TEST REPORT

Application No.:	SZEM2102002074AT
Applicant:	Seeed Technology Co., Ltd.
Address of Applicant:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P. R. C
Manufacturer:	Seeed Technology Co., Ltd.
Address of Manufacturer:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P. R. C
Factory:	Seeed Technology Co., Ltd.
Address of Factory:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P. R. C
Equipment Under Test (EUT):	
EUT Name:	BeagleBone® Black
Model No.:	BeagleBone® Black, BeagleBone® Black Industrial ♣
♣	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark:	Beagleboard. org
Standard(s) :	EN 55032: 2015+A11:2020
	EN 61000-3-3: 2013+A1: 2019
	EN IEC 61000-3-2: 2019
	EN 55035:2017+A11:2020
Date of Receipt:	2021-02-25
Date of Test:	2021-02-26 to 2021-03-10
Date of Issue:	2021-03-12
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2021-03-12		Original

Authorized for issue by:				
		Harry Wu/Project Engineer		
		Eric Fu/Reviewer		

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2 Test Summary

Emission Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Emissions at Mains Power Port (150kHz-30MHz)	EN 55032: 2015+A11:2020	EN 55032: 2015+A11:2020	Class B	Pass
Asymmetric Mode Conducted Emissions(150kHz-30MHz)	EN 55032: 2015+A11:2020	EN 55032: 2015+A11:2020	Class B	Pass
Radiated Emissions (30MHz-1GHz)	EN 55032: 2015+A11:2020	EN 55032: 2015+A11:2020	Class B	Pass
Radiated Emissions (above 1GHz)	EN 55032: 2015+A11:2020	EN 55032: 2015+A11:2020	Class B	Pass
Voltage Fluctuations and Flicker	EN 61000-3-3: 2013+A1: 2019	EN 61000-3-3: 2013+A1: 2019	Clause 5	Pass
Harmonic Current Emission	EN IEC 61000-3-2: 2019	EN IEC 61000-3-2: 2019	Class A	Pass

Immunity Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Electrostatic Discharge	EN 55035:2017+A11:2020	EN 61000-4-2: 2009	4kV Contact Discharge, 8kV Air Discharge	Pass
Radiated Immunity (80MHz-1GHz, 1800MHz,2600MHz, 3500MHz,5000MHz)	EN 55035:2017+A11:2020	EN 61000-4-3: 2006 +A1: 2008+A2: 2010	3V/m, 80%, 1kHz Amp. Mod.	Pass
Electrical Fast Transients & Burst at AC Power Port	EN 55035:2017+A11:2020	EN 61000-4-4: 2012	1kV; 5/50ns Tr/Td; 5kHz Repetition Frequency	Pass
Electrical Fast Transients & Burst at Signal Port	EN 55035:2017+A11:2020	EN 61000-4-4: 2012	0.5kV; 5/50ns Tr/Td; 5kHz Repetition Frequency	Pass
Surge at AC Power Port	EN 55035:2017+A11:2020	EN 61000-4-5: 2014 +A1: 2017	1.2/50μs Tr/Td; 1kV Line to Line	Pass
Conducted Immunity at AC Power Port (150kHz-80MHz)	EN 55035:2017+A11:2020	EN 61000-4-6: 2014	0,15 to 10MHz 3Vrms (emf), 10 to 30MHz 3Vrms(emf), 30 to 80MHz 1Vrms(emf), 80%,1kHz Amp. Mod.	Pass

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Immunity Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Immunity at Signal Port (150kHz-80MHz)	EN 55035:2017+A11:2020	EN 61000-4-6: 2014	0,15 to 10MHz 3Vrms (emf), 10 to 30MHz 3Vrms(emf), 30 to 80MHz 1Vrms(emf), 80%,1kHz Amp. Mod.	Pass
Voltage Dips and Interruptions	EN 55035:2017+A11:2020	EN 61000-4-11: 2004 +A1: 2017	<5% residual voltage for 0.5 periods: B, 70% residual voltage for 25 periods: C, <5% residual voltage for 250 periods: C	Pass

Declaration of EUT Family Grouping:

Model No.: BeagleBone® Black, BeagleBone® Black Industrial

Only the model BeagleBone® Black was tested, since according to the declaration from the applicant, the electrical circuit design, PCB layout, components used and internal wiring and functions were identical for the above models, with only difference on the work temperature. BeagleBone® Black work between 0-70°, but BeagleBone® Black Industrial work between -40 and +85°.

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3 Contents

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4 General Information

4.1 Details of E.U.T.

Power supply:	DC5.0V, 1.0A or Powered from USB port

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Network Cable	SGS	N/A	REF. No.SEA1100
Router	NETGEAR	DGN2200	REF. No.SEA2200
Television	SONY	KDL-24EX520	6351646
Adapter	Apple	A1443	REF. No.SEA05D08A
Mini USB Cable	SANBO	SU-T21	REF. No.SEA07B01
TF Card	Kingston	SDC8GB	REF. No.SEA04A00
U-Disk	Sandisk	SDCZ60-016G	REF. No.SEA01A00
HDMI Cable	Seeed	1.34 meters, Shielded, 3 Core	N/A

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at Mains Power Port (150kHz-30MHz)	± 3.0dB
Asymmetric Mode Conducted Emissions(150kHz-30MHz)	± 3.0dB
Radiated Emissions (30MHz-1GHz)	± 4.5dB
Radiated Emissions (above 1GHz)	± 4.8dB
Voltage Fluctuations and Flicker	± 3.7%
Harmonic Current Emission	± 3.7%
Electrostatic Discharge	±6 %
Radiated Immunity (80MHz-1GHz,1800MHz,2600MHz,3500MHz,5000MHz)	± 1.64dB
Electrical Fast Transients & Burst at AC Power Port	± 5 %
Electrical Fast Transients & Burst at Signal Port	± 5 %
Surge at AC Power Port	± 5 %
Conducted Immunity at AC Power Port (150kHz-80MHz)	± 0.96dB
Conducted Immunity at Signal Port (150kHz-80MHz)	± 0.96dB
Voltage Dips and Interruptions	± 4 %

Remark:
The U_{lab} (lab Uncertainty) is less than U_{cispr} (CISPR Uncertainty), so the test results
– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
– non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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4.4 Test Location

All tests were performed at:

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No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

4.8 EMS Monitor

Visual: Monitored the light indicator and work status of the EUT.

Audio: None.

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5 Equipment List

Conducted Emissions at Mains Power Port (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2019-06-13	2022-06-12
EMI Test Receiver	Rohde&Schwarz	ESCI	SEM004-02	2020-03-24	2021-03-23
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2020-07-10	2021-07-09
LISN	Rohde&Schwarz	ENV216	SEM007-01	2020-09-23	2021-09-22
LISN	ETS-LINDGREN	3816/2	SEM007-02	2020-04-01	2021-03-31

Asymmetric Mode Conducted Emissions(150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2019-06-13	2022-06-12
EMI Test Receiver	Rohde&Schwarz	ESCI	SEM004-02	2020-03-24	2021-03-23
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Impedance Stabilisation Network	SCHWARZBECK MESS-ELEKTRONIK	ISN S8	EMC2122	2020-05-24	2021-05-23
ISN T8-Cat6	Teseq	ISN T8-Cat6	SEM007-12	2020-04-01	2021-03-31
ISN T800	Teseq	ISN T800	SEM007-11	2020-04-01	2021-03-31

Radiated Emissions (30MHz-1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2020-07-19	2023-07-18
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-15	2020-11-02	2021-11-01
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-02	2019-05-24	2022-05-23
Pre-Amplifier	Agilent Technologies	8447D	SEM005-01	2020-04-01	2021-03-31
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2020-07-10	2021-07-09

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Radiated Emissions (above 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
EXA Signal Analyzer	Agilent Technologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2020-09-23	2021-09-22
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2020-07-10	2021-07-09

Voltage Fluctuations and Flicker					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
AC Power Source	California Instruments	5001ix	SEM016-02	2020-04-09	2021-04-08
Power Analyzer	California Instruments	PACS-1	SEM016-01	2020-04-09	2021-04-08
Measurement Software	California Instruments	CTS 4.0 V4.17.0	N/A	N/A	N/A

Electrostatic Discharge					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
ESD Generator	TESEQ AG	NSG 437	SEM019-02	2020-04-17	2021-04-16
ESD Ground Plane	SGS(3m*3m)	N/A	SEN006-01	N/A	N/A

Radiated Immunity (80MHz-1GHz,1800MHz,2600MHz,3500MHz,5000MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Fully-Anechoic Chamber 2	Chang Zhou Zhong Shuo	854	SEM001-05	2020-07-10	2021-07-09
Power Sensor	Rohde&Schwarz	NRP-Z91	SEM009-09	2020-03-23	2021-03-22
Stacked Log.-Per.-Broadband Antenna	Schwarzbeck	STLP 9129	SEM003-25	N/A	N/A
Signal Generator	Rohde&Schwarz	SMB100A	SEM006-11	2020-03-23	2021-03-22
Broadband Amplifier	Rohde&Schwarz	BBA150-BC250	SEM005-12	2020-09-23	2021-09-22
Broadband Amplifier	Rohde&Schwarz	BBA150-D110	SEM005-13	2020-04-01	2021-03-31
Broadband Amplifier	Rohde&Schwarz	BBA150-E60	SEM005-16	2020-05-21	2021-05-20
Measurement Software	Rohde&Schwarz	EMC32 V9.25.00	N/A	N/A	N/A

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Electrical Fast Transients & Burst at AC Power Port					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-03-26	2021-03-25

Electrical Fast Transients & Burst at Signal Port					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-03-26	2021-03-25
Capacitive Coupling Clamp	EM Test	HFK	SEM018-03	2020-03-26	2021-03-25

Surge at AC Power Port					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-03-26	2021-03-25

Conducted Immunity at AC Power Port (150kHz-80MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	AUDIX	N/A	SEM001-08	2019-06-13	2022-06-12
RF-Generator	SCHAFFNER	NSG 2070	SEM006-01	2020-10-22	2021-10-21
Coupling/Decoupling Network	SCHAFFNER	CDN M016	SEM007-03	2020-04-09	2021-04-08

Conducted Immunity at Signal Port (150kHz-80MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	AUDIX	N/A	SEM001-08	2019-06-13	2022-06-12
RF-Generator	SCHAFFNER	NSG 2070	SEM006-01	2020-10-22	2021-10-21
Coupling/Decoupling Network	SCHAFFNER	CDN M016	SEM007-03	2020-04-09	2021-04-08
EM Clamp	SCHAFFNER	KEMZ 801	SEM013-01	2020-09-23	2021-09-22

Voltage Dips and Interruptions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-03-26	2021-03-25

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General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2020-09-15	2021-09-14
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2020-09-15	2021-09-14
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2020-04-07	2021-04-06

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6 Emission Test Results

6.1 Conducted Emissions at Mains Power Port (150kHz-30MHz)

Test Requirement: EN 55032: 2015+A11:2020

Test Method: EN 55032: 2015+A11:2020

Limit:

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.		
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz		

6.1.1 E.U.T. Operation

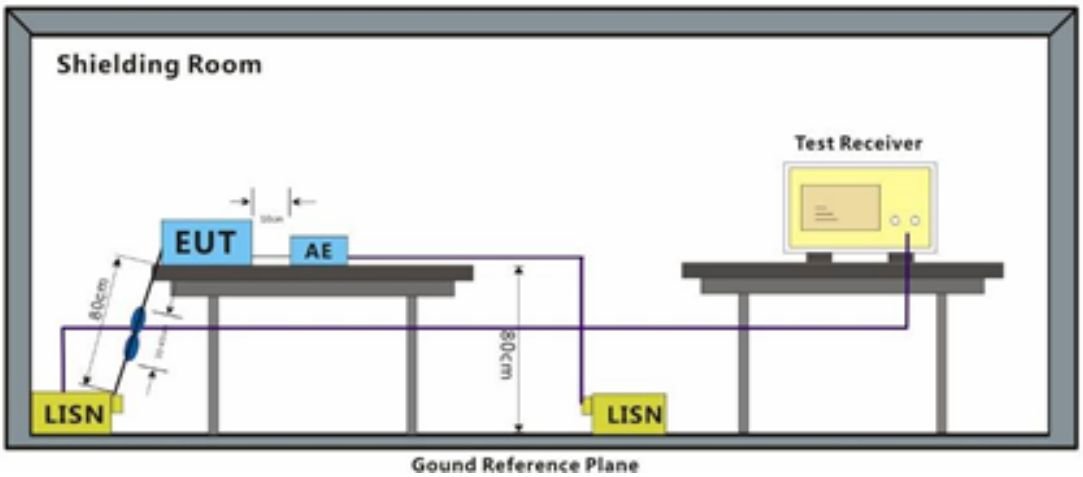
Operating Environment:

Temperature: 22.8 °C Humidity: 64.3 % RH Atmospheric Pressure: 1010 mbar

6.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

6.1.3 Test Setup Diagram



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6.1.4 Measurement Procedure and Data

An initial pre-scan was performed with peak detector.Quasi-Peak or Average measurement were performed at the frequencies with maximized peak emission were detected.

