SUMEC MACHINERY & ELECTRIC CO.,LTD

REMOTE CONTROLLER

Main Model: RC-1
Serial Model: N/A

April 18, 2014

Report No.: 14020140-FCC-R1
(This report supersedes NONE)

Modifications made to the product : None

This Test Report is Issued Under the Authority of:		
William Long	Alex Liu	
William Long **Compliance Engineer**	**Alex Liu** **Technical Manager**	

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Test result presented in this test report is applicable to the representative sample only.

RF Test Report

TO: FCC 15.231:2013, ANSI C63.4:2009

SIEMIC, INC.
Accessing global markets

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management through out a project. Our extensive experience with China, Asia Pacific, North America, European, and international compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC , RF/Wireless , Telecom
Canada	EMC, RF/Wireless , Telecom
Taiwan	EMC, RF, Telecom , Safety
Hong Kong	RF/Wireless ,Telecom
Australia	EMC, RF, Telecom , Safety
Korea	EMI, EMS, RF , Telecom, Safety
Japan	EMI, RF/Wireless, Telecom
Singapore	EMC , RF , Telecom
Europe	EMC, RF, Telecom , Safety

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CONTENTS

1 EXECUTIVE SUMMARY & EUT INFORMATION

The purpose of this test programmed was to demonstrate compliance of the SUMEC MACHINERY & ELECTRIC CO.,LTD. The REMOTE CONTROLLER and model: RC-1 against the current Stipulated Standards. The REMOTE CONTROLLER has demonstrated compliance with the FCC 15.231:2013, ANSI C63.4:2009.

EUT Information

EUT Description	**REMOTE CONTROLLER**
Main Model	**RC-1**
Serial Model	**N/A**
Antenna Gain	**1 dBi**
Input Power	**12V DC battery of power supply**
Classification Per Stipulated Test Standard	**FCC 15.231:2013, ANSI C63.4:2009**

2 TECHNICAL DETAILS

Purpose	**Compliance testing of REMOTE CONTROLLER with stipulated standard**
Applicant / Client	**SUMEC MACHINERY & ELECTRIC CO.,LTD CHANGJIANG ROAD 198,NANJING ,CHINA**
Manufacturer	**SUMEC MACHINERY & ELECTRIC CO.,LTD CHANGJIANG ROAD 198,NANJING ,CHINA**
Laboratory performing the tests	**SIEMIC (Nanjing-China) Laboratories NO.2-1,Longcang Dadao, Yuhua Economic Development Zone, Nanjing, China Tel:+86(25)86730128/86730129 Fax:+86(25)86730127 Email: China@siemic.com.cn**
Test report reference number	**14020140-FCC-R1**
Date EUT received	**February 25, 2014**
Standard applied	**FCC 15.231:2013, ANSI C63.4:2009**
Dates of test	**April 11, 2014**
No of Units:	**1#**
Equipment Category:	**DSC**
Trade Name :	**FIRMAN**
RF Operating Frequency (ies)	**Tx: 433.988MHz**
Number of Channels :	**1 CH**
Modulation :	**OKK**
FCC ID:	**2ABXMSF-360453010**

3 MODIFICATION

NONE

4 TEST SUMMARY

The product was tested in accordance with the following specifications.
All testing has been performed according to below product classification:

Test Results Summary

Test Standard	Description	Pass / Fail
CFR 47 Part 15.231: 2013		
15.203	Antenna Requirement	Pass
15.207	Conducted Emissions Voltage	N/A
15.231(b)	Fundamental & Radiated Spurious Emission	Pass
15.231(c)	20dB Bandwidth	Pass
15.231(a)(1)	Deactivation	Pass
ANSI C63.4: 2009 PS: All measurement uncertainties are not taken into consideration for all presented test result.		

5 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

5.1 Antenna Requirement

Requirement(s): 47 CFR §15.203

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.

Antenna requirement must meet at least one of the following:

a) Antenna must be permanently attached to the device.

b) Antenna must use a unique type of connector to attach to the device.

c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with the device.

The antenna is permanently attached to the device which meets the requirement.

5.2 Conducted Emissions Voltage

Requirement:

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

Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted 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% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
4. Environmental Conditions — Temperature 20°C; Relative Humidity 48%; Atmospheric Pressure 1019mbar
5. Test date : N/A
   Tested By : William Long

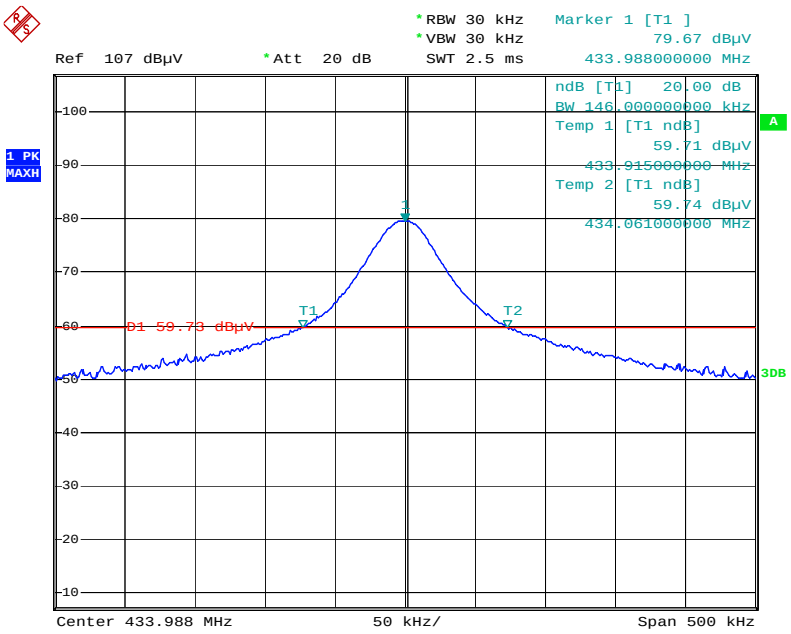
Test result: N/A (Batteries operated)

