



# Variant FCC Test Report

**APPLICANT** : QUANTA Computer Inc.  
**EQUIPMENT** : LTE mPCIe-full-size module  
**BRAND NAME** : Quanta; Aptos  
**MODEL NAME** : LM172G/LM172  
**MARKETING NAME** : LM172G/LM172  
**FCC ID** : HFS-LI170  
**STANDARD** : FCC 47 CFR FCC Part 15 Subpart B  
**CLASSIFICATION** : Certification

This is a variant report which is only valid together with the original test report. The product was received on Oct. 28, 2013 and testing was completed on Nov. 27, 2013. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2003 and shown to be compliant with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Louis Wu / Manager

Approved by: Jones Tsai / Manager



***SPORTON INTERNATIONAL INC.***  
No. 52, Hwa Ya 1<sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.



## TABLE OF CONTENTS

<b>REVISION HISTORY.....</b>	<b>3</b>
<b>SUMMARY OF TEST RESULT .....</b>	<b>4</b>
<b>1. GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1. Applicant.....	5
1.2. Manufacturer .....	5
1.3. Feature of Equipment Under Test.....	5
1.4. Product Specification of Equipment Under Test .....	6
1.5. Modification of EUT .....	6
1.6. Test Site .....	6
1.7. Applied Standards .....	7
<b>2. TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....</b>	<b>8</b>
2.1. Test Mode .....	8
2.2. Connection Diagram of Test System .....	9
2.3. Support Unit used in test configuration and system.....	9
2.4. EUT Operation Test Setup .....	10
<b>3. TEST RESULT.....</b>	<b>11</b>
3.1. Test of AC Conducted Emission Measurement.....	11
3.2. Test of Radiated Emission Measurement .....	15
<b>4. LIST OF MEASURING EQUIPMENT .....</b>	<b>19</b>
<b>5. UNCERTAINTY OF EVALUATION.....</b>	<b>20</b>

### APPENDIX A. SETUP PHOTOGRAPHS

### APPENDIX B. ORIGINAL REPORT



# REVISION HISTORY



## SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.107	ICES003 Section 6.1	AC Conducted Emission	< 15.107 limits < ICES003 6.1 limits	PASS	Under limit 7.60 dB at 0.158 MHz
3.2	15.109	ICES003 Section 6.2	Radiated Emission	< 15.109 limits < ICES003 6.2 limits	PASS	Under limit 6.05 dB at 288.660 MHz



## 1. General Description

### 1.1. Applicant

**QUANTA Computer Inc.**

211, Wen Hua 2nd Rd., Kueishan, Taoyuan 33377, Taiwan

### 1.2. Manufacturer

**QUANTA Computer Inc.**

211, Wen Hua 2nd Rd., Kueishan, Taoyuan 33377, Taiwan

### 1.3. Feature of Equipment Under Test

Product Feature	
<b>Equipment</b>	LTE mPCIe-full-size module
<b>Brand Name</b>	Quanta; Aptos
<b>Model Name</b>	LM172G/LM172
<b>Marketing Name</b>	LM172G/LM172
<b>FCC ID</b>	HFS-LI170
<b>Sample 1</b>	Model Name: LM172G Marketing Name: LM172G EUT with GPS function
<b>Sample 2</b>	Model Name: LM172 Marketing Name: LM172 EUT without GPS function
<b>EUT supports Radios application</b>	LTE
<b>HW Version</b>	LM172G/LM172 R2
<b>EUT Stage</b>	Production Unit

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



## 1.4. Product Specification of Equipment Under Test

<Sample 1>

Product Specification subjective to this standard	
<b>Tx Frequency</b>	LTE Band 13 : 779.5 MHz ~ 784.5 MHz
<b>Rx Frequency</b>	LTE Band 13 : 748.5 MHz ~ 753.5 MHz GPS : 1.57542 GHz
<b>Antenna Type</b>	WWAN: Dipole Antenna GPS: Patch Antenna
<b>Type of Modulation</b>	QPSK / 16QAM GPS : BPSK

