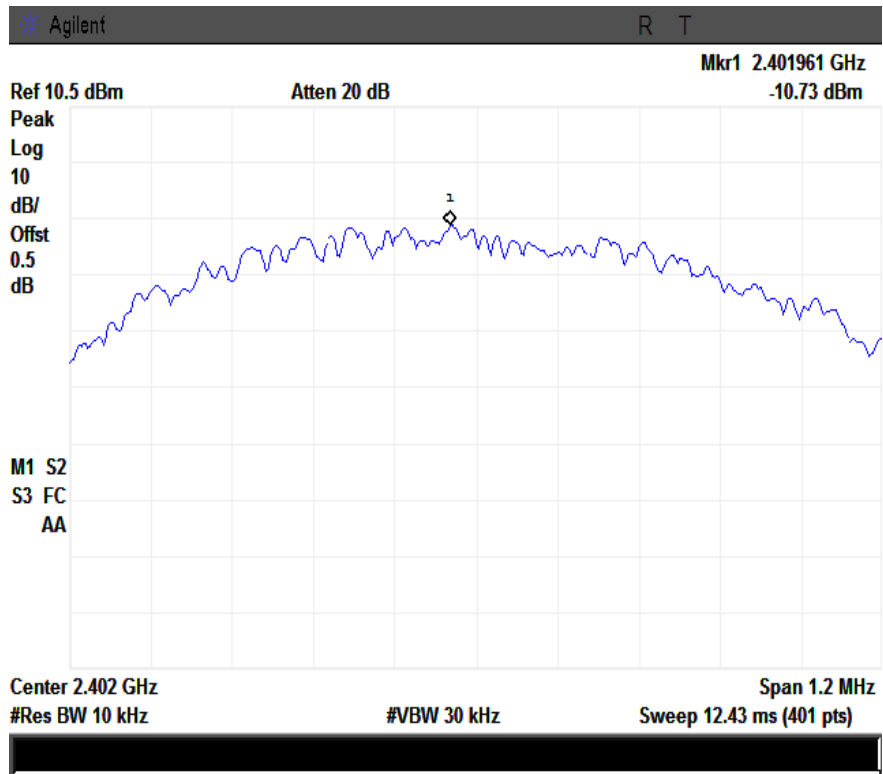
This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set the VBW  $\geq 3 \text{ RBW}$ .
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

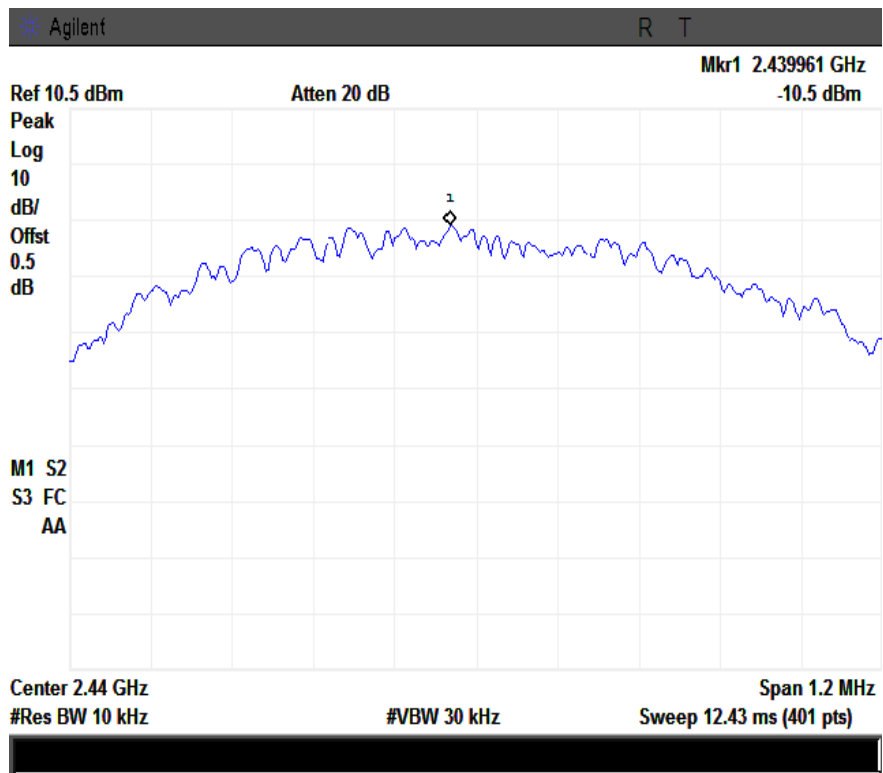
**Test Result: Pass.**

Please refer to the following tables and plots.

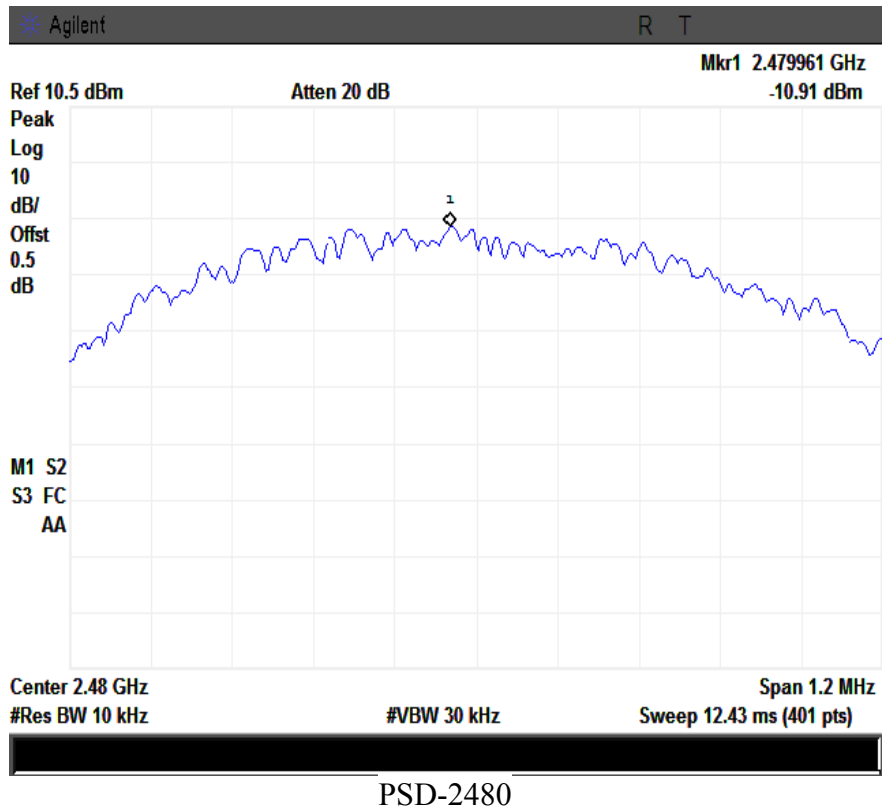
| Channel | Frequency (MHz) | PSD (dBm) | Limit (dBm) |
|---------|-----------------|-----------|-------------|
| Low     | 2402            | -10.73    | 8           |
| Middle  | 2440            | -10.50    | 8           |
| High    | 2480            | -10.91    | 8           |



PSD-2402



PSD-2440



## 5.6 §15.247(d) –Band-Edge

- 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))
- |                          |                      |          |
|--------------------------|----------------------|----------|
| Environmental Conditions | Temperature          | 20°C     |
|                          | Relative Humidity    | 55%      |
|                          | Atmospheric Pressure | 1016mbar |
- |                             |
|-----------------------------|
| Test date : August 15, 2014 |
| Tested By : Hank Li         |

### Requirement(s):

#### Band-Edge Measurements

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

#### Procedures: (Radiated Method Only)

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
- First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below:
  - The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.
  - The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
  - The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth for Average detection (AV) as below at frequency above 1GHz.