5.3 20dB Occupied Bandwidth

1. 20dB bandwidth was measured by conducted method using a spectrum analyzer.
2. Environmental Conditions
   Temperature 20°C
   Relative Humidity 51%
   Atmospheric Pressure 1009mbar
3. Test Date: April 11, 2014
   Test By: William Long

Test Result:

Fundamental Frequency (MHz)	Measured 20dB Bandwidth (kHz)	FCC 15.231 Limit (kHz)	Result
433.988	146	1084.97	Pass



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5.4 Radiated Fundamental and Spurious Emission

1. Radiated emissions were measured according to ANSI C63.4. The EUT was set 3 meter away from the measuring antenna. The loop antenna was positioned 1meter above the ground from the center of the loop. The measuring bandwidth was set to 10kHz. All possible modes of operation were investigated. Only the worst case emissions measured, All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Sample Calculation: Corrected Amplitude=Raw Amplitude(dBuV/m)+ACF(dB)+Cable Loss(dB)-Distance Correction Factor.
   Sample Calculation:
   1) Corrected Amplitude= Raw Amplitude(dBuV/m)+ACF(dB)+Cable Loss(dB)-Distance Correction Factor
   2) Average = peak reading + 20log(duty cycle)
4. 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% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz(QP only3m & 10m) is +5.6/-4.5dB(for EUTs<0.5m×0.5m×0.5m).In range of 1-40GHz) is ±3.6dB.
5. Environmental Conditions

Temperature	20°C
Relative Humidity	50%
Atmospheric Pressure	1009mbar

6. Test date : April 11, 2014
   Tested By : William Long

Standard Requirement:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750	125 to 375
174-260	3750	375
260-470	3750-12500	375 to 1250
Above 470	12500	1250

Test Result: Pass

Fundamental Measurement @ 433.988MHz @3 Meter FCC 15.231(a)

Frequency (MHz)	correct (dBμV/m)	Azimuth	Polarity	Height(m)	Factors(dB)	FCC 15.231(a) Limit (dBμV)	Margin(dB)	Comments
433.988	72.03	156.23	V	2.20	-31.37	100.83	-28.80	Peak
433.988	67.55	-	V	-	-4.48	80.83	-13.27	Ave
433.988	79.85	151.20	H	1.80	-31.37	100.83	-20.98	Peak
433.988	75.37	-	H	-	-4.48	80.83	-5.45	Ave

Spurious Emissions (＜1GHz) Measurement @ 3 Meter FCC 15.231(a)

Frequency (MHz)	correct (dBμV/m)	Azimuth	Polarity	Height(m)	Factors(dB)	FCC 15.231(a) Limit (dBμV)	Margin(dB)	Comments
867.976	55.33	55.60	V	2.1	-25.03	80.83	-25.50	Pk
867.976	50.85	-	V	-	-4.48	60.83	-9.97	Ave
867.976	60.22	251.02	H	2.6	-25.03	80.83	-20.61	Pk
867.976	55.74	-	H	-	-4.48	60.83	-5.08	Ave

Notes:

1. Duty cycle is 59.73%, 20log (duty cycle) = *-4.48*dB correction was used to determine the average level from the peak reading. Average = peak reading + 20log (duty cycle), Final Average= peak reading *-4.48*
2. All the data measurement of peak values.
3. FCC Limit for Average Measurement=41.6667 *(433.988MHz)-7083.3333=10999.51μV/m=80.83dBμV/m
4. Average pulsed signal over one complete pulse train or 100 ms time frame if pulse train exceeds 100 ms
5. Maximum average in 100 ms
6. Calculate duty cycle for pulse train or 100 ms
7. Duty cycle = (t1 + t2 + t3+…tn)/T where tn = pulse width, T = pulse train length or 100 ms

Spurious Emissions (＞1GHz) Measurement @ 3 Meter FCC 15.231(a)