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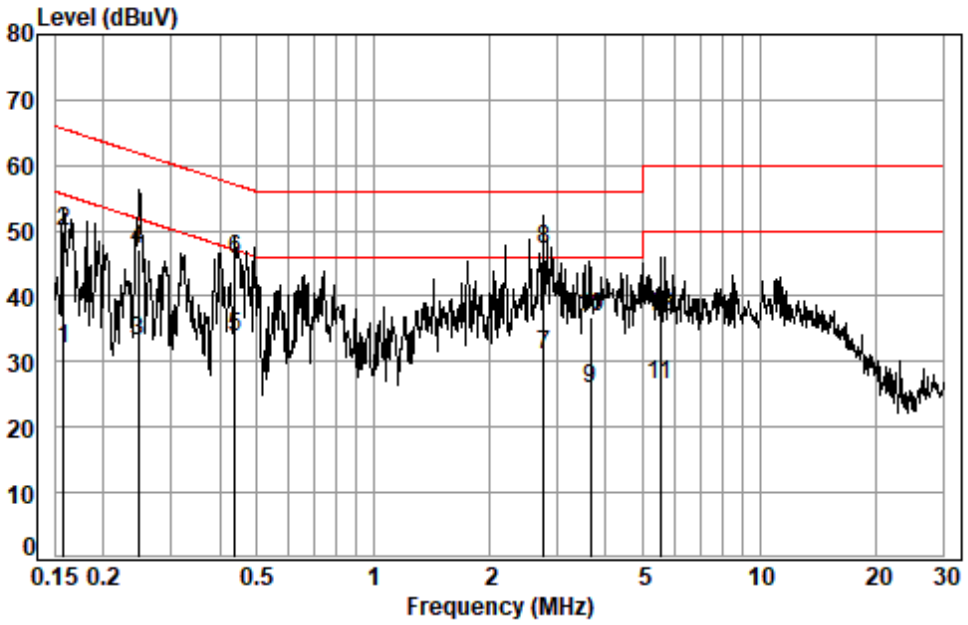
Test Mode: 00; Line: Live line



Site : Shielding Room
Condition: Line
Job No. : 02074AT
Test mode: 00

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1582	0.03	9.70	22.19	31.92	55.56	-23.64	Average
2	0.1582	0.03	9.70	40.21	49.94	65.56	-15.62	QP
3	0.2468	0.05	9.74	23.52	33.31	51.86	-18.55	Average
4	0.2468	0.05	9.74	37.43	47.22	61.86	-14.64	QP
5	0.4397	0.07	9.76	24.00	33.83	47.07	-13.24	Average
6	0.4397	0.07	9.76	35.73	45.56	57.07	-11.51	QP
7	2.7568	0.14	9.83	21.00	30.97	46.00	-15.03	Average
8	2.7568	0.14	9.83	37.10	47.07	56.00	-8.93	QP
9	3.6504	0.15	9.87	15.97	25.99	46.00	-20.01	Average
10	3.6504	0.15	9.87	26.66	36.68	56.00	-19.32	QP
11	5.5347	0.16	9.96	16.22	26.34	50.00	-23.66	Average
12	5.5347	0.16	9.96	26.73	36.85	60.00	-23.15	QP

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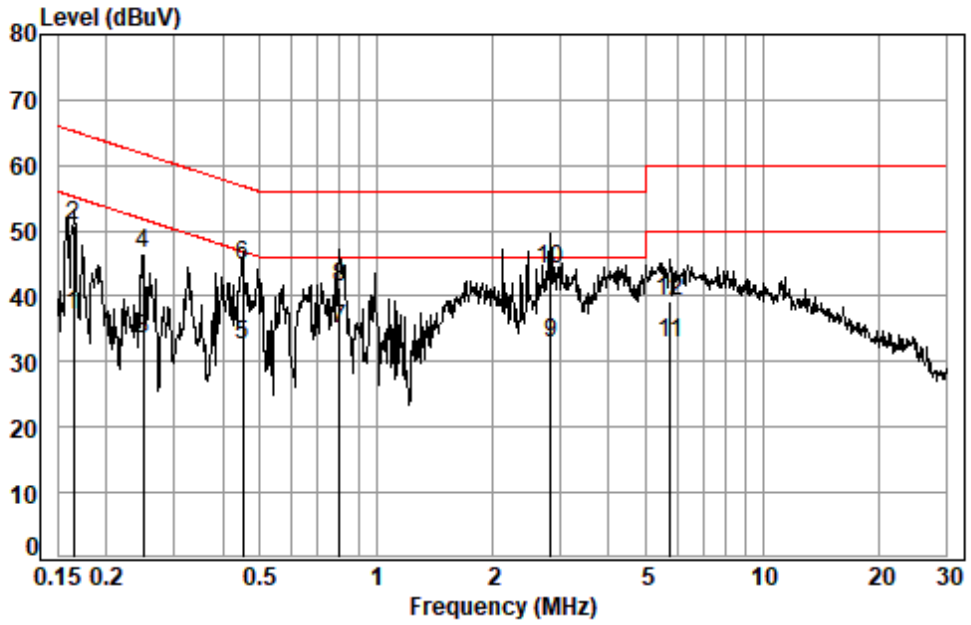
Test Mode: 00; Line: Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 02074AT
Test mode: 00

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1650	0.03	9.71	27.41	37.15	55.21	-18.06	Average
2	0.1650	0.03	9.71	41.04	50.78	65.21	-14.43	QP
3	0.2495	0.05	9.73	23.72	33.50	51.78	-18.28	Average
4	0.2495	0.05	9.73	36.81	46.59	61.78	-15.19	QP
5	0.4515	0.07	9.76	22.61	32.44	46.85	-14.41	Average
6	0.4515	0.07	9.76	34.92	44.75	56.85	-12.10	QP
7	0.8045	0.09	9.77	25.15	35.01	46.00	-10.99	Average
8	0.8045	0.09	9.77	31.50	41.36	56.00	-14.64	QP
9	2.8240	0.14	9.83	22.78	32.75	46.00	-13.25	Average
10	2.8240	0.14	9.83	34.04	44.01	56.00	-11.99	QP
11	5.7743	0.16	9.98	22.70	32.84	50.00	-17.16	Average
12	5.7743	0.16	9.98	28.95	39.09	60.00	-20.91	QP

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6.2 Asymmetric Mode Conducted Emissions(150kHz-30MHz)

Test Requirement: EN 55032: 2015+A11:2020

Test Method: EN 55032: 2015+A11:2020

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	84 to 74*	74 to 64*
0.5-30	74	64
*Decreases with the logarithm of the frequency.		

6.2.1 E.U.T. Operation

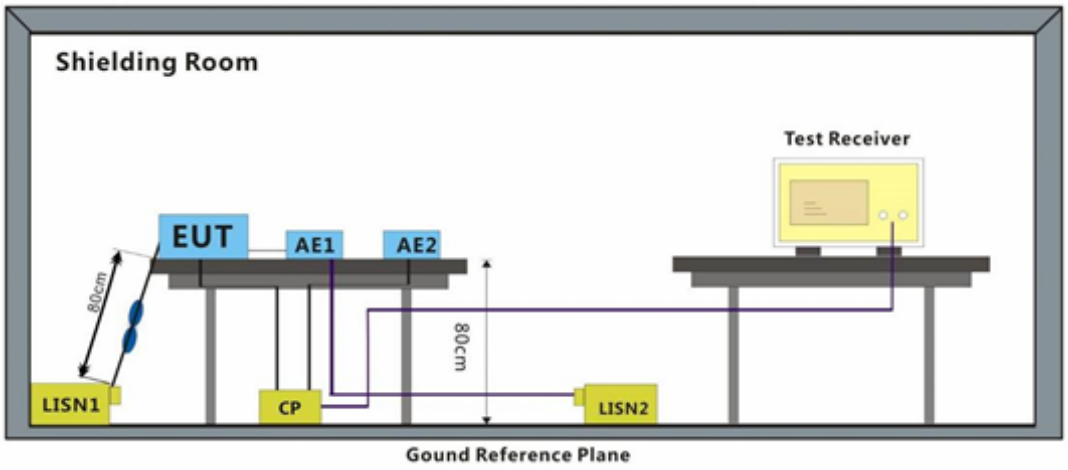
Operating Environment:

Temperature: 22.8 °C Humidity: 64.3 % RH Atmospheric Pressure: 1010 mbar

6.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

6.2.3 Test Setup Diagram



6.2.4 Measurement Procedure and Data

An initial pre-scan was performed with peak detector.Quasi-Peak or Average measurement were performed at the frequencies with maximized peak emission were detected.

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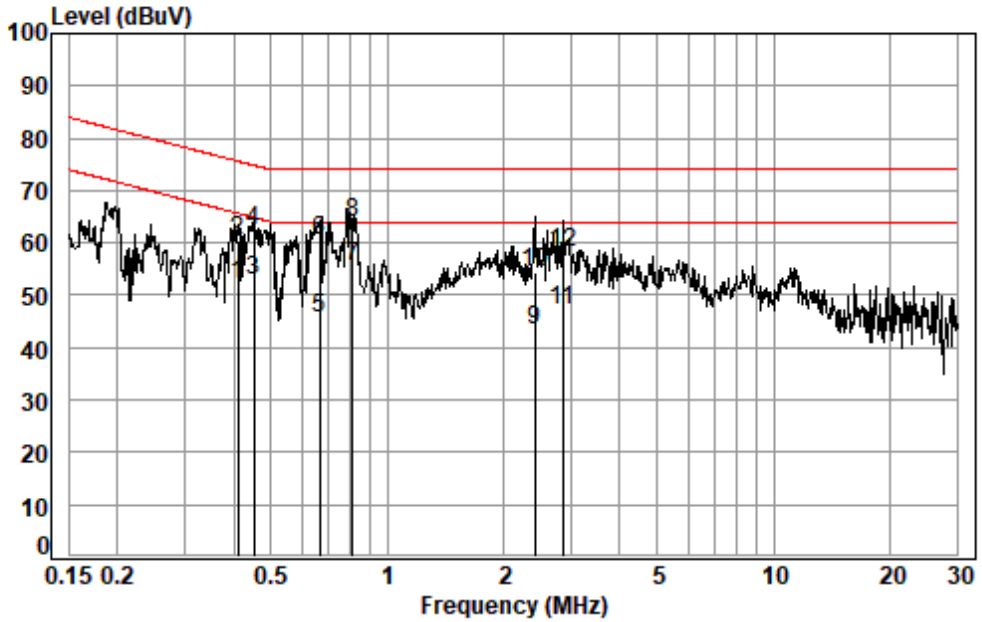

Site : Shielding Room
Condition:
Job No. : 02074AT
Test mode: 00

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.4105	0.07	9.57	42.35	51.99	65.64	-13.65	Average
2	0.4105	0.07	9.57	50.63	60.27	75.64	-15.37	QP
3	0.4515	0.07	9.56	43.31	52.94	64.85	-11.91	Average
4	0.4515	0.07	9.56	52.66	62.29	74.85	-12.56	QP
5	0.6683	0.08	9.52	36.14	45.74	64.00	-18.26	Average
6	0.6683	0.08	9.52	50.69	60.29	74.00	-13.71	QP
7	0.8131	0.09	9.50	45.81	55.40	64.00	-8.60	Average
8	0.8131	0.09	9.50	54.47	64.06	74.00	-9.94	QP
9	2.4090	0.13	9.42	33.77	43.32	64.00	-20.68	Average
10	2.4090	0.13	9.42	44.79	54.34	74.00	-19.66	QP
11	2.8390	0.14	9.42	37.54	47.10	64.00	-16.90	Average
12	2.8390	0.14	9.42	48.47	58.03	74.00	-15.97	QP

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6.3 Radiated Emissions (30MHz-1GHz)

Test Requirement: EN 55032: 2015+A11:2020
Test Method: EN 55032: 2015+A11:2020
Measurement Distance: 3m

Limit:

FREQUENCY (MHz)	dB(μV/m) At 10m	dB(μV/m) At 3m
30MHz-230MHz	30	40
230MHz-1GHz	37	47
Detector: Peak for pre-scan (120kHz resolution bandwidth) 30M to 1000MHz		

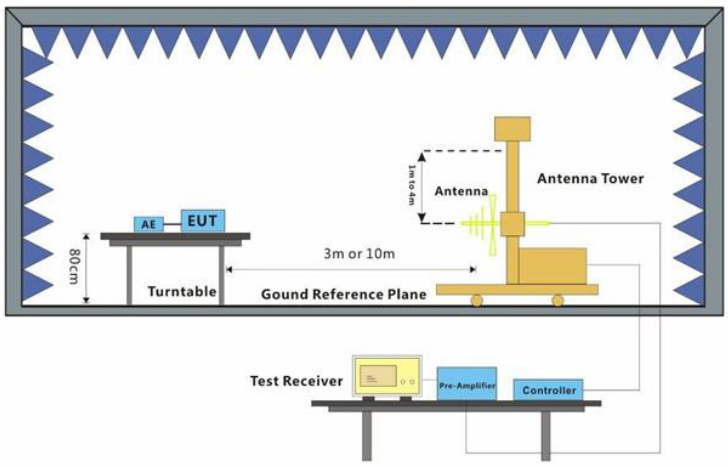
6.3.1 E.U.T. Operation

Operating Environment:
Temperature: 20.5 °C Humidity: 50.1 % RH Atmospheric Pressure: 1010 mbar

6.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.
Final test	01	Normal working(BeagleBone® Black Industria)_Keep all the port of EUT working normally.