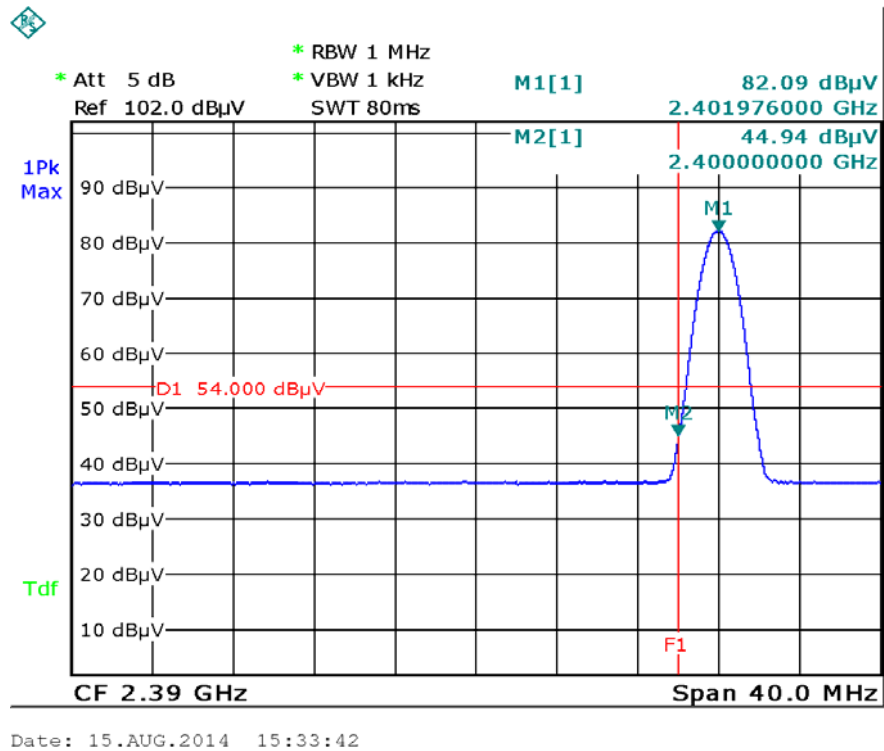
☒ 1 kHz (Duty cycle < 98%)      ☐ 10 Hz (Duty cycle > 98%)
- Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- Repeat above procedures until all measured frequencies were complete.

**Note:**

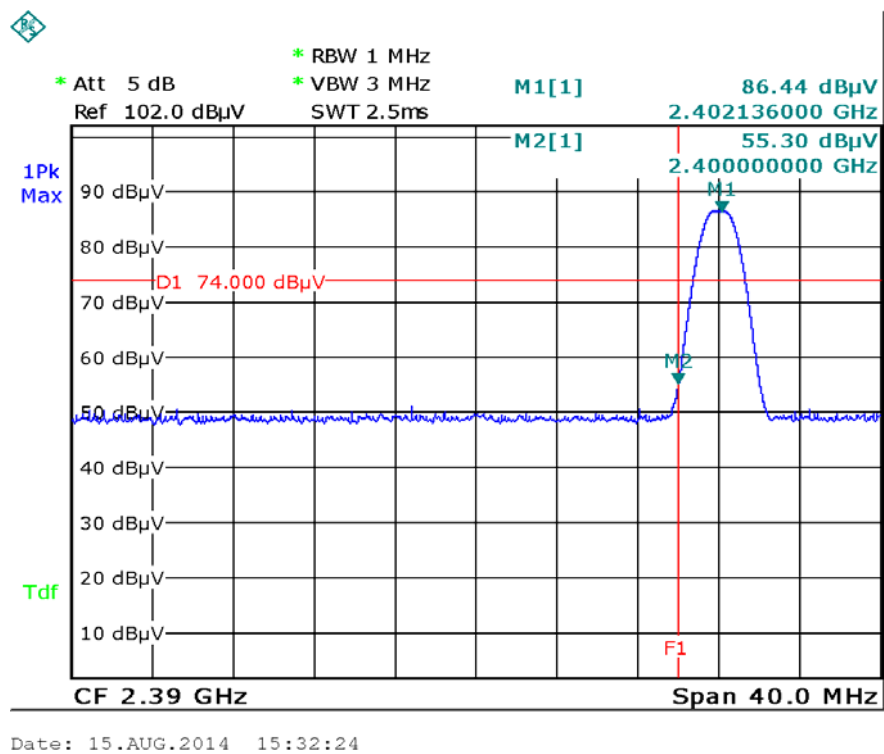
For Hopping device, should test hopping mode and CW Tx mode separately. For hopping mode, find out the worst points outside the frequency band firstly, then set the worst points as the center frequency, use above average 3 (c) spectrum analyzer set, find out the final worst average value separately.

**Test Result: Pass.**

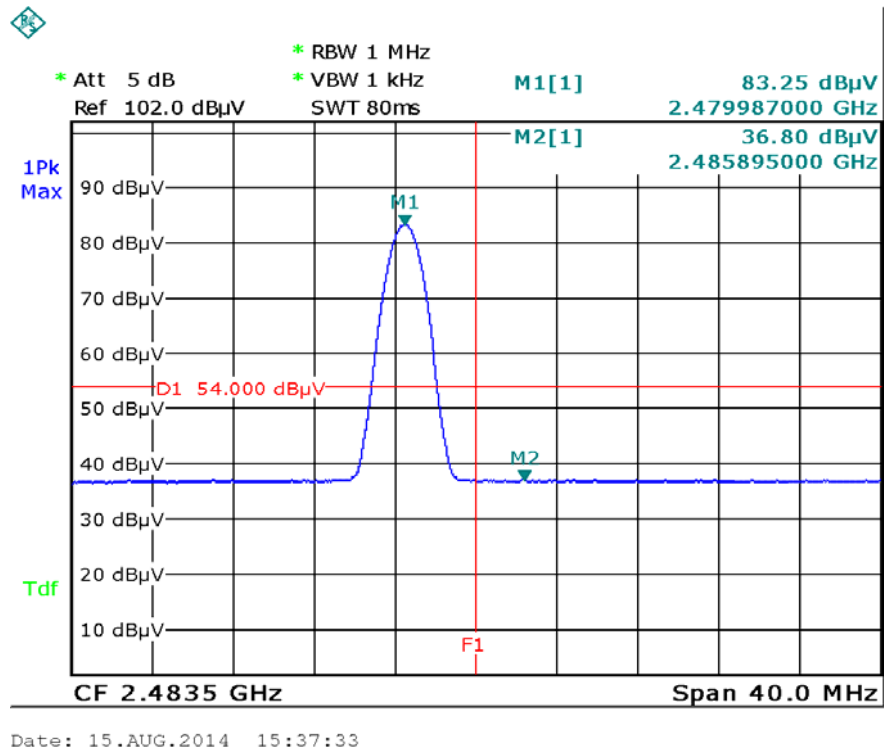
Please refer to the following tables and plots.



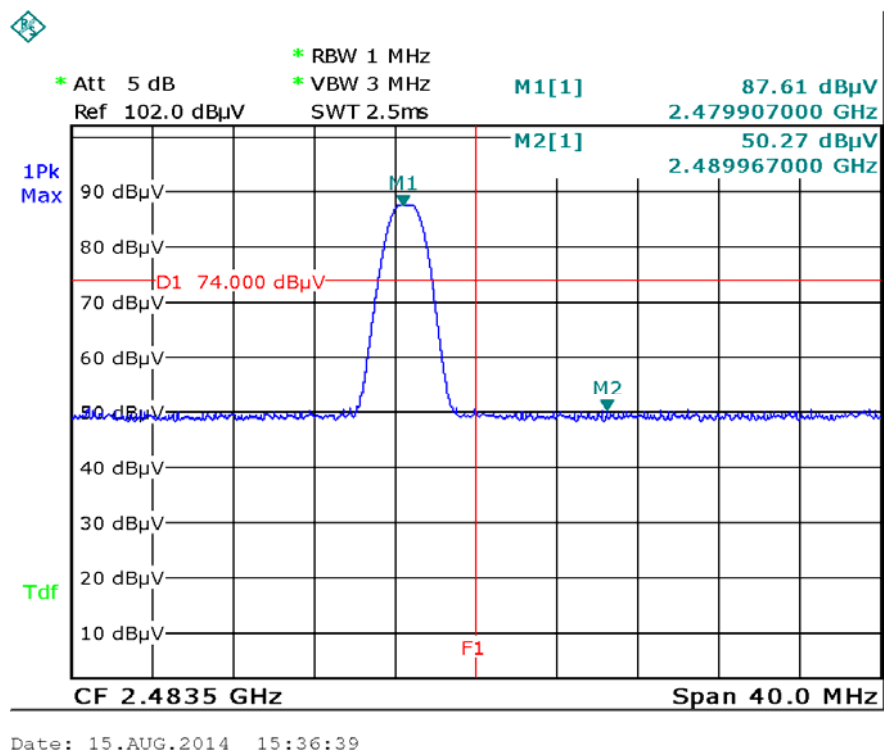
Left Side-AV



Left Side-PK



Right Side-AV



Right Side-PK

## 5.7 §15.207 (a) - AC Power Line Conducted Emissions

Requirement:

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15–0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5–5                       | 56                           | 46        |
| 5–30                        | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