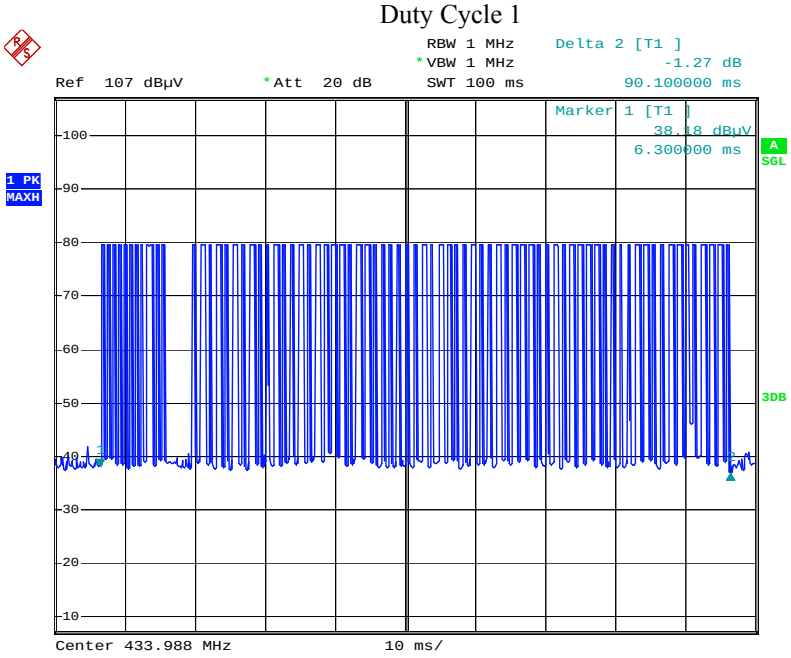
Frequency	**Height**	**Polar**	**Factors (dB)**	**Amplifier**	**correct (dBμV/m)**	**FCC 15.231**	Margin	Comments
GHz	Meter	H/V	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	(dB)	(Pk/Av)
1301.96	1.2	H	-26.7	55	52.66	74.00	-21.34	Peak
1301.96	-	H	-4.48	-	48.18	54.00	-5.82	*Ave*
1735.93	1.6	H	-25.47	55	55.02	80.83	-25.81	Peak
1735.93	-	H	-4.48	-	50.54	60.83	-10.28	*Ave*
2169.26	1.8	H	-23.17	55	53.36	80.83	-27.47	Peak
2169.26	-	H	-4.48	-	48.88	60.83	-11.94	*Ave*
3037.89	1.4	H	-19.37	55	51.06	80.83	-29.77	Peak
3037.89	-	H	-4.48	-	46.58	60.83	-14.24	*Ave*
3472.02	1.9	H	-18.7	55	48.58	80.83	-32.25	Peak
3472.02	-	H	-4.48	-	44.10	60.83	-16.72	*Ave*
3905.89	1.2	H	-17.63	55	44.66	74.00	-29.34	Peak
3905.89	-	H	-4.48	-	40.18	54.00	-13.82	*Ave*
1301.96	1.3	V	-26.7	55	54.33	74.00	-19.67	Peak
1301.96	-	V	-4.48	-	49.85	54.00	-4.15	*Ave*
1735.93	2.3	V	-25.47	55	52.6	80.83	-28.23	Peak
1735.93	-	V	-4.48	-	48.12	60.83	-12.70	*Ave*
2169.26	1.9	V	-23.17	55	52.69	80.83	-28.14	Peak
2169.26	-	V	-4.48	-	48.21	60.83	-12.61	*Ave*
3037.89	1.2	V	-19.37	55	47.36	80.83	-33.47	Peak
3037.89	-	V	-4.48	-	42.88	60.83	-17.94	*Ave*
3472.02	1.6	V	-18.7	55	44.66	80.83	-36.17	Peak
3472.02	-	V	-4.48	-	40.18	60.83	-20.64	*Ave*
3905.89	1.7	V	-17.63	55	41.56	74.00	-32.44	Peak
3905.89	-	V	-4.48	-	37.08	54.00	-16.92	*Ave*

Note: Duty cycle is 59.73%, 20log (duty cycle) = -4.48dB correction was used to determine the average level from the peak reading. Average = peak reading + 20log (duty cycle), final Average= peak reading -4.48dB

Note:
Pulse width (PW) = 1338ms
1/PW = 1/1338ms =0.000747kHz
RBW > 1/PW (0.000747kHz)
Therefore PDCF is not needed.

Pulse Duty Cycle:
Wide Pulse: 0.9ms
Narrow Pulse: 0.54ms
Duty cycle= (0.9*34+0.54*43)/90.1 =59.73%
Average Duty Factor: 20*log (Duty Cycle) = -4.48dB

Duty Cycle 1



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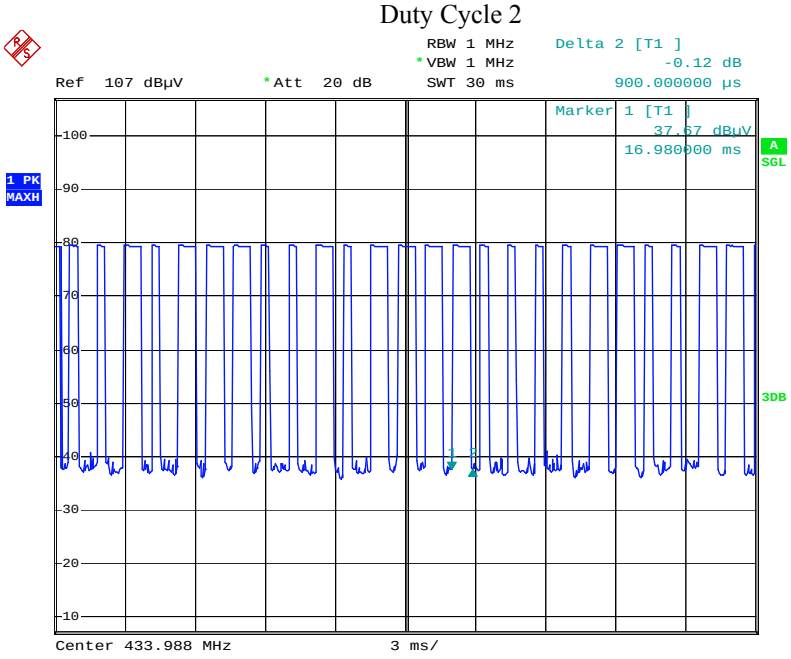
Duty Cycle 2



