



EMC TEST REPORT

Company Name: *Pulsiv Ltd*

Product: *Pulsiv PFC Development System
PSV-AD-250-DS
PSV-AD-150-DS
PSV-AD-50-DS*

Test Report Number	ETS/C3732/EN
Issue Date:	09 August 2022
Applicable Standards	EN55032:2015+A1:2020 Class B
Pursuant to	EMC Directive 2014/30/EU and UK Electromagnetic Compatibility Regulations 2016

Revision Record

Revision	Date	Details
1.0	09 August 2022	Issue Version 1

Note:

This Test Report consists of 43 pages. This report records the test results of the equipment submitted, under the conditions and operating modes described herein. This report is issued in Adobe Acrobat document format (PDF). The report shall not be reproduced except in full, without the written approval of Electromagnetic Testing Services Limited.

Note: *Information supplied by the customer is identified in italic*

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**REPORT ON EMC TESTS CARRIED OUT ON A
PULSIV LTD PULSIV PFC DEVELOPMENT SYSTEM
PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS**

Produced on behalf of

*Pulsiv Ltd
Milton Hall, Ely Road, Milton
Cambridge, England, CB24 6WZ*

By

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This laboratory is:

- UKAS Accredited Testing Laboratory Number 4416
Scope of Accreditation may be found at:
<https://search.ukas.com/#/tabbed/search?q=electromagnetic%20testing%20services&ati=1>
- F.C.C. (Federal Communications Commission) listed as per the requirements of section 2.948 of the Code Of Federal Regulations CFR 47 for Parts 15 & 18 under Test Firm Registration 361375, Designation Number UK0016
<https://apps.fcc.gov/oetcf/eas/reports/TestFirmSearchResult.cfm>

Approved by the Vehicle Certification Agency for testing Automotive Products, certificate number: VCA-TS-0037

<https://www.vehicle-certification-agency.gov.uk/vehicletype/technical-service-designations.asp>

Distribution: 01 *Pulsiv Ltd*
 02 Electromagnetic Testing Services Limited

Tested By: Test Engineer	Anthony Rogers <i>AR</i>
Approved and Authorised By:	George Vassila Technical Director <i>[Signature]</i>
Prepared by:	Sarah Jones <i>[Signature]</i>

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Electromagnetic emissions and immunity tests were carried out on a *Pulsiv Ltd, Pulsiv PFC Development System, PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS* unit to assess compliance against the requirements of:

EN55032, Class B (emissions)

This Standard is covered under the ETS LTD UKAS Accreditation Flexible Scope

The results obtained indicate compliance with the test limits of the above standards as follows:

Emissions Tests	Standard	Status
Emission Standard for Multimedia Equipment	EN55032, Class B	Complied
Conducted Emissions AC Port	EN55032, Class B	Complied

* Non UKAS Accredited Tests

The *Pulsiv Ltd, Pulsiv PFC Development System, PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS*, is a power factor correction (PFC) development system, which is used by power supply circuit designers.

The model tested was a *PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS*.

The test results contained in this report refer to a single product supplied for testing. Tests were carried out for the purpose of demonstrating compliance.

The EUT was received on 02 August 2022. All tests were carried out on 02 August 2022 at the Electromagnetic Testing Services Limited EMC Facilities, Stebbing, Essex, England. The work was carried out under ETS Test Number 08A22C304.

The EUT was tested under normal laboratory conditions. The EUT was tested in the worst case configuration to maximise emissions, which is evaluated during pre-test, where applicable. Where applicable worst case test results are included in the appendix section of the report.

Client Information:

Contact: Andy Hills

Company: Eastmap Ltd

Tel.: 07780 958871

Email: andy.hills@eastmap.co.uk

Tests were carried out in the presence of Andy Hills of Eastmap Ltd

Model Selection for test

PSV-AD-250-DS - Current development system as shipped: 250W nominal

PSV-AD-150-DS - Development system, if fitted with the PSV-AD-150 chip variant: 150W nominal

PSV-AD-50-DS - Development system, if fitted with the PSV-AD-50 chip variant: 50W nominal

4.1 Identification of Equipment

Product Type	: Power factor correction (PFC) development system
Product Name	: Pulsiv PFC Development System
Model Number	: PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Serial Number	: PSV-AD-250-DS: Ser no. 045 PSV-AD-150-DS: Ser no. 041 PSV-AD-50-DS: Ser no. 044
Power Requirements	: 230VAC 300W 50Hz
Dimensions:	: 60 x 68 x 32
Weight:	: 80g
Manufacturer Name	: Pulsiv Ltd
Manufacturer Address	: Milton Hall, Ely Road, Milton, Cambridge, England, CB24 6WZ
Signatory's Name	: -
Signatory's Address	: Pulsiv Ltd Milton Hall, Ely Road, Milton, Cambridge, England, CB24 6WZ

Photograph of EUT



4.2 Description of Apparatus: *The EUT is a power factor correction (PFC) circuit supplied as a PCB assembly intended for use by power supply circuit designers. The circuit utilises a unique control method and circuit topology to achieve power factor correction. The EUT incorporates mains rectifier and EMI filter part of the power supply circuit in addition to the PFC.*

The PFC is normally used to supply a following DC-DC stage such as a flyback converter. As it is not practical to test the EMC of the PFC and DC-DC separately, the testing is performed using a resistive load. Typically, the 250W nominal version would be expected to be used with up to a 150W DC-DC (approx. 170W load). The power factor of a typical DC-DC load will be much lower than a resistive load so the resistive load has been increased to 250W to present a more representative output current. This configuration is fitted with a 1.7A input common mode choke so testing has been limited to 200VA at the input for 115VAC operation to prevent overload of the input filter.

The EUT is supplied as a PCB assembly and as such has no chassis (earthed metal parts). The EUT is connected using a 3 core mains cable for this test. The earth conductor is connected to 4 x M3 mounting holes via the PCB tracking. There are also two Y2 safety capacitors connected between the earth terminal one to the L and one to the N connection.

4.3 Intended Use of Apparatus: *Power factor correction stage for power supply. The EUT is intended as a development system for use by power supply designers (not a stand-alone product).*

4.4 Intended Physical Location of EUT: *Industrial/residential*

4.5 Description of Variants: *This test (PSV-CCAD-250AH hardware configuration.) is intended to cover all of the following hardware configurations:*

*PSV-CCAD-150
PSV-CCAD-150H
PSV-CCAD-250
PSV-CCAD-250H
PSV-CCAD-250X
PSV-CCAD-250A
PSV-CCAD-50HX
PSV-CCAD-50AH*

OPTIONS					
Configuration Number	Output Power Range	Basic Configuration	Hold Up	Half Active Bridge	X-Cap Discharge
PSV-CCAD-150	1W – 150W	☑	x	x	x
PSV-CCAD-150H		☑	☑	x	x
PSV-CCAD-250	1W – 250W	☑	x	x	x
PSV-CCAD-250H		☑	☑	x	x
PSV-CCAD-250X		☑	x	x	☑
PSV-CCAD-250A		☑	x	☑	☑
PSV-CCAD-250HX		☑	☑	x	☑
PSV-CCAD-250AH		☑	☑	☑	☑

None of the configuration options contain additional high frequency switching circuits. EUTs have all options fitted i.e PSV-CCAD-250AH hardware configuration.

Important Note

The list of variants is identical to the unit submitted for testing and relate to features that could not have any bearing on the EMC status of the product as declared by the client. This list is under the authority and sole responsibility of the client.

Note:

This document has been prepared to enable manufacturers with no mechanism for producing their own Build State Declaration, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by Electromagnetic Testing Services Ltd as to the accuracy of the information declared on this Build State Declaration by the manufacturer.

4.6 Declared EUT Configuration:

Build Status		Pre-production	
Item	Description of board/sub assemblies	Part Number	Revision No.
1	<i>Pulsiv PFC development system motherboard</i>	<i>PSV-AD-250-MB</i>	<i>Rev 3.00</i>
2	<i>Pulsiv PFC development system daughterboard</i>	<i>PSV-AD-250-MCI</i>	<i>Rev 3.00</i>

4.7 Declared Suppression Measures:

The following modifications were applied to the EUT in order to achieve compliance
Warning: Compliance is subject to the correct application of all listed modifications

Mod Status	Description of Suppression Measures	Reason	Date & Time
0	EUT as supplied with no additional modifications		

4.8 Declared Internal Clock Frequencies:

-

Support Equipment - Simulators, Accessories and Auxiliary Equipment

The table below provides a list of all the support equipment used during the test.

Item	Description, Brand Name, Model	Serial Number
1	15V linear power supply, Eastmap Ltd, EMC test kit (linear PSU in metal enclosure)	-
2	Rheostat 369 Ω 1A	-
3	Rhoestat 150 Ω 2.8A	-
4	Power resistor 1k Ω 300W	-
5	1m 0.75mm ² mains cable, 1m length	-

Documentation of firmware or software needed to perform testing

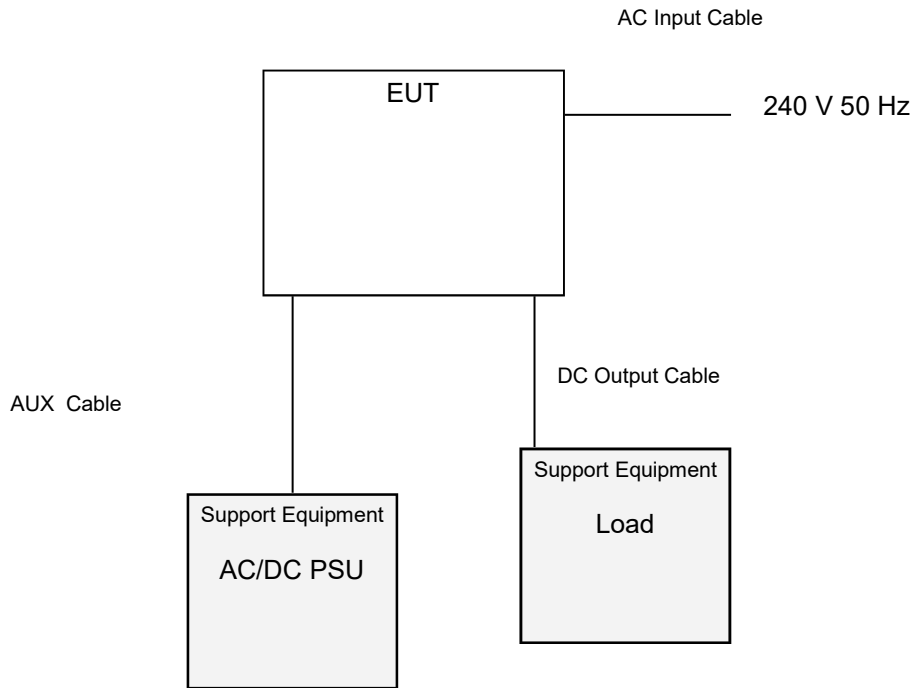
Item	Description	Part Number	Revision No.
1	F/W for each unit	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS	N/A

6.0 Deviations From Applicable Standards

Deviation From Applicable Standards

Test	Description	Deviation
Conducted Emissions		None

Block Diagram



LIST OF CABLES

Ref.	Cable	Type	Length / m
1	AC Mains	Three core Unshielded	1
2	DC Output	Two core Unshielded	0.3
3	AUX cable	Two core Unshielded	0.3

Emissions And Immunity Standards for Multimedia Equipment



Test Plan and check list Reference EN55032:2015 + A1:2020 EN55035:2017+A11:2020
(template issue 07- 09/03/2022)

Test Plan number:	08A22C304	Customer:	Pulsiv Ltd
Date:	02 August 2022	EUT:	PSV-AD-250-DS, PSV-AD-150-DS, PSV-AD-50-DS

This Standard is covered under the ETS LTD UKAS Accreditation - Flexible Scope

Key: **X** - Applicable Test
For number reference - see page 19

Supply Voltage: 230V 50 Hz

Port tested	Standard & Emission phenomenon	Test value	Class required	Test required
Radiated Emission - Group 1				
Measured in SAR				
Enclosure	EN55032:2015 + A1:2020 / EN55016-2-3:2010 + AC 2013 + A1:2010 + A2:2014	30MHz to 1GHz (QPk) 3/10 m A1-A2.1 A3-A2.2 B1-A4.1 B3-A4.2	B	1
	EN55032:2015 + A1:2020 / EN55016-2-3:2010 + AC 2013 + A1:2010 + A2:2014	1GHz to 6 GHz 3 m A3(Av)-A3.1 A3(Pk)-A3.2 B3(Av)-A5.1 B3(Pk)-A5.2	B	1
Conducted Emission - AC Mains				
AC mains	EN55032:2015 + A1:2020 / EN55016-2-1:2014 + A1:017	150kHz to 30MHz A - A8 AMN B - A9 AMN	B	X
Conducted Emission - Wired Network Ports - Asymmetric				
1. Wired Network Ports 2. Optical Fibre Ports with Metal Shield 3. Antenna Ports	EN55032:2015 + A1:2020 / EN55016-2-1:2014 + A1:017	150 KHz to 30 MHz AAN CVP and Current Probe Current Probe	B	1
Conducted Emission - Differential Voltage For Class B Equipment				
1. TV Broadcast Receiver 2. RF Modulator 3. FM Broadcast Receiver	EN55032:2015 + A1:2020 / EN55016-2-1:2014 + A1:017	30 MHz to 2150 MHz A12.1 For Frequencies < 1 GHz QP / 120 KHz For Frequencies > 1 GHz Pk / 1 MHz Television receivers (analogue or digital), video recorders and PC TV broadcast receiver tuner cards working in channels between 30 MHz and 1 GHz, and digital audio receivers		1

Port tested	Standard & Emission phenomenon	Test value	Class required	Test required
Harmonics				
AC mains	EN61000-3-2:2019 + A1:2021	0Hz - 0.002 MHz (specified power <600W)	A	1
Flicker				
AC mains	EN61000-3-3:2013 + A1:2019 + A2:2021	< 1 P _{st}		1
		< 0.65 P _{lt}		
		< 3.3% d _c		
		< 4% d _{max}		
		< 3.3% 500mS d _t		
Inrush Current				
AC mains	EN61000-3-3:2013 + A1:2019 + A2:2021	Measured result:		1

Port tested**Standard &
Immunity
phenomenon****Test value**

Test required
Performance criteria required
Non UKAS Accredited

Radiated RF Immunity - (Swept Test)

Enclosure	EN61000-4-3:2006 +A1:2008 + A2:2010 (FAR)	3V/m (80% 1kHz) 80MHz – 1.0GHz		A	1
	EN61000-4-20:2010 (GTEM)	3V/m (80% 1kHz) 80MHz – 1.0GHz		A	1
	EN61000-4-3:2006 +A1:2008 + A2:2010 (FAR)	Ref: Annex G 550335 acoustic noise		B	1
	EN61000-4-20:2010 (GTEM)	Ref: Annex G 550335 acoustic noise		B	1

Radiated RF Immunity - (Spot Test)

Enclosure	EN61000-4-3:2006 +A1:2008 + A2:2010 (FAR)	3V/m (80% 1kHz) 1.8, 2.6, 3.5, 5.0 GHz		A	1
	EN61000-4-20:2010 (GTEM)	3V/m (80% 1kHz) 1.8, 2.6, 3.5, 5.0 GHz		A	1

Power frequency Magnetic Field

Enclosure	EN61000-4-8:2010	1 A/m (r.m.s) at 50Hz Applicable only to equipment containing susceptible devices		A	1
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ESD

Enclosure	EN61000-4-2:2009	4kV contact 8kV air		B	1
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Port tested

Standard & Immunity phenomenon

Test value

Non UKAS Accredited	Performance criteria required	Test required
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Conducted RF Immunity - AC Mains

AC Power	EN61000-4-6:2014	0.15 -10 MHz 3 V rms 10 - 30 MHz 3 - 1 V rms 30 - 80 MHz 3 V rms Modulation:1 kHz 80% AM		A	1
	EN61000-4-6:2014	Ref: Annex G 550335 acoustic noise		B	1

Conducted RF Immunity - DC Mains

DC Power	EN61000-4-6:2014	0.15 -10 MHz 3 V rms 1 kHz 80% AM 10 - 30 MHz 3 - 1 V rms 1 kHz 80% AM 30 - 80 MHz 3 V rms 1 kHz 80% AM		A	1
	EN61000-4-6:2014	Ref: Annex G 550335 acoustic noise		B	1

