EMC Test Report

Product	:	Electric Scooter
Model Number	:	L1
Prepared for	:	IU SMART CO.,LTD
Address	:	808-809,8 FLOOR ZHANRUN internationgal，33 longguan road，Longhua newdistrict，Shenzhen, Guangdong, China.
Prepared By	:	Shenzhen WJT Technology Co., Ltd.
Address	:	3/F, Block A1, No. 5, 8th Road, Yangyong Industrial Park, Shapu Community, Songgang Street, Bao'an District, Shenzhen, China Tel : +86-755-89542147
Report No.	:	WJT190524-EMC-B-01
Date of Test	:	May 24, 2019 to May 28, 2019
Date of Rep.	:	May 28, 2019

Prepared by(Engineer):

Reviewer(Quality Manager):

Approved & Authorized Signer(Manager):

SHENZHEN WJT TECHNOLOGY CO., LTD. WJT APPROVE

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1 Test Summary

Test procedures according to the technical standards:

EMC Emission				
Standard	Test Item	Limit	Judgment	Remark
EN 55032:2015	Conducted Emission	Class B	PASS	
	Radiated Emission	Class B	PASS	
EN 61000-3-2:2014	Harmonic Current Emission	Class A or D NOTE (2)	PASS	
EN 61000-3-3:2013	Voltage Fluctuations & Flicker	------	PASS	

EMC Immunity				
Section EN 55024:2010+A1:2015	Test Item	Performance Criteria	Judgment	Remark
EN 61000-4-2	Electrostatic Discharge Measurement	B	PASS	
EN 61000-4-3	RF Field Strength Susceptibility Measurement	B	PASS	
EN 61000-4-4	Electrical Fast Transient/Burst Measurement	A	PASS	
EN 61000-4-5	Surge Immunity Measurement	A	PASS	
EN 61000-4-6	Conducted Susceptibility Measurement	A	PASS	
EN 61000-4-8	Power Frequency Magnetic Field Immunity (50/60Hz)	A	N/A	
EN 61000-4-11	Voltage Dips and Interruptions Measurement	A	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) The power consumption of EUT is less than 75W and no Limits apply.

(3) For client's request and manual description, the test will not be executed.

2 General Information

2.1 General Description Of EUT

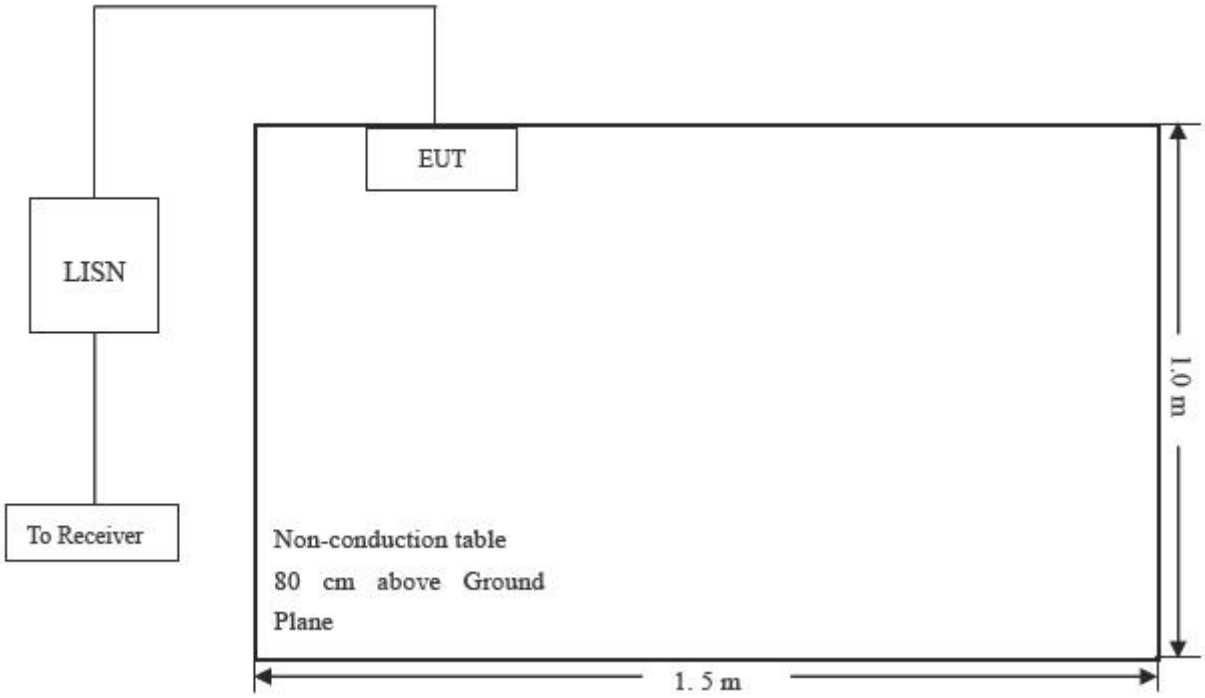
Manufacturer:	IU SMART CO.,LTD
Manufacturer Address:	808-809,8 FLOOR ZHANRUN internationgal，33 longguan road，Longhua newdistrict，Shenzhen, Guangdong, China.
EUT Name:	Electric Scooter
Trade Name:	/
Model No:	L1
Attached No.:	/
Power Supply:	Input: 100-240V~, 50/60Hz, 1.8A Output: 42.0V, 1.5A
Test Supply:	42.0V, 1.5A
Power Cord:	/
Signal Cable:	/
	/