<Sample 2>

Product Specification subjective to this standard	
<b>Tx Frequency</b>	LTE Band 13 : 779.5 MHz ~ 784.5 MHz
<b>Rx Frequency</b>	LTE Band 13 : 748.5 MHz ~ 753.5 MHz
<b>Antenna Type</b>	WWAN: Dipole Antenna
<b>Type of Modulation</b>	QPSK / 16QAM

## 1.5. Modification of EUT

No modifications are made to the EUT during all test items.

## 1.6. Test Site

<b>Test Site</b>	SPORTON INTERNATIONAL INC.		
<b>Test Site Location</b>	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		<b>FCC/IC Registration No.</b>
	CO05-HY	03CH06-HY	TW1022/4086B-1



## **1.7. Applied Standards**

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR FCC Part 15 Subpart B
- ANSI C63.4-2003

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.



## 2. Test Configuration of Equipment Under Test

### 2.1. Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (30MHz to the 5th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT uses a USB interface and microprocessor operating 26MHz which is the maximum frequency used.

The following tables are showing the test modes as the worst cases and recorded in this report.

Item	EUT Configuration	Test Condition	
		EMI AC	EMI RE
1.	Charging Mode (EUT connected to notebook)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

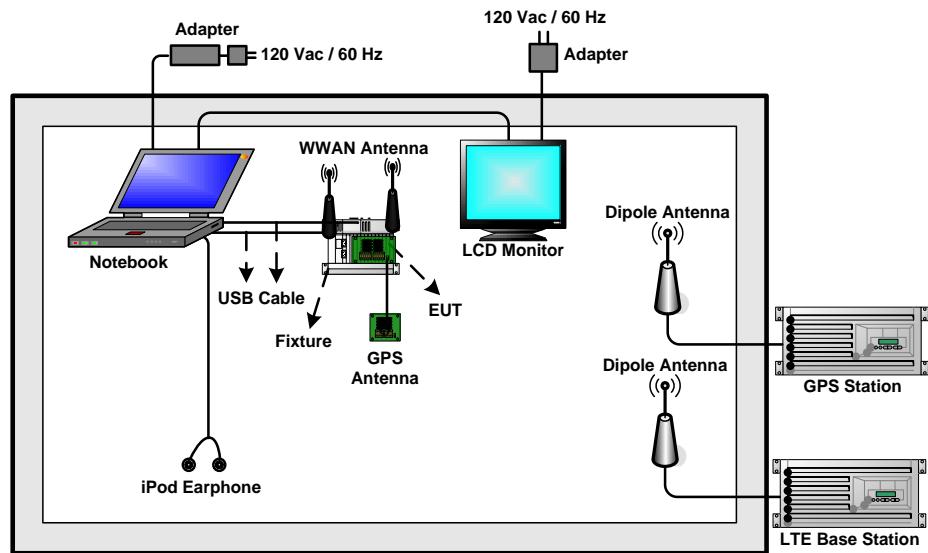
#### Abbreviations:

- EMI AC: AC conducted emissions
- EMI RE: EUT radiated emissions

Test Items	EUT Configure Mode	Function Type
AC Conducted Emission	1	Mode 1: LTE Band 13 Idle + Charging from Notebook + GPS Rx
Radiated Emissions	1	Mode 1: LTE Band 13 Idle + Charging from Notebook + GPS Rx

**Remark:** All the tests were performed with Sample 1.

## 2.2. Connection Diagram of Test System



## 2.3. Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
5.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
6.	Fixture	NA	NA	NA	NA	NA
7.	WWAN Antenna	NA	NA	NA	NA	NA
8.	GPS Antenna	NA	PA1590MI4G-10 1-17	NA	NA	NA
9.	USB Cable	NA	NA	NA	Shielded, 0.9 m	NA
10.	USB Cable	NA	NA	NA	Shielded, 1.5 m	NA



## **2.4. EUT Operation Test Setup**

The EUT was in LTE idle mode during the testing. The EUT was synchronized to the BCCH, and was in continuous receiving mode by setting system simulator's paging reorganization.