6.3.3 Test Setup Diagram



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6.3.4 Measurement Procedure and Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities.

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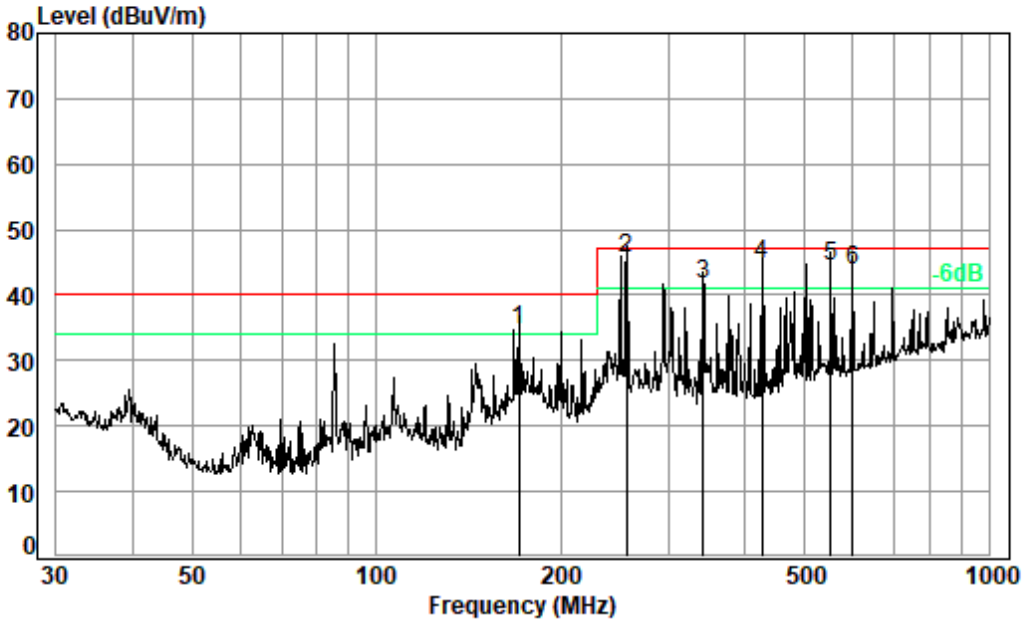
Test Mode: 00; Polarity: Horizontal



Condition: 3m HORIZONTAL
Job No. : 02074AT
Test Mode: 00

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	170.79	1.18	15.58	27.25	45.26	34.77	40.00	-5.23	QP
2 pp	256.52	1.69	18.13	26.98	52.69	45.53	47.00	-1.47	QP
3	341.98	2.14	20.52	27.11	45.99	41.54	47.00	-5.46	QP
4	426.52	2.36	22.13	27.51	47.61	44.59	47.00	-2.41	QP
5	552.88	2.61	25.07	27.98	44.70	44.40	47.00	-2.60	QP
6	599.32	2.70	25.79	28.13	43.50	43.86	47.00	-3.14	QP

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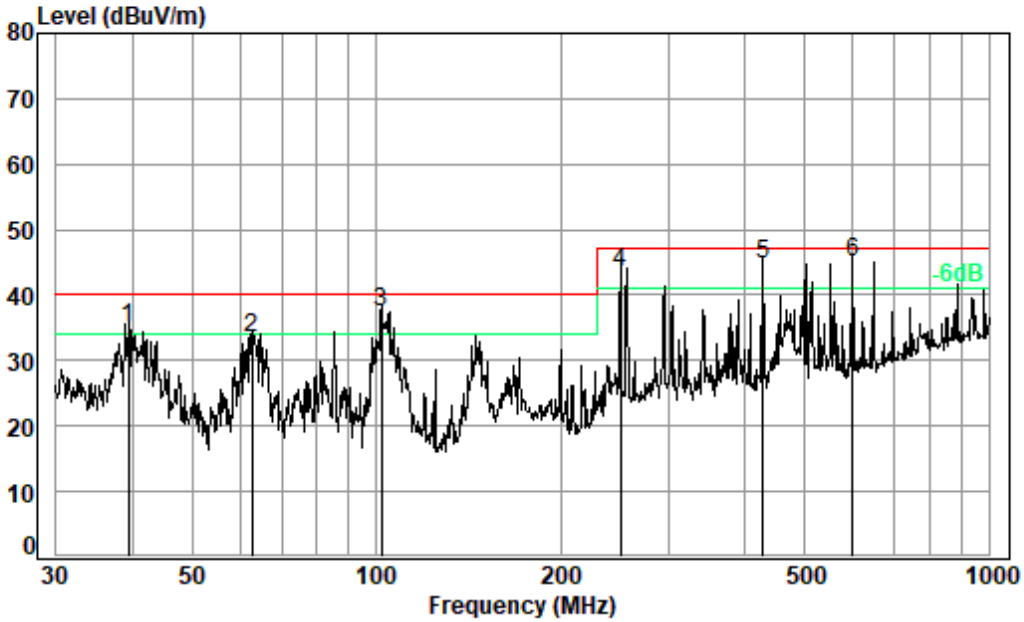
Test Mode: 00; Polarity: Vertical



Condition: 3m VERTICAL
Job No. : 02074AT
Test Mode: 00

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	39.44	0.70	18.33	27.71	43.70	35.02	40.00	-4.98	QP
2	62.65	0.80	12.90	27.66	47.51	33.55	40.00	-6.45	QP
3	102.00	1.10	13.94	27.60	49.89	37.33	40.00	-2.67	QP
4	250.30	1.64	18.20	26.99	50.80	43.65	47.00	-3.35	QP
5	428.02	2.36	22.16	27.52	47.65	44.65	47.00	-2.35	QP
6 pp	599.32	2.70	25.79	28.13	44.76	45.12	47.00	-1.88	QP

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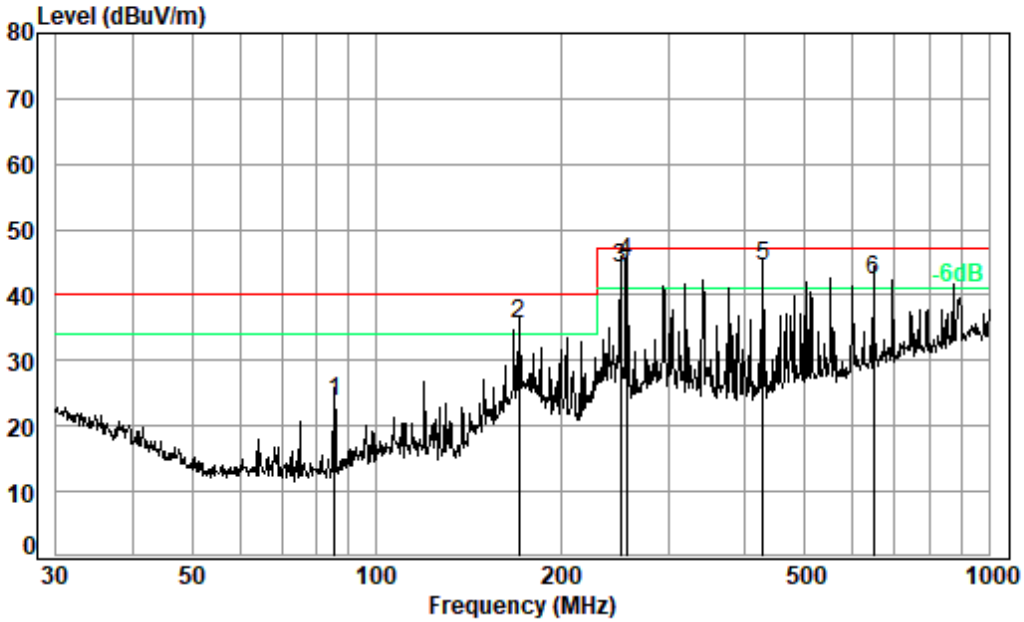
Test Mode: 01; Polarity: Horizontal



Condition: 3m HORIZONTAL
Job No. : 02074AT
Test Mode: 01

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	85.60	1.26	12.46	27.63	37.63	23.72	40.00	-16.28	QP
2	170.79	1.18	15.58	27.25	46.05	35.56	40.00	-4.44	QP
3	250.30	1.64	18.20	26.99	51.12	43.97	47.00	-3.03	QP
4 pp	256.52	1.69	18.13	26.98	52.21	45.05	47.00	-1.95	QP
5	428.02	2.36	22.16	27.52	47.42	44.42	47.00	-2.58	QP
6	647.39	2.80	26.27	28.02	41.30	42.35	47.00	-4.65	QP

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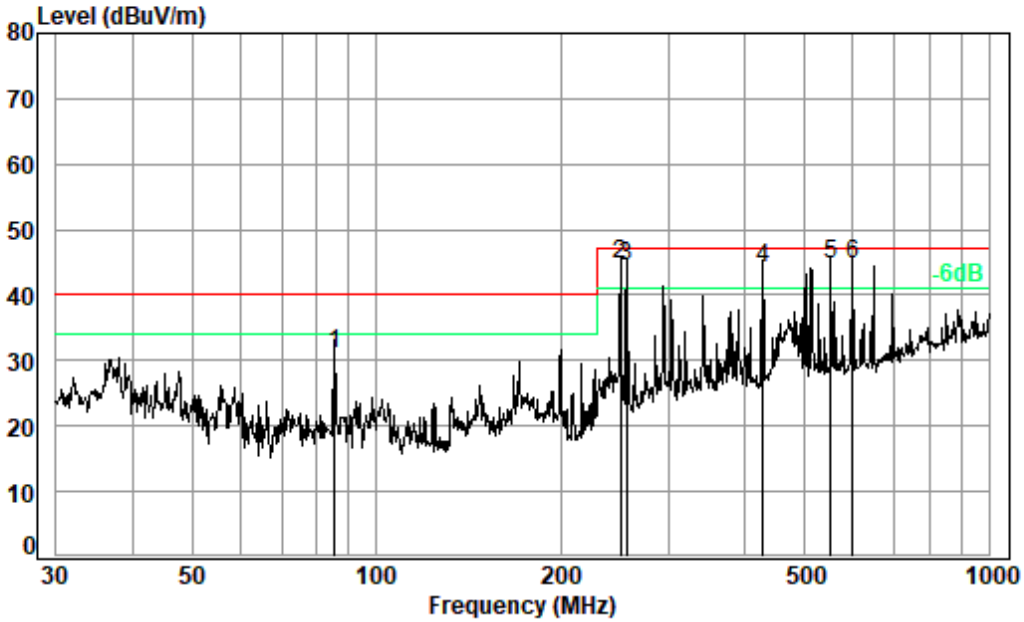
Test Mode: 01; Polarity: Vertical



Condition: 3m VERTICAL
Job No. : 02074AT
Test Mode: 01

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	85.60	1.26	12.46	27.63	44.94	31.03	40.00	-8.97	QP
2	250.30	1.64	18.20	26.99	51.96	44.81	47.00	-2.19	QP
3	256.52	1.69	18.13	26.98	51.68	44.52	47.00	-2.48	QP
4	428.02	2.36	22.16	27.52	47.22	44.22	47.00	-2.78	QP
5	552.88	2.61	25.07	27.98	44.92	44.62	47.00	-2.38	QP
6 pp	599.32	2.70	25.79	28.13	44.47	44.83	47.00	-2.17	QP

