



STC Test Report

Date: 2015-03-20

Page 1 of 27

No. : MH191251

Applicant: Starspot Limited
Unit 11 High March, Daventry, Northants, NN114HB,
United Kingdom

Description of Sample(s): Submitted sample(s) said to be
Product: Wine Thermometer
Brand Name: Kelvin
Model Number: Kelvin Duo
FCC ID: 2AD6XKELVINDUO

Date Sample(s) Received: 2015-03-04

Date Tested: 2015-03-18 to 2015-03-19

Investigation Requested: Perform ElectroMagnetic Interference measurement in
accordance with FCC 47CFR [Codes of Federal Regulations]
Part 15: 2014 and ANSI C63.4: 2009 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

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STC Test Report

Date: 2015-03-20

Page 2 of 27

No. : MH191251

CONTENT:

Cover	Page 1 of 27
Content	Page 2-3 of 27
<u>1.0</u>	<u>General Details</u>
1.1	Equipment Under Test [EUT] Description of EUT operation
1.2	Date of Order
1.3	Submitted Sample(s)
1.4	Test Duration
1.5	Country of Origin
<u>2.0</u>	<u>Technical Details</u>
2.1	Investigations Requested
2.2	Test Standards and Results Summary
<u>3.0</u>	<u>Test Results</u>
3.1	Emission
3.2	Bandwidth Measurement

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STC Test Report

Date: 2015-03-20

Page 3 of 27

No. : MH191251

Appendix A

List of Measurement Equipment

Page 19 of 27

Appendix B

Duty Cycle Correction During 100 msec

Page 20-21 of 27

Appendix C

A manually Operation

Page 22-23 of 27

Appendix D

Photographs

Page 24-27 of 27

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STC Test Report

Date: 2015-03-20

Page 4 of 27

No. : MH191251

1.0 General Details

1.1 Equipment Under Test [EUT] Description of Sample(s)

Submitted sample(s) said to be

Product: Wine Thermometer

Manufacturer: ANCHOR FAR EAST LTD

506A, 5/F, Harbour Crystal Centre, 100 Granville Road, Tsim
Sha Tsui, Kowloon, Hong Kong

Brand Name: Kelvin

Model Number: Kelvin Duo

Rating: 5.0Vd.c. /

3.7Vd.c (Li-ion rechargeable battery x1)

1.1.1 Description of EUT Operation

The Equipment Under Test (EUT) is a Wine Thermometer of Starspot Limited

The transmitter used a master chip which included low-voltage detection, temperature & humidity detection of the current environment. When the main IC connected to power, the temperature & humidity sensor will detect the current temperature / humidity data, then encode this data to OOK format and transfer the signal by 433. 92MHz transmitter module.

1.2 Date of Order

2015-03-04

1.3 Submitted Sample(s):

1 Sample

1.4 Test Duration

2015-03-18 to 2015-03-19

1.5 Country of Origin

China

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STC Test Report

Date: 2015-03-20

Page 5 of 27

No. : MH191251

2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2014 and ANSI C63.4:2009 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	Failed	N/A
Field Strength of Fundamental Emissions & Spurious Emissions	FCC 47CFR 15.231e	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Emissions	FCC 47CFR 15.209	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A - Not Applicable

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STC Test Report

Date: 2015-03-20

Page 6 of 27

No. : MH191251

3.0 Test Results

3.1 Emission

3.1.1 Radiated Emissions

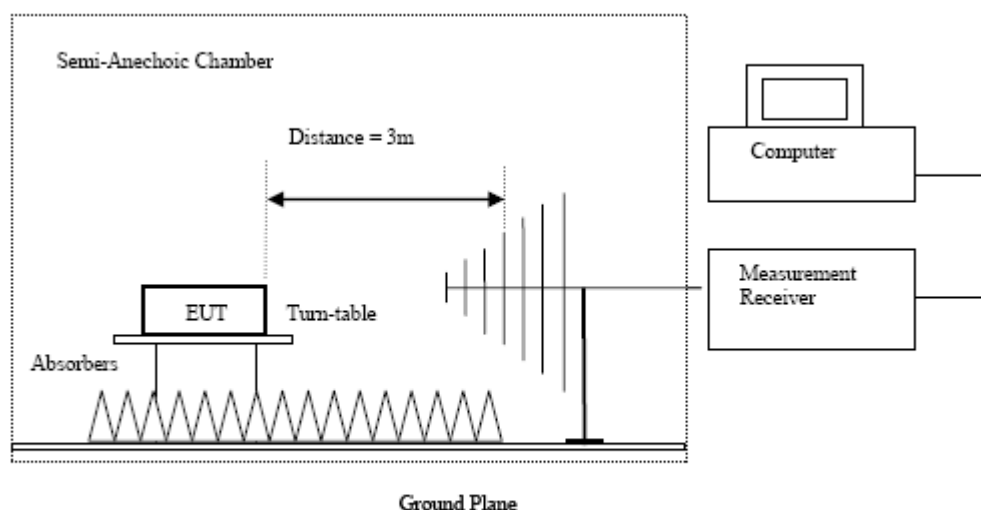
Test Requirement:	FCC 47CFR 15.231e
Test Method:	ANSI C63.4:2009
Test Date:	2015-03-18
Mode of Operation:	Tx mode/ Charge mode

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:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used.

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STC Test Report

Date: 2015-03-20

Page 7 of 27

No. : MH191251

Limits for Field Strength of Fundamental Emissions [FCC 47CFR 15.231e]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [Average] [μV/m]	Field Strength of Spurious Emission [Average] [μV/m]
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 ¹	50 to 150 ¹
174-260	1,500	150
260-470	1,500 to 5,000 ¹	150 to 500 ¹
Above 470	5,000	500

¹Linear interpolations.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

Results of Tx mode (CH1, Worst case): PASS

Field Strength of Fundamental Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
433.92	49.9	18.4	68.3	2600.2	43,986.7	Horizontal

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
867.80	24.2	24.3	48.5	266.1	4,398.7	Horizontal
+ 1301.80	14.3	30.6	44.9	175.8	5,000.0	Vertical
1735.70	10.7	33.1	43.8	154.9	4,398.7	Horizontal

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STC Test Report

Date: 2015-03-20

Page 8 of 27

No. : MH191251

Results of Tx mode (CH1, Worst case): PASS

Field Strength of Fundamental Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
* 433.92	41.9	18.4	60.3	1035.1	4,398.7	Horizontal

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
867.80	16.2	24.3	40.5	105.9	439.9	Horizontal
+ 1301.80	6.3	30.6	36.9	70.0	439.9	Vertical
1735.70	2.7	33.1	35.8	61.7	439.9	Horizontal

Remarks:

*: Adjusted by Duty Cycle = -8.0dB

+: 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 were not adjusted for averaging and the limits of FCC Rules Part 15 Section 15.209 were applied.