At the same time, the notebook executed "GLMap 2012" to make the EUT receive continuous signals from GPS station.



### 3. Test Result

#### 3.1. Test of AC Conducted Emission Measurement

##### 3.1.1 Limits of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	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.

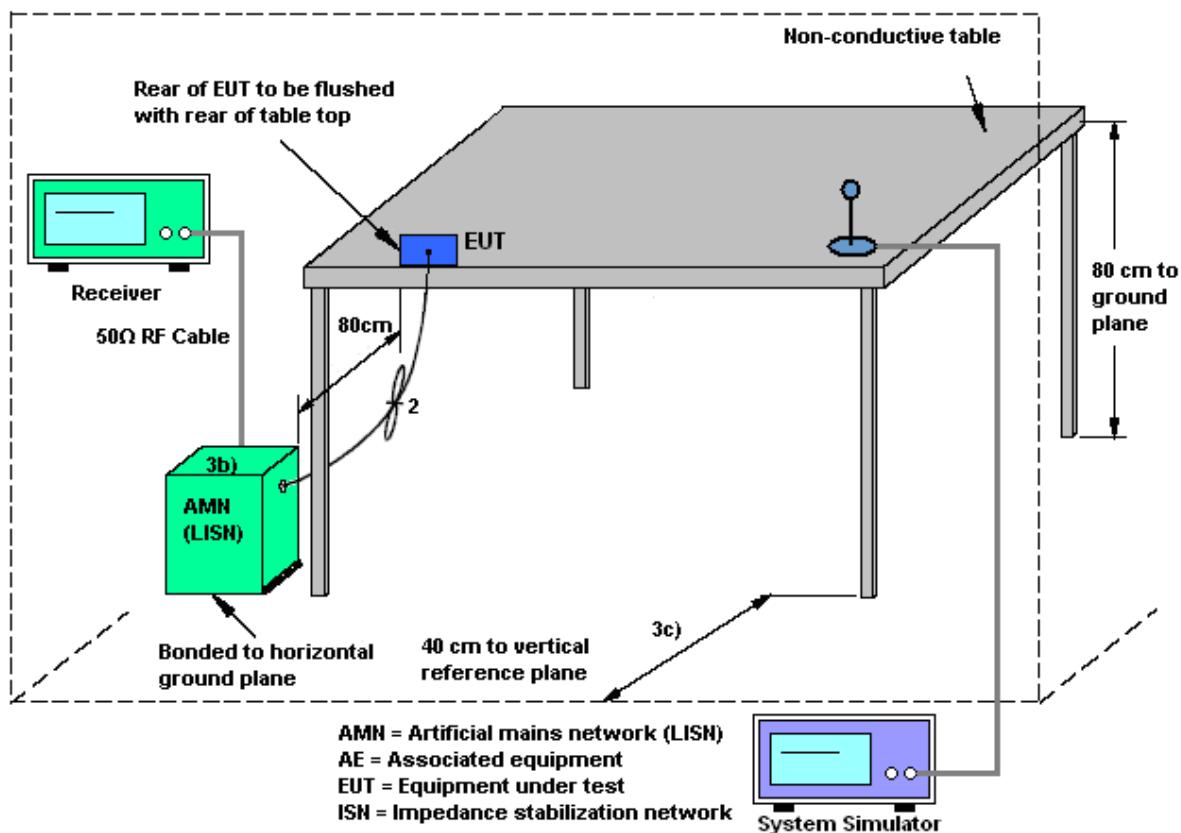
##### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

