

## FCC TEST REPORT

**REPORT NO.:** SE08FCI22BR

**MODEL NO.:** ESP-GEN2-02

**LISTED MODELS:** N/A

**RECEIVED:** Feb 22, 2009

**TESTED:** Mar 10~ Mar 15, 2009

**APPLICANT:** ESP SYSTEMS, LLC.

**ADDRESS:** 401 N. Tryon St-10th Floor, Charlotte,  
North Carolina 28202 United States

**ISSUED BY:** SHENZHEN SETEK TECHNOLOGY CO., LTD.

**LAB LOCATION:** 2/F,A3 Bldg, East Industry Zone, Overseas Chinese Town,  
Shenzhen,China

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**SHENZHEN SETEK TECHNOLOGY CO., LTD.**

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Prepared for : ESP SYSTEMS, LLC.

Address : 401 N.Tryon St-10th Floor, Charlotte,  
North Carolina 28202 United States

Product : HUB

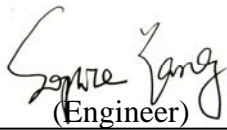
Model No(s). : ESP-GEN2-02


Trademark : N/A

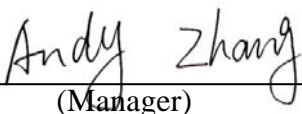
Test Standard : FCC Part 15 Paragraph 15.249

Prepared by : SHENZHEN SETEK TECHNOLOGY CO., LTD.

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Reviewer by :   
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Approved by :   
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Report Number : SE08FCI22BR

Date of Test : Mar 10 to Mar 15, 2009

Date of Report : Apr 02, 2009

The device described above is tested by SHENZHEN SETEK TECHNOLOGY CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. This report applies to above tested sample only and shall not be reproduced in part without written approval of SHENZHEN SETEK TECHNOLOGY CO., LTD.

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# 1. GENERAL INFORMATION

## 1.1 Description of Device (EUT)

Applicant : ESP SYSTEMS, LLC.

Address : 401 N.Tryon St-10th Floor, Charlotte,  
North Carolina 28202 United States

Manufacturer : ESP Technology (Shenzhen) Ltd.

Address : East wing, 3rd Floor, Block 2, Phase 1 of Vision  
Shenzhen Business Park Keji South Rd. , Shenzhen Hi-Tech  
Industrial Park, Shenzhen

EUT : HUB

Model Number(s) : ESP-GEN2-02

Description of Antenna : Unique PCB Antenna

Power Supply : AC 120V/60Hz from Adapter

Operation Frequency : 2405MHz-2480 MHz

Number of Channels : 16

Type of Modulation : FHSS

Received : Feb 22, 2009

Date of Test : Mar 10 to Mar 15, 2009

## 1.2 Test Summary

Test	Test Requirement	Test Method	Class / Severity	Result
Radiated Emission (30MHz to 25GHz)	FCC PART 15: Oct 2007	ANSI C63.4: 2003	Class B	PASS
Conducted Emission (150KHz to 30MHz)	FCC PART 15: Oct 2007	ANSI C63.4: 2003	Class B	PASS

## 1.3 Description of Support Device

The EUT has been tested as an independent unit.

## 1.4 Standards Applicable for Testing

The customer requested FCC tests for a HUB. The standards used were FCC 15 Paragraph 15.249, Paragraph 15.207, Paragraph 15.209, Paragraph 15.31, Paragraph 15.33, Paragraph 15.35.

## 1.5 List of Measuring Equipments Used

For Radiated Spurious Emission (30~25GHz) test:

Items	Equipment	Manufacturer	Model No.	Last Cal	Calibration Period
1	EMI Test Receiver	R&S	ESI 26	2008/6	1 year
2	Horn Antenna	R/S	CH14-H052	2008/6	1 year
3	3m Semi- Anechoic Chamber	ETS	N/A	2008/6	1 year
4	Horn Antenna	R/S	HF906	2008/6	1 year
5	Spectrum Analyzer	HP	8594EM	2008/6	1 year

### For Conducted Emissions Test:

Items	Equipment	Manufacturer	Model No.	Last Cal	Calibration Period
1	EMI Test Receiver	R&S	ESCI	2009/02	1 Year
2	EMI Test Receiver	R&S	ESPI	2009/02	1 Year
3	Amplifier	HP	8447D	2009/02	1 Year
4	3 phase Artificial Mains (L.I.S.N)	SCHWARZBEC K	NSLK 8128	2009/02	1 Year
5	TRILOG Broadband Test-Antenna	SCHWARZBEC K	VULB9163	2009/02	1 Year
6	Horn Antenna	SCHWARZBEC K	BBHA9120A	2009/02	1 Year
7	High Field Biconical Antenna	ELECTRO-METRICS	EM-6913	2008/09	1 Year
8	Log Periodic Antenna	ELECTRO-METRICS	EM-6950	2008/09	1 Year
9	Remote Active Vertical Antenna	ELECTRO-METRICS	EM-6892	2008/09	1 Year
10	Power Clamp	SCHWARZBEC K	MDS-21	2009/02	1 Year

## 1.6 Test Facility

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

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.

## 1.7 Measurement Uncertainty

Radiation Uncertainty :  $U_r = \pm 4.22\text{dB}$

Conduction Uncertainty :  $U_c = \pm 3.29\text{dB}$

## 2. Conducted Emission Test

Product Name:	HUB
Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	Based on FCC Part15 Paragraph 15.207
Test Date:	Mar 11, 2009
Frequency Range:	150 kHz to 30MHz
Class:	Class B
Detector:	Peak for pre-scan (9 kHz Resolution Bandwidth) Quasi-Peak & Average if maximized peak within 6dB of Average Limit

### 2.1. Test Equipment

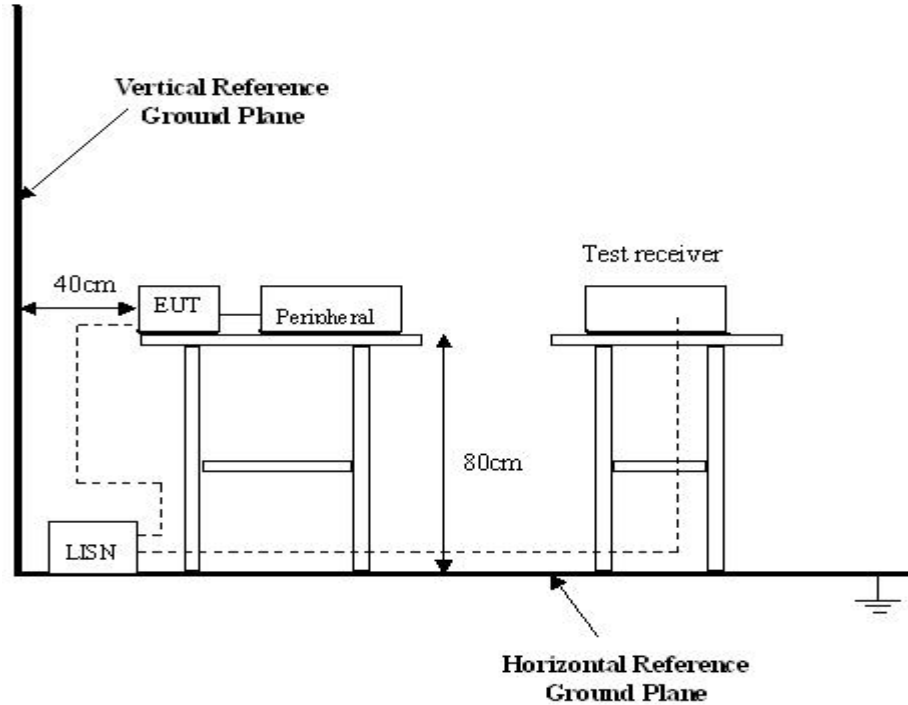
Please refer to Section 1.5. this report.