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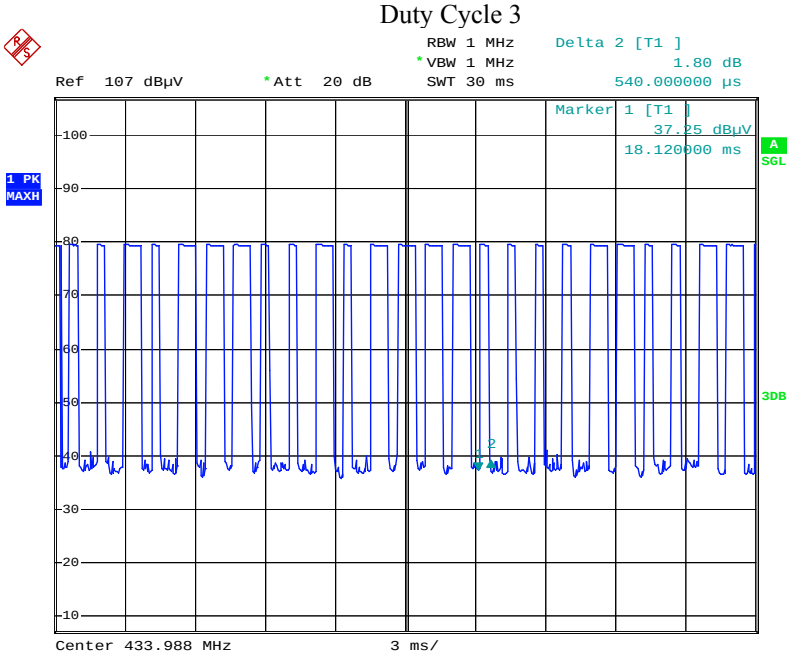
Duty Cycle 3



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5.5 Deactivation

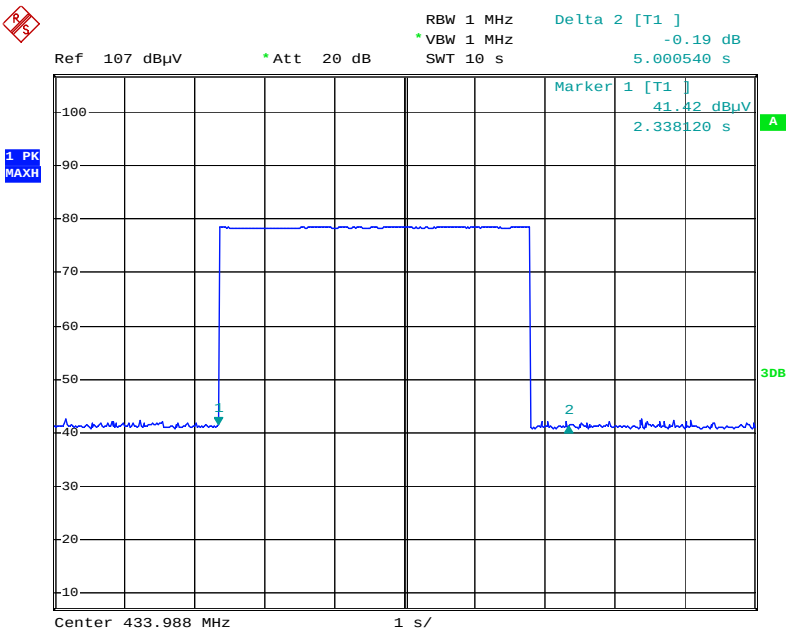
1. Deactivation was measured by conducted method using a spectrum analyzer.
2. Environmental Conditions

Temperature	20°C
Relative Humidity	51%
Atmospheric Pressure	1009mbar

3. Test Data: April 11, 2014
   Test By: William Long

Standard requirement: 47 CFR §15.231 (a)(1)
Release Time ＜5 seconds

Test Result: Pass



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Annex A. TEST INSTRUMENT & METHOD