3 Equipments List For All Test Items

No.	Equipment	Manufacturer	Model No.	S/N	Cal date
1	EMI Test Receiver	R&S	ESCI	100612	2018-07-01
2	EMI Test Receiver	R&S	ESPI	100067	2018-07-01
3	Amplifier	HP	8447D	1937A02415	2018-07-01
4	Single Power Conductor Module	FCC	FCC-LISN-5-50-1-01-CISPR25	07118	2018-07-01
5	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	9163-387	2018-07-01
6	Horn Antenna		BBHA9120A	B08000991-0021	2018-07-01
7	High Field Biconical Antenna	ELECTRO-METRICS	EM-6913	169	2018-07-01
8	Log Periodic Antenna		EM-6950	818	2018-07-01
9	Remote Active Vertical Antenna		EM-6892	354	2018-07-01
10	Power Clamp	SCHWARZBECK	MDS-21	3898	2018-07-01
11	Single Power Conductor Module	FCC	FCC-LISN-5-50-1-01-CISPR25	07254	2018-07-01
12	Teo Line Single Phase Module	SCHWARZBECK	NSLK8128	D-69124	2018-07-01
13	Positioning Controller	C&C	CC-C-1F	MF7802155	2018-07-01
14	`Electrostatic Discharge Simulator	TESEQ	NSG437	128	2018-07-01
15	Fast Transient Burst Generator	SCHAFFNER	MODULA6150	34587	2018-07-01
16	Fast Transient Noise Simulator	Noiseken	FNS-105AX	31438	2018-07-01
17	Capacitive Coupling Clamp	TESEQ	CDN8014	25115	2018-07-01
18	Color TV Pattern Genenator	PHILIPS	PM5418	TM209966	N/A
19	Power Frequency Magnetic Field Gene	EVERFINE	EMS61000-8K	608085	2018-07-01
20	Triple-Loop Antenna	EVERFINE	LLA-2	607035	2018-07-01
21	10dB attenuator	SCHWARZBECK	MTAIMP-136	R65.90.0009	2018-07-01

4 Conducted Emission

4.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

4.2 Measurement Standard and Limits of Radiated Disturbances

4.2.1 Standard:

EN 55032:2015

4.2.2 Limits

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

Note:

(1) The tighter limit shall apply at the edge between two frequency bands.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

4.3 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ±2.88 dB.

4.4 Test Procedure

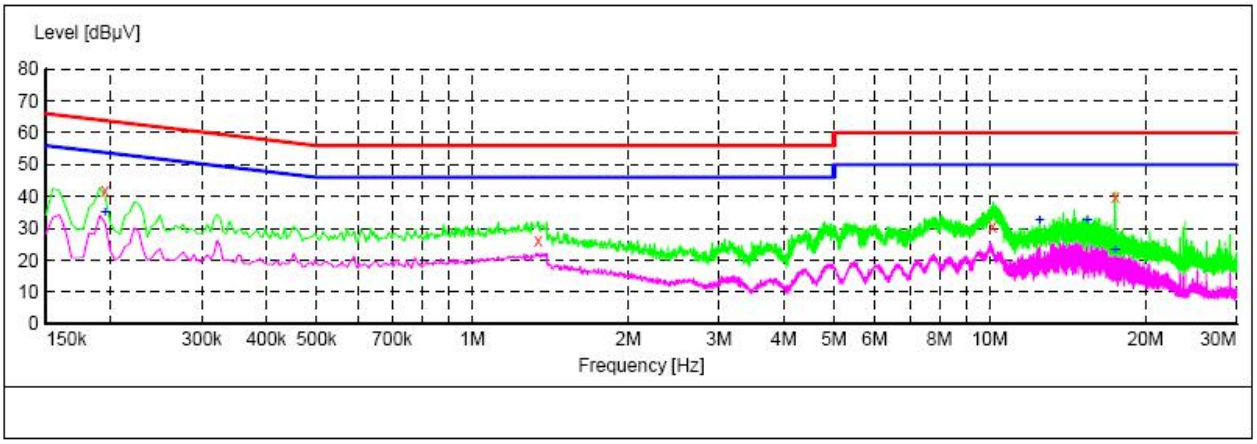
Test is conducting under the description of EN 55032 Power line communication apparatus used in low-voltage installations - Radio disturbance characteristics - Limits and methods of measurement - Part 1: Apparatus for in-home use.

4.5 Measurement Results

PASS.

EUT	:	Electric Scooter	Applicant	:	IU SMART CO.,LTD
M/N	:	L1	Mode	:	ON
Test Item	:	Conducted Emission	Phase Polarity	:	Line

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.195000	41.70	10.1	64	22.1	QP	L1	GND
1.341500	26.40	10.4	56	29.6	QP	L1	GND
10.125500	30.60	10.6	60	29.4	QP	L1	GND
17.487500	40.10	10.7	60	19.9	QP	L1	GND

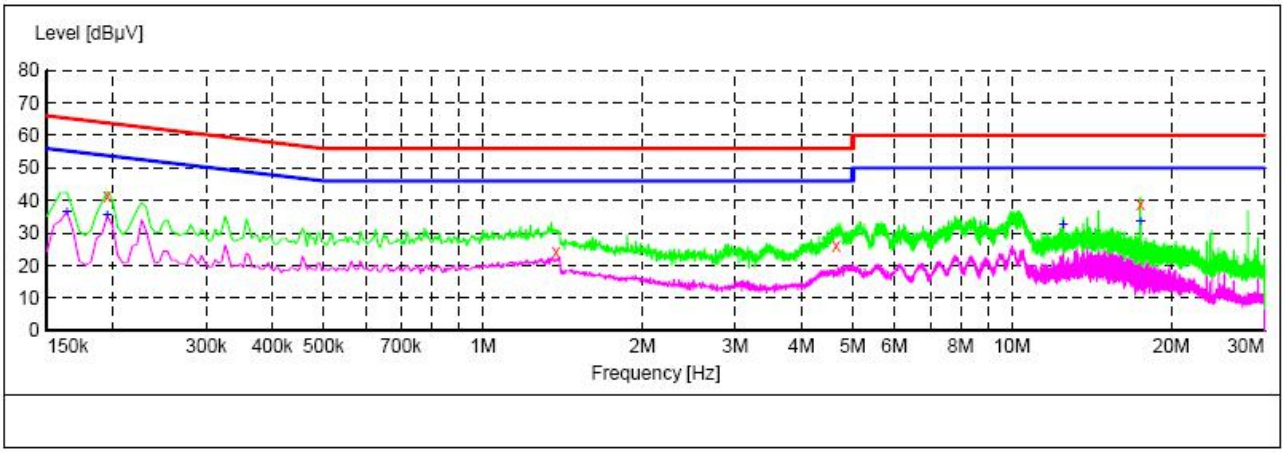
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.195000	34.80	10.1	54	19.0	AV	L1	GND
12.506000	32.60	10.6	50	17.4	AV	L1	GND
15.453500	32.60	10.7	50	17.4	AV	L1	GND
17.487500	23.30	10.7	50	26.7	AV	L1	GND