Conducted RF Immunity - Analogue / Digital Data Ports

	EN61000-4-6:2014	0.15 -10 MHz 3 V rms 10 - 30 MHz 3 - 1 V rms 30 - 80 MHz 3 V rms Modulation:1 kHz 80% AM (cables > 3m)		A	1
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Conducted RF Immunity Broadband Impulse noise Disturbance Repetitive (xDSL) - Analogue / Digital Data Ports

	EN55035:2017+A11:2020 Clause 4.2.7	0.15 - 0.5 MHz 107 dBuV 0.5 - 10 MHz 107 - 36 dBuV 10 - 30 MHz 36 - 30 dBuV		B	1
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Port tested

Standard & Immunity phenomenon

Test value

Test required
Performance criteria required
Non UKAS Accredited

Conducted RF Immunity Broadband Impulse noise Disturbance Isolated Analogue / Digital Data Ports

	EN55035:2017+A11:2020 Clause 4.2.7	0.15 - 30 MHz 110 dBuV		B	1
Voltage Dips and Interrupts					
AC Power ¹	EN61000-4-11:2004	240 VAC 10mS (50Hz) 100%		B	1
	EN61000-4-11:2004	240 VAC 0.5S (50Hz) 30%		C	
	EN61000-4-11:2004	240 VAC 5.0S (50Hz) 100%		C	
	EN61000-4-11:2004	100 VAC 10mS (50Hz) 100%		B	1
	EN61000-4-11:2004	100 VAC 0.5S (50Hz) 30%		C	
	EN61000-4-11:2004	100 VAC 5.0S (50Hz) 100%		C	

Port tested	Standard & Immunity phenomenon	Test value	Non UKAS Accredited	Performance criteria required	Test required
Fast transient burst AC mains power					
AC Power ²	EN61000-4-4:2012	1kV		B	1
Fast transient burst DC power					
DC Power	EN61000-4-4:2012	0.5kV		B	1
Fast transient burst -Analogue / Digital Data Ports					
	EN61000-4-4:2012	0.5kV lines >3m		B	1
Surge AC mains power					
AC Power	EN61000-4-5:2014 EN55035:2017+A11:2020 Table 4 Clause 4.4	1kV L-L 2kV L-E 20 s ⁴ (1.2/50 (8/20) Tr/Th us)		B	1
AC Power (MLTV) ³	EN61000-4-5:2014 E55035:2017+A11:2020 Table 4 Clause 4.4	20 s ⁴ (1.2/50 (8/20) Tr/Th us)		B	1
Surge DC mains power					
DC Power (Outdoor Cables)	EN61000-4-5:2014	0.5kV L-E 20 s ⁴ (1.2/50 (8/20) Tr/Th us)		B	1
DC Power (MLTV) ³ (Outdoor Cables)	EN61000-4-5:2014	20 s ⁴ (1.2/50 (8/20) Tr/Th us)		B	1
Surge Unshielded Symmetrical - Analogue / Digital Data Ports					
	EN61000-4-5:2014	0.5 and 4 kV Line to Earth (Outdoor cables) 10/700 (5/320) or 1,2/50 (8/20) see table 2. Applicable where primary protection is intended.		C	1

Port tested

Standard & Immunity phenomenon

Test value

Test required
Performance criteria required
Non UKAS Accredited

Surge Unshielded Symmetrical - Analogue / Digital Data Ports

	EN61000-4-5:2014	0.5 kV Line to Earth 10/700 (5/320) or 1,2/50 (8/20) see table 2. Applicable where primary protection is not intended.		C	1
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Surge Coaxial or Shielded Ports

Analogue / Digital Data Ports	EN61000-4-5:2014	0.5 kV Shield to Earth 1,2/50 (8/20) see table 2. Applicable to coaxial or shielded ports		B	1
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Tests not carried out

Reference	Reason
1	Tests not applicable / not requested

Comments

Operating Mode

During testing the EUT was powered up and operated in accordance with the manufacturer's instructions and in a manner that represented its normal use.

On load as documented in test results

Important test Notes

None

Important Notes

Testing

¹ The Voltage Dips include testing at 240 V. For products with universal voltage power supplies, EN61000-4-11 requires that testing is also carried out at the lowest specified voltage. If the products will be sold exclusively in a 240 V / 220 V market, then, on request of the customer, the lower voltage test can be omitted and a 'Deviation from Standard' will be recorded in the test report.

² Fast Transient testing can be applied as a minimum or maximum test, as follows:
Minimum - the fast transient bursts are applied common mode.
Maximum - the fast transient bursts are applied individually to the supply terminals and includes all possible combinations for a more complete test.

³ EN61000-4-5 advises that additional surge testing to be carried out at the Protection Devices Maximum Let Through Voltage Level. This could be a worst case testing of the EUT since the surge is applied at a level just before breakdown is initiated. This test is optional and carried out at the customers request.

⁴ EN61000-4-5 specifies surges to be applied with an interval of 60 seconds which allows protection devices cooling time between surges. Test times can be reduced by applying an interval of 20 seconds which is considered to be a more stringent test than the standard requires. This however, could cause systems to fail / get damaged that could have passed if the test was carried out at 60 seconds. Being aware of these possibilities customers can specify testing to be carried out with a 20 second interval, hence reducing test time. If testing at 20 second intervals cause failures and testing at 60 seconds do not, the test results at 60 second intervals prevails.

Test Configuration

The EUT shall be configured, installed, arranged and operated in a manner consistent with typical applications. Cable lengths shall be selected to produce maximum disturbance.

Interface cables / loads / devices shall be connected to all EUT ports and terminated in devices and loads typical of actual usage. EN55022 section 8.2 allows the use of a restricted number of cables to be used in the case of multiple interface ports, subject to conditions that can be assessed in conjunction with the Laboratory Manager. All cables must be supplied by the client and of the type recommended in a typical use.

Operation of the EUT

The operational conditions of the EUT shall be determined by the manufacturer according to the typical use of the EUT to the expected highest level of emissions.

The EUT shall be operated in the rated (nominal) operating voltage range and typical load conditions.

The test programmes or other means of exercising the equipment should ensure that various parts of a system are exercised in a manner that permits detection of all system disturbances.

Support equipment and test jigs necessary for testing must be supplied by the manufacturer, in accordance with the requirements of the standard.

Multifunction equipment shall be tested with each function tested in isolation. It is the responsibility of the manufacturer to declare all operating modes when testing multi functional products, prior to commencement of tests.

Measurements at telecommunication ports

In order to make reliable emission measurements representative of high LAN utilisation it is only necessary to create a condition of LAN utilisation in excess of 10% and sustain that level for a minimum of 250 ms. The content of the test traffic should consist of both periodic and pseudo-random messages in order to emulate realistic types of data transmission.

Decision Rules Commercial EMC

For Radiated and Conducted Emissions EN 55014-1, EN 55011, EN 55022, EN 55032 Compliance or non-compliance to a disturbance limit shall be determined with reference to EN55016-4-2 in the following manner:

If U_{lab} is less than or equal to U_{cisprr} in table 1, then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{lab} is greater than U_{cisprr} in table 1, then:

- compliance is deemed to occur if no measured disturbance, increased by $(U_{lab} - U_{cisprr})$, exceeds the disturbance limit.
- non-compliance is deemed to occur if any measured disturbance, increased by $(U_{lab} - U_{cisprr})$, exceeds the disturbance limit.

Note: U_{lab} is the calculated uncertainty of measurement for the ETS laboratory measurement.

U_{cisprr} is the calculated uncertainty of measurement taken from EN55016-4-2 Table 1

(The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements).

ETS CISPR table radiated and conducted emissions uncertainty of measurement (30th October 2019 issue 8)	issue	EN55016-4-2	uncertainty table	U_{cisprr} Table 1	U_{lab}	$>U_{cisprr}$ $\leq U_{cisprr}$
Conducted AMN 9 KHz – 150 KHz	6	2004	A1	4.0	3.96	-0.04
Conducted AMN 9 KHz – 150 KHz 3 phase	7	2004	A1	4.0	3.96	-0.04
Conducted AMN 150 KHz – 30 MHz	6	2004	A2	3.6	3.59	-0.01
Conducted AMN 150 KHz – 30 MHz 3 phase	7	2004	A2	3.6	3.59	-0.01
Conducted AAN Telecoms 55...40 dB CAT 3	5	2011	B4	5.0	4.11	-0.89
Conducted AAN Telecoms 65...50 dB CAT 5	5	2011	B4	5.0	4.50	-0.50
Conducted AAN Telecoms 75...60 dB CAT 6	5	2011	B4	5.0	4.93	-0.07
Radiated OATS 30 MHz – 200 MHz 3 meters H	5	2004	A4	5.2	4.79	-0.41
Radiated OATS 30 MHz – 200 MHz 10 meters H	5	2004	A4	5.2	4.78	-0.42
Radiated OATS 30 MHz – 200 MHz 3 meters V	5	2004	A5	5.2	4.81	-0.39
Radiated OATS 30 MHz – 200 MHz 10 meters V	5	2004	A5	5.2	4.80	-0.41
Radiated OATS 200 MHz – 1 GHz 3 meters H	5	2004	A6	5.2	5.15	-0.05
Radiated OATS 200 MHz – 1 GHz 10 meters H	5	2004	A6	5.2	5.02	-0.18
Radiated OATS 200 MHz – 1 GHz 3 meters V	5	2004	A7	5.2	5.14	-0.06
Radiated OATS 200 MHz – 1 GHz 10 meters V	5	2004	A7	5.2	5.02	-0.18
Radiated FAR 1 GHz - 6 GHz	8	2011	E1	5.2	6.11	0.91
Radiated FAR 6 GHz - 18 GHz	4	2011	E2	5.5	5.16	-0.34
Radiated SAC Horizontal 30 MHz - 200 MHz	4	2011	D1	6.3	4.87	-1.43
Radiated SAC Horizontal 200 MHz - 1 GHz	4	2011	D3	6.3	4.97	-1.34
Radiated SAC Vertical 30 MHz - 200 MHz	4	2011	D2	6.3	4.98	-1.32
Radiated SAC Vertical 200 MHz - 1 GHz	4	2011	D4	6.3	6.07	-0.23

Decision Rules Commercial EMC - continued

For Harmonic Current Emissions EN 61000-3-2 Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **EN 61000-3-2** as published in the European Official Journal. No additional allowance is made. This being so as the test equipment performance including uncertainty of measurement is effectively controlled and defined in the equipment standard **EN 61000-4-7**.

For Voltage Changes, Voltage Fluctuations and Flicker EN 61000-3-3 Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **EN 61000-3-3** as published in the European Official Journal. No additional allowance is made. This being so as the test equipment performance including uncertainty of measurement is effectively controlled and defined in the test equipment standard **EN 61000-4-15**.

For Magnetic Field Emissions 2m loop EN 55011 and EN 55015 Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **EN 55011 and EN 55015** as published in the European Official Journal. Where the magnetic field emission result is above the limit when taking into account the uncertainty of measurement testing is halted and the customer consulted. If at the customers request remedial action is not taken an explanatory note is included in the reported results.

For ESD EN 61000-4-2, Fast Transient Burst EN 61000-4-4, Surge EN 61000-4-5, Voltage Dips and Interrupts EN 61000-4-11 The Immunity test levels and EUT performance criteria are as required by the product standard. No additional allowance is made. This being so as the test equipment performance including uncertainty of measurement is effectively controlled and defined in the test equipment standard.

For Conducted RF Immunity EN 61000-4-6, Radiated RF Immunity EN 61000-4-3, Power Frequency Magnetic Field EN 61000-4-8, Pulse Magnetic Field EN 61000-4-9, Radiated RF Immunity GTEM These standards do not require adjustment of the levels to compensate for the calculated uncertainty of measurement. The Immunity test levels and EUT performance criteria are as required by the product standard.

Flexible Scope Checklist	
Equivalent standard	Reference
BS EN 301 489-1 V1.9.2:2011 (Emissions)	Gap Analysis - ETS_FXGA034_55032-A1
BS EN 61000-6-1:2019(Immunity)	Gap Analysis - ETS_FXGA035_55035-A11
EN61000-3-2:2014 - Mains Harmonics	Gap Analysis - ETS_FXGA011_61000_3_2
EN61000-3-3:2013 - Flicker	Gap Analysis - ETS_FXGA012_61000_3_3
Additional requirements	
Notes	

9.1 Conducted Emissions Results - AC Power Port - PSV-AD-250-DS (225 Ohm Load) -250W

Company	Pulsiv
Product	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Applicable Standard	EN 55032 Class B
Test Procedure	ETS tpCE

PSV-AD-250-DS (225 Ohm Load) -250W

Test File	Detector	Port	Frequency (MHz)	Level (dBuV)	Margin (dB)	Result
C304CEL3	Average	Live	0.180	34.8	-19.7	Pass
C304CEN3	Average	Neutral	1.359	31.3	-14.7	Pass
C304CEL3	Quasi Peak	Live	0.177	54.0	-10.6	Pass
C304CEN3	Quasi Peak	Neutral	1.359	47.8	-8.2	Pass

The AC Port, Conducted Emissions, plots illustrate the emissions from the EUT on the live and neutral conductors. These results can be compared directly with the EN55032, Class B limit line shown on the plot.

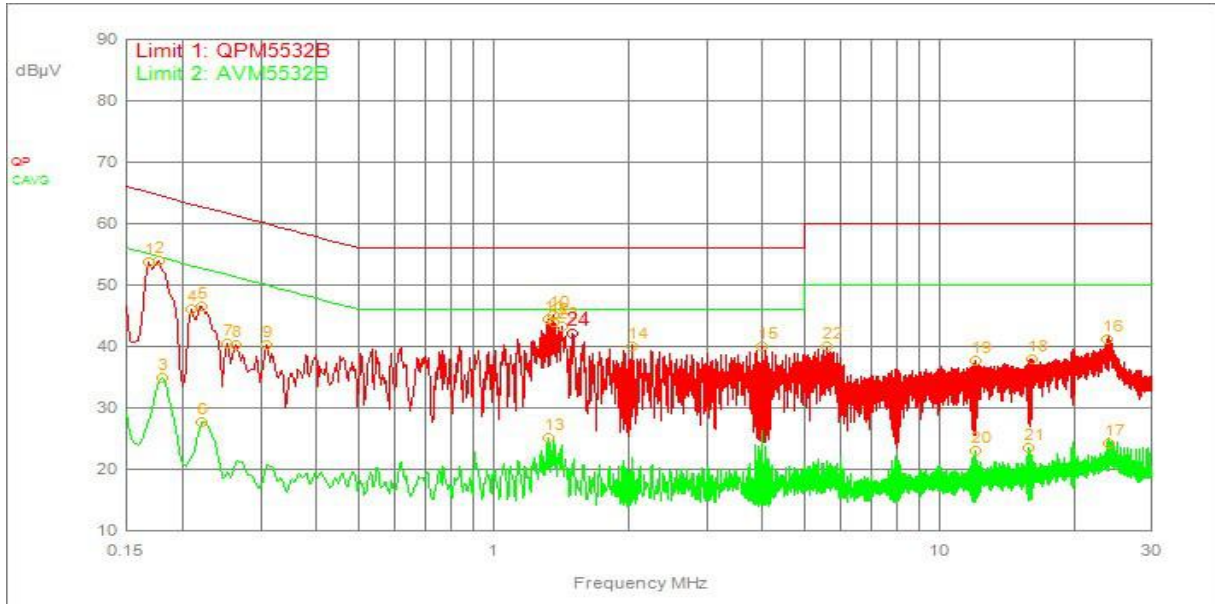
As it can be seen from the plots, all the emission levels from the EUT were below the limit line.

The narrowest compliance margin was -8.2 dB at 1.359 MHz where the measured level was 47.8 dBuV.

The EUT achieved compliance.

