EMC TEST REPORT

Report: EMC_ SL18040601-RIO-001_CE

Supersedes: N/A

Applicant Name:	Resin.io
Product Name:	Raspberry Compute Module 3 Lite
Model Name:	Balena Fin
Test Standard:	ETSI EN 301 489-1 V2.2.0, EN 301 489-17 V3.2.0
Test Method:	EN 55032: 2012 + AC 2013, EN 61000-4-2:2009, EN 61000-4-3:2010, EN 61000-4-4:2012, EN 61000-4-5:2014, EN 61000-4-6:2014, EN 61000-4-11:2004.
Date of Test:	05/07/2018 to 05/11/2018
Report Issue Date:	05/23/2018

Test Result: ☒ Pass ☐ Fail

Equipment complied with the specifications: ☒

Equipment did not comply with the specifications: ☐

This test report is issued under the authority of:

Full Name:	Kushal Shastri	Full Name:	Anish Kumar
Title:	EMC Test Engineer	Title:	Compliance Engineer (Reviewer)

ISSUED BY:

SIEMIC Laboratories

775 Montague Expressway, Milpitas, CA 95035 USA

ACCREDITED
TESTING CERT # 2742-01

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 throughout 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	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for conformity assessment

Country/Region	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & RED Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

Table of Contents

1. Report revision history

Report No.	Version No.	Description	Issue Date
EMC_ SL18040601-RIO-001_CE	Original	EN 301 489 Report	05/23/2018

2. Executive summary

The purpose of this test program was to demonstrate compliance of following product:

Company: Resin.io
Product: Raspberry Compute Module 3 Lite
Model: Balena Fin

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3. Customer information

Applicant Name:	Resin.io
Applicant Address:	One London Wall 6th floor London EC2Y 5EB United Kingdom
Manufacturer Name:	Resin.io
Manufacturer Address:	One London Wall 6th floor London EC2Y 5EB United Kingdom

4. Test site information

Lab Performing Tests:	SIEMIC Laboratories
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No:	881796
IC Test Site No:	4842D-2
VCCI Test Site No:	A0133

5. Modification

Index	Item	Description	Note
N/A	N/A	N/A	N/A

6. Test software version

Test Item	Vendor	Software	Version
Radiated Emission	EMISoft	EMISoft Vasona	V5.0
Conducted Emission	EMISoft	EMISoft Vasona	V5.0
Harmonic Emission and	California Instrument	CTS 30	V3.2.0.31
Radiated Immunity	EMISoft	EMISoft Vasona	V5.0
Conducted Immunity	EMISoft	EMISoft Vasona	V5.0
Surge Immunity	Thermo Electron	CEWare	V4.0
Electrical Fast Transient	Thermo Electron	CEWare	V4.0
Power Frequency Magnetic	Thermo Electron	CEWare	V4.0
Voltage Dips and Short	Thermo Electron	CEWare	V4.0

7. EUT Information

7.1. EUT Description

Product Name:	Raspberry Compute Module 3 Lite
Model Name.:	Balena Fin
Trade Name:	Resin.io
Serial No.:	N/A
Input Power:	230VAC~50Hz
Date of EUT received:	04/15/218
Equipment Class:	Class A
Highest frequency generated or used in the device or on which the device operates or tunes:	5.8GHz
Port/Connectors:	1 X RJ45, 2 X USB, 1 X mini USB, 1 X HDMI
Remarks:	N/A

7.2. EUT Test Modes / Configurations description

7.2.1. EUT Test modes: Pre-test mode Configuration

Pre-scan Test Mode and Configuration	
Pre-test Mode and Configuration	Normal Operation
Remarks:	EUT was communicating with laptop wirelessly via router.

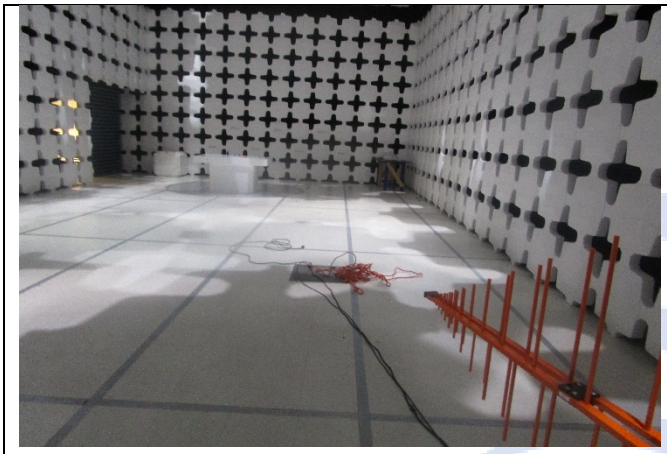
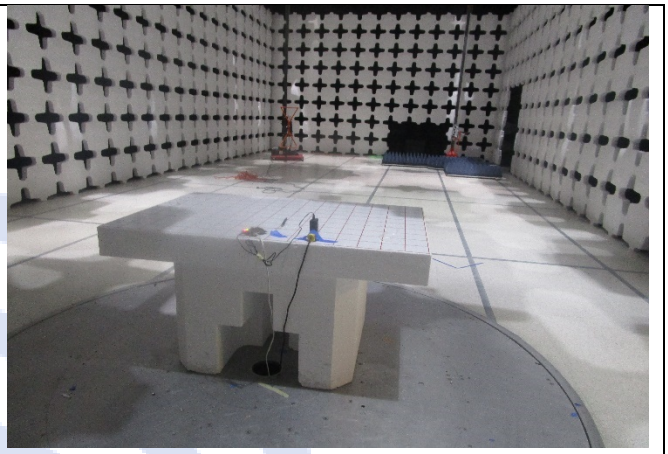
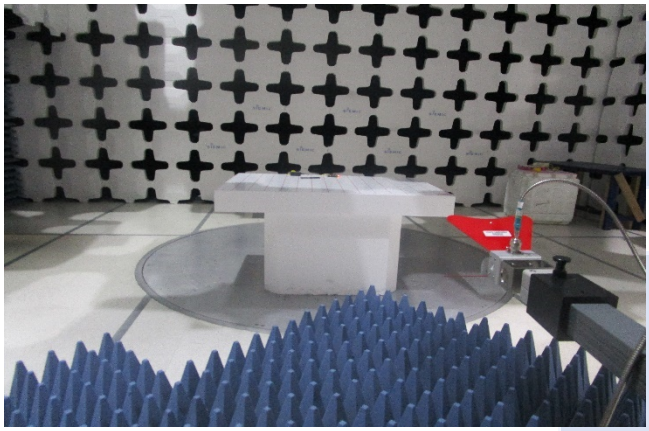
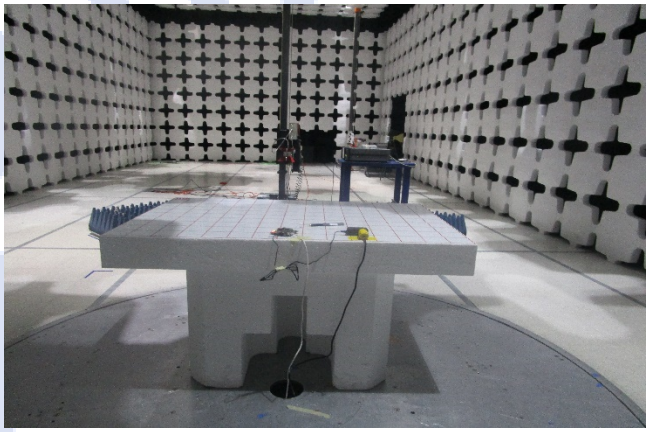
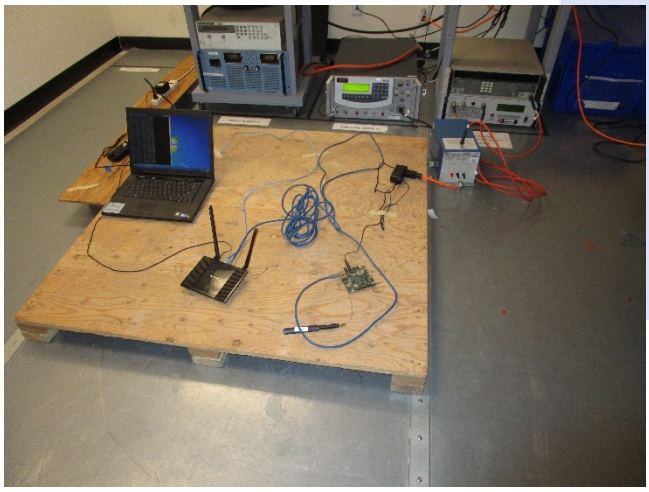
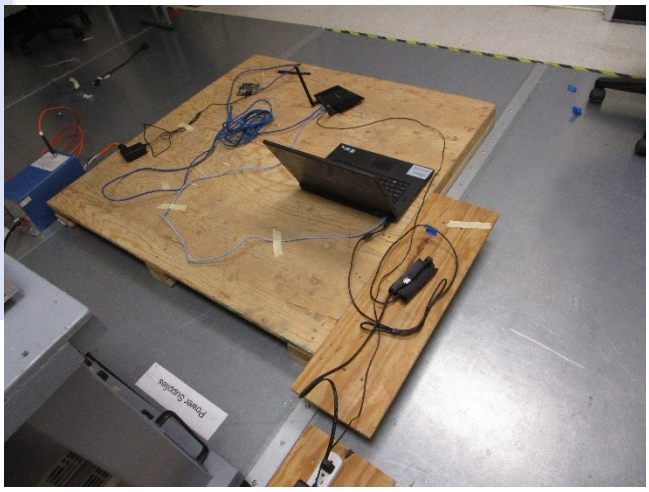
7.2.2. EUT Test modes: Final test mode and Configuration

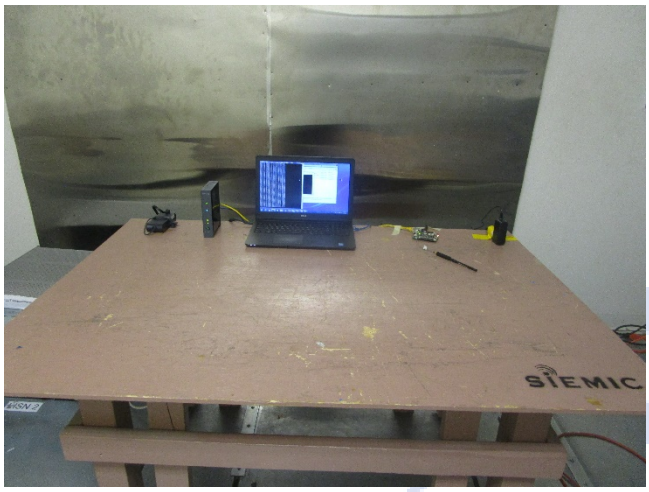
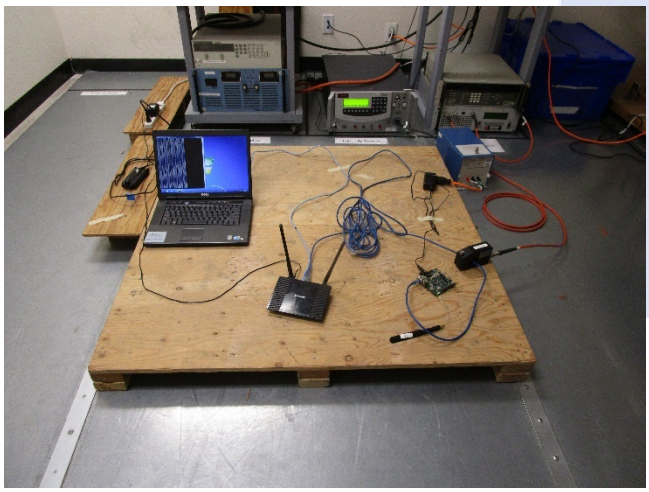
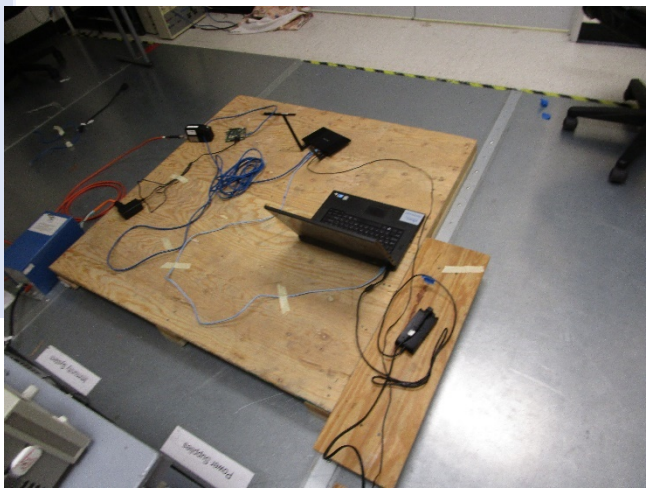
Final Test Mode and Configuration	
Final-test Mode 1	Normal Operation
Remarks:	EUT was communicating with laptop wirelessly via router.