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6.4 Radiated Emissions (above 1GHz)

Test Requirement: EN 55032: 2015+A11:2020

Test Method: EN 55032: 2015+A11:2020

Measurement Distance: 3m

Limit:

Frequency range(MHz)	Radiated emissions limit(dBμV/m)	
	Peak	Average
1000-3000	70	50
3000-6000	74	54
Detector: Peak for pre-scan (1000kHz resolution bandwidth) 1000M to 6000MHz		

6.4.1 E.U.T. Operation

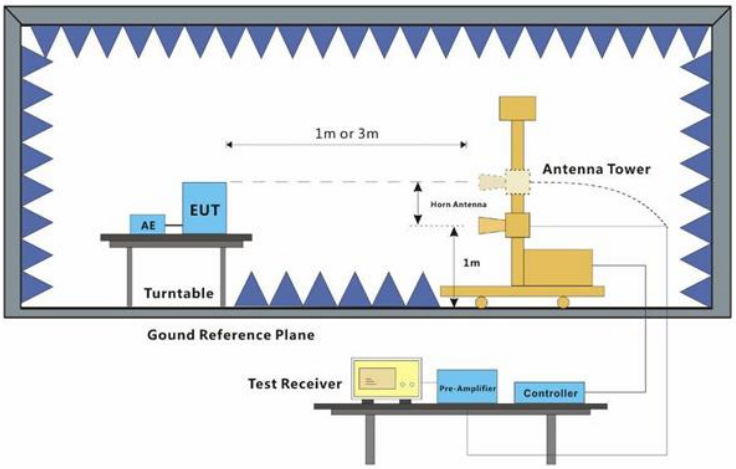
Operating Environment:

Temperature: 22.6 °C Humidity: 51.9 % RH Atmospheric Pressure: 1010 mbar

6.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

6.4.3 Test Setup Diagram



6.4.4 Measurement Procedure and Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Average measurements were conducted based on the peak sweep graph. The EUT was measured by Horn antenna with 2 orthogonal polarities.

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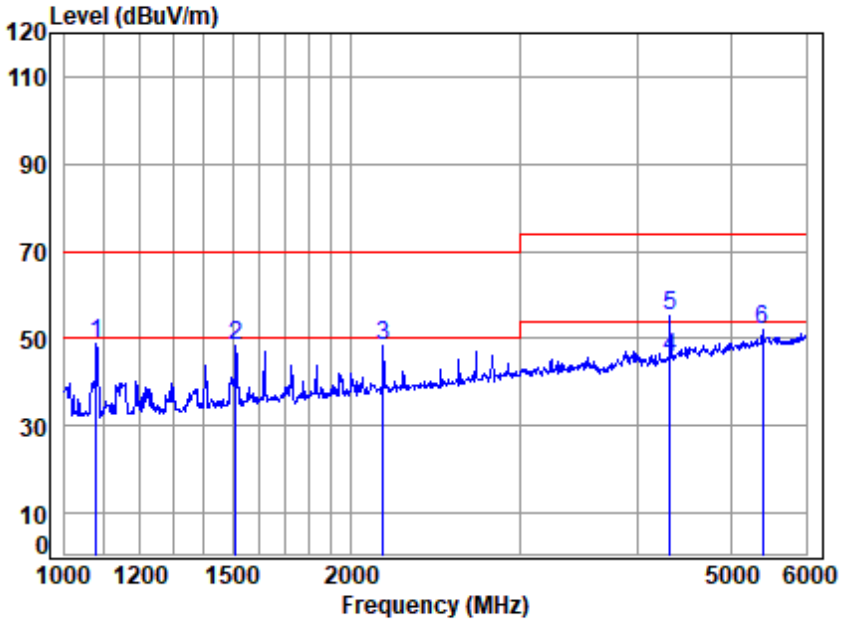
Test Mode: 00; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 02074AT
Mode : 00
Note : yellow

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1080.091	2.53	24.02	39.67	61.77	48.65	70.00	-21.35	Peak
2	1512.700	3.27	25.86	39.96	59.19	48.36	70.00	-21.64	Peak
3	2160.753	3.95	28.11	40.30	56.71	48.47	70.00	-21.53	Peak
4	4322.645	6.60	33.29	41.71	47.59	45.77	54.00	-8.23	Average
5	4322.645	6.60	33.29	41.71	56.85	55.03	74.00	-18.97	Peak
6	5398.093	8.01	34.52	42.34	51.67	51.86	74.00	-22.14	Peak

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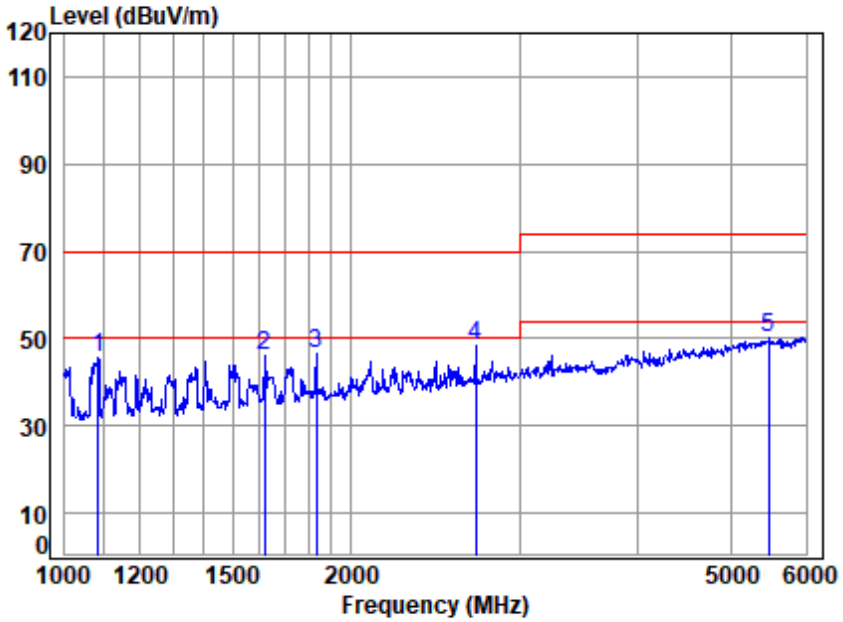
Test Mode: 00; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 02074AT
Mode : 00
Note : yellow

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1083.969	2.54	24.04	39.67	58.53	45.44	70.00	-24.56	Peak
2	1619.283	3.36	26.33	40.02	56.47	46.14	70.00	-23.86	Peak
3	1835.664	3.53	27.20	40.13	56.07	46.67	70.00	-23.33	Peak
4	2703.174	4.67	29.64	40.57	54.48	48.22	70.00	-21.78	Peak
5	5485.847	8.16	34.59	42.35	49.88	50.28	74.00	-23.72	Peak

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6.5 Voltage Fluctuations and Flicker

Test Requirement: EN 61000-3-3: 2013+A1: 2019

Test Method: EN 61000-3-3: 2013+A1: 2019

6.5.1 E.U.T. Operation

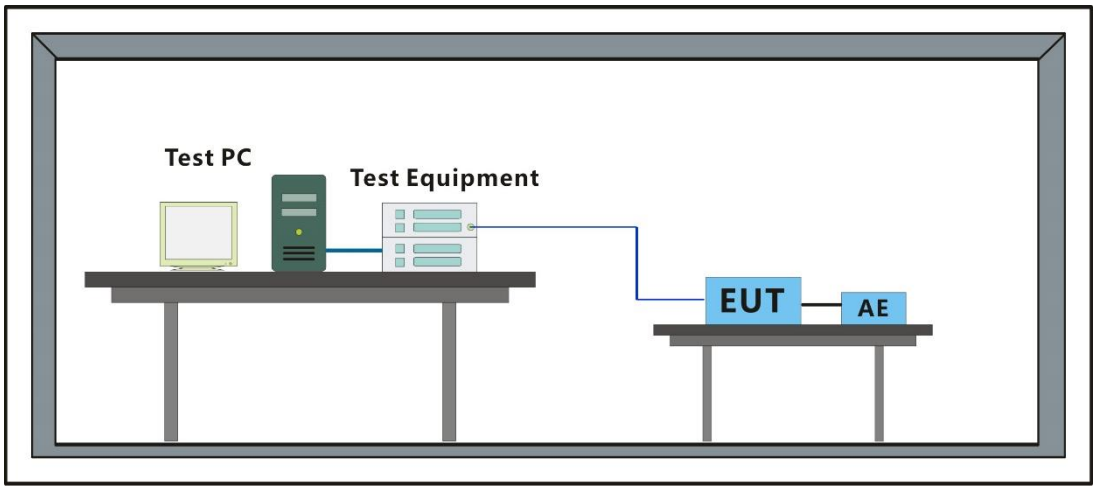
Operating Environment:

Temperature: 26.0 °C Humidity: 50.3 % RH Atmospheric Pressure: 1010 mbar

6.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

6.5.3 Test Setup Diagram



6.5.4 Measurement Procedure and Data

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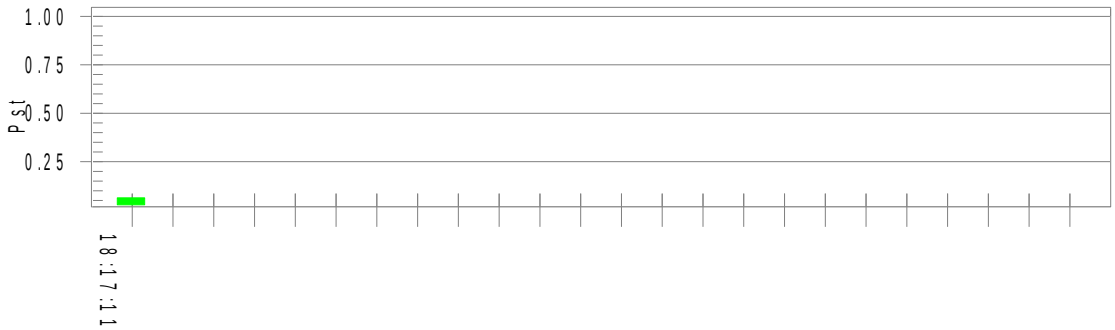
Test Result: Pass **Status: Test Completed**

Pst$_l$ and limit line **European Limits**



Plt and limit line

Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.95**			
T-max (mS):	**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**

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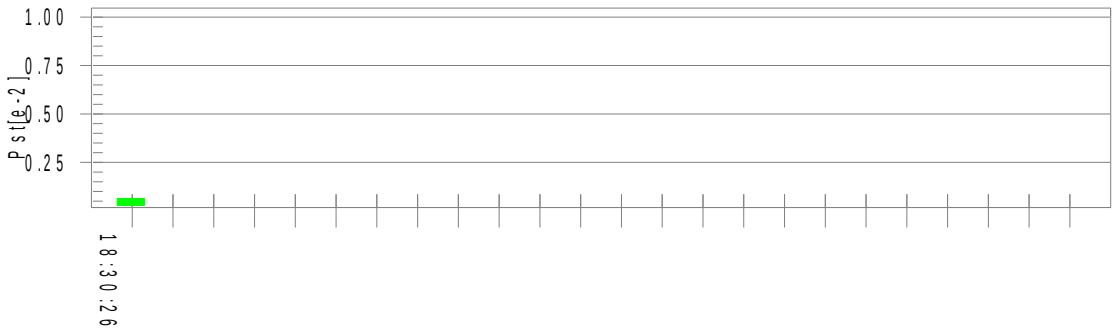
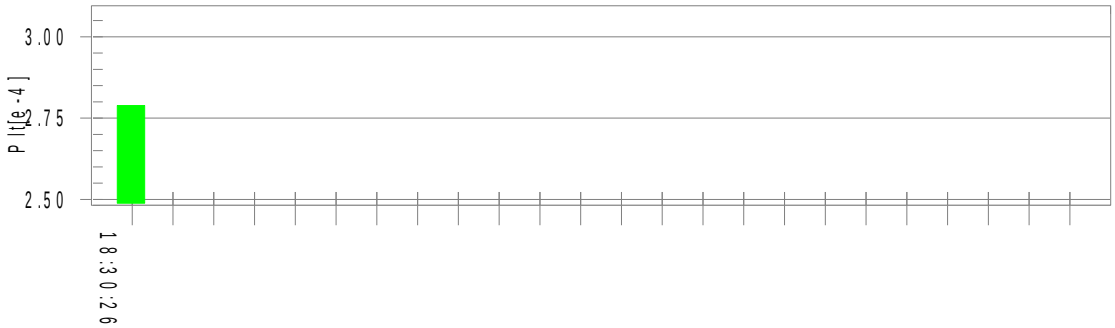
Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**230.03**			
T-max (mS):	**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**

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6.6 Harmonic Current Emission

Test Requirement: EN IEC 61000-3-2: 2019

Test Method: EN IEC 61000-3-2: 2019

6.6.1 Conclusion

There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN IEC 61000-3-2:2019.