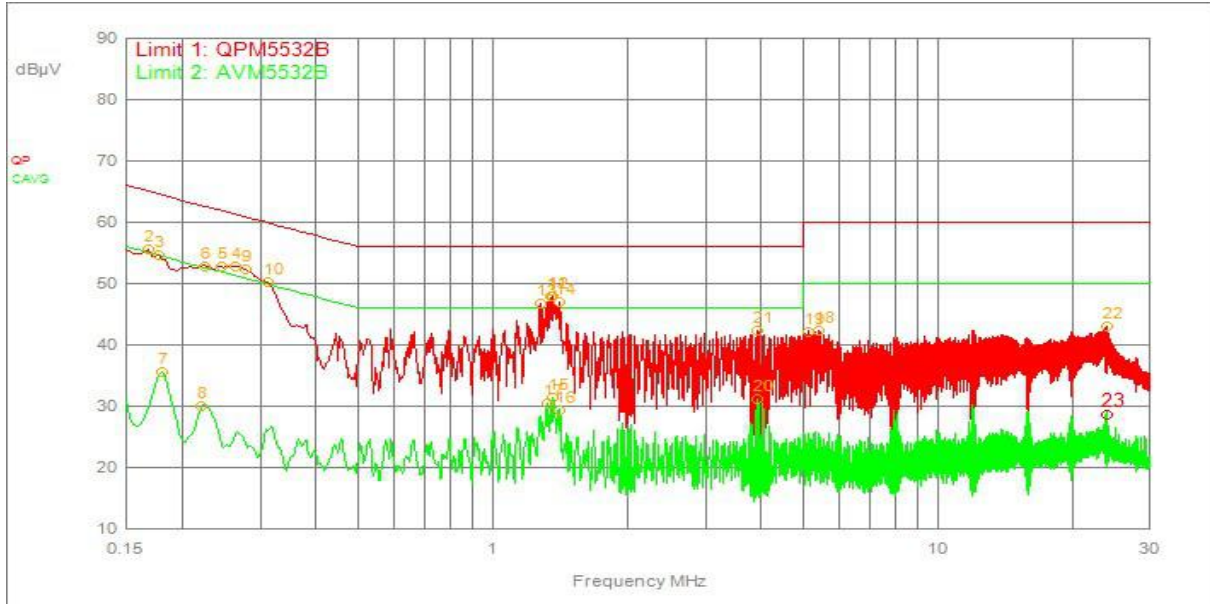
Facility	Temp: ° C	% RH	Pa mbar	Tested by:	Date:
Site 09	22	58	1010	AR	02/08/2022

C304CEL3



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
2	177.000kHz	9.6	0.3		QPeak	44.1	54.0	64.6	-10.6
10	1.362MHz	9.6	0.3		QPeak	35.3	45.2	56.0	-10.8
1	168.000kHz	9.6	0.3		QPeak	43.9	53.8	65.1	-11.3
11	1.332MHz	9.6	0.3		QPeak	34.6	44.5	56.0	-11.5
12	1.365MHz	9.6	0.3		QPeak	34.0	43.9	56.0	-12.1
23	1.422MHz	9.6	0.3		QPeak	33.3	43.2	56.0	-12.8
24	1.509MHz	9.6	0.3		QPeak	32.2	42.2	56.0	-13.8
14	2.043MHz	9.6	0.3		QPeak	30.2	40.1	56.0	-15.9
15	3.996MHz	9.6	0.4		QPeak	30.0	40.0	56.0	-16.0
5	222.000kHz	9.6	0.3		QPeak	36.6	46.5	62.7	-16.2
4	210.000kHz	9.6	0.3		QPeak	36.2	46.1	63.2	-17.1
16	23.838MHz	9.7	0.5		QPeak	31.1	41.2	60.0	-18.8
3	180.000kHz	9.6	0.3		C_AVG	24.9	34.8	54.5	-19.7
9	309.000kHz	9.6	0.3		QPeak	30.3	40.2	60.0	-19.8
22	5.595MHz	9.7	0.4		QPeak	29.8	39.9	60.0	-20.1
13	1.332MHz	9.6	0.3		C_AVG	15.3	25.2	46.0	-20.8
8	264.000kHz	9.6	0.3		QPeak	30.4	40.3	61.3	-21.0
7	252.000kHz	9.6	0.3		QPeak	30.6	40.5	61.7	-21.2
18	16.122MHz	9.7	0.4		QPeak	27.8	37.9	60.0	-22.1
19	12.033MHz	9.7	0.4		QPeak	27.5	37.6	60.0	-22.4
6	222.000kHz	9.6	0.3		C_AVG	17.8	27.7	52.7	-25.0
17	23.985MHz	9.7	0.5		C_AVG	13.9	24.1	50.0	-25.9
21	15.897MHz	9.7	0.4		C_AVG	13.5	23.6	50.0	-26.4
20	12.036MHz	9.7	0.4		C_AVG	12.9	23.0	50.0	-27.0

C304CEN3



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
11	1.347MHz	9.6	0.3		QPeak	37.8	47.8	56.0	-8.2
12	1.359MHz	9.6	0.3		QPeak	37.9	47.8	56.0	-8.2
4	264.000kHz	9.6	0.3		QPeak	42.9	52.9	61.3	-8.5
9	279.000kHz	9.6	0.3		QPeak	42.4	52.3	60.8	-8.6
5	246.000kHz	9.6	0.3		QPeak	42.9	52.8	61.9	-9.1
14	1.407MHz	9.6	0.3		QPeak	37.0	46.9	56.0	-9.1
13	1.287MHz	9.6	0.3		QPeak	36.8	46.8	56.0	-9.2
2	168.000kHz	9.6	0.3		QPeak	45.7	55.6	65.1	-9.4
6	225.000kHz	9.6	0.3		QPeak	43.0	52.9	62.6	-9.7
10	312.000kHz	9.6	0.3		QPeak	40.3	50.2	59.9	-9.7
3	177.000kHz	9.6	0.3		QPeak	44.8	54.7	64.6	-9.9
1	150.000kHz	9.6	0.3		QPeak	45.7	55.6	66.0	-10.4
21	3.951MHz	9.6	0.4		QPeak	32.3	42.3	56.0	-13.7
15	1.359MHz	9.6	0.3		C_AVG	21.4	31.3	46.0	-14.7
20	3.951MHz	9.6	0.4		C_AVG	21.2	31.2	46.0	-14.8
17	1.329MHz	9.6	0.3		C_AVG	20.5	30.4	46.0	-15.6
16	1.407MHz	9.6	0.3		C_AVG	19.5	29.4	46.0	-16.6
22	23.985MHz	9.7	0.5		QPeak	32.8	43.0	60.0	-17.0
18	5.406MHz	9.7	0.4		QPeak	32.3	42.3	60.0	-17.7
19	5.133MHz	9.7	0.4		QPeak	32.2	42.2	60.0	-17.8
7	180.000kHz	9.6	0.3		C_AVG	25.6	35.5	54.5	-19.0
23	23.982MHz	9.7	0.5		C_AVG	18.5	28.7	50.0	-21.3
8	222.000kHz	9.6	0.3		C_AVG	20.1	30.0	52.7	-22.7

9.2 Conducted Emissions Results - AC Power Port - PSV-AD-150-DS (380 Ohm Load) -150W

Company	Pulsiv
Product	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Applicable Standard	EN 55032 Class B
Test Procedure	ETS tpCE

PSV-AD-150-DS (380 Ohm Load) - 150W

Test File	Detector	Port	Frequency (MHz)	Level (dBuV)	Margin (dB)	Result
C304CEL4	Average	Live	1.380	25.6	-20.4	Pass
C304CEN4	Average	Neutral	3.960	27.3	-18.7	Pass
C304CEL4	Quasi Peak	Live	1.380	46.9	-9.1	Pass
C304CEN4	Quasi Peak	Neutral	1.335	48.6	-7.4	Pass

The AC Port, Conducted Emissions, plots illustrate the emissions from the EUT on the live and neutral conductors. These results can be compared directly with the EN55032, Class B limit line shown on the plot.

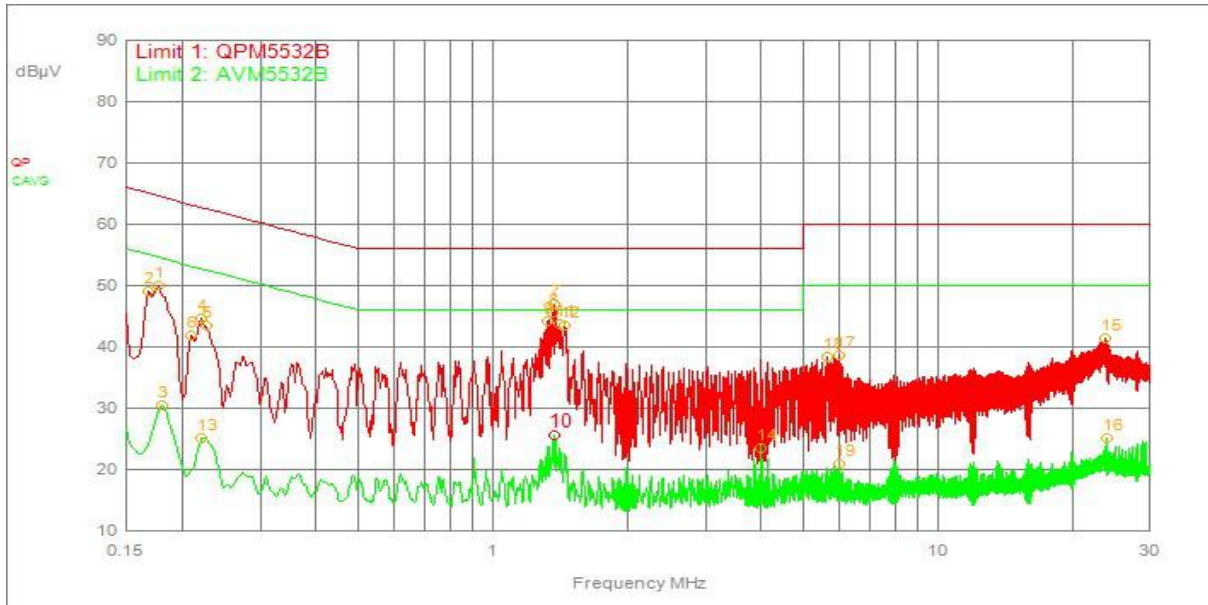
As it can be seen from the plots, all the emission levels from the EUT were below the limit line.

The narrowest compliance margin was -7.4 dB at 1.335 MHz where the measured level was 48.6dBuV.

The EUT achieved compliance.

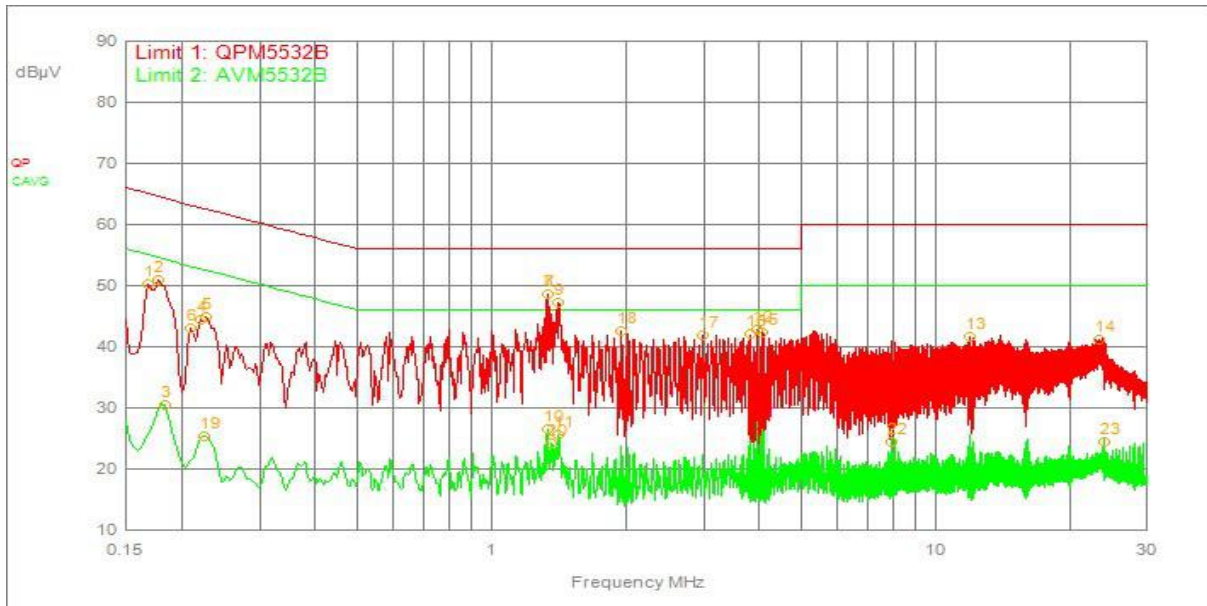
Facility	Temp: ° C	% RH	Pa mbar	Tested by:	Date:
Site 09	22	58	1010	AR	02/08/2022

C304CEL4



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
7	1.380MHz	9.6	0.3		QPeak	37.0	46.9	56.0	-9.1
8	1.365MHz	9.6	0.3		QPeak	35.7	45.6	56.0	-10.4
9	1.332MHz	9.6	0.3		QPeak	34.3	44.3	56.0	-11.7
11	1.410MHz	9.6	0.3		QPeak	33.9	43.8	56.0	-12.2
12	1.455MHz	9.6	0.3		QPeak	33.5	43.4	56.0	-12.6
1	177.000kHz	9.6	0.3		QPeak	40.2	50.1	64.6	-14.5
2	168.000kHz	9.6	0.3		QPeak	39.1	49.0	65.1	-16.1
4	222.000kHz	9.6	0.3		QPeak	34.7	44.6	62.7	-18.2
15	23.928MHz	9.7	0.5		QPeak	31.1	41.3	60.0	-18.7
5	228.000kHz	9.6	0.3		QPeak	33.4	43.4	62.5	-19.2
10	1.380MHz	9.6	0.3		C_AVG	15.7	25.6	46.0	-20.4
6	210.000kHz	9.6	0.3		QPeak	32.0	41.9	63.2	-21.3
17	6.003MHz	9.7	0.4		QPeak	28.4	38.5	60.0	-21.5
18	5.649MHz	9.7	0.4		QPeak	28.3	38.3	60.0	-21.7
14	4.005MHz	9.7	0.4		C_AVG	13.5	23.5	46.0	-22.5
3	180.000kHz	9.6	0.3		C_AVG	20.6	30.5	54.5	-24.0
16	24.069MHz	9.7	0.5		C_AVG	15.0	25.2	50.0	-24.8
13	222.000kHz	9.6	0.3		C_AVG	15.1	25.0	52.7	-27.7
19	6.003MHz	9.7	0.4		C_AVG	10.9	21.0	50.0	-29.0

C304CEN4



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
7	1.335MHz	9.6	0.3		QPeak	38.6	48.6	56.0	-7.4
8	1.335MHz	9.6	0.3		QPeak	38.6	48.6	56.0	-7.4
9	1.410MHz	9.6	0.3		QPeak	37.3	47.2	56.0	-8.8
12	3.957MHz	9.6	0.4		QPeak	32.7	42.7	56.0	-13.3
18	1.956MHz	9.6	0.3		QPeak	32.5	42.5	56.0	-13.5
2	177.000kHz	9.6	0.3		QPeak	41.0	50.9	64.6	-13.7
15	4.095MHz	9.7	0.4		QPeak	32.2	42.3	56.0	-13.7
16	3.822MHz	9.6	0.4		QPeak	31.9	42.0	56.0	-14.0
17	3.003MHz	9.6	0.4		QPeak	31.9	41.9	56.0	-14.1
1	168.000kHz	9.6	0.3		QPeak	40.4	50.3	65.1	-14.8
5	228.000kHz	9.6	0.3		QPeak	35.0	44.9	62.5	-17.7
4	222.000kHz	9.6	0.3		QPeak	34.6	44.5	62.7	-18.2
13	12.012MHz	9.7	0.4		QPeak	31.6	41.7	60.0	-18.3
21	3.960MHz	9.6	0.4		C_AVG	17.3	27.3	46.0	-18.7
14	23.445MHz	9.7	0.5		QPeak	31.0	41.2	60.0	-18.8

10	1.335MHz	9.6	0.3		C_AVG	16.5	26.4	46.0	-19.6
6	210.000kHz	9.6	0.3		QPeak	33.1	43.1	63.2	-20.1
11	1.410MHz	9.6	0.3		C_AVG	15.6	25.6	46.0	-20.4
20	1.365MHz	9.6	0.3		C_AVG	14.4	24.3	46.0	-21.7
3	183.000kHz	9.6	0.3		C_AVG	20.6	30.5	54.3	-23.8
22	7.959MHz	9.7	0.4		C_AVG	14.4	24.5	50.0	-25.5
23	24.072MHz	9.7	0.5		C_AVG	14.3	24.5	50.0	-25.5
19	225.000kHz	9.6	0.3		C_AVG	15.5	25.4	52.6	-27.2

9.3 Conducted Emissions Results - AC Power Port - PSV-AD-50-DS (1184 Ohm Load) -50W

Company	Pulsiv
Product	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Applicable Standard	EN 55032 Class B
Test Procedure	ETS tpCE

PSV-AD-50-DS (1184 Ohm load) - 50W

Test File	Detector	Port	Frequency (MHz)	Level (dBuV)	Margin (dB)	Result
C304CEL5	Average	Live	1.335	19.4	-26.6	Pass
C304CEN5	Average	Neutral	4.056	21.2	-24.8	Pass
C304CEL5	Quasi Peak	Live	1.335	44.2	-11.8	Pass
C304CEN5	Quasi Peak	Neutral	1.383	46.7	-9.3	Pass

The AC Port, Conducted Emissions, plots illustrate the emissions from the EUT on the live and neutral conductors. These results can be compared directly with the EN55032, Class B limit line shown on the plot.

