EMC

MEASUREMENT AND TEST REPORT

FOR

Cubietech Co., Ltd.

303,1st Bldg, A Zone, Baoan Internet Industry Base, No.1009, Baoyuan Road, Baoan District, Shenzhen, China.

Report Concerns: Original Report	**Equipment Type:** Cubietruck
Model:	Cubietruck
Report No.:	MWR150708202
Test Date:	2015-07-17 to 2015-08-03
Issue Date:	2015-08-04
Tested By:	***Young Li*** ***Project Engineer***
Reviewed By:	***Dixon Hao*** ***Reviewer***
Approved & Authorized By:	**Jackson Long** **Laboratory Manager**
Prepared By:	

Maxwell International Co., Ltd.
Room 509, Hongfa Center Building, Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-85279863 Fax: +86-755-85279201

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Maxwell International Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Cubietech Co., Ltd.

Address of applicant: 303,1st Bldg, A Zone, Baoan Internet Industry Base, No.1009, Baoyuan Road, Baoan District, Shenzhen, China.

Manufacturer: Cubietech Co., Ltd.

Address of manufacturer: 303,1st Bldg, A Zone, Baoan Internet Industry Base, No.1009, Baoyuan Road, Baoan District, Shenzhen, China.

General Description of E.U.T

Items	Description
EUT Description:	Cubietruck
Trade Name:	Cubieboard
Model No.:	Cubietruck
Power Supply:	DC5V,2A
Adaptor Model:	SP0502000EU
Rated Voltage:	100-240VAC,50/60Hz,0.2A
Battery Capacity:	/
For more information refer to the circuit diagram form and the user's manual.	

The test data is gathered from a production sample, provided by the manufacturer.

1.2 Test Standards

The following report is accordance with EN55022, Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement equipment. EN61000-3-2:2010, Electromagnetic compatibility (EMC) -- Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase). EN61000-3-3: 2013, Electromagnetic compatibility (EMC) -- Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection. And EN55024, Immunity characteristics Limits and methods of measurement.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the emission/immunity should be checked to ensure compliance has been maintained

1.3 Test Facility Location

Building1, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang Street, Bao'an District, Shenzhen, China

1.5 Performance Criteria

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the emission/immunity should be checked to ensure compliance has been maintained

2. SUMMARY OF TEST RESULTS

EN 55022,EN55024	DESCRIPTION OF TEST	RESULT
§7.1 Emission	Conducted Emissions	Compliant
§7.1 Emission	Radiated Emissions	Compliant
§7.1 Emission	EN61000-3-2 Harmonic Current Emission	Compliant
§7.1 Emission	EN61000-3-3 Voltage Fluctuation And Flicker	Compliant
§7.2 Immunity	Electrostatic Discharge	Compliant
§7.2 Immunity	Electromagnetic Field (80 MHz -1000 MHz)	Compliant
§7.2 Immunity	Electrical Fast Transient/Burst	Compliant
§7.2 Immunity	Surge Immunity Test	Compliant
§7.2 Immunity	Immunity to Conducted Disturbances	Compliant
§7.2 Immunity	Voltage Dips/Interruptions Immunity	Compliant

NOTE: Test is carried out with the most representative operation mode which the results can be the worse case emission/immunity.

3. CONDUCTED EMISSION

3.1 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.

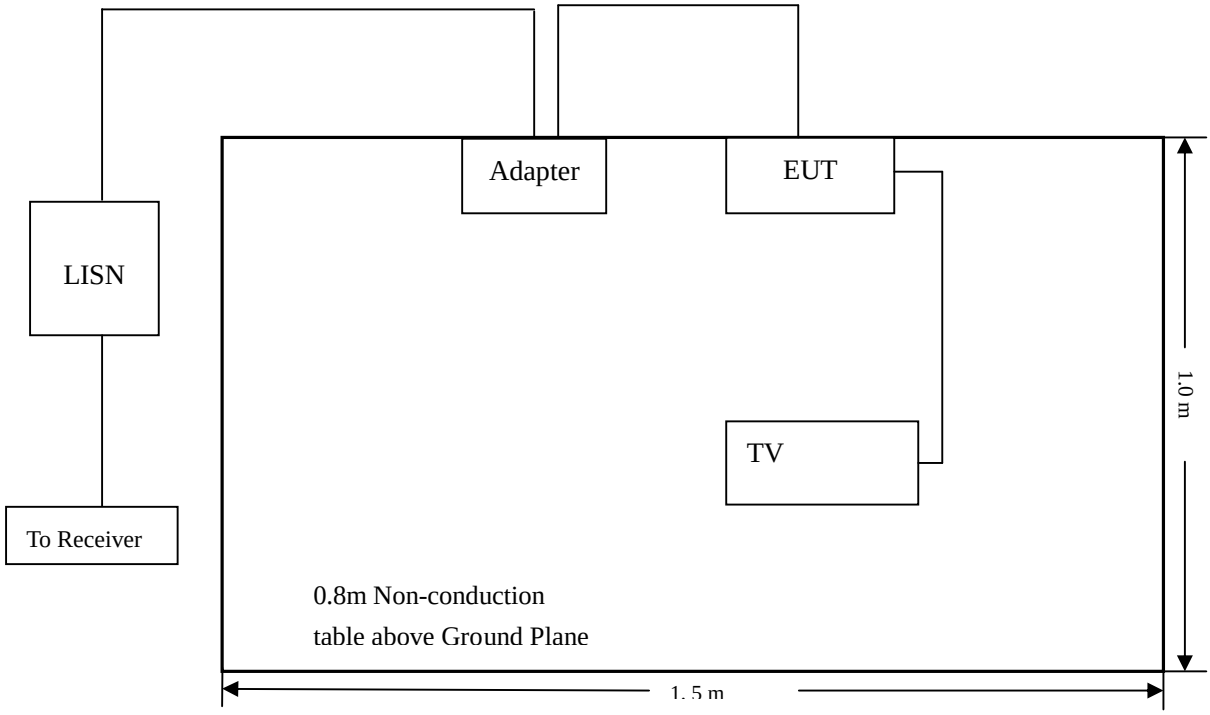
3.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2015-03-28	2016-03-27
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2015-03-28	2016-03-27
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2015-03-28	2016-03-27
AMN	EMCO	3825/2	11967C	2015-03-28	2016-03-27
Power Divider	Weinschel	1506A	PM204	2015-03-28	2016-03-27
Current Probe	FCC	F-33-4	091684	2015-03-28	2016-03-27

3.3 Test Procedure

Test is conducting under the description of EN55022, Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement equipment.