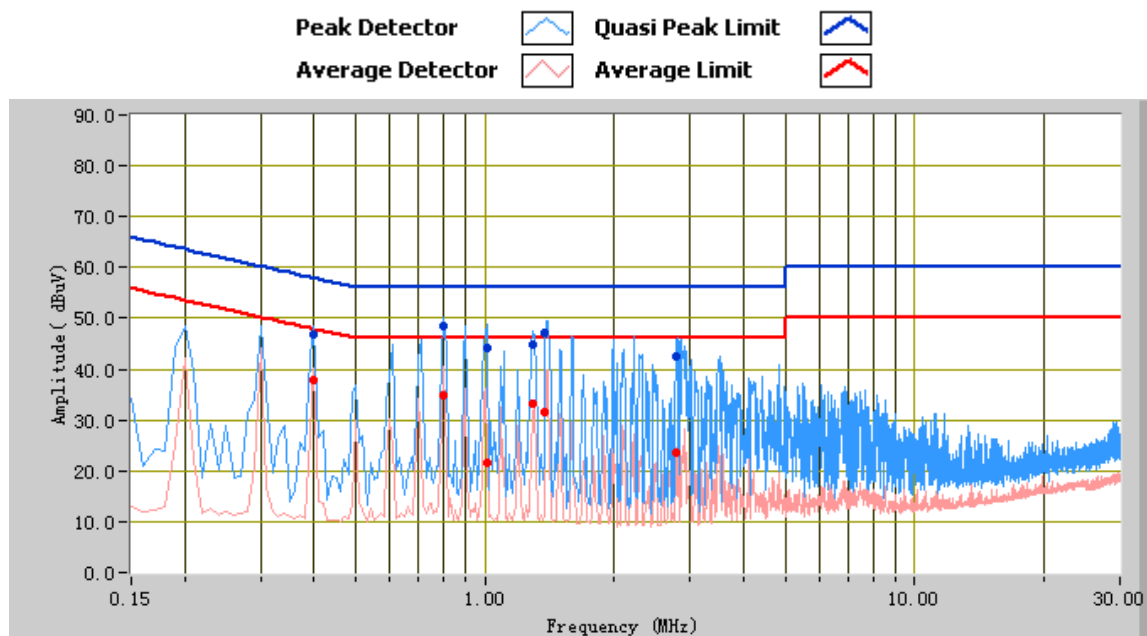
### Procedures:

- All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
- A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- Conducted Emissions Measurement Uncertainty  
 All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is  $\pm 3.5$ dB.
- Environmental Conditions
 

|                      |         |
|----------------------|---------|
| Temperature          | 21 °C   |
| Relative Humidity    | 51%     |
| Atmospheric Pressure | 1002mar |
- Test date: September 02, 2014  
 Tested By : Hank Li



|                   |                               |
|-------------------|-------------------------------|
| <b>Test Mode:</b> | <b>GFSK Transmitting Mode</b> |
|-------------------|-------------------------------|

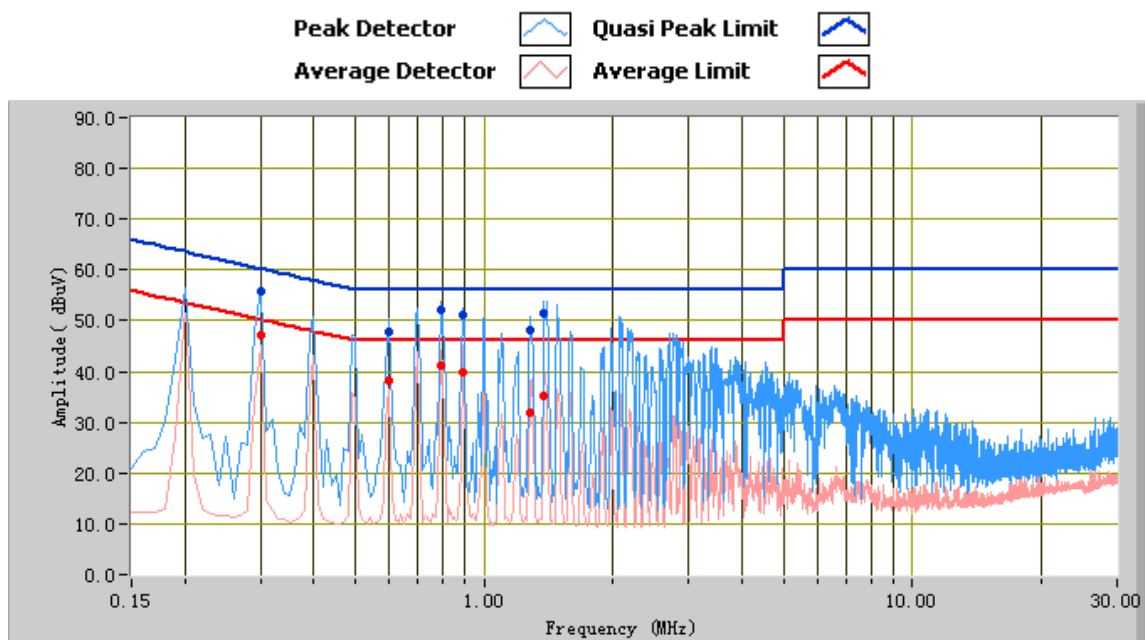


### Test Data

#### Phase Line Plot at 120Vac, 60Hz

| Frequency (MHz) | Quasi Peak (dBuV) | Limit (dBuV) | Margin (dB) | Average (dBuV) | Limit (dBuV) | Margin (dB) | Factors (dB) |
|-----------------|-------------------|--------------|-------------|----------------|--------------|-------------|--------------|
| 0.80            | 48.42             | 56.00        | -7.58       | 34.73          | 46.00        | -11.27      | 10.40        |
| 1.01            | 44.29             | 56.00        | -11.71      | 21.44          | 46.00        | -24.56      | 10.29        |
| 1.29            | 44.98             | 56.00        | -11.02      | 33.28          | 46.00        | -12.72      | 10.31        |
| 0.40            | 46.82             | 57.85        | -11.03      | 37.82          | 47.85        | -10.03      | 10.98        |
| 1.38            | 47.13             | 56.00        | -8.87       | 31.53          | 46.00        | -14.47      | 10.33        |
| 2.78            | 42.37             | 56.00        | -13.63      | 23.46          | 46.00        | -22.54      | 10.58        |

**Test Mode:** GFSK Transmitting Mode



### Test Data

#### Phase Neutral Plot at 120Vac, 60Hz

| Frequency (MHz) | Quasi Peak (dBuV) | Limit (dBuV) | Margin (dB) | Average (dBuV) | Limit (dBuV) | Margin (dB) | Factors (dB) |
|-----------------|-------------------|--------------|-------------|----------------|--------------|-------------|--------------|
| 1.38            | 51.40             | 56.00        | -4.60       | 35.25          | 46.00        | -10.75      | 10.33        |
| 0.79            | 52.18             | 56.00        | -3.82       | 41.29          | 46.00        | -4.71       | 10.40        |
| 0.89            | 51.00             | 56.00        | -5.00       | 39.77          | 46.00        | -6.23       | 10.35        |
| 0.30            | 55.68             | 60.24        | -4.56       | 47.14          | 50.24        | -3.10       | 11.50        |
| 1.28            | 48.24             | 56.00        | -7.76       | 31.98          | 46.00        | -14.02      | 10.31        |
| 0.60            | 47.80             | 56.00        | -8.20       | 38.13          | 46.00        | -7.87       | 10.51        |

## **5.8 §15.209, §15.205 & §15.247(d) - Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands**

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty  
 All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz & 1GHz above ( 3m & 10m) is +/-6dB.
4. Environmental Conditions
 

|                      |          |
|----------------------|----------|
| Temperature          | 22°C     |
| Relative Humidity    | 52%      |
| Atmospheric Pressure | 1003mbar |
5. Test date : September 03, 2014  
 Tested By : Hank Li

### **Requirement:**

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### **Procedures:**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. A Quasi-peak measurement was then made for that frequency point for below 1GHz test, PK and AV for above 1GHz emission test.
  - a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.
  - b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
  - c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth for Average detection (AV) as below at frequency above 1GHz.

