



Test Report issued under the responsibility of:



TEST REPORT

IEC 62368-1

Audio/video, information and communication technology equipment

Part 1: Safety requirements

Report Number: E135494-A6045-CB-1
Date of issue.....: 2020-08-06
Total number of pages: 78

Applicant's name.....: **TDK-LAMBDA UK LTD**
Address: **KINGSLEY AVE**
ILFRACOMBE
EX34 8ES UNITED KINGDOM

Name of Test Laboratory: UL VS Limited
preparing the Report: Unit 1-3 Horizon, Wade Road, Kingsland Business Park, Basingstoke
RG24 8AH, United Kingdom

Test specification:
Standard: IEC 62368-1:2014 (Second Edition)
Test procedure: CB Scheme
Non-standard test method: N/A

Test Report Form No.....: IEC62368_1B
Test Report Form(s) Originator: UL(US)
Master TRF.....: 2014-03




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Test Item description	: Switch Mode Power Supply	
Trade Mark	: TDK-Lambda 	
Manufacturer	: TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM	
Model/Type reference	: CM4 (for nomenclature - output ratings correlation, see Additional Information below.)	
Ratings	: CM4 input rating: 100-240 Vac nom, 7A rms max, 50-60 Hz, (or 120-370Vdc, 7A max) Maximum output power is 600 W. Individual outputs are rated according to combinations between modules fitted. The output modules are: S1 = 1.5 - 7.5 V dc, 25 A, 125 W S2 = 4.5 - 15 V dc, 15 A, 150 W S3 = 9 - 30 V dc, 7.5 A, 150 W S4 = 18 - 58 V dc, 3.75 A, 150 W (see Model Differences for output configurations and ratings)	
Testing procedure and testing location:		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	
Testing location/ address	: UL VS Limited, Unit 1-3 Horizon, Wade Road, Kingsland Business Park, Basingstoke RG24 8AH, United Kingdom	
Tested by (name + signature)	Mark John De sagun / Project Handler	
Approved by (name + signature)	Dennis Butcher / Reviewer	
<input type="checkbox"/>	Testing procedure: CTF Stage 1	
Testing location/ address	:	
Tested by (name + signature)	:	

Approved by (name + signature)			
<input type="checkbox"/>	Testing procedure: CTF Stage 2		
Testing location/ address			
Tested by (name + signature).....:			
Witnessed by (name + signature).....:			
Approved by (name + signature)			
<input type="checkbox"/>	Testing procedure: CTF Stage 3		
<input type="checkbox"/>	Testing procedure: CTF Stage 4		
Testing location/ address			
Tested by (name + signature).....:			
Witnessed by (name + signature).....:			
Approved by (name + signature)			
Supervised by (name + signature)			

List of Attachments (including a total number of pages in each attachment):

National Differences (30 pages)

Enclosures (158 pages)

Summary of testing:**Tests performed (name of test and test clause): None****Testing Location: None****Summary of compliance with National Differences:****List of countries addressed:** Australia / New Zealand, EU Group and National Differences, Japan, USA / Canada

EU Group and National Differences applies to CENELEC member countries: Austria , Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom

 The product fulfils the requirements of: EN 62368-1:2014 + A11:2017

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

TDK-Lambda Product Code: CM400042
 www.emea.tdk-lambda.com CM4 1.5S1 16S3 12S2 31S4
 Input: 100-240Vac nom, 7A rms max 50-60Hz
 120-370Vdc, 7A max. Serial Number
 Output Power: 600W max 1111111111
 Manual: emea.tdk-lambda.com/manual
 Test Results: testcert.emea.tdk-lambda.com

CM4

Customer Part Number
 08-OCT-17 Made in the UK

MODULE OUTPUT

S1	S3	S2	S4
1.5V	16V	12V	31V
+	+	+	+
-	-	-	-
25A	7.5A	15A	3.75A

TDK-Lambda 200439
  CAUTION!
 HOT SURFACE TVH1234567 **CM-S4** PG ADJUST 

Note: The above markings are the minimum requirements required by the safety lab. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.

TEST ITEM PARTICULARS:	
Classification of use by	Skilled person
Supply Connection	AC Mains
Supply % Tolerance	+10%/-15%
Supply Connection – Type	unit for building-in, wiring terminals provided
Considered current rating of protective device as part of building or equipment installation	20 A; building;
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class I
Access location	N/A
Pollution degree (PD)	PD 2
Manufacturer’s specified maximum operating ambient (°C)	70°C with power deratings above 50 °C as described in Additional Information section of this test report
IP protection class	IPX0
Power Systems	TN TT IT - 240 V L-L
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	0.65 + 0.1 kg per output module
POSSIBLE TEST CASE VERDICTS:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement :	P (Pass)
- test object does not meet the requirement :	F (Fail)
TESTING:	
Date of receipt of test item..... :	2019-03-27, 2019-04-16, 2019-05-09, 2019-11-20
Date (s) of performance of tests..... :	2019-12-11 to 2019-12-12, 2020-01-11 to 2020-02-13
GENERAL REMARKS:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer’s Declaration per sub-clause 4.2.5 of IEC60068-2-1:	

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided :	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Not applicable
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When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) :	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM PANYU TRIO MICROTRONICS CO LTD SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA GUANGZHOU GUANGDONG 511453 CHINA
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GENERAL PRODUCT INFORMATION:

Report Summary

All applicable tests according to the referenced standard(s) have been carried out.