EUT	:	Electric Scooter	Applicant	:	IU SMART CO.,LTD
M/N	:	L1	Mode	:	ON
Test Site	:	Conducted Emission	Phase Polarity	:	Neutral

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

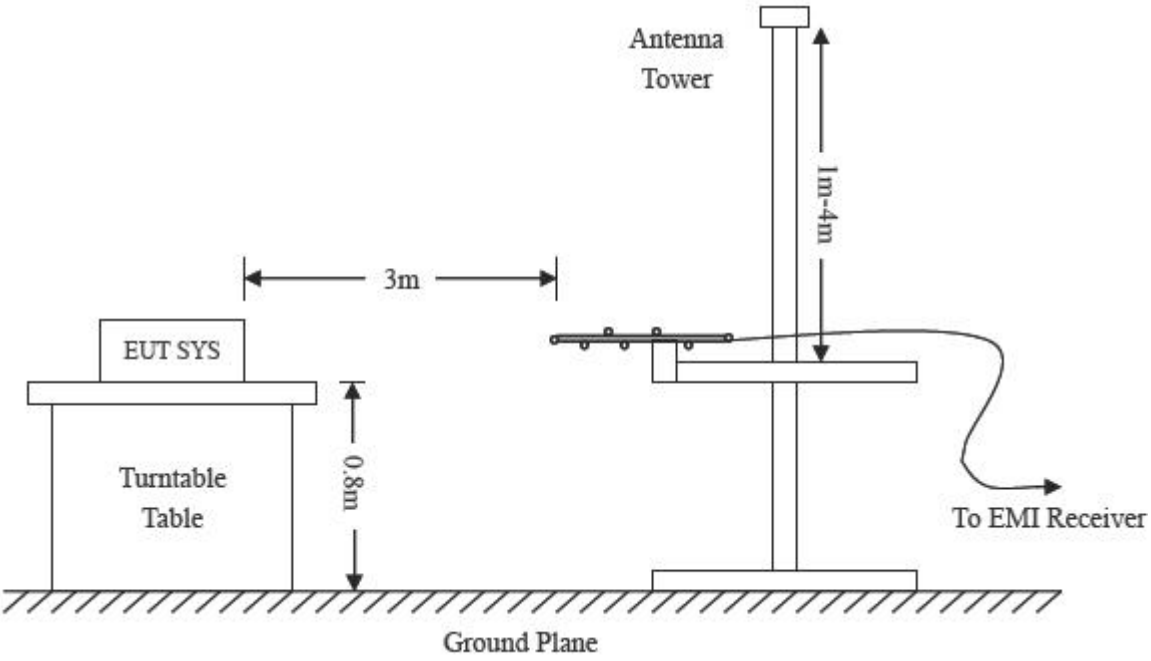
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.195000	41.40	10.1	64	22.4	QP	N	GND
1.373000	24.40	10.3	56	31.6	QP	N	GND
4.658000	26.30	10.5	56	29.7	QP	N	GND
17.483000	39.00	10.7	60	21.0	QP	N	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.163500	36.30	10.1	55	19.0	AV	N	GND
0.195000	35.40	10.1	54	18.4	AV	N	GND
12.506000	32.50	10.6	50	17.5	AV	N	GND
17.483000	33.40	10.7	50	16.6	AV	N	GND

5 Radiated Emissions

5.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

5.2 Measurement Standard and Limits of Radiated Disturbances

5.2.1 Standard:

EN 55032:2015

5.2.2 Limits

Frequency (MHz)	Distance (Meters)	Field Strengths Limits (dBμV/m)
30 ~ 230	3	40
230 ~ 1000	3	47

Frequency (MHz)	Distance (Meters)	Field Strengths Limits AV(dBμV/m)	Field Strengths Limits PK(dBμV/m)
1000~3000	3	50	70
3000-6000	3	54	74

Note:

(1) The tighter limit shall apply at the edge between two frequency bands.

(2) Distance refers to the distance in meters between the test instrument antenna and the closest point of any part of the E.U.T.

5.3 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ±5.10 dB.

5.4 Test Procedure

Test is conducting under the description of EN 55032 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

5.5 Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The Margin column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B device. The equation for margin calculation is as follows:

Margin = EN 55032 Class B Limit –Corr. Ampl.

5.6 Measurement Results

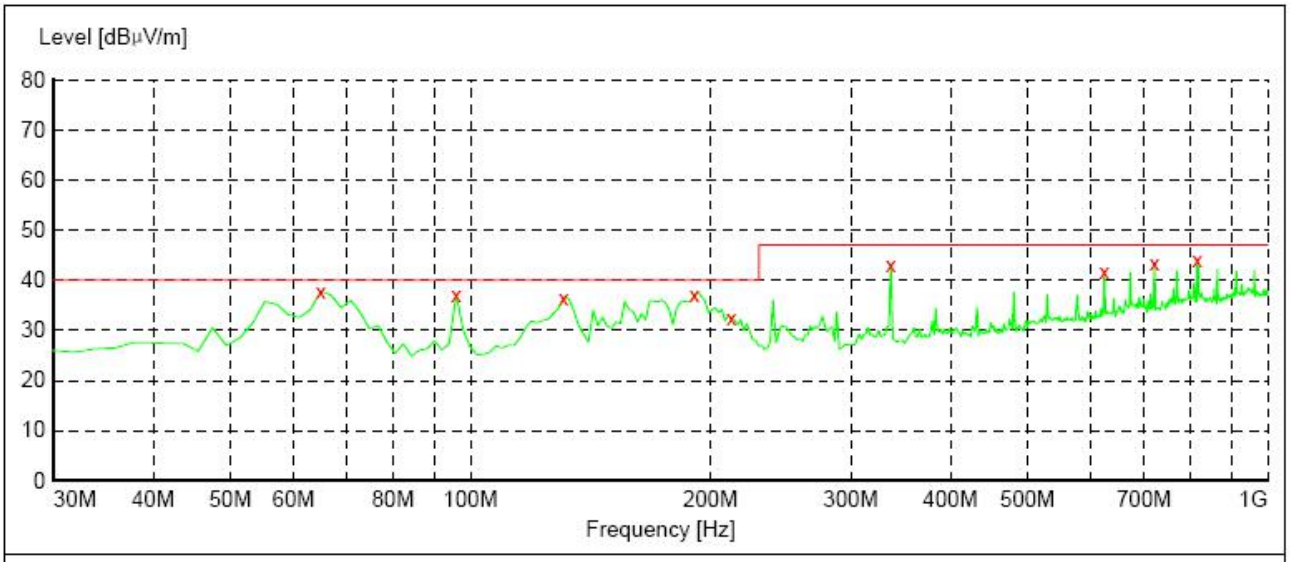
PASS.

