TUV SUD PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH

FCC Parts 15B & C: 2008

OF A
RF REMOTE CONTROL
[Model: RC1984751/01B]
[FCC ID: RCSRC1984751]

TEST FACILITY TÜV SÜD PSB Pte Ltd,

Electrical & Electronics Centre (EEC), Product Services,

1 Science Park Drive, Singapore 118221

FCC REG. NO. 90937 (3m & 10m OATS)

99142 (10m Semi-Anechoic Chamber) 871638 (3m Semi-Anechoic Chamber) 325572 (10m Semi-Anechoic Chamber)

IND. CANADA REG. NO. 2932I-1 (3m and 10m Semi-Anechoic Chambers)

PREPARED FOR Philips Electronics Singapore Pte Ltd

Remote Control Systems 620A Lorong 1 Toa Payoh

Singapore 319762

Tel: (65) 6882 3321 Fax: (65) 6254 1691

QUOTATION NUMBER Q09EEC02324 & 56Q0700684

JOB NUMBER S09EEC01781 & 56S070510

TEST PERIOD 20 Jul 2009
PREPARED BY

Quek Keng Huat

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APPROVED BY

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LA-2007-0380-A-1 LA-2007-0381-F LA-2007-0382-B LA-2007-0383-G LA-2007-0384-G LA-2007-0386-E LA-2007-0386-C

LA-2007-0380-A

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accreditation in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.



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### **TEST SUMMARY**

The product was tested in accordance with the customer's specifications.

### **Test Results Summary**

Test Standard	Description	Pass / Fail
FCC Part 15: 2008		
15.107(a), 15.207	Conducted Emissions	Not Applicable *See Note 2
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.231(b)	Radiated Emissions (Fundamental and Harmonics)	Pass
15.231(c)	20dB Bandwidth	Pass
15.35(c)	Duty Cycle Factor Computation	Refer to page 19



### **TEST SUMMARY**

#### **Notes**

- 1. The EUT is a Class B device when in non-transmitting state and meets the FCC Part15B Class B requirements.
- 2. The Equipment Under Test (EUT) is a battery-operated device and contains no provision for public utility connections.
- 3. All test measurement procedures are according to ANSI C63.4: 2003.
- 4. The following EUT models are the derived models from base model RC11984720/00RF. Shall the tested model comply to the requirements, the IR model (RC1984741/01B) is deemed to meet the same requirements.
  - a. RC1984751/01B (IR remote with RF support)
  - b. RC1984741/01B (IR remote only)

#### **Modifications**

No modifications were made.





### PRODUCT DESCRIPTION

Description : The Equipment Under Test (EUT) is a RF REMOTE CONTROL.

Manufacturer : Philips Electronics Singapore Pte Ltd

Remote Control Systems 620A Lorong 1 Toa Payoh

Singapore 319762

Model Number : RC1984751/01B

FCC ID : RCSRC1984751

Serial Number : 3139 228 57131

Microprocessor : Samsung - S3C80F9BRX

Operating / Transmitting

Frequency

433.92MHz ± 14kHz

Clock / Oscillator Frequency : 8MHz & 13.56MHz

Modulation : Frequency Shift Keying (FSK)

Port / Connectors : Nil

Rated Input Power : 3Vdc Battery Powered (2×1.5V AA size batteries)

Accessories : Nil



### SUPPORTING DESCRIPTION DESCRIPTION

The EUT was tested as a stand-alone unit without any supporting equipment.





### **EUT OPERATING CONDITIONS**

### FCC Part 15

1. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)

The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at 433.92MHz continuously.