For further details, please refer to Clause 7 of EN IEC 61000-3-2:2019 which states:

"For the following categories of equipment, limits are not specified in this standard.

equipment with a rated power of 75W or less, other than lighting equipment."

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7 Immunity Test Results

General Performance Criteria Description in EN 55035:2017+A11:2020+A11:2020

Criterion A The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Criterion B During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.
After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.
If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Criterion C Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.
Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

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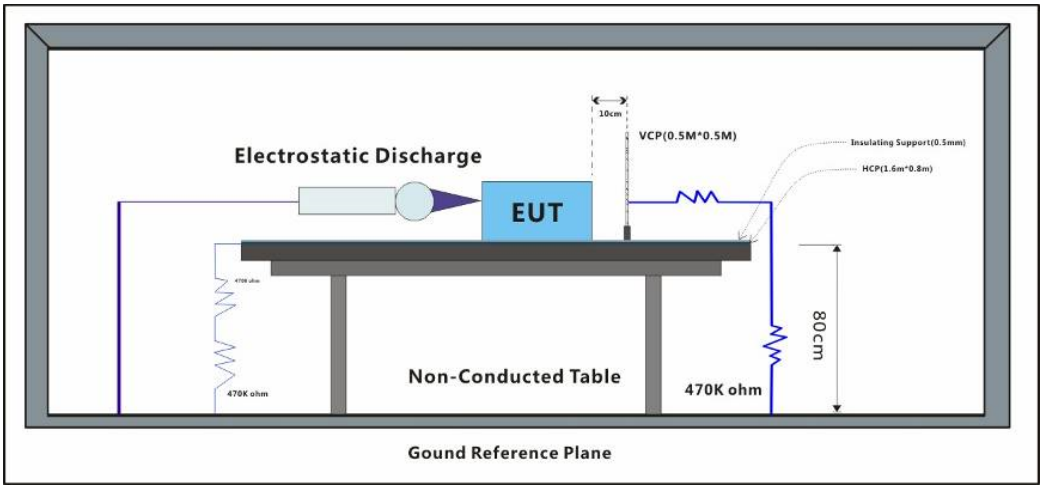
7.1 Electrostatic Discharge

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-2: 2009

7.1.1 Test Setup Diagram



7.1.2 E.U.T. Operation

Operating Environment:

Temperature: 23.6 °C Humidity: 45.1 % RH Atmospheric Pressure: 1010 mbar

7.1.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.1.4 Test Condition and Results:

Performance Criterion: B

Discharge Impedance: 330Ω/150pF

Number of Discharge: Minimum 10 times at each test point

Discharge Mode: Single Discharge

Discharge Period: 1 second minimum

Test Point: 1. All insulated enclosure and seams.

2. All accessible metal parts of the enclosure.

3. All side

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Discharge type	Level (kV)	Polarity	Test Point	Result / Observations
Air Discharge	2,4,8	+	1	A
Air Discharge	2,4,8	-	1	A
Contact Discharge	4	+	2	A
Contact Discharge	4	-	2	A
Horizontal Coupling	4	+	3	A
Horizontal Coupling	4	-	3	A
Vertical Coupling	4	+	3	A
Vertical Coupling	4	-	3	A
A: No degradation in the performance of the EUT was observed				

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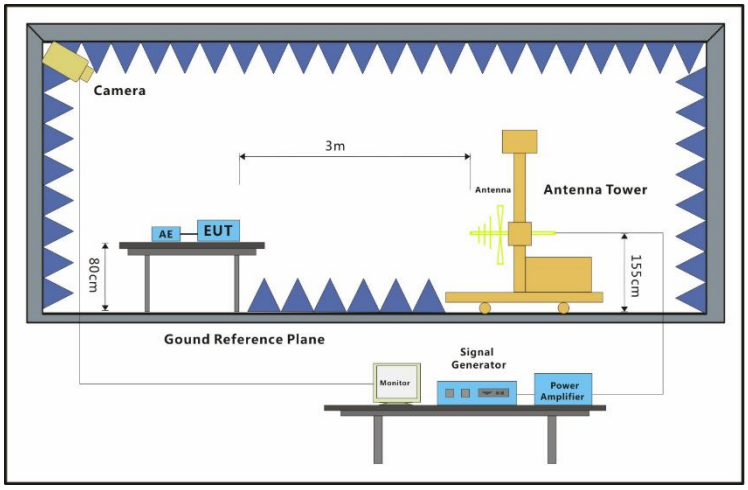
7.2 Radiated Immunity (80MHz-1GHz,1800MHz,2600MHz,3500MHz,5000MHz)

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-3: 2006 +A1: 2008+A2: 2010

7.2.1 Test Setup Diagram



7.2.2 E.U.T. Operation

Operating Environment:

Temperature: 25.6 °C Humidity: 53.6 % RH Atmospheric Pressure: 1010 mbar

7.2.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.2.4 Test Condition and Results:

Performance Criterion: A

Frequency Range: 80MHz to 1GHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz

Antenna Polarisation: Vertical and Horizontal

Modulation: 1kHz,80% Amp. Mod,1% increment

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Frequency	Level (V/m)	EUT Face	Dwell time	Result / Observations
80MHz-1GHz	3	Front	3s	A
80MHz-1GHz	3	Back	3s	A
80MHz-1GHz	3	Left	3s	A
80MHz-1GHz	3	Right	3s	A
80MHz-1GHz	3	Top	3s	A
80MHz-1GHz	3	Underside	3s	A
1800MHz	3	Front	3s	A
1800MHz	3	Back	3s	A
1800MHz	3	Left	3s	A
1800MHz	3	Right	3s	A
1800MHz	3	Top	3s	A
1800MHz	3	Underside	3s	A
2600MHz	3	Front	3s	A
2600MHz	3	Back	3s	A
2600MHz	3	Left	3s	A
2600MHz	3	Right	3s	A
2600MHz	3	Top	3s	A
2600MHz	3	Underside	3s	A
3500MHz	3	Front	3s	A
3500MHz	3	Back	3s	A
3500MHz	3	Left	3s	A
3500MHz	3	Right	3s	A
3500MHz	3	Top	3s	A
3500MHz	3	Underside	3s	A
5000MHz	3	Front	3s	A
5000MHz	3	Back	3s	A
5000MHz	3	Left	3s	A
5000MHz	3	Right	3s	A
5000MHz	3	Top	3s	A
5000MHz	3	Underside	3s	A
A: No degradation in the performance of the EUT was observed				

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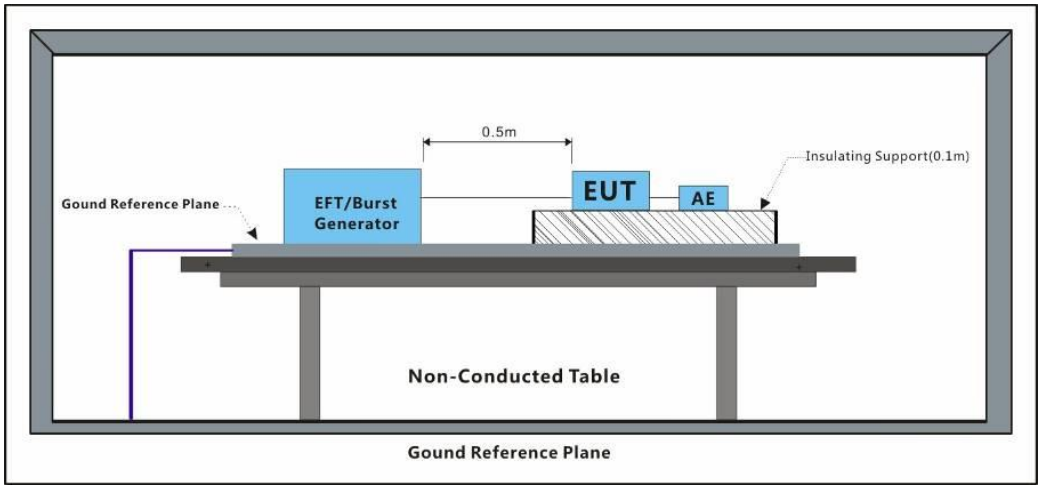
7.3 Electrical Fast Transients & Burst at AC Power Port

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-4: 2012

7.3.1 Test Setup Diagram



7.3.2 E.U.T. Operation

Operating Environment:

Temperature: 26.0 °C Humidity: 50.3 % RH Atmospheric Pressure: 1010 mbar

7.3.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.3.4 Test Condition and Results:

Performance Criterion: B

Repetition Frequency: 5kHz

Burst Period: 300ms

Test Duration: 2 minute per level & polarity

Test Line	Level (kV)	Polarity	CDN/Clamp	Result / Observations
AC power port	1	+	CDN	A
AC power port	1	-	CDN	A
A: No degradation in the performance of the EUT was observed				

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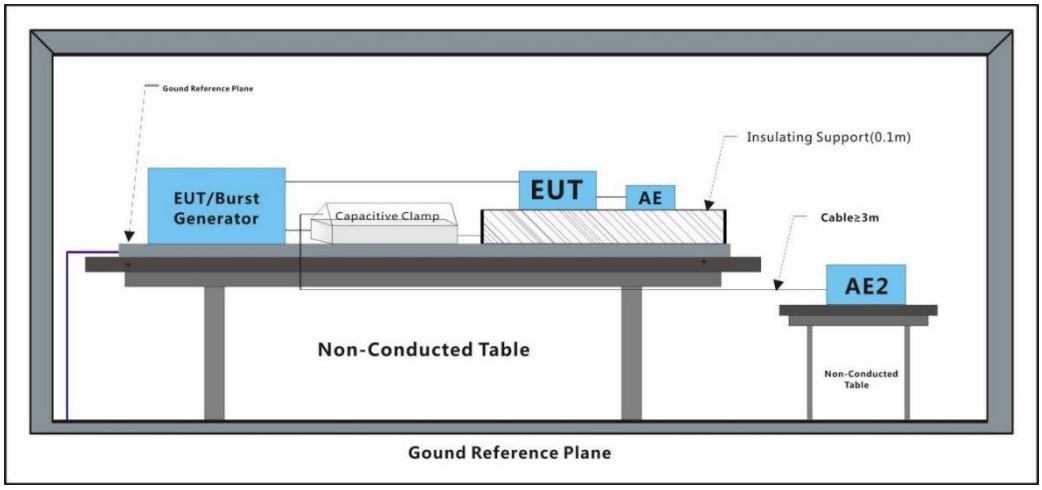
7.4 Electrical Fast Transients & Burst at Signal Port

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-4: 2012

7.4.1 Test Setup Diagram



7.4.2 E.U.T. Operation

Operating Environment:

Temperature: 26.0 °C Humidity: 50.2 % RH Atmospheric Pressure: 1010 mbar

7.4.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.4.4 Test Condition and Results:

Performance Criterion: B

Repetition Frequency: 5kHz

Burst Period: 300ms

Test Duration: 2 minute per level & polarity

Port	Level (kV)	Polarity	CDN/Clamp	Result / Observations
Signal port	0.5	+	Clamp	A
Signal port	0.5	-	Clamp	A
A: No degradation in the performance of the EUT was observed				

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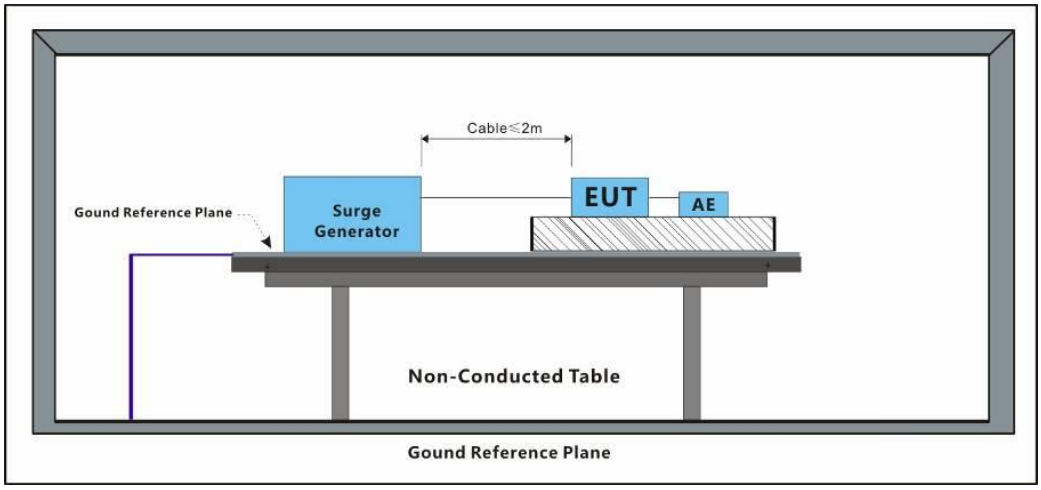
7.5 Surge at AC Power Port