EUT	:	Electric Scooter	Applicant	:	IU SMART CO.,LTD
M/N	:	L1	Mode	:	ON
Test Site	:	Radiated Emission	Test Specification	:	Horizontal

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

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	500.0 ms	100 kHz	VULB9168

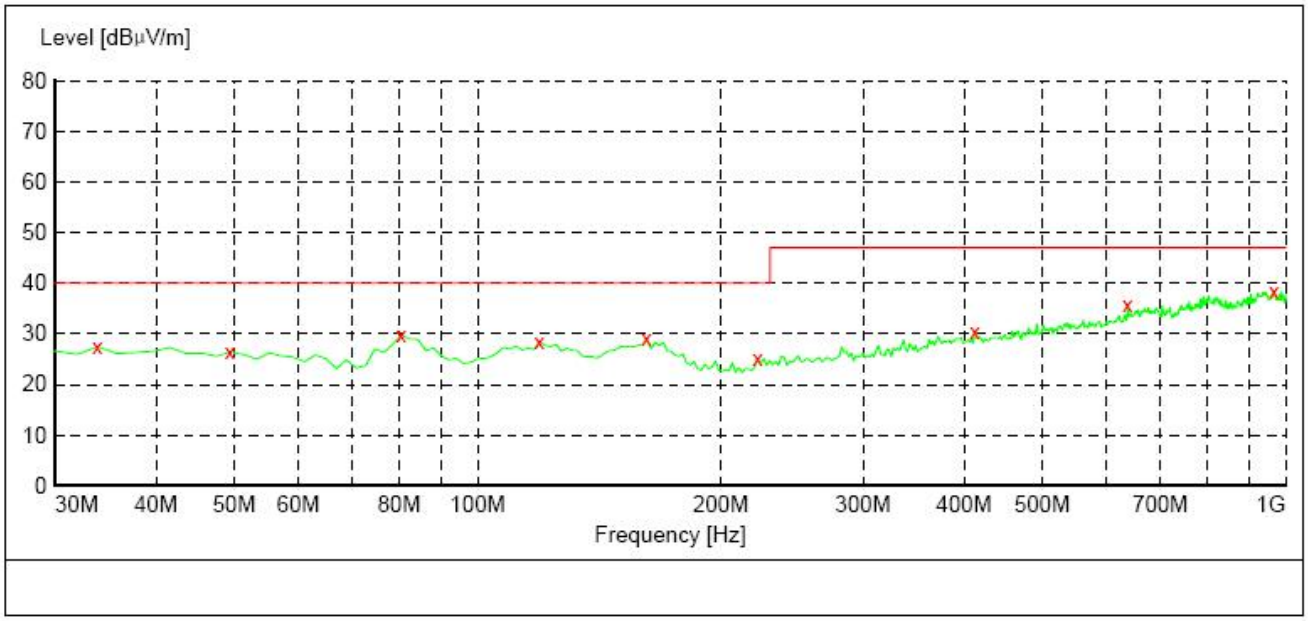


EUT	:	Electric Scooter	Applicant	:	IU SMART CO.,LTD
M/N	:	L1	Mode	:	ON
Test Site	:	Radiated Emission	Test Specification	:	Vertical

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

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	500.0 ms	100 kHz	VULB9168



MEASUREMENT RESULT:

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	27.40	13.9	40.0	12.6	---	100.0	0.00	VERTICAL
49.400000	26.40	14.1	40.0	13.6	---	100.0	0.00	VERTICAL
80.440000	29.70	10.2	40.0	10.3	---	100.0	0.00	VERTICAL
119.240000	28.40	13.1	40.0	11.6	---	100.0	0.00	VERTICAL
161.920000	29.10	15.2	40.0	10.9	---	100.0	0.00	VERTICAL
222.060000	25.20	12.3	40.0	14.8	---	100.0	0.00	VERTICAL
412.180000	30.60	17.1	47.0	16.4	---	100.0	0.00	VERTICAL
637.220000	35.80	21.5	47.0	11.2	---	100.0	0.00	VERTICAL
967.020000	38.50	25.4	47.0	8.5	---	100.0	0.00	VERTICAL

6 Harmonic Current Measurement (EN 61000-3-2)

6.1 Measurement Standard and Limits of Harmonics Current

6.1.1 Standard:

EN 61000-3-2:2014, Clause 7.1 Limits for Class A equipment.

6.1.2 Limits

IEC 555-2					
Table - I			Table - II		
Equipment Category	Harmonic Order n	Max. Permissible Harmonic Current (in Ampers)	Equipment Category	Harmonic Order n	Max. Permissible Harmonic Current (in Ampers)
Non Portable Tools or TV Receivers	Odd Harmonics		TV Receivers	Odd Harmonics	
	3	2.30		3	0.80
	5	1.14		5	0.60
	7	0.77		7	0.45
	9	0.40		9	0.30
	11	0.33		11	0.17
	13	0.21		13	0.12
	15≤n≤39	0.15 · 15/n		15≤n≤39	0.10 · 15/n
	Even Harmonics			Even Harmonics	
	2	1.08		2	0.30
	4	0.43		4	0.15
	8	0.30			
	8≤n≤40	0.23 · 8/n		DC	0.05

EN 61000-3-2/IEC 61000-3-2					
Equipment Category	Max. Permissible Harmonic Current (in Ampers)	Equipment Category	Harmonic Order n	Max. Permissible Harmonic Current (in A)	(mA/w)
Class A	Same as Limits Specified in 4-2.1, Table - I, but only odd harmonics required	Class D	3	2.30	3.4
			5	1.14	1.9
			7	0.77	1.0
			9	0.40	0.5
			11	0.33	0.35
			13≤n≤39	see Table I	3.85/n
			only odd harmonics required		

