STC Test Report

Date : 2010-02-05
No. : HM164881

Applicant (XLT001): X 10 (USA) Inc.
620 Naches Ave SW, Building A, Renton WA 98057, United States

Manufacturer: X-10 Electronics (Shenzhen) Co., Ltd.
Together Rich Industrial Park B, Sanwei Industrial District, Xixiang Town, Baoan Country, Shengzhen, China

Description of Sample(s): Submitted sample(s) said to be:

Product:	RF-to-IR transceiver
Brand Name:	Motorola
Model Number:	RF2IR
FCC ID:	B4S-RF2IR

Date Sample(s) Received: 2010-01-28

Date Tested: 2010-02-04

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2009 and ANSI C63.4:2003 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): ----

Dr. LEE Kam Chuen,
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

The Hong Kong Standards and Testing Centre Ltd.
10 Dai Wang Street, Taipo Industrial Estate, N.T., Hong Kong
Tel: (852) 2666 1888 Fax: (852) 2664 4353 Homepage: www.hkstc.org E-mail: hkstc@hkstc.org

CONTENT:

1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate
New Territories, Hong Kong

1.2 Applicant Detail(s)

Applicant

X 10 (USA) Inc.
620 Naches Ave SW, Building A, Renton WA 98057,
United States

Manufacturer

X-10 Electronics (Shenzhen) Co., Ltd.
Together Rich Industrial Park B, Sanwei Industrial District,
Xixiang Town, Baoan Country, Shengzhen, China

1.3 Equipment Under Test [EUT]

Description of Sample(s)

Submitted sample(s) said to be:

Product:	RF-to-IR transceiver
Manufacturer:	X-10 Electronics (Shenzhen) Co., Ltd.
Brand Name:	Motorola
Model Number:	RF2IR
Input Voltage:	5Vd.c. from USB Port (REMARK: USB port for set top box only)

1.3.1 Description of EUT Operation

The Equipment Under Test (EUT) is an X 10 (USA) Inc., The EUT appears to be a transceiver acting as receiver for the IR/IF remote control operating in the 2.4GHz ISM frequency band. The EUT continues to transmit while Key is being pressed. It is FSK transmitter, Modulation by digital data; and type is FSK modulation.

1.4 Date of Order

2010-01-28

1.5 Submitted Sample(s):

1 Sample

1.6 Test Duration

2010-02-04

1.7 Country of Origin

China

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2009 Regulations and ANSI C63.4:2003 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION
Results Summary

Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Fail	N/A
Field Strength of Fundamental & Harmonics Emissions	FCC 47CFR 15.249	ANSI C63.4:2003	N/A	☒	☐	☐
Radiated Emissions	FCC 47CFR 15.209	ANSI C63.4:2003	N/A	☒	☐	☐

Note: N/A - Not Applicable

3.0 Test Results

3.1 Emission

3.1.1 Radiated Emissions

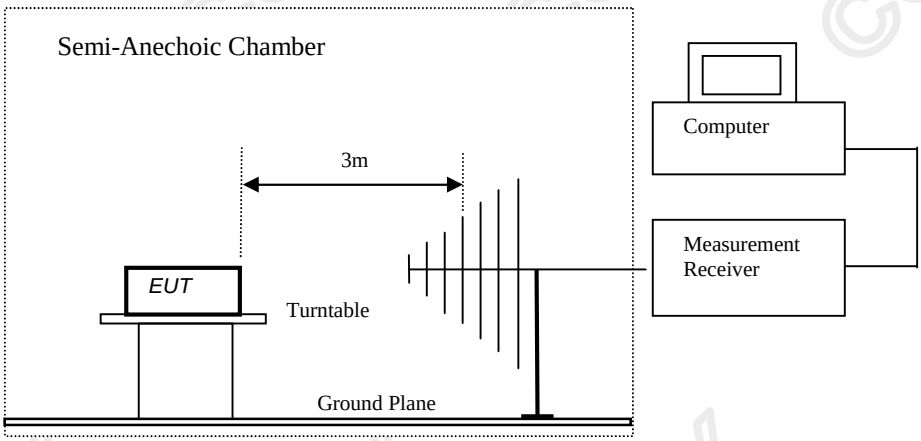
Test Requirement:	FCC 47CFR 15.249
Test Method:	ANSI C63.4:2003
Test Date:	2010-02-04
Mode of Operation:	Tx on mode

Test Method:

The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

* Semi-anechoic chamber located on the G/F of The Hong Kong Standards and Testing Centre Ltd. with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

Test Setup:



Limits for Field Strength of Fundamental & Harmonics Emissions [FCC 47CFR 15.249]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [microvolts/meter]	Field Strength of Harmonics Emission [microvolts/meter]
902-928	50,000 [Average]	500 [Average]
2400-2483.5	50,000 [Average]	500 [Average]

Results of Tx on mode (Channel 1): Pass

	Field Strength of Fundamental Emissions Peak Value					
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2404.0	58.0	29.1	87.1	22,646.4	500,000	Vertical
* 4808.2	18.7	33.2	51.9	393.6	500	Vertical
7212.0	**Emission detected are more than 20dB below the limit line**				500	Vertical
9616.0					500	Vertical
* 12020.0					500	Vertical
14424.0					500	Vertical
16828.0					500	Vertical
* 19232.0					500	Vertical
21636.0					500	Vertical
24040.0					500	Vertical

	Field Strength of Fundamental Emissions Average Value					
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
+ 2404.0	47.4	29.1	76.5	6,683.4	50,000	Vertical

Remarks:
No additional spurious emissions found between lowest internal used/generated frequen cy and 30 MHz
*: Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000 MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 1 5.209 were applied.