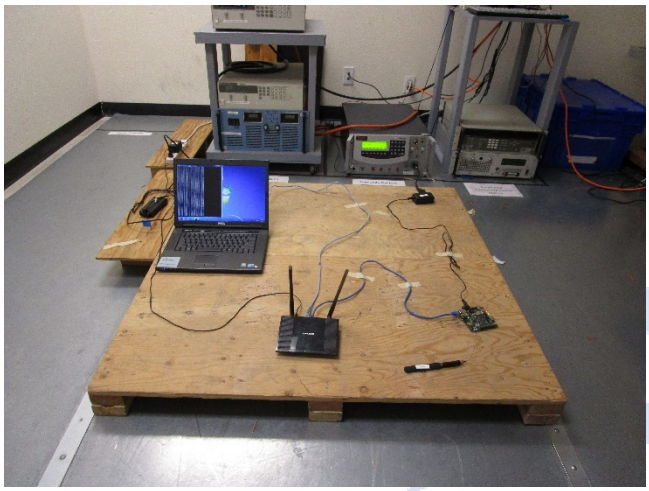
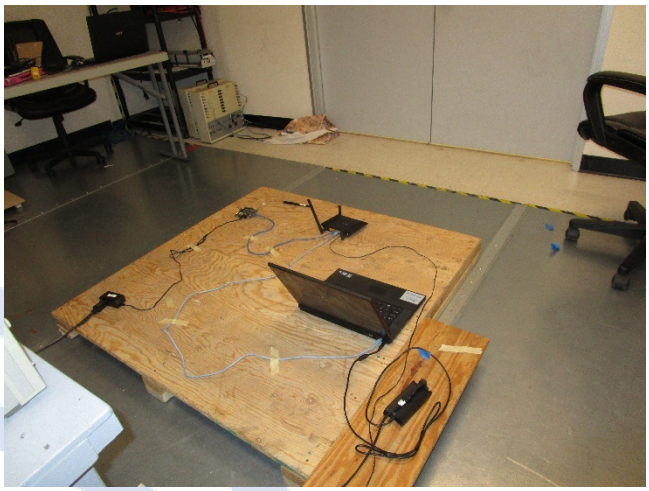
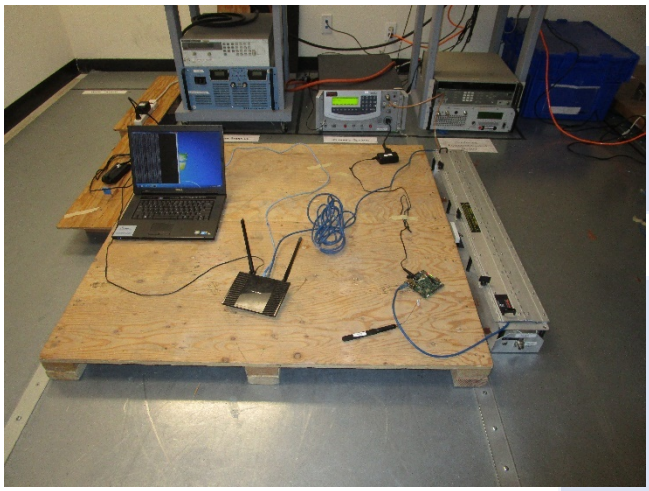
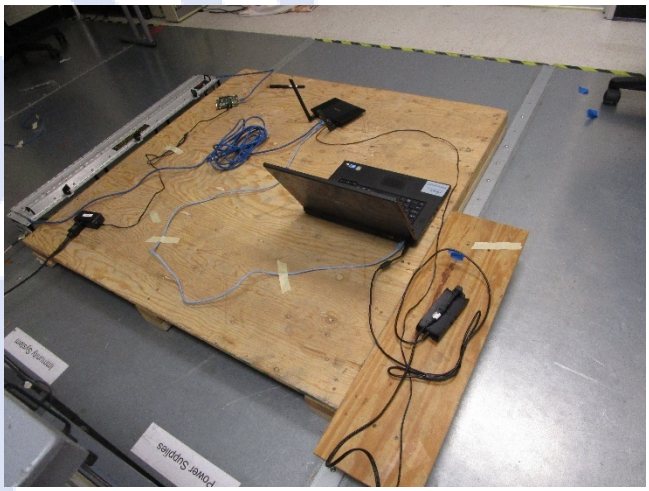
7.3. EUT Photos

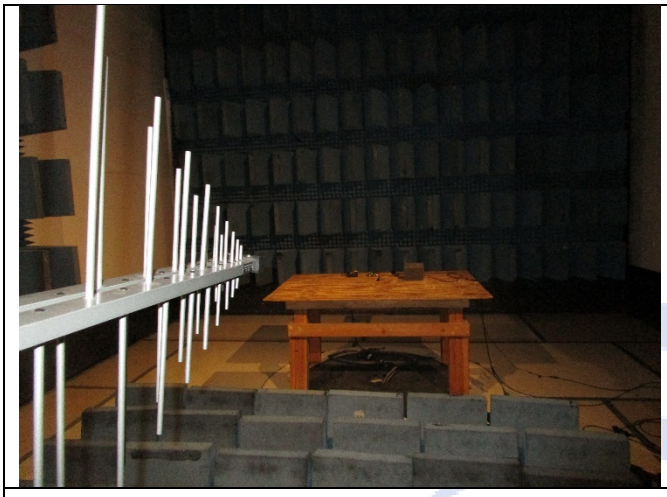
	
EUT – Picture-1	EUT – Picture-2

7.4. EUT | Test Setup Photos

	
Radiated Emissions below 1GHz – Front View	Radiated Emissions below 1GHz – Rear View
	
Radiated Emissions above 1GHz – Front View	Radiated Emissions above 1GHz – Rear View
	
AC Line Conducted Immunity – Front View	AC Line Conducted Immunity – Rear View

	
AC Line Conducted Emission– Front View	AC Line Conducted Emission– Rear View
	
Signal Line Conducted Emission– Front View	Signal Line Conducted Emission– Rear View
	
Signal Line Conducted Immunity – Front View	Signal Line Conducted Immunity – Side View

	
Surge, Dips and Interrupts, and Electrical Fast Transients – Front View	Surge, Dips and Interrupts, and Electrical Fast Transients – Rear View
	
Signal Line- Electrical Fast Transients – Front View	Signal Line - Electrical Fast Transients – Rear View

	
Radiated Immunity Below 1GHz – Front View	Radiated Immunity Below 1GHz – Rear View
	
Radiated Immunity Above 1GHz – Front View	Radiated Immunity Above 1GHz – Rear View
	
Electrostatic Discharge – Front View	Electrostatic Discharge – Rear View

*Note: The second laptop was off site the testing environment to monitor the wireless communication.

8. Supporting equipment / Software / Cabling information

8.1. Support equipment

Item	Support Equipment Description	Model / Part	Serial Number	Manufacturer
1	Laptop	Vostro 1520	C6ZKQK1	DELL
2	Laptop	Latitude	JB526TBX3Q	DELL
3	Router	DIR-859	RZOS3FC006146	D-Link
4	Router	TL-WR3487	C43DC7846112	TP-Link
5	Router	WNR3500L	215802000480	Net gear

8.2. I/O Ports

Item	Connection Start		Connection Stop		Length / shielding Info	
	From	I/O Port	To	I/O Port	Length (m)	Shielding
1	Laptop	RJ45	Router	RJ45	<3M	No
2	EUT	RJ45	Router	RJ45	>3M	No

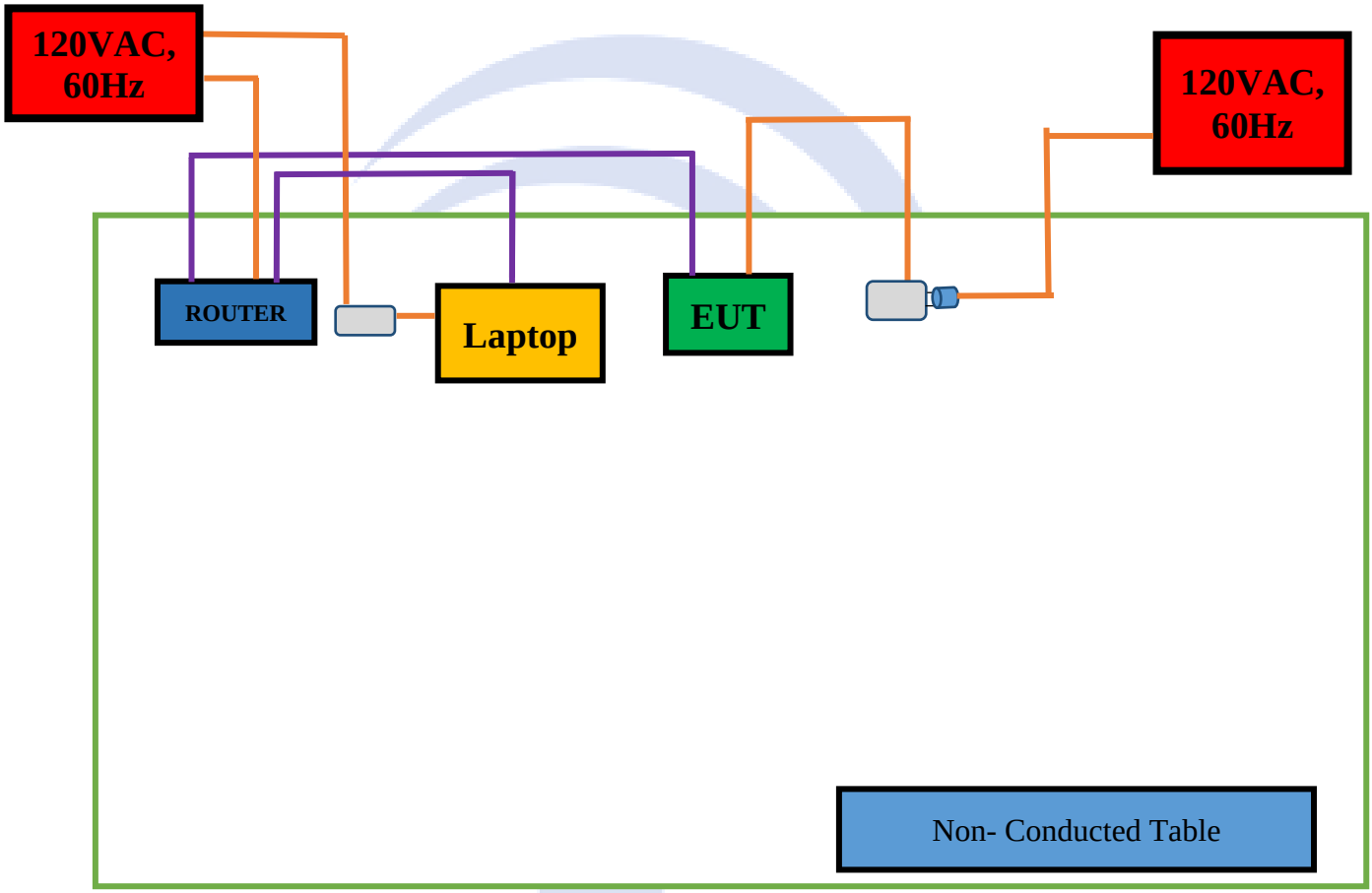
Test software description

Test Item	Software	Description
1	Command Prompt	For Continuously pinging the EUT via Laptop
2	Resin.io	Manufacturer Provided Test Mode Software

8.3. System setup block diagram

RJ45

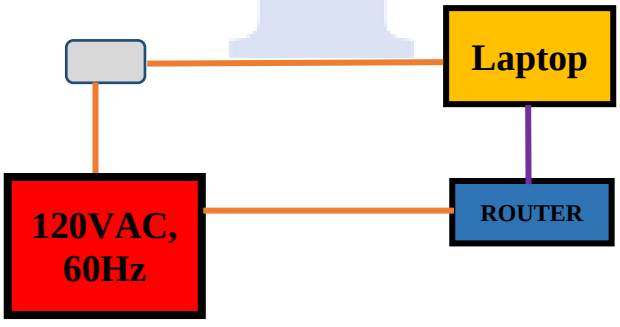
POWER Cable



(On-Site Area)

(Offsite Test Area)

Peripherals equipment (Laptop) is connected wirelessly to the EUT.