3.4 Basic Test Setup Block Diagram



3.5 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1018 mbar

3.6 Summary of Test Results/Plots

According to the data in section 3.7, the EUT complied with the EN 55022 Conducted margin for a the device, with the *worst* case reading of:

-11.99 dB at **0.154 MHz** in the **Line**, **Peak** detector, 0.15-30MHz

3.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

Conducted Disturbance

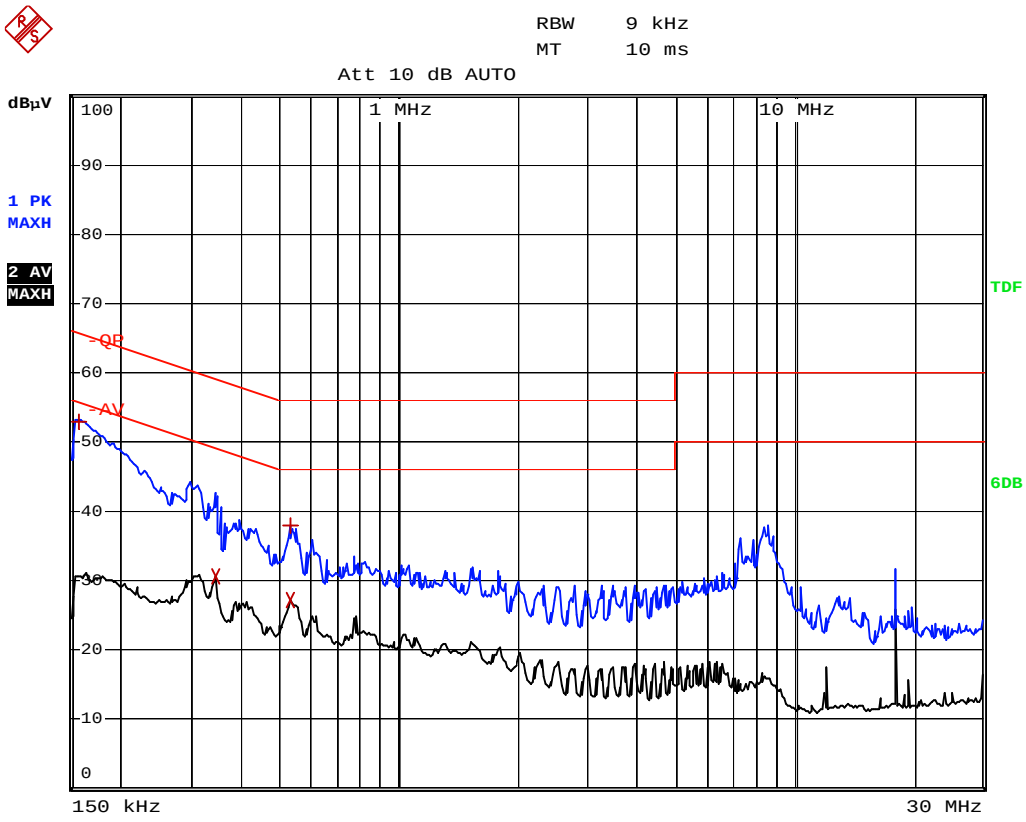
EUT: Cubietruck

M/N: Cubietruck

Operating Condition: Playing

Test Specification: Neutral

Comment: AC 230V/50Hz/Adapter DC 5V



EDIT PEAK LIST (Prescan Results)			
Trace1:	-QP		
Trace2:	-AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Max Peak	158 kHz	53.01	-12.55
2 Average	342 kHz	30.48	-18.66
1 Max Peak	530 kHz	38.05	-17.94
2 Average	530 kHz	27.19	-18.80

Plot of Conducted Emissions Test Data

Conducted Disturbance

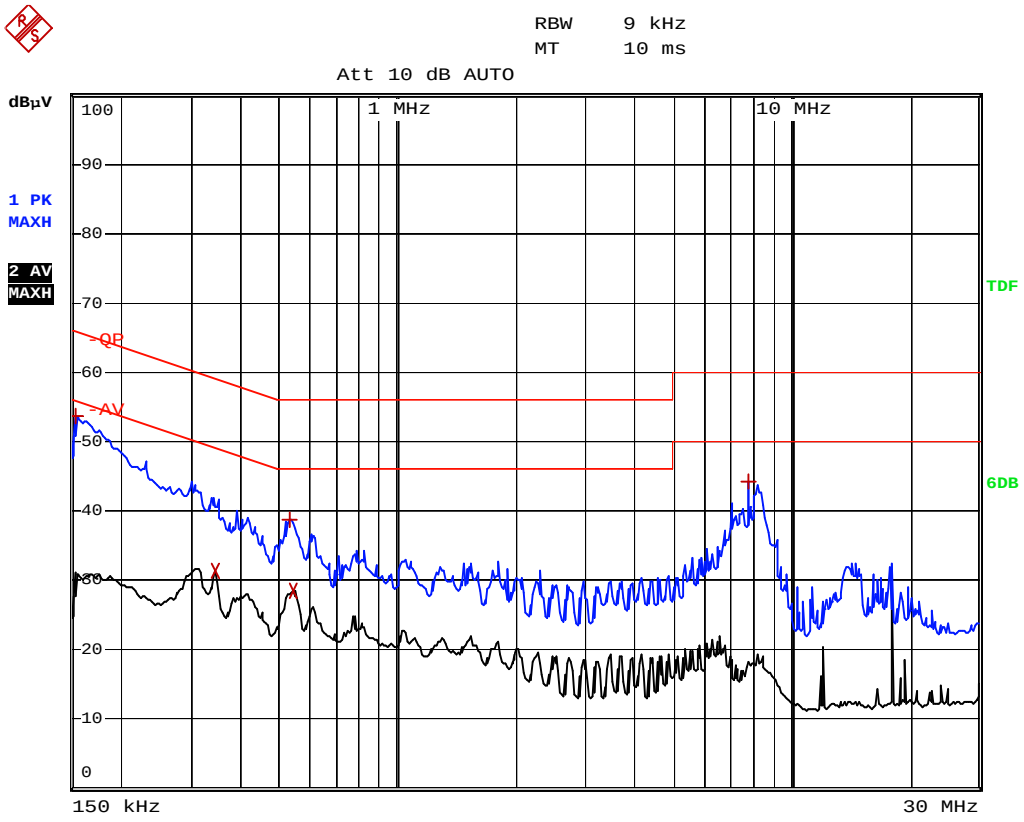
EUT: Cubietruck

M/N: Cubietruck

Operating Condition: Playing

Test Specification: Line

Comment: AC 230V/50Hz/Adapter DC 5V



EDIT PEAK LIST (Prescan Results)			
Trace1:	-QP		
Trace2:	-AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Max Peak	154 kHz	53.78	-11.99
2 Average	342 kHz	31.30	-17.85
1 Max Peak	530 kHz	38.79	-17.20
2 Average	542 kHz	28.51	-17.48
1 Max Peak	7.766 MHz	44.32	-15.67