+: Adjusted by Duty Cycle = -10.6dB
Duty Cycle Correction =-20dB, if the calculation duty cycle correction >-20dB

Calculated measurement uncertainty : 30MHz to 1GHz 5.2dB
1GHz to 18GHz 5.1dB

Limits for Field Strength of Fundamental & Harmonics Emissions [FCC 47CFR 15.249]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [microvolts/meter]	Field Strength of Harmonics Emission [microvolts/meter]
902-928	50,000 [Average]	500 [Average]
2400-2483.5	50,000 [Average]	500 [Average]

Results of Tx on mode (Channel 2): Pass

Field Strength of Fundamental Emissions
Peak Value

	Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
	2437.0	59.3	29.3	88.6	26,915.3	500,000	Vertical
*	4875.1	16.9	33.8	50.7	342.8	500	Vertical
	7311.0	**Emission detected are more than 20dB below the limit line**				500	Vertical
	9748.0					500	Vertical
*	12185.0					500	Vertical
	14622.0					500	Vertical
	17059.0					500	Vertical
*	19496.0					500	Vertical
	21933.0					500	Vertical
	24370.0					500	Vertical

Field Strength of Fundamental Emissions
Average Value

	Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
+	2437.0	48.7	29.3	78.0	7,943.3	50,000	Vertical

Remarks:
No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz
*: Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000 MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

+: Adjusted by Duty Cycle = -10.6dB
Duty Cycle Correction =-20dB, if the calculation duty cycle correction >-20dB

Calculated measurement uncertainty : 30MHz to 1GHz 5.2dB
1GHz to 18GHz 5.1dB

Limits for Field Strength of Fundamental & Harmonics Emissions [FCC 47CFR 15.249]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [microvolts/meter]	Field Strength of Harmonics Emission [microvolts/meter]
902-928	50,000 [Average]	500 [Average]
2400-2483.5	50,000 [Average]	500 [Average]

Results of Tx on mode (Channel 3): Pass

Field Strength of Fundamental Emissions
Peak Value

	Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
	2470.0	59.7	29.7	89.4	29,512.1	500,000	Vertical
*	4940.7	17.5	34.0	51.5	375.8	500	Vertical
	7410.0	**Emission detected are more than 20dB below the limit line**				500	Vertical
	9880.0					500	Vertical
*	12350.0					500	Vertical
	14820.0					500	Vertical
	17290.0					500	Vertical
*	19760.0					500	Vertical
	22230.0					500	Vertical
	24700.0					500	Vertical

Field Strength of Fundamental Emissions
Average Value

	Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
+	2470.0	49.1	29.7	78.8	8,709.6	50,000	Vertical

Remarks:
No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz
*: Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000 MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

+: Adjusted by Duty Cycle = -10.6dB
Duty Cycle Correction =-20dB, if the calculation duty cycle correction >-20dB

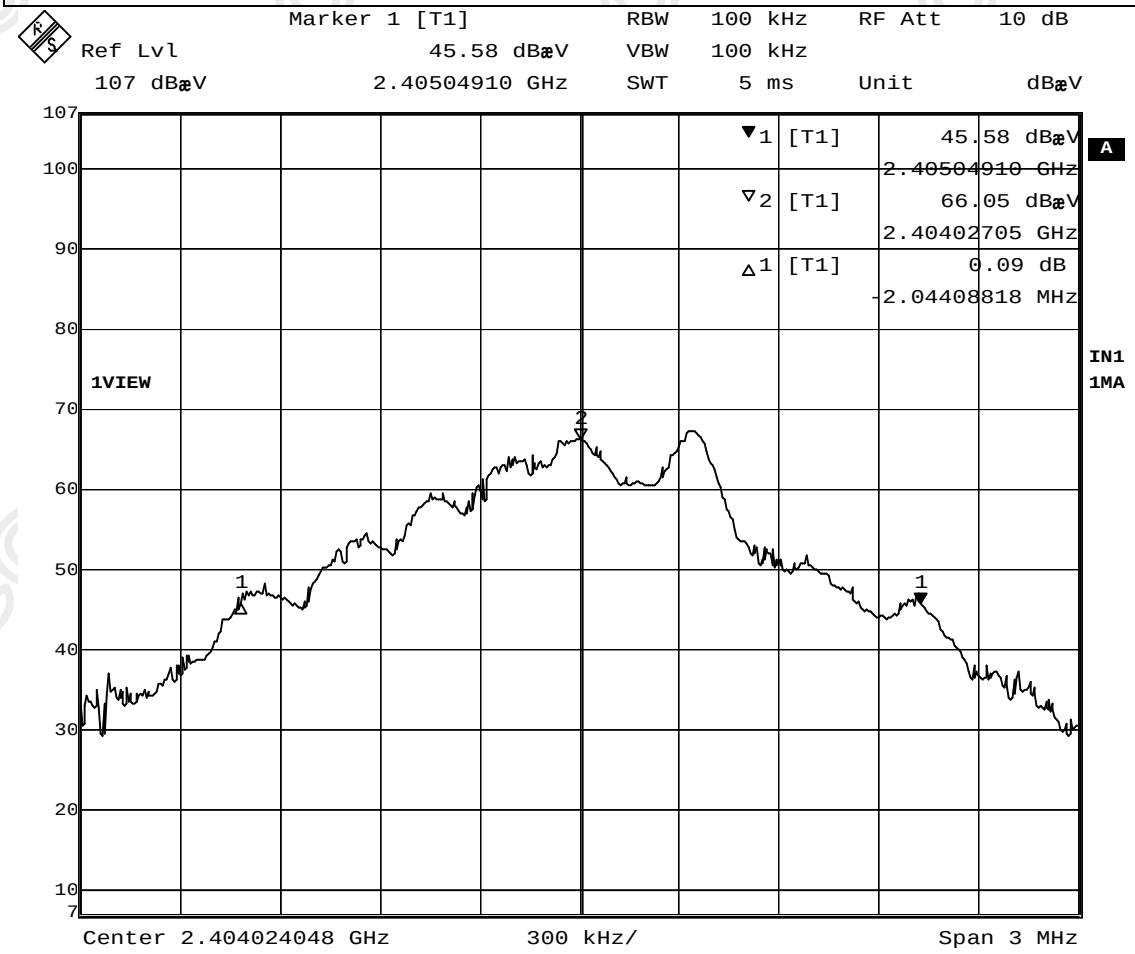
Calculated measurement uncertainty : 30MHz to 1GHz 5.2dB
1GHz to 18GHz 5.1dB