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STC Test Report

Date: 2015-03-20

Page 9 of 27

No. : MH191251

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

Frequency Range [MHz]	Quasi-Peak Limits [μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
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.

Result of Tx mode (9kHz - 30MHz): PASS

Emissions detected are more than 20 dB below the limit line(s).

Results of Tx mode (CH1, Worst case) (30MHz – 1GHz): 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
35.2	Horizontal	26.9	40.0	22.1	100
218.3	Horizontal	24.4	46.0	16.6	200

Remarks:

Correction Factor includes Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty (30MHz – 1GHz): 4.9dB

(1GHz – 18GHz): 4.0dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

CH1, 2, 3 have been investigated and the worst-case test results are recorded in this report.

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STC Test Report

Date: 2015-03-20

Page 10 of 27

No. : MH191251

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

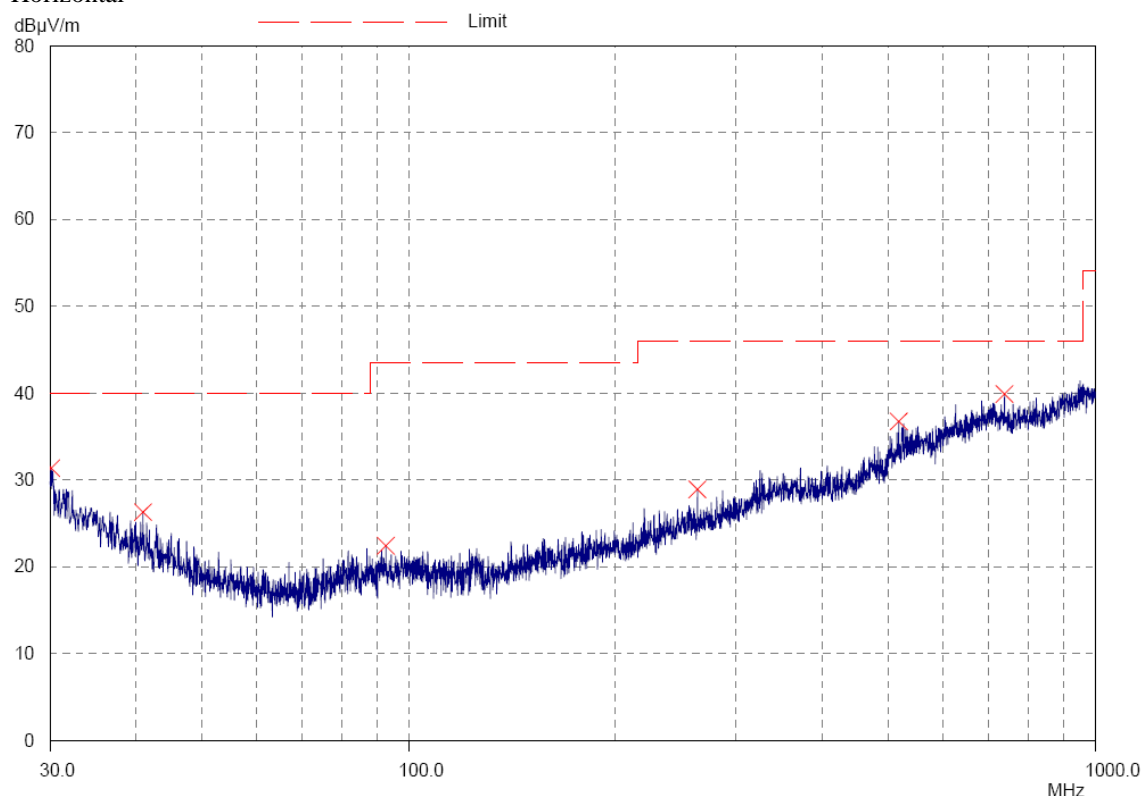
Frequency Range	Quasi-Peak Limits
[MHz]	[$\mu\text{V/m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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.

Result of Charge mode (30MHz – 1GHz): Pass

Please refer to the following table for result details

Horizontal



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STC Test Report

Date: 2015-03-20

Page 11 of 27

No. : MH191251

Result of Charge mode (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dB μ V/m	Limit @3m dB μ V/m	Level @3m μ V/m	Limit @3m μ V/m
30.1	Horizontal	31.3	40.0	36.7	100
41.0	Horizontal	26.3	40.0	20.7	100
92.6	Horizontal	22.4	43.5	13.2	150
263.3	Horizontal	28.9	46.0	27.9	200
517.3	Horizontal	36.7	46.0	68.4	200
737.8	Horizontal	39.9	46.0	98.9	200