### **RADIATED EMISSION TEST**

### FCC Part 15.205 Restricted Bands

N	ИHz			MHz			MHz			GHz	
0.090	-	0.110	16.42	-	16.423	399.9	-	410	4.5	-	5.15
0.495	-	0.505	16.69475	-	16.69525	608	-	614	5.35	-	5.46
2.1735	-	2.1905	16.80425	-	16.80475	960	-	1240	7.25	-	7.75
4.125	-	4.128	25.5	-	25.67	1300	-	1427	8.025	-	8.5
4.17725	-	4.17775	37.5	-	38.25	1435	-	1626.5	9.0	-	9.2
4.20725	-	4.20775	73	-	74.6	1645.5	-	1646.5	9.3	-	9.5
6.215	-	6.218	74.8	-	75.2	1660	-	1710	10.6	-	12.7
6.26775	-	6.26825	108	-	121.94	1718.8	-	1722.2	13.25	-	13.4
6.31175	-	6.31225	123	-	138	2200	-	2300	14.47	-	14.5
8.291	-	8.294	149.9	-	150.05	2310	S	2390	15.35	-	16.2
8.362	-	8.366	156.52475	-	156.52525	2483.5	. The .	2500	17.7	-	21.4
8.37625	-	8.38675	156.7	-	156.9	2690	10.75	2900	22.01	-	23.12
8.41425	-	8.41475	162.0125	-	167.17	3260		3267	23.6	-	24.0
12.29	-	12.293	167.72	ye.	173.2	3332	-	3339	31.2	-	31.8
12.51975	-	12.52025	240	-	285	3345.8	-	3358	36.43	-	36.5
12.57675	-	12.57725	322	-	335.4	3600		4400	Ab	ove 3	8.6
13.36	-	13.41	7/				76				

### FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Quasi-Peak Limit Values (dBµV/m) @ 3m
40.0
43.5
46.0
54.0*

### FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) –	ESMI	829214/005	08 Jan 2010
ESMI3		829550/004	
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	16 Feb 2010
Schaffner Bilog Antenna – BL4	CBL6112B	2593	19 May 2010
Teseq Preamplifier (PA16)	LNA6018	70214	06 Oct 2009
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2010



#### RADIATED EMISSION TEST

### FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

- 1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
- The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
- 3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

### FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

- The EUT was switched on and allowed to warm up to its normal operating condition.
- 2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which attitude and equipment arrangement produces such emissions.
- 3. The test was carried out at the selected frequency points obtained from the prescan in step 2. 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.
- 4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
- 5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
- 6. The frequency range covered was from 30MHz to 10<sup>th</sup> harmonics of the EUT fundamental frequency, using the Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

#### Sample Calculation Example

At 300 MHz

Q-P limit (Class B) =  $200 \mu V/m = 46.0 dB\mu V/m$ 

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dB<sub>µ</sub>V/m

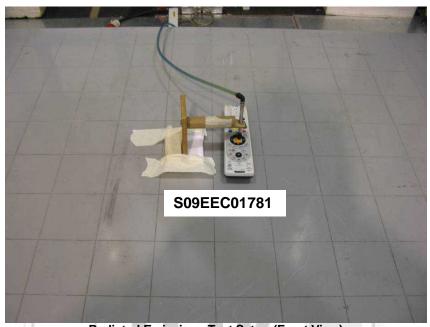
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40.0 - 46.0 = -6.0

i.e. 6 dB below Q-P limit



### **RADIATED EMISSION TEST**



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)



#### RADIATED EMISSION TEST

### FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Test Input Power	3Vdc Battery Powered	Temperature	24°C
Test Distance	3m	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (GHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)
32.1770	19.5	-20.5	285	201	Н
50.6830	23.3	-16.7	346	201	Н
125.0000	18.0	-25.5	0	100	Н
149.7410	19.2	-24.3	116	201	Н
170.0000	14.0	-29.5	0	100	Н
603.6690	32.2	-13.8	31	100	Н

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)
			0-0	4-		
		-				

#### **Notes**

- 1. All possible modes of operation were investigated. Only the worst case emissions measured, using the average and peak detectors, are reported. All other emissions were relatively insignificant.
- 2. "--" indicates no emissions were found and shows compliance to the limits.
- 3. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
- 4. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- 5. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:

30MHz - 1GHz

- 6. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
- 7. 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%, with a coverage factor of 2, in the range 30 MHz - 25 GHz is  $\pm 4.6 \text{dB}$ .



### RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

### FCC Part 15.231(b) Radiated Emission (Fundamental and Harmonics) Limits

Fundamental Frequency (MHz)	Field Strength of Fundamental Limit Values @ 3m (dBµV/m) *	Field Strength of Harmonics Limit Values @ 3m (dBµV/m) *
40.66 - 40.70	67.0	47.0
70 - 130	62.0	42.0
130 - 174	62.0 to 71.5 **	42.0 to 51.5 **
174 - 260	71.5	51.5
260 - 470	71.5 to 82.0 **	51.5 to 62.0 **
Above 470	82.0	62.0

<sup>\*</sup> Average detector employed. A peak limit of 20dB above the average limit does apply.

### Note:

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows. The maximum permitted unwanted emission level (harmonic) is 20dB below the maximum permitted fundamental level.

- Band 130MHz 174MHz 20 log [56.81818(F) - 6136.3636]
- Band 260MHz 470MHz
   20 log [41.6667(F) 7083.3333]

### FCC Parts 15.231(b) Radiated Emission (Fundamental and Harmonics) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) –	ESMI	829214/005	08 Jan 2010
ESMI3		829550/004	
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	16 Feb 2010
Schaffner Bilog Antenna – BL4	CBL6112B	2593	19 May 2010
Teseq Preamplifier (PA16)	LNA6018	70214	06 Oct 2009
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2010

<sup>\*\*</sup> Liner interpolations (in  $\mu V/m$ ).



#### RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

### FCC Part 15.231(b) Radiated Emission (Fundamental and Harmonics) Test Setup

- 1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
- The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
- 3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

### FCC Part 15.231(b) Radiated Emission (Fundamental and Harmonics) Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition.
- A prescan was carried out to pick the fundamental and harmonics emission frequencies from the EUT.
   For EUT which is a portable device, the prescan was carried out by rotating the EUT through three
   orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
- 3. The test was carried out at the selected frequency points obtained from the prescan in step 2. 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.
- 4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
- 5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
- 6. The frequency range covered was from the EUT fundamental frequency until its 10<sup>th</sup> harmonics, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

#### Sample Calculation Example

At 300 MHz

Q-P limit (Class B) =  $200 \mu V/m = 46.0 dB\mu V/m$ 

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBµV/m

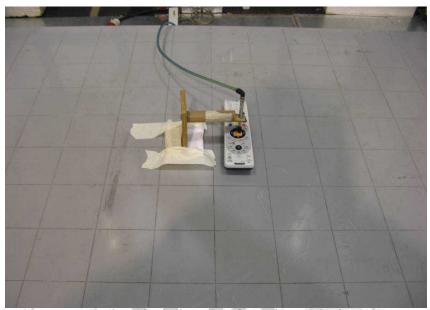
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40.0 - 46.0 = -6.0

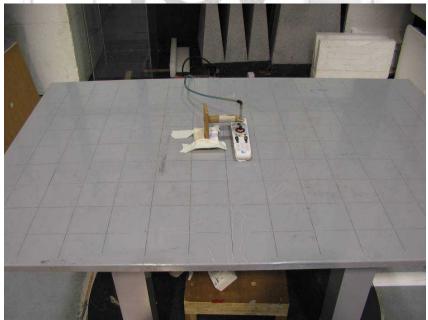
i.e. 6 dB below Q-P limit



### RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)



### RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

### FCC Part 15.231(b) Radiated Emission (Fundamental and Harmonics) Results

Test Input Power	3Vdc Battery Powered	Temperature	24°C
Test Distance	3m	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (GHz)	Peak Value (dB <sub>µ</sub> V/m)	Average Value (dBμV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Note
433.9458	79.2	74.3	-6.5	95	100	Н	Fundamental
867.3650	47.3	42.4	-18.4	208	100	Н	Harmonics
1301.0321	50.5	45.6	-15.2	0	100	Н	Harmonics
1735.8816	45.2	40.3	-20.5	0	100	V	Harmonics
2169.5523	48.3	43.4	-17.4	0	100	V	Harmonics
2603.6798	53.9	49.0	-11.8	0	100	V	Harmonics