9. Test summary

Emissions			
Test Item	Test Standard	Test Method / Procedure	Pass / Fail
Conducted Emissions	ETSI EN 301 489-1 V2.2.0	EN 55032: 2012 + AC 2013	☒ Pass ☐ Fail ☐ N/A
Radiated Spurious Emissions	ETSI EN 301 489-1 V2.2.0	EN 55032: 2012 + AC 2013	☒ Pass ☐ Fail ☐ N/A
Limits for Harmonic Current Emissions	EN 61000-3-2: 2014	EN 61000-3-2: 2014	☒ Pass ☐ Fail ☐ N/A
Limitation of Voltage Changes, Fluctuation & Flicker	EN 61000-3-3:2013	EN 61000-3-3:2013	☒ Pass ☐ Fail ☐ N/A

Immunity			
Test Item	Test Standard	Test Method / Procedure	Pass / Fail
Electrostatic Discharge Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-2:2009	☒ Pass ☐ Fail ☐ N/A
Radiated RF Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-3:2010	☒ Pass ☐ Fail ☐ N/A
Electrical Fast Transients/Bust Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-4:2012	☒ Pass ☐ Fail ☐ N/A
Voltage Surge Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-5:2014	☒ Pass ☐ Fail ☐ N/A
Conducted Disturbances Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-6:2014	☒ Pass ☐ Fail ☐ N/A
Power Frequency Magnetic Field Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-8:2010	☐ Pass ☐ Fail ☒ N/A*
Voltage Dips and Short Interruptions Immunity	ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	EN 61000-4-11:2004	☒ Pass ☐ Fail ☐ N/A
Remarks	1. All measurement uncertainties are not taken into consideration for all presented test result. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. 3. N/A: Test not applicable *EUT does not contain any magnetic sensitive component.		

10. Measurement uncertainty

Emissions			
Test Item	Frequency Range	Description	Uncertainty
AC Conducted Emissions	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Radiated Spurious Emissions	1GHz – 6Ghz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+4.3dB/-4.1dB

Performance Criteria Per EN 301 489-1

The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests. For the purpose of the present document four categories of performance criteria apply:

•Performance criteria for continuous phenomena applied to transmitters and receivers

•Performance criteria for transient phenomena applied to transmitters and receivers

•Performance criteria for equipment which does not provide a continuous communication link

•Performance criteria for ancillary equipment tested on a stand alone basis

Normally, the performance criteria depend on the type of radio equipment. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment. More specific and product-related performance criteria for a dedicated type of radio equipment may be found in the part of ETSI EN 301 489 series [i.13] dealing with the particular type of radio equipment and if present takes precedence over the requirements in clauses 6.1, 6.2, 6.3 and 6.4 of the present document.

Performance criteria for continuous phenomena applied to transmitters and receivers

If no further details are given in the relevant part of ETSI EN 301 489 series [i.13] dealing with the particular type of radio equipment, the following general performance criteria for continuous phenomena shall apply.

During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of
function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as
intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended

Performance criteria for transient phenomena applied to transmitters and receivers

If no further details are given in the relevant part of ETSI EN 301 489 series [i.13] dealing with the particular type of radio equipment, the following general performance criteria for transient phenomena shall apply.

For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the
following criteria applies:

•For products with only one symmetrical port intended for connection to outdoor lines, 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 SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

•For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

For all other ports the following applies:

•After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

•During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.

•If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criteria for equipment which does not provide a continuous communication link

For radio equipment which does not provide a continuous communication link, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, in these cases the manufacturer shall declare, for inclusion in the test report, his
own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2.

Performance criteria for ancillary equipment tested on a stand alone basis

If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, in these cases the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.
The performance specification shall be included in the product description and documentation. The related specifications set
out in clause 5.3 have also to be taken into account.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2.

11. Guideline for interference allowed

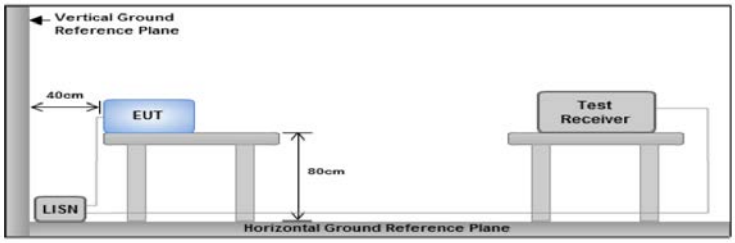
11.1. Conducted emissions

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
EN 55032:2012 + AC 2013 Class A Limit	0.15 ~ 0.5	79	66
	0.5 ~ 5	73	60
NOTE 1 The lower limit shall apply at the transition frequencies. NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz			

Limits for Conducted Emissions at the Telecommunication Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
EN 55032: 2012 + AC 2013 Class A Limit	0.15 ~ 0.5	97 – 87	84 – 74
	0.5 ~ 30	87	74
NOTE 1 The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz NOTE 2 The voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to the telecommunication port under test (conversion factor is 20 log10 150 / I = 44 dB).			

Spec	Requirement	Applicable
ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0	The equipment under test (EUT) shall meet the limits of disturbance of Class B device including the average limits and the quasi-peak limits when using, respectively, an average detector receiver and a quasi-peak detector receiver, and measured in accordance with the methods described in Clause 9 of EN 55032: 2012 + AC 2013.	YES
Test Setup	 Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes	
Procedure	1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table. 2. The power supply for the EUT was fed through a 50□/50□H EUT LISN, connected to filtered mains. 3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. 4. All other supporting equipment was powered separately from another main supply. 5. The EUT was switched on and allowed to warm up to its normal operating condition. 6. A scan was made on the Neutral/Phase line (for AC mains) or Earth line over the required frequency range using an EMI test receiver. 7. High peaks, relative to the limit line, were then selected. 8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made 9. All possible modes of operation were investigated. Only the 6 worst case emissions were measured and reported. All other emissions were relatively insignificant.	

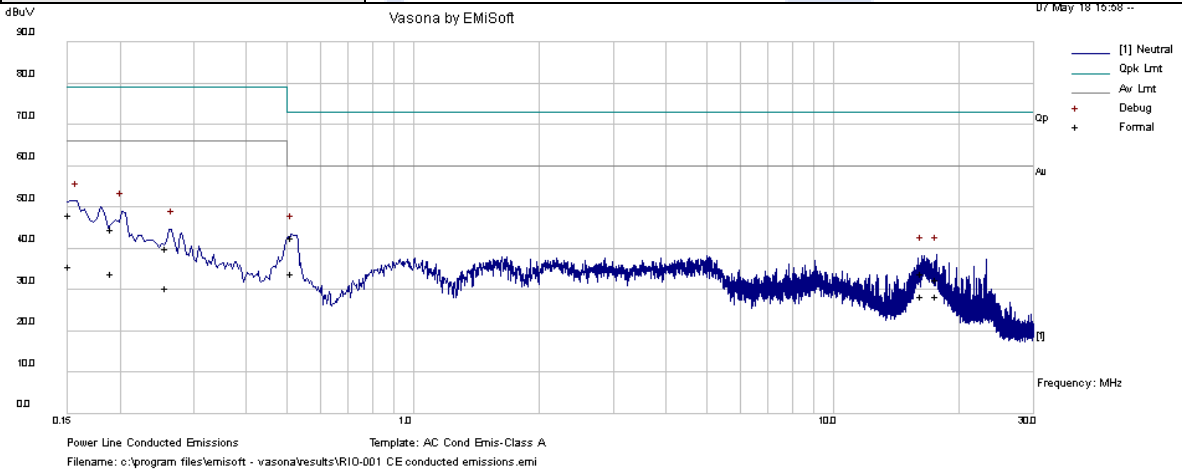
Description of the Conducted Emission Program	This EMC Measurement software, EMI Soft Vasona offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the common scan range from 15 kHz to 30 MHz; the program will first start a peak and average scan on selectable measurement time and step size. After the program complete the pre-scan, this program will perform the Quasi Peak and Average measurement, based on the pre-scan peak data reduction result.
Sample Calculation Example	At 20 MHz limit = 250 μV = 47.96 dBμV Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB Q-P reading obtained directly from EMI Receiver = 40.00 dBμV (Calibrated for system losses) Therefore, Q-P margin = 47.96 – 40.00 = 7.96 i.e. 7.96 dB below limit
Remarks	N/A

Test Data: ☒ Yes ☐ N/A

Test Plot: ☒ Yes (See below) ☐ N/A

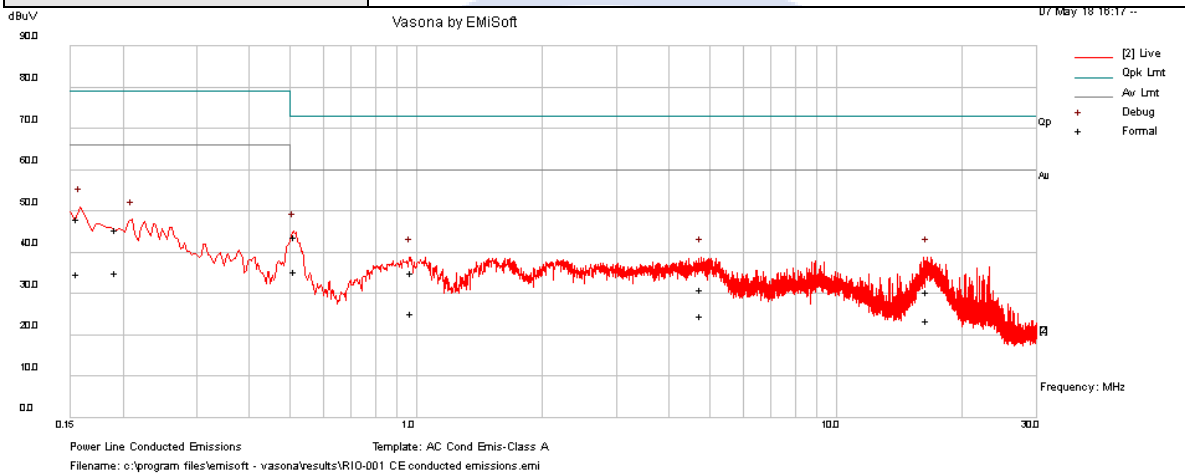
AC Line Conducted Emissions

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	46		X Pass
	Atmospheric(mbar):	1012		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	Neutral Connection			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.151094	37.6	9.33	1.23	48.15	Quasi Peak	Neutral	79	-30.85	Pass
0.511611	32.81	9.33	0.36	42.5	Quasi Peak	Neutral	73	-30.5	Pass
0.190341	34.42	9.32	0.9	44.65	Quasi Peak	Neutral	79	-34.35	Pass
0.257158	29.98	9.32	0.63	39.94	Quasi Peak	Neutral	79	-39.06	Pass
17.69175	22.63	9.38	0.56	32.57	Quasi Peak	Neutral	73	-40.43	Pass
16.22908	24.17	9.37	0.45	33.99	Quasi Peak	Neutral	73	-39.01	Pass
0.151094	25.12	9.33	1.23	35.68	Average	Neutral	66	-30.32	Pass
0.511611	24.28	9.33	0.36	33.96	Average	Neutral	60	-26.04	Pass
0.190341	23.71	9.32	0.9	33.94	Average	Neutral	66	-32.06	Pass
0.257158	20.48	9.32	0.63	30.44	Average	Neutral	66	-35.56	Pass
17.69175	18.51	9.38	0.56	28.46	Average	Neutral	60	-31.54	Pass
16.22908	18.7	9.37	0.45	28.52	Average	Neutral	60	-31.48	Pass