Class A POWER≤75W

6.2 Test Results

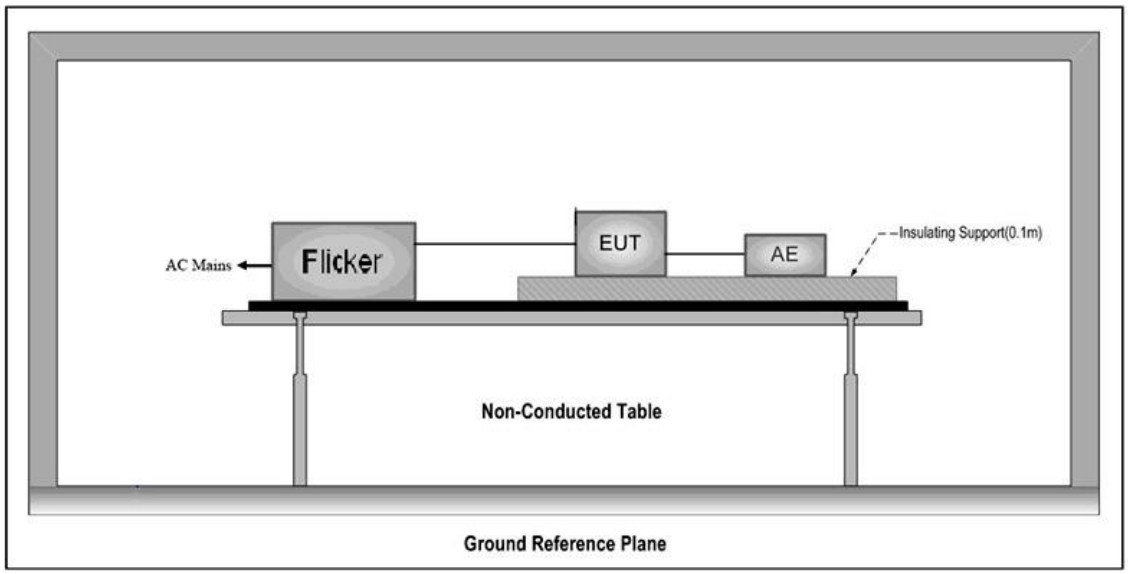
PASS.

According to Clause 7 of EN61000-3-2, the EUT rated power is less than 75W, belong to ‘equipment with a rated power of 75W or less’, therefore ‘limits are not specified in this edition of the standards’. It is deem to full fit the requirements of the standards.

Result: The EUT complies with the requirements of this section

7 VOLTAGE FLUCTUATIONS & FLICKER MEASUREMENT

7.1 Block Diagram of Test Setup



(EUT:Electric Scooter)

7.2 Measurement Standard and Limits of Voltage Fluctuation and Flickers

7.2.1 Standard:

EN 61000-3-3:2013, Limit: Clause 5.

7.2.2 Limits

Tests	Limits		Descriptions
	IEC555-3	IEC/EN 61000-3-3	
Pst	≤ 1.0, Tp= 10 min.	≤ 1.0, Tp= 10 min.	Short Term Flicker Indicator
Plt	N/A	≤ 0.65, Tp=2 hr.	Long Term Flicker Indicator
dc	≤ 3%	≤ 3.3%	Relative Steady-State V-Chang
dmax	≤ 4%	≤ 4%	Maximum Relative V-change
d (t)	N/A	≤ 3.3% for > 500 ms	Relative V-change characteristic

7.3 Application of Voltage Fluctuations and Flicker Test

Compliance to these standards ensures that tested equipment will not generate harmonic currents at levels that cause unacceptable degradation of the main environment. This directly contributes to meeting compatibility levels established in other EMC standards, which defines compatibility levels for low-frequency conducted disturbances in low-voltage supply systems.

7.4 Test Results

PASS.

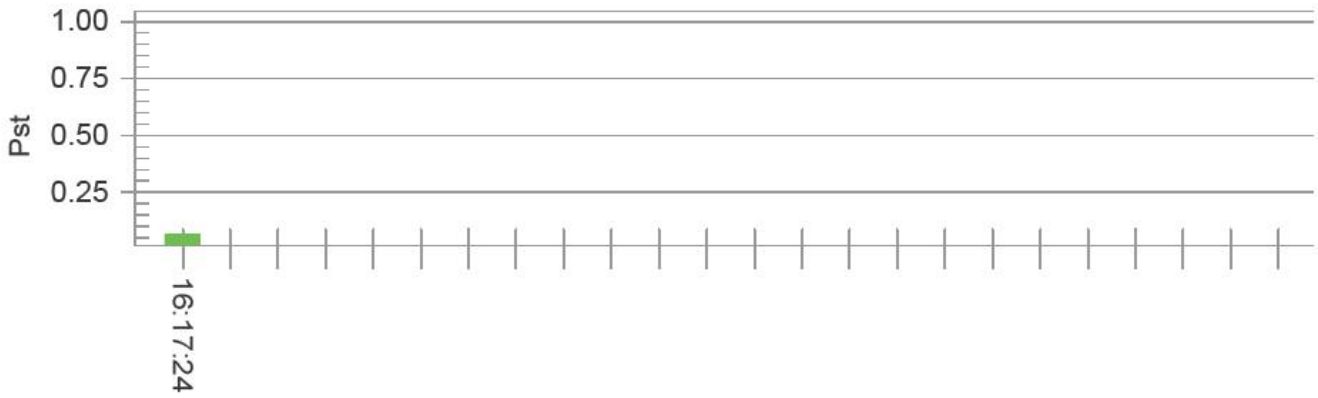
Result: The EUT complies with the requirements of this section.

Please refer to the following pages.

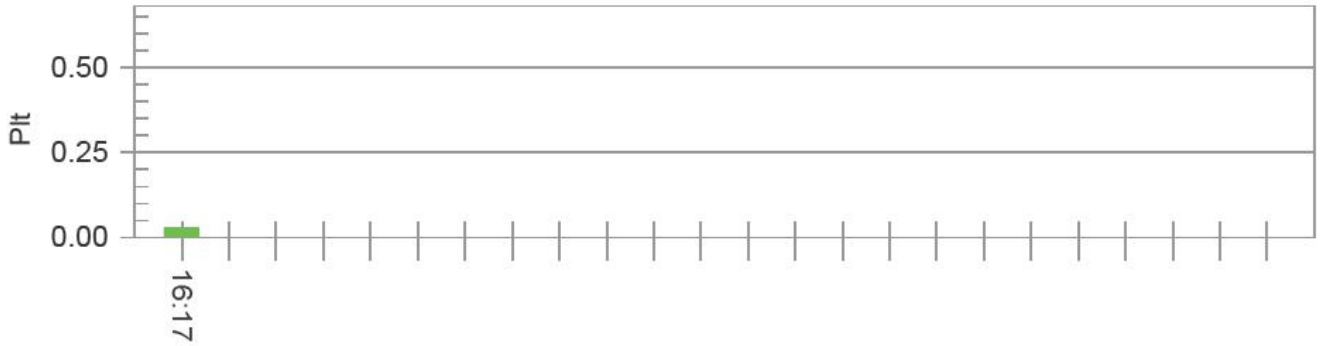
Date of Test	:	14: 25 May 24, 2019
Standard Used	:	EN/IEC 61000-3-3 Flicker
Short Time (Pst)	:	10 min
Observation Time	:	10 min (1 Flicker measurement)
Flicker Meter	:	42.0V, 1.5A
Customer	:	IU SMART CO.,LTD
E. U. T.	:	Electric Scooter
M/N	:	L1
Test Result	:	PASS