#### **Notes**

- 1. All possible modes of operation were investigated. Only the worst case emissions measured, using the average and peak detectors, are reported. All other emissions were relatively insignificant.
- 2. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
- 3. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- 4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:

30MHz - 1GHz

RBW: 120kHz VBW: 1MHz

>1GHz

RBW: 1MHz VBW: 1MHz

- 5. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
- 6. 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%, with a coverage factor of 2, in the range 30MHz - 25GHz is  $\pm 4.6dB$ .



#### 20dB BANDWIDTH TEST

#### FCC Part 15.231(c) 20dB Bandwidth Limits

The EUT shows compliance to the requirements of this section, which states that the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

### FCC Part 15.231(c) 20dB Bandwidth Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) –	ESMI	829214/005	08 Jan 2010
ESMI3		829550/004	
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	16 Feb 2010
Schaffner Bilog Antenna – BL4	CBL6112B	2593	19 May 2010

### FCC Part 15.231(c) 20dB Bandwidth Test Setup

- The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 120kHz and 1000kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

### FCC Part 15.231(c) 20dB Bandwidth Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at 433.92MHz.
- 2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 20dB bandwidth of the transmitting frequency.
- 3. The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.
- 4. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. The frequencies below the 20dB peak frequency at lower (f<sub>L</sub>) and upper (f<sub>H</sub>) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser.
- 5. The 20dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies,  $|f_H f_L|$ .



### 20dB BANDWIDTH TEST





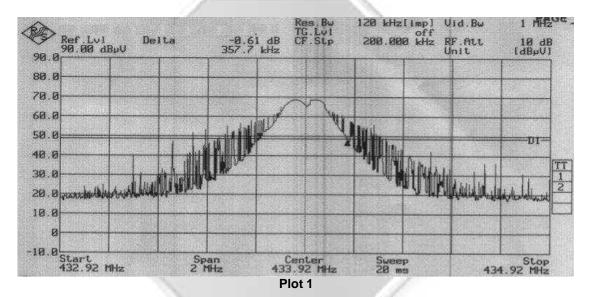
### **20dB BANDWIDTH TEST**

### FCC Part 15.231(c) 20dB Bandwidth Results

Test Input Power	3Vdc Battery Powered	Temperature	24°C
Attached Plots	3m	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Channel Frequency (MHz)	20dB Bandwidth (MHz)	
433.9200	0.3577	

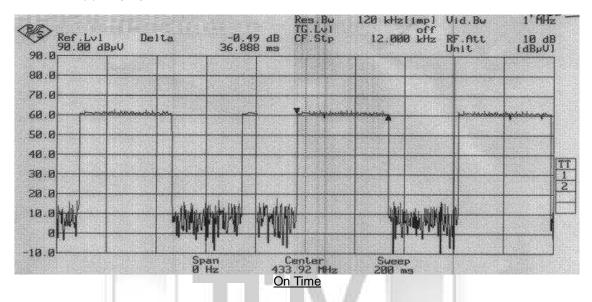
### 20dB Bandwidth Plots

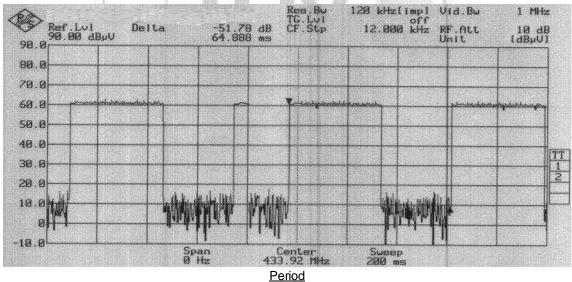




### **DUTY CYCLE FACTOR COMPUTATION**

### FCC Part 15.35(c) Duty Cycle Correction Factor





Duty Cycle Factor (worst-case)