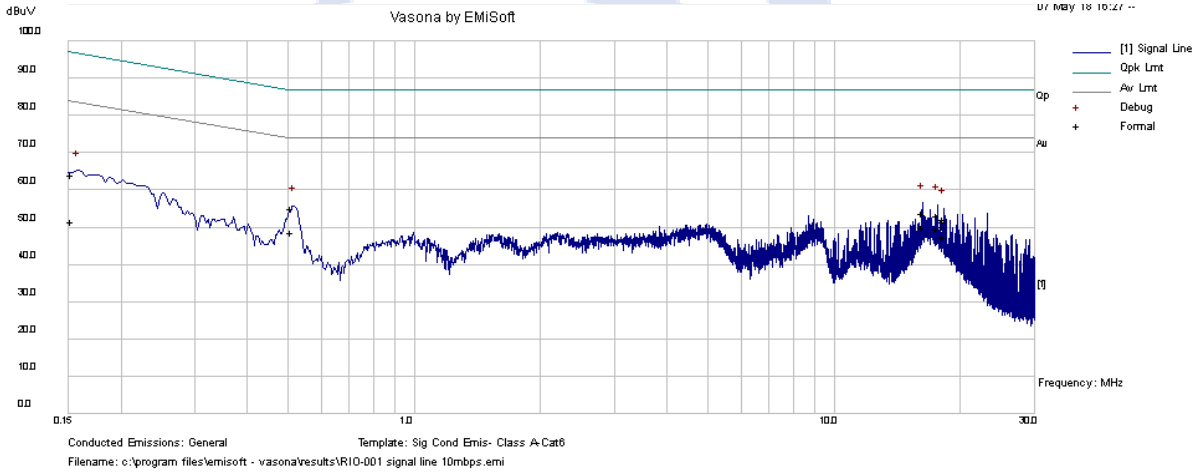
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	46		X Pass
	Atmospheric(mbar):	1012		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	Live Connection			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.155567	37.59	9.33	1.18	48.1	Quasi Peak	Live	79	-30.9	Pass
0.511623	33.99	9.33	0.36	43.67	Quasi Peak	Live	73	-29.33	Pass
0.192048	35.2	9.32	0.89	45.41	Quasi Peak	Live	79	-33.59	Pass
16.53819	20.68	9.38	0.47	30.53	Quasi Peak	Live	73	-42.47	Pass
0.975198	25.49	9.33	0.29	35.11	Quasi Peak	Live	73	-37.89	Pass
4.761485	21.48	9.35	0.3	31.12	Quasi Peak	Live	73	-41.88	Pass
0.155567	24.23	9.33	1.18	34.74	Average	Live	66	-31.26	Pass
0.511623	25.81	9.33	0.36	35.5	Average	Live	60	-24.5	Pass
0.192048	24.78	9.32	0.89	35	Average	Live	66	-31	Pass
16.53819	13.77	9.38	0.47	23.62	Average	Live	60	-36.38	Pass
0.975198	15.63	9.33	0.29	25.25	Average	Live	60	-34.75	Pass

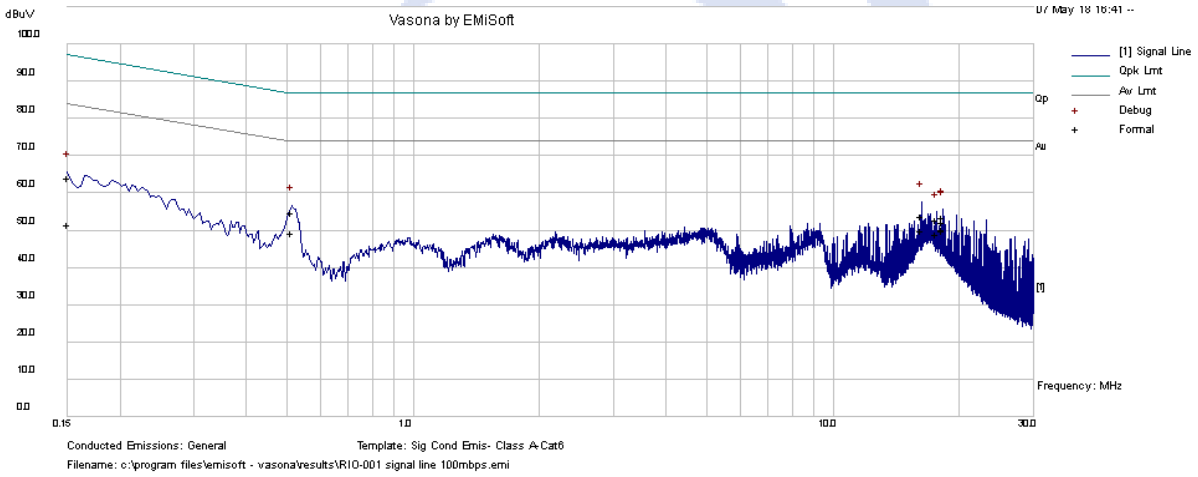
Telecom Line Conducted Emissions

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	46		X Pass
	Atmospheric(mbar):	1012		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	10mbps			



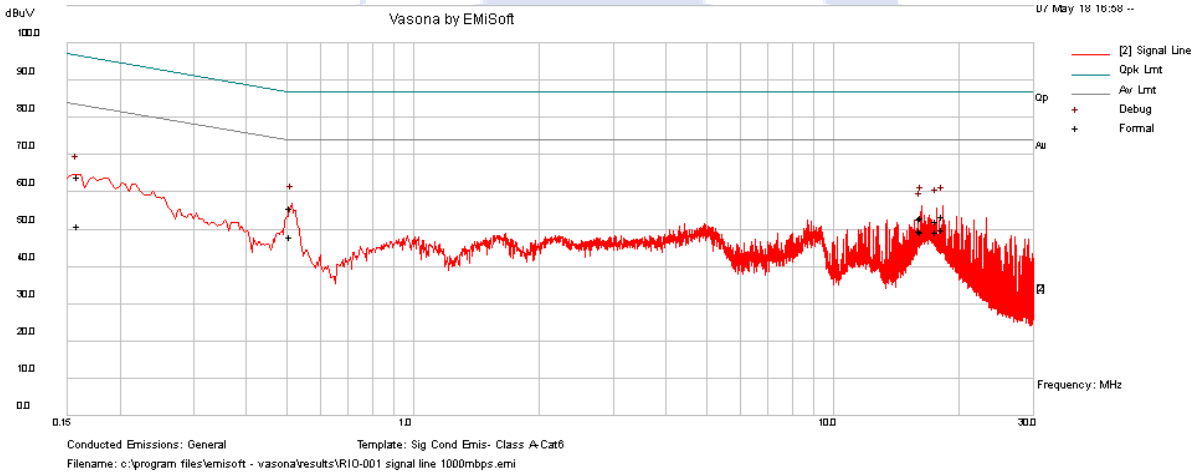
Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
16.22858	34.83	9.37	9.42	53.63	Quasi Peak	Signal	87	-33.37	Pass
17.69383	34.25	9.38	9.43	53.06	Quasi Peak	Signal	87	-33.94	Pass
0.508281	35.93	9.33	9.68	54.94	Quasi Peak	Signal	87	-32.06	Pass
0.152032	44.67	9.33	10.08	64.08	Quasi Peak	Signal	96.89	-32.81	Pass
18.30376	33.23	9.38	9.43	52.04	Quasi Peak	Signal	87	-34.96	Pass
18.24547	32.56	9.38	9.43	51.37	Quasi Peak	Signal	87	-35.63	Pass
16.22858	31.18	9.37	9.42	49.97	Average	Signal	74	-24.03	Pass
17.69383	30.93	9.38	9.43	49.74	Average	Signal	74	-24.26	Pass
0.508281	29.59	9.33	9.68	48.6	Average	Signal	74	-25.4	Pass
0.152032	31.97	9.33	10.08	51.38	Average	Signal	83.89	-32.51	Pass
18.30376	31.37	9.38	9.43	50.19	Average	Signal	74	-23.81	Pass

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	46		X Pass
	Atmospheric(mbar):	1012		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	100mbps			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
16.2285	34.87	9.37	9.42	53.67	Quasi Peak	Signal	87	-33.33	Pass
0.512838	35.85	9.33	9.67	54.85	Quasi Peak	Signal	87	-32.15	Pass
18.24288	34.7	9.38	9.43	53.52	Quasi Peak	Signal	87	-33.48	Pass
0.150176	44.76	9.33	10.09	64.18	Quasi Peak	Signal	96.99	-32.81	Pass
18.30383	33.27	9.38	9.43	52.08	Quasi Peak	Signal	87	-34.92	Pass
17.69435	33.97	9.38	9.43	52.78	Quasi Peak	Signal	87	-34.22	Pass
16.2285	31.15	9.37	9.42	49.95	Average	Signal	74	-24.05	Pass
0.512838	30.17	9.33	9.67	49.17	Average	Signal	74	-24.83	Pass
18.24288	31.1	9.38	9.43	49.91	Average	Signal	74	-24.09	Pass
0.150176	31.98	9.33	10.09	51.39	Average	Signal	83.99	-32.6	Pass
18.30383	31.41	9.38	9.43	50.22	Average	Signal	74	-23.78	Pass

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	46		X Pass
	Atmospheric(mbar):	1012		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	1000mbps			

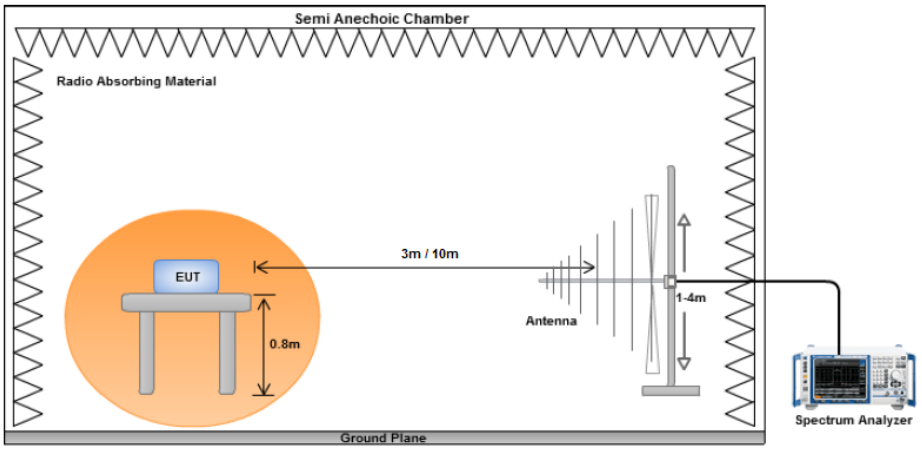


Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.509952	36.55	9.33	9.68	55.56	Quasi Peak	Signal	87	-31.44	Pass
18.24237	34.64	9.38	9.43	53.46	Quasi Peak	Signal	87	-33.54	Pass
16.22922	34.43	9.37	9.42	53.23	Quasi Peak	Signal	87	-33.77	Pass
17.69521	33.24	9.38	9.43	52.05	Quasi Peak	Signal	87	-34.95	Pass
0.158597	44.7	9.33	10.06	64.09	Quasi Peak	Signal	96.54	-32.44	Pass
16.16652	33.94	9.37	9.42	52.73	Quasi Peak	Signal	87	-34.27	Pass
0.509952	28.98	9.33	9.68	47.99	Average	Signal	74	-26.01	Pass
18.24237	30.94	9.38	9.43	49.76	Average	Signal	74	-24.24	Pass
16.22922	30.63	9.37	9.42	49.43	Average	Signal	74	-24.57	Pass
17.69521	30.3	9.38	9.43	49.11	Average	Signal	74	-24.89	Pass
0.158597	31.53	9.33	10.06	50.92	Average	Signal	83.54	-32.62	Pass

Radiated Spurious Emissions Below 1GHz (Class A)

Requirement(s):

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0
ETSI EN 301 489-17 V3.2.0</td><td>The EUT shall meet the limits of the table below when measuring below 1GHz at a distance of 3m in accordance with the methods described in Clause 10 of EN 55032: 2012 + AC 2013.