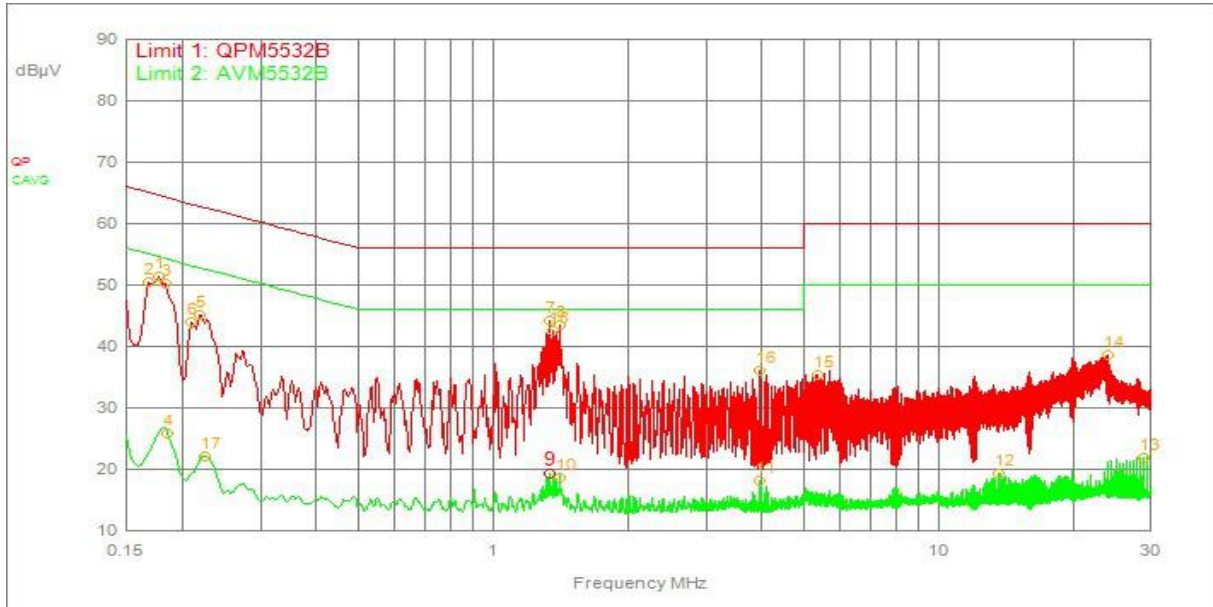
As it can be seen from the plots, all the emission levels from the EUT were below the limit line.

The narrowest compliance margin was -9.3 dB at 1.383 MHz where the measured level was 46.7 dBuV.

The EUT achieved compliance.

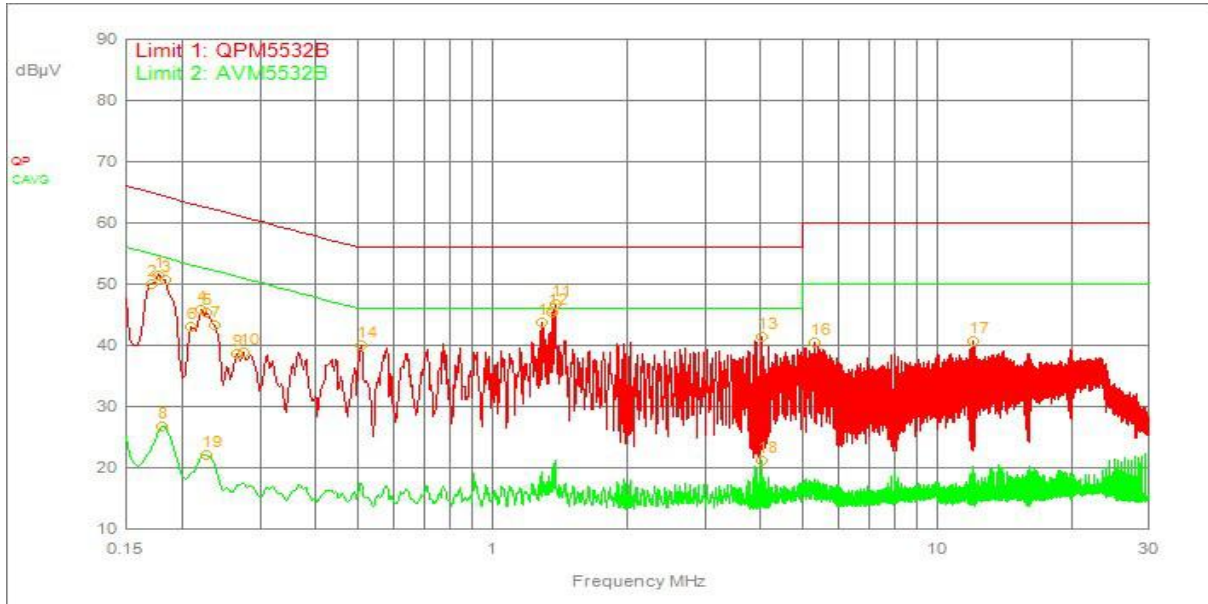
Facility	Temp: ° C	% RH	Pa mbar	Tested by:	Date:
Site 09	22	58	1010	AR	02/08/2022

C304CEL5



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
7	1.335MHz	9.6	0.3		QPeak	34.3	44.2	56.0	-11.8
8	1.413MHz	9.6	0.3		QPeak	33.6	43.5	56.0	-12.5
1	177.000kHz	9.6	0.3		QPeak	41.6	51.5	64.6	-13.1
18	1.368MHz	9.6	0.3		QPeak	32.7	42.6	56.0	-13.4
3	183.000kHz	9.6	0.3		QPeak	40.4	50.3	64.3	-14.0
2	168.000kHz	9.6	0.3		QPeak	40.5	50.4	65.1	-14.7
5	219.000kHz	9.6	0.3		QPeak	35.1	45.1	62.9	-17.8
6	210.000kHz	9.6	0.3		QPeak	34.0	44.0	63.2	-19.2
16	3.963MHz	9.6	0.4		QPeak	26.0	36.0	56.0	-20.0
14	24.009MHz	9.7	0.5		QPeak	28.5	38.7	60.0	-21.3
15	5.361MHz	9.7	0.4		QPeak	25.2	35.3	60.0	-24.7
9	1.335MHz	9.6	0.3		C_AVG	9.4	19.4	46.0	-26.6
10	1.410MHz	9.6	0.3		C_AVG	8.7	18.7	46.0	-27.3
11	3.963MHz	9.6	0.4		C_AVG	8.1	18.1	46.0	-27.9
13	29.073MHz	9.6	0.6		C_AVG	11.7	21.9	50.0	-28.1
4	186.000kHz	9.6	0.3		C_AVG	15.9	25.8	54.2	-28.4
17	225.000kHz	9.6	0.3		C_AVG	12.3	22.2	52.6	-30.4
12	13.614MHz	9.7	0.4		C_AVG	9.2	19.3	50.0	-30.7

C304CEN5



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
11	1.383MHz	9.6	0.3		QPeak	36.7	46.7	56.0	-9.3
12	1.368MHz	9.6	0.3		QPeak	35.4	45.3	56.0	-10.7
15	1.290MHz	9.6	0.3		QPeak	33.7	43.7	56.0	-12.3
1	177.000kHz	9.6	0.3		QPeak	41.6	51.5	64.6	-13.1
3	183.000kHz	9.6	0.3		QPeak	40.7	50.6	64.3	-13.8
13	4.056MHz	9.7	0.4		QPeak	31.4	41.5	56.0	-14.5
2	171.000kHz	9.6	0.3		QPeak	40.0	49.9	64.9	-15.0
14	507.000kHz	9.6	0.3		QPeak	30.1	40.0	56.0	-16.0
4	222.000kHz	9.6	0.3		QPeak	35.8	45.7	62.7	-17.0
5	228.000kHz	9.6	0.3		QPeak	35.4	45.3	62.5	-17.2
7	237.000kHz	9.6	0.3		QPeak	33.3	43.2	62.2	-19.0
17	12.030MHz	9.7	0.4		QPeak	30.5	40.6	60.0	-19.4
16	5.331MHz	9.7	0.4		QPeak	30.4	40.4	60.0	-19.6
6	210.000kHz	9.6	0.3		QPeak	33.1	43.0	63.2	-20.2
10	276.000kHz	9.6	0.3		QPeak	28.9	38.8	60.9	-22.1
9	267.000kHz	9.6	0.3		QPeak	28.8	38.7	61.2	-22.5
18	4.056MHz	9.7	0.4		C_AVG	11.1	21.2	46.0	-24.8
8	180.000kHz	9.6	0.3		C_AVG	16.9	26.8	54.5	-27.7
19	228.000kHz	9.6	0.3		C_AVG	12.1	22.0	52.5	-30.5
20	150.000kHz	9.6	0.3		C_AVG	15.3	25.2	56.0	-30.8

From the results obtained, the *Pulsiv PFC Development System, PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS* system tested, was found to be compliant with the following test requirements:

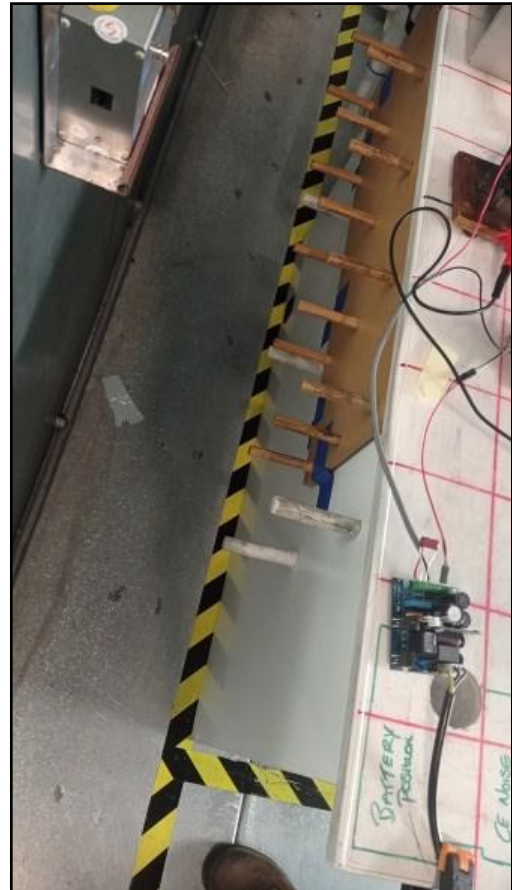
Emissions Tests	Standard	Status
Emission Standard for Multimedia Equipment	EN55032, Blass B	Complied
Conducted Emissions AC Port	EN55032, Class B	Complied

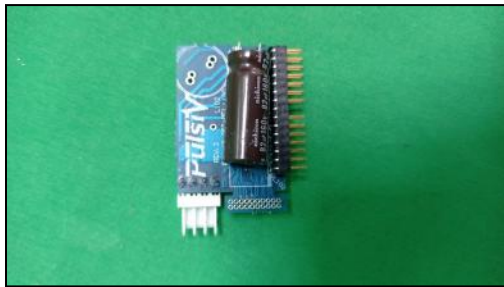
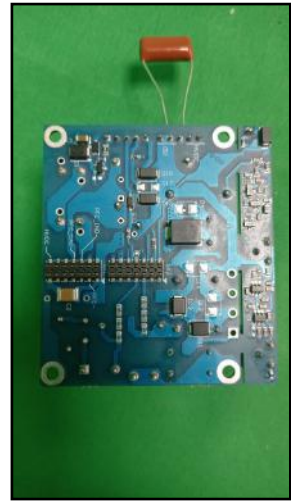
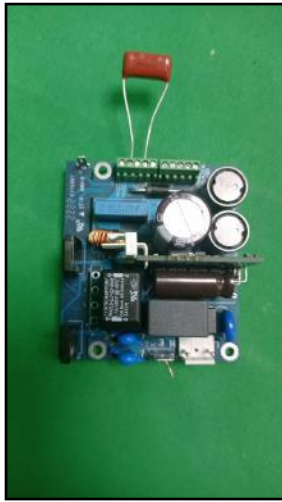
The EUT achieved compliance.

* Non UKAS Accredited Tests

Appendix A	Photographs
Appendix B	Measurement Uncertainty
Appendix C	List of Equipment Used
Appendix D	Emissions - Test Procedures / Set-Up Conducted Emissions
Appendix E	Abbreviations
Appendix F	EU & GB Compliance and Labelling Requirements

Conducted Emissions AC Port





Measurement Uncertainty

The reported expanded measurement uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a confidence level of approx. 95%. The uncertainty evaluation has been carried out in accordance with EN55016-4-2, U_{cispr} and U_{lab}.

The estimated combined standard measurement uncertainties are:

ETS CISPR table radiated and conducted emissions uncertainty of measurement (30th October 2019 issue 8)	issue	EN55016-4-2	uncertainty table	U _{cispr} Table 1	U _{lab}	>U _{cispr} ≤U _{cispr}
Conducted AMN 9 KHz – 150 KHz	6	2004	A1	4.0	3.96	-0.04
Conducted AMN 9 KHz – 150 KHz 3 phase	7	2004	A1	4.0	3.96	-0.04
Conducted AMN 150 KHz – 30 MHz	6	2004	A2	3.6	3.59	-0.01
Conducted AMN 150 KHz – 30 MHz 3 phase	7	2004	A2	3.6	3.59	-0.01
Conducted AAN Telecoms 55...40 dB CAT 3	5	2011	B4	5.0	4.11	-0.89
Conducted AAN Telecoms 65...50 dB CAT 5	5	2011	B4	5.0	4.50	-0.50
Conducted AAN Telecoms 75...60 dB CAT 6	5	2011	B4	5.0	4.93	-0.07
Radiated OATS 30 MHz – 200 MHz 3 meters H	5	2004	A4	5.2	4.79	-0.41
Radiated OATS 30 MHz – 200 MHz 10 meters H	5	2004	A4	5.2	4.78	-0.42
Radiated OATS 30 MHz – 200 MHz 3 meters V	5	2004	A5	5.2	4.81	-0.39
Radiated OATS 30 MHz – 200 MHz 10 meters V	5	2004	A5	5.2	4.80	-0.41
Radiated OATS 200 MHz – 1 GHz 3 meters H	5	2004	A6	5.2	5.15	-0.05
Radiated OATS 200 MHz – 1 GHz 10 meters H	5	2004	A6	5.2	5.02	-0.18
Radiated OATS 200 MHz – 1 GHz 3 meters V	5	2004	A7	5.2	5.14	-0.06
Radiated OATS 200 MHz – 1 GHz 10 meters V	5	2004	A7	5.2	5.02	-0.18
Radiated FAR 1 GHz - 6 GHz	8	2011	E1	5.2	6.11	0.91
Radiated FAR 6 GHz - 18 GHz	4	2011	E2	5.5	5.16	-0.34
Radiated SAC Horizontal 30 MHz - 200 MHz	4	2011	D1	6.3	4.87	-1.43
Radiated SAC Horizontal 200 MHz - 1 GHz	4	2011	D3	6.3	4.97	-1.34
Radiated SAC Vertical 30 MHz - 200 MHz	4	2011	D2	6.3	4.98	-1.32
Radiated SAC Vertical 200 MHz - 1 GHz	4	2011	D4	6.3	6.07	-0.23

Radiated Immunity	+1.939 dB	Mains Harmonics	It has been demonstrated that the test generator meets the specified requirements in the standard with at least a 95% confidence	Surges	It has been demonstrated that the test generator meets the specified requirements in the standard with at least a 95% confidence
Conducted Immunity	BCI +1.5 dB EM +3.17 dB CDN +1.32 dB	Flicker		Magnetic Immunity	
		ESD		Voltage Dips / interruptions	
		Fast Transients			

For Radiated and Conducted Emissions EN 55014-1, EN 55011, EN 55022, EN 55032 Compliance or non-compliance to a disturbance limit shall be determined with reference to EN55016-4-2 in the following manner:

If U_{lab} is less than or equal to U_{cispr} in table 1, then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} in table 1, then:

- compliance is deemed to occur if no measured disturbance, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit.
- non-compliance is deemed to occur if any measured disturbance, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit.

Note: U_{lab} is the calculated uncertainty of measurement for the ETS laboratory measurement.

U_{cispr} is the calculated uncertainty of measurement taken from EN55016-4-2 Table 1

(The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements).