4. RADIATED EMISSION

4.1 Measurement Uncertainty

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

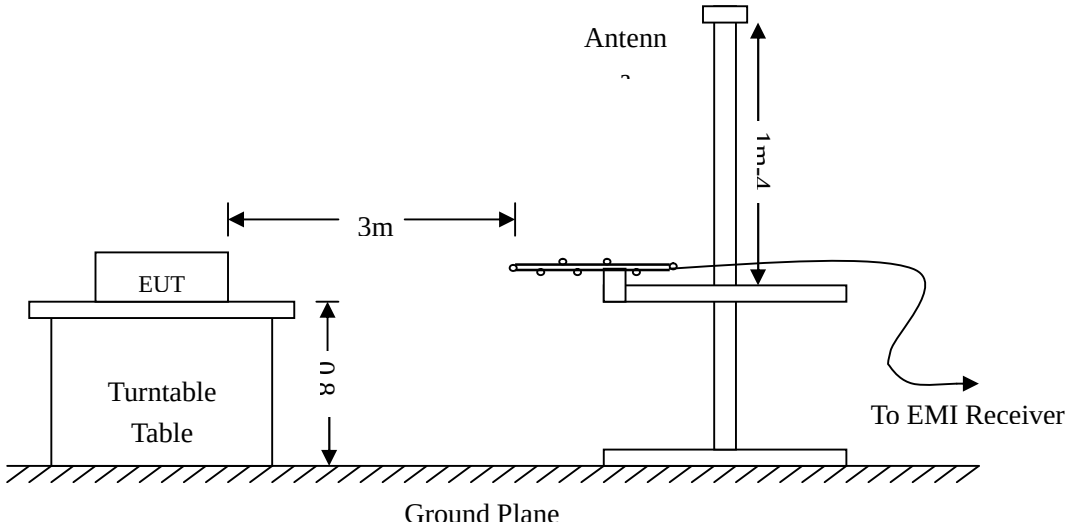
4.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2015-03-28	2015-03-27
EMI Test Receiver	R&S	ESVB	825471/005	2015-03-28	2015-03-27
Positioning Controller	C&C	CC-C-1F	N/A	2015-03-28	2015-03-27
RF Switch	EM	EMSW18	SW060023	2015-03-28	2015-03-27
Pre-amplifier	Agilent	8447F	3113A06717	2015-03-28	2017-03-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2015-03-28	2017-03-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2015-03-28	2015-03-27
Horn Antenna	ETS	3117	00086197	2015-03-28	2015-03-27

4.3 Test Procedure

Test is conducting under the description of Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement equipment. The test method shall be in accordance with EN 55022 [7].

4.4 Test System Setup



4.5 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 -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – EN55022 Limit

4.6 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	41%
ATM Pressure:	1012 mbar

4.7 Summary of Test Results/Plots

According to the data, the EUT complied with the EN 55022 standards, and had the worst margin of:

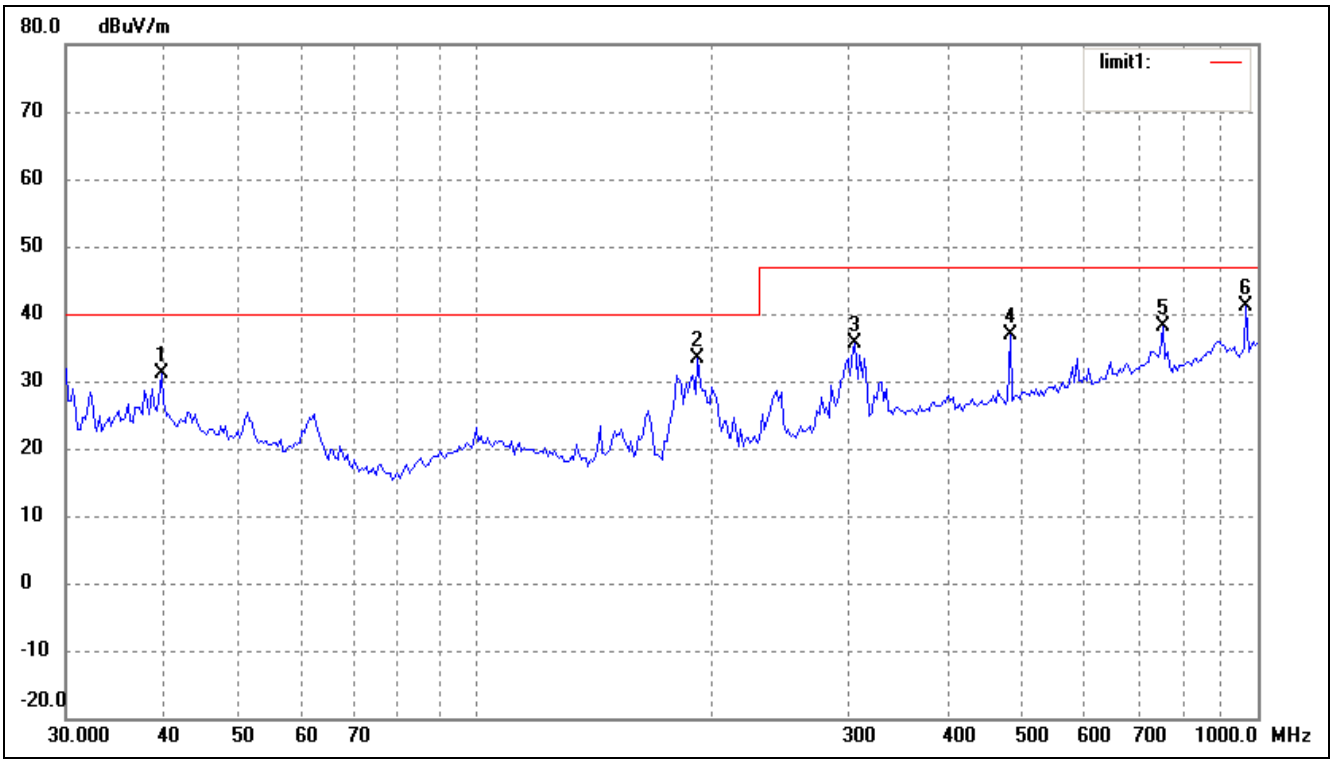
-5.82 dBmV at **965.5421 MHz** in the **Horizontal** polarization, **Playing** mode, Frequency range