<table><tr><th>Frequency range (MHz)</th><th>Quasi-peak limits dB (uV/m)</th></tr><tr><td>30 – 230</td><td>40</td></tr><tr><td>230 – 1000</td><td>47</td></tr><tr><td colspan="2">NOTE 1: The lower limit shall apply at the transition frequencies.</td></tr></table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 
</td><td></td></tr>
<tr><td>Procedure</td><td>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 EUT was switched on and allowed to warm up to its normal operating condition.
3. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was then made for that frequency point.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 1GHz using the broadband antenna.</td><td></td></tr>
<tr><td>Description of the Radiated Emissions Program</td><td>This EMC Measurement software, EMI Soft Vasona offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the scan on four different antenna heights, 2 antenna polarity, and 360 degrees' table rotation. For example, the program was set to run 30 MHz to 1 GHz scan; the program will first start from a meter antenna height and divide the 30 MHz to 1 GHz into 10 separate parts of maximum hold sweeps. Each parts of maximum hold sweep, the program will collect the data from 0 degree to 360 degrees' table rotation. After the program complete the 1m scan, the antenna continues to rise to 2m and continue the scan. The step will be repeated for specified antenna height and polarity. This program will perform the Quasi Peak measurement after the signal maximization process and pre-scan routine. The final measurement will be based on the pre-scan data reduction result.</td><td></td></tr>
</table>

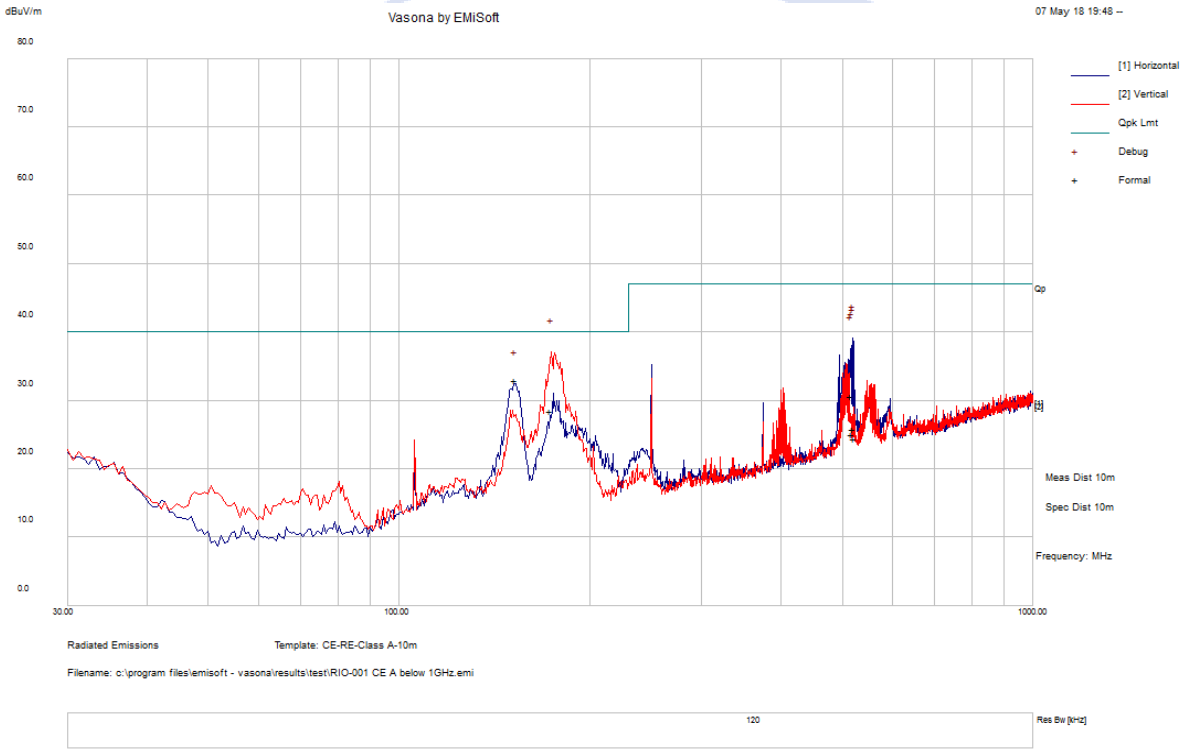
Sample Calculation Example	At 300 MHz limit = 200 µV/m = 46.00 dBµV/m Log-periodic antenna factor & cable loss at 300 MHz = 18.50 dB Q-P reading obtained directly from EMI Receiver = 40.00 dBµV/m (Calibrated level including antenna factors & cable losses Therefore, Q-P margin = 46.00 – 40.00 = 6.00 i.e. 6 dB below limit
Remarks	N/A

Test Data: ☒ Yes (See below) ☐ N/A

Test Data: ☒ Yes (See below) ☐ N/A

Radiated Emission Test Results (Below 1GHz)

Test specification:	Radiated Emissions			
Environmental Conditions:	Temp(°C):	25	Result:	
	Humidity (%):	39		X Pass
	Atmospheric(mbar):	1010		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	30 – 1000 MHz. The testing was done in a 10m chamber			

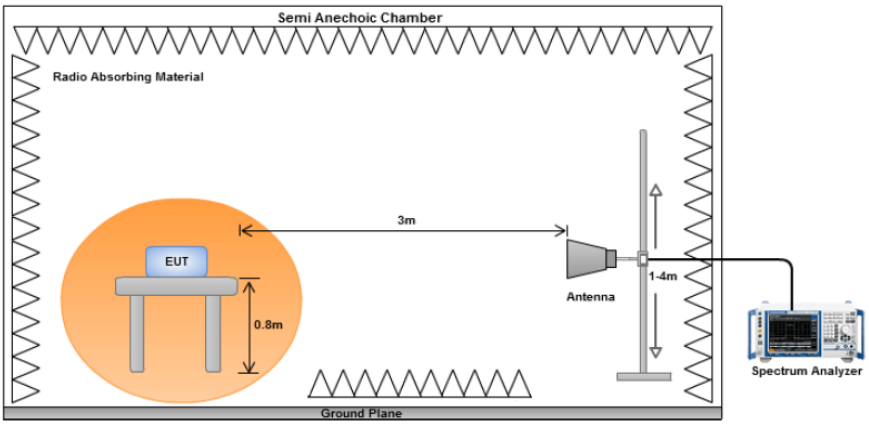


Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
173.4313	40.65	12.38	-24.54	28.49	Quasi Max	V	216	249	40	-11.51	Pass
152.6778	44.4	12.21	-23.63	32.98	Quasi Max	H	351	215	40	-7.02	Pass
519.0903	29.66	14.37	-18.23	25.81	Quasi Max	H	234	17	47	-21.19	Pass
521.2253	28.34	14.39	-18.19	24.54	Quasi Max	H	189	18	47	-22.46	Pass
517.3209	29.05	14.36	-18.26	25.14	Quasi Max	H	213	192	47	-21.86	Pass
515.4763	34.63	14.34	-18.3	30.67	Quasi Max	H	172	160	47	-16.33	Pass
173.4313	40.65	12.38	-24.54	28.49	Quasi Max	V	216	249	40	-11.51	Pass

11.2. Radiated Spurious Emissions above 1GHz (Class A)

Requirement(s):

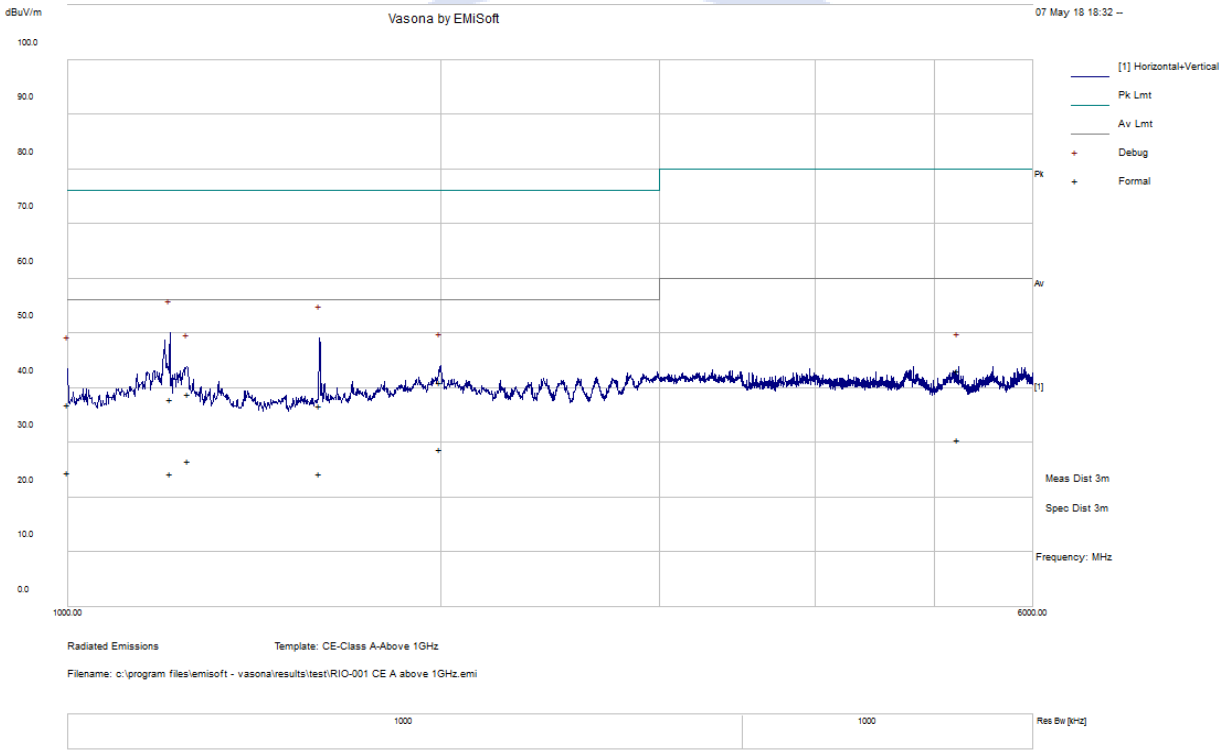
<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0</td><td>The EUT shall meet the limits of the table below when measuring above 1GHz at a distance of 3m in accordance with the methods described in Clause 10 of EN 55032: 2012 + AC 2013.
<table>
<tr><th>Frequency range (GHz)</th><th>Average limit dB(uV/m)</th><th>Peak limit dB(uV/m)</th></tr>
<tr><td>1 to 3</td><td>56</td><td>76</td></tr>
<tr><td>3 to 6</td><td>60</td><td>80</td></tr>
<tr><td colspan="3">Note: The lower limit applies at the transition frequency.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 
</td><td></td></tr>
<tr><td>Procedure</td><td>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 EUT was switched on and allowed to warm up to its normal operating condition.
3. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Peak and Average measurement was then made for that frequency point.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 1GHz to 6GHz (for FCC tests, until the 5th harmonic for operating frequencies ≥ 1000MHz) using a horn antenna.</td><td></td></tr>
<tr><td>Remarks</td><td>N/A</td><td></td></tr>
</table>

Test Data: ☒Yes (See below) N/A

Test Data: ☒Yes (See below) N/A

Test specification:	Radiated Emissions			
Environmental Conditions:	Temp(°C):	25	Result:	
	Humidity (%):	39		X Pass
	Atmospheric(mbar):	1010		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/07/2018			
Remarks:	1000 – 6000 MHz. The testing was done in a 3m chamber			

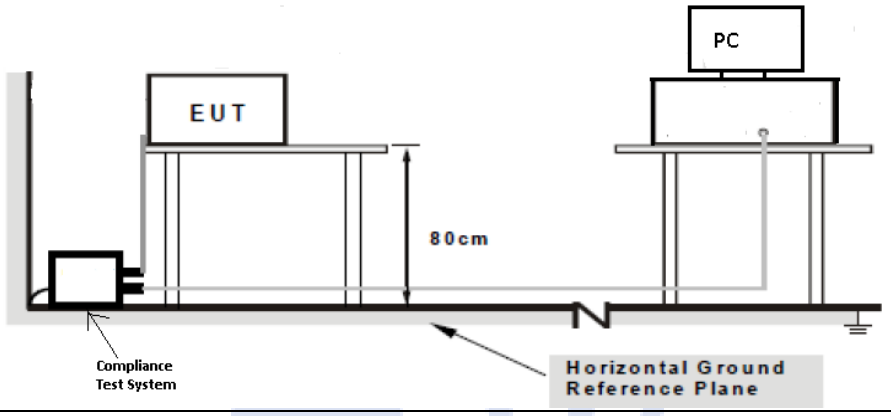


Note: - Horizontal and Vertical Polarization was Tested on same Trace.