##### 3.1.3 Test Procedure

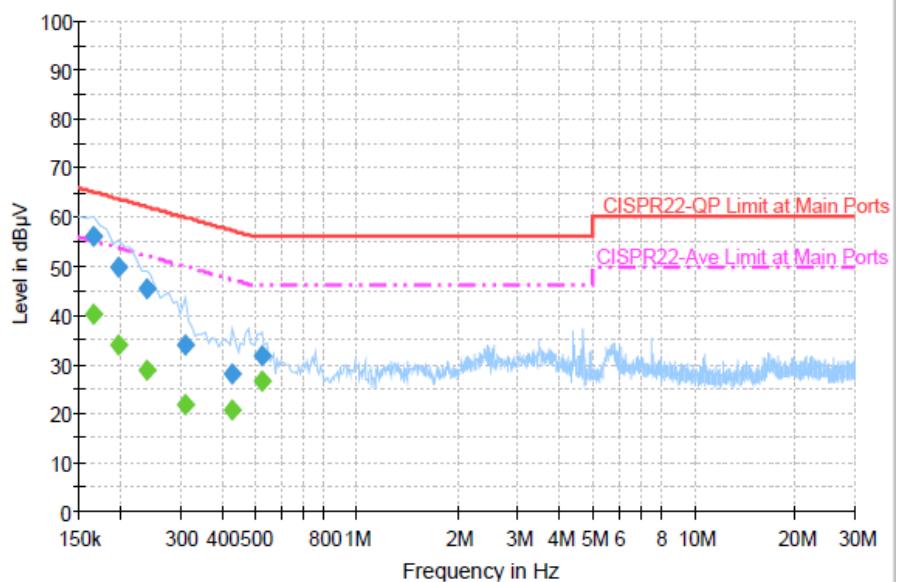
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.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

### 3.1.4 Test Setup



### 3.1.5 Test Result of AC Conducted Emission

<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	20~22°C
<b>Test Engineer :</b>	Cosmo Xu	<b>Relative Humidity :</b>	46~48%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line
<b>Function Type :</b> LTE Band 13 Idle + Charging from Notebook + GPS Rx			



#### Final Result : Quasi-Peak

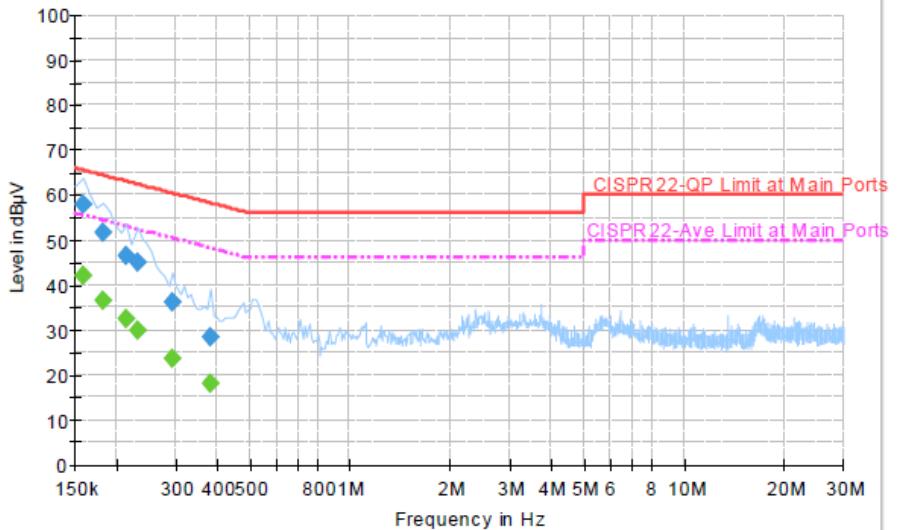
Frequency (MHz)	Quasi-Peak (dB $\mu$ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.166000	56.2	Off	L1	19.4	9.0	65.2
0.198000	50.0	Off	L1	19.3	13.7	63.7
0.238000	45.4	Off	L1	19.5	16.8	62.2
0.310000	34.1	Off	L1	19.4	25.9	60.0
0.430000	28.2	Off	L1	19.4	29.1	57.3
0.526000	31.7	Off	L1	19.4	24.3	56.0