30 MHz to 6 GHz

Plot of Radiation Emission Test Data

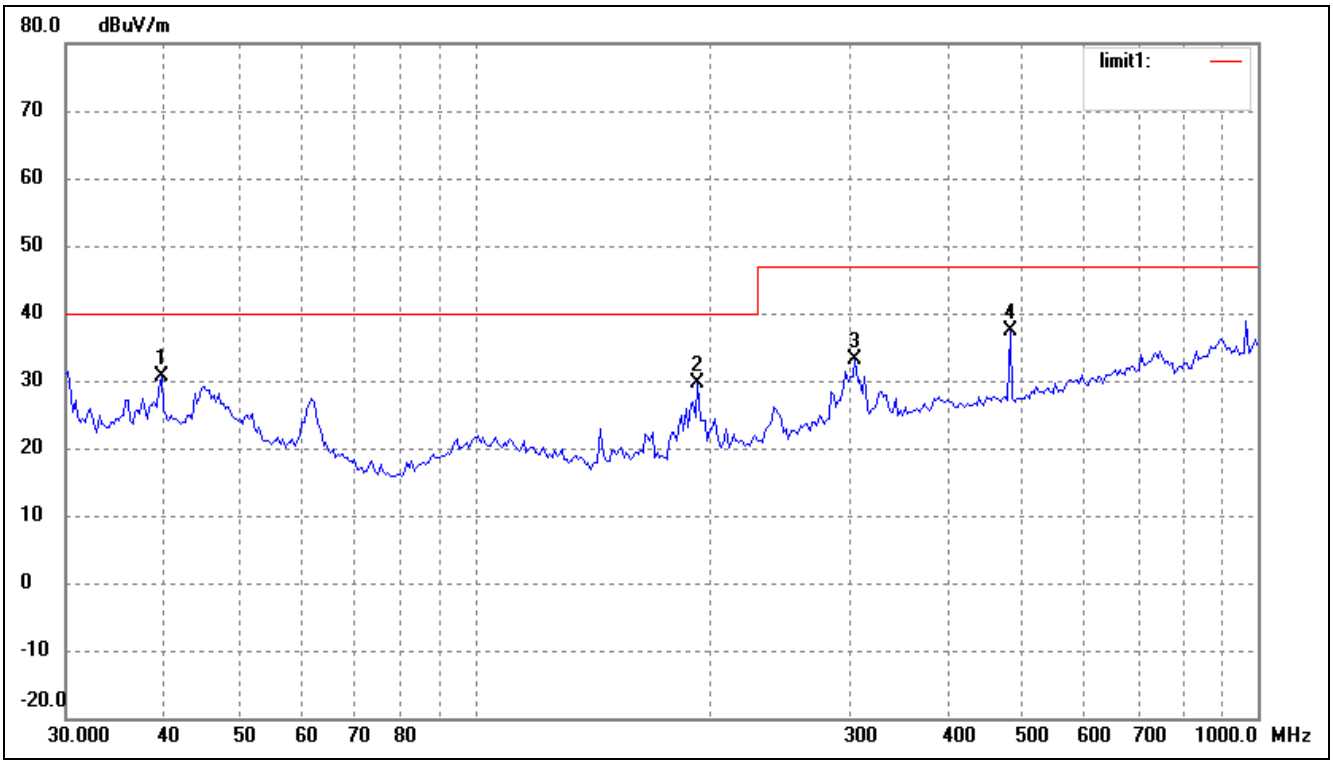
Test Mode: Playing Mode

Horizontal:



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	39.7147	21.55	9.64	31.19	40.00	-8.81	359	200	peak
2	192.4186	29.00	4.31	33.31	40.00	-6.69	359	200	peak
3	305.6800	25.38	10.27	35.65	47.00	-11.35	359	200	peak
4	482.2156	25.39	11.49	36.88	47.00	-10.12	359	200	peak
5	755.3873	20.63	17.48	38.11	47.00	-8.89	359	200	peak
6	965.5421	22.81	18.37	41.18	47.00	-5.82	359	200	peak

Vertical:



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	39.7146	20.94	9.64	30.58	40.00	-9.42	359	100	peak
2	192.4186	25.23	4.31	29.54	40.00	-10.46	359	100	peak
3	305.6800	22.95	10.27	33.22	47.00	-13.78	359	100	peak
4	482.2156	25.85	11.49	37.34	47.00	-9.66	359	100	peak

Emissions attenuated more than 20 dB below the permissible value are not reported. There is only the base noise in frequency 1GHz to 6GHz.

5. Electrostatic Discharge Immunity (ESD)

5.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
ESD Generator	TESQ AG	NSG 437	161	2015-03-28	2016-03-27

5.2 Test Procedure

Test is conducting under the description of IEC 61000-4-2.

Test Performance

Performance Criterion: B

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	45 %
ATM Pressure:	1019 mbar

5.3 EN61000-4-2: Electrostatic Discharge Immunity Test Data

Test Mode: Playing Mode

Table 1: Electrostatic Discharge Immunity (Air Discharge)

EN 61000-4-2 Test Points	Test Levels (kV)									
	-2	+2	-4	+4	-6	+6	-8	+8	-15	+15
Slots	A	A	A	A	A	A	A	A		
---	---	---	---	---	---	---	---	---		
---	---	---	---	---	---	---	---	---		

Table 2: Electrostatic Discharge Immunity (Direct Contact)

EN 61000-4-2 Test Points	Test Levels (kV)									
	-2	+2	-4	+4	-6	+6	-8	+8	-15	+15
Screw	A	A	A	A						
/	/	/	/	/						

Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)

EN 61000-4-2	Test Levels (kV)									
Test Points	-2	+2	-4	+4	-6	+6	-8	+8	-15	+15
Front Side	A	A	A	A						
Top Side	A	A	A	A						
Back Side	A	A	A	A						
Left Side	A	A	A	A						
Right Side	A	A	A	A						

Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

EN 61000-4-2	Test Levels (kV)									
Test Points	-2	+2	-4	+4	-6	+6	-8	+8	-15	+15
Front Side	A	A	A	A						
Top Side	A	A	A	A						
Back Side	A	A	A	A						
Left Side	A	A	A	A						
Right Side	A	A	A	A						

6. Radiated RF-Electromagnetic Field Immunity

6.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Signal Generator	Rohde & Schwarz	SMT03	100059	2015-03-28	2016-03-27
Voltage Probe	Rohde & Schwarz	URV5-Z2	100013	2015-03-28	2016-03-27
Power Amplifier	AR	150W1000	300999	2015-03-28	2016-03-27
Power Amplifier	AR	25S1G4AM1	305993	2015-03-28	2016-03-27
Trilog Antenna	SCHWARZBECK	VULB9163	9163-333	2015-03-28	2017-03-27
Anechoic chamber	Albatross Projects	MCDC	----	2015-03-28	2017-03-27

6.2 Test Procedure

Test is conducting under the description of IEC 61000-4-3.