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-5: 2014 +A1: 2017

7.5.1 Test Setup Diagram



7.5.2 E.U.T. Operation

Operating Environment:

Temperature: 26.0 °C Humidity: 50.3 % RH Atmospheric Pressure: 1010 mbar

7.5.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.5.4 Test Condition and Results:

Performance Criterion: B

Interval: 60s between each surge

No. of surges: 5 positive, 5 negative at 90°, 270°

Test Line	Level (kV)	Polarity	Phase (deg)	Result / Observations
Line to Neutral	1	+	90°	A
Line to Neutral	1	-	270°	A
A: No degradation in the performance of the EUT was observed				

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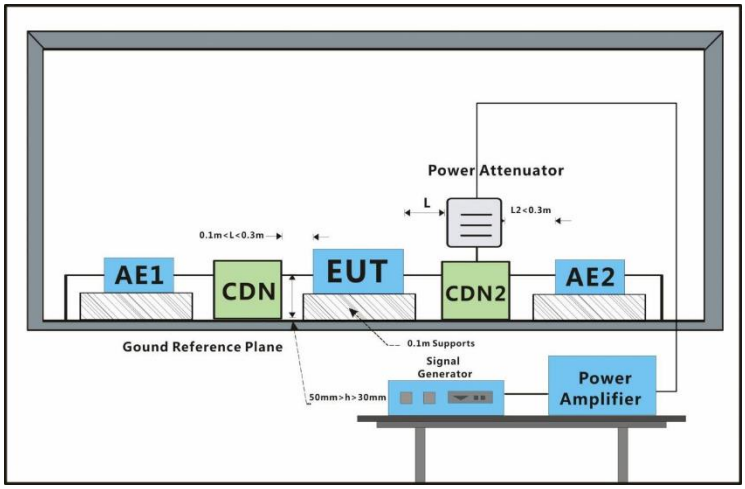
7.6 Conducted Immunity at AC Power Port (150kHz-80MHz)

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-6: 2014

7.6.1 Test Setup Diagram



7.6.2 E.U.T. Operation

Operating Environment:

Temperature: 26.0 °C Humidity: 50.3 % RH Atmospheric Pressure: 1010 mbar

7.6.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.6.4 Test Condition and Results:

Performance Criterion: A

Frequency Range: 0.15MHz to 80MHz

Modulation: 80%, 1kHz Amplitude Modulation

Step Size: 1%

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Cable port	Level (Vrms)	CDN/Clamp	Dwell time	Result / Observations
AC power port	3(0.15MHz-10MHz)	CDN	3s	A
AC power port	3 to 1(10MHz-30MHz, Lines)	CDN	3s	A
AC power port	1(30MHz-80MHz)	CDN	3s	A
A: No degradation in the performance of the EUT was observed				

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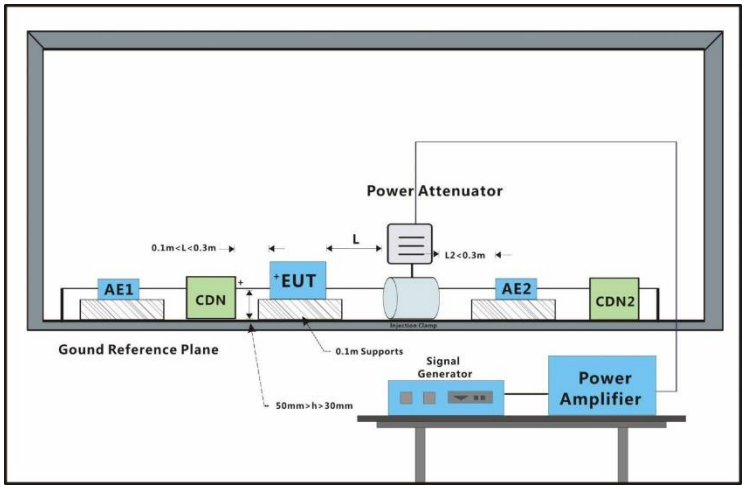
7.7 Conducted Immunity at Signal Port (150kHz-80MHz)

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-6: 2014

7.7.1 Test Setup Diagram



7.7.2 E.U.T. Operation

Operating Environment:

Temperature: 26.0 °C Humidity: 50.3 % RH Atmospheric Pressure: 1010 mbar

7.7.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.7.4 Test Condition and Results:

Performance Criterion: A

Frequency Range: 0.15MHz to 80MHz

Modulation: 80%, 1kHz Amplitude Modulation

Step Size: 1%

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Port	Level (Vrms)	CDN/Clamp	Dwell time	Result / Observations
Signal port	3(0.15MHz-10MHz)	Clamp	3s	A
Signal port	3 to 1(10MHz-30MHz, Lines)	Clamp	3s	A
Signal port	1(30MHz-80MHz)	Clamp	3s	A
A: No degradation in the performance of the EUT was observed				

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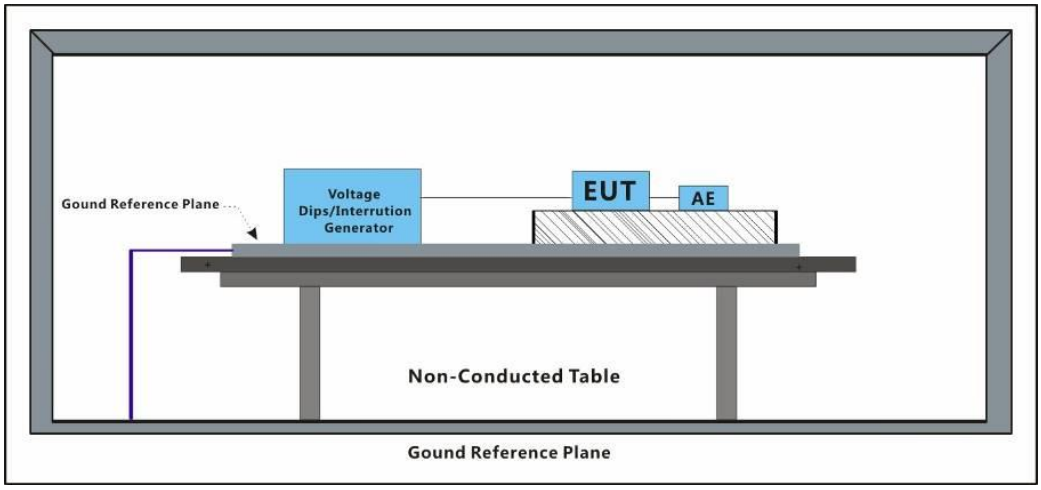
7.8 Voltage Dips and Interruptions

Test Requirement: EN 55035:2017+A11:2020

Test Method: EN 61000-4-11: 2004 +A1: 2017

7.8.1 Test Setup Diagram



7.8.2 E.U.T. Operation

Operating Environment:

Temperature: 26.0 °C Humidity: 50.3 % RH Atmospheric Pressure: 1010 mbar

7.8.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Normal working(BeagleBone® Black)_Keep all the port of EUT working normally.

7.8.4 Test Condition and Results:

Performance Criterion:

<5% residual voltage for 0.5 periods: B

70% residual voltage for 25 periods: C

<5% residual voltage for 250 periods: C

No. of Dips / Interruptions: 3 per Level

Time between dropout: 10s

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Level % UT	Phase (deg)	Duration	No. of Dips / Interruptions	Result / Observations
0	0°	0.5 Cycles	3	A
0	0°	250 Cycles	3	C
70	0°	25 Cycles	3	A
A: No degradation in the performance of the EUT was observed C: The EUT stop working during the test. It can be recovered by user after the test.				

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8 Test Setup Photo

Conducted Emissions at Mains Power Port (150kHz-30MHz)

Asymmetric Mode Conducted Emissions(150kHz-30MHz)

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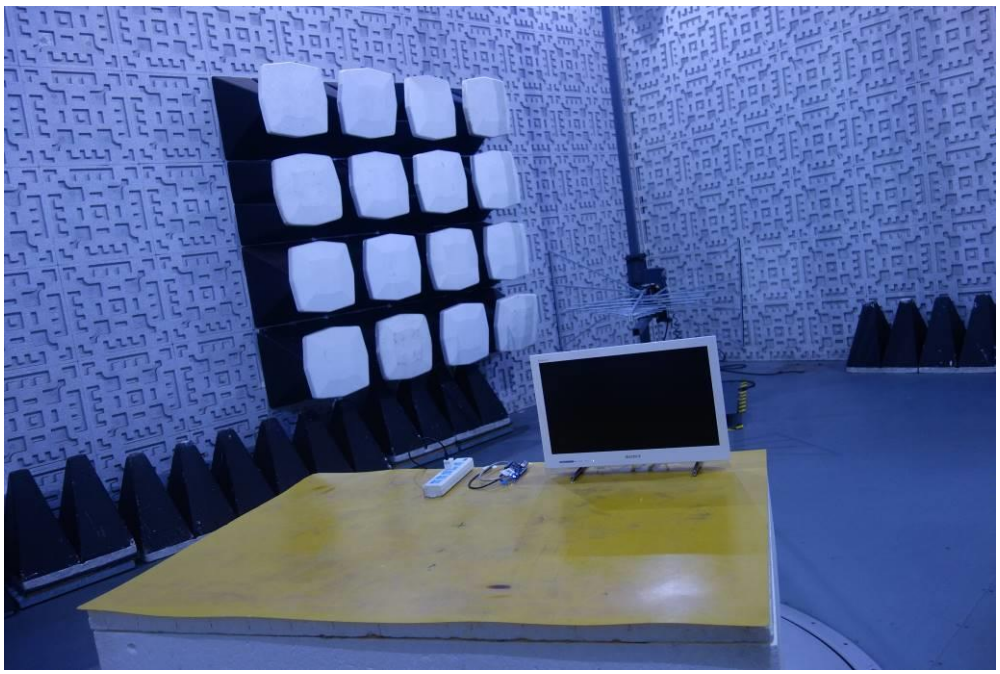
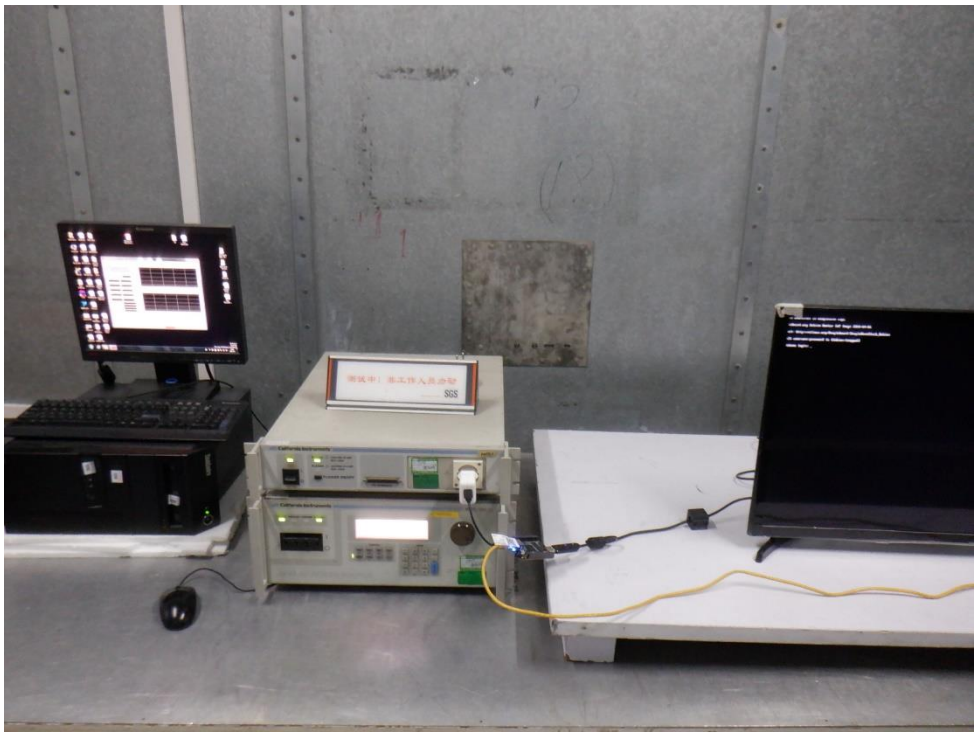
Radiated Emissions (30MHz-1GHz)