#### Final Result : Average

Frequency (MHz)	Average (dB $\mu$ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.166000	40.2	Off	L1	19.4	15.0	55.2
0.198000	34.0	Off	L1	19.3	19.7	53.7
0.238000	28.9	Off	L1	19.5	23.3	52.2
0.310000	21.9	Off	L1	19.4	28.1	50.0
0.430000	20.7	Off	L1	19.4	26.6	47.3
0.526000	26.4	Off	L1	19.4	19.6	46.0



<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	20~22°C
<b>Test Engineer :</b>	Cosmo Xu	<b>Relative Humidity :</b>	46~48%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral
<b>Function Type :</b> LTE Band 13 Idle + Charging from Notebook + GPS Rx			

**Final Result : Quasi-Peak**

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	58.0	Off	N	19.3	7.6	65.6
0.182000	51.8	Off	N	19.4	12.6	64.4
0.214000	46.4	Off	N	19.4	16.6	63.0
0.230000	44.9	Off	N	19.4	17.5	62.4
0.294000	36.0	Off	N	19.4	24.4	60.4
0.382000	28.3	Off	N	19.4	29.9	58.2

**Final Result : Average**

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	42.0	Off	N	19.3	13.6	55.6
0.182000	36.5	Off	N	19.4	17.9	54.4
0.214000	32.6	Off	N	19.4	20.4	53.0
0.230000	29.9	Off	N	19.4	22.5	52.4
0.294000	23.6	Off	N	19.4	26.8	50.4
0.382000	18.0	Off	N	19.4	30.2	48.2



## 3.2. Test of Radiated Emission Measurement

### 3.2.1. Limit of Radiated Emission

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

### 3.2.2. Measuring Instruments

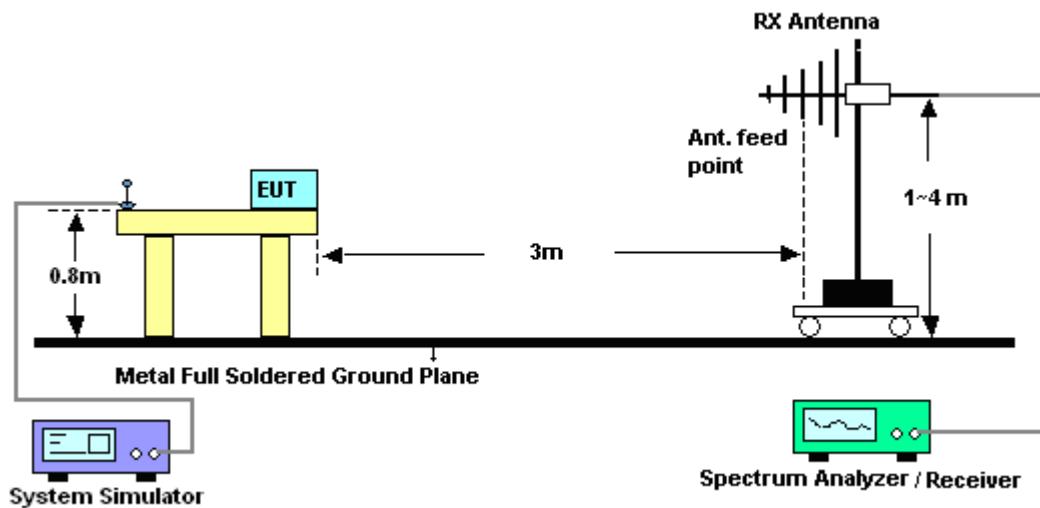
The measuring equipment is listed in the section 4 of this test report.