Traceability

All measurement equipment calibrations are traceable to national standards.

Calibration

Equipment requiring calibration is calibrated to Manufacturer's specifications. Additional verification tests are performed on a regular basis using in house standards and comparisons.

ID No	Description	Model Number	Manufacturer	Serial Number	Calibration Due	Calibration Date
-------	-------------	--------------	--------------	---------------	-----------------	------------------

TEST		Conducted Emission						
Site	C061	Screened Room	site 9	ETS	N/A	N/A	N/A	Site 09
Equipment	A089	Two-Line V Network	ENV216	Rohde & Schwarz	3560.6550.12-101724-gt	20/11/2022	20/11/2020	
	A149	EMI Receiver	FFT3010	AFJ Instruments	3.0102E+11	20/10/2022	20/10/2020	
	B094	CE RF Cable Site 09	RG214	ITC	N/A	23/03/2023	23/03/2022	
	B118	CE Link Cable 2	0	ETS	0	19/07/2023	19/07/2022	
	B144	Coaxial RF Switch 04	CX-210	Diamond Antenna	0	09/02/2023	09/02/2022	

Conducted Emissions Measurements

Objectives

The objectives are to determine the level of conducted emissions at the Telecommunication ports in the frequency range 150 kHz to 30 MHz. Measured levels are evaluated against the applicable limits of the EN55032 standard.

Test Procedure ETS tpCE

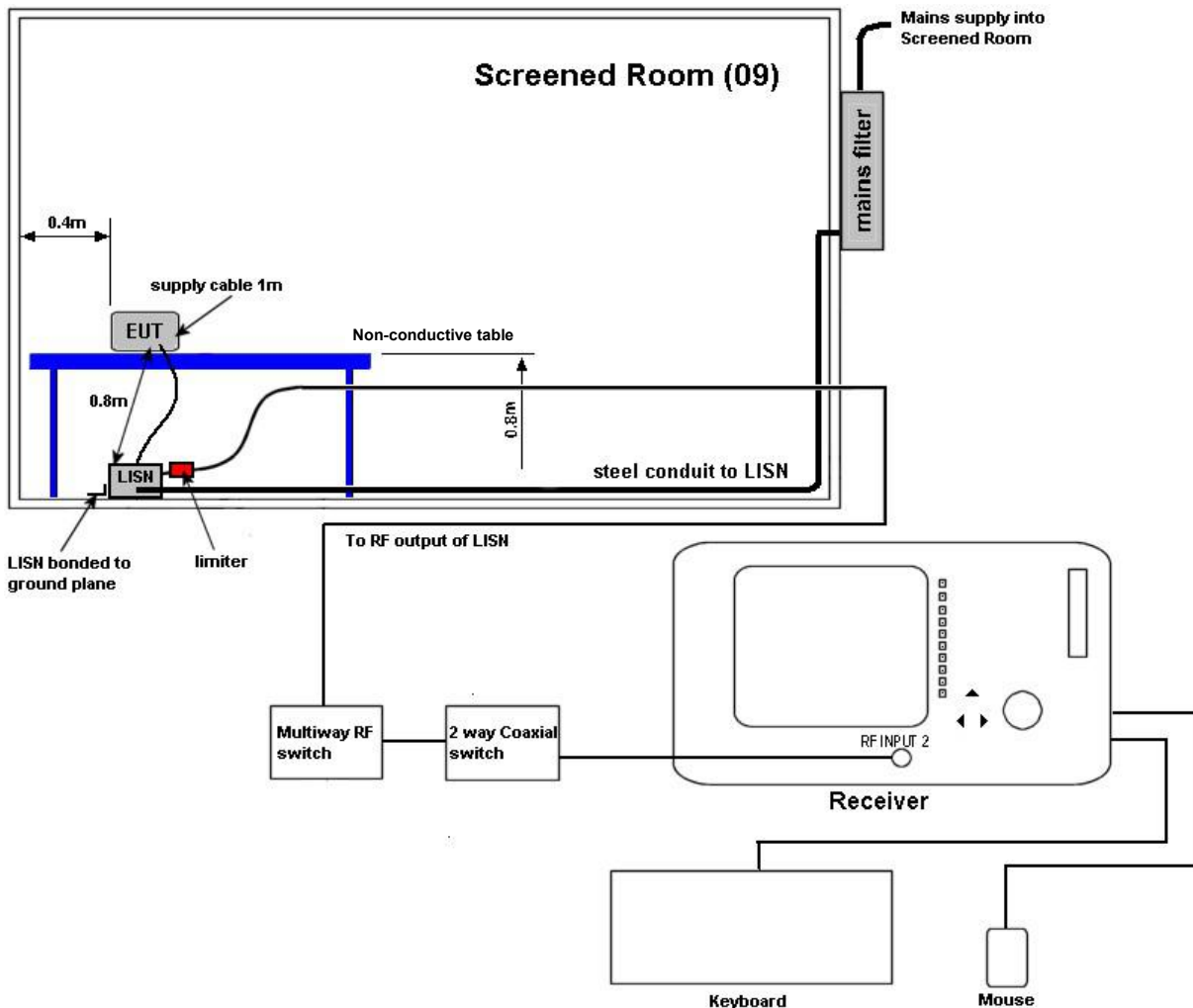
Test Method

Conducted emissions measurements are made over the frequency range 150 kHz - 30 MHz in accordance with EN55032. Prior to the commencement of tests the test equipment, EUT and support equipment are switched on and allowed to warm up for a minimum of thirty minutes. The RF test receiver parameters are set as per the requirements of CISPR 16/EN55032.

The EUT is positioned on a non-conductive table 0.8 m above the ground plane.

Recording of test results is by automated scans with the presentation of results in a graphical and tabulated form. References must also be made to EN55032 Section 9.

Test Set-up



Acronyms and Abbreviations	
AV	Average
EFT	Electrical Fast Transients
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
HCP	Horizontal Coupling Plane
ITE	Information Technology Equipment
OATS	Open Area Test Site
PC	Personal Computer
QP	Quasi Peak
RF	Radio Frequency
VCP	Vertical Coupling Plane
RHS	Right Hand Side
LHS	Left Hand Side

COMPLIANCE NOTE

The test results documented in this report refer exclusively to the product (s) submitted for testing. On going compliance with the applicable standards is subject to manufacturers equipment being identical in design, construction and quality to the assessed sample. All product modifications must be evaluated for assessment of any impact on the EMC status.

To ensure continued compliance future retests may be necessary.

EU LABELING REQUIREMENTS

Products that have been found to comply with the applicable standards and meet the essential requirements of the EMC Directive 2014/30/EU, shall be identified with the CE mark and labelling requirements.



The EMC directive is one of several EU directives for which the CE mark provides presumption of conformance. Compliance with the essential requirements of all applicable directives must be met before the CE mark can be legally applied.

Product Labelling

Manufacturer's Trade Name / Mark

Full Postal Address

Web Address (recommended but not mandatory)

Product Name / Type

Batch / Serial Number

Further Data as required by other Directives



COMPLIANCE NOTE

The test results documented in this report refer exclusively to the product (s) submitted for testing. On going compliance with the applicable standards is subject to manufacturers equipment being identical in design, construction and quality to the assessed sample. All product modifications must be evaluated for assessment of any impact on the EMC status.

To ensure continued compliance future retests may be necessary.

GREAT BRITAIN LABELING REQUIREMENTS

Products that have been found to comply with the applicable standards and meet the essential requirements of the UK Electromagnetic Compatibility Regulations 2016, shall be identified with the UKCA mark and labelling requirements.



The UK Electromagnetic Compatibility Regulations 2016 is one of several regulations for which the UKCA mark provides presumption of conformance. Compliance with the essential requirements of all applicable regulations must be met before the UKCA mark can be legally applied.

PLACING THE UKCA MARKING

In most cases the UKCA marking must be applied to the product itself or to the packaging. In some cases, it may be placed on the manual or on other supporting literature. This will vary depending on the specific regulations that apply to the product.

Product Labelling

Manufacturer's Trade Name / Mark

Full Postal Address

Web Address (recommended but not mandatory)

Product Name / Type

Batch / Serial Number

Further Data as required by other Regulations



FCC TEST REPORT

Company Name: *Pulsiv Ltd*

Product: *Pulsiv PFC Development System
PSV-AD-250-DS
PSV-AD-150-DS
PSV-AD-50-DS*

Test Report Number	ETS/C3733/FCC
Issue Date:	09 August 2022
Applicable Standards	CFR 47 FCC Part 15 Class B: 2016 ANSI C63.4:2014

Revision Record

Revision	Date	Details
1.0	09 August 2022	Issue Version 1

Note:

This Test Report consists of 32 pages. This report records the test results of the equipment submitted, under the conditions and operating modes described herein. This report is issued in Adobe Acrobat document format (PDF). The report shall not be reproduced except in full, without the written approval of Electromagnetic Testing Services Limited.

Note: *Information supplied by the customer is identified in italic*

PAGE: 1

**REPORT ON EMC TEST CARRIED OUT ON A
PULSIV LTD PULSIV PFC DEVELOPMENT SYSTEM
PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS**

Produced on behalf of

*Pulsiv Ltd
Milton Hall, Ely Road, Milton
Cambridge, England, CB24 6WZ*

By

Electromagnetic Testing Services Limited
Pratts Fields
Lubberhedges Lane
Stebbing, Dunmow
Essex, CM6 3BT
England, U K

Registered in England, No. 269 6255
Registered Office: Pratts Fields, Lubberhedges Lane, Stebbing, Dunmow, Essex, CM6 3BT, England, U K

Tel. +44 (0) 1371 856061
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Fax: +44 (0) 1371 856144
Web Site: www.etsemc.co.uk

This laboratory is:

- UKAS Accredited Testing Laboratory Number 4416
Scope of Accreditation may be found at:
http://www.ukas.org/testing/lab_detail.asp?lab_id=2806&location_id=&vMenuOption=3
- F.C.C. (Federal Communications Commission) accredited for the requirements of the Code Of Federal Regulations CFR 47 for Parts 15 & 18 under Test Firm Registration #:361375, Designation Number UK0016
- Approved by the Vehicle Certification Agency for testing Automotive Products

Distribution: 01 *Pulsiv Ltd*
 02 Electromagnetic Testing Services Limited

Tested By: Test Engineer	Anthony Rogers <i>AR</i>
Approved and Authorised By:	George Vassila Technical Director <i>[Signature]</i>
Prepared by:	Sarah Jones <i>[Signature]</i>

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Electromagnetic emissions tests were carried out on a *Pulsiv Ltd, Pulsiv PFC Development System, PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS*, to assess compliance against the requirements of FCC Pt 15 Class B

The results obtained indicate compliance with the test limits of the above standards as follows:

Test Conducted Emissions	Standard	Status
PSV-AD-50-DS (300 Ohm load) - 50W	FCC Pt 15 Class B	Passed with a compliance margin of -9.8 dB
PSV-AD-150-DS (90 Ohm load) - 150W	FCC Pt 15 Class B	Passed with a compliance margin of -12.3 dB
PSV-AD-250-DS (76.6 Ohm load) - 175W	FCC Pt 15 Class B	Passed with a compliance margin of -10.2 dB

The *Pulsiv Ltd, Pulsiv PFC Development System, PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS*, is a power factor correction (PFC) development system, which is used by power supply circuit designers.

The model tested was a *PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS*.

The test results contained in this report refer to a single product supplied for testing. Tests were carried out for the purpose of demonstrating compliance.

The EUT was received on 02 August 2022. All tests were carried out on 02 August 2022 at the Electromagnetic Testing Services Limited EMC Facilities, Stebbing, Essex, England. The work was carried out under ETS Test Number 08A22C305.

The EUT was tested under normal laboratory conditions. The EUT was tested in the worst case configuration to maximise emissions, which is evaluated during pre-test, where applicable. Where applicable worst case test results are included in the appendix section of the report.

Client Information:

Contact: Andy Hills

Company: Eastmap Ltd

Tel.: 07780 958871

Email: andy.hills@eastmap.co.uk

Tests were carried out in the presence of Andy Hills of Eastmap Ltd

ELECTROMAGNETIC TESTING SERVICES LIMITED

EUT: PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS

COMPANY: PULSIV LTD

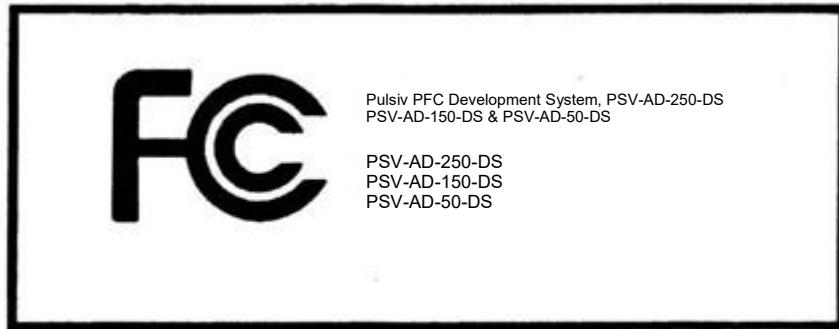
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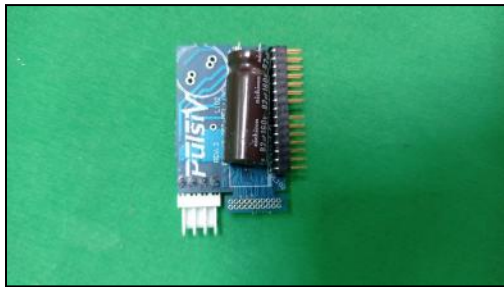
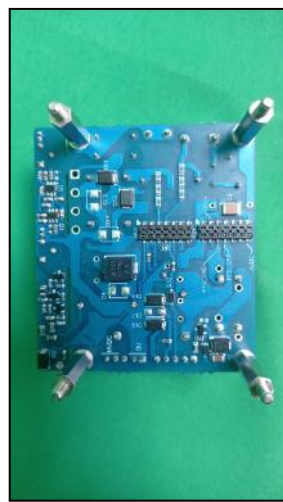
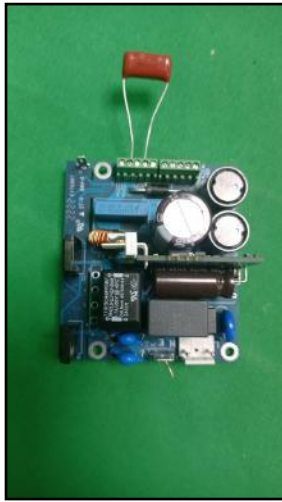
TEST REPORT NO: ETS/C3733/FCC

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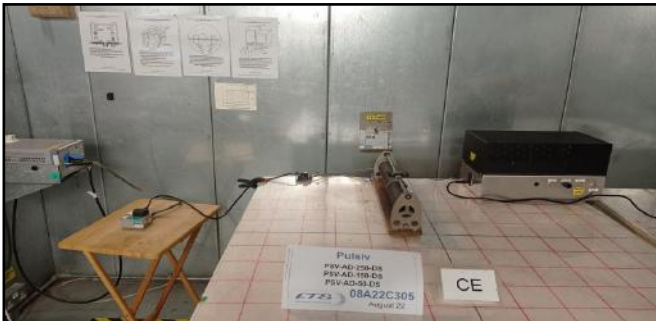
ISSUE DATE: 09 AUGUST 2022

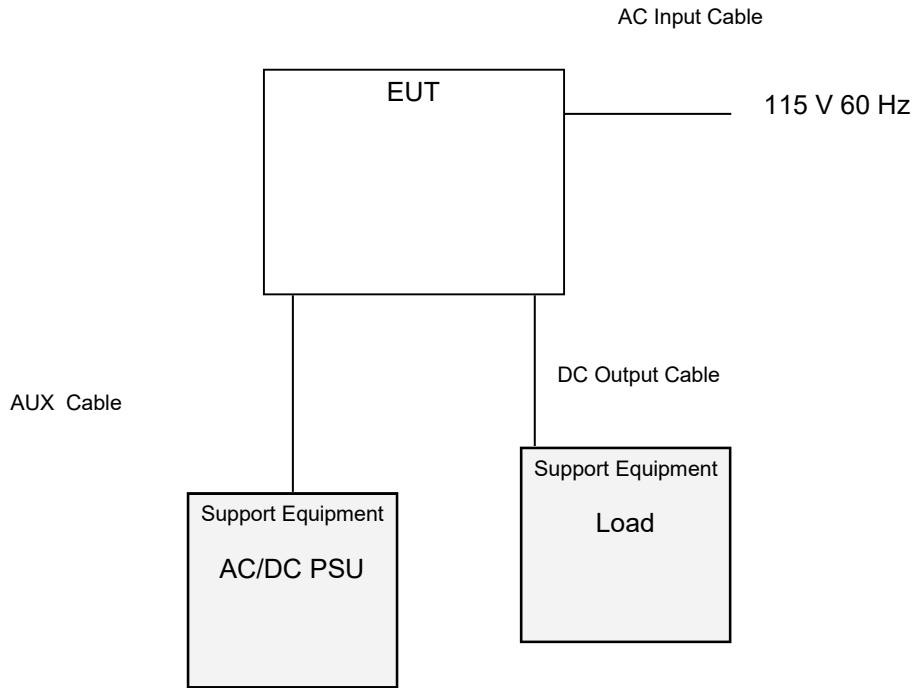
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Conducted Emissions