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Instrument	Model	Serial #	Calibration Date	Calibration Due Date
Radiated Emissions				
R&S Receiver	ESPI 3	101216	09/27/2013	09/26/2014
Hp Spectrum Analyzer	8563E	3821A09023	09/27/2013	09/26/2014
HP Pre-amplifier	8447F	1937A01160	10/27/2013	10/26/2014
Sunol Sciences, Inc. antenna	JB6	A121411	03/26/2014	03/25/2015
A-INFOMW Horn Antenna (1~18GHz)	JXTXLB-10180	J2031081120092	10/09/2013	10/08/2014
MITEQ Pre-Amplifier(0.1 ~ 18GHz)	AMF-7D-00101800-30-10P	1451710	11/03/2013	11/02/2014
SIEMIC Labview Radiated Emissions software	V1.0	N/A	N/A	N/A

Annex A. ii. RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 10th Harmonic, was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

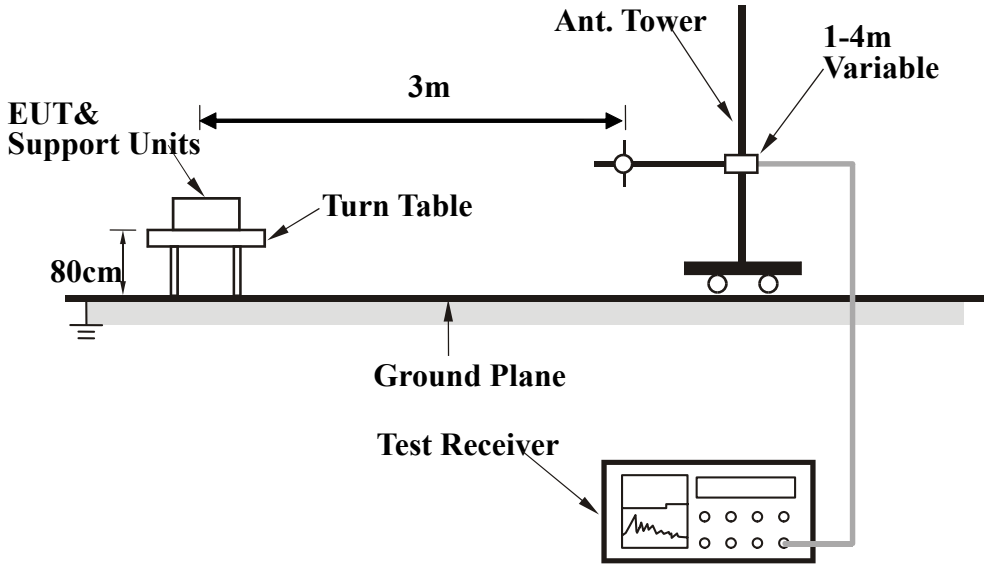
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS).

Test Set-up

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.

2. 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.



Test Method

The following procedure was performed to determine the maximum emission axis of EUT:
1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

Final Radiated Emission Measurement
1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ◦ to 360 ◦ with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Sample Calculation Example

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where
Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)
And the average value is

Average = Peak Value + Duty Factor or
Set RBW = 1MHz, VBW = 10Hz.

Note:
If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex B. EUT AND TEST SETUP PHOTOGRAPHS