Maximum Flicker Results

Pst_i and limit line



Plt and limit line

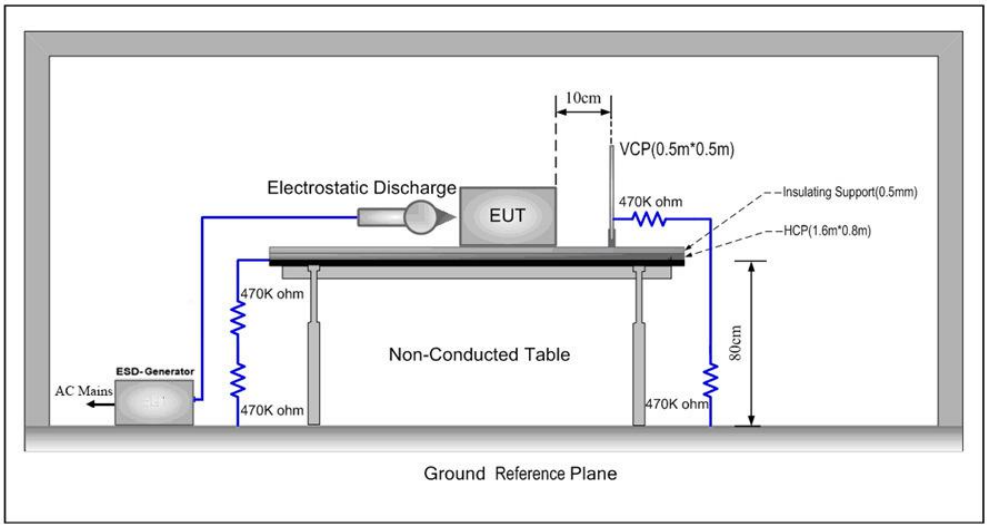


	EUT Values	Limit	Result
Pst	0.064	1.00	PASS
dc [%]	0.00	3.30	PASS
dmax [%]	0.00	4.00	PASS
dt >3.3%[s]	0.00	0.50	PASS

8 Electrostatic Discharge TEST

8.1 Block Diagram of Test Setup

Block Diagram of connection between the EUT and simulators



(EUT: Electric Scooter)

8.2 Test Standard

EN 55024: 2010+A1:2015 (EN 61000-4-2)

8.3 Severity Levels and Performance Criterion

8.3.1 Severity Level

Level	Test Voltage Contact Discharge (KV)	Test Voltage Air Discharge (KV)
1.	±2	±2
2.	±4	±4
3.	±6	±8
4.	±8	±15
X	Special	Special

8.3.2 Performance Criterion: B

8.4 Test Results

PASS

Electrostatic discharge immunity test data, Please refer to the following page.

ELECTROSTATIC DISCHARGE TEST

Applicant	:	IU SMART CO.,LTD	Test Date	:	May 24, 2019
EUT	:	Electric Scooter	Temperature	:	22℃
M/N	:	L1	Humidity	:	52%
Power Supply	:	42.0V, 1.5A	Criterion	:	B

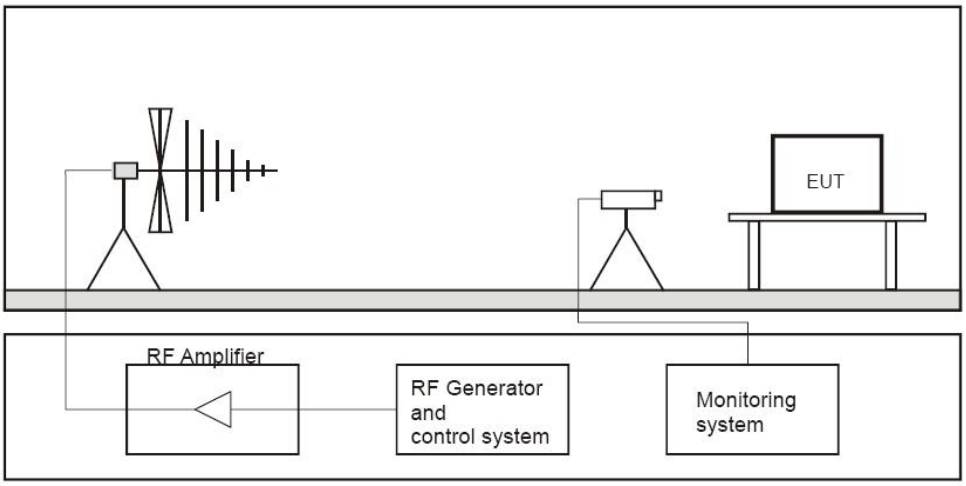
Test Mode: ON

	Test Levels (kV)							
	-2	+2	-4	+4	-6	+6	-8	+8
Air Discharge								
Aperture	A	A	A	A	A	A	A	A
Surface	A	A	A	A	A	A	A	A
Output port	A	A	A	A	A	A	A	A
Direct Contact Discharge								
/	/	/	/	/				

	Test Levels (kV)							
	Indirect Contact Discharge(HCP)				Indirect Contact Discharge(VCP)			
	-2	+2	-4	+4	-2	+2	-4	+4
Front Side	A	A	A	A	A	A	A	A
Top Side	A	A	A	A	A	A	A	A
Back Side	A	A	A	A	A	A	A	A
Left Side	A	A	A	A	A	A	A	A
Right Side	A	A	A	A	A	A	A	A

9 RAdio Frequency electromagnetic Field Test

9.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

9.2 Test Standard

EN 55024:2010+A1:2015 (EN 61000-4-3)

9.3 Severity Levels and Performance Criterion

9.3.1 Severity Level

Level	Field Strength V/m
1.	1
2.	3
3.	10
X.	Special

9.3.2 Performance Criterion: A

9.4 Test Results

PASS.