Voltage Fluctuations and Flicker



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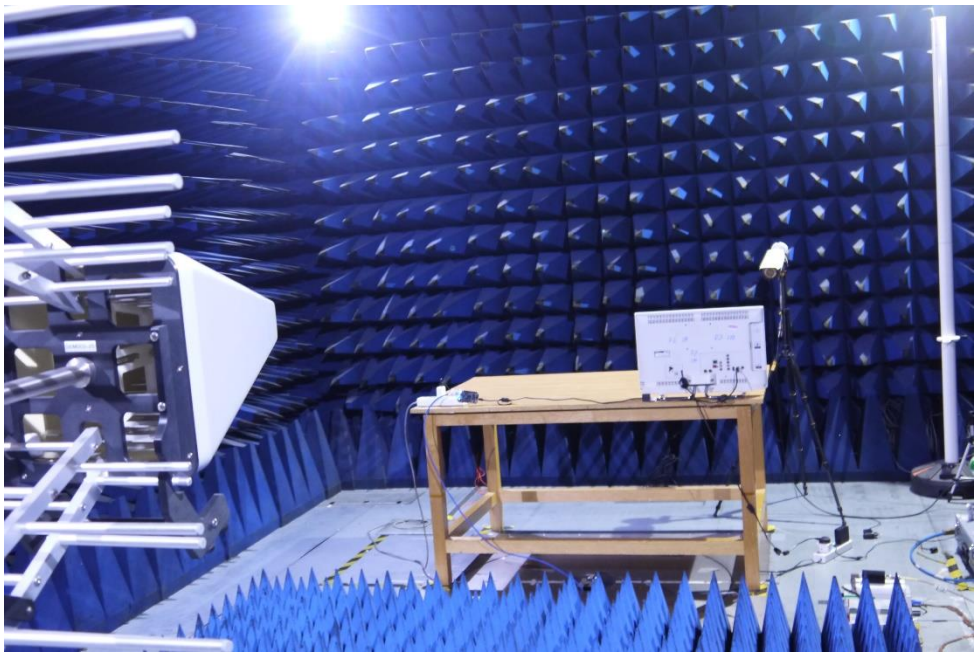
Electrostatic Discharge

Radiated Immunity (80MHz-1GHz,1800MHz,2600MHz,3500MHz,5000MHz)



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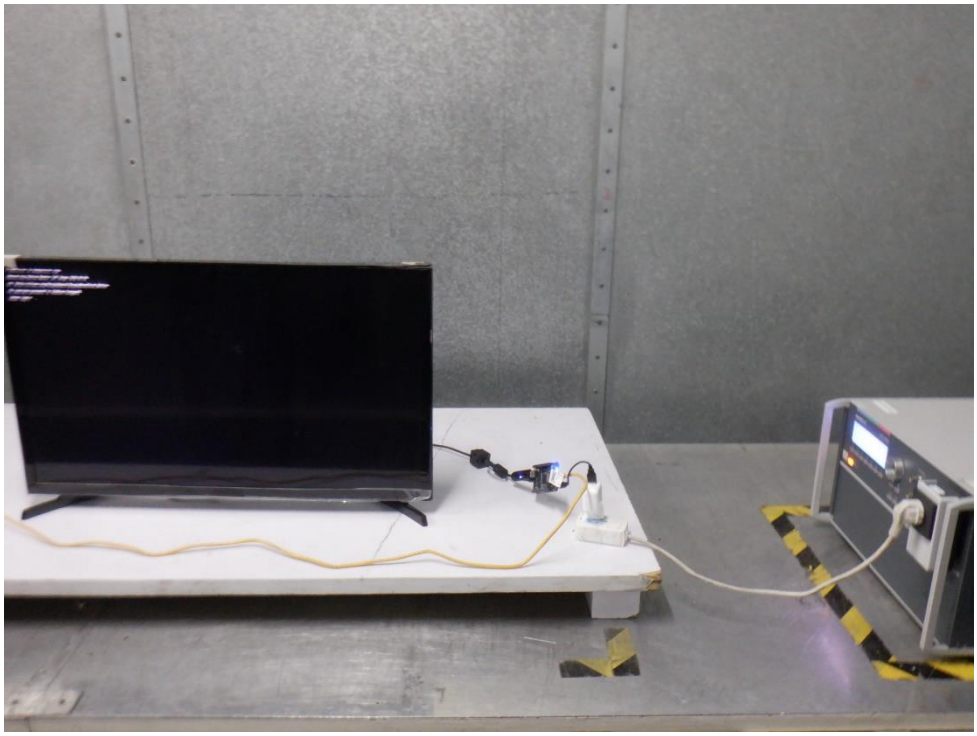
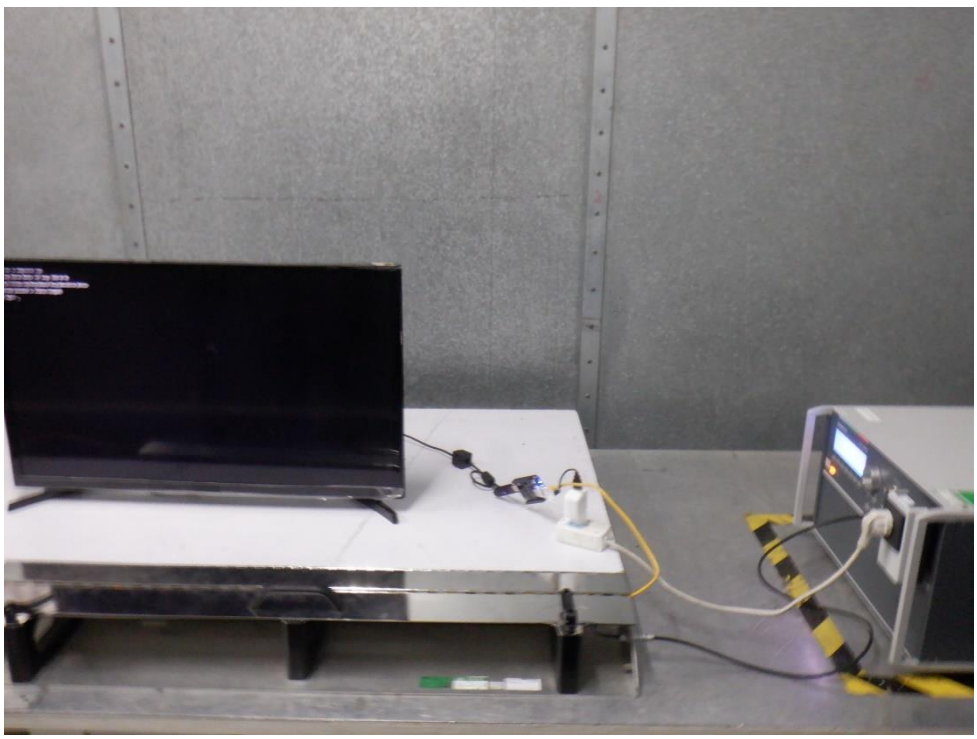
Electrical Fast Transients & Burst at AC Power Port



Electrical Fast Transients & Burst at Signal Port



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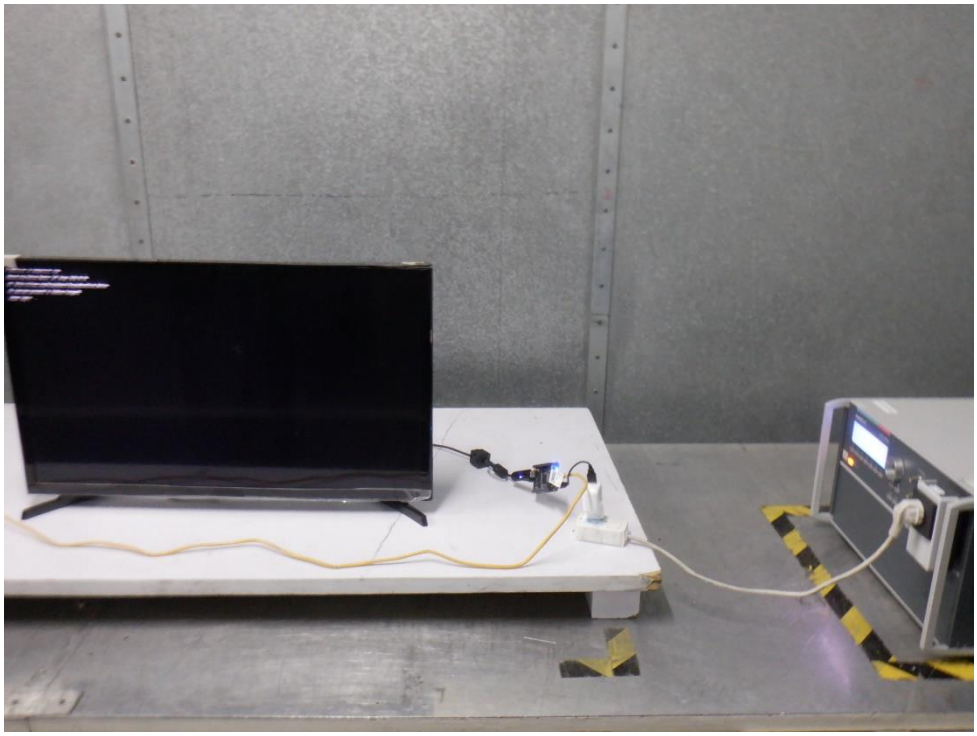
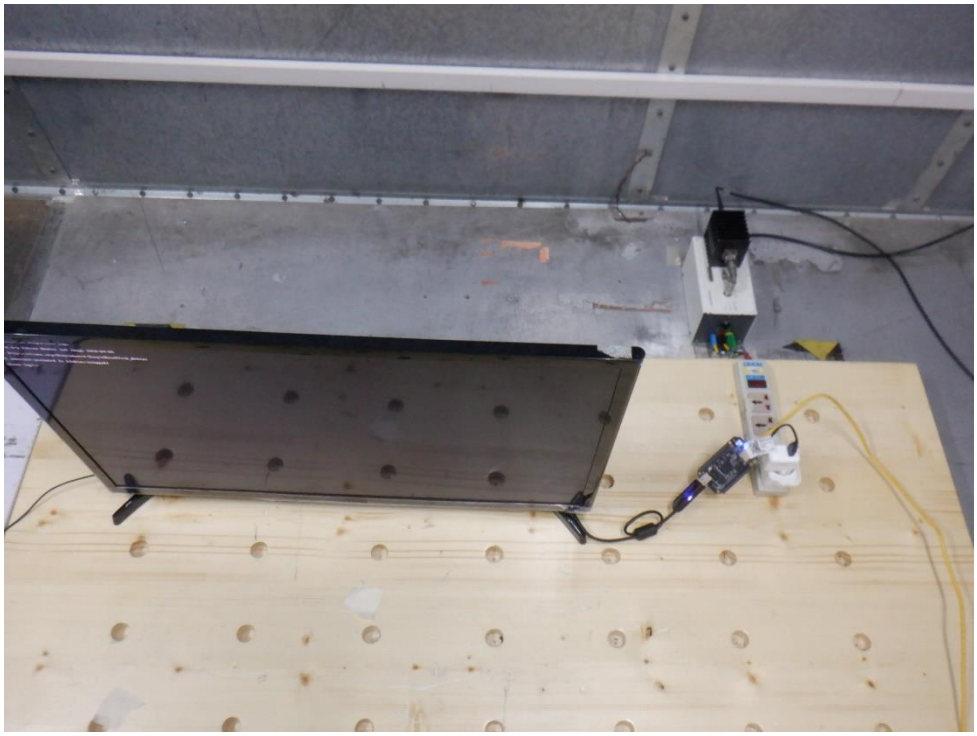
Surge at AC Power Port



Conducted Immunity at AC Power Port (150kHz-80MHz)