Annex B.i. Photograph : EUT External Photo

Front View of EUT

Rear View of EUT

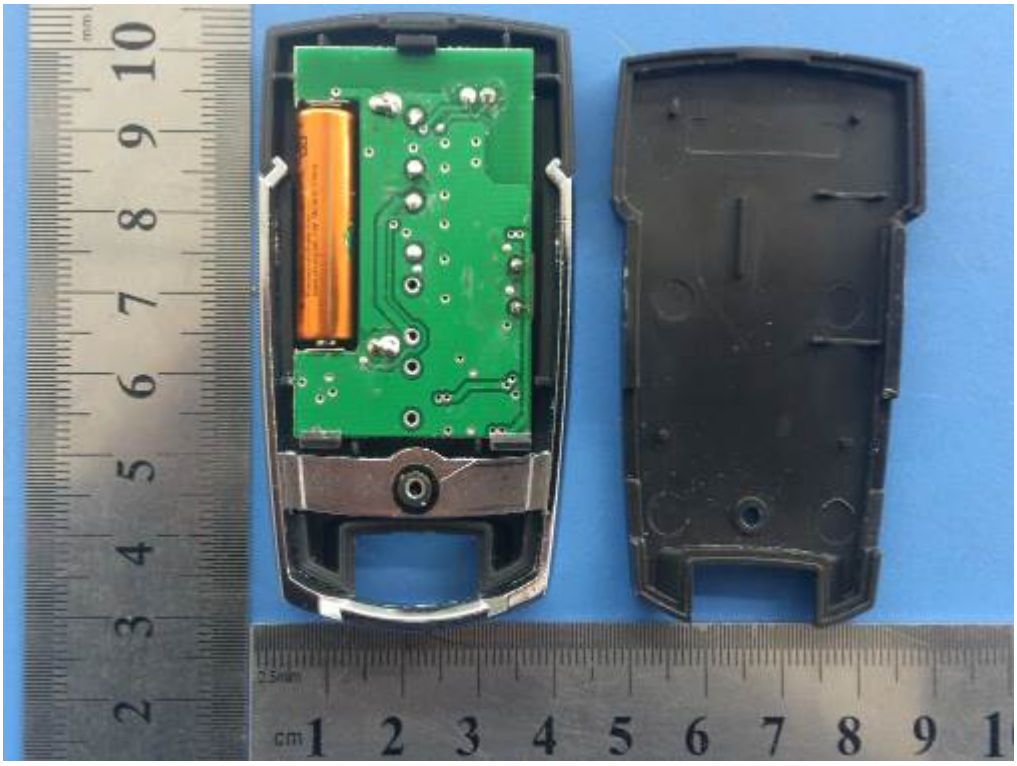
Top View of EUT

Bottom View of EUT

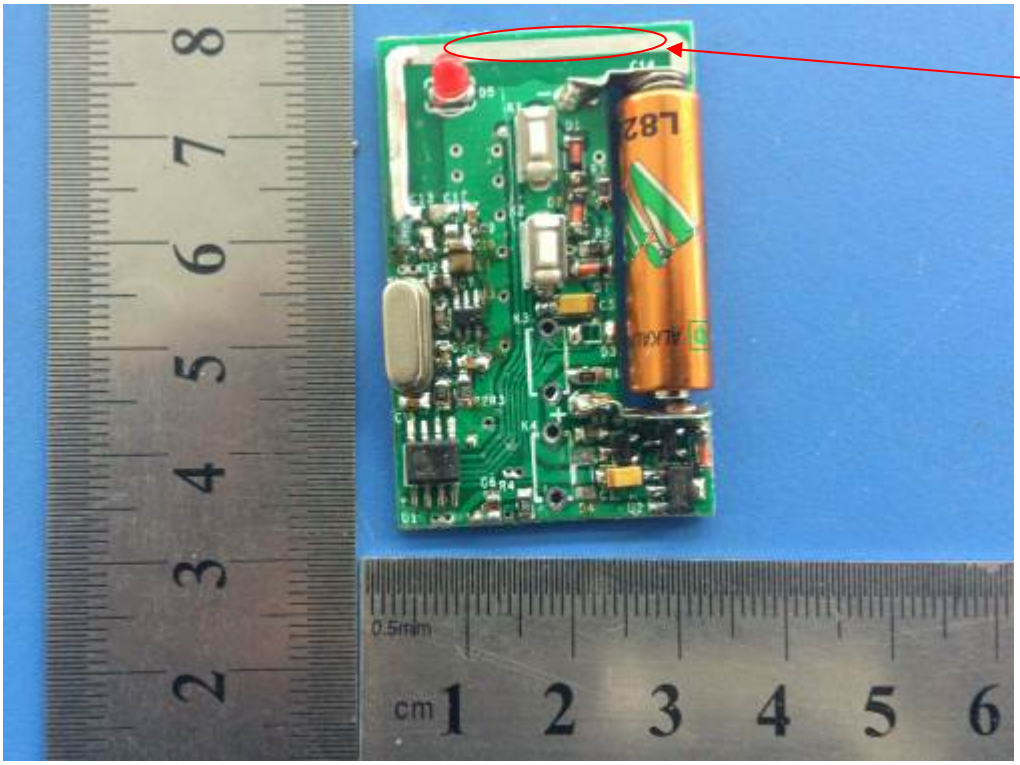
Left View of EUT

Right View of EUT

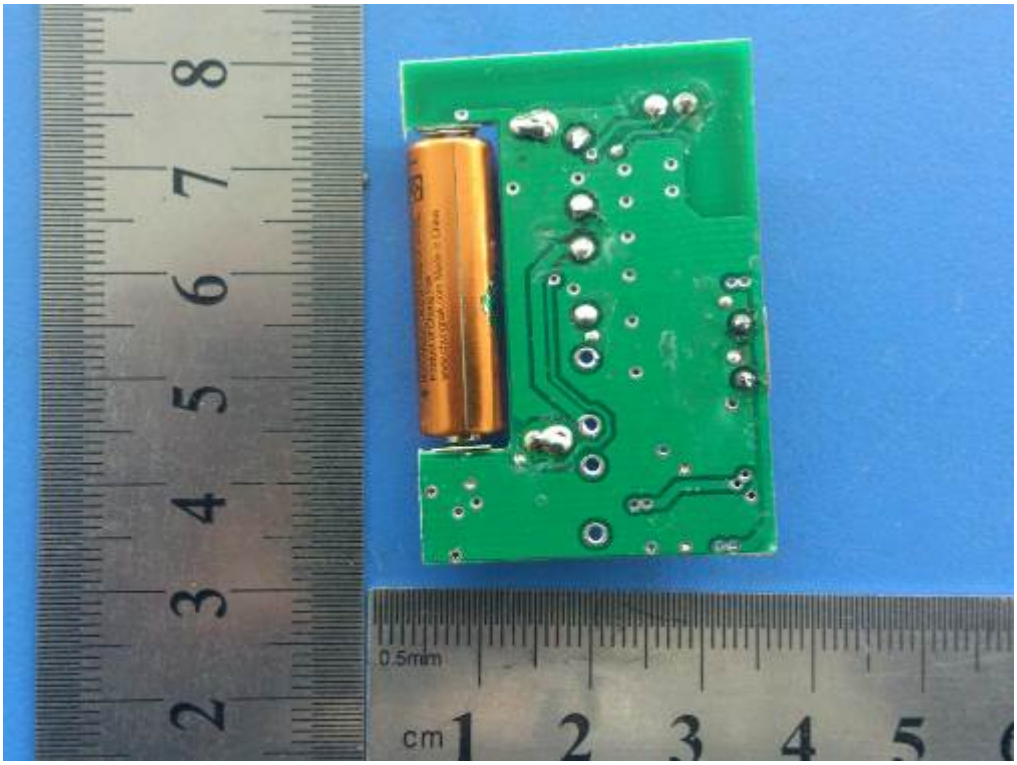
Annex B.ii. Photograph : EUT Internal Photo