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STC Test Report

Date: 2015-03-20

Page 12 of 27

No. : MH191251

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

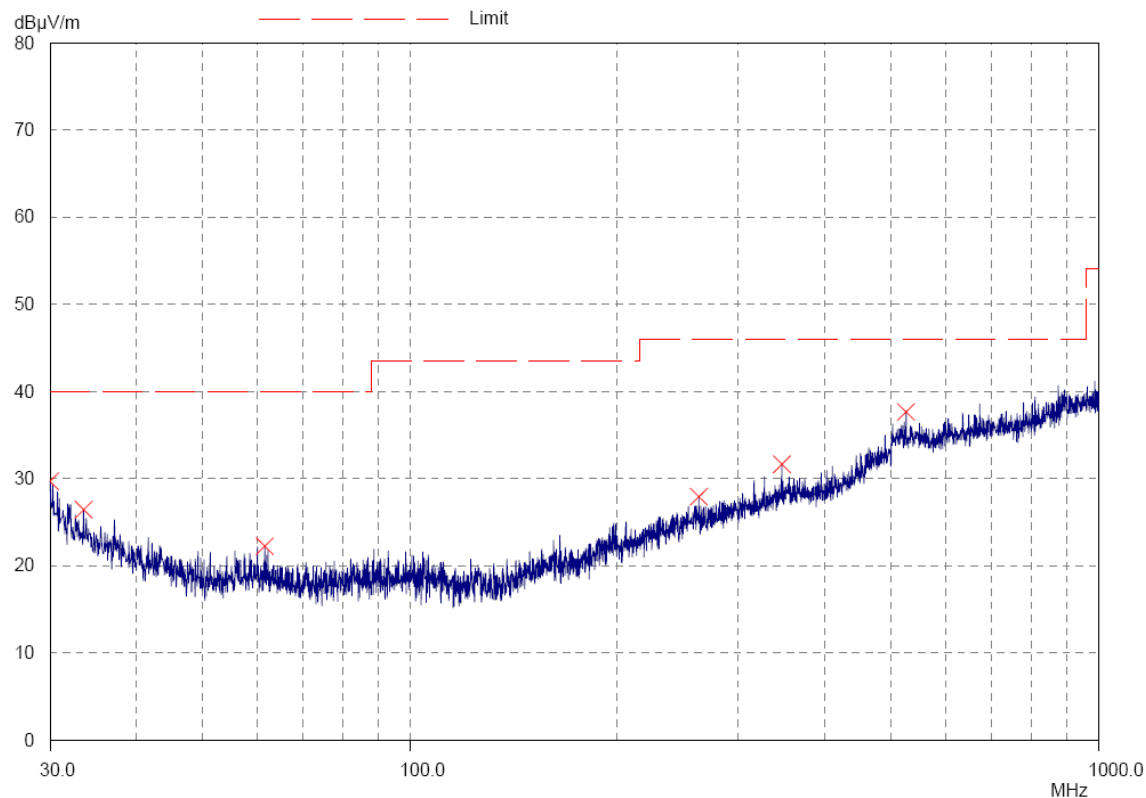
Frequency Range	Quasi-Peak Limits
[MHz]	[$\mu\text{V/m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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.

Result of Charge mode (30MHz – 1GHz): Pass

Please refer to the following table for result details

Vertical



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STC Test Report

Date: 2015-03-20

Page 13 of 27

No. : MH191251

Result of Charge mode (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @ 3m dB μ V/m	Limit @ 3m dB μ V/m	Level @ 3m μ V/m	Limit @ 3m μ V/m
30.0	Vertical	29.7	40.0	30.5	100
33.6	Vertical	26.4	40.0	20.9	100
61.5	Vertical	22.2	40.0	12.9	100
262.9	Vertical	27.9	46.0	24.8	200
346.9	Vertical	31.6	46.0	38.0	200
525.8	Vertical	37.6	46.0	75.9	200

Remarks:

Calculated measurement uncertainty (30MHz – 1GHz): 4.9dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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STC Test Report

Date: 2015-03-20

Page 14 of 27

No. : MH191251

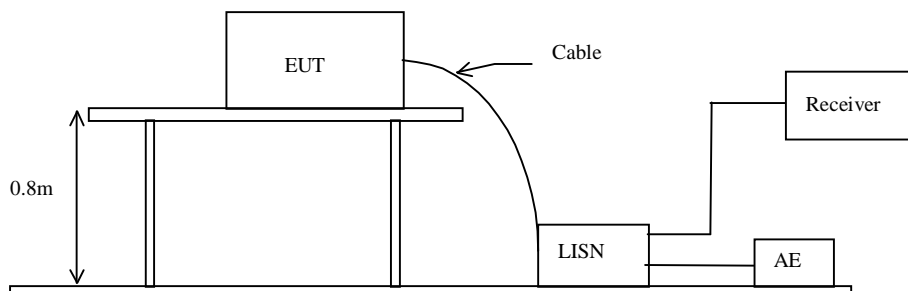
3.1.2 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:2009
Test Date:	2015-03-18
Mode of Operation:	Charging mode
Test Voltage:	120Va.c., 60Hz

Test Method:

The test was performed in accordance with ANSI C63.4: 2009, 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:



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STC Test Report

Date: 2015-03-20

Page 15 of 27

No. : MH191251

Limit for Conducted Emissions (FCC 47 CFR 15.207):

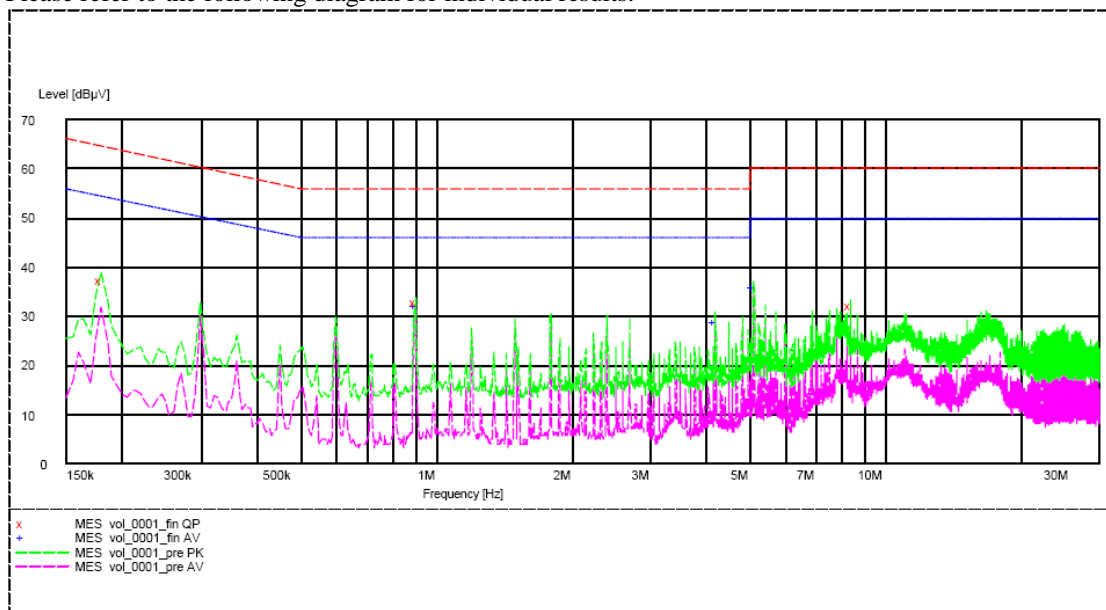
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* 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.