Product Description

CM4 series is an AC/DC switch mode power supply. The device uses fan-less, modular architecture based on selection of output modules. Unit can be configured with up to four output modules (in parallel / series combinations) that determine output ratings. The total output power is 600 W (for deratings see additional information). Equipment is open-frame, uses metal baseplate and is intended for building-in to the host equipment.

The CM4 switch mode power supply consists of:

1. Input filter board and power conversion board (PRIMARY)
2. Planar transformer (PRI/SEC)
3. Output modules (SECONDARY)

See Model Differences for details of output modules.

Model Differences

Nomenclature:
 CM4 xZ xY xY xY [opt] [fact]

Where x = Output voltage from the table below.
 Where Z = module from the table below.
 Where Y = optional (depending on total number of slots) module from the table below or O for not fitted.
 Where [opt] can be blank or -IN for power supply inhibit or -EN for power supply enable.
 Where [fact] (for factory option) can be blank for standard unit or -xxx where xxx is any combination of letters or numbers for non-safety related modifications.

CM4 series switch mode power supply can be configured in the following variations "CM4" followed by "Sx", "Zx", "Yx" or "Hx". For output values corresponding to each configuration see table below:

Module	#Slots	Output Voltage Range (Vdc)	Nominal Voltage (Vdc)	Current (A)	Power (W)
S1	1	1.5 - 7.5	5	25	125
Z1	2	1.5 - 7.5	5	50	250
ZA	3	1.5 - 7.5	5	75	375
ZN	4	1.5 - 7.5	5	100	500
Y1	2	3 - 15	10	25	250
HA	4	3 - 15	10	50	500
S2	1	4.5 - 15	12	15	150
Z2	2	4.5 - 15	12	30	300
YA	3	4.5 - 22.5	15	25	375
ZB	3	4.5 - 15	12	45	450
ZP	4	4.5 - 15	12	60	600
YN	4	6 - 30	20	25	500
S3	1	9 - 30	24	7.5	150
Y2	2	9 - 30	24	15	300
ZC	3	9 - 30	24	22.5	450
HB	4	9 - 30	24	30	600
ZQ	4	9 - 30	24	30	600
YB	3	13.5 - 45	36	15	450
S4	1	18 - 58	48	3.75	150
Y3	2	18 - 60	48	7.5	300
ZD	3	18 - 58	48	11.25	450
ZR	4	18 - 58	48	15	600
YP	4	18 - 60	48	15	600
YC	3	27 - 90	72	7.5	450
Y4	2	36 - 116	96	3.75	300
YQ	4	36 - 120	96	7.5	600
YD	3	54 - 174	144	3.75	450
YR	4	72 - 232	192	3.75	600

Additional application considerations – (Considerations used to test a component or sub-assembly) -

Input Parameters:

Nominal input voltage 100 - 240 Vac (or 120 - 370 V dc)

Input voltage range 85 - 264 Vac (or 120 - 370 V dc)

Input frequency range 50 / 60 Hz (47 - 63 Hz tolerated)

Maximum input current 7 A rms (fuse 8 A)

The total output power is 600 W from output modules plus 5 W bias power from J3-Global Signals (5 V dc, 1 A).

The following power deratings are applicable:

a. Line voltages <120 V ac:

600 W @ 120 V ac to 425 W @ 85 V ac (linear, applies to input and output power)

b. Baseplate temperatures > 85°C:

600 W @ 85°C To 300 W @ 105°C (linear, applies to output power and bias power). Baseplate temperature shall be measured on the TS1 reference point defined in the Diagram-01 (see Enclosures).

c. Ambient temperatures > 50°C:

600 W @ 50°C to 300 W @ 70°C (linear, applies to output power)

Line deratings and temperature deratings are cumulative.