Test Performance

Performance Criterion: A

Environmental Conditions

Temperature:	21 °C
Relative Humidity:	40 %
ATM Pressure:	1015 mbar

6.3 EN61000-4-3: Continuous Radiated Disturbances Test Data

Frequency step: 1% fundamental
Dwell time: 2 second

Test Mode: Playing Mode

Frequency Range (MHz)	Front (3 V/m)		Rear (3 V/m)		Left Side (3 V/m)		Right Side (3 V/m)	
80-1000	VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
	A	A	A	A	A	A	A	A

Test Result: Pass

7. Electrical Fast Transients

7.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Transient 2000	EMC PARTNER	TRA2000	863	2015-03-28	2016-03-27
Couple Clamp	EMC PARTNER	CN-EFT1000	513	2015-03-28	2016-03-27

7.2 Test Procedure

Test is conducting under the description of IEC 61000-4-4.

Test Performance

Performance Criterion: B

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	38%
ATM Pressure:	1015 mbar

7.3 EN61000-4-4: Electrical Fast Transients Test Data

Test Mode: Playing Mode

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

Test Result: Pass

8. Surge

8.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Transient 2000	EMC PARTNER	TRA2000	863	2015-03-28	2016-03-27
Couple Clamp	EMC PARTNER	CN-EFT1000	513	2015-03-28	2016-03-27

8.2 Test Procedure

Test is conducting under the description of IEC 61000-4-5.

Test Performance

Performance Criterion: B

Environmental Conditions

Temperature:	22 °C
Relative Humidity:	48%
ATM Pressure:	1015 mbar

8.3 EN61000-4-5: Surge Test Data

Test Mode: Playing Mode

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

Test Result: Pass

9. Continuous Conducted Disturbances

9.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
CS Immunity Tester	EMTEST	CWS500	0900-03	2015-03-28	2016-03-27
CDN	Luthi	L-801M2/M3	2665	2015-03-28	2016-03-27
Attenuator	EMTEST	MA-5100/6BF2	1009	2015-03-28	2016-03-27

9.2 Test Procedure

Test is conducting under the description of IEC 61000-4-6.

Test Performance

Performance Criterion: A

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	38 %
ATM Pressure:	1014 mbar

9.3 EN61000-4-6: Continuous Conducted Disturbances Test Data

Frequency step: 1% fundamental
Dwell time: 2 second

Test Mode: Playing Mode

Level	Voltage Level (e.m.f.) U_0	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Level	Voltage Level (e.m.f.) U_0	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test Result: Pass

10. Voltage Dips And Interruptions

10.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Transient 2000	EMC PARTNER	TRA2000	863	2015-03-28	2016-03-27
Couple Clamp	EMC PARTNER	CN-EFT1000	513	2015-03-28	2016-03-27

10.2 Test Procedure

Test is conducting under the description of IEC 61000-4-11.

Test Performance

Performance Criterion: B/C

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	38%
ATM Pressure:	1020 mbar

10.3 EN61000-4-11: Voltage Dips And Interruptions Test Data

Test Mode: Playing Mode

Level	U2	td	Phase Angle	N	Pass	Fail
1	100%	10ms	0/90/180/270	3	A	/
2	100%	20ms	0/90/180/270	3	A	/
3	30%	500ms	0/90/180/270	3	B	/
4	100%	5000ms	0/90/180/270	3	B	/

Test Result: Pass

11. EN 61000-3-2 HARMONIC CURRENT EMISSIONS

11.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Digital Power Analyzer	Em Test AG/Switzerland	DPA 500	V0745103095	2015-03-28	2016-03-27
Source	Em Test AG/Switzerland	ACS 500	V0745103096	2015-03-28	2016-03-27

11.2 Test Procedure

Test is conducting under the description of EN61000-3-2: 2010 See the clause 7 of EN61000-3-2:, the EUT with a rated power is less than 75W, other than lighting equipment .No limits in the EN 61000-3-2. In such a case it is required that the decision and justification not to measure.

Result: Pass

12. EN 61000-3-3 VOLTAGE FLUCTUATION AND FLICKER

12.1 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Digital Power Analyzer	Em Test AG/Switzerland	DPA 500	V0745103095	2015-03-28	2016-03-27
Source	Em Test AG/Switzerland	ACS 500	V0745103096	2015-03-28	2016-03-27

12.2 Test Procedure

Test is conducting under the description of EN61000-3-3: 2013

12.3 Test Standards

EN61000-3-3: 2013
Limit: Clause 5

Environmental Conditions

Temperature:	22 °C
Relative Humidity:	54%
ATM Pressure:	1022 mbar

12.4 EN 61000-3-3: Voltage Fluctuation and Flicker Test Data

Flicker Test Summary per EN/IEC61000-3-3 (Run time)

EUT: Cubietruck | Tested by: Vigoss

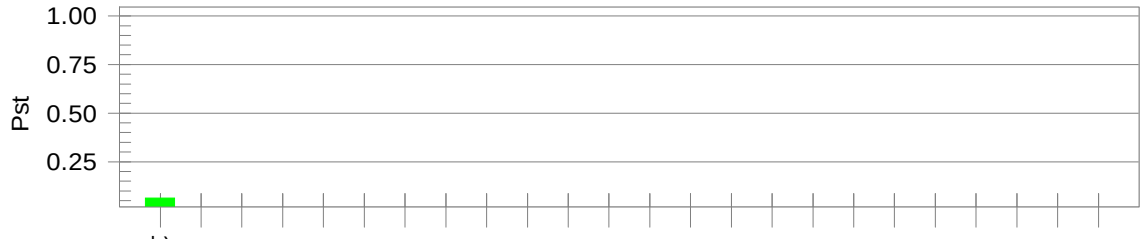
Test category: All parameters (European limits) | Test Margin: 100