Result of Charging mode(Charging with PC, PC mains) (L): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Live	0.180	37.3	65.0	-*-	-*-
Live	0.900	33.0	56.0	-*-	-*-
Live	8.395	32.2	60.0	-*-	-*-
Live	0.900	-*-	-*-	32.0	46.0
Live	4.195	-*-	-*-	28.8	46.0
Live	5.095	-*-	-*-	35.9	50.0

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STC Test Report

Date: 2015-03-20

Page 16 of 27

No. : MH191251

Limit for Conducted Emissions (FCC 47 CFR 15.207):

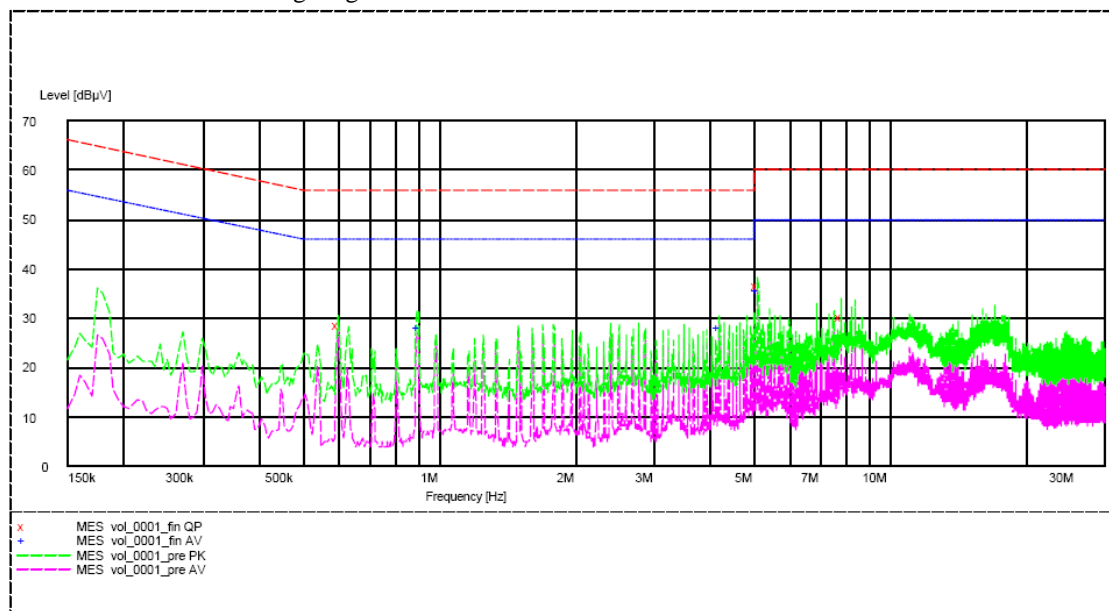
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* 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.

Result of Charging mode(Charging with PC, PC mains) (N): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Neutral	0.600	28.5	56.0	-*-	-*-
Neutral	5.095	36.8	60.0	-*-	-*-
Neutral	7.790	30.5	60.0	-*-	-*-
Neutral	0.900	-*-	-*-	28.3	46.0
Neutral	4.195	-*-	-*-	28.4	46.0
Neutral	5.095	-*-	-*-	35.6	50.0

Remarks:

Calculated measurement uncertainty (0.15MHz – 30MHz): 3.25dB

-*- Emission(s) that is far below the corresponding limit line.

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STC Test Report

Date: 2015-03-20

Page 17 of 27

No. : MH191251

3.2 20dB Bandwidth of Fundamental Emission

Test Requirement:	FCC 47 CFR 15.231e
Test Method:	ANSI C63.4:2009 (Section 13.1.7)
Test Date:	2015-03-18
Mode of Operation:	Tx mode

Test Method:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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STC Test Report

Date: 2015-03-20

Page 18 of 27

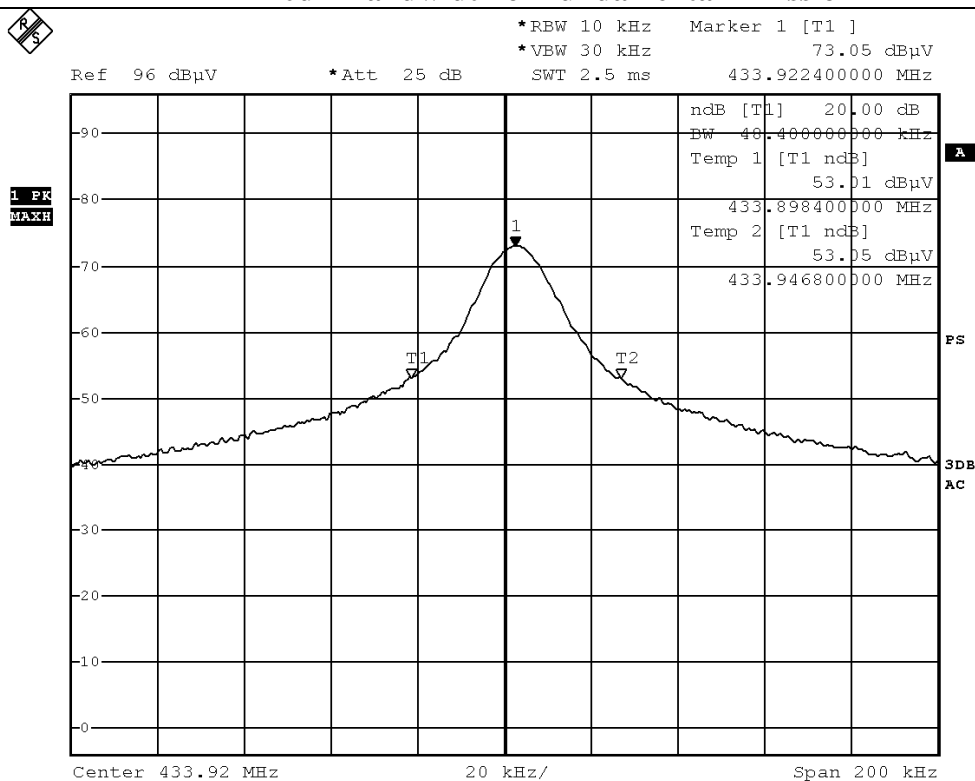
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Limits for 20 dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [kHz]	FCC Limits * [kHz]
433.92	40.4	1084.8