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
1209.61	42.5	2.07	-6.52	38.06	Peak Max	H	181	11	76	-37.94	Pass
1597.008	40.44	2.44	-6.02	36.86	Peak Max	V	298	186	76	-39.14	Pass
1997.125	40.8	2.73	-2.37	41.16	Peak Max	V	350	168	76	-34.84	Pass
1250.14	42.69	2.1	-5.85	38.94	Peak Max	V	270	341	76	-37.06	Pass
1000.005	43.02	1.88	-7.85	37.05	Peak Max	H	347	80	76	-38.95	Pass
5223.655	39.69	4.35	-0.93	43.11	Peak Max	H	106	117	80	-36.89	Pass
1209.61	28.84	2.07	-6.52	24.4	Average Max	H	181	11	56	-31.61	Pass
1597.008	28	2.44	-6.02	24.42	Average Max	V	298	186	56	-31.58	Pass
1997.125	28.39	2.73	-2.37	28.75	Average Max	V	350	168	56	-27.25	Pass
1250.14	30.52	2.1	-5.85	26.77	Average Max	V	270	341	56	-29.23	Pass
1000.005	30.46	1.88	-7.85	24.49	Average Max	H	347	80	56	-31.51	Pass
5223.655	27.11	4.35	-0.93	30.53	Average Max	H	106	117	60	-29.47	Pass

11.3. Harmonic Current Emissions

Requirement(s):

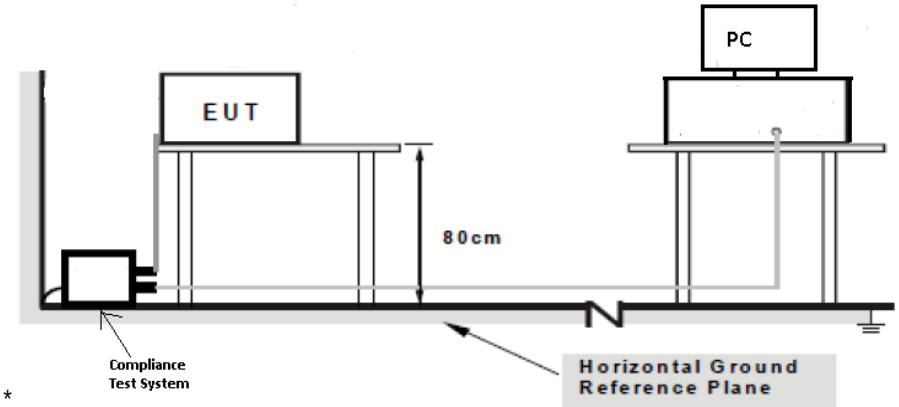
Spec	Requirement	Applicable
ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0 EN 61000-3-2	The requirements and limits specified in EN 61000-3-2 are applicable to the power input terminals of equipment intended to be connected to 220/380 V, 230/400 V and 240/415 V systems operating at 50 Hz or 60 Hz.	☐
Test Setup		
Test Procedure	1. The test was performed using harmonic current measuring equipment that was compliant with the standard. 2. The EUT was placed on a 0.8m high, non-conductive table. 3. The harmonic current measuring equipment was connected to the EUT AC power cord. 4. The power supply of EUT was switched on and allowed to warm up to its normal operating condition. 5. Repeat above steps for different test channel and other modulation type. 6. The harmonic current measuring equipment was set to 230 Vac with 50 Hz. 7. The EUT was observed during and checked after the test to determine the result.	
Remarks	This Test is not applicable because EUT is low power device.	
Result	☐ Pass ☐ Fail ☒ N/A	

Test Data Yes ☒ N/A

Test Plot Yes (See below) ☒ N/A

11.4. Voltage Fluctuation and Flicker Test Results

Requirement(s):

Spec	Requirement	Applicable
ETSI EN 301 489-1 V2.2.0 ETSI EN 301 489-17 V3.2.0 EN 61000-3-2	The requirements and limits specified in EN 61000-3-3 are applicable to electrical and electronic equipment having an input current equal to or less than 16A per phase, intended to be connected to public low-voltage distribution systems of between 220V and 250V line to neutral at 50Hz and not subject to conditional connection.	☐
Test Setup	 *	
Test Procedure	1. The test was performed using harmonic current measuring equipment that was compliant with the standard. 2. The EUT was placed on a 0.8m high, non-conductive table. 3. The harmonic current measuring equipment was connected to the EUT AC power cord. 4. The power supply of EUT was switched on and allowed to warm up to its normal operating condition. 5. Repeat above steps for different test channel and other modulation type. 6. The harmonic current measuring equipment was set to 230 Vac with 50 Hz. 7. The EUT was observed during and checked after the test to determine the result.	
Remarks	This Test is not applicable because EUT is low power device.	
Result	☐ Pass ☐ Fail ☒ N/A	

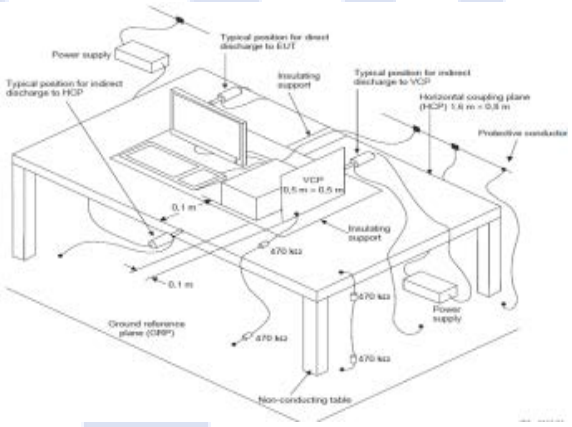
Test Data ☐ Yes ☒ N/A

Test Plot ☐Yes (See below) ☒ N/A

11.5. Electrostatic Discharge Immunity

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0

EN 61000-4-2</td><td>The test procedure shall be in accordance with EN 61000-4-2. Electrostatic discharges shall be applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual.
The preferred range of test levels for ESD in given in the following table:
<table>
<tr><th colspan="2">Contact Discharge</th><th colspan="2">Air Discharge</th></tr>
<tr><th>Level</th><th>Test Voltage (kV)</th><th>Level</th><th>Test Voltage (kV)</th></tr>
<tr><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>2</td><td>4</td><td>2</td><td>4</td></tr>
<tr><td>3</td><td>6</td><td>3</td><td>8</td></tr>
<tr><td>4</td><td>8</td><td>4</td><td>15</td></tr>
<tr><td>x[a]</td><td>Special</td><td>x[a]</td><td>Special</td></tr>
<tr><td colspan="4">[a] "x" is an open level. The level has to be specified in the dedicated equipment specification. If higher voltages than those shown are specified, special test equipment may be needed.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Condition</td><td>Discharging interval: 1 time / 1 second
Discharging impedance: 330 Ω / 150 pF
Discharge types: Direct discharge-aerial/contact discharge
Indirect Discharge - the horizontal coupling plane, the vertical coupling plane
Polarity: + / -
Discharging times: Aerial- more than 10 per position injected
Contact-more than 25 per position injected</td><td></td></tr>
<tr><td>Procedure</td><td>Common Conditions
1. Test sample and lab or metal materials must maintain more than 1m of separated distance.
2. Discharging return cable on generator must connect to a basic earth section (about 2m) and make sure that extra cable is not near earth section or placed more than 0.2m from electric conduction.
3. For portable devices or ones on table, place them on non-conducted test platform of 0.8m high from a basic earth section. For devices on floor, install a terminating stand of 0.1m thickness over a basic earth section and place test sample and cable over the said stand.
4. For reproducibility on test results, let generator on static electricity discharge inject test voltage on test sample surface vertically.

Aerial discharging test
Please move discharging polar tips (circular type) near to contact point of test sample as soon as possible avoiding mechanical damages of the said sample and separate it from sample after each discharge.
Contact discharge test
1. Please connect a discharging polar tip (chip type) to test sample before turning switch on.</td><td></td></tr>
</table>

	2. If sample's surface is applied with paint but paint composition is not mentioned on manufacture's manual, have discharging polar tip penetrate on paint section and take a contact discharging test.
Remarks	EUT does not have enclosure. Only Indirect Contact and Air Discharge was performed. While investigating, before, during and after the immunity phenomena, the EUT was observed for any signs of performance degradation.
Result	☒ Pass ☐ Fail ☐ N/A

Test Data ☒ Yes (See below) ☐ N/A

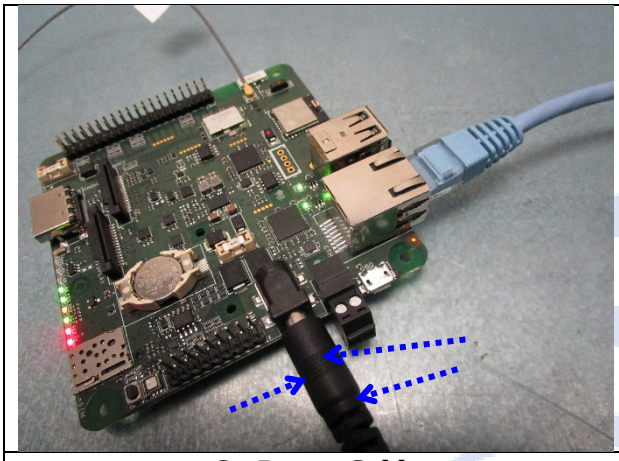
Test Plot ☒ Yes (See below) ☐ N/A

Test specification:	Electrostatic Discharge Immunity			
Environmental Conditions:	Temp(°C):	25	Result:	
	Humidity (%):	39		X Pass
	Atmospheric(mbar):	1011		
Mains Power:	230Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/11/2018			

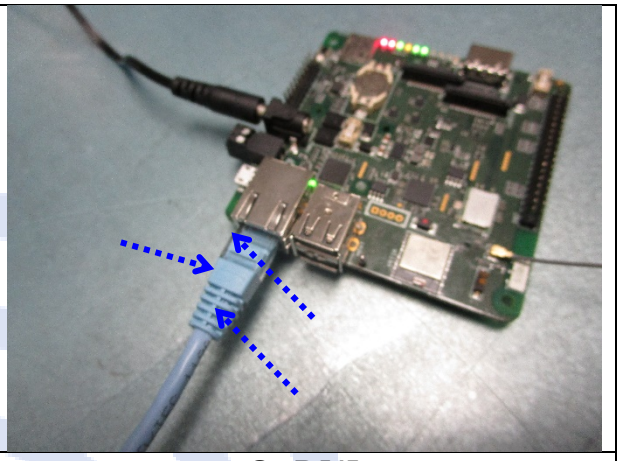
Test Results		
Discharge Type	Test Severity Level	Results
Air Discharges	±2kV, ±4kV, ±8kV	Pass
Direct Contact Discharges	±2kV, ±4kV	See Remarks (Section 11.5)
Indirect Contact Discharges	±2kV, ±4kV	Pass

Injection type	No.	Injection position	Discharging	Standard	Tested	Results
Indirect Injection	Horizontally connecting section		Contact	B	A	PASS
	Vertically connecting section			B	A	PASS
Direct Injection	1	On power Cable	Air	B	A	PASS
	2	On RJ45 Cable Port	Air	B	A	PASS
	3	Antenna	Air	B	A	PASS