### 2.2. Test Procedure

1. The EUT was tested according to ANSI C63.4: 2003. The frequency spectrum from 150kHz to 30MHz was investigated.
2. The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

### 2.3. Conducted Test Setup

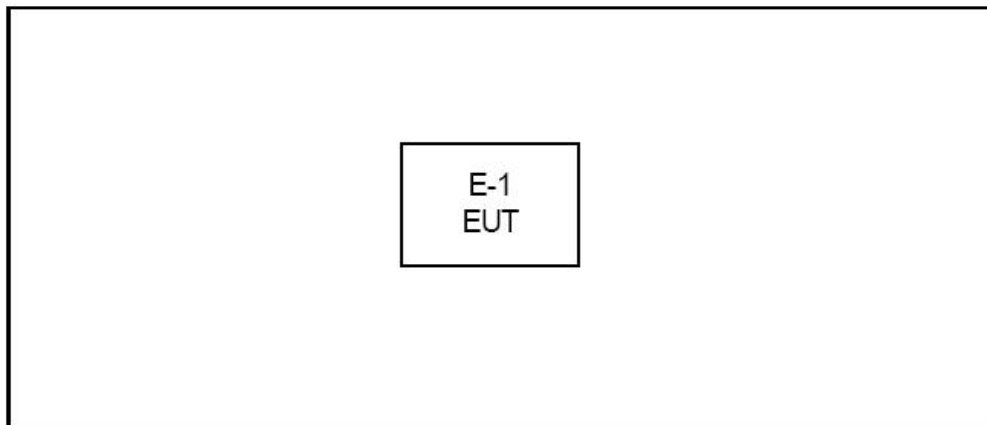
The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003, The specification used in this report was the FCC Part15 Paragraph 15.207 limits.



### 2.4. EUT Operating Condition

Operating condition is according to ANSI C63.4: 2003.

- A. Setup the EUT and simulators as shown on follow.
- B. Enable RF signal and confirm EUT active.
- C. Modulate output capacity of EUT up to specification.





## 2.5. Conducted Emission Limits

66-56 dBuV/m between 0.15MHz & 0.5MHz

56 dBuV/m between 0.5MHz & 5MHz

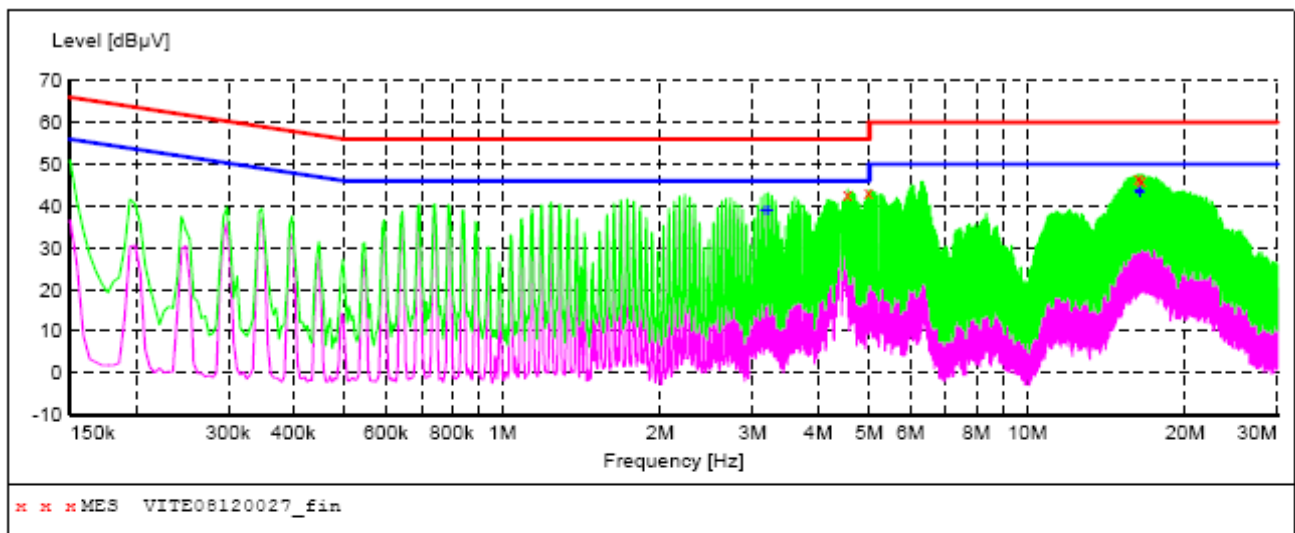
60 dBuV/m between 5MHz & 30MHz

**Note:** In the above limits, the tighter limit applies at the band edges.

## 2.6. Test Result

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

Short Description: 150K-30M Voltage



**MEASUREMENT RESULT: "VITE08120027\_fin"**

12/24/2008 8:45PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
4.546500	42.70	10.7	56	13.3	QP	N	GND
4.992000	43.10	10.7	56	12.9	QP	N	GND
16.309500	46.80	11.0	60	13.2	QP	N	GND
16.507500	46.30	11.0	60	13.7	QP	N	GND

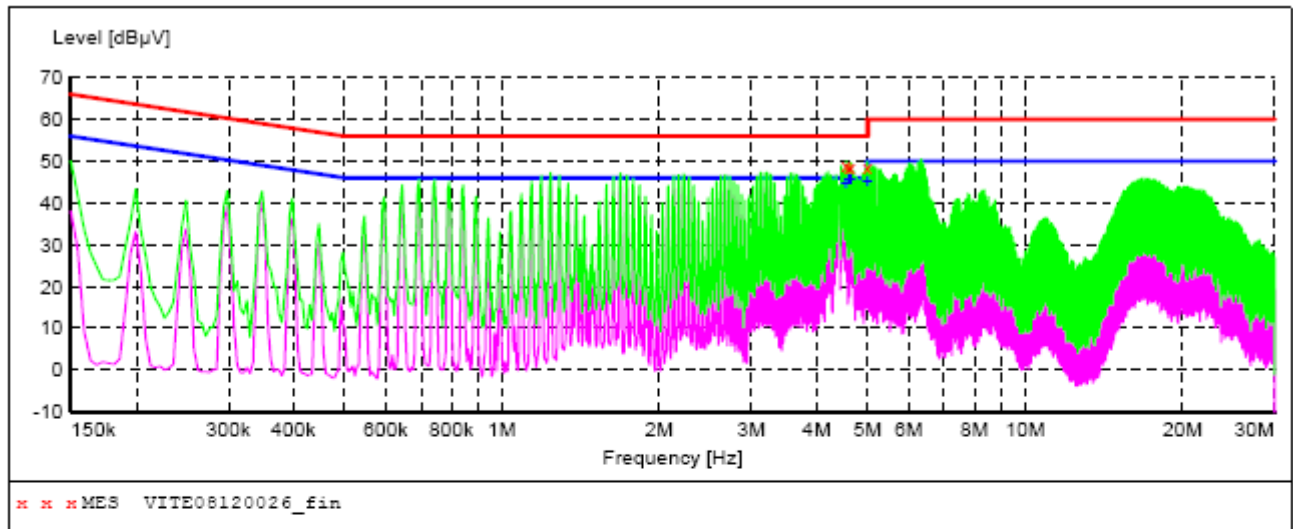
**MEASUREMENT RESULT: "VITE08120027\_fin2"**

12/24/2008 8:45PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
3.165000	39.10	10.7	46	6.9	AV	N	GND
3.214500	39.00	10.7	46	7.0	AV	N	GND
16.359000	43.70	11.0	50	6.3	AV	N	GND
16.408500	43.40	11.0	50	6.6	AV	N	GND