Limits for 20dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [MHz]
2404	2.04

Channel 1

20dB Bandwidth of Fundamental Emission

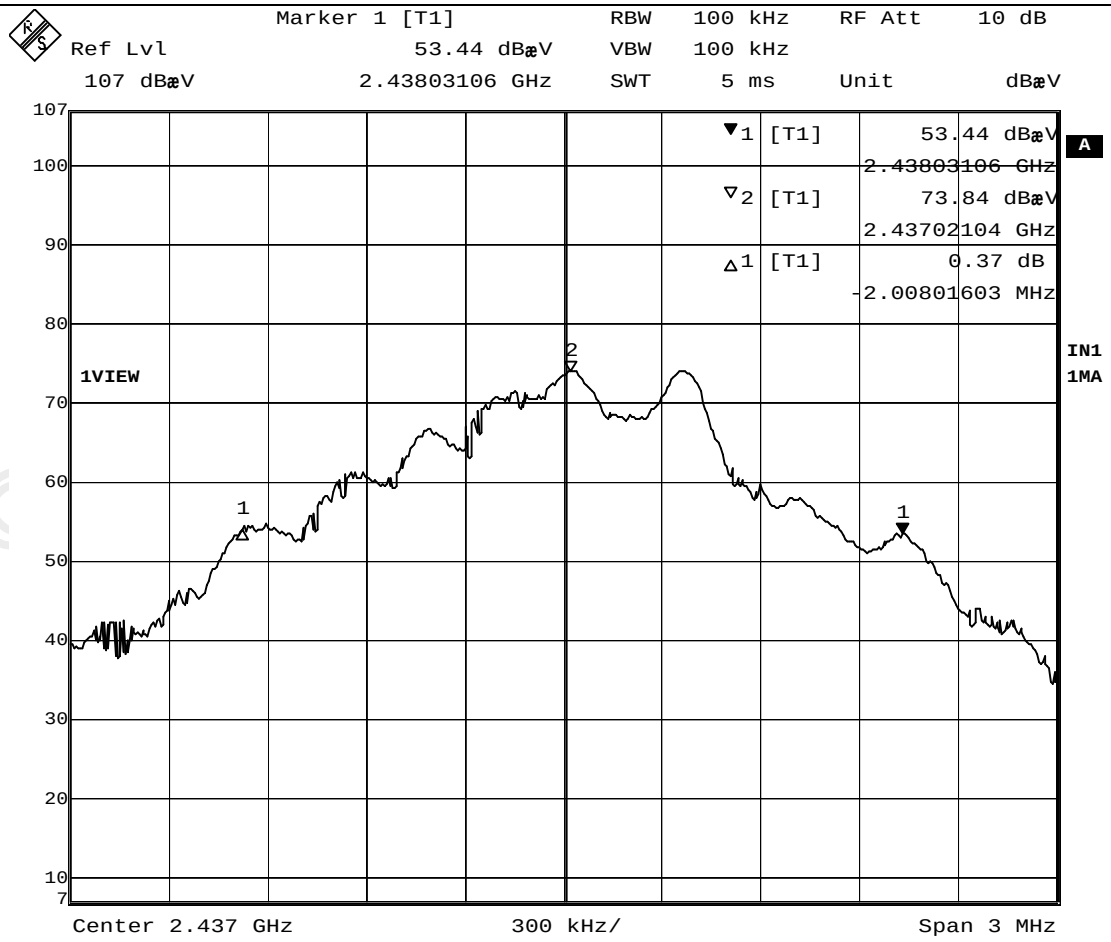


Limits for 20dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [MHz]
2437	2.01