Continuous radiated disturbances test data, please refer to the following page.

Radio Frequency Electromagnetic Field Test

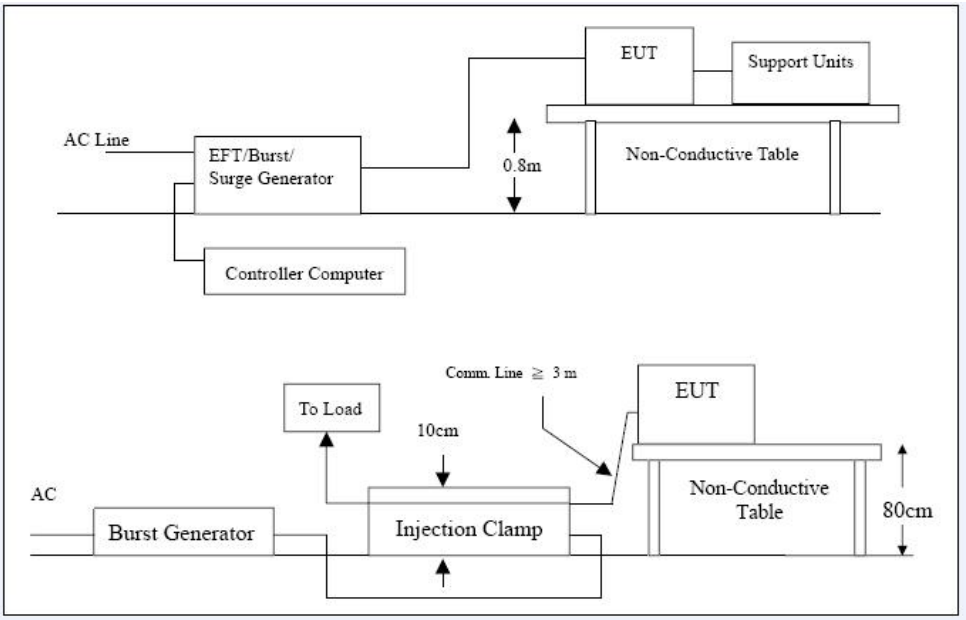
Applicant	:	IU SMART CO.,LTD	Test Date	:	May 24, 2019
EUT	:	Electric Scooter	Temperature	:	22℃
M/N	:	L1	Humidity	:	52%
Power Supply	:	42.0V, 1.5A	Criterion	:	A

Test Mode: ON

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		Vert	Hori	Vert	Hori	Vert	Hori	Vert	Hori
80-1000	3	A	A	A	A	A	A	A	A
1400-2700	3	/	/	/	/	/	/	/	/

10 Electrical Fast Transient/Burst Test

10.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

10.2 Test Standard

EN 55024:2010+A1:2015 (EN 61000-4-4)

10.3 Severity Levels and Performance Criterion

10.3.1 Severity Level

Open Circuit Output Test Voltage and Repetition Rate of The Impulses		
Level	On PC Lines	On I/O (Input/Output) Signal data and control lines
1	±0.5 KV	±0.25 KV
2	±1 KV	±0.5 KV
3	±2 KV	±1 KV
4	±4 KV	±2 KV
X	Special	Special
NOTE 1: Use of 5 KHz repetition rates is traditional; however, 100 KHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types. NOTE 2: With some products, there may be no clear distinction, between power ports and I/O ports, in which case it is up to product committees to make this determination for test purposes.		
“X” is an open level. The level has to be specified in the dedicated equipment specification.		

10.3.2 Performance Criterion: B

10.4 Test Results

PASS

Electrical fast transients test data, please refer to the following page.

Electrical Fast Transient/Burst Test Results

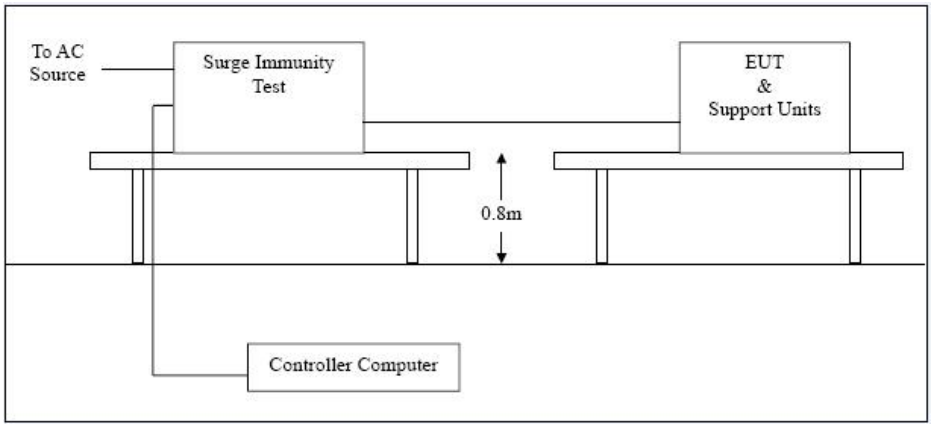
Standard	:	☒ IEC 61000-4-4 ☐ EN 61000-4-4	Result : ☐ PASS / ☒ FAIL
Applicant	:	IU SMART CO.,LTD	
EUT	:	Electric Scooter	
M/N	:	L1	
Input Voltage	:	42.0V, 1.5A	
Criterion	:	B	
Ambient Condition	:	20°C, 50%RH	

Test Mode: ON

EN 61000-4-4		Test Levels (kV)							
		-0.5	+0.5	-1.0	+1.0	-2.0	+2.0	-4.0	+4.0
Power Supply Power Port of EUT	L1	A	A	A	A	/	/	/	/
	L2	A	A	A	A	/	/	/	/
	PE	/	/	/	/	/	/	/	/
	L1+L2	A	A	A	A	/	/	/	/
	L1+PE	/	/	/	/	/	/	/	/
	L2+PE	/	/	/	/	/	/	/	/
	L1+L2+PE	/	/	/	/	/	/	/	/
Signal ports		/	/	/	/	/	/	/	/

11 SURGE immunity Test

11.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

11.2 Test Standard

EN 55024:2010+A1:2015 (EN 61000-4-5)

11.3 Severity Levels and Performance Criterion

11.3.1 Severity Level

Severity Level	Open-Circuit Test Voltage KV
1	±0.5
2	±1.0
3	±2.0
4	±4.0
*	Special

11.3.2 Performance Criterion: B

11.4 Test Results

PASS.