The following load conditions were considered during tests and referred as condition A, B or C:

- condition A: 4 x S2 modules loaded with 10Vdc@15A, ambient 50 °C, total power 600 W (4 x 150) + 5 W at Bias Power J3 connector, horizontal mounting on test rig

- condition B: 4 x S2 modules loaded with 10Vdc@7.5A, ambient 50°C and TS1 105°C, total power 300 W (4 x 75) + 2.5 W at Bias Power J3 connector, horizontal mounting on test rig

- condition C: 4 x S2 modules loaded with 10Vdc@15A, ambient 50°C and TS1 85°C, total power 600 W (4 x 150) + 5 W at Bias Power J3 connector, horizontal mounting on test rig.

This report is a reissue of CBTR Ref. No. E316486-A6003-CB-1-Original, CBTC Ref. No. DK-93519-UL.

The following changes were applied:

1. Change of applicant's to TDK-LAMBDA UK LTD;

2. Change of manufacturer's to

TDK-LAMBDA UK LTD

KINGSLEY AVE

ILFRACOMBE

EX34 8ES UNITED KINGDOM

3. Change of factory to:

TDK-LAMBDA UK LTD

KINGSLEY AVE

ILFRACOMBE

EX34 8ES UNITED KINGDOM

PANYU TRIO MICROTRONICS CO LTD

SHIJI INDUSTRIAL ESTATE

DONGYONG

NANSHA

GUANGZHOU

GUANGDONG 511453 CHINA

4. Change of model name to "CM4" series (see Model Differences for nomenclature).

5. The model names and output variants in the report were modified to match the new nomenclature.

6. Installation/ Safety Manual, Letter of Assurance and signed copy of the CB Certificate were updated to match the new details.

There are no changes to the product's construction/configuration.

Based on previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, has been determined that the product continues to comply with the standard. All required tests were carried out under the original investigation.

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of : 70°C (with power deratings above 50°C - see additional information)
- The product is intended for use on the following power systems : TN, TT, IT
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply values : +10%/-15% (for AC mains)
- The equipment disconnect device is considered to be : provided in end-product
- The following circuit locations (with circuit/schematic designation) were investigated as a limited power source (LPS) : PCB0052x.J4 Output Signals connector in all Output Modules, J3 Global Signals (PCB0051A.J3)
- The following were investigated as part of the protective earthing/bonding : Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- The Risk Group of a lamp or lamp system (including LEDs) is : Exempt
- The following are available from the Applicant upon request : Installation (Safety) Instructions / Manual
- The product was investigated to the following additional standard : EN 62368-1:2014 + A11:2017

Engineering Conditions of Acceptability

When installed in an end-product, consideration must be given to the following:

- The following product-line tests are conducted for this product : Earthing Continuity, Electric Strength
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary – Earthed Dead Metal: 370 Vrms, 540 Vpk, Primary-Secondary: 370 Vrms, 487 Vpk
- The following output circuits are at ES1 energy levels : All except module S4. Additionally outputs may be connected in series and exceed ES1 limits and shall be evaluated in end-product.
- The following output circuits are at ES2 energy levels : Output module S4.
- The following output circuits are at PS1 energy levels : J3 Global Signals
- The following output circuits are at PS2 energy levels : .J4 Output Signals connector in all Output Modules
- The following output circuits are at PS3 energy levels : Power outputs of all output modules
- Proper bonding to the end-product main protective earthing termination is : Required
- An investigation of the protective bonding terminals has : been conducted
- The following input terminals/connectors must be connected to the end-product supply neutral : J1 pin N
- The following end-product enclosures are required : Mechanical, Electrical, Fire
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : enclosure - metal (106.8°C), additionally TS1 reference point (85°C or 105°C depending on operation mode - see Additional Information for de-ratings), planar transformer (embedded TC 119.7 °C)
- The maximum continuous power supply output (Watts) relied on forced air cooling from : Fan (AUB0912VH) rated 12 Vdc, 0.6A, at max. 67.8 cfm applied to test rig located at the bottom of unit at 20 mm distance.
- The input voltage and current ratings may need additional evaluation in end-product due to derating used for supply voltage below 120 Vac.

- Additionally, clearance and creepage are deemed sufficient for working voltage up to 370 Vdc . Additional evaluation may be necessary in end-product.
- Product employs T2 signal wound transformer (Class A) and potted planar transformer with PWBs rated 130 °C, for which class A limits are considered during transformer overload test.

ENERGY SOURCE IDENTIFICATION AND CLASSIFICATION TABLE:

(Note 1: Identify the following six (6) energy source forms based on the origin of the energy.)
 (Note 2: The identified classification e.g., ES2, TS1, should be with respect to its ability to cause pain or injury on the body or its ability to ignite a combustible material. Any energy source can be declared Class 3 as a worse case classification e.g. PS3, ES3.)