### 3.2.3. Test Procedures

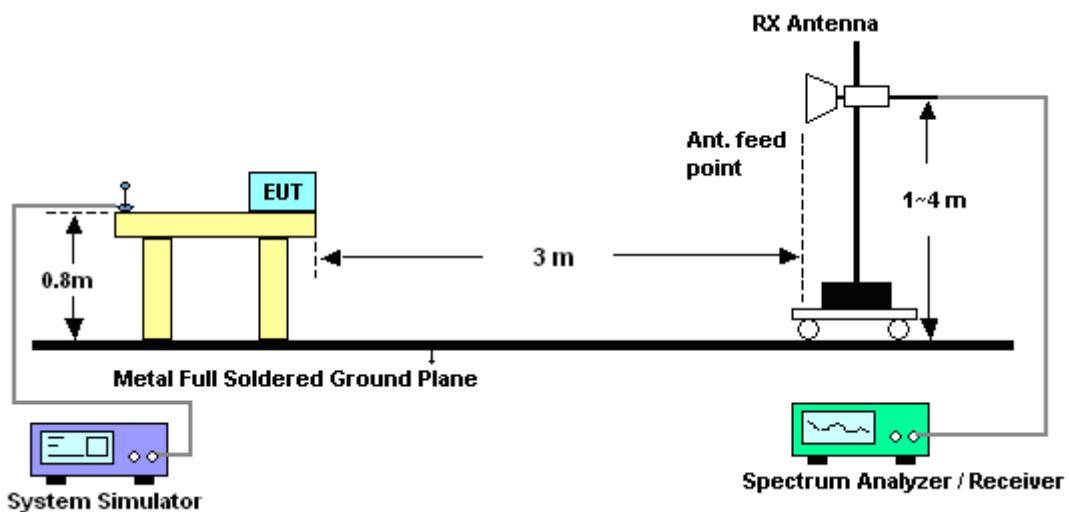
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dB $\mu$ V/m) = 20 log Emission level ( $\mu$ V/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