Channel 2

20dB Bandwidth of Fundamental Emission

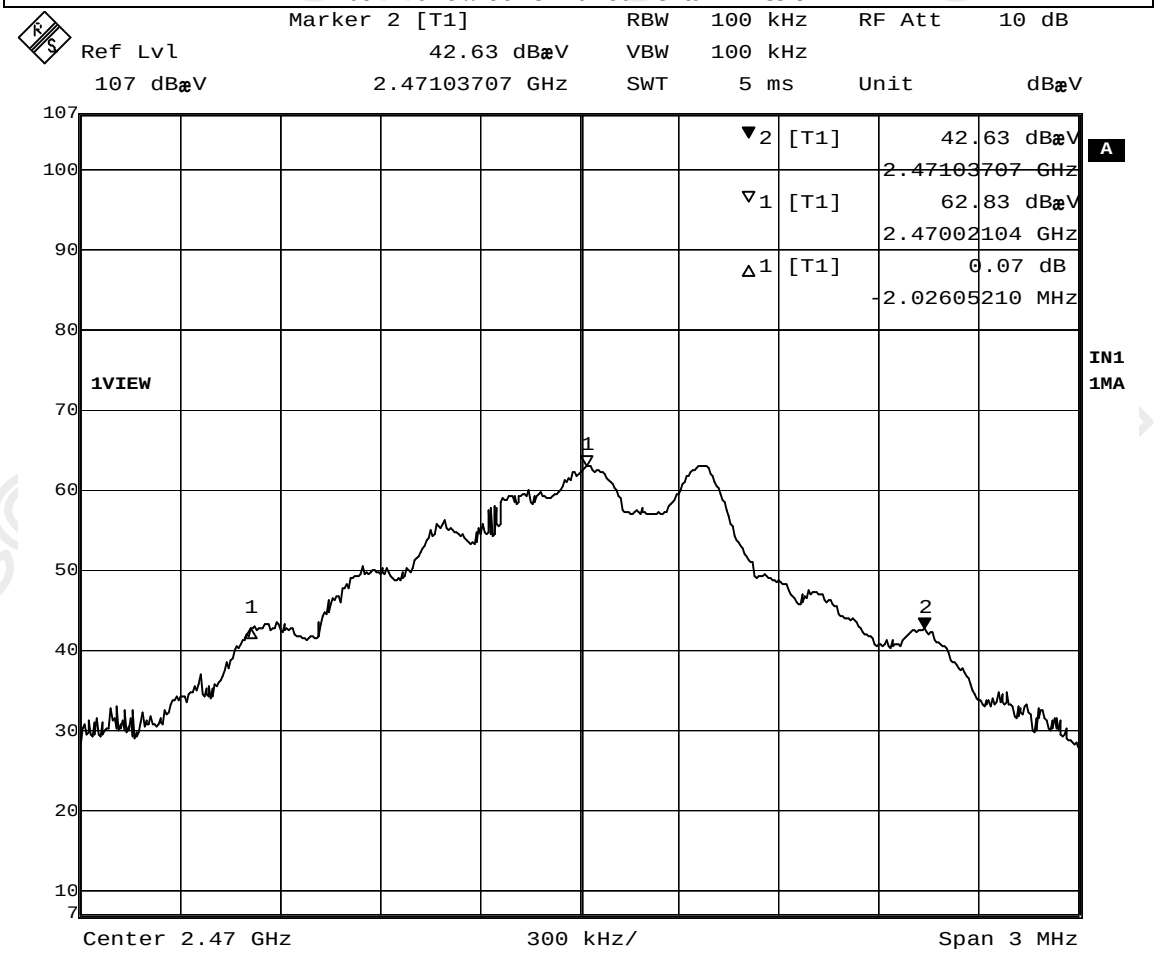


Limits for 20dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [MHz]
2470	2.03

Channel 3

20dB Bandwidth of Fundamental Emission



Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [μV/m]
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Results of Tx On Mode: PASS

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dBμV/m	Limit @3m dBμV/m	Level @3m μV/m	Limit @3m μV/m
Emissions detected are more than 20 dB below the FCC Limits					

Results of Rx On Mode: PASS

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dBμV/m	Limit @3m dBμV/m	Level @3m μV/m	Limit @3m μV/m
Emissions detected are more than 20 dB below the FCC Limits					

Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : 30MHz to 1GHz 5.2dB

1GHz to 18GHz 5.1dB

Appendix A

List of Measurement Equipment

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM020	HORN ANTENNA	EMCO	3115	4032	2009/09/02	2010/09/02
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-Linggren	FACT-3	--	2008/12/01	2011/12/01
EM083	STCOATS	--	--	--	2008/12/08	2011/12/08
EM194	BICONILOG ANTENNA	EMCO	3142B	1795	2008/09/08	2010/09/08
EM219	BICONILOG ANTENNA	EMCO	3142C	00029071	2009/01/06	2011/01/06
EM229	EMI Test Receiver	R&S	ESIB40	100248	2009/09/27	2010/09/27
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2009/07/26	2011/07/26

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM197	LISN	EMCO	4825/2	1193	2009/05/15	2010/05/15
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2009/06/29	2010/06/29
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2010/01/23	2011/01/23

Remarks:-

CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

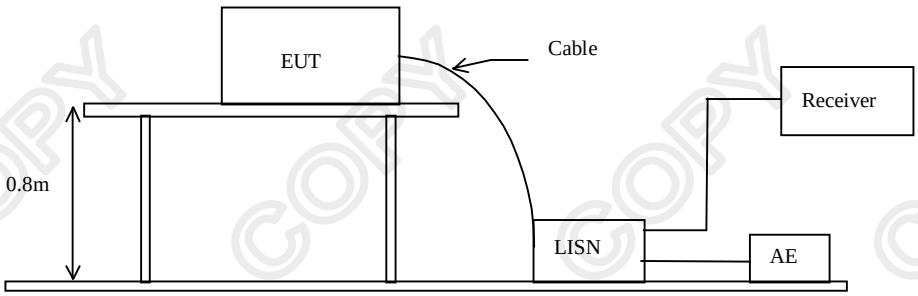
3.1.2 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:2003
Test Date:	2010-02-11
Mode of Operation:	On mode

Test Method:

The test was performed in accordance with ANSI C63.4: 2003, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



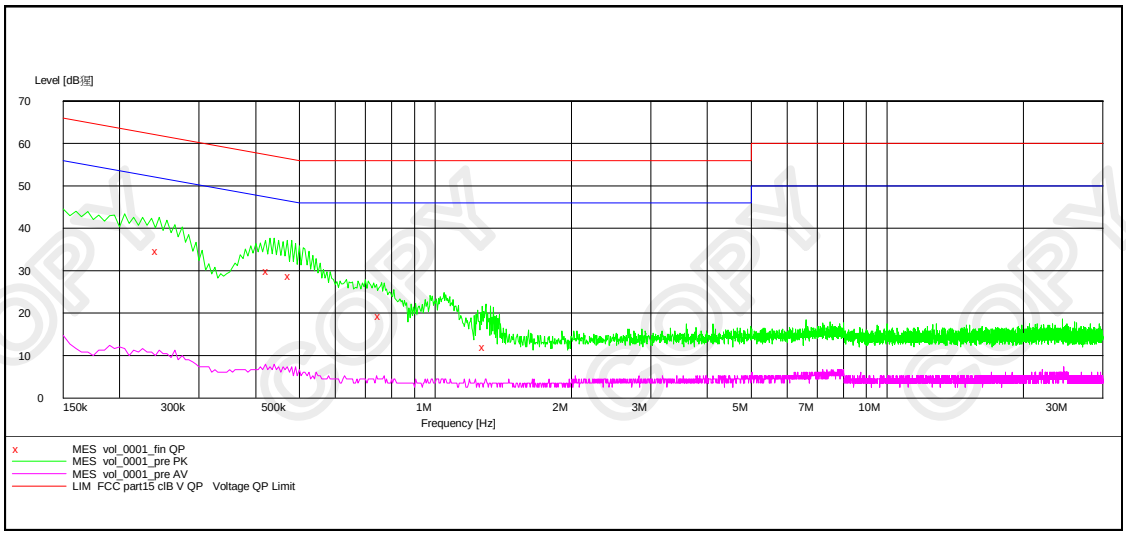
Limit for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of On mode: PASS