*: FCC Limit for Bandwidth measurement
= (0.25%)(Center Frequency)
= (0.0025)(433.9)
= 1084.8kHz

20dB Bandwidth of Fundamental Emission



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STC Test Report

Date: 2015-03-20

Page 19 of 27

No. : MH191251

Appendix A

List of Measurement Equipment

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM276	BROADBAND HORN ANTENNA	A-INFOMW	JXTXLB-10180-SF	J2031090903007	2013/03/23	2016/03/23
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-LINDGREN	FACT-3	--	2014/09/29	2015/09/29
EM219	BICONILOG ANTENNA	EMCO	3142C	00029071	2013/04/25	2015/04/25
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2014/01/15	2016/01/15

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM232	LISN	SCHAFFNER	NNB41	04/100082	2014/12/08	2015/12/08
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2014/05/26	2015/05/26
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	2014/05/26	2015/05/26
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2015/01/14	2016/01/14
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2012/02/03	2017/02/03

Remarks:-

N/A Not Applicable

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STC Test Report

Date: 2015-03-20

Page 20 of 27

No. : MH191251

Appendix B

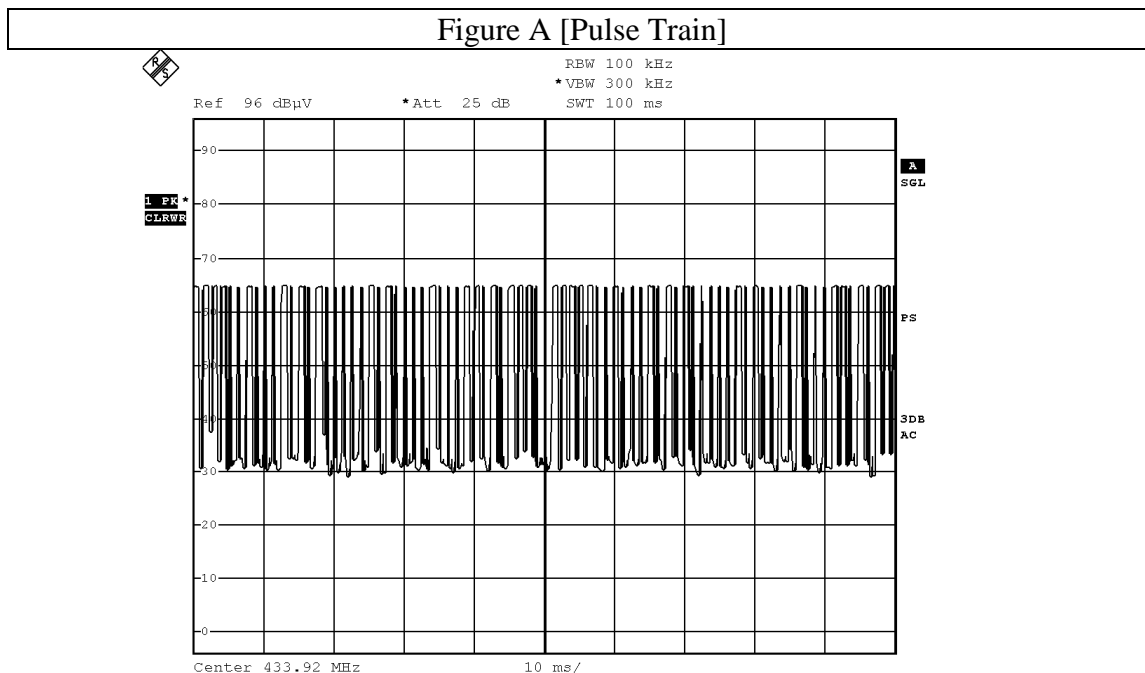
Duty Cycle Correction During 100msec

Each packet period (100msec) never exceeds a series of 34 (0.84 msec) long pulses and 46 (0.24 msec) short pulses. Assuming any combination of short and long pulses may be obtained due to encoding the worst case transmit duty cycle would be considered $(34 \times 0.84 + 46 \times 0.24)$ msec per 100msec = 39.6% duty cycle. Figure A through D shows the characteristics of the pulses train for one of these functions.

Remarks:

Duty cycle = $20\text{Log} [(0.84 \times 34 + 0.24 \times 46)/100] = -8.0\text{dB}$

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



Date: 18.MAR.2015 09:33:13

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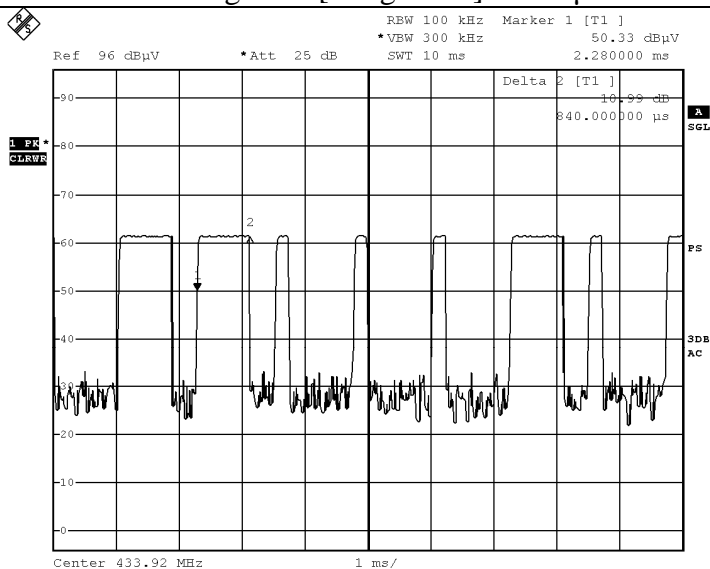
STC Test Report