LIST OF CABLES

Ref.	Cable	Type	Length
1	AC Mains	Three core Unshielded	1
2	DC Output	Two core Unshielded	0.3
3	AUX cable	Two core Unshielded	0.3

7.1 Identification of Equipment

Product Type : *Power factor correction (PFC) development system*

Product Name : *Pulsiv PFC Development System*

Model Number : *PSV-AD-250-DS
PSV-AD-150-DS
PSV-AD-50-DS*

Serial Number : *PSV-AD-250-DS: Ser no. 045
PSV-AD-150-DS: Ser no. 041
PSV-AD-50-DS: Ser no. 044*

Dimensions: *60 x 68 x 32*

Weight: *80g*

Power Requirements : *115VAC 300W 60Hz*

Manufacturer Name : *Pulsiv Ltd*

Manufacturer Address : *Milton Hall, Ely Road, Milton, Cambridge, England,
CB24 6WZ*

Signatory's Name : *-*

Signatory's Address : *Pulsiv Ltd
Milton Hall, Ely Road, Milton, Cambridge, England,
CB24 6WZ*

7.2 Description of Apparatus: *The EUT is a power factor correction (PFC) circuit supplied as a PCB assembly intended for use by power supply circuit designers. The circuit utilises a unique control method and circuit topology to achieve power factor correction. The EUT incorporates mains rectifier and EMI filter part of the power supply circuit in addition to the PFC.*

The PFC is normally used to supply a following DC-DC stage such as a flyback converter. As it is not practical to test the EMC of the PFC and DC-DC separately, the testing is performed using a resistive load. Typically, the 250W nominal version would be expected to be used with up to a 150W DC-DC (approx. 170W load). The power factor of a typical DC-DC load will be much lower than a resistive load so the resistive load has been increased to 250W to present a more representative output current. This configuration is fitted with a 1.7A input common mode choke so testing has been limited to 200VA at the input for 115VAC operation to prevent overload of the input filter.

The EUT is supplied as a PCB assembly and as such has no chassis (earthed metal parts). The EUT is connected using a 3 core mains cable for this test. The earth conductor is connected to 4 x M3 mounting holes via the PCB tracking. There are also two Y2 safety capacitors connected between the earth terminal one to the L and one to the N connection.

7.3 Intended Use of Apparatus: *Power factor correction stage for power supply. The EUT is intended as a development system for use by power supply designers (not a stand-alone product).*

7.4 Physical Location of Installation: *Industrial/residential*

7.5 Description of Variants: *This test (PSV-CCAD-250AH hardware configuration.) is intended to cover all of the following hardware configurations:*

- PSV-CCAD-150
- PSV-CCAD-150H
- PSV-CCAD-250
- PSV-CCAD-250H
- PSV-CCAD-250X
- PSV-CCAD-250A
- PSV-CCAD-50HX
- PSV-CCAD-50AH

OPTIONS					
Configuration Number	Output Power Range	Basic Configuration	Hold Up	Half Active Bridge	X-Cap Discharge
PSV-CCAD-150	1W - 150W	☑	x	x	x
PSV-CCAD-150H		☑	☑	x	x
PSV-CCAD-250	1W - 250W	☑	x	x	x
PSV-CCAD-250H		☑	☑	x	x
PSV-CCAD-250X		☑	x	x	☑
PSV-CCAD-250A		☑	x	☑	☑
PSV-CCAD-250HX		☑	☑	x	☑
PSV-CCAD-250AH		☑	☑	☑	☑

None of the configuration options contain additional high frequency switching circuits. EUTs have all options fitted i.e PSV-CCAD-250AH hardware configuration.

Important Note

The list of variants is identical to the unit submitted for testing and relate to features that could not have any bearing on the EMC status of the product as declared by the client. This list is under the authority and sole responsibility of the client.

7.6 Rationale for selecting EUT: *Worse case configuration.*

7.6 Declared EUT Configuration:

Item	Description of board/sub assemblies	Part Number	Revision No.
1	<i>Pulsiv PFC development system motherboard</i>	<i>PSV-AD-250-MB</i>	<i>Rev 3.00</i>
2	<i>Pulsiv PFC development system daughterboard</i>	<i>PSV-AD-250-MCI</i>	<i>Rev 3.00</i>

7.7 Declared Suppression Measures:

The following modifications were applied to the EUT in order to achieve compliance
 Warning: Compliance is subject to the correct application of all listed modifications

Mod Status	Description of Suppression Measures	Reason	Date & Time
0	EUT as supplied with no additional modifications		

7.8 Declared Internal Clock Frequencies:

-

I certify that sections 7.6 and 7.7 are correct and describes the equipment tested and will be manufactured as stated.

Signature _____ Title _____



**Test Plan and check list Reference CFR 47 FCC Part 15 Subpart B: 2016
ANSI C63.4:2014** (template issue 08 - 22/10/2021)

Test Plan Number:	08A22C305	Customer:	Pulsiv Ltd
Date:	02 August 2022	EUT:	PSV-AD-250-DS, PSV-AD-150-DS, PSV-AD-50-DS

Key: **X** - Applicable Test
For number reference - see page 14

Supply Voltage for USA: 120V 60 Hz

Port tested	Standard & Emission phenomenon	Test value	Class required / Test required	
			Class required	Test required
Radiated Emission			Measured in SAR	
Enclosure	FCC part 15.109	30 MHz to 1 GHz	B	1
	FCC part 15.109	1 GHz to 18 GHz	B	1
	FCC part 15.109	18 GHz to 40 GHz	B	1
Conducted Emission - AC Mains				
AC mains power	FCC part 15.107	150kHz to 30MHz	B	X

Tests not carried out

Reference	Reason
1	Tests not applicable / not requested

Comments

Operating Mode

During testing the EUT was powered up and operated in accordance with the manufacturer's instructions and in a manner that represented its normal use.

On load as documented in test results

Important test Notes

None

Important Notes

Test Configuration

The EUT shall be configured, installed, arranged and operated in a manner consistent with typical applications. Cable lengths shall be selected to produce maximum disturbance.

Interface cables / loads / devices shall be connected to all EUT ports and terminated in devices and loads typical of actual usage. The basic emission standards, allows the use of a restricted number of cables to be used in the case of multiple interface ports, subject to conditions that can be assessed in conjunction with the Laboratory Manager. All cables must be supplied by the client and of the type recommended in a typical use.

Operation of the EUT

The operational conditions of the EUT shall be determined by the manufacturer according to the typical use of the EUT to the expected highest level of emissions.

The EUT shall be operated in the rated (nominal) operating voltage range and typical load conditions.

The test programmes or other means of exercising the equipment should ensure that various parts of a system are exercised in a manner that permits detection of all system disturbances.

Support equipment and test jigs necessary for testing must be supplied by the manufacturer, in accordance with the requirements of the standard.

Multifunction equipment shall be tested with each function tested in isolation. It is the responsibility of the manufacturer to declare all operating modes when testing multi functional products, prior to commencement of tests.

Measurements at telecommunication ports

In order to make reliable emission measurements representative of high LAN utilisation it is only necessary to create a condition of LAN utilisation in excess of 10% and sustain that level for a minimum of 250 ms. The content of the test traffic should consist of both periodic and pseudo-random messages in order to emulate realistic types of data transmission.

Decision rules for FCC Emission measurements

Decision rules for FCC Emission measurements issue 1 reference ISO/IEC 17025:2017 clause 7.1.3

FCC Part 15 subpart B. ANSI C63.4:2014 (reference clause 10.2.8.2)

Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **FCC Part 15 subpart B**. Where the emission result is above the limit when taking into account the uncertainty of measurement testing is halted, and the customer consulted. If at the customer's request remedial action is not taken an explanatory note is included in the reported results. Note the calculated uncertainty is U_{lab} as shown in the following table.

FCC Part 18 subpart C. FCC MP-5 1986 (Note MP-5 makes no reference to uncertainty of measurement. ETS have taken the decision to follow the guidance as provided in ANSI C63.4:2014 clause 10.2.8.2)

Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **FCC Part 18 subpart C**. Where the emission result is above the limit when taking into account the uncertainty of measurement testing is halted, and the customer consulted. If at the customer's request remedial action is not taken an explanatory note is included in the reported results. Note the calculated uncertainty is U_{lab} as shown in the following

ETS CISPR table radiated and conducted emissions uncertainty of measurement (30th October 2019 issue 8)	issue	EN55016-4-2	uncertainty table	U_{CISPR} Table 1	U_{lab}	$>U_{CISPR}$ $\leq U_{CISPR}$
Conducted AMN 9 KHz – 150 KHz	6	2004	A1	4.0	3.96	-0.04
Conducted AMN 9 KHz – 150 KHz 3 phase	7	2004	A1	4.0	3.96	-0.04
Conducted AMN 150 KHz – 30 MHz	6	2004	A2	3.6	3.59	-0.01
Conducted AMN 150 KHz – 30 MHz 3 phase	7	2004	A2	3.6	3.59	-0.01
Conducted AAN Telecoms 55...40 dB CAT 3	5	2011	B4	5.0	4.11	-0.89
Conducted AAN Telecoms 65...50 dB CAT 5	5	2011	B4	5.0	4.50	-0.50
Conducted AAN Telecoms 75...60 dB CAT 6	5	2011	B4	5.0	4.93	-0.07
Radiated OATS 30 MHz – 200 MHz 3 meters H	5	2004	A4	5.2	4.79	-0.41
Radiated OATS 30 MHz – 200 MHz 10 meters H	5	2004	A4	5.2	4.78	-0.42
Radiated OATS 30 MHz – 200 MHz 3 meters V	5	2004	A5	5.2	4.81	-0.39
Radiated OATS 30 MHz – 200 MHz 10 meters V	5	2004	A5	5.2	4.80	-0.41
Radiated OATS 200 MHz – 1 GHz 3 meters H	5	2004	A6	5.2	5.15	-0.05
Radiated OATS 200 MHz – 1 GHz 10 meters H	5	2004	A6	5.2	5.02	-0.18
Radiated OATS 200 MHz – 1 GHz 3 meters V	5	2004	A7	5.2	5.14	-0.06
Radiated OATS 200 MHz – 1 GHz 10 meters V	5	2004	A7	5.2	5.02	-0.18
Radiated FAR 1 GHz - 6 GHz	8	2011	E1	5.2	6.11	0.91
Radiated FAR 6 GHz - 18 GHz	4	2011	E2	5.5	5.16	-0.34
Radiated SAC Horizontal 30 MHz - 200 MHz	4	2011	D1	6.3	4.87	-1.43
Radiated SAC Horizontal 200 MHz - 1 GHz	4	2011	D3	6.3	4.97	-1.34
Radiated SAC Vertical 30 MHz - 200 MHz	4	2011	D2	6.3	4.98	-1.32
Radiated SAC Vertical 200 MHz - 1 GHz	4	2011	D4	6.3	6.07	-0.23

9.1 Powerline Conducted Emissions Results and Discussion - PSV-AD-50-DS (300 Ohm load) - 50W

Company	Pulsiv
Product	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Applicable Standard	FCC Part 15 Class B

PSV-AD-50-DS (300 Ohm load) - 50W

Test File	Detector	Port	Frequency (MHz)	Level (dBuV)	Margin (dB)	Result
C305CEL1	Average	Live	0.180	33.1	-21.4	Pass
C305CEN1	Average	Neutral	0.180	32.9	-21.5	Pass
C305CEL1	Quasi Peak	Live	1.344	39.8	-16.2	Pass
C305CEN1	Quasi Peak	Neutral	0.177	54.8	-9.8	Pass

The AC Port, Conducted Emissions, plots illustrate the emissions from the EUT on the live and neutral conductors. These results can be compared directly with the FCC Part 15 Class B, limit line shown on the plot.

As it can be seen from the plots, all the emission levels from the EUT were below the FCC Part 15 Class B limit line.

The narrowest compliance margin was -9.8 dB at 0.177 MHz where the measured level was 54.8 dBuV.

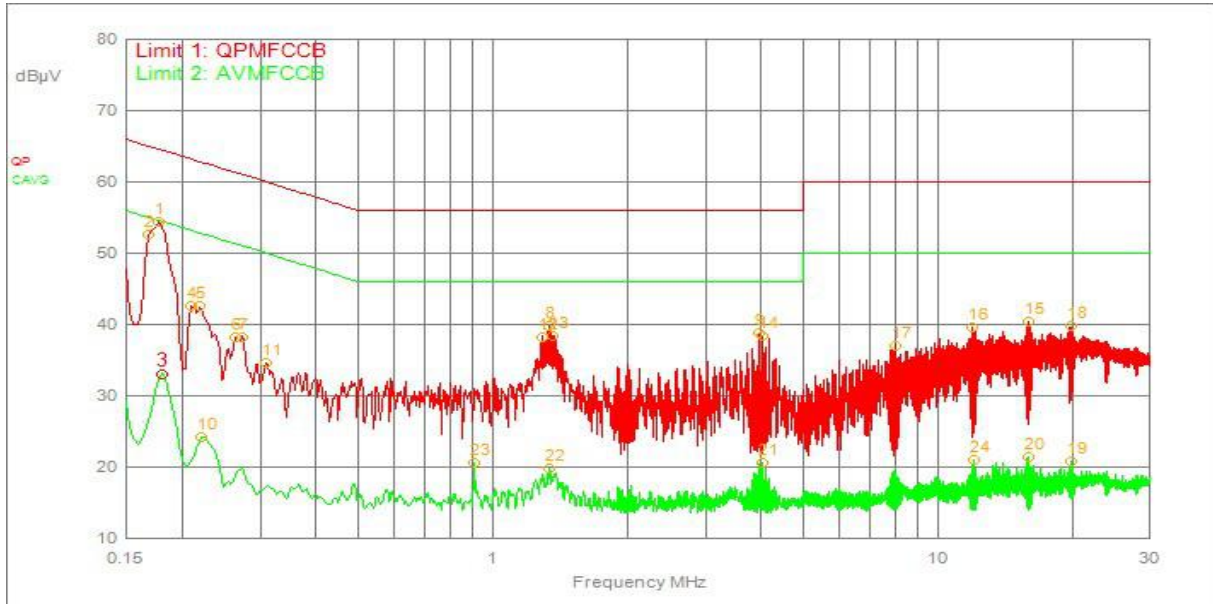
The EUT achieved compliance.

NOTE:

- Emission Level (dBuV) = Reading (dBuV) + Cable Loss (dB) + LISN Factors (dB)
The above calculation is carried out by the test software.