### 3.2.4. Test Setup of Radiated Emission

For radiated emissions from 30MHz to 1GHz

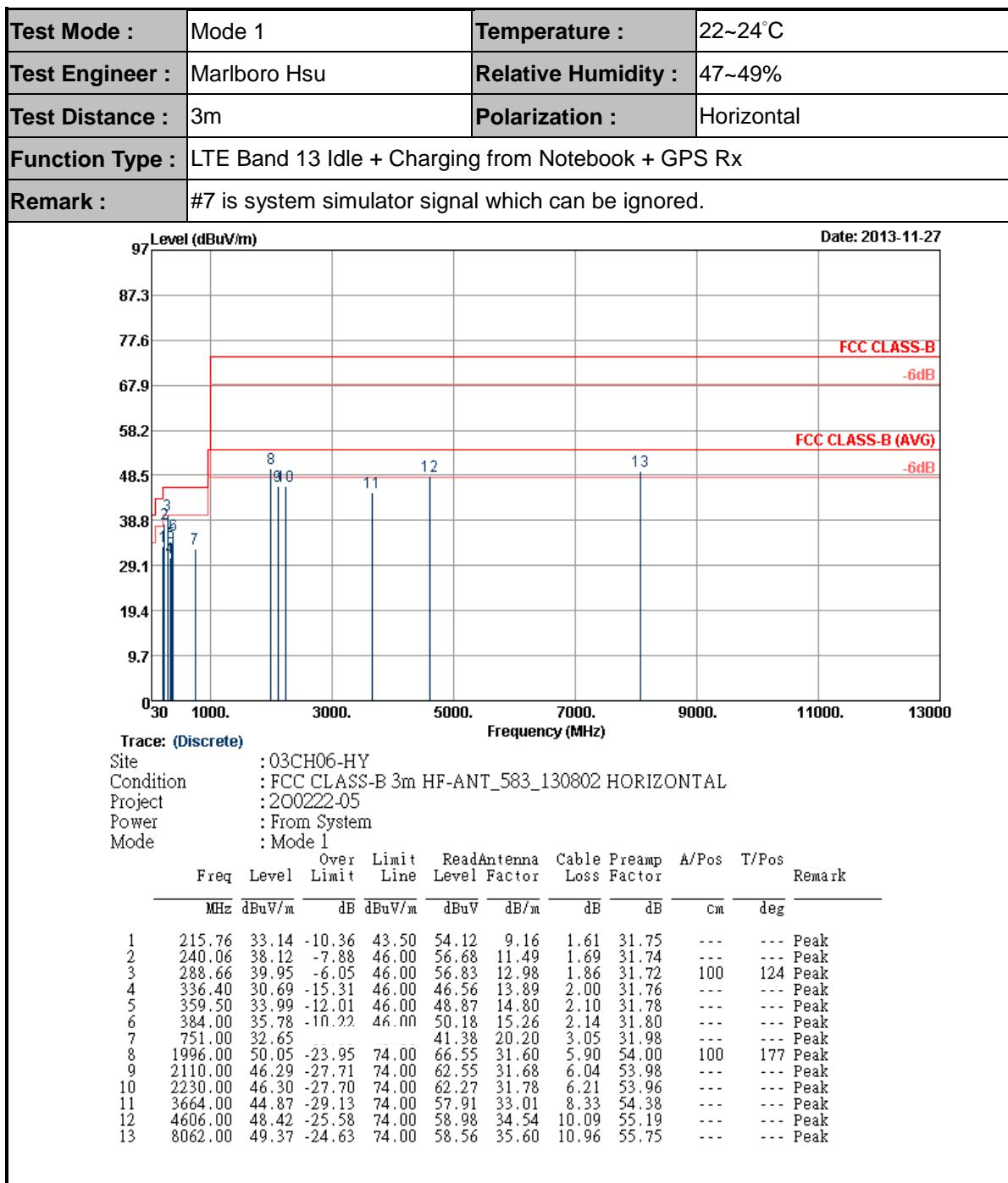


For radiated emissions above 1GHz



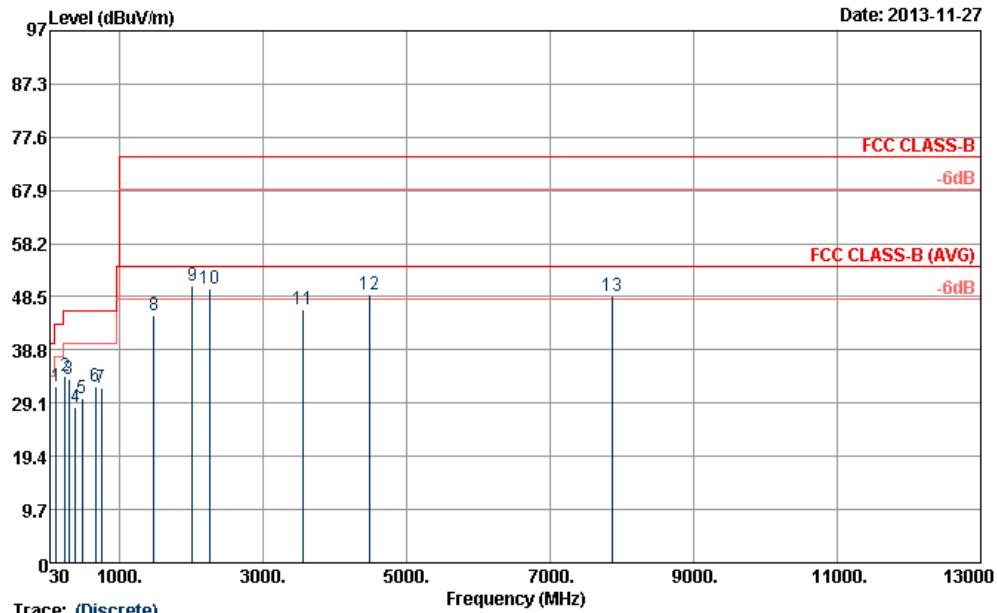


## 3.2.5. Test Result of Radiated Emission





<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	22~24°C
<b>Test Engineer :</b>	Marlboro Hsu	<b>Relative Humidity :</b>	47~49%
<b>Test Distance :</b>	3m	<b>Polarization :</b>	Vertical
<b>Function Type :</b>	LTE Band 13 Idle + Charging from Notebook + GPS Rx		
<b>Remark :</b>	#7 is system simulator signal which can be ignored.		



Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	A/Pos	T/Pos	Remark
		Line	Limit	Level	Factor	Cable	Preamp	A/Pos	T/Pos	
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	119.64	32.12	-11.38	43.50	50.50	12.16	1.21	31.75	100	106 Peak
2	239.25	34.00	-12.00	46.00	52.65	11.40	1.69	31.74	---	--- Peak
3	288.66	33.57	-12.43	46.00	50.45	12.98	1.86	31.72	---	--- Peak
4	384.00	28.43	-17.57	46.00	42.83	15.26	2.14	31.80	---	--- Peak
5	480.60	29.94	-16.06	46.00	41.93	17.61	2.31	31.91	---	--- Peak
6	665.40	32.27	-13.73	46.00	42.02	19.45	2.83	32.03	---	--- Peak
7	751.00	31.94	---	40.67	20.20	3.05	31.98	---	---	Peak
8	1474.00	45.23	-28.77	74.00	66.66	27.80	4.68	53.91	---	--- Peak
9	2014.00	50.54	-23.46	74.00	67.03	31.61	5.90	54.00	100	121 Peak
10	2250.00	50.07	-23.93	74.00	65.97	31.81	6.24	53.95	---	--- Peak
11	3566.00	46.31	-27.69	74.00	59.48	32.88	8.16	54.21	---	--- Peak
12	4492.00	48.89	-25.11	74.00	59.27	34.56	10.06	55.00	---	--- Peak
13	7872.00	48.65	-25.35	74.00	57.87	35.57	10.96	55.75	---	--- Peak