Date: 2015-03-20

Page 21 of 27

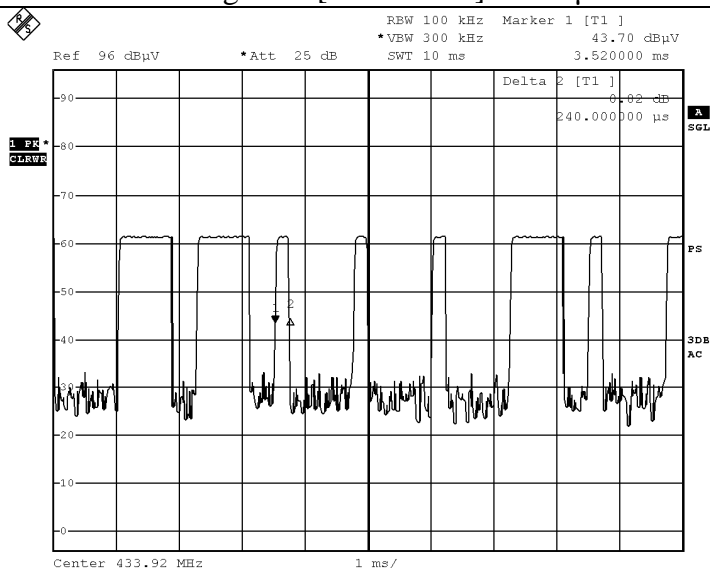
No. : MH191251

Figure B [Long Pulse] = 840 μ s



Date: 18.MAR.2015 09:29:37

Figure C [Short Pulse] = 240 μ s



Date: 18.MAR.2015 09:30:01

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STC Test Report

Date: 2015-03-20

Page 22 of 27

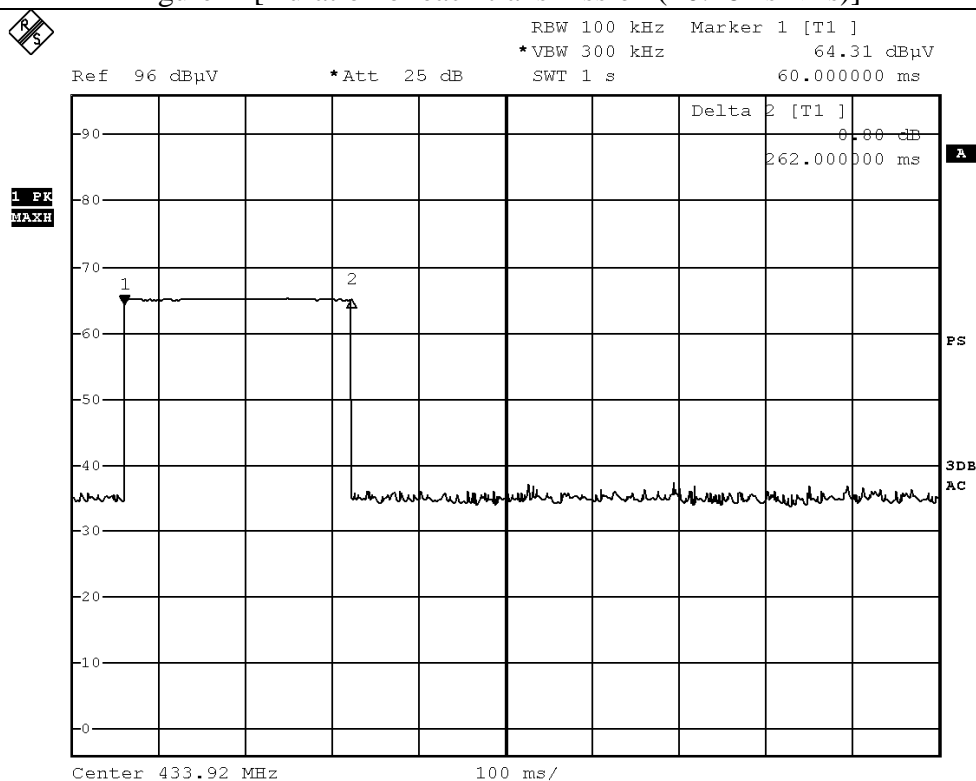
No. : MH191251

Appendix C

Periodic Operation [FCC 47CFR 15.231(e)]

According to FCC 47CFR15.231 (e). A periodic transmitter shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Figure D [Duration of each transmission ($=0.262\text{ s} < 1\text{ s}$)]



Date: 18.MAR.2015 09:34:36

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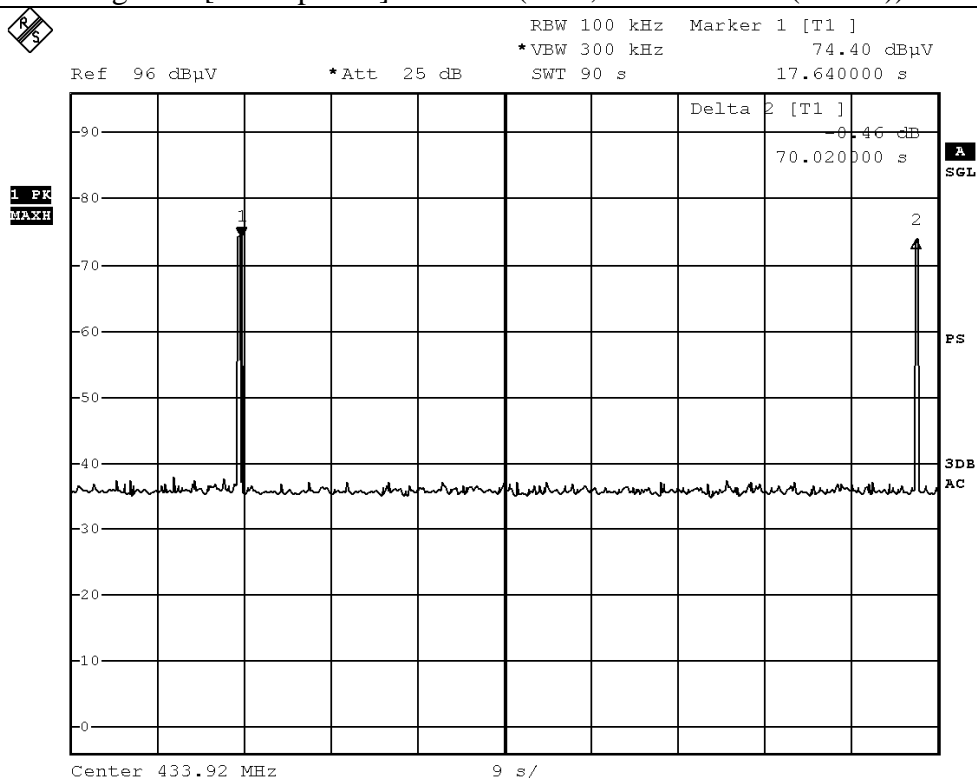
STC Test Report