Facility	Temp: ° C	% RH	Pa mbar	Tested by:	Date:
Site 09	22	50	1003	AR	02/08/2022

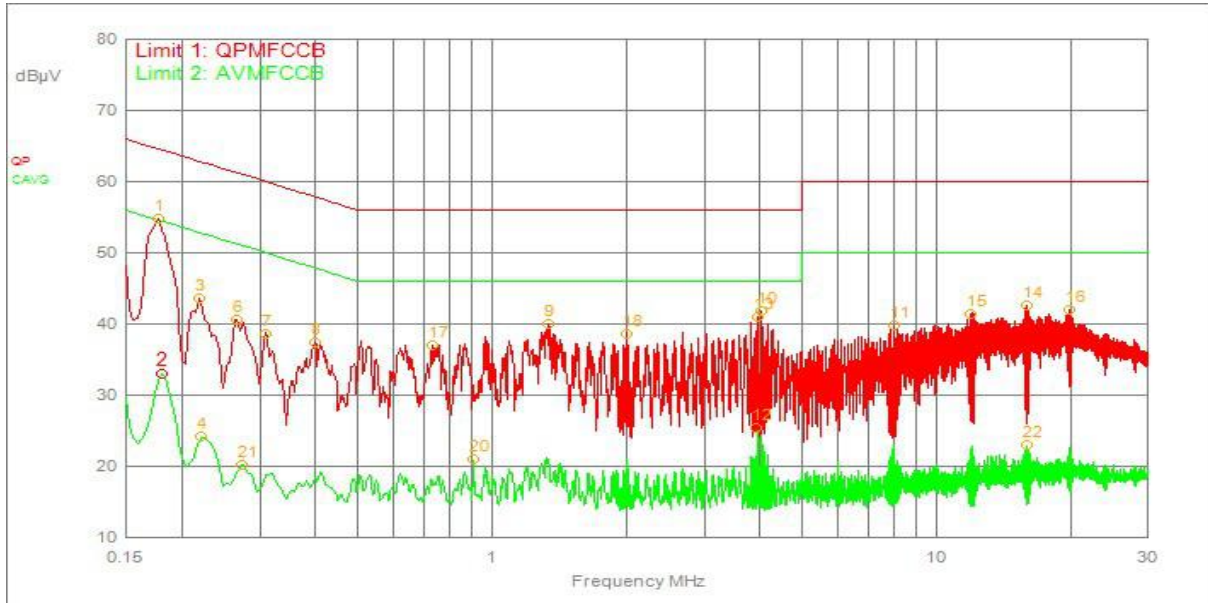
C305CEL1



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
1	177.000kHz	9.6	0.3		QPeak	44.5	54.4	64.6	-10.2
2	168.000kHz	9.6	0.3		QPeak	42.6	52.6	65.1	-12.5
8	1.344MHz	9.6	0.3		QPeak	29.9	39.8	56.0	-16.2
9	3.966MHz	9.6	0.4		QPeak	28.8	38.8	56.0	-17.2
13	1.359MHz	9.6	0.3		QPeak	28.5	38.4	56.0	-17.6
14	4.053MHz	9.7	0.4		QPeak	28.4	38.4	56.0	-17.6
12	1.299MHz	9.6	0.3		QPeak	28.4	38.3	56.0	-17.7
15	16.041MHz	9.7	0.4		QPeak	30.3	40.4	60.0	-19.6
18	19.917MHz	9.7	0.5		QPeak	29.5	39.7	60.0	-20.3
5	219.000kHz	9.6	0.3		QPeak	32.6	42.5	62.9	-20.4
16	11.943MHz	9.7	0.4		QPeak	29.5	39.6	60.0	-20.4
4	210.000kHz	9.6	0.3		QPeak	32.7	42.6	63.2	-20.6
3	180.000kHz	9.6	0.3		C_AVG	23.2	33.1	54.5	-21.4
7	273.000kHz	9.6	0.3		QPeak	28.4	38.3	61.0	-22.7
17	8.064MHz	9.7	0.4		QPeak	27.0	37.0	60.0	-23.0

6	264.000kHz	9.6	0.3		QPeak	28.2	38.1	61.3	-23.2
11	309.000kHz	9.6	0.3		QPeak	24.6	34.6	60.0	-25.4
21	4.056MHz	9.7	0.4		C_AVG	10.6	20.6	46.0	-25.4
23	909.000kHz	9.6	0.3		C_AVG	10.7	20.6	46.0	-25.4
22	1.344MHz	9.6	0.3		C_AVG	9.9	19.8	46.0	-26.2
10	222.000kHz	9.6	0.3		C_AVG	14.3	24.2	52.7	-28.5
20	16.044MHz	9.7	0.4		C_AVG	11.2	21.3	50.0	-28.7
24	12.078MHz	9.7	0.4		C_AVG	10.9	21.0	50.0	-29.0
19	19.962MHz	9.7	0.5		C_AVG	10.6	20.8	50.0	-29.2

C305CEN1



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
1	177.000kHz	9.6	0.3		QPeak	44.9	54.8	64.6	-9.8
10	4.056MHz	9.7	0.4		QPeak	31.8	41.8	56.0	-14.2
13	3.966MHz	9.6	0.4		QPeak	31.0	41.0	56.0	-15.0
9	1.344MHz	9.6	0.3		QPeak	30.0	40.0	56.0	-16.0
18	2.007MHz	9.6	0.3		QPeak	28.8	38.7	56.0	-17.3
14	16.050MHz	9.7	0.4		QPeak	32.5	42.6	60.0	-17.4
16	19.926MHz	9.7	0.5		QPeak	31.8	42.0	60.0	-18.0
15	11.946MHz	9.7	0.4		QPeak	31.4	41.5	60.0	-18.5
17	738.000kHz	9.6	0.3		QPeak	27.1	37.0	56.0	-19.0
3	219.000kHz	9.6	0.3		QPeak	33.7	43.6	62.9	-19.3
11	8.070MHz	9.7	0.4		QPeak	29.6	39.7	60.0	-20.3
8	399.000kHz	9.6	0.3		QPeak	27.4	37.4	57.9	-20.5
6	267.000kHz	9.6	0.3		QPeak	30.7	40.6	61.2	-20.6
7	309.000kHz	9.6	0.3		QPeak	28.8	38.7	60.0	-21.3
2	180.000kHz	9.6	0.3		C_AVG	23.0	32.9	54.5	-21.5

20	909.000kHz	9.6	0.3		C_AVG	11.0	20.9	46.0	-25.1
5	150.000kHz	9.6	0.3		C_AVG	19.7	29.6	56.0	-26.4
22	16.050MHz	9.7	0.4		C_AVG	12.8	22.9	50.0	-27.1
4	222.000kHz	9.6	0.3		C_AVG	14.2	24.1	52.7	-28.7
12	3.951MHz	9.6	0.4		QPeak	15.3	25.3	56.0	-30.7
21	273.000kHz	9.6	0.3		C_AVG	10.2	20.2	51.0	-30.9

9.2 Powerline Conducted Emissions Results and Discussion - PSV-AD-150-DS (90 Ohm load) - 150W

Company	Pulsiv
Product	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Applicable Standard	FCC Part 15 Class B

PSV-AD-150-DS (90 Ohm load) - 150W

Test File	Detector	Port	Frequency (MHz)	Level (dBuV)	Margin (dB)	Result
C305CEL2	Average	Live	0.180	35.5	-19.0	Pass
C305CEN2	Average	Neutral	0.180	35.3	-19.2	Pass
C305CEL2	Quasi Peak	Live	0.177	49.8	-14.8	Pass
C305CEN2	Quasi Peak	Neutral	3.963	43.7	-12.3	Pass

The AC Port, Conducted Emissions, plots illustrate the emissions from the EUT on the live and neutral conductors. These results can be compared directly with the FCC Part 15 Class B, limit line shown on the plot.

As it can be seen from the plots, all the emission levels from the EUT were below the FCC Part 15 Class B limit line.

The narrowest compliance margin was -12.3 dB at 3.963 MHz where the measured level was 43.7 dBuV.

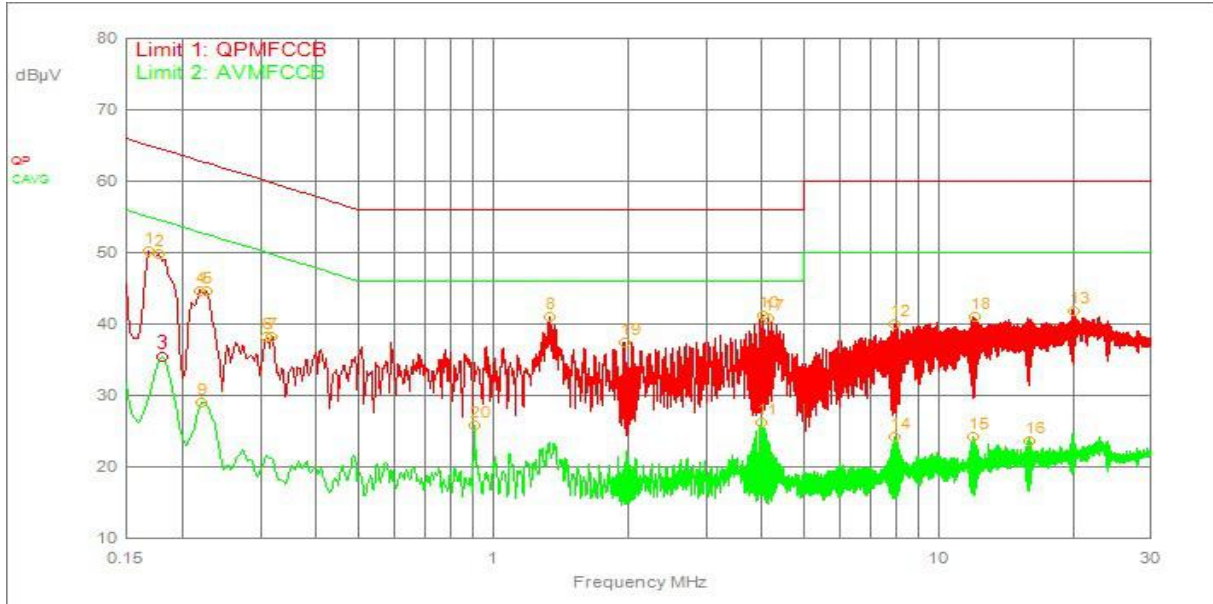
The EUT achieved compliance.

NOTE:

- Emission Level (dBuV) = Reading (dBuV) + Cable Loss (dB) + LISN Factors (dB)
The above calculation is carried out by the test software.

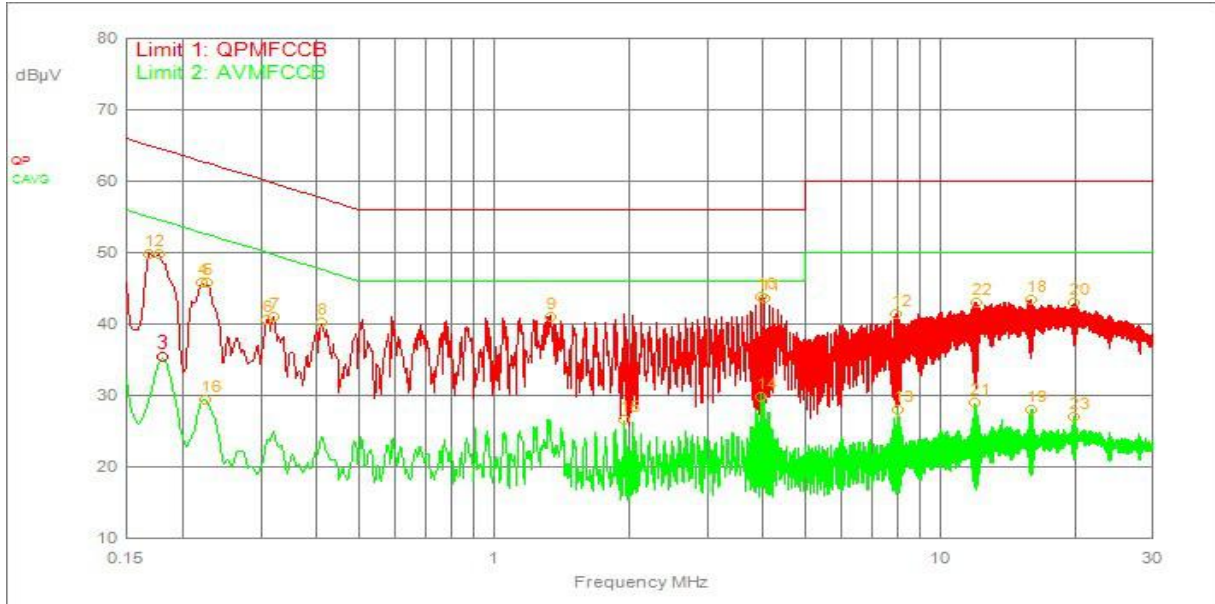
Facility	Temp: ° C	% RH	Pa mbar	Tested by:	Date:
Site 09	22	50	1003	AR	02/08/2022

C305CEL2



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
2	177.000kHz	9.6	0.3		QPeak	39.9	49.8	64.6	-14.8
10	4.047MHz	9.7	0.4		QPeak	31.2	41.2	56.0	-14.8
1	168.000kHz	9.6	0.3		QPeak	40.2	50.1	65.1	-14.9
8	1.341MHz	9.6	0.3		QPeak	31.1	41.0	56.0	-15.0
17	4.140MHz	9.7	0.4		QPeak	30.7	40.8	56.0	-15.2
5	228.000kHz	9.6	0.3		QPeak	34.7	44.6	62.5	-17.9
4	219.000kHz	9.6	0.3		QPeak	34.8	44.7	62.9	-18.1
13	20.112MHz	9.7	0.5		QPeak	31.7	41.8	60.0	-18.2
19	1.980MHz	9.6	0.3		QPeak	27.4	37.4	56.0	-18.6
3	180.000kHz	9.6	0.3		C_AVG	25.6	35.5	54.5	-19.0
18	12.102MHz	9.7	0.4		QPeak	30.8	40.9	60.0	-19.1
11	4.005MHz	9.7	0.4		C_AVG	16.0	26.1	46.0	-19.9
12	7.962MHz	9.7	0.4		QPeak	29.9	40.0	60.0	-20.0
20	909.000kHz	9.6	0.3		C_AVG	15.8	25.8	46.0	-20.2
7	318.000kHz	9.6	0.3		QPeak	28.4	38.3	59.8	-21.4
6	309.000kHz	9.6	0.3		QPeak	28.4	38.3	60.0	-21.7
9	222.000kHz	9.6	0.3		C_AVG	19.2	29.1	52.7	-23.7
14	8.007MHz	9.7	0.4		C_AVG	14.1	24.2	50.0	-25.8
15	12.012MHz	9.7	0.4		C_AVG	14.1	24.2	50.0	-25.8
16	15.972MHz	9.7	0.4		C_AVG	13.5	23.6	50.0	-26.4

C305CEN2



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
10	3.963MHz	9.6	0.4		QPeak	33.7	43.7	56.0	-12.3
11	4.053MHz	9.7	0.4		QPeak	33.6	43.6	56.0	-12.4
2	177.000kHz	9.6	0.3		QPeak	39.8	49.8	64.6	-14.9
1	168.000kHz	9.6	0.3		QPeak	40.0	49.9	65.1	-15.1
9	1.341MHz	9.6	0.3		QPeak	31.0	40.9	56.0	-15.1
18	15.987MHz	9.7	0.4		QPeak	33.2	43.3	60.0	-16.7
5	228.000kHz	9.6	0.3		QPeak	35.8	45.7	62.5	-16.8
4	222.000kHz	9.6	0.3		QPeak	35.9	45.8	62.7	-17.0
22	12.072MHz	9.7	0.4		QPeak	32.9	43.0	60.0	-17.0
20	20.043MHz	9.7	0.5		QPeak	32.7	42.9	60.0	-17.1
8	411.000kHz	9.6	0.3		QPeak	30.1	40.1	57.6	-17.6
12	7.971MHz	9.7	0.4		QPeak	31.3	41.4	60.0	-18.6
7	321.000kHz	9.6	0.3		QPeak	31.1	41.0	59.7	-18.7
3	180.000kHz	9.6	0.3		C_AVG	25.4	35.3	54.5	-19.2
6	309.000kHz	9.6	0.3		QPeak	30.7	40.7	60.0	-19.3

15	1.959MHz	9.6	0.3		C_AVG	16.5	26.5	46.0	-19.5
17	150.000kHz	9.6	0.3		QPeak	35.8	45.7	66.0	-20.3
21	12.024MHz	9.7	0.4		C_AVG	18.8	28.9	50.0	-21.1
13	8.016MHz	9.7	0.4		C_AVG	17.9	28.0	50.0	-22.0
19	16.032MHz	9.7	0.4		C_AVG	17.9	28.0	50.0	-22.0
23	19.995MHz	9.7	0.5		C_AVG	16.9	27.0	50.0	-23.0
16	225.000kHz	9.6	0.3		C_AVG	19.4	29.3	52.6	-23.3
14	3.978MHz	9.6	0.4		QPeak	19.8	29.8	56.0	-26.2

9.3 Powerline Conducted Emissions Results and Discussion - PSV-AD-250-DS (76.6 Ohm load) - 175W

Company	Pulsiv
Product	PSV-AD-250-DS PSV-AD-150-DS PSV-AD-50-DS
Applicable Standard	FCC Part 15 Class B

PSV-AD-250-DS (76.6 Ohm load) - 175W

Test File	Detector	Port	Frequency (MHz)	Level (dBuV)	Margin (dB)	Result
C305CEL3	Average	Live	0.180	38.2	-16.3	Pass
C305CEN3	Average	Neutral	3.999	30.2	-15.8	Pass
C305CEL3	Quasi Peak	Live	0.159	55.3	-10.2	Pass
C305CEN3	Quasi Peak	Neutral	4.044	44.0	-12.0	Pass

The AC Port, Conducted Emissions, plots illustrate the emissions from the EUT on the live and neutral conductors. These results can be compared directly with the FCC Part 15 Class B, limit line shown on the plot.