Air Discharges ⇢ Contact Discharges →



On Power Cable



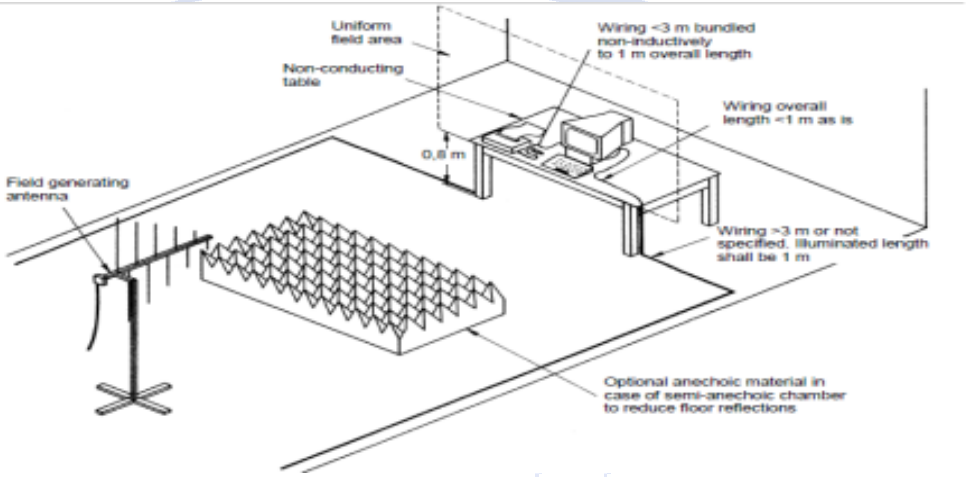
On RJ45

On Antenna

11.6. Radiated Susceptibility (RS)

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0

EN 61000-4-3</td><td>The test procedure shall be in accordance with EN 61000-4-3. The frequency range for the Radiated RF Immunity test is 80MHz to 6000MHz. The test levels are given in the following table.
<table>
<tr><th>Level</th><th>Test field strength (V/m)</th></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>2</td><td>3</td></tr>
<tr><td>3</td><td>10</td></tr>
<tr><td>x</td><td>Special</td></tr>
<tr><td colspan="2">Note: “x” is an open test level and the associated field strength may be any value. This level may be given in the product standard.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Condition</td><td>Antenna position: Horizontal & Vertical
Antenna distance: 3 meters from 80 MHz to 1 GHz, and 1 meter from 1 to 6 GHz
Magnetic field strength: 3 V/m
Frequency ranges: 80 MHz to 6000MHz,
Modulation: AM, 80 %, 1 kHz sine wave & 3V/m,
Sweep rates: 1.5 x 10-3 decades/sec
Frequency steps: 1 % step
Injection position: 4 sections
Performance evaluation standard: A</td><td></td></tr>
<tr><td>Procedure</td><td>1. The EUT was setup inside a semi-anechoic chamber in accordance with the standard.
2. The EUT was placed on top of a 0.8m high, non-metallic table in a typical configuration.
3. An isotropic field probe was placed adjacent to the EUT.
4. The EUT was switched on and allowed to warm up to its normal operating condition.
5. The EUT was exercised and monitored in the manner specified by the customer.
6. All test instruments were PC controlled, via their IEEE 488.2 bus interfaces, and the test was conducted in the following manner:
a. The testing frequencies were swept over the required frequency range, with a step frequency equal to 1% of fundamental. The sweep rate was 1.0 x 10-3 decades/s.
b. For each frequency tested, the signal generator output level was adjusted automatically until the unmodulated field strength registered by the field monitor reached the desired level. This level was held constant for the specified dwell time.
7. The EUT was continuously monitored during the test in accordance with the Pass / Fail criteria declared by the customer.
8. The test was done in both horizontal and vertical antenna polarizations and for all necessary sides of the EUT.</td><td></td></tr>
<tr><td>Remarks</td><td>While investigating, before, during and after the immunity phenomena, the EUT was observed for any signs of performance degradation.</td><td></td></tr>
</table>

Result	☒ Pass ☐ Fail ☐ N/A

Test Data ☒ Yes ☐ N/A
Test Plot ☒ Yes (See below) ☐ N/A

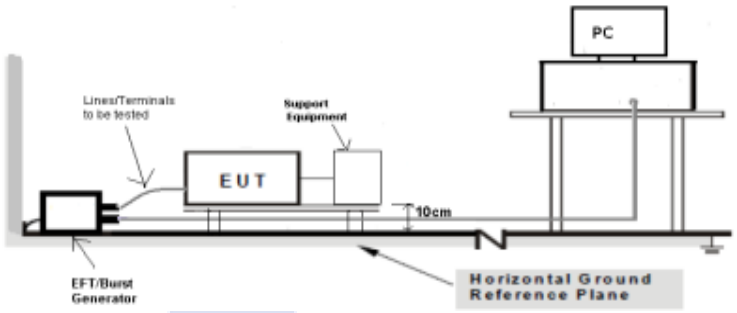
Test specification:	Radiated RF Immunity			
Environmental Conditions:	Temp(°C):	21 & 22	Result:	
	Humidity (%):	41 & 38		X Pass
	Atmospheric(mbar):	1014 & 1012		
Mains Power:	230 Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/08/2018 & 05/09/218			
Remarks:	N/A			

Test Results						
Sides Tested	Frequency Range (MHz)	Test Severity Level	Antenna Polarity	Standard	Tested	Result
Front	80 – 6000	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Rear	80 – 6000	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Right	80 – 6000	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Left	80 – 6000	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Front	80 – 6000	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS
Rear	80 – 6000	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS
Right	80 – 6000	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS
Left	80 – 6000	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS

11.7. Electrical Fast Transients (EFT)

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0

EN 61000-4-4</td><td>The test procedure shall be in accordance with EN 61000-4-4. The preferential range of test levels for the electrical fast transient test, applicable to power, ground, signal and control ports of the equipment are given in the table below.
<table>
<tr><th colspan="5">Open circuit output test voltage and repetition rate of the impulses</th></tr>
<tr><th rowspan="2">Level</th><th colspan="2">On power port, PE</th><th colspan="2">On I/O (input/output) signals, data and control ports</th></tr>
<tr><th>Voltage peak (kV)</th><th>Repetition rate (kHz)</th><th>Voltage peak (kV)</th><th>Repetition rate (kHz)</th></tr>
<tr><td>1</td><td>0.5</td><td>5 or 100</td><td>0.25</td><td>5 or 100</td></tr>
<tr><td>2</td><td>1</td><td>5 or 100</td><td>0.5</td><td>5 or 100</td></tr>
<tr><td>3</td><td>2</td><td>5 or 100</td><td>1</td><td>5 or 100</td></tr>
<tr><td>4</td><td>4</td><td>5 or 100</td><td>2</td><td>5 or 100</td></tr>
<tr><td>Xa</td><td>Special</td><td>Special</td><td>Special</td><td>Special</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td colspan="5">a “x” is an open level. The level has to be specified in the dedicated equipment specification.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Condition</td><td colspan="2">Injection voltage & Polarity: Input/output AC power source terminal ±1.0 kV
Input/output DC power source terminal ±0.5 kV
Signal line & communication terminal ±0.5 kV
Impulse repeating rates: 5 kHz
Impulse rising time: 5 ns ±30 %
Impulse period: 50 ns±30 %
Burst staying time: 15 ms±20 %
Burst period: 300 ms±20 %
Injection time: More than one minute
Injection method: Input AC power source terminal (coupling/decoupling circuit networks)
Others (Capacitance coupling clamp)
Performance evaluation standard: B</td></tr>
<tr><td>Procedure</td><td colspan="2">1. The test was performed using an EFT/B generator and capacitive coupling clamp that were compliant with the standard.
2. The EFT/B generator was placed on top of the ground plane and connected to the protective earth.
3. D.C./A.C. Power Line Test
o The EUT was placed on top of a 0.1m high, non-metallic table, and placed at least 0.5m away from the walls of the room and other conductive surfaces.
o The required power was supplied to the EUT via direct connection to the EFT/B generator.
4. I/O Signal & Control Line Test</td></tr>
</table>

	o Insulating supports were used to ensure that the EUT and its cables were 0.1m above the metallic ground plane. o The capacitive coupling clamp was placed on top (and in contact with) the metallic ground plane. o The Cable Under Test (CUT) was sandwiched between the plates of the capacitive coupling clamp. All other cables were kept as far away from the capacitive coupling clamp as possible, where possible, perpendicularly orientated with respect to the CUT. o The EFT/B generator output was connected to the capacitive coupling clamp. 5. The EUT was switched on and allowed to warm up to its normal operating condition. 6. The EUT was monitored during and after the test in accordance with the Pass / Fail criteria declared by the customer. 7. The test was performed with EFT bursts in the positive and negative polarities and repeated on all necessary lines.
Remarks	While investigating, before, during and after the immunity phenomena, the EUT was observed for any signs of performance degradation.
Result	☒ Pass ☐ Fail ☐ N/A

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test specification:	Electrical Fast Transients/Burst Immunity			
Environmental Conditions:	Temp(°C):	25	Result:	
	Humidity (%):	41		X Pass
	Atmospheric(mbar):	1014		
Mains Power:	230 Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/10/2018			
Remarks:	N/A			

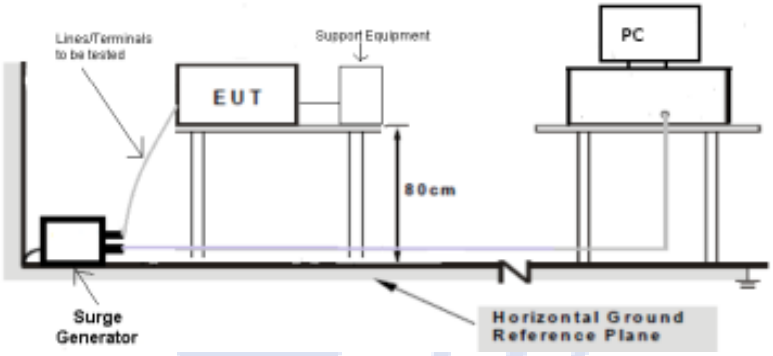
AC Power Input Port						
No. of Test	Voltage	Frequency	Output: Line Coupling (Mains)	Standard	Tested	Results
1	±0.5kV, ±1.0kV	5.0kHz	Powerline - L	B	A	Pass
2	±0.5kV, ±1.0kV	5.0kHz	Powerline – N	B	A	Pass
3	±0.5kV, ±1.0kV	5.0kHz	Powerline – L-N	B	A	Pass

Signal Line Input Port						
No. of Test	Voltage	Frequency	Output: Line Coupling (Signal)	Standard	Tested	Results
1	±0.5kV	5.0kHz	RJ45	B	A	Pass

11.8. Surge

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0

EN 61000-4-5</td><td>The test procedure shall be in accordance with EN 61000-4-5. The preferred range of test levels for the surge test is given in the table below.
<table>
<tr><th>Level</th><th>Open-circuit test voltage ±10% kV</th></tr>
<tr><td>1</td><td>0.5</td></tr>
<tr><td>2</td><td>1.0</td></tr>
<tr><td>3</td><td>2.0</td></tr>
<tr><td>4</td><td>4.0</td></tr>
<tr><td>X</td><td>Special</td></tr>
<tr><td colspan="2">Note: X can be any level, above, below or in between the other levels. This level can be specified in the product standard.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Condition</td><td colspan="2">Surge voltage: Input AC power source terminal (line to line): ±1.0 kV
Line to earth plate: ± 2.0 kV
Input DC power source terminal line to earth plate: ± 0.5 kV
Signal & communication terminal line to line: ± 0.5 kV
Signal & communication terminal line to earth plate: ± 1.0 kV</td></tr>
<tr><td>Procedure</td><td colspan="2">1. The EUT was placed on a 0.8m high, non-conductive table.
2. The test was performed using a voltage surge generator, mains, and signal line coupling/decoupling networks that were compliant with the standard.
3. The voltage surge generator and coupling/decoupling networks were connected to the same protective earth.
4. The test level was set with the surge generator's HV output open-circuited.
5. For testing of the mains line, the mains coupling/decoupling network was inserted into the line. The voltage surge generator HV output cables were connected to the mains coupling/decoupling network, which has the necessary resistor/capacitor configurations (as required by the standard) built-in. The settings on the mains coupling/decoupling network were selected to give the required resistor/capacitor configuration as follows:
a. An 18μF capacitor in series with the output of the generator for differential (line-to-line) mode testing.
b. A 10 Ohm resistor and 9μF capacitor in series with the output of the generator for common (line-to-ground) mode testing
6. For testing of the signal lines, the signal line coupling/decoupling network was inserted into the line. The voltage surge generator HV output cables were connected to the signal line coupling/decoupling network, which has the necessary resistor/capacitor/gas arrestor configurations (as required by the standard) built-in. The settings on this network were selected to give the required resistor/capacitor/gas arrestor configuration as reflected in the standard.
7. The power supply of the EUT was switched on and allowed to warm up to its normal operating condition.
8. The open-circuit test level was set with the surge generator disconnected from the coupling network.
9. The output of the generator was then reconnected back to the coupling network.
10. Five discharges, generated by the voltage surge generator, were made on each relevant line, for</td></tr>
</table>

	each polarity, at each test level, with the relevant discharge interval. 11. The EUT was observed during and checked after the test to determine the result.
Remarks	While investigating, before, during and after the immunity phenomena, the EUT was observed for any signs of performance degradation.
Result	☒ Pass ☐ Fail ☐ N/A

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test specification:	Voltage Surge Immunity			
Environmental Conditions:	Temp(°C):	21	Result:	
	Humidity (%):	35		X Pass
	Atmospheric(mbar):	1018		
Mains Power:	230 Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/09/2018			
Remarks:	N/A			