Test date: 2015-07-23 | Start time: 10:43:22 AM | End time: 10:53:38 AM

Test duration (min): 10 | Data file name: F-000598.cts_data

Test Result: Pass | Status: Test Completed

Pst_i and limit line | European Limits



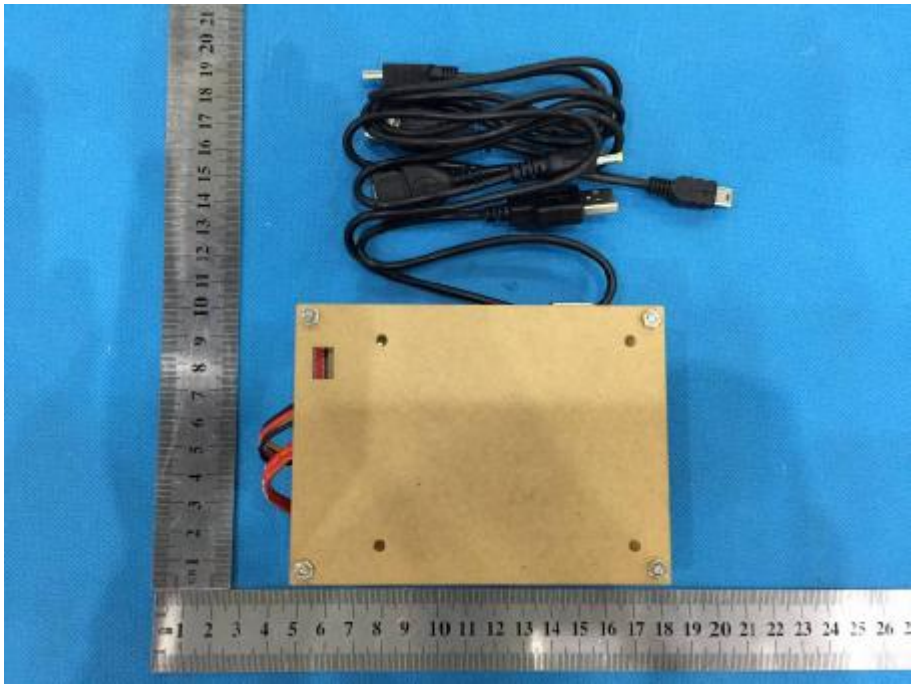
Plt and limit line

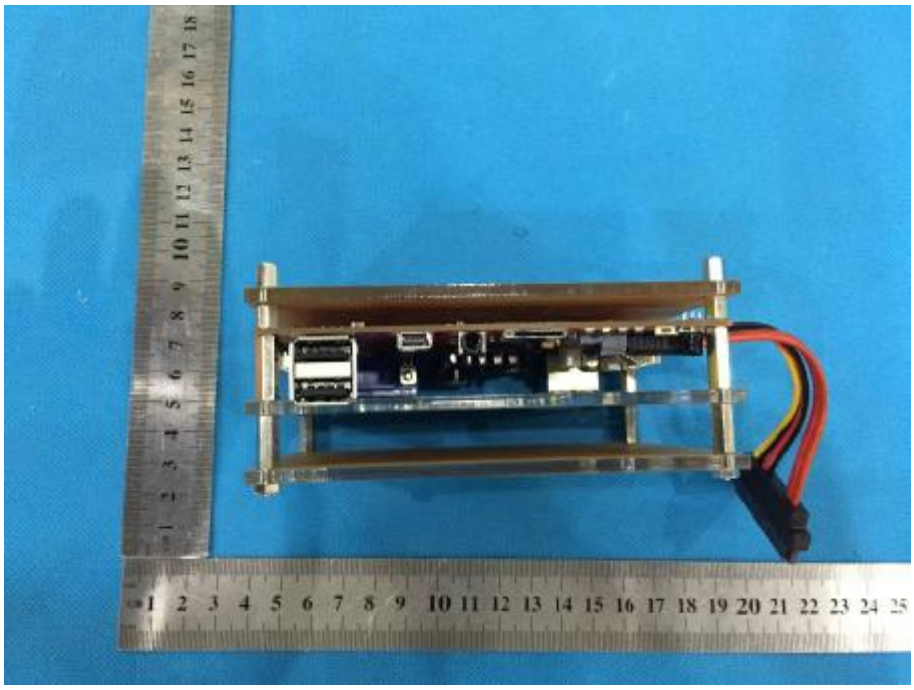
Parameter values recorded during the test:

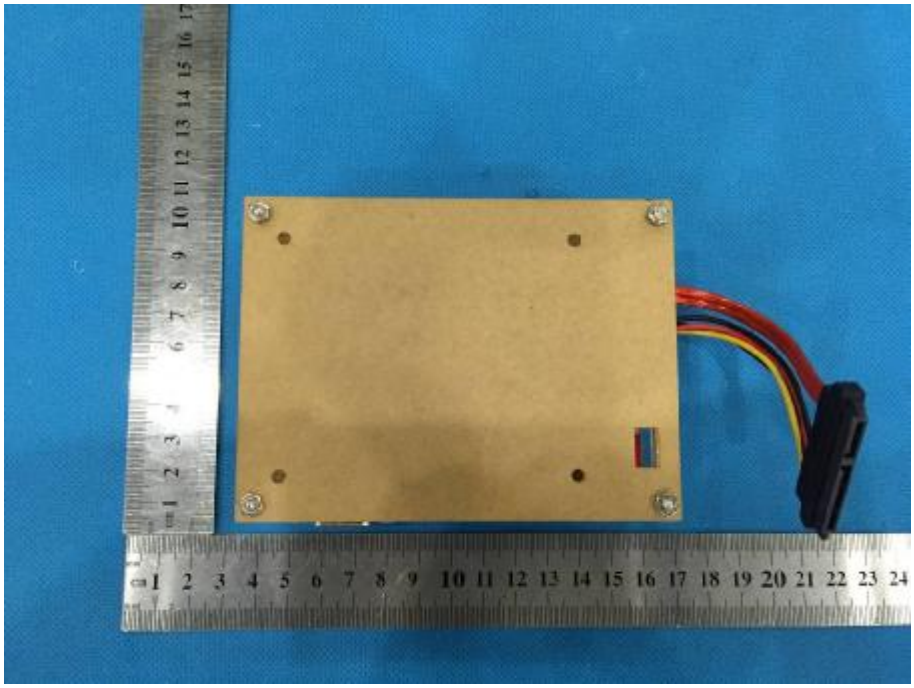
Vrms at the end of test (Volt):	230.58			
Highest dt (%):	0.00	Test limit (%):	3.30	Pass
Time(mS) > dt:	0.0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	0.00	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.064	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.028	Test limit:	0.650	Pass