Date: 2015-03-20

Page 23 of 27

No. : MH191251

Figure E [Silent period] = 70.02s ($>10s$, and $>30 \times 0.262(7.868s)$)



Date: 18.MAR.2015 09:40:05

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STC Test Report

Date: 2015-03-20

Page 24 of 27

No. : MH191251

Appendix D

Photographs of EUT

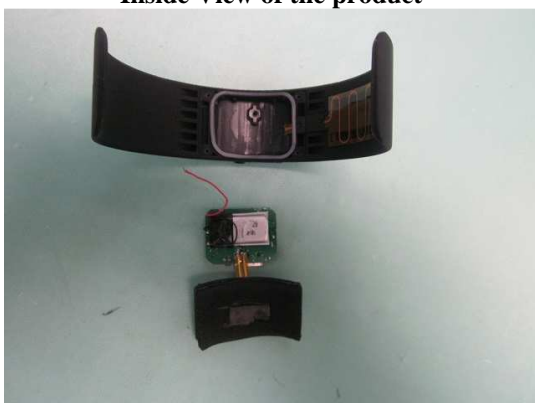
Front View of the product



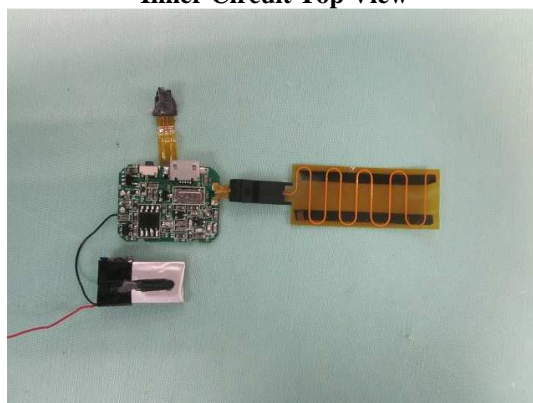
Rear View of the product



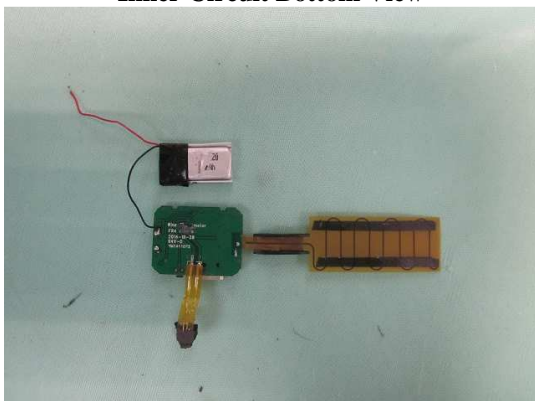
Inside View of the product



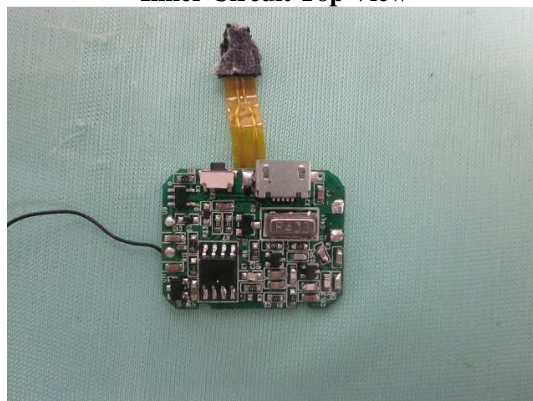
Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



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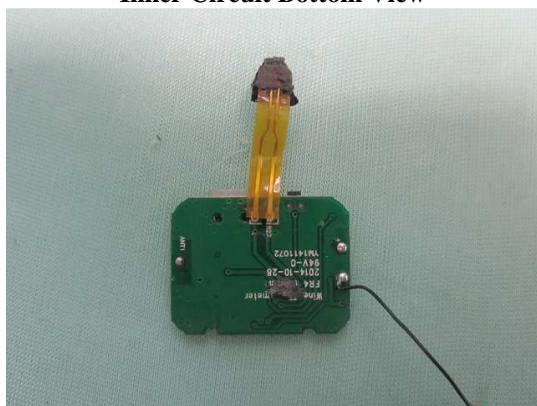
Date: 2015-03-20

Page 25 of 27

No. : MH191251

Photographs of EUT

Inner Circuit Bottom View



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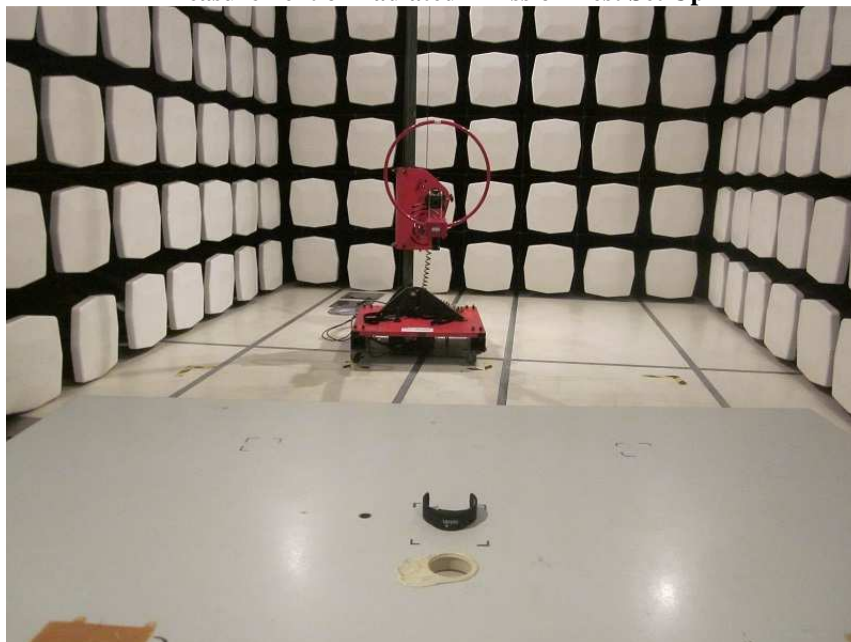
Date: 2015-03-20