EUT – Uncover Front View

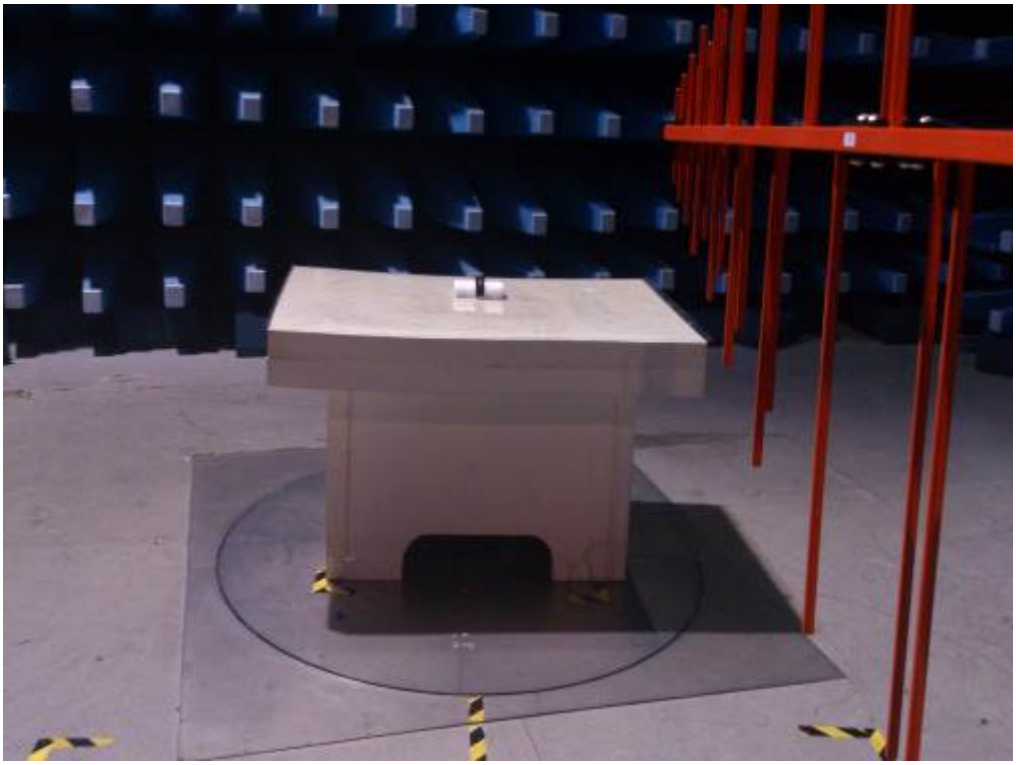


EUT –PCB Front View

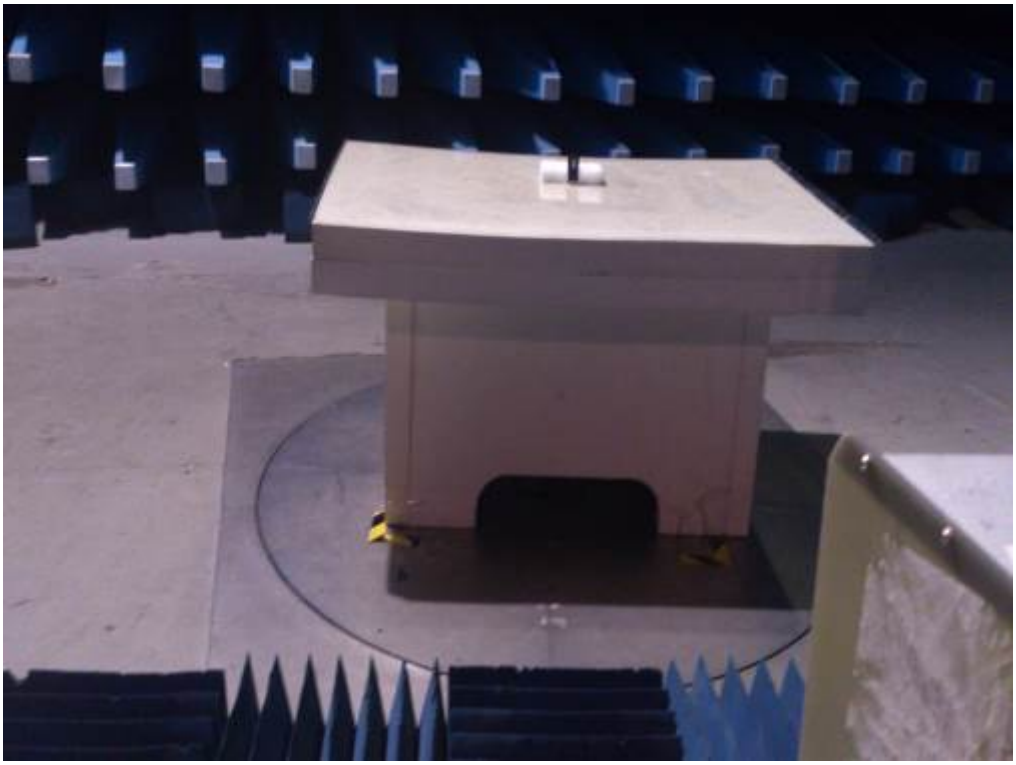


EUT –PCB Rear View

Annex B.iii. Photograph : Test Setup Photo



Radiated Emission Test Setup Rear View Below 1GHz



Radiated Emission Test Setup Front View Above 1GHz

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

EUT TEST CONDITIONS

Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

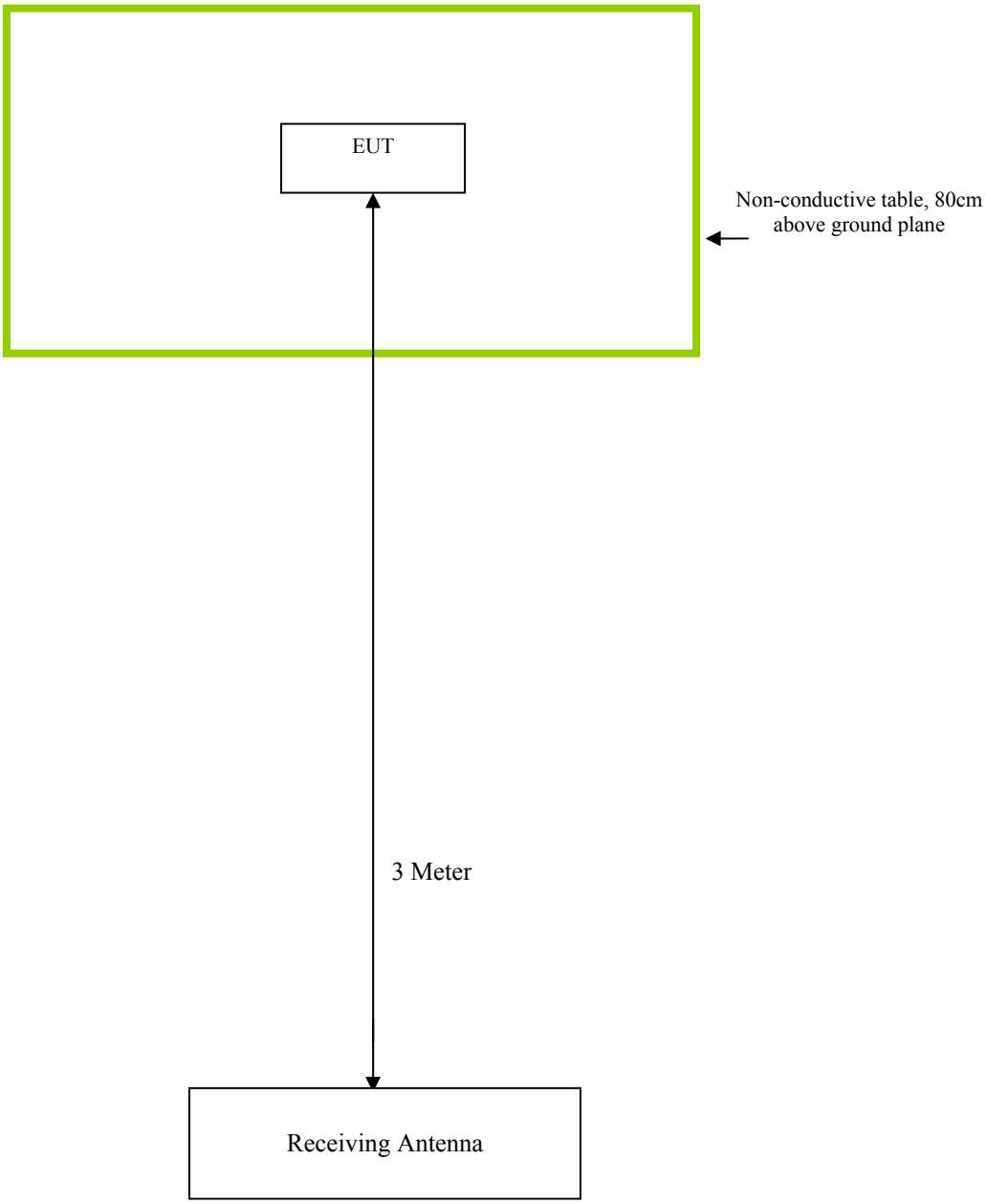
The following is a description of supporting equipment and details of cables used with the EUT.

Equipment Description (Including Brand Name)	Model & Serial Number	Cable Description (List Length, Type & Purpose)
N/A	N/A	N/A

Block Configuration Diagram for Conducted Emission

N/A

Block Configuration Diagram for Radiated Emission



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	TX mode is continuous transmitting with full power.

Annex D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PART LIST

Please see attachment

Annex E. DECLARATION OF SIMILARITY

N/A