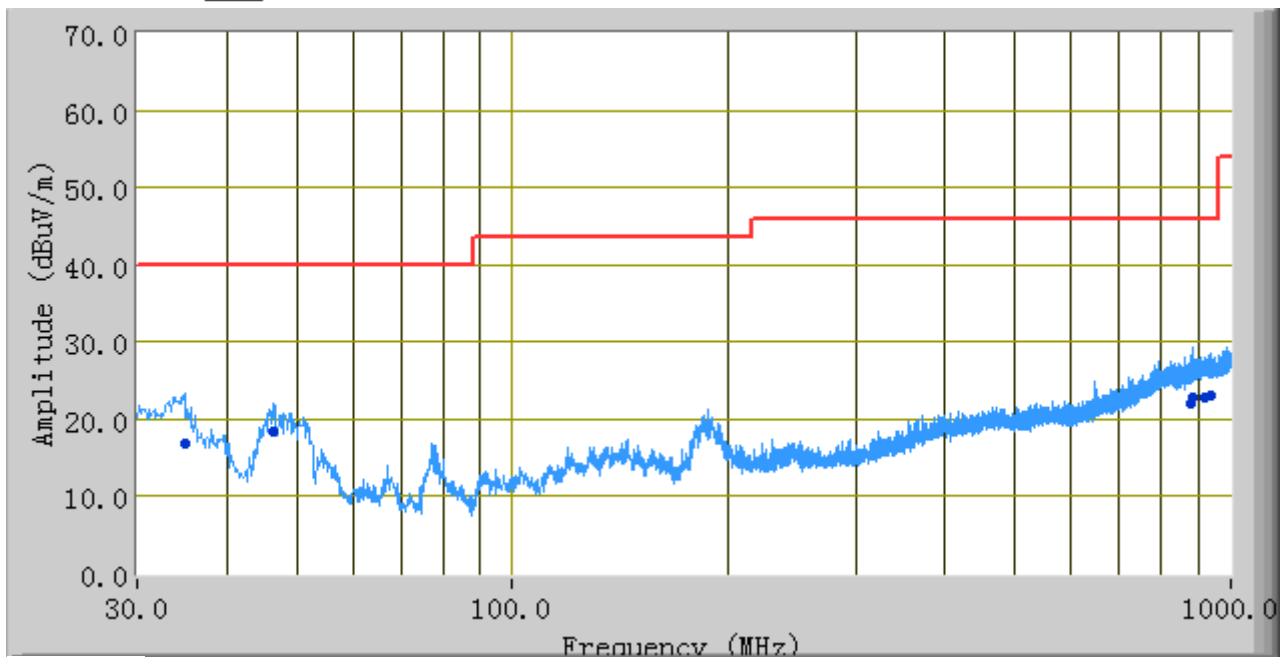
☒ 1 kHz (Duty cycle < 98%)
 ☐ 10 Hz (Duty cycle > 98%)

4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

**Test Result: Pass**

|                   |                               |
|-------------------|-------------------------------|
| <b>Test Mode:</b> | <b>GFSK Transmitting Mode</b> |
|-------------------|-------------------------------|

Peak Detector   
 Quasi Peak Limit 



**Test Data**

| Frequency (MHz) | Quasi Peak (dBuV/m) | Azimuth | Polarity(H/V) | Height (cm) | Factors (dB) | Limit (dBuV) | Margin (dB) |
|-----------------|---------------------|---------|---------------|-------------|--------------|--------------|-------------|
| 34.96           | 16.89               | 0.00    | V             | 168.00      | -4.13        | 40.00        | -23.11      |
| 884.03          | 22.71               | 1.00    | V             | 122.00      | 4.56         | 46.00        | -23.29      |
| 936.61          | 23.02               | 291.00  | H             | 290.00      | 5.35         | 46.00        | -22.98      |
| 878.22          | 21.97               | 92.00   | V             | 254.00      | 4.49         | 46.00        | -24.03      |
| 917.86          | 22.77               | 91.00   | V             | 398.00      | 5.05         | 46.00        | -23.23      |
| 46.54           | 18.32               | 197.00  | V             | 101.00      | -12.28       | 40.00        | -21.68      |

## Above 1 GHz:

### Test Mode: Transmitting

#### Low Channel (2402 MHz)

| Frequency (MHz) | S.A. Reading (dBμV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Duty cycle Factor (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|----------------|--------------------|-----------------|------------------------|--------------------|---------------------|----------------|-------------|
| 4804            | 30.63               | AV               | V              | 33.83              | 4.87            | 3.88                   | 24                 | 49.21               | 54             | -4.79       |
| 4804            | 31.27               | AV               | H              | 33.83              | 4.87            | 3.88                   | 24                 | 49.85               | 54             | -4.15       |
| 4804            | 40.35               | PK               | V              | 33.83              | 4.87            | —                      | 24                 | 55.05               | 74             | -18.95      |
| 4804            | 41.61               | PK               | H              | 33.83              | 4.87            | —                      | 24                 | 56.31               | 74             | -17.69      |

Duty cycle factor=20log(1/Duty cycle)=20log(1/0.64)=3.88

#### Middle Channel (2440 MHz)

| Frequency (MHz) | S.A. Reading (dBμV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Duty cycle Factor (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|----------------|--------------------|-----------------|------------------------|--------------------|---------------------|----------------|-------------|
| 4880            | 30.68               | AV               | V              | 33.86              | 4.87            | 3.74                   | 24                 | 49.15               | 54             | -4.85       |
| 4880            | 31.21               | AV               | H              | 33.86              | 4.87            | 3.74                   | 24                 | 49.68               | 54             | -4.32       |
| 4880            | 40.91               | PK               | V              | 33.86              | 4.87            | —                      | 24                 | 55.64               | 74             | -18.36      |
| 4880            | 41.89               | PK               | H              | 33.86              | 4.87            | —                      | 24                 | 56.62               | 74             | -17.38      |

Duty cycle factor=20log(1/Duty cycle)=20log(1/0.65)=3.74

#### High Channel (2480 MHz)

| Frequency (MHz) | S.A. Reading (dBμV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Duty cycle Factor (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|----------------|--------------------|-----------------|------------------------|--------------------|---------------------|----------------|-------------|
| 4960            | 30.24               | AV               | V              | 33.9               | 4.87            | 3.1                    | 24                 | 48.11               | 54             | -5.89       |
| 4960            | 31.57               | AV               | H              | 33.9               | 4.87            | 3.1                    | 24                 | 49.44               | 54             | -4.56       |
| 4960            | 41.01               | PK               | V              | 33.9               | 4.87            | —                      | 24                 | 55.78               | 74             | -18.22      |
| 4960            | 41.87               | PK               | H              | 33.9               | 4.87            | —                      | 24                 | 56.64               | 74             | -17.36      |

Duty cycle factor=20log(1/Duty cycle)=20log(1/0.7)=3.10

## **Annex A. TEST INSTRUMENT & METHOD**

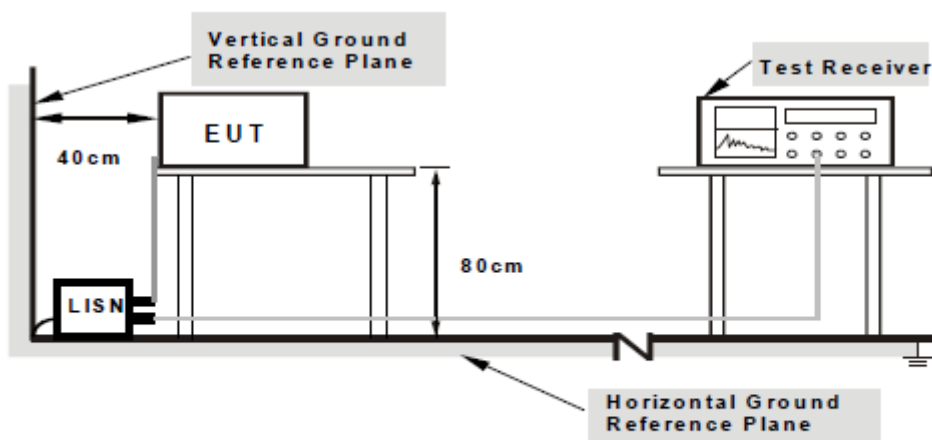
### **Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES**