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level μV	Limit μV
Live	0.245	34.7	62.0	-*-	-*-
Neutral	0.430	-*-	-*-	30.0	57.0
Neutral	0.480	-*-	-*-	28.7	56.0
Neutral	0.760	-*-	-*-	19.4	56.0
Neutral	1.295	-*-	-*-	12.0	56.0

Remarks:
Calculated measurement uncertainty : 3.97dB
-*- Emission(s) that is far below the corresponding limit line.

Appendix A

Appendix B

Duty Cycle Correction During 100msec

Each sample unit sends a different series of characters, but each pulse period (100msec) never exceeds a series of 184 long (0.160msec) pulses. Assuming any combination of short and long pulses may be obtained due to encoding the worst case transmit duty cycle would be considered 184x0.16msec per 100msec=29.4% duty cycle. Figure A through E show the characteristics of the pulse train for one of these functions.

Remarks:

Duty Cycle Correction = 20Log (0.294) =-10.6dB
Duty Cycle Correction =-20dB, if the calculation duty cycle correction >-20dB

The following figures [Figure A to Figure E] showed the characteristics of the pulse train for one of these functions.

Figure A [100ms period]

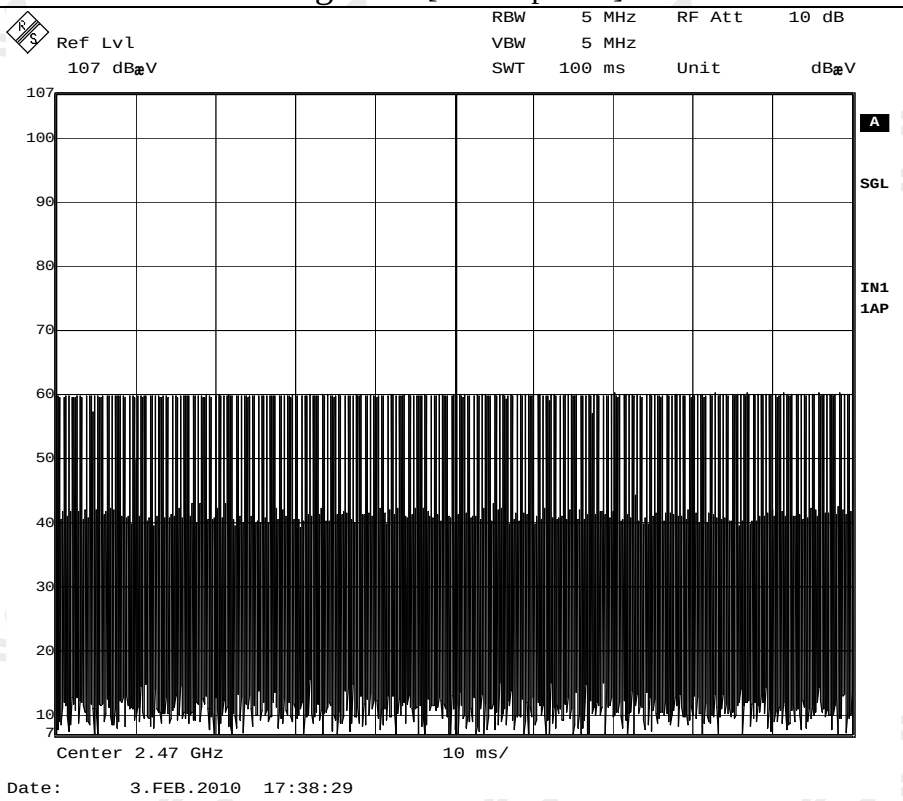


Figure B [50ms period]