## 4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 15, 2013	Nov. 27, 2013	Nov. 14, 2014	Conduction (CO05-HY)
Two-LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2012	Nov. 27, 2013	Dec. 11, 2013	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 06, 2012	Nov. 27, 2013	Dec. 05, 2013	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Nov. 27, 2013	N/A	Conduction (CO05-HY)
Spectrum Analyzer	Rohde & Schwarz	ESU26	100390	20Hz ~ 26.5GHz	Doc. 14, 2012	Nov. 27, 2013	Dec. 13, 2013	Radiation (03CH06-HY)
Spectrum Analyzer	Agilent	E4446A	MY50180136	3Hz~44GHz	Apr. 17, 2013	Nov. 27, 2013	Apr. 16, 2014	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/0003	20MHz ~ 1000MHz	May 06, 2013	Nov. 27, 2013	May 05, 2014	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL6112B	2885	30MHz -2GHz	Oct. 10, 2013	Nov. 27, 2013	Oct. 09, 2014	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz ~ 18GHz	Aug. 02, 2013	Nov. 27, 2013	Aug. 01, 2014	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9kHz ~ 1GHz	Apr. 12, 2013	Nov. 27, 2013	Apr. 11, 2014	Radiation (03CH06-HY)
Pre Amplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 18, 2013	Nov. 27, 2013	Jul. 17, 2014	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0 - 360 degree	N/A	Nov. 27, 2013	N/A	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1 m ~ 4 m	N/A	Nov. 27, 2013	N/A	Radiation (03CH06-HY)



## 5. Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2U <sub>c</sub> (y))	2.26
--	------

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2U <sub>c</sub> (y))	4.50
--	------



## **Appendix B. Original Report**

Please refer to Sporton report number FC2O0222 as below.