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

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "VITE08120026\_fin"**

12/24/2008 8:43PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
4.551000	48.90	10.7	56	7.1	QP	L1	GND
4.600500	48.60	10.7	56	7.4	QP	L1	GND
4.650000	48.40	10.7	56	7.6	QP	L1	GND
4.996500	48.50	10.7	56	7.5	QP	L1	GND

**MEASUREMENT RESULT: "VITE08120026\_fin2"**

12/24/2008 8:43PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
4.551000	44.80	10.7	46	1.2	AV	L1	GND
4.600500	45.60	10.7	46	0.4	AV	L1	GND
4.650000	45.50	10.7	46	0.5	AV	L1	GND
4.996500	45.10	10.7	46	0.9	AV	L1	GND

### 3 Radiation Emission Test

Product Name:	HUB
Test Requirement:	FCC Part15 Paragraph 15.249
Test Method:	Based on FCC Part15 Paragraph 15.31 and Paragraph 15.33
Test Date:	Jan 11, 2009
Frequency Range:	30MHz to 25GHz
Measurement Distance:	3m
Detector:	Peak for pre-scan (120kHz resolution bandwidth) Quasi-Peak if maximised peak within 6dB of limit

#### 3.1. Test Equipment

Please refer to Section 1.5. in this report.

#### 3.2. Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase centre variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

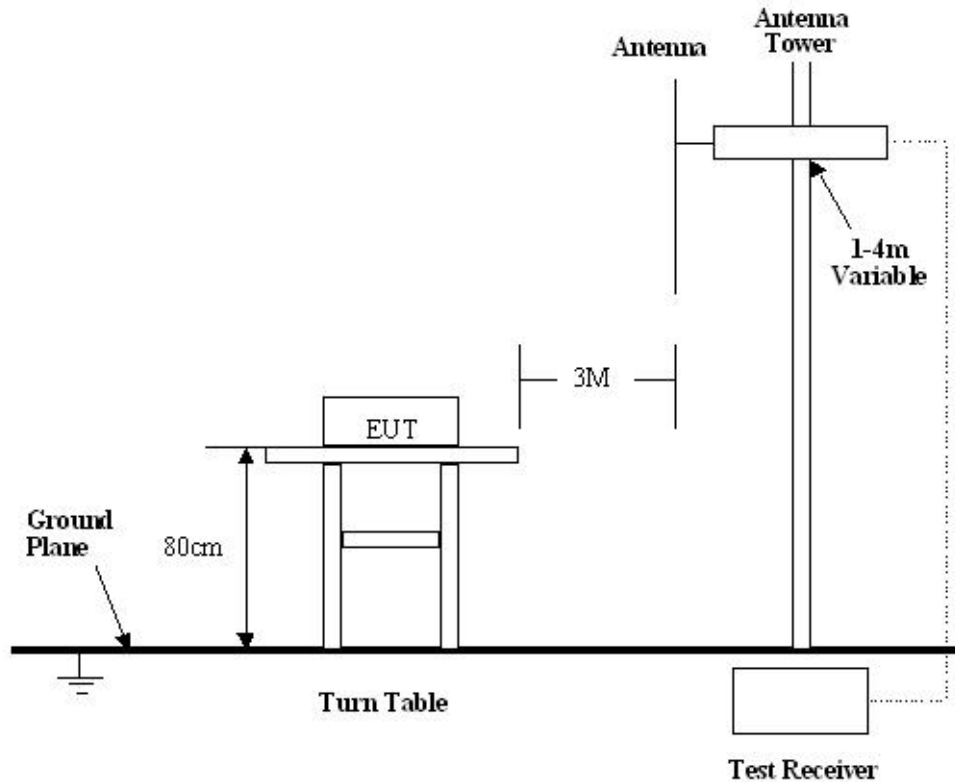
Based on ANSI C63.4: 2003, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at EMC Lab is  $\pm 3.84$  dB.

#### 3.3. Test Procedure

1. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
2. All data was recorded in the peak detection mode.
3. The EUT was under normal mode during the final qualification test and the configuration was used to represent the worst case results.
4. According to the FCC Part 15 Paragraph 15.205, 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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product has a Reverse-Polarity antenna, fulfill the requirement of this section.

### 3.4. Radiated Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003, The specification used in this report was the FCC Part15 Paragraph 15.249 and Paragraph 15.209 limits.



### 3.5. Spectrum Analyzer Setup

According to FCC Part15 Paragraph 15.249 Rules, the system was tested to 25000 MHz.

Start Frequency.....	30 MHz
Stop Frequency.....	25000 MHz
Sweep Speed .....	Auto
IF Bandwidth.....	100 kHz
Video Bandwidth.....	1 MHz
Quasi-Peak Adapter Bandwidth .....	120 kHz
Quasi-Peak Adapter Mode .....	Normal
Resolution Bandwidth .....	1MHz

### 3.6. Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBuV means the emission is 7dBuV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

### 3.7. Summary of Test Results

According to the data in section 7.10, the EUT complied with the FCC Part15 Paragraph 15.249 standards.

### 3.8. EUT Operating Condition

Same as section 6.4 of this report.

### 3.9. Radiated Emissions Limit

#### A. FCC Part 15 subpart C Paragraph 15.249 Limit

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25GHz	250	108	2500	68

- Note:**
- (1)  $\text{RF Voltage(dBuV)} = 20 \log \text{RF Voltage(uV)}$
  - (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
  - (3) The emission limit in this paragraph is based on measurement instrumentation employing an average detector. Measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
  - (4) Limit fundamental is 94dBuV/m@3m(AV) and 114dBuV/m@3m(PK)  
Limit field strength of harmonics: 54 dBuV/m@3m(AV) and 74dBuV/m@3m(PK)

**B. Frequencies in restricted band are complied to limit on Paragraph 15.209**

Frequency(MHZ)	Distance(m)	Field strength(dBuV/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

**Note:** (1) RF Voltage(dBuV)=20 log RF Voltage(uV)  
 (2) In the Above Table, the tighter limit applies at the band edges.  
 (3) Distance refers to the distance in meters between the measuring instrument antenna.

**3.10. Radiated Emissions Test Result**

Formula of conversion factors: the field strength at 3m was established by adding The meter reading of the spectrum analyzer (which is set to read in units of dBuV) To the antenna correction factor supplied by the antenna manufacturer. The antenna Correction factors are stated in terms of dB. The gain of the pressletor was accounted For in the spectrum analyser meter reading.

Example:

Freq(MHz) Meter Reading +ACF=FS

33 20dBuV+10.36dB=30.36dBuV/m @3m

**Radiated Emission Test Data**

Test Voltage: AC 120V/60Hz from Adapter

Test Mode: Normal Working

Temperature: 24 °C

Humidity: 52%RH

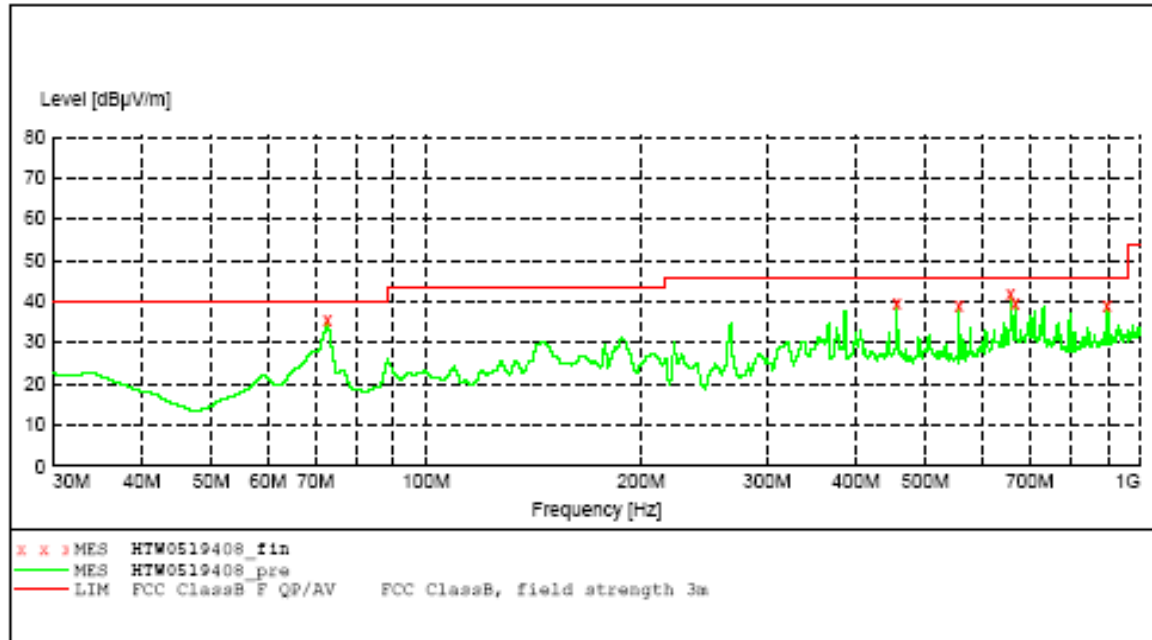
Test Result: PASS

Remarks: No further spurious emission found between lowest internal generated/used frequency to 30 MHz

## 30MHz-1GHz Radiation emission test:

***SWEEP TABLE: "test (30M-1G)"***

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency 30.0 MHz	Frequency 1.0 GHz	MaxPeak	500.0 ms	120 kHz	HL562new

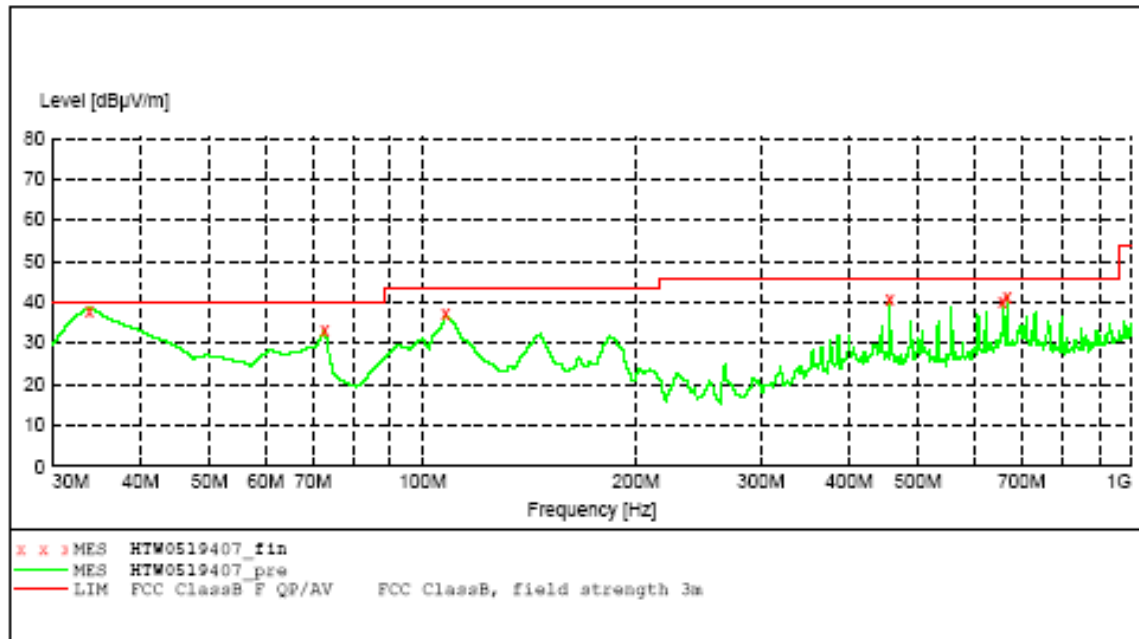
***MEASUREMENT RESULT: "HTW0519408\_fin"***

2007-5-19 9:21

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Asimuth deg	Polarisation
72.765531	35.60	11.1	40.0	4.4	QP	300.0	239.00	HORIZONTAL
455.711423	39.40	20.2	46.0	6.6	QP	100.0	167.00	HORIZONTAL
556.793587	39.00	21.7	46.0	7.0	QP	100.0	49.00	HORIZONTAL
657.875752	41.90	25.5	46.0	4.1	QP	100.0	49.00	HORIZONTAL
667.595190	39.80	25.7	46.0	6.2	QP	100.0	49.00	HORIZONTAL
898.917836	39.10	25.4	46.0	6.9	QP	100.0	127.00	HORIZONTAL

**SWEEP TABLE: "test (30M-1G)"**

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	500.0 ms	120 kHz	HL562new

**MEASUREMENT RESULT: "HTW0519407\_fin"**

2007-5-19 9:17

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Asimuth deg	Polarisation
33.887776	37.80	19.0	40.0	2.2	QP	100.0	88.00	VERTICAL
72.765531	33.20	11.1	40.0	6.8	QP	100.0	88.00	VERTICAL
107.755511	36.90	11.7	43.5	6.6	QP	100.0	127.00	VERTICAL
455.711423	40.40	20.2	46.0	5.6	QP	100.0	88.00	VERTICAL
657.875752	39.90	25.5	46.0	6.1	QP	100.0	88.00	VERTICAL
667.595190	41.40	25.7	46.0	4.6	QP	100.0	7.00	VERTICAL



**Above 1GHz Radiation emission test:****Top Channel:**

Freq. (MHz)	Ant.Pol. H/V	DetectorMode (PK/AV)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)	Note
2480	V	Peak	86.40	-3.30	83.10	93.98	-10.88	F
2480	H	Peak	84.80	-3.30	81.50	93.98	-12.48	F
4960	V	Peak	47.40	3.90	51.30	73.98	-22.68	H
4960	H	Peak	40.90	3.90	44.80	73.98	-29.18	H
7440	V		---					H
7440	H		---					H
Others			---					

**Middle Channel:**

Freq. (MHz)	Ant.Pol. H/V	DetectorMode (PK/AV)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)	Note
2445	V	Peak	86.20	-3.40	82.80	93.98	-11.18	F
2445	H	Peak	84.70	-3.40	81.30	93.98	-12.68	F
4890	V	Peak	48.30	3.70	52.00	73.98	-21.98	H
4890	H	Peak	40.90	3.70	44.60	73.98	-29.38	H
7335	V		---					H
7335	H		---					H
Others			---					

**Bottom Channel:**

Freq. (MHz)	Ant.Pol. H/V	DetectorMode (PK/AV)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)	Note
2405	V	Peak	85.90	-3.50	82.40	93.98	-11.58	F
2405	H	Peak	85.10	-3.50	81.60	93.98	-12.38	F
4810	V	Peak	47.80	3.80	51.60	73.98	-22.38	H
4810	H	Peak	43.00	3.80	46.80	73.98	-27.18	H
7215	V		---					H
7215	H		---					H
Others			---					

**NOTE:**

A Measuring frequencies from 30 MHz to the 25 GHz.

B “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.

C \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.

D Data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

E The IF bandwidth of EMI Test Receiver was 120KHz for measuring from 30 MHz to 1 GHz and 1 MHz for measuring above 1 GHz

## 4 Band Edge

### 4.1. Test Equipment

Please refer to Section 1.5. this report.