- = 20 log [Total On time / Period]
- = 20 log [( 36.8880/64.8880)]
- = <u>-4.9dB</u>



This Report is issued under the following conditions:

- 1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.
- 2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.
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- 10. Unless otherwise stated, the tests are carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

March 2009



**EUT PHOTOGRAPHS / DIAGRAMS** 

**ANNEX A** 





### **EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A** 

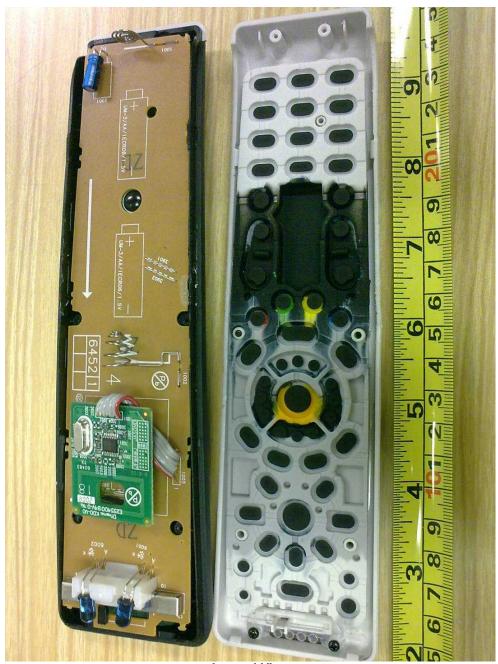


**Rear View** 



### **EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A** 

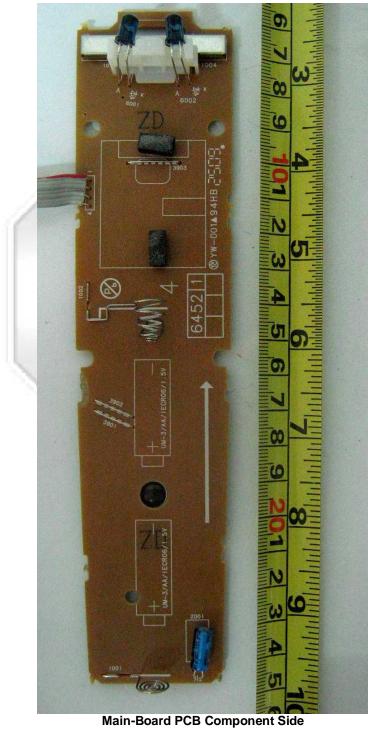


**Internal View** 



### **EUT PHOTOGRAPHS / DIAGRAMS**

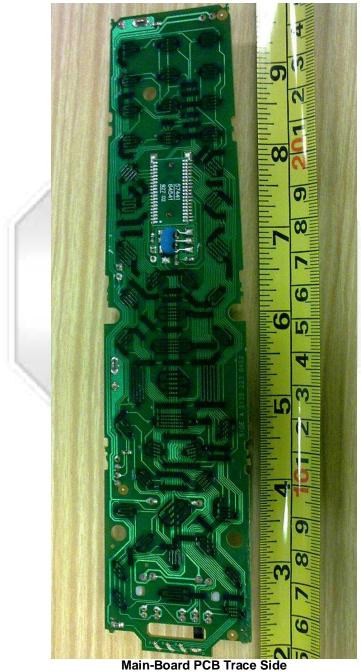
**ANNEX A** 





### **EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A** 





### **EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A** 



**RF Module Circuit Componet Side** 



### **EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A** 



**RF Module Circuit Trace Side** 



**FCC LABEL & POSITION** 

**ANNEX B** 





### **FCC LABEL & POSITION**

**ANNEX B** 

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.



Physical Location of FCC Label on EUT



# USER MANUAL TECHINCAL DESCRIPTION BLOCK & CIRCUIT DIAGRAM

**ANNEX C** 

### **ANNEX C**

# USER MANUAL TECHNICAL DESCRIPTION BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)