| Instrument                             | Model    | Serial #    | Calibration Date | Calibration Due Date |
|----------------------------------------|----------|-------------|------------------|----------------------|
| <b>AC Line Conducted Emissions</b>     |          |             |                  |                      |
| EMI test receiver                      | ESCS30   | 8471241027  | 05/27/2014       | 05/26/2015           |
| Line Impedance Stabilization Network   | LI-125A  | 191106      | 11/14/2013       | 11/13/2014           |
| Line Impedance Stabilization Network   | LI-125A  | 191107      | 11/14/2013       | 11/13/2014           |
| LISN                                   | ISN T800 | 34373       | 01/11/2014       | 01/10/2015           |
| Double Ridge Horn Antenna (1 ~18GHz)   | AH-118   | 71283       | 11/20/2013       | 11/19/2014           |
| Transient Limiter                      | LIT-153  | 531118      | 09/02/2014       | 09/01/2015           |
| <b>RF conducted test</b>               |          |             |                  |                      |
| Agilent ESA-E SERIES SPECTRUM ANALYZER | E4407B   | MY45108319  | 09/17/2013       | 09/16/2014           |
| Power Splitter                         | 1#       | 1#          | 09/02/2014       | 09/01/2015           |
| DC Power Supply                        | E3640A   | MY40004013  | 09/17/2013       | 09/16/2014           |
| Wireless Connectivity Test Set         | N4010A   | GB44440198  | 03/20/2014       | 03/19/2015           |
| <b>Radiated Emissions</b>              |          |             |                  |                      |
| EMI test receiver                      | ESL6     | 100262      | 11/23/2013       | 11/22/2014           |
| Positioning Controller                 | UC3000   | MF780208282 | 11/19/2013       | 11/19/2014           |
| OPT 010 AMPLIFIER (0.1-1300MHz)        | 8447E    | 2727A02430  | 09/02/2014       | 09/01/2015           |
| Microwave Preamplifier (0.5~18GHz)     | PAM-118  | 443008      | 09/02/2014       | 09/01/2015           |
| Bilog Antenna (30MHz~6GHz)             | JB6      | A110712     | 09/23/2013       | 09/22/2014           |
| Double Ridge Horn Antenna (1 ~18GHz)   | AH-118   | 71283       | 11/20/2013       | 11/19/2014           |
| Universal Radio Communication Tester   | CMU200   | 121393      | 09/17/2013       | 09/16/2014           |

## **Annex A. ii. CONDUCTED EMISSIONS TEST DESCRIPTION**

### **Test Set-up**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipments were powered separately from another main supply.



**Note: 1. Support units were connected to second LISN.**  
**2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration1.

### **Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line (for AC mains) or DC line (for DC power).

### **Description of Conducted Emission Program**

This EMC Measurement software run Lab View automation software and offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the common scan range from 150 kHz to 30 MHz; the program will first start a peak and average scan on selectable measurement time and step size. After the program complete the pre-scan, this program will perform the Quasi Peak and Average measurement, based on the pre-scan peak data reduction result.

### **Sample Calculation Example**

At 20 MHz

limit = 250  $\mu$ V = 47.96 dB $\mu$ V

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB

Q-P reading obtained directly from EMI Receiver = 40.00 dB $\mu$ V  
(Calibrated for system losses)

Therefore, Q-P margin = 47.96 – 40.00 = 7.96                      i.e. **7.96 dB below limit**

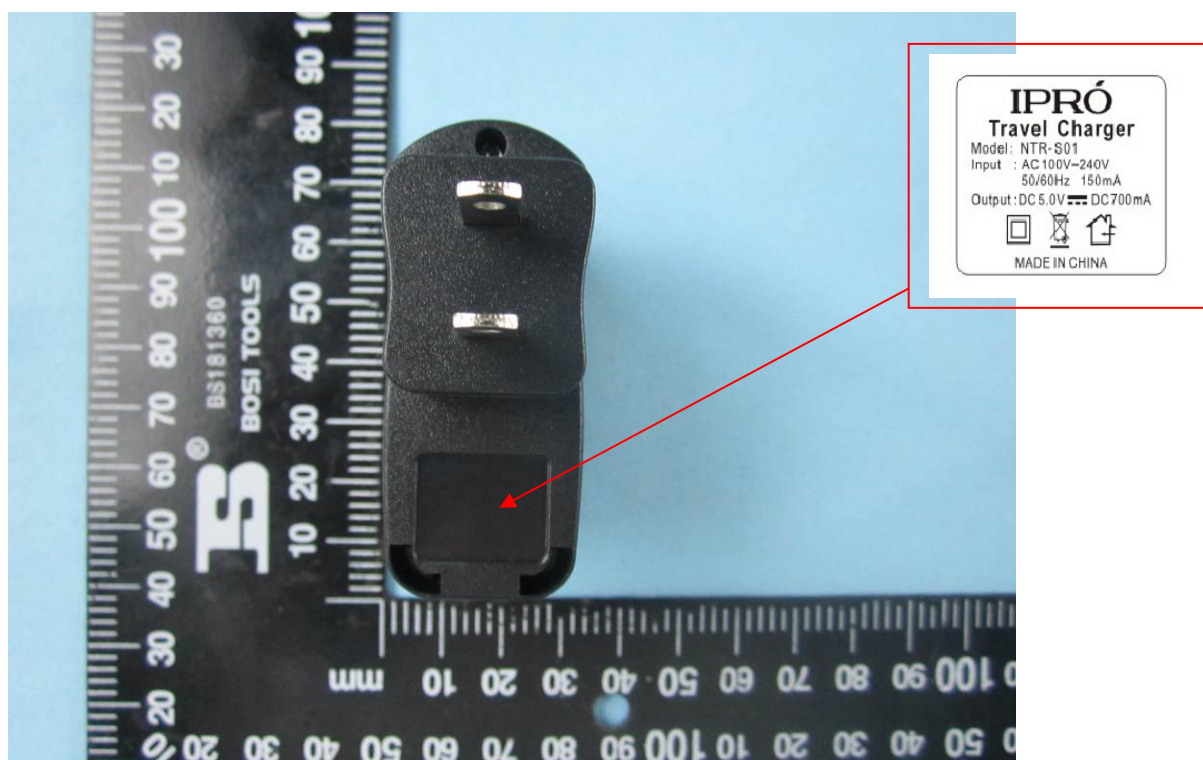


## Annex B. EUT AND TEST SETUP PHOTOGRAPHS

### Annex B. i. Photograph 1: EUT External Photo



Whole Package - Top View



Adapter – Front View



EUT - Front View



EUT - Rear View





EUT - Top View



EUT - Bottom View



EUT - Left View



EUT - Right View



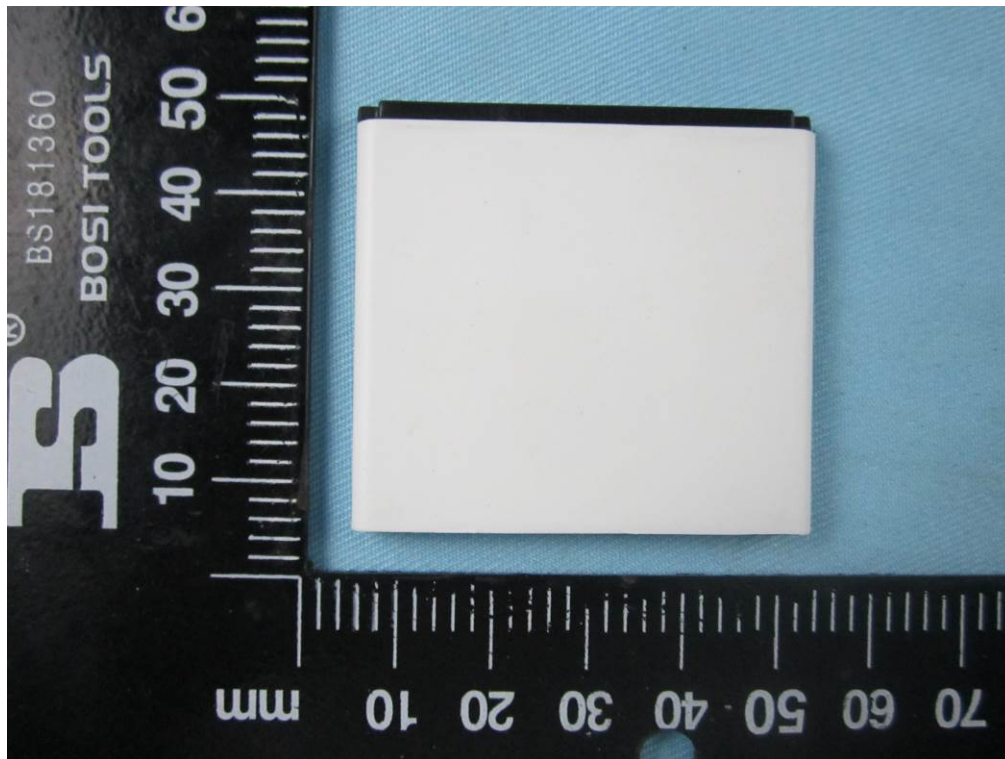
**Annex B. ii. Photograph 2: EUT Internal Photo**