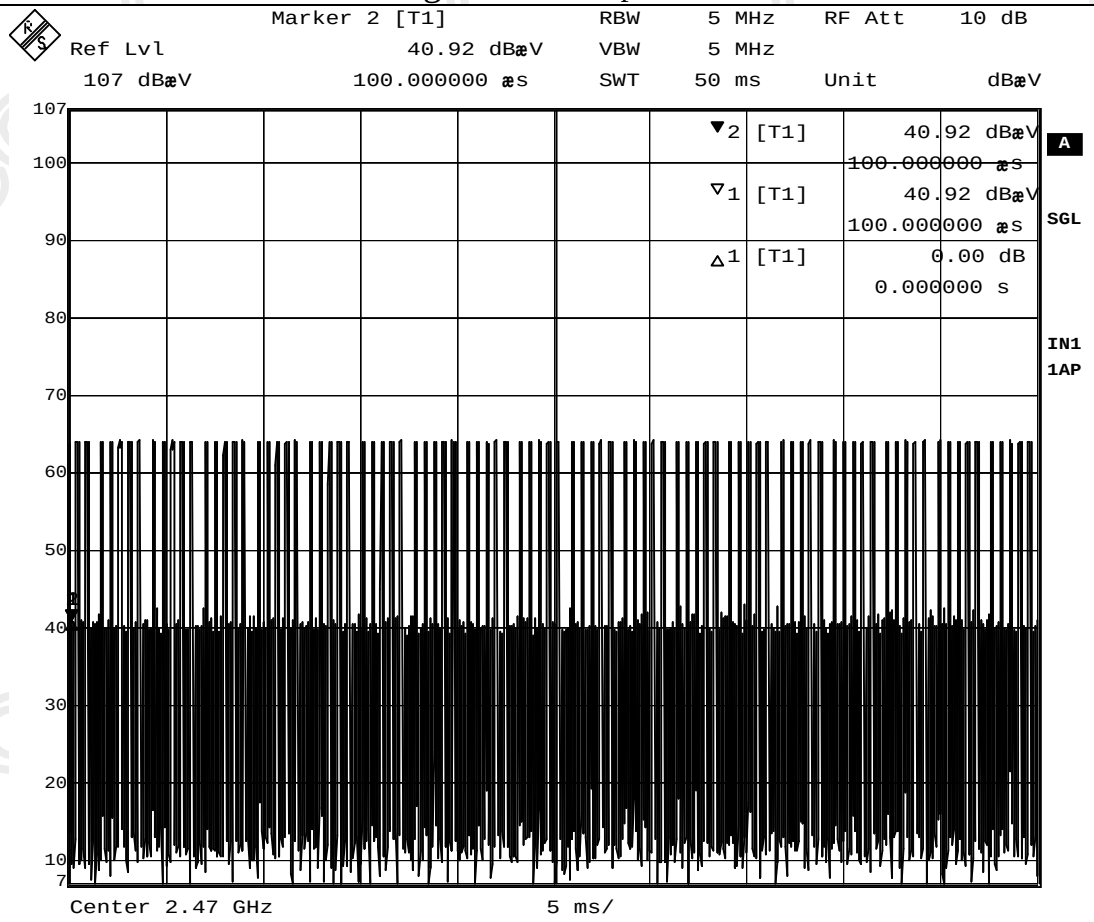


Figure C [pulses period]

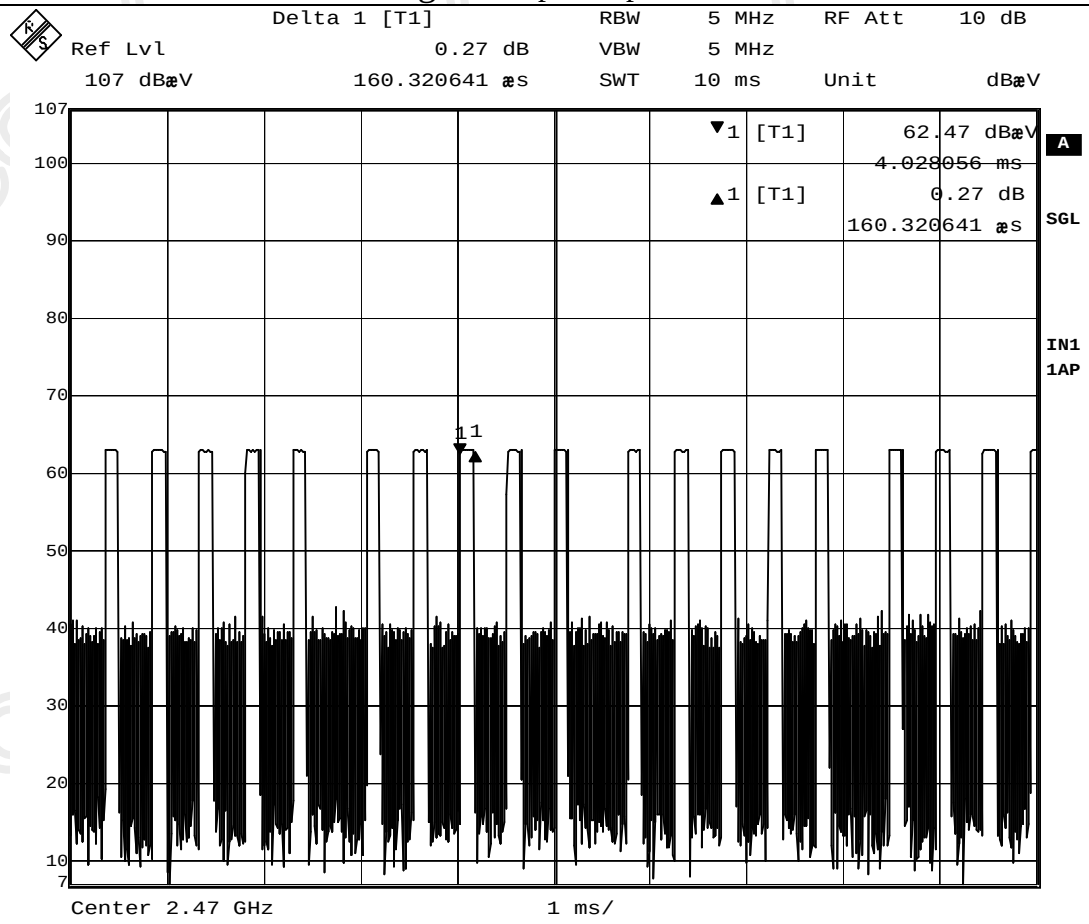
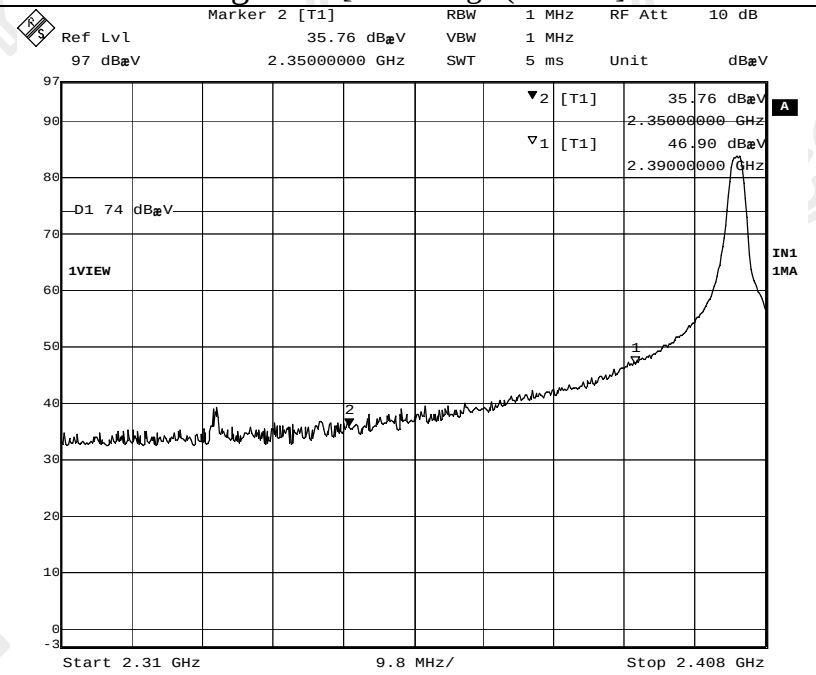