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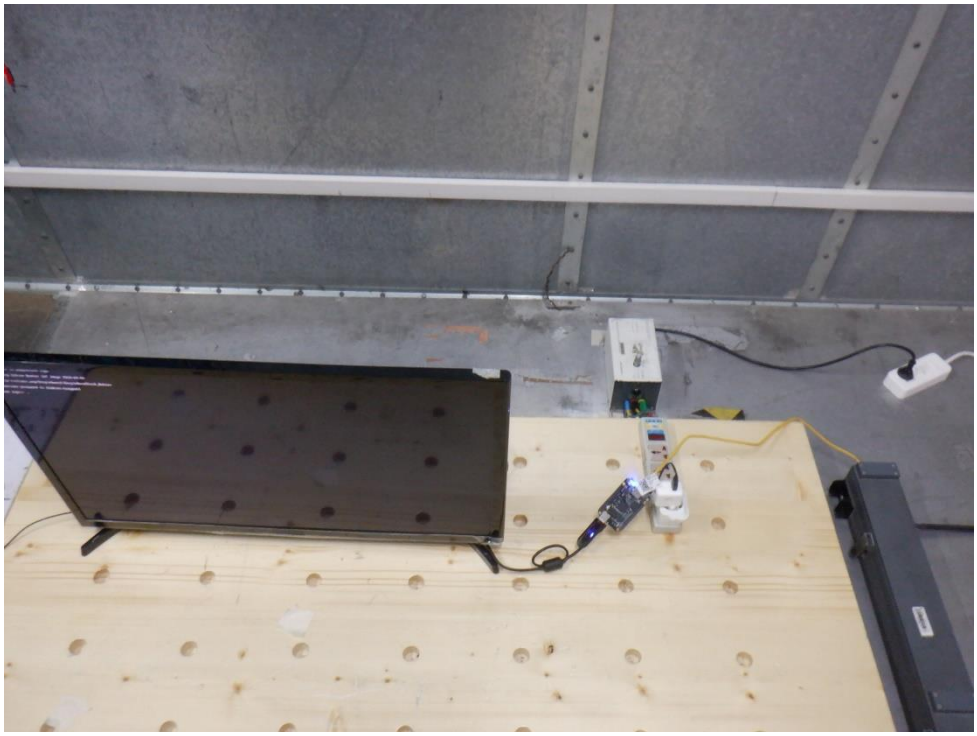
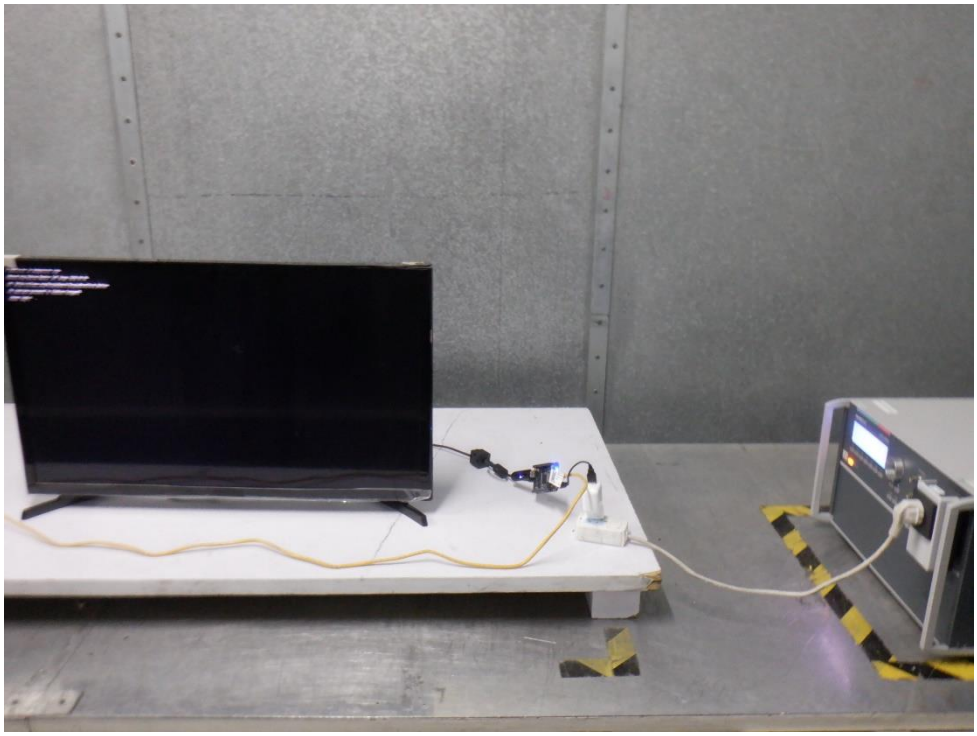
Conducted Immunity at Signal Port (150kHz-80MHz)



Voltage Dips and Interruptions



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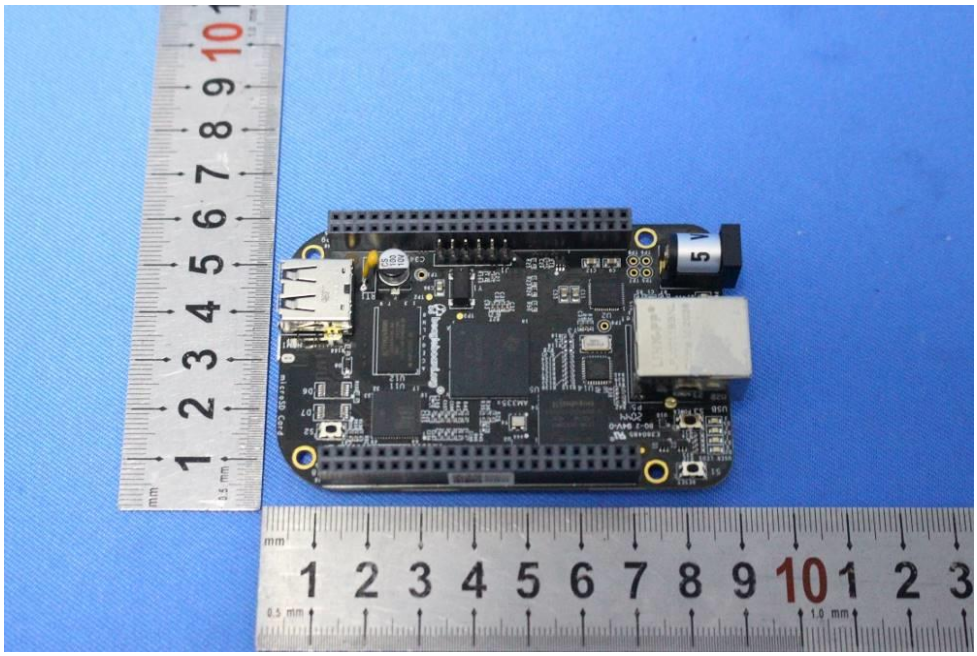
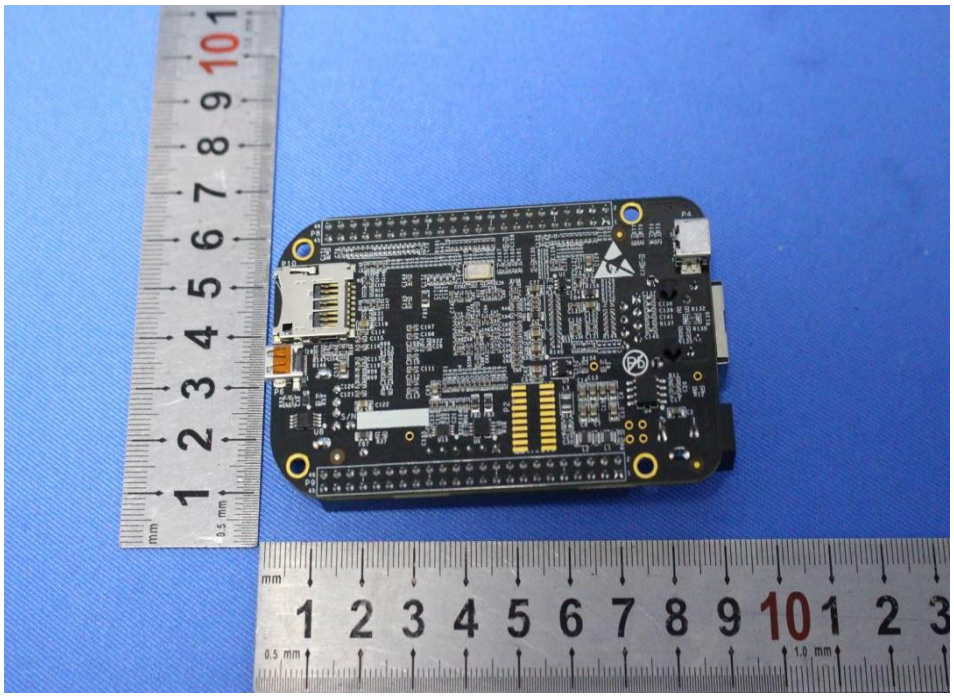
9 EUT Constructional Details (EUT Photos)





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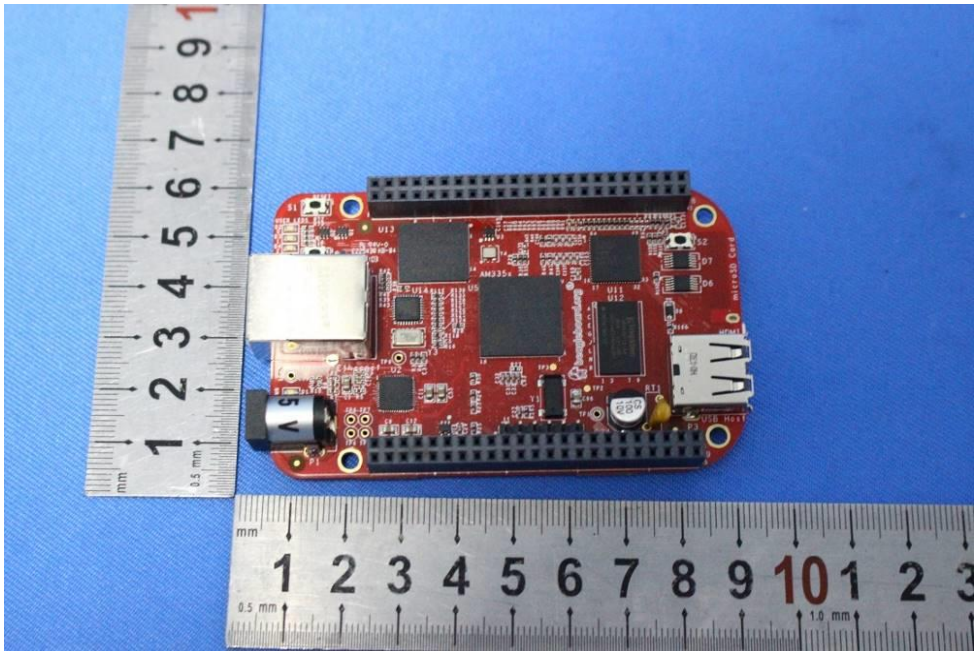

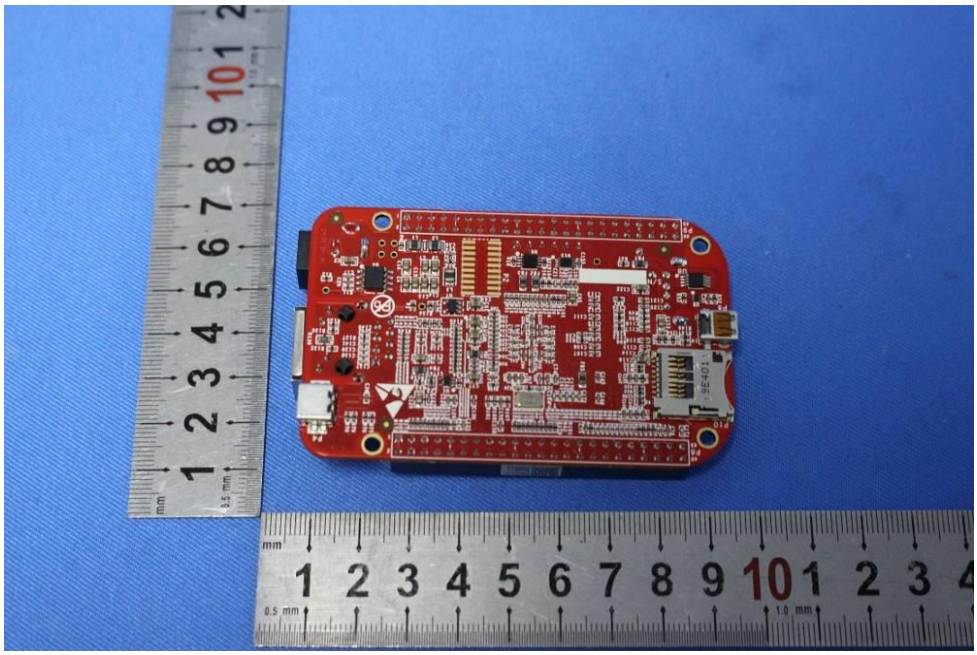

- End of the Report -

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