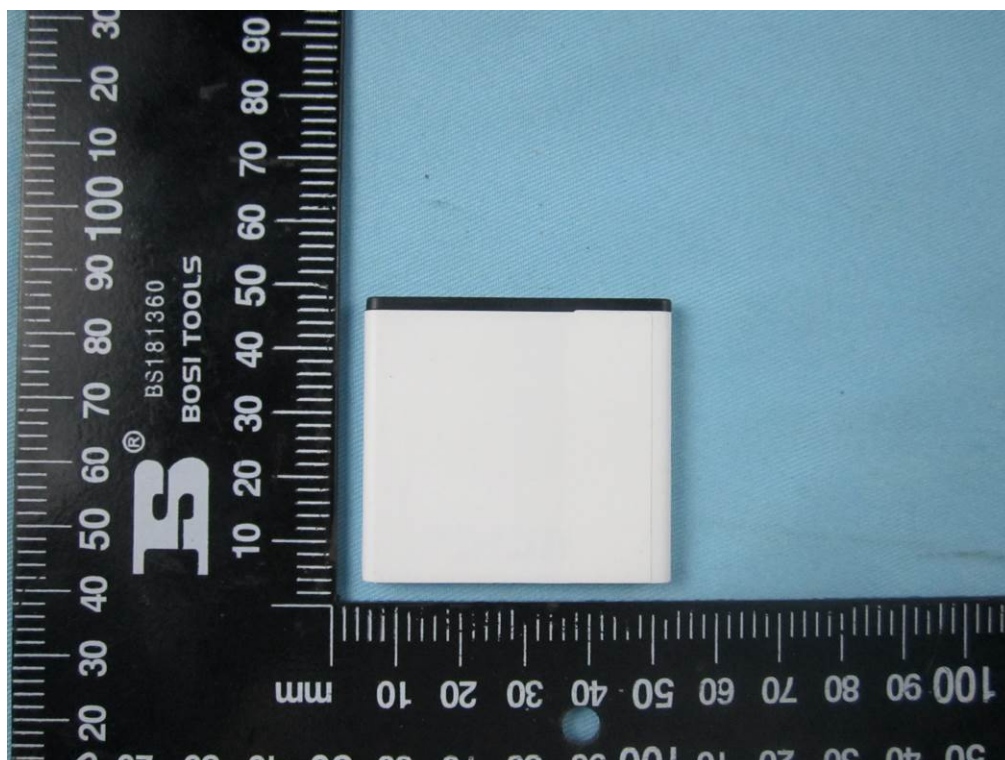
Cover Off - Top View 1



Cover Off - Top View 2



Battery - Top View



Battery - Bottom View

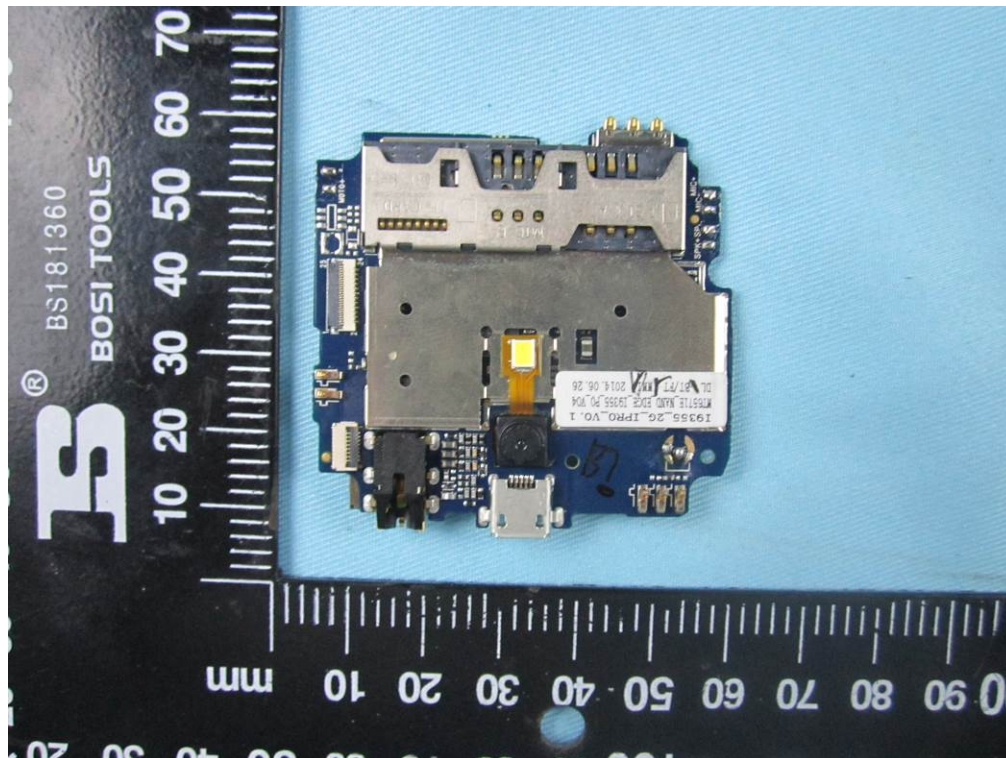




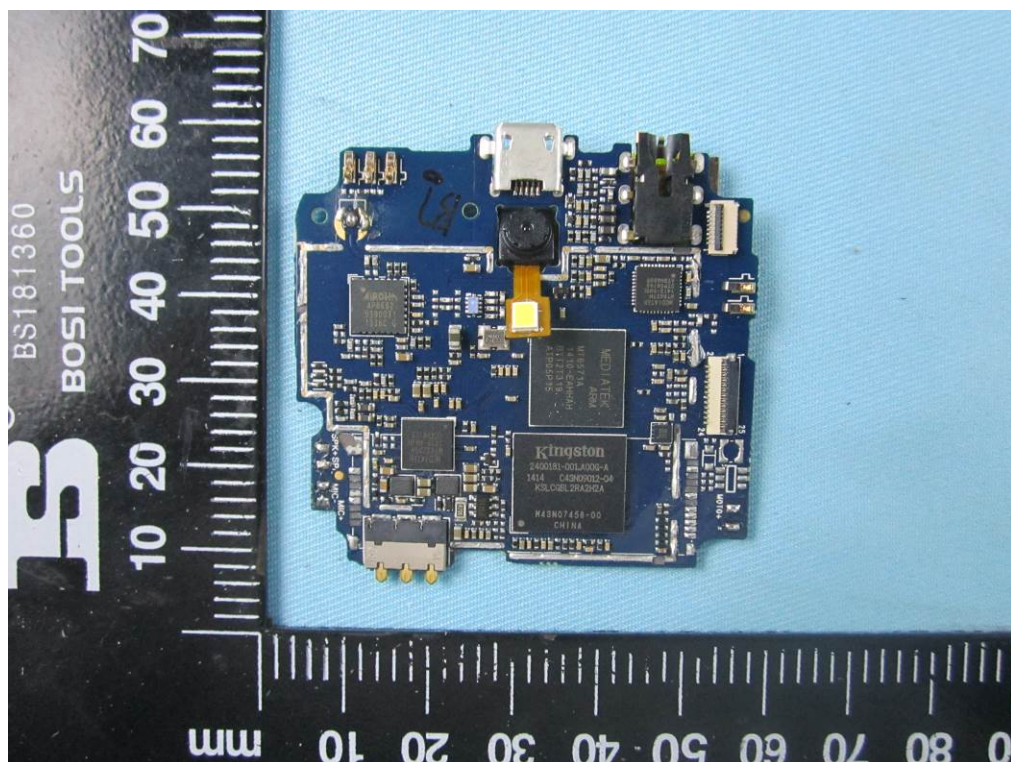
LCD – Front View



LCD – Rear View

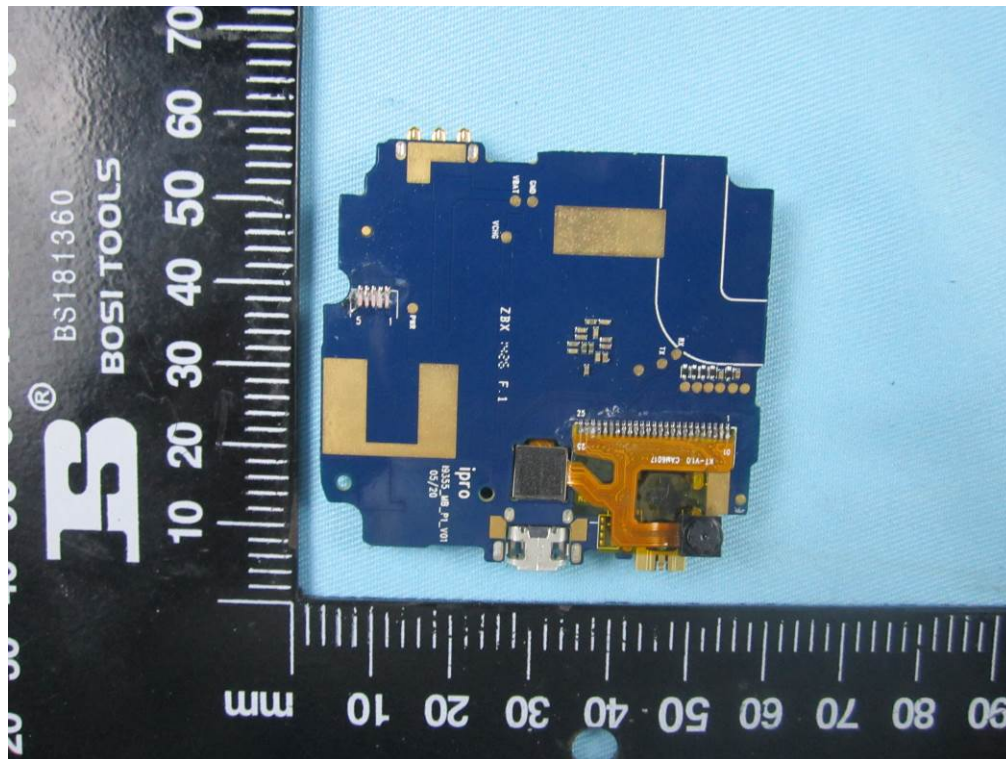


Mainboard With Shielding - Front View

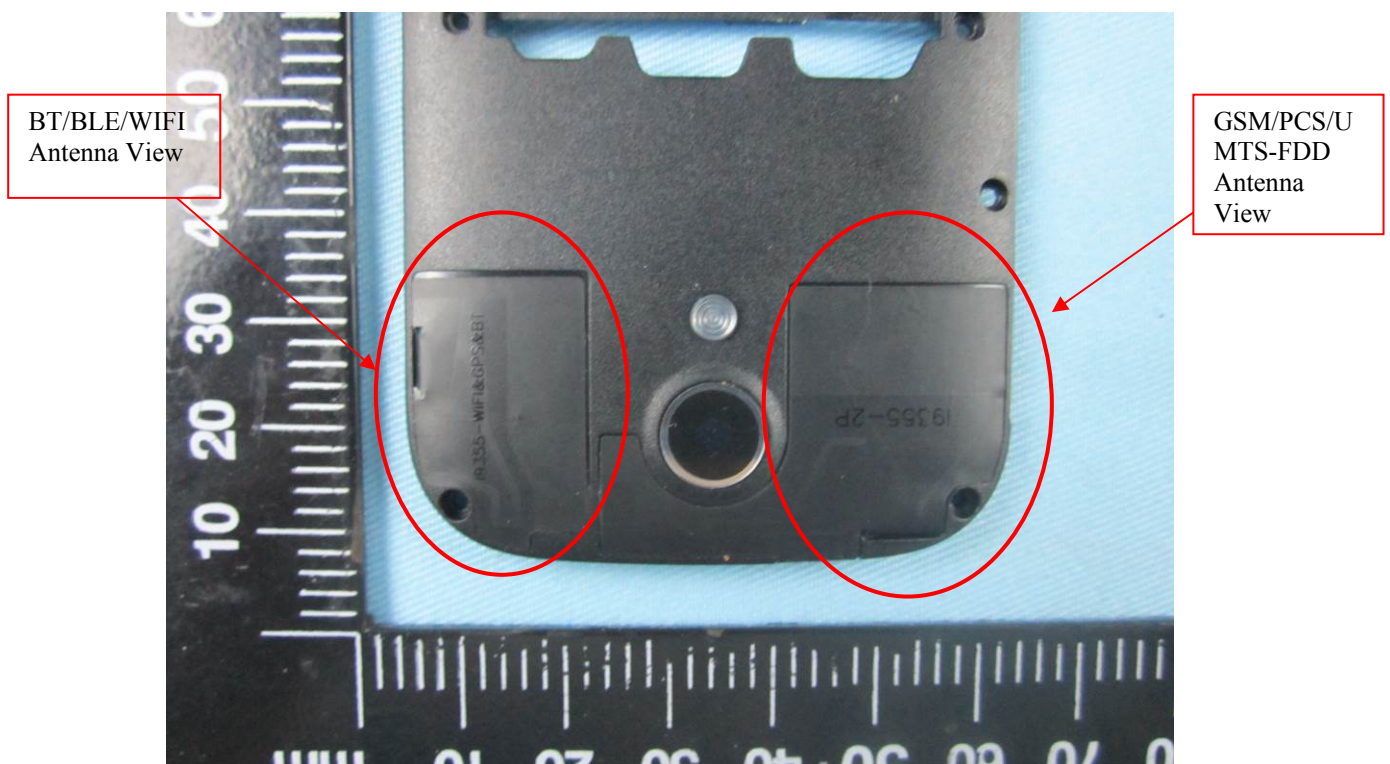


Mainboard Without Shielding - Front View





Mainboard – Rear View



BT/BLE/WIFI/GSM/PCS/UMTS-FDD Antenna View

**Annex B.iii. Photograph 3: Test Setup Photo**

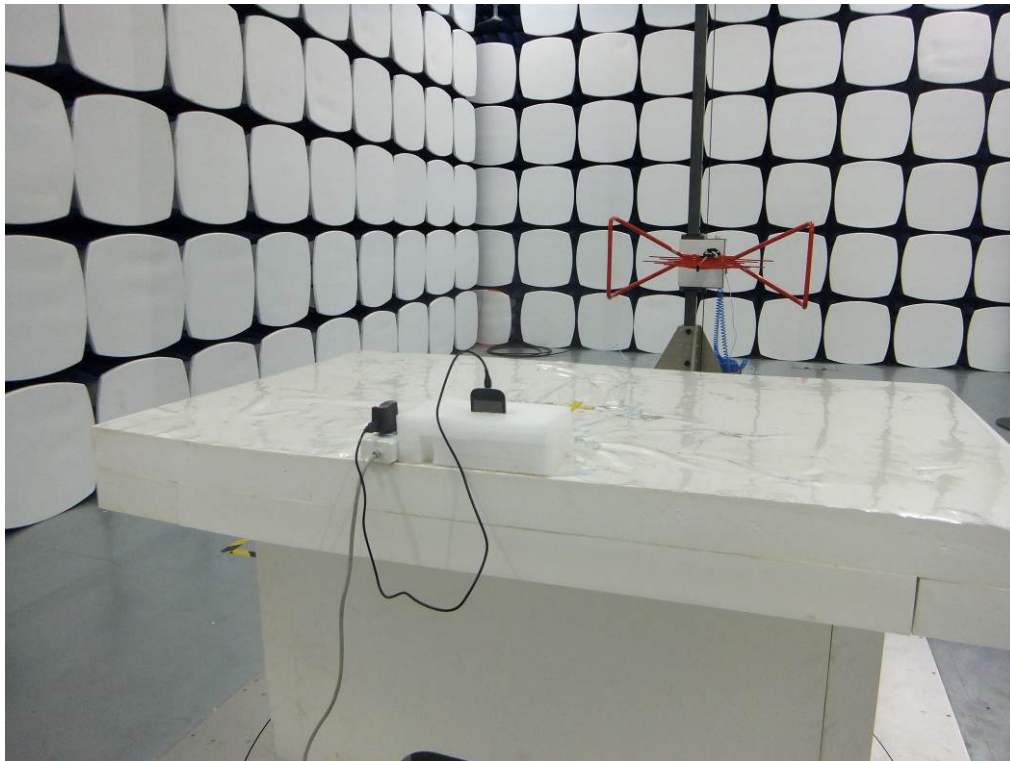


Conducted Emissions Test Setup Front View

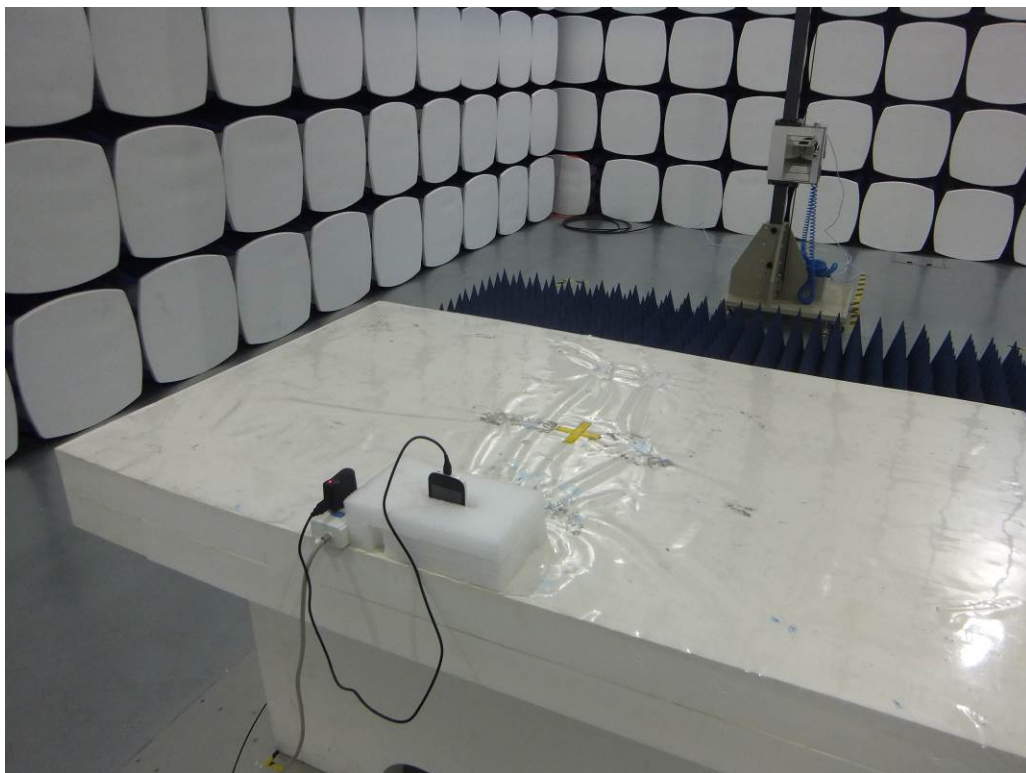


Conducted Emissions Test Setup Side View