### 4.2. Test Procedure

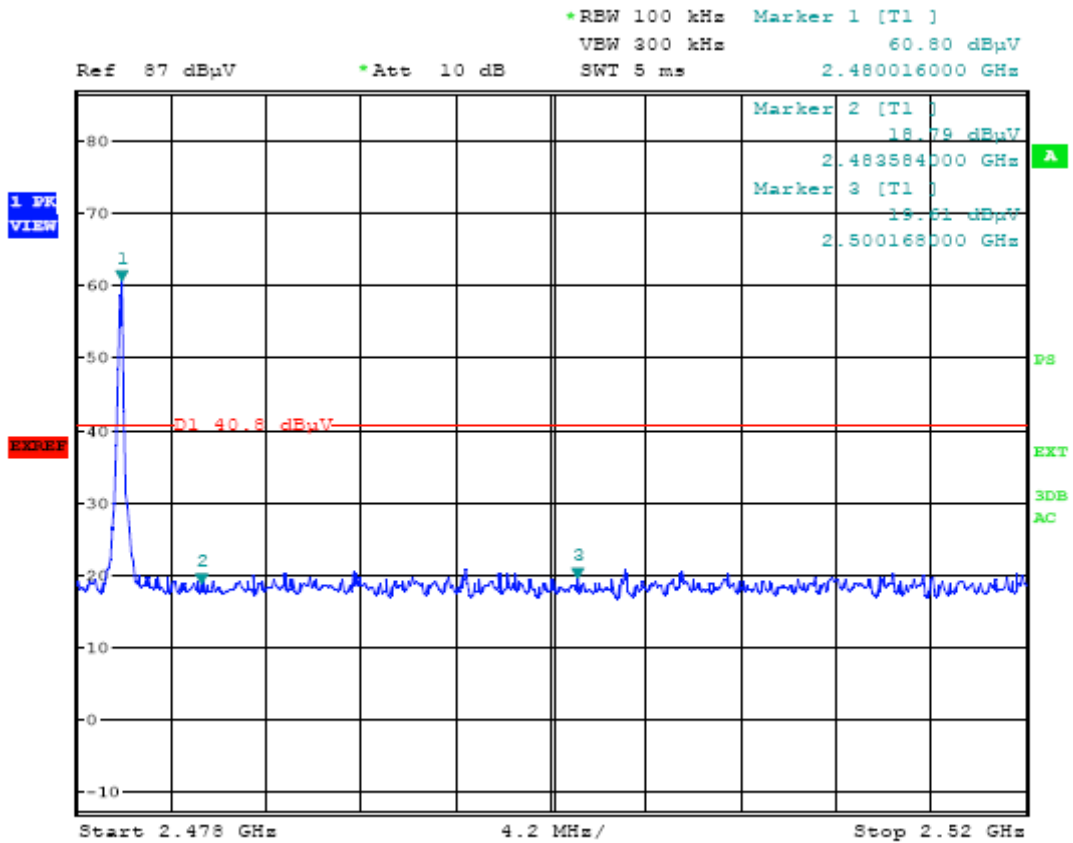
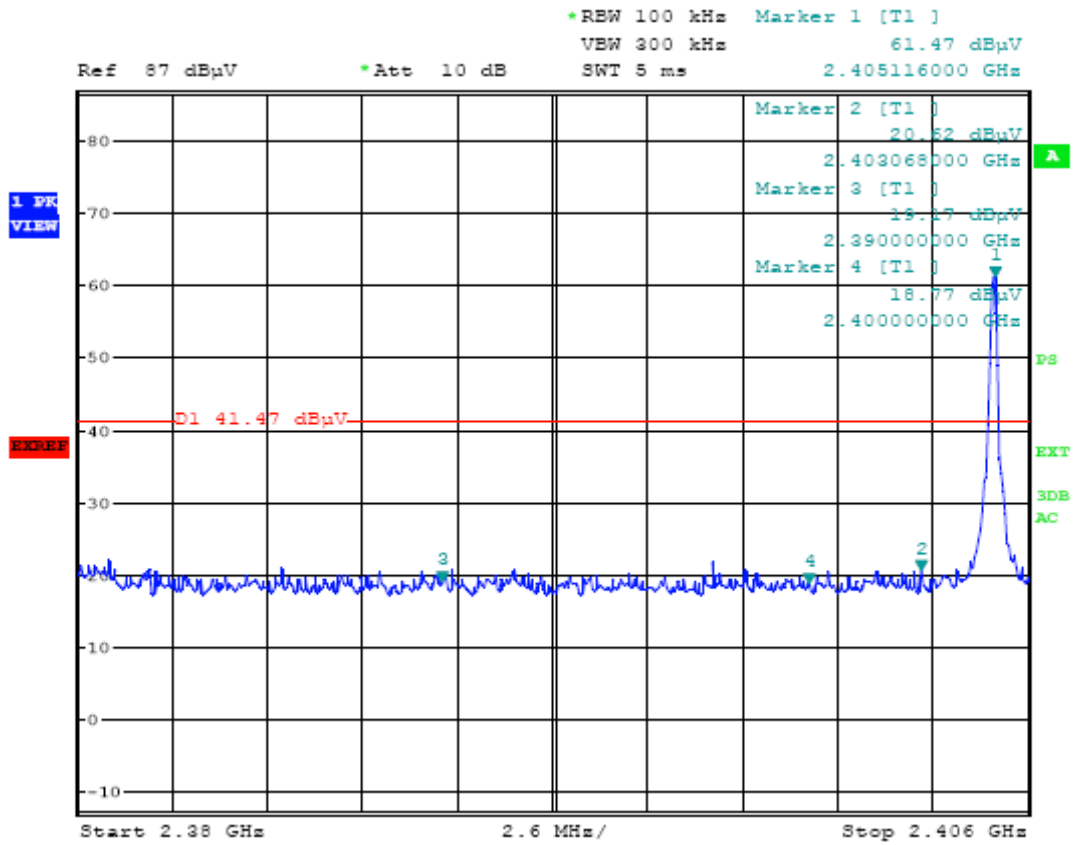
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below:



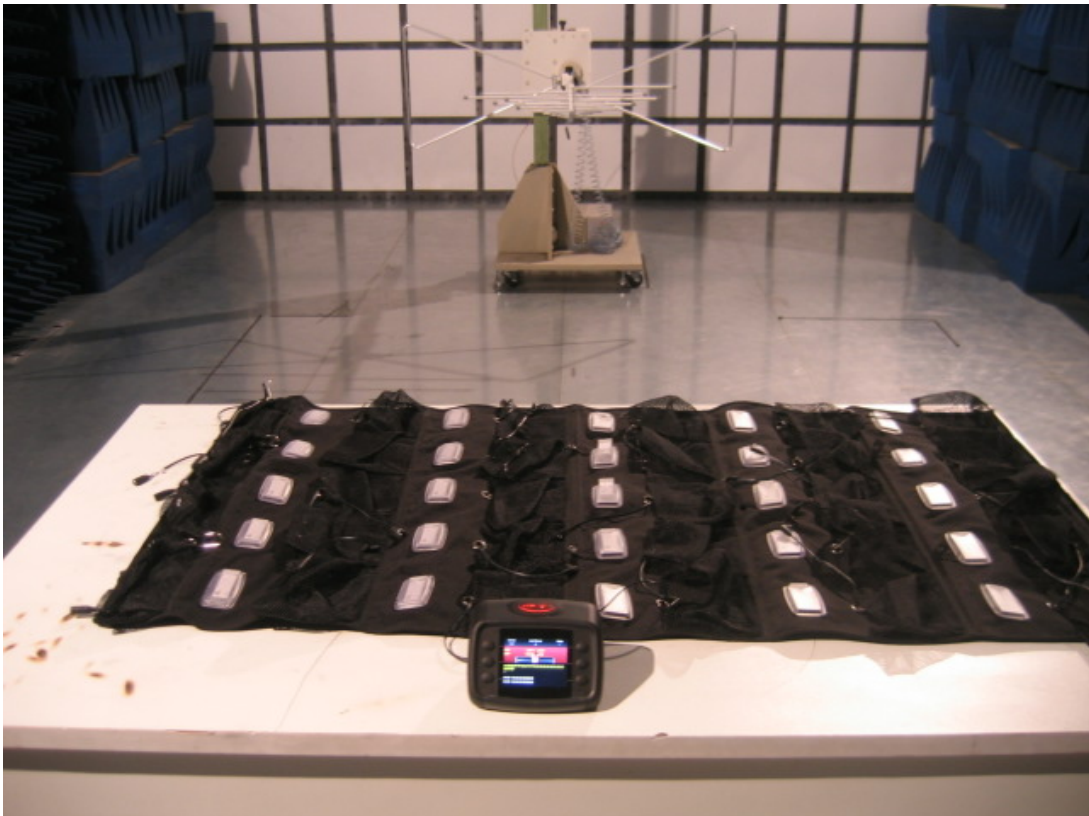
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 1MHz RBW and 1MHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