Surge test data, please refer to the following page.

Surge Immunity Test Results

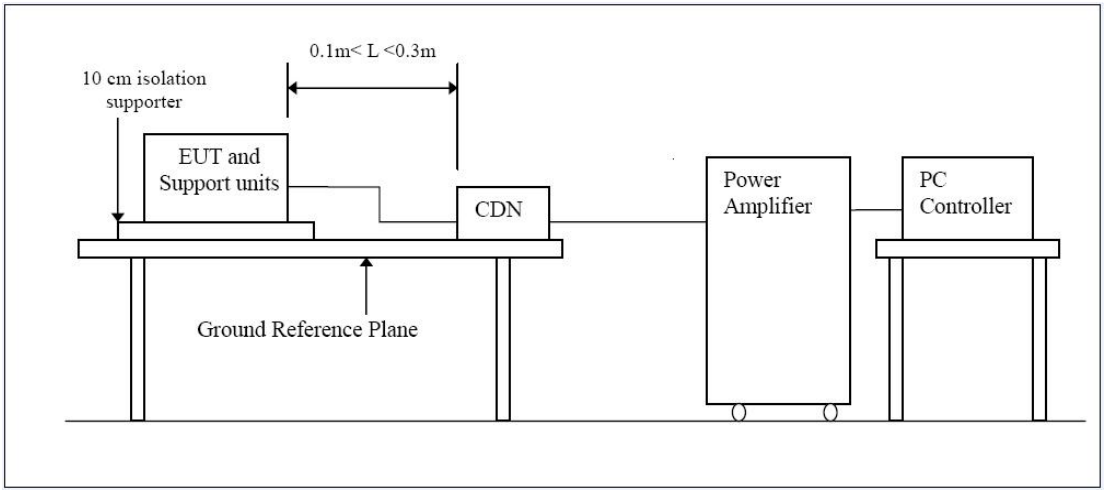
Applicant	:	IU SMART CO.,LTD	Test Date	:	May 24, 2019
EUT	:	Electric Scooter	Temperature	:	20°C
M/N	:	L1	Humidity	:	50%
Power Supply	:	42.0V, 1.5A	Test Engineer	:	Bill

Test Mode: ON

Level	Voltage	Poll	Path	Pass	Fail
1	0.5kV	±	L-N	A	/
2	1 kV	±	L-N	A	/
3	2 kV	±	L-PE, N-PE	/	/
4	4 kV	±	L-N, L-PE, N-PE	/	/

12 Conducted Susceptibility Test

12.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

12.2 Test Standard

EN 55024:2010+A1:2015 (EN 61000-4-6)

12.3 Severity Levels and Performance Criterion

12.3.1 Severity Level

Level	Field Strength V
1	1
2	3
3	10
X	Special

12.3.2 Performance Criterion: A

12.4 Test Results

PASS

Continuous conducted disturbances test data, please refer to the following page.

Conducted Susceptibility Test Results

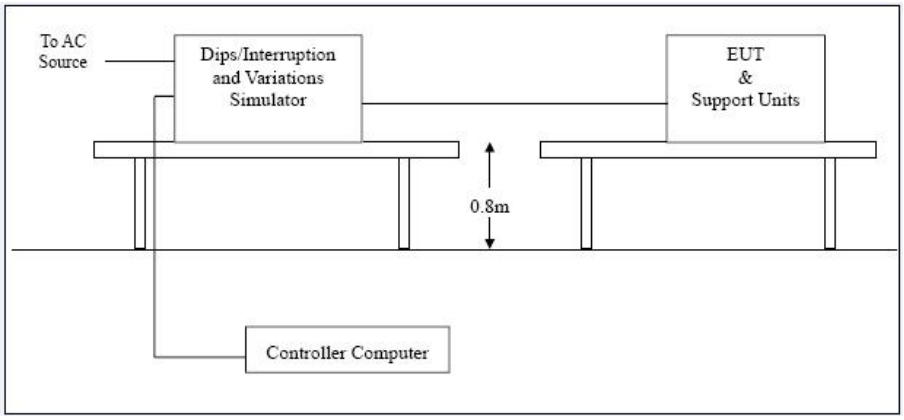
Applicant	:	IU SMART CO.,LTD	Test Date	:	May 24, 2019
EUT	:	Electric Scooter	Temperature	:	20°C
M/N	:	L1	Humidity	:	50%
Power Supply	:	42.0V, 1.5A	Frequency step	:	1% of fundamental
Frequency Range	:	150KHz-80MHz	Dwell time	:	1s

Test Mode: ON

Level	Voltage(V) (rms, unmodulated)	Modulated	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

13. Voltage dips and interruptions test

13.1 Block Diagram of Test Setup



(EUT: Electric Scooter)

13.2 Test Standard

EN 55024:2010+A1:2015 (EN 61000-4-11)

13.3 Severity Levels and Performance Criterion

13.3.1 Severity Level

Test Level %UT	Voltage Dip and Short Interruptions %UT	Duration (in period)
0	100	0.5 1 5 10 25 50 *
40	60	
70	30	

13.3.2 Performance Criterion: B&C

13.4 Test Results

PASS.

Voltage dips and interruptions test data, please refer to the following page.

Voltage Dips and Interruptions Test Results

Applicant	:	IU SMART CO.,LTD	Test Date	:	May 24, 2019
EUT	:	Electric Scooter	Temperature	:	20°C
M/N	:	L1	Humidity	:	50%
Power Supply	:	42.0V, 1.5A	Test Engineer	:	Bill
U	:	Vlotage dips in % UT (UT is rated voltage for the EUT)			

Test Mode: ON

Level	U	Test duration	Phase Angle	N	Pass	Fail
1	100%	10ms	0/90/180/270	3	B	/
3	30%	500ms	0/90/180/270	3	C	/
4	100%	5000ms	0/90/180/270	3	C	/

APPENDIX-Photos

======End of Report======