EXHIBIT 1 - EUT PHOTOGRAPHS

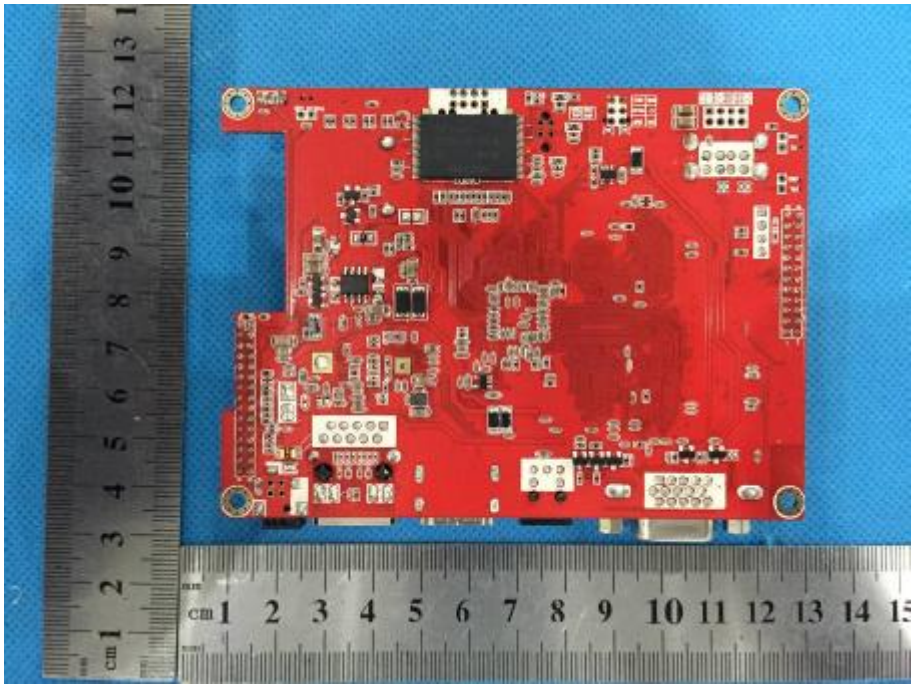
External Views

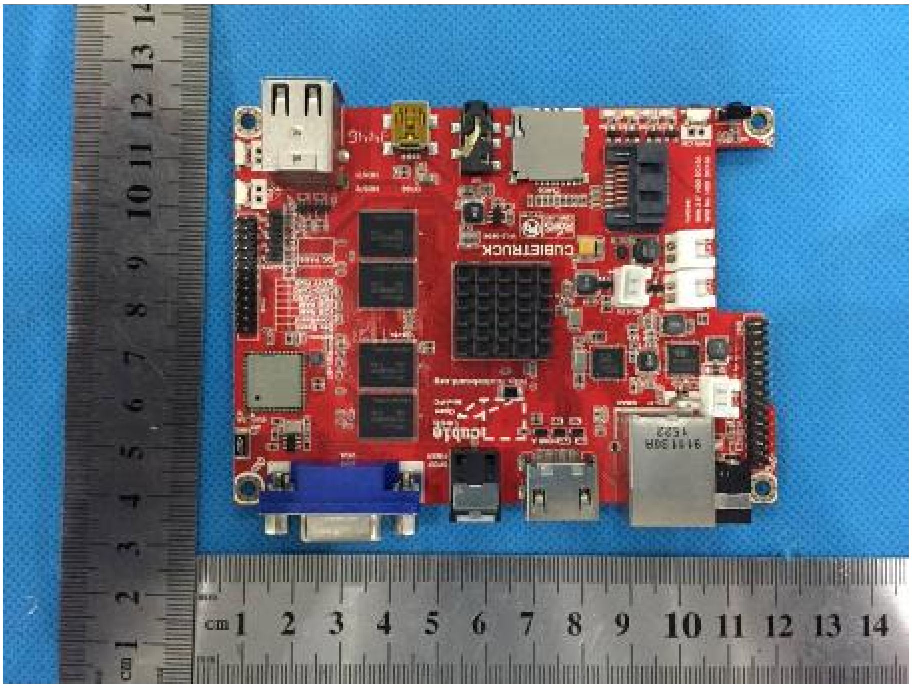






Internal Views




cm 1 2 3 4 5 6 7 8 9 10 11 12 13 14
CUBIETRUCK

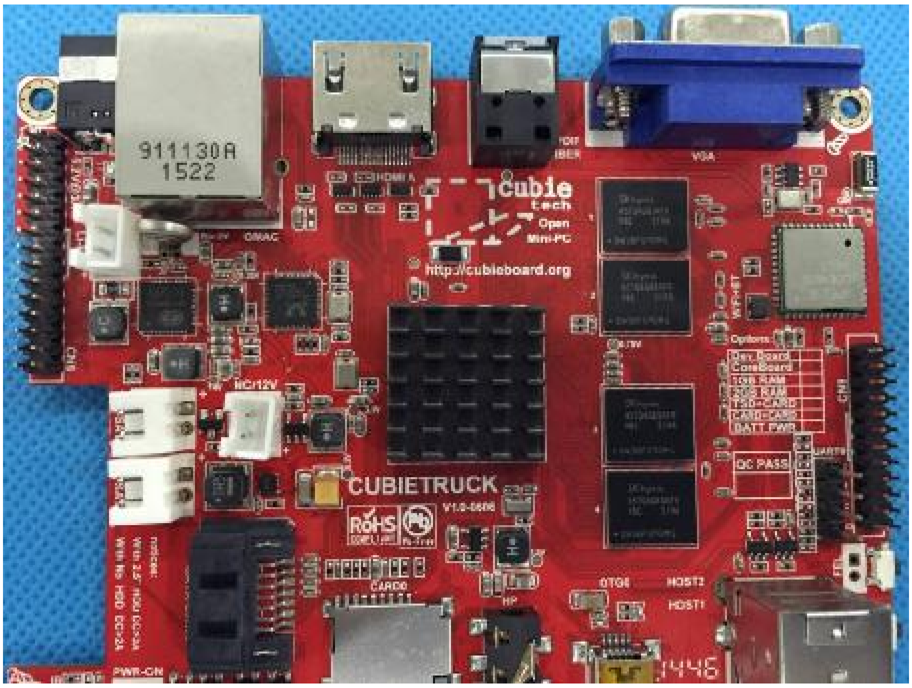

911130A
1522
Cubie
tech
Open
Mini-PC
http://cubieboard.org
CUBIETRUCK
VGA
QC PASS
HOST2
HOST1
PWR-ON