### 4.3. Test Result

Product Name:	HUB
Test Item:	20dB Band Edge Test
Test Voltage:	AC 120V/60Hz from Adapter
Mode:	TX On
Temperature:	24 °C
Humidity:	52%RH



## 5 Photographs of Test setup



## 6 Photographs of EUT

### External Photos:





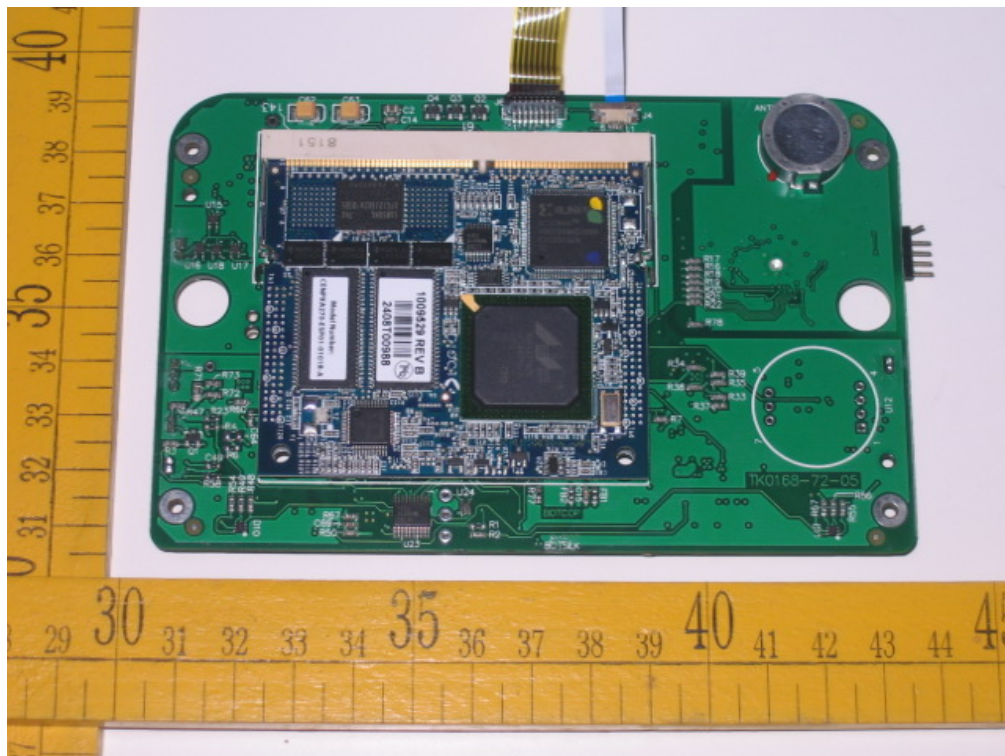


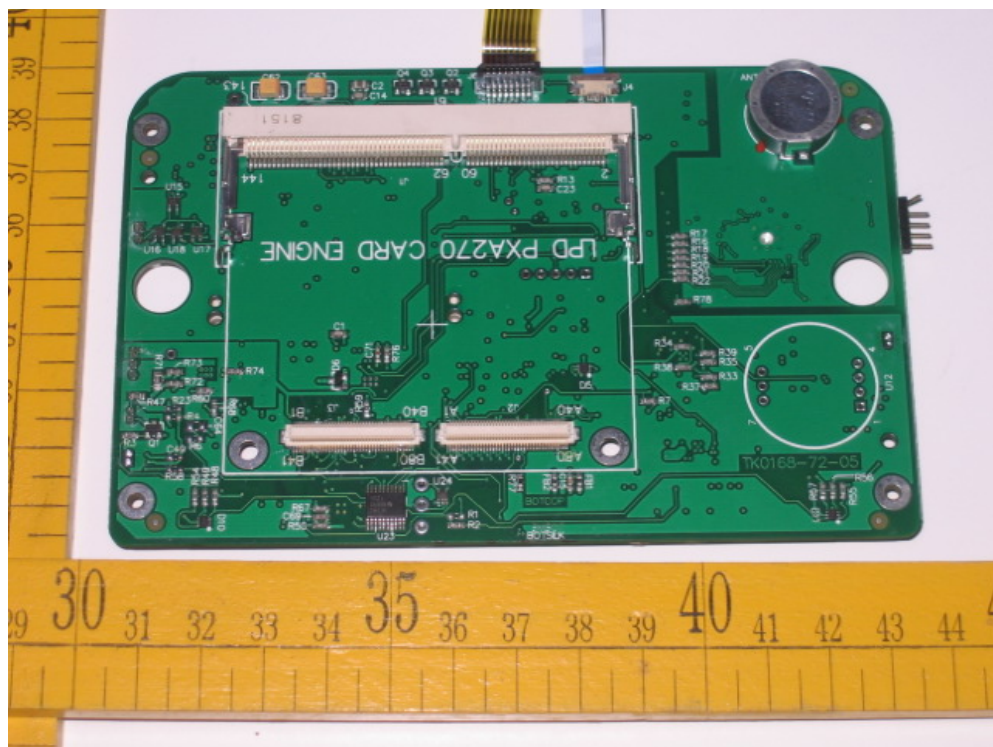
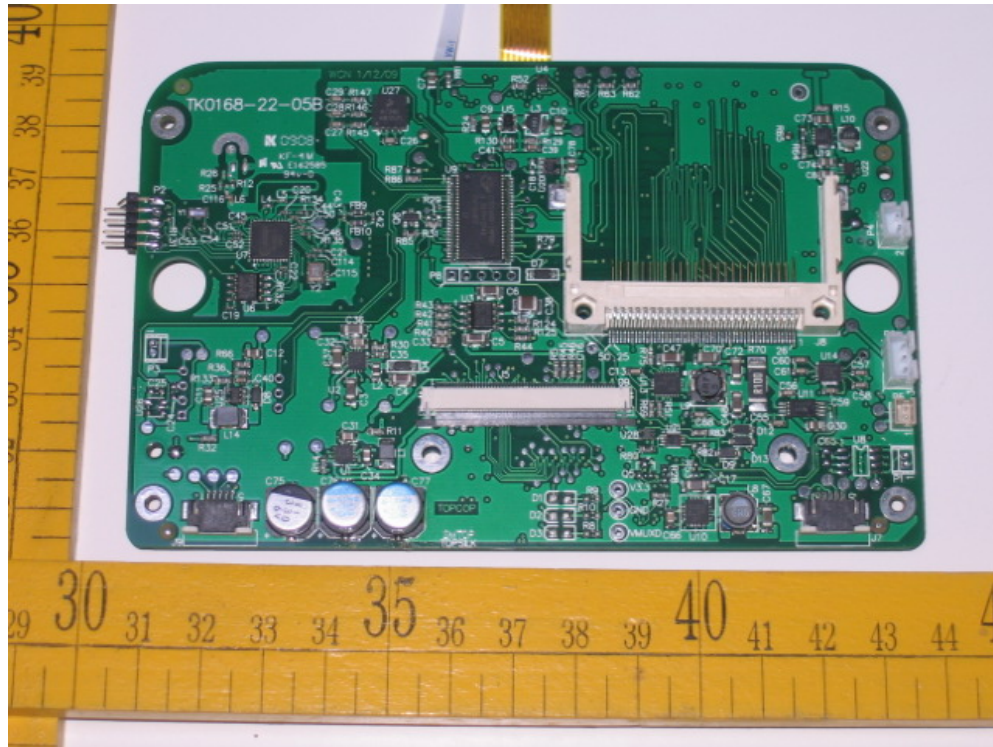