Radiated Spurious Emissions Test Setup Below 1GHz - Front View



Radiated Spurious Emissions Test Setup Above 1GHz –Front View

## **Annex C. TEST SETUP AND SUPPORTING EQUIPMENT**

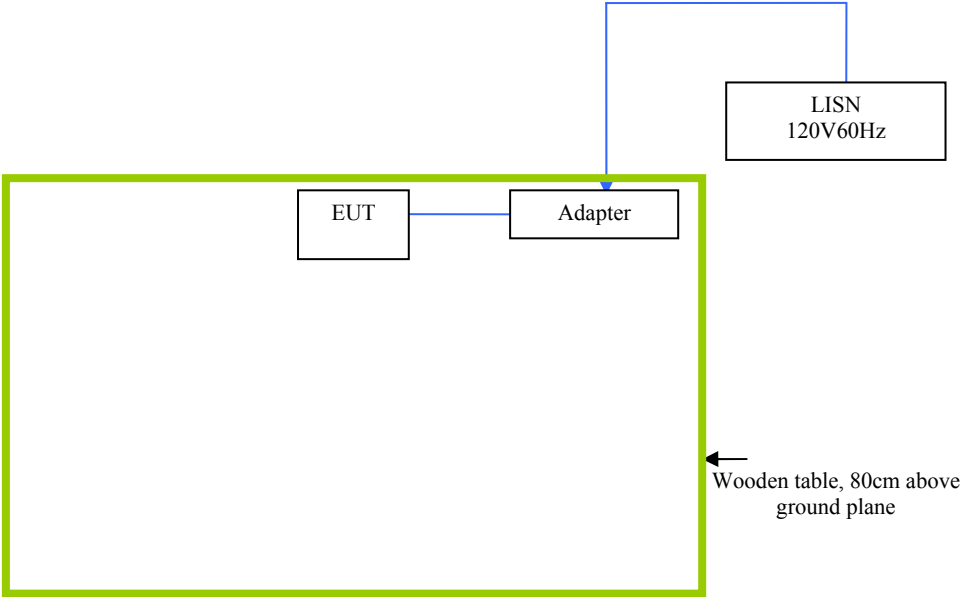
### **EUT TEST CONDITIONS**

#### **Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION**

The following is a description of supporting equipment and details of cables used with the EUT.

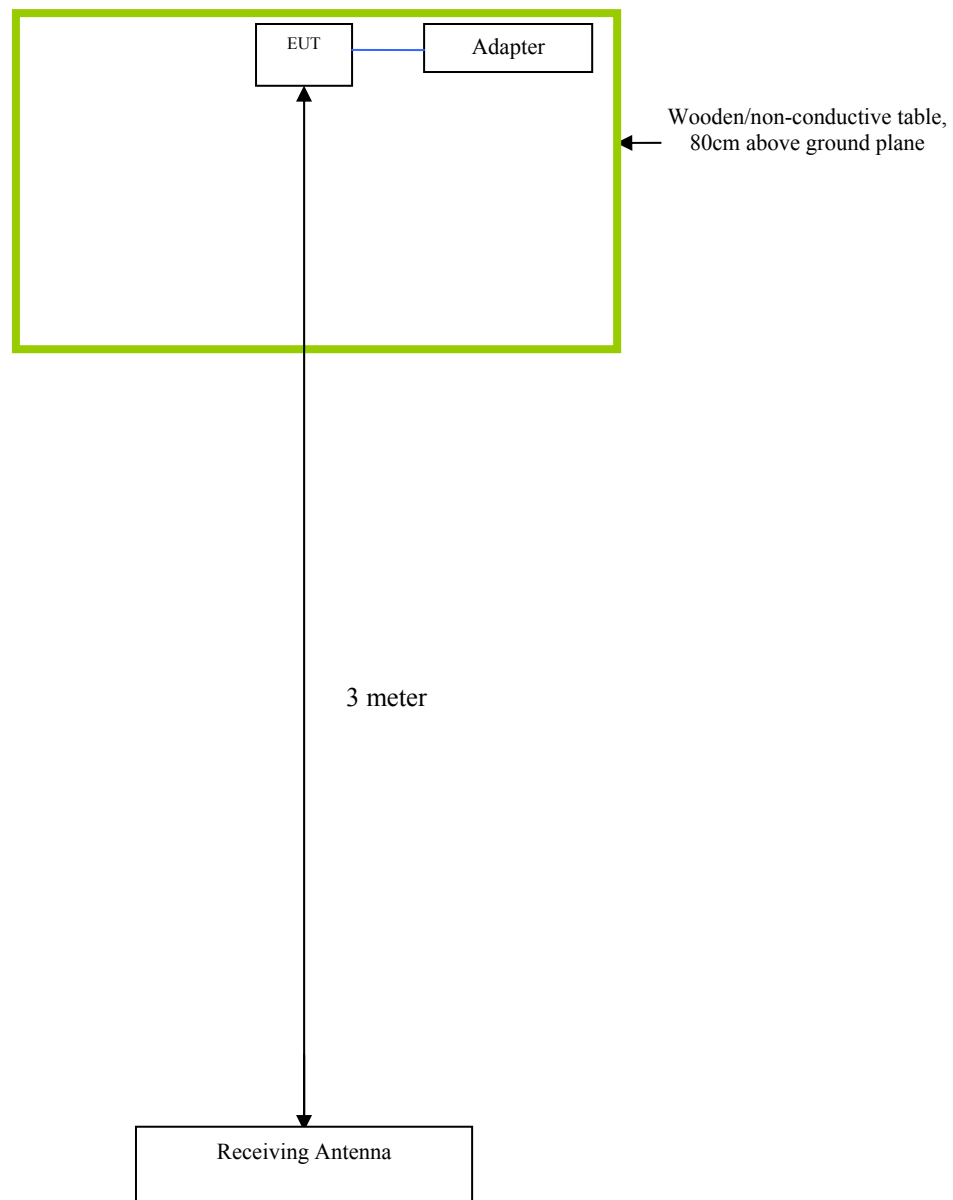
| Manufacturer | Equipment Description<br>(Including Brand Name) | Model | Calibration Date | Calibration Due Date |
|--------------|-------------------------------------------------|-------|------------------|----------------------|
| N/A          | N/A                                             | N/A   | N/A              | N/A                  |

Block Configuration Diagram for AC Line Conducted Emissions





## Block Configuration Diagram for Radiated Emissions



## **Annex C. ii. EUT OPERATING CONDITIONS**

The following is the description of how the EUT is exercised during testing.

| Test              | Description Of Operation                                           |
|-------------------|--------------------------------------------------------------------|
| Emissions Testing | The EUT was continuously transmitting to stimulate the worst case. |

## **Annex D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PART LIST**

**Please see attachment**

## **Annex E. DECLARATION OF SI**

**N/A**