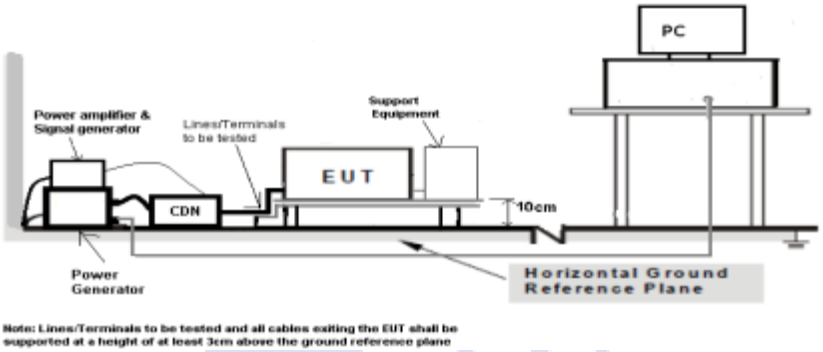
AC Power Input Port						
No. of Test	Voltage	Output: Line Coupling (Mains)	Phase Angles (Degrees)	Standard	Tested	Results
1	±0.5kV; ±1.0kV	L1-L2	0, 90, 180, 270	B	A	PASS

*Note: Surge signal line is not applicable to this EUT

11.9. Conducted Susceptibility (CS)

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0

EN 61000-4-6</td><td>The test procedure shall be in accordance with EN 61000-4-6. The preferred range of test levels for the conducted disturbances, induced by radio-frequency fields test is given in the table below.
<table>
<tr><th colspan="3">Frequency range 150 kHz-80 MHz</th></tr>
<tr><th rowspan="2">Level</th><th colspan="2">Voltage level (e.m.f.)</th></tr>
<tr><th>u_0
dB(PV)</th><th>u_0
v</th></tr>
<tr><td>1</td><td>120</td><td>1</td></tr>
<tr><td>2</td><td>130</td><td>3</td></tr>
<tr><td>3</td><td>140</td><td>10</td></tr>
<tr><td>X[a]</td><td colspan="2">Special</td></tr>
<tr><td colspan="3">[a] X is an open level.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Condition</td><td colspan="2">Frequency ranges: 150 kHz - 80 MHz
Voltage Level: 3 V_{RMS}
Modulation: AM, 80 %, 1 kHz sine wave
Sweep rates: 1.5 x 10-3 decades/sec
Frequency steps: 1 % step
Performance evaluation standard: A</td></tr>
<tr><td>Procedure</td><td colspan="2">1. The EUT and auxiliary equipment were placed on top of the GRP and isolated from it by a 0.1m thick insulating support.
2. The test system includes a RF signal generator, a power amplifier, attenuators, a spectrum analyzer and various types of Coupling and Decoupling Networks (CDNs).
3. The EUT's Cables Under Test (CUT) were kept as short as possible to maintain a distance of 0.1m to 0.3m between the EUT and the CDNs.
4. The interconnecting cables between the EUT, CDNs and auxiliary equipment were kept at a height of 3cm to 5cm above the GRP.
5. The interfering signal was swept from 150 kHz to 80MHz, with a step frequency equal to 1% of fundamental. The sweep rate was ≤ 1.5 X 10^{-3} decades/s.
6. The output power level from the power amplifier to the CDN was adjusted through the signal generator so that the incident power reached the same level as that established during calibration. Once the incident power to the CDN reached the calibrated level, the 80% AM 1 kHz AF was switched on for the specified dwell time.
7. The EUT was continuously monitored during the test in accordance with the PASS/FAIL criteria declared by the customer.</td></tr>
<tr><td>Remarks</td><td colspan="2">While investigating, before, during and after the immunity phenomena, the EUT was observed for any signs of performance degradation.</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail ☐ N/A</td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test specification:	Conducted Disturbances Immunity			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	43		X Pass
	Atmospheric(mbar):	1017		
Mains Power:	230 Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/10/2018			
Remarks:	N/A			

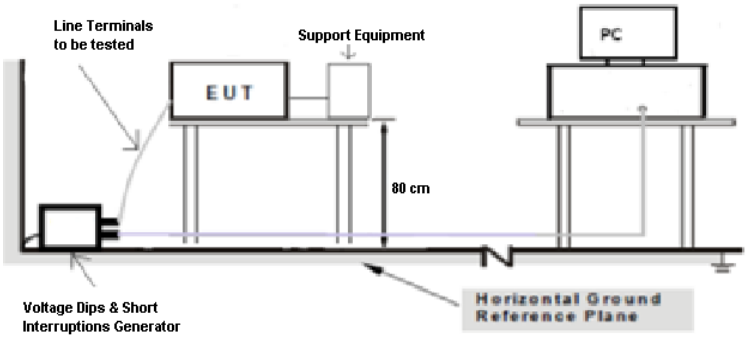
AC Line Test Results					
Line	Frequency range	Test severity level	Standard	Tested	Result
AC Power Port	150K-80MHz	3Vrms, 80% AM (1kHz)	A	A	Pass

Signal Line Test Results					
Line	Frequency range	Test severity level	Standard	Tested	Result
RJ45	150K-80MHz	3Vrms, 80% AM (1kHz)	A	A	Pass

11.10. Voltage Dips and Interruptions

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>ETSI EN 301 489-1 V2.2.0

ETSI EN 301 489-17 V3.2.0

EN 61000-4-11</td><td>
The test procedure shall be in accordance with EN 61000-4-11. The preferred range of test levels for the voltage dips and short interruptions test is given in the tables below.
<table>
<tr><th>Class[a]</th><th colspan="5">Test level and durations for voltage dips (t_s) (50Hz/60Hz)</th></tr>
<tr><td>Class 1</td><td colspan="5">Case-by-case according to the equipment requirements</td></tr>
<tr><td>Class 2</td><td>0 % during ½ cycle</td><td>0 % during 1 cycle</td><td colspan="3">70 % during 25/30 cycle[C]</td></tr>
<tr><td>Class 3</td><td>0 % during ½ cycle</td><td>0 % during 1 cycle</td><td>40 % during 10/12 cycle</td><td>70 % during 25/30 cycle</td><td>80 % during 250/300 cycle</td></tr>
<tr><td>Class X[b]</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td colspan="6">a Classes are per IEC 61000-2-4; SEE Annex B.
b To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.
c “25/30 cycles” means 25 cycles for 50 Hz test” and “30 cycles for 60Hz test”</td></tr>
<tr><th>Class[a]</th><th colspan="5">Test level and durations for short interruptions (t_s) (50Hz/60Hz)</th></tr>
<tr><td>Class 1</td><td colspan="5">Case-by-case according to the equipment requirements</td></tr>
<tr><td>Class 2</td><td colspan="5">0% during 250/300 cycle[C]</td></tr>
<tr><td>Class 3</td><td colspan="5">0% during 250/300 cycles</td></tr>
<tr><td>Class X[b]</td><td colspan="5">X</td></tr>
<tr><td colspan="6">a Classes are per IEC 61000-2-4; SEE Annex B.
b To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.
c “25/30 cycles” means 25 cycles for 50 Hz test” and “30 cycles for 60Hz test”</td></tr>
</table>
</td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 
</td><td></td></tr>
<tr><td>Test Condition</td><td>Voltage overshoot/undershoot: within 5 % of voltage changes
Voltage ups & downs time: 1 μs – 5 μs
Frequency deviation of test voltage: within ± 2 %
Injection voltage of test sample: Min, and Max of Rated input voltage
Test times: 3
Test intervals: 10 seconds</td><td></td></tr>
<tr><td>Procedure</td><td>1. For test, sample must be connected to test equipment using the shortest wire specified by manufacturer.
2. When it comes to test voltage’s frequency, it must be within ±2% of rated frequency.
3. Primary power source’s voltage must be monitoring within accuracy of 2% and zero crossing adjustment must have ± 10˚of accuracy during test.
4. Sudden change of power supply’s voltage comes from voltage’s zero crossing.</td><td></td></tr>
<tr><td>Remarks</td><td>N/A</td><td></td></tr>
<tr><td>Result</td><td>☒ Pass ☐ Fail ☐ N/A</td><td></td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test specification:	Voltage Dips and Short Interruptions Immunity			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	43		X Pass
	Atmospheric(mbar):	1017		
Mains Power:	200/240 Vac			
Tested by:	Kushal Shastri			Fail
Test Date:	05/11/2018			
Remarks:	N/A			

Test Results Per EN 55024 & CISPR 24

Test	Duration (Cycles)	Test severity level	Standard	Tested	Result
Voltage Dips	0.5	>95%	B	A	Pass
Voltage Dips	25	30%	C	A	Pass
Voltage Interruptions	250	>95%	C	B*	Pass

*During Voltage Short Interruptions at for 250 cycles, the Power Supply under test temporarily lost power but, EUT is self-recovered by its own.

Test Results Per ETSI EN 301 489

Test	Duration (periods)	Test severity level	Standard	Tested	Result
Voltage Dips	0.5	0%	B	A	Pass
Voltage Dips	1	0%	B	A	Pass
Voltage Dips	25	70%	C	A	Pass
Voltage Interruptions	250	0%	C	B*	Pass

*During Voltage Short Interruptions at for 250 cycles, the Power Supply under test temporarily lost power but, EUT is self-recovered by its own.

12. Annex A | Test instruments and method

Instrument	Model	Serial #	Cal Cycle	Cal Due	In use
Radiated Emissions					
50 GHz Spectrum Analyzer	N9030B	MY57140374	1 Year	09/06/2018	YES
Hybrid Antenna	JB6	A111717	1 Year	12/05/2018	YES
Double Ridged Waveguide Horn Antenna (1 - 18 GHz)	3117	218554	2 Years	11/29/2019	YES
RF Preamplifier	LPA-6-30	11170602	1 Year	08/9/2018	YES
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	1 Year	8/16/2018	YES
Pre-Amplifier (18 - 40GHz)	PA-840	181251	1 Year	09/23/2018	NO
5GHz Notch Filter	BRM50705	41	1 Year	08/11/2018	YES
2.4GHz Notch Filter	BRM50702	G242	1 Year	8/11/2018	YES
Conducted Emissions					
EMI Test Receiver	ESIB 40	100179	1 Year	7/21/2018	YES
Transient Limiter (9 kHz - 100 MHz)	EM-7600-5	106	1 Year	9/7/2018	YES
LISN	3816/2NM	214372	1 Year	9/27/2018	YES
ESD Immunity					
ESD Simulator	ONYX 16	182432	1 Year	9/15/2018	YES
Harmonics and Flicker					
AC Power Source	5001 iX-208-411	56615	1 Year	11/27/2018	NO
Power Analyzer & Conditioning System	PACS-1	1319A01862	1 Year	11/27/2018	NO
Radiated RF Immunity					
High Power Solid State Amplifier (80 - 1000MHz)	CMC150	M631-0408	N/A	N/A	YES
Vector Signal Generator (0.3 - 3300MHz)	SMIQ03B	837810/02	1 Year	11/15/2018	YES
Vector Signal Generator (0.1 – 6000MHz)	N5182A	MY47071065	1 Year	6/28/18	YES
RF Power Amplifier 700-6000 MHz, 50 Watts)	5293RE	1035	N/A	N/A	YES
Antenna - Biconlog (26MHz – 2GHz)	3141	1203	N/A	N/A	YES
Horn Antenna (700MHz - 18GHz)	SAS-571	411	1 Year	8/13/2018	YES
EMC Field Probe	HI-6005	156327	1 Year	9/3/2018	YES
EFT/Burst Immunity					

EMCPro PLUS Systems Immunity Test System	EMCPRO-PLUS	802203	1 Year	2/9/2019	YES
Keytek Capacitive Coupling Clamp	Keytek CCL	802255	1 Year	8/3/2018	YES
Conducted Disturbance Immunity					
High Power Solid State Amplifier (10kHz - 220MHz)	SCCX75	M630	N/A	N/A-	YES
Synthesized RF Signal Generator (100kHz - 2100MHz)	6062A	5285403	1 Year	11/28/2018	YES
M3 Coupling/Decoupling Network	CDN M3-25	521022	1 Year	10/26/2018	YES
EMCPro PLUS Systems Immunity Test System	EMCPRO-PLUS	610292	1 Year	8/18/2018	YES
Surge Immunity					
EMCPro PLUS Systems Immunity Test System	EMCPRO-PLUS	802203	1 Year	2/9/2019	YES
Voltage Dips & Short Interruptions Immunity					
EMCPro PLUS Systems Immunity Test System	EMCPRO-PLUS	802203	1 Year	2/9/2019	YES

13. Annex B | SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		Radio Equipment: EN45011: EN ISO/IEC 17065
		Electromagnetic Compatibility: EN45011 – EN ISO/IEC 17065
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		(Phase II) OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		Radio: Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		Radio: A1. Terminal equipment for purpose of calling Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI EMS: KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF

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