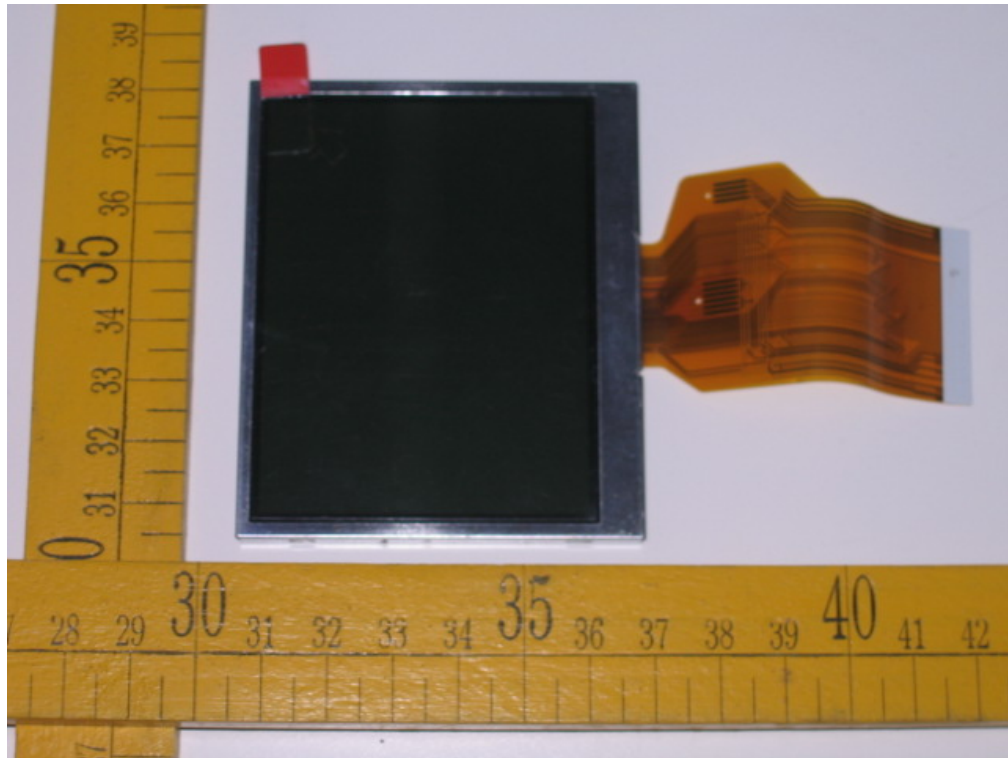


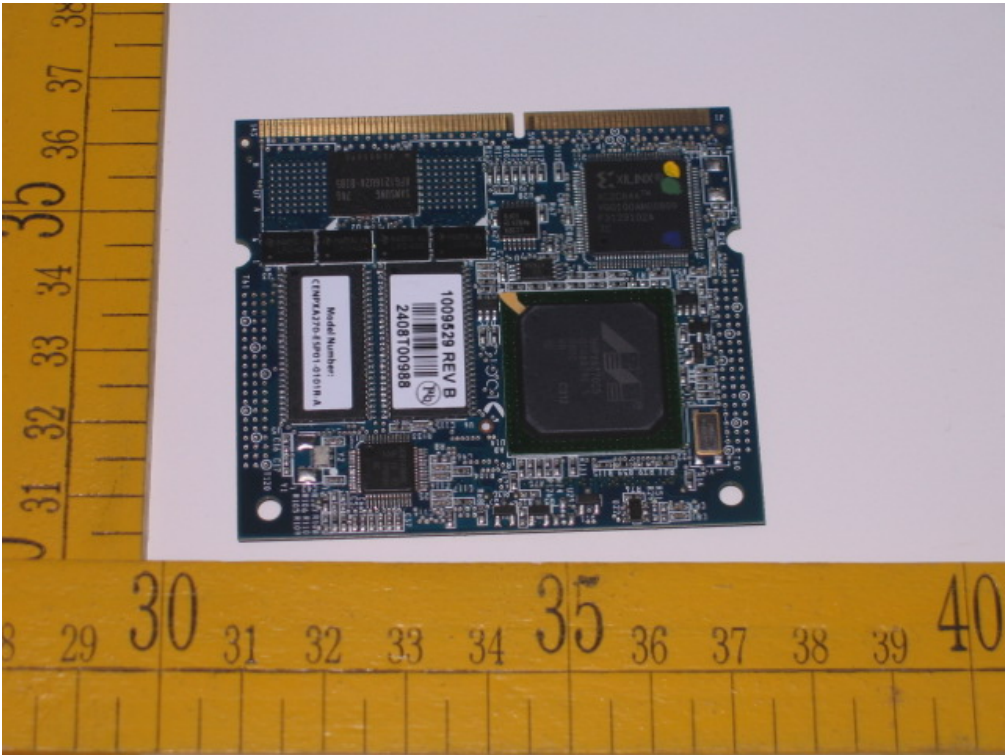
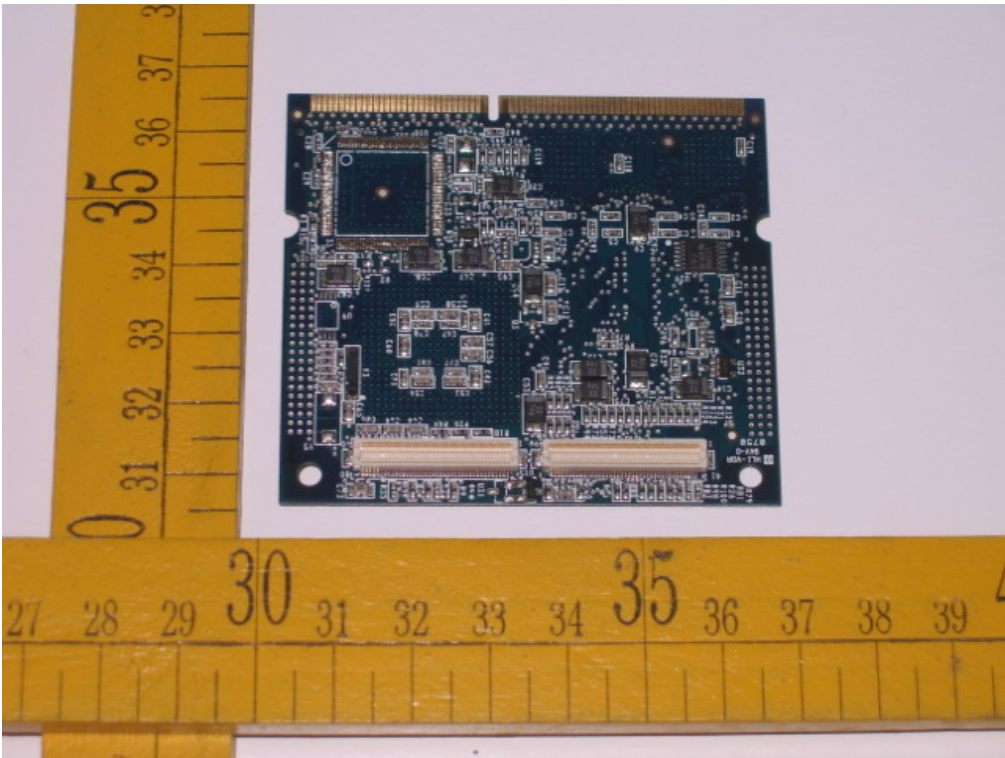
Internal Photos:

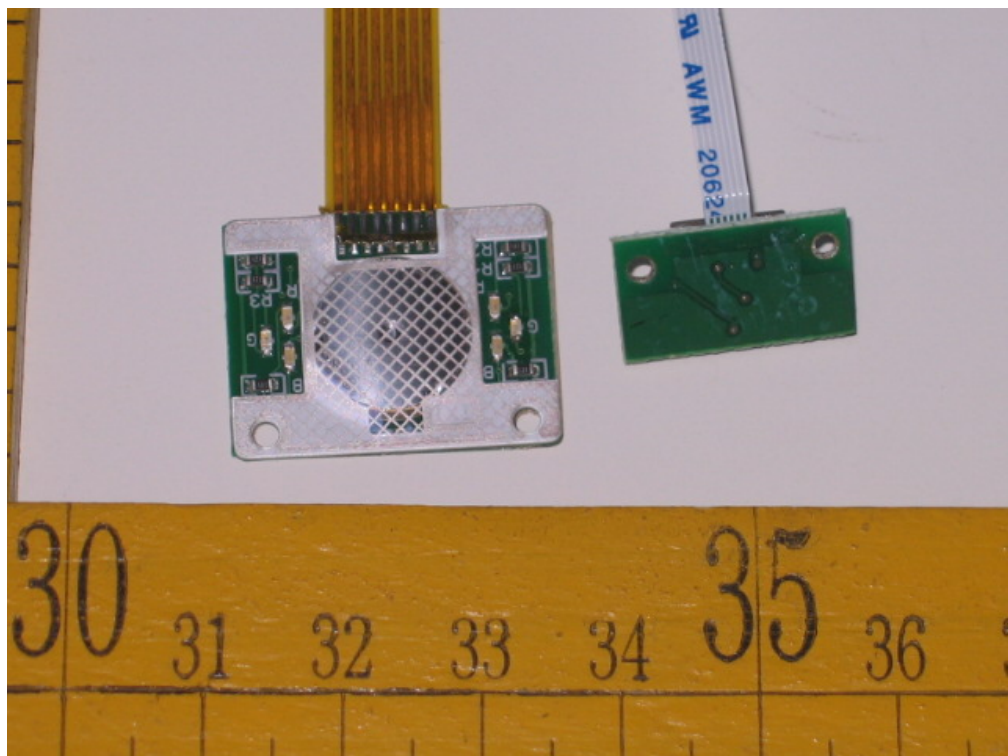
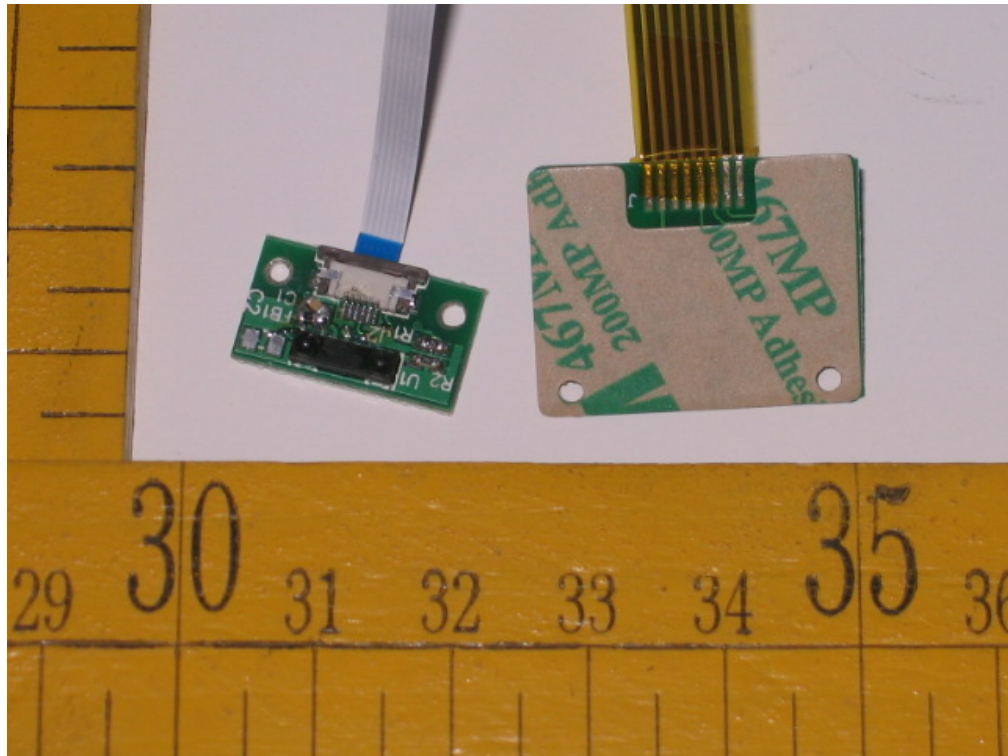










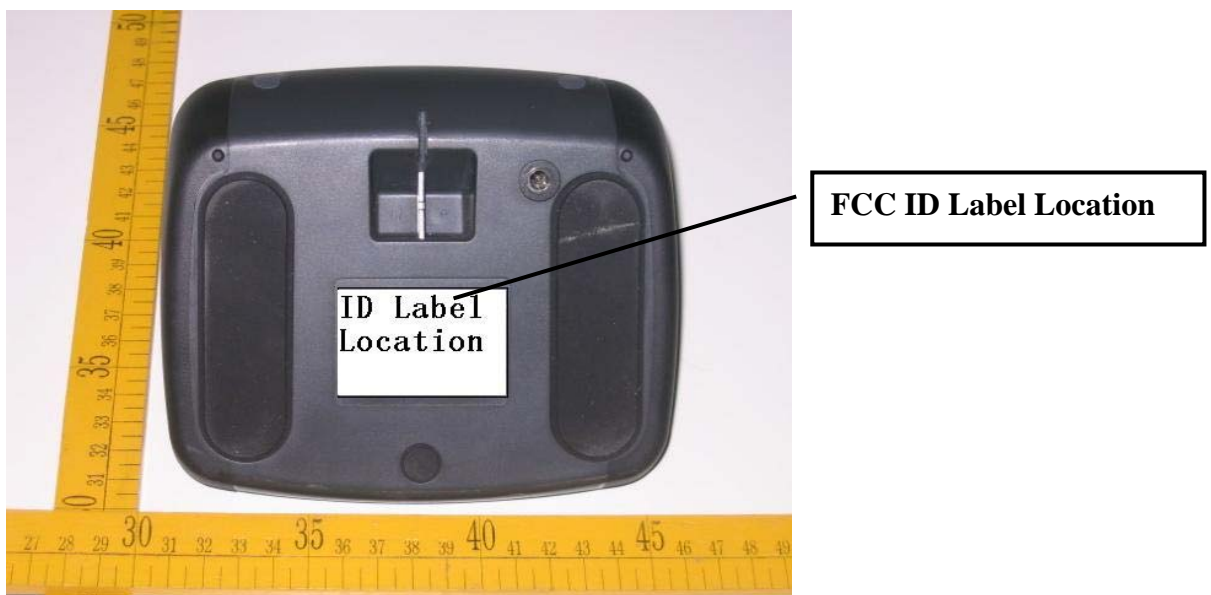




## 7 FCC ID Label

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:(1)this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.



**END of Report**