Page 26 of 27

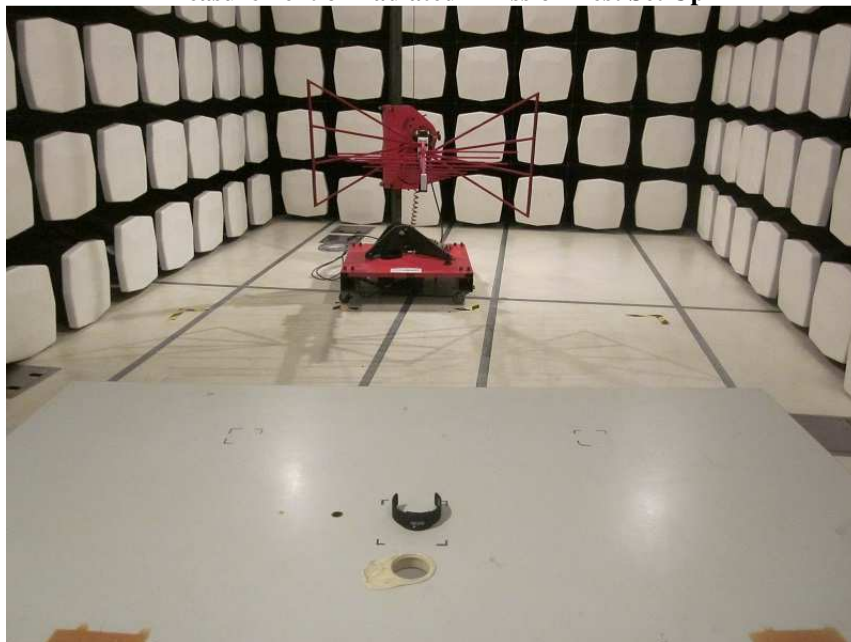
No. : MH191251

Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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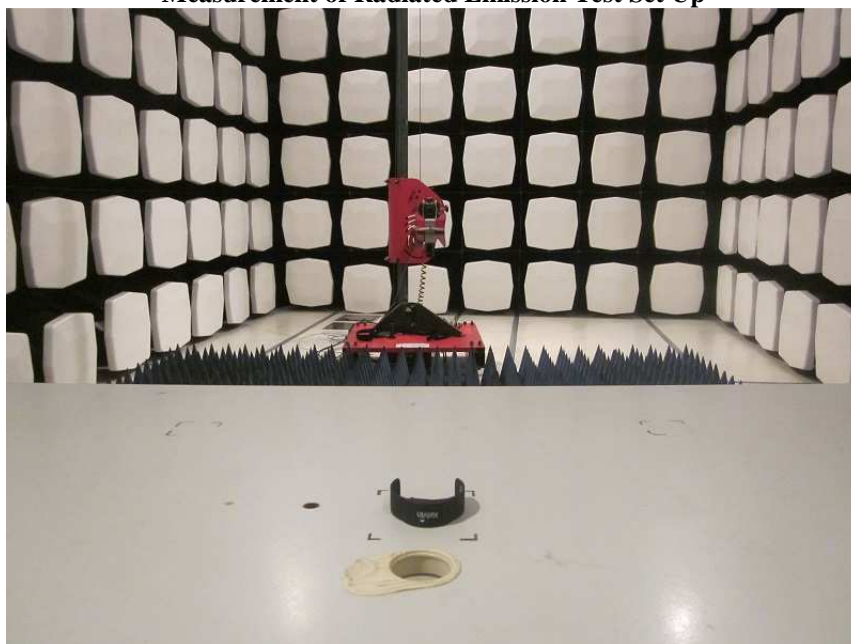
Date: 2015-03-20

Page 27 of 27

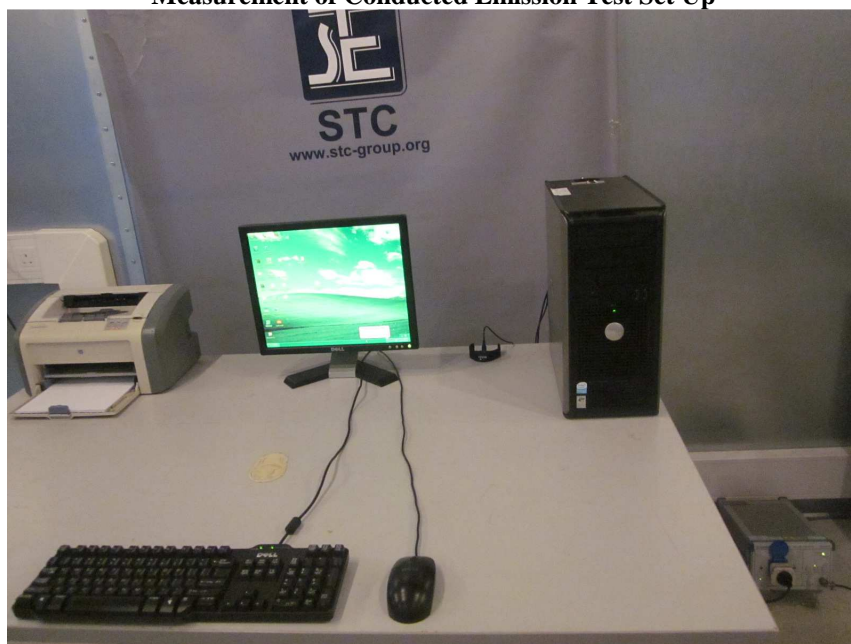
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Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Conducted Emission Test Set Up



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

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