Figure D [Band-Edge (CH low]



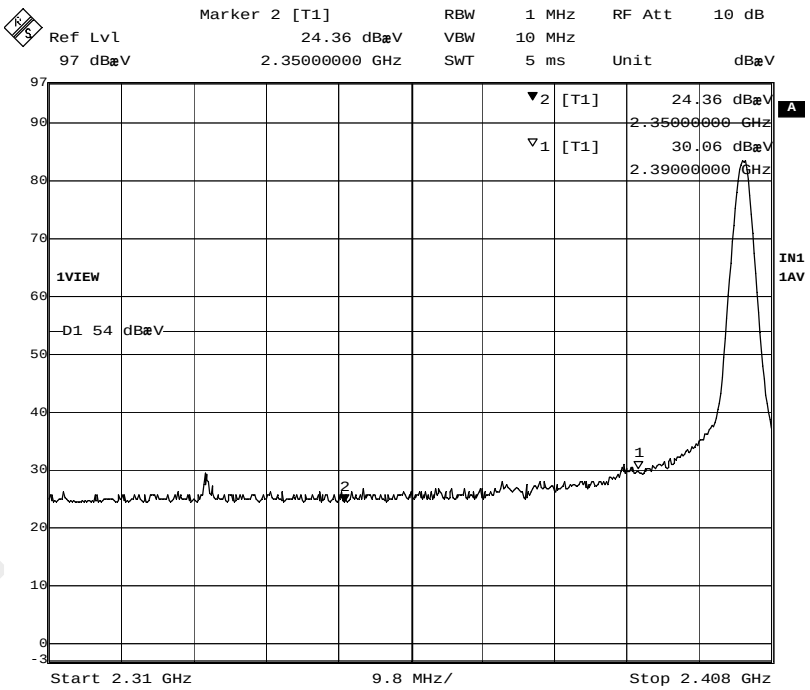
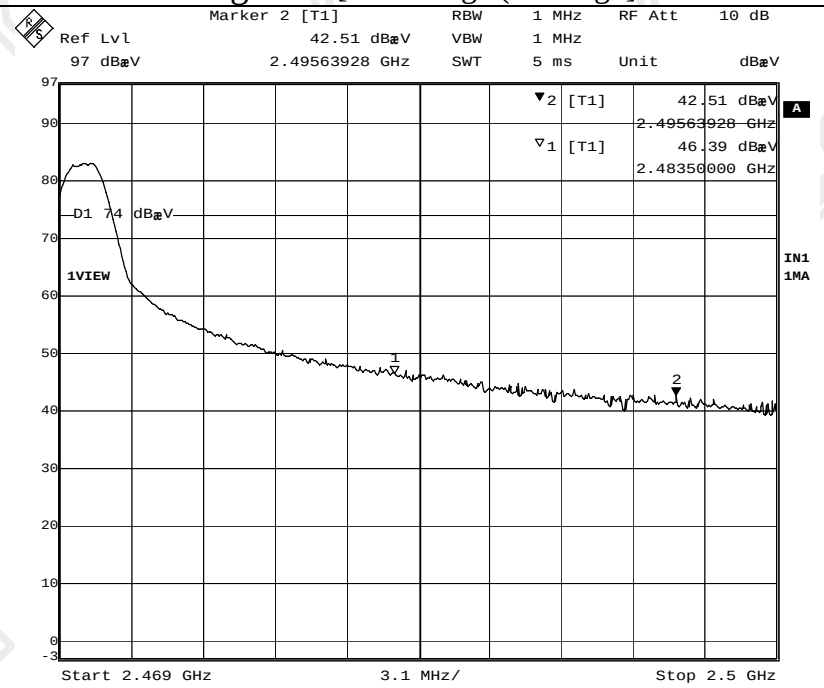
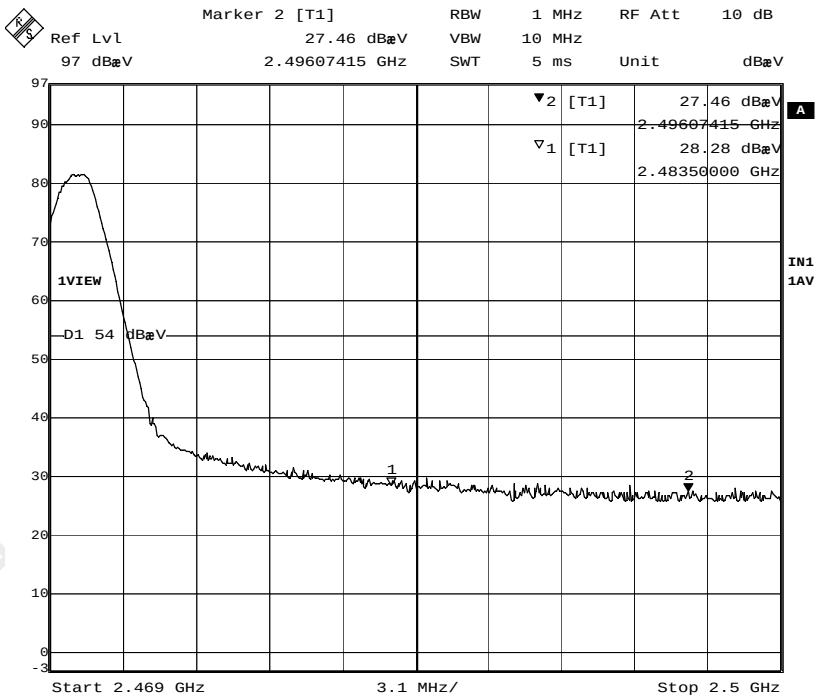