As it can be seen from the plots, all the emission levels from the EUT were below the FCC Part 15 Class B limit line.

The narrowest compliance margin was -10.2 dB at 0.159 MHz where the measured level was 55.3 dBuV.

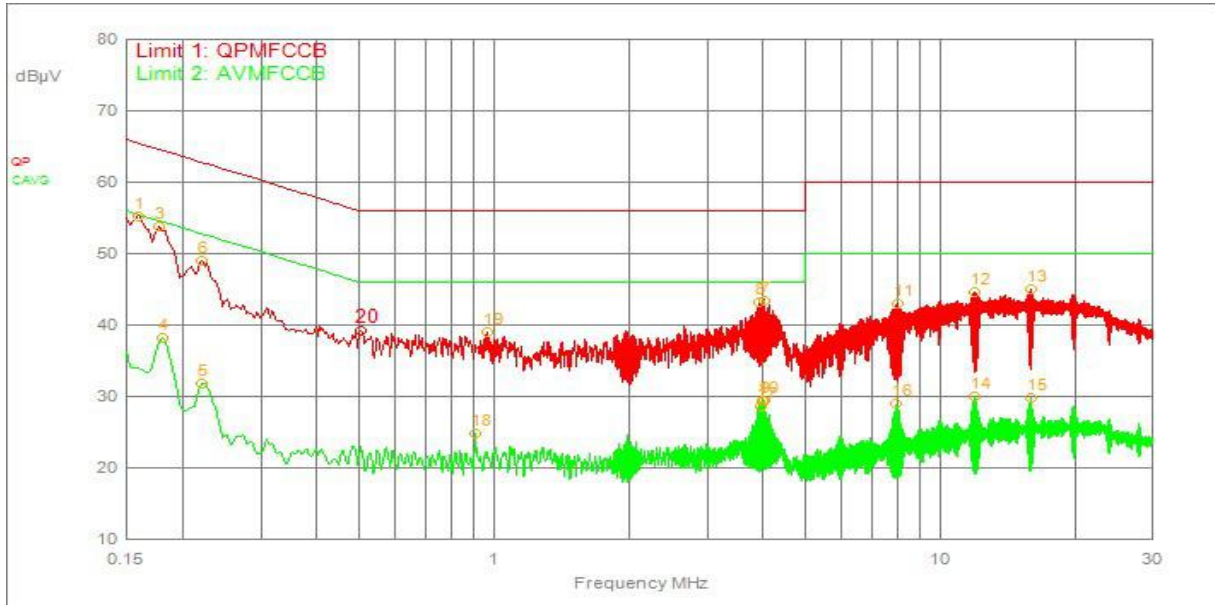
The EUT achieved compliance.

NOTE:

- Emission Level (dBuV) = Reading (dBuV) + Cable Loss (dB) + LISN Factors (dB)
The above calculation is carried out by the test software.

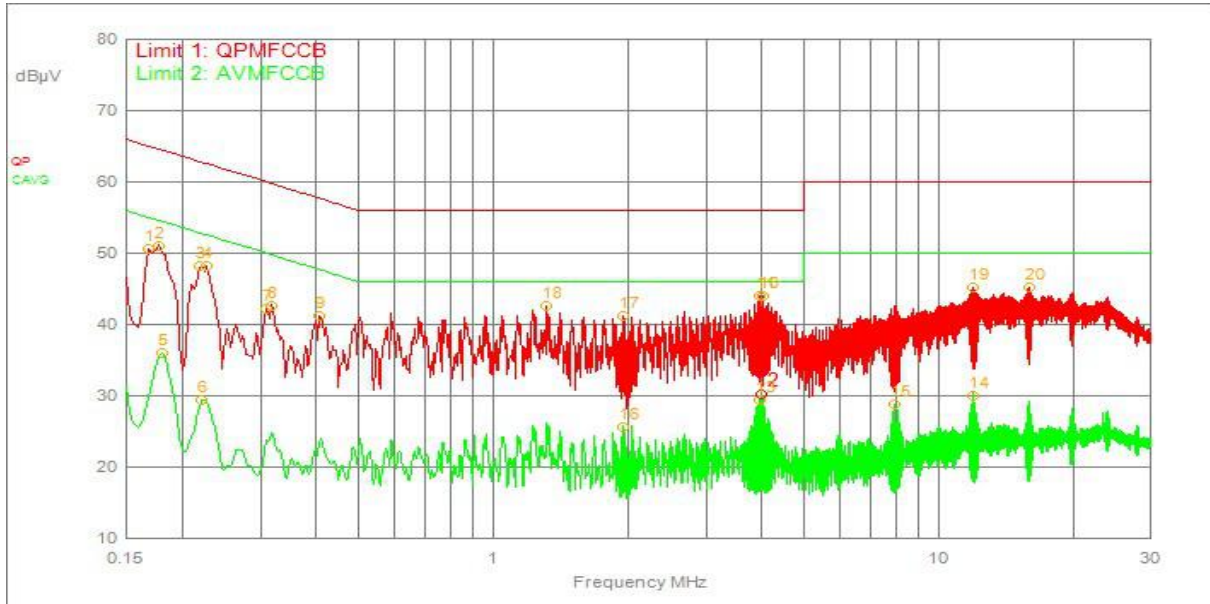
Facility	Temp: ° C	% RH	Pa mbar	Tested by:	Date:
Site 09	22	50	1003	AR	02/08/2022

C305CEL3



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
1	159.000kHz	9.6	0.3		QPeak	45.4	55.3	65.5	-10.2
3	177.000kHz	9.6	0.3		QPeak	43.8	53.8	64.6	-10.9
2	150.000kHz	9.6	0.3		QPeak	45.0	54.9	66.0	-11.1
7	4.044MHz	9.7	0.4		QPeak	33.5	43.5	56.0	-12.5
8	3.951MHz	9.6	0.4		QPeak	33.2	43.2	56.0	-12.8
6	222.000kHz	9.6	0.3		QPeak	39.1	49.0	62.7	-13.7
13	15.987MHz	9.7	0.4		QPeak	34.8	45.0	60.0	-15.0
12	11.991MHz	9.7	0.4		QPeak	34.6	44.7	60.0	-15.3
4	180.000kHz	9.6	0.3		C_AVG	28.3	38.2	54.5	-16.3
9	4.044MHz	9.7	0.4		C_AVG	19.4	29.5	46.0	-16.5
10	3.996MHz	9.6	0.4		C_AVG	19.3	29.4	46.0	-16.6
20	504.000kHz	9.6	0.3		QPeak	29.3	39.2	56.0	-16.8
11	8.043MHz	9.7	0.4		QPeak	32.9	43.0	60.0	-17.0
19	966.000kHz	9.6	0.3		QPeak	29.0	39.0	56.0	-17.0
17	3.954MHz	9.6	0.4		C_AVG	18.6	28.6	46.0	-17.4
14	11.991MHz	9.7	0.4		C_AVG	19.9	30.0	50.0	-20.0
15	15.987MHz	9.7	0.4		C_AVG	19.6	29.7	50.0	-20.3
5	222.000kHz	9.6	0.3		C_AVG	22.0	31.9	52.7	-20.8
16	7.998MHz	9.7	0.4		C_AVG	18.8	28.9	50.0	-21.1
18	909.000kHz	9.6	0.3		C_AVG	14.9	24.8	46.0	-21.2

C305CEN3



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit	Limit Dist.
10	4.044MHz	9.7	0.4		QPeak	34.0	44.0	56.0	-12.0
11	3.954MHz	9.6	0.4		QPeak	33.9	44.0	56.0	-12.0
18	1.317MHz	9.6	0.3		QPeak	32.7	42.6	56.0	-13.4
2	177.000kHz	9.6	0.3		QPeak	41.2	51.1	64.6	-13.5
4	228.000kHz	9.6	0.3		QPeak	38.3	48.2	62.5	-14.3
1	168.000kHz	9.6	0.3		QPeak	40.7	50.6	65.1	-14.4
3	219.000kHz	9.6	0.3		QPeak	38.2	48.1	62.9	-14.8
17	1.956MHz	9.6	0.3		QPeak	31.3	41.2	56.0	-14.8
19	11.997MHz	9.7	0.4		QPeak	35.1	45.2	60.0	-14.8
20	15.999MHz	9.7	0.4		QPeak	35.1	45.2	60.0	-14.8
12	3.999MHz	9.6	0.4		C_AVG	20.2	30.2	46.0	-15.8
9	408.000kHz	9.6	0.3		QPeak	31.3	41.2	57.7	-16.5
13	3.954MHz	9.6	0.4		C_AVG	19.4	29.4	46.0	-16.6
8	318.000kHz	9.6	0.3		QPeak	32.8	42.7	59.8	-17.0
7	309.000kHz	9.6	0.3		QPeak	32.3	42.2	60.0	-17.8
5	180.000kHz	9.6	0.3		C_AVG	26.1	36.0	54.5	-18.5
14	11.997MHz	9.7	0.4		C_AVG	19.9	30.0	50.0	-20.0
16	1.956MHz	9.6	0.3		C_AVG	15.7	25.6	46.0	-20.4
15	7.998MHz	9.7	0.4		C_AVG	18.7	28.8	50.0	-21.2
6	222.000kHz	9.6	0.3		C_AVG	19.4	29.4	52.7	-23.4

From the results obtained, the *Pulsiv Ltd, Pulsiv PFC Development System, PSV-AD-250-DS, PSV-AD-150-DS & PSV-AD-50-DS* system tested, was found to be compliant with the FCC Pt 15 Class B requirements for conducted emissions as follows:

Test Conducted Emissions	Standard	Status
PSV-AD-50-DS (300 Ohm load) - 50W	FCC Pt 15 Class B	Passed with a compliance margin of -9.8 dB
PSV-AD-150-DS (90 Ohm load) - 150W	FCC Pt 15 Class B	Passed with a compliance margin of -12.3 dB
PSV-AD-250-DS (76.6 Ohm load) - 175W	FCC Pt 15 Class B	Passed with a compliance margin of -10.2 dB

The EUT achieved compliance.

Appendix A	Measurement Uncertainty
Appendix B	List of Equipment Used
Appendix C	Support Equipment
Appendix D	Emissions - Test Procedures / Set-Up Conducted Emissions

Measurement Uncertainty

The reported expanded measurement uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a confidence level of approx. 95%. The uncertainty evaluation has been carried out in accordance with M3003 requirements.

The estimated combined standard measurement uncertainties are:

ETS CISPR table radiated and conducted emissions uncertainty of measurement (30th October 2019 issue 8)	issue	EN55016-4-2	uncertainty table	U_{cispr} Table 1	U_{lab}	$>U_{\text{cispr}}$ $\leq U_{\text{cispr}}$
Conducted AMN 9 KHz – 150 KHz	6	2004	A1	4.0	3.96	-0.04
Conducted AMN 9 KHz – 150 KHz 3 phase	7	2004	A1	4.0	3.96	-0.04
Conducted AMN 150 KHz – 30 MHz	6	2004	A2	3.6	3.59	-0.01
Conducted AMN 150 KHz – 30 MHz 3 phase	7	2004	A2	3.6	3.59	-0.01
Conducted AAN Telecoms 55...40 dB CAT 3	5	2011	B4	5.0	4.11	-0.89
Conducted AAN Telecoms 65...50 dB CAT 5	5	2011	B4	5.0	4.50	-0.50
Conducted AAN Telecoms 75...60 dB CAT 6	5	2011	B4	5.0	4.93	-0.07
Radiated OATS 30 MHz – 200 MHz 3 meters H	5	2004	A4	5.2	4.79	-0.41
Radiated OATS 30 MHz – 200 MHz 10 meters H	5	2004	A4	5.2	4.78	-0.42
Radiated OATS 30 MHz – 200 MHz 3 meters V	5	2004	A5	5.2	4.81	-0.39
Radiated OATS 30 MHz – 200 MHz 10 meters V	5	2004	A5	5.2	4.80	-0.41
Radiated OATS 200 MHz – 1 GHz 3 meters H	5	2004	A6	5.2	5.15	-0.05
Radiated OATS 200 MHz – 1 GHz 10 meters H	5	2004	A6	5.2	5.02	-0.18
Radiated OATS 200 MHz – 1 GHz 3 meters V	5	2004	A7	5.2	5.14	-0.06
Radiated OATS 200 MHz – 1 GHz 10 meters V	5	2004	A7	5.2	5.02	-0.18
Radiated FAR 1 GHz - 6 GHz	8	2011	E1	5.2	6.11	0.91
Radiated FAR 6 GHz - 18 GHz	4	2011	E2	5.5	5.16	-0.34
Radiated SAC Horizontal 30 MHz - 200 MHz	4	2011	D1	6.3	4.87	-1.43
Radiated SAC Horizontal 200 MHz - 1 GHz	4	2011	D3	6.3	4.97	-1.34
Radiated SAC Vertical 30 MHz - 200 MHz	4	2011	D2	6.3	4.98	-1.32
Radiated SAC Vertical 200 MHz - 1 GHz	4	2011	D4	6.3	6.07	-0.23

Decision rules for FCC Emission measurements issue 1 reference ISO/IEC 17025:2017 clause 7.1.3

FCC Part 15 subpart B. ANSI C63.4:2014 (reference clause 10.2.8.2)

Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **FCC Part 15 subpart B**. Where the emission result is above the limit when taking into account the uncertainty of measurement testing is halted, and the customer consulted. If at the customer's request remedial action is not taken an explanatory note is included in the reported results. Note the calculated uncertainty is U_{lab} as shown in the following table.

FCC Part 18 subpart C. FCC MP-5 1986 (Note MP-5 makes no reference to uncertainty of measurement. ETS have taken the decision to follow the guidance as provided in ANSI C63.4:2014 clause 10.2.8.2)

Compliance or non-compliance is determined with reference to the relevant limits set for the product group defined in **FCC Part 18 subpart C**. Where the emission result is above the limit when taking into account the uncertainty of measurement testing is halted, and the customer consulted. If at the customer's request remedial action is not taken an explanatory note is included in the reported results. Note the calculated uncertainty is U_{lab} as shown in the following

Compliance Case FCC Part 15 & 18 in accordance with ANSI 63.4:2014 and CISPR 16-4-2:2011
Pass / Fail

Traceability

All measurement equipment calibrations are traceable to national standards.

Calibration

Equipment requiring calibration is calibrated to Manufacturer's specifications. Additional verification tests are performed on a regular basis using in house standards and comparisons.

ID No	Description	Model Number	Manufacturer	Serial Number	Calibration Due	Calibration Date
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TEST		Conducted Emission						
Site	C061	Screened Room	site 9	ETS	N/A	N/A	N/A	Site 09
Equipment	A089	Two-Line V Network	ENV216	Rohde & Schwarz	3560.6550.12-101724-gt	20/11/2022	20/11/2020	
	A089a	FCC AC Cable	0	0	0	20/11/2022	20/11/2020	
	A149	EMI Receiver	FFT3010	AFJ Instruments	3.0102E+11	20/10/2022	20/10/2020	
	B094	CE RF Cable Site 09	RG214	ITC	N/A	23/03/2023	23/03/2022	
	B118	CE Link Cable 2	0	ETS	0	19/07/2023	19/07/2022	
	B144	Coaxial RF Switch 04	CX-210	Diamond Antenna	0	09/02/2023	09/02/2022	

Support Equipment

The table below provides a list of all the support equipment used during the test.

Item	Description, Brand Name, Model	Serial Number
1	15V linear power supply, Eastmap Ltd, EMC test kit (linear PSU in metal enclosure)	-
2	Rheostat 369 Ω 1A	-
3	Rhoestat 150 Ω 2.8A	-
4	Power resistor 1k Ω 300W	-
5	1m 0.75mm ² mains cable, 1m length	-

Conducted Emissions Measurements

Objectives

The objectives are to determine the level of conducted emissions at the Telecommunication ports in the frequency range 150 kHz to 30 MHz. Measured levels are evaluated against the applicable limits of the CFR 47 FCC Part 15 Class B:2016. Test Procedure ETS tpCE

Test Method

Conducted emissions measurements are made over the frequency range 150 kHz - 30 MHz in accordance with CFR 47 FCC Part 15 Class B:2016. Prior to the commencement of tests the test equipment, EUT and support equipment are switched on and allowed to warm up for a minimum of thirty minutes. The RF test receiver parameters are set as per the requirements of CISPR 16. The EUT is positioned on a non-conductive table 0.8 m above the ground plane. Recording of test results is by automated scans with the presentation of results in a graphical and tabulated form.

Test Set-up