EXHIBIT 2 - TEST SETUP PHOTOGRAPHS

Conducted Emission Test Setup View

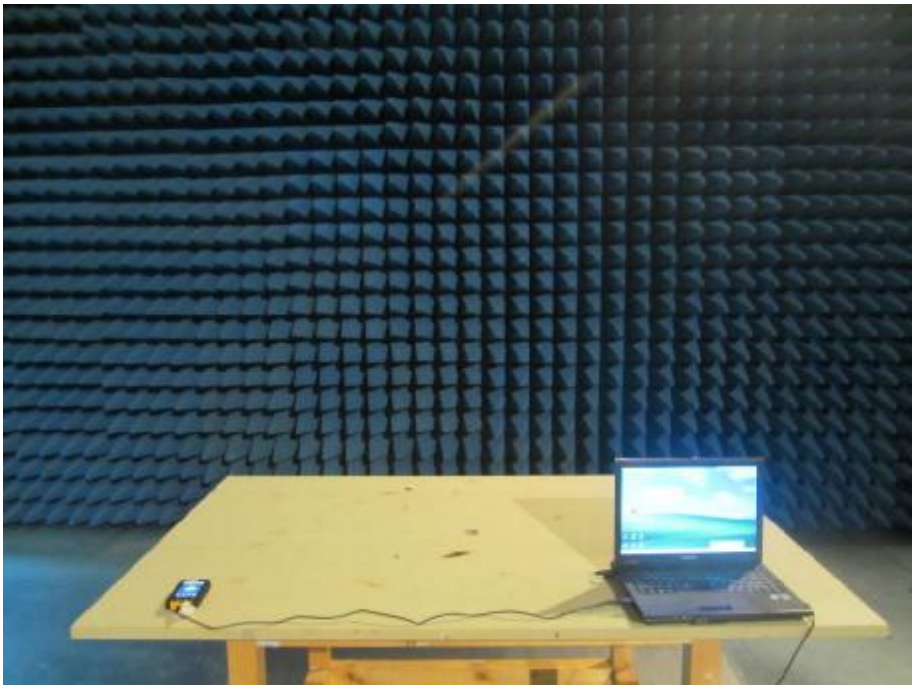
Radiated Emission Test Setup View

EN61000-3-2/3

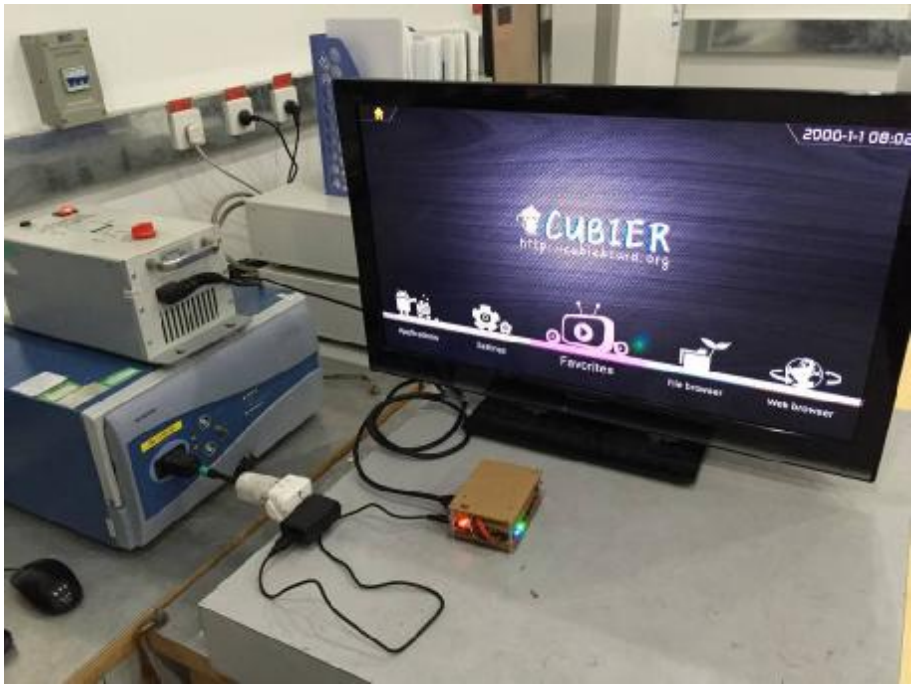
IEC 61000-4-2

IEC 61000-4-3

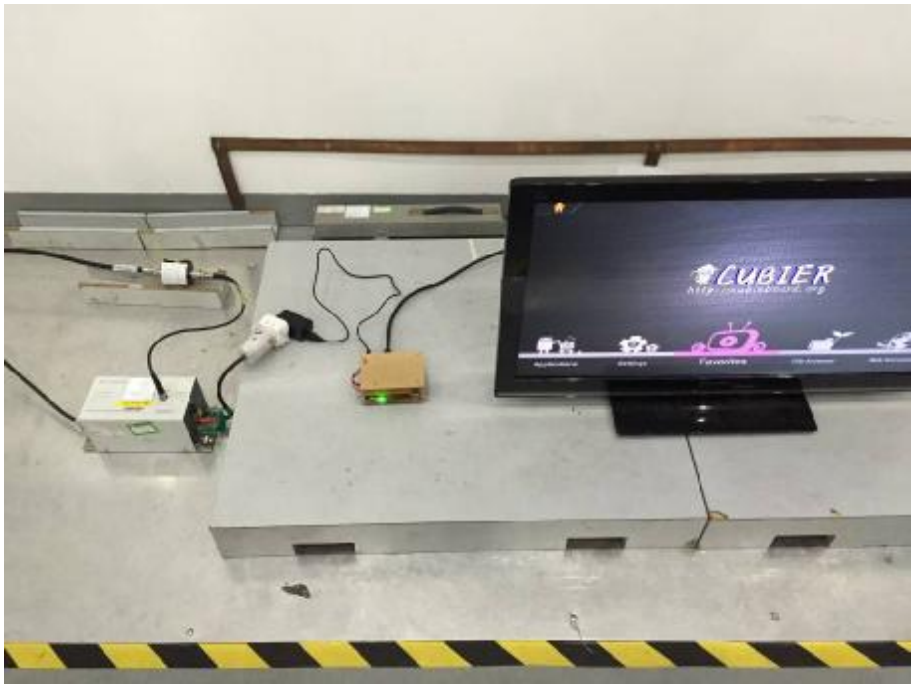
Test Mode: Downloading mode



IEC 61000-4-4/5/11



IEC 61000-4-6



******* END OF REPORT *******