Figure E [Band-Edge (CH High]





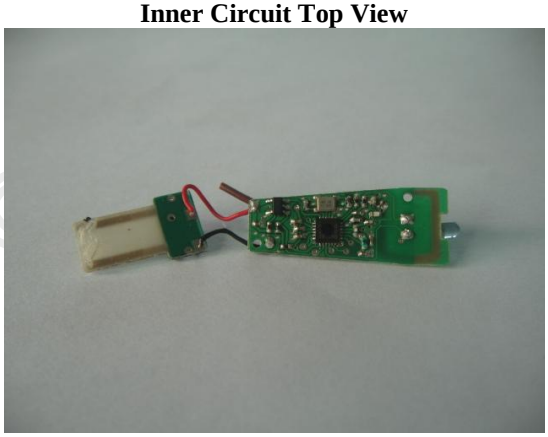
Appendix C

Photographs of EUT

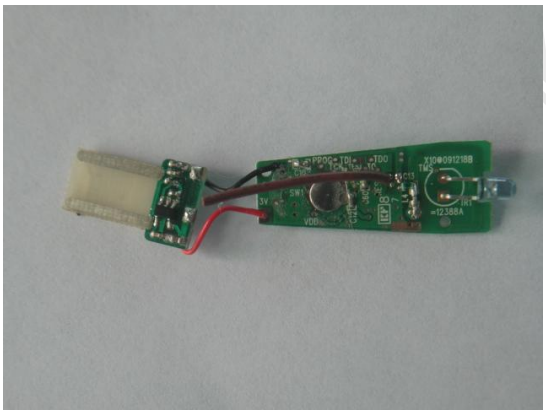
Front View of the product

Rear View of the product

Inner Circuit Top View

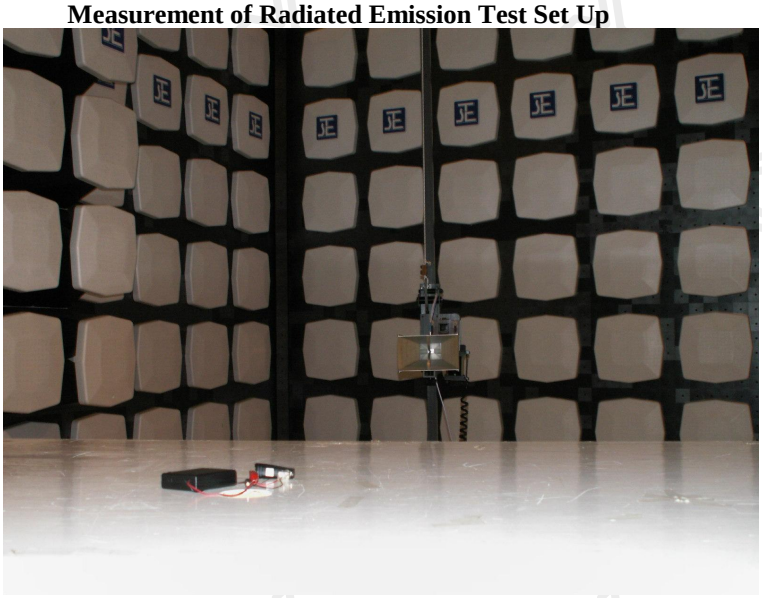


Inner Circuit Bottom View

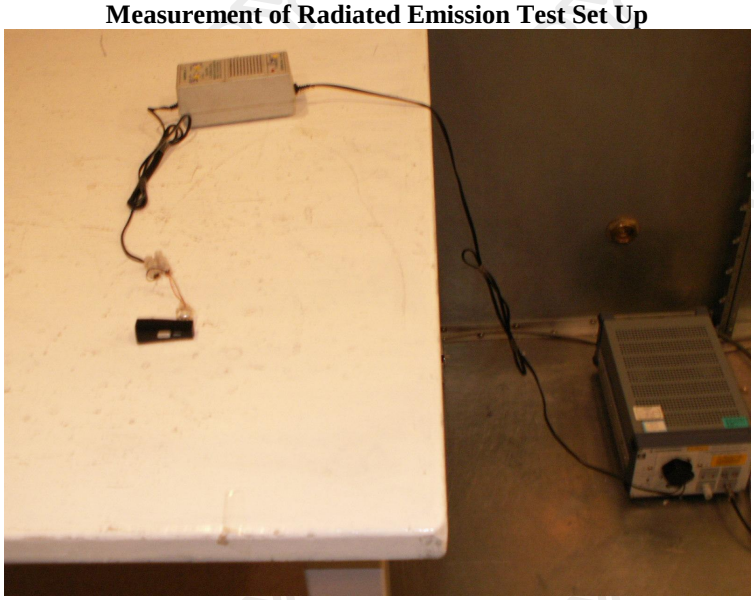


Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



******* End of Test Report *******