Electrically-caused injury (Clause 5):

(Note: Identify type of source, list sub-assembly or circuit designation and corresponding energy source classification)

Example: +5 V dc input

ES1

Source of electrical energy	Corresponding classification (ES)
Filter board, power board, planar transformer primary winding	ES3
Planar transformer secondary windings, XFMR distribution board PCB0051A.J1-4 with OPD module fitted	ES2
XFMR distribution board PCB0051A.J1-4 with S1, S2, S3 or no module fitted	ES1
Output Modules S1, S2, S3 main outputs	ES1
Output module S4 main output	ES2
J3 Global signals	ES1
J2 Standby control	ES1
J4 Output Signal on all output modules	ES1

Electrically-caused fire (Clause 6):

(Note: List sub-assembly or circuit designation and corresponding energy source classification)

Example: Battery pack (maximum 85 watts):

PS2

Source of power or PIS	Corresponding classification (PS)
All circuits except J3 Global signals and J4 Output Signals (on all output modules)	PS3
J3 Global signals	PS2
J4 Output Signals (on all output modules)	PS1

Injury caused by hazardous substances (Clause 7)

(Note: Specify hazardous chemicals, whether produces ozone or other chemical construction not addressed as part of the component evaluation.)

Example: Liquid in filled component

Glycol

Source of hazardous substances	Corresponding chemical
N/A	--

Mechanically-caused injury (Clause 8)

(Note: List moving part(s), fan, special installations, etc. & corresponding MS classification based on Table 35.)

Example: Wall mount unit

MS2

Source of kinetic/mechanical energy	Corresponding classification (MS)
Edges and corners	MS1

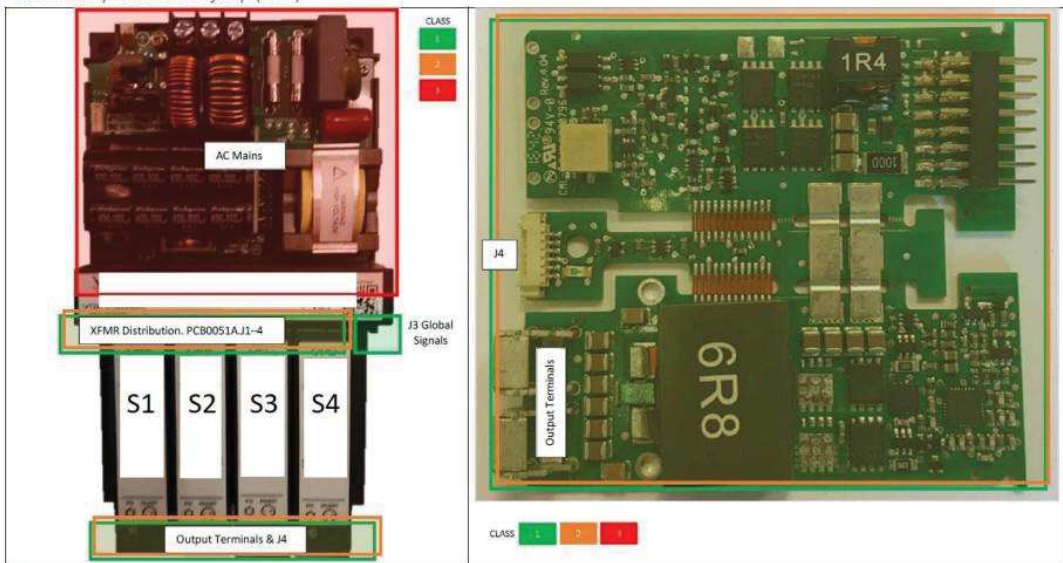
ENERGY SOURCE IDENTIFICATION AND CLASSIFICATION TABLE:	
Thermal burn injury (Clause 9)	
(Note: Identify the surface or support, and corresponding energy source classification based on type of part, location, operating temperature and contact time in Table 38.)	
Example: Hand-held scanner – thermoplastic enclosure TS1	
Source of thermal energy	Corresponding classification (TS)
All surfaces (unit for building-in)	TS3
Radiation (Clause 10)	
(Note: List the types of radiation present in the product and the corresponding energy source classification.)	
Example: DVD – Class 1 Laser Product RS1	
Type of radiation	Corresponding classification (RS)
PCB0052A.LED1 and PCB0051A.LED1	RS1 (Exempt Group)

ENERGY SOURCE DIAGRAM

Indicate which energy sources are included in the energy source diagram. Insert diagram below

ES PS MS TS RS

Electrically Caused Injury (ESx)



Notes:

- 1. Output terminals & J4 = ES1 for S1, S2, S3 and ES2 for S4.
- 2. PCB0051A.J1-4 = ES1 when S1, S2, S3 or no OP module fitted and ES2 when S4 fitted. (Pins not accessible when module fitted)

Electrically Caused Fire (PSx)

AC Mains, Output Terminals & XFMR distribution

CM4

S1 S2 S3 S4

J4

J3 Global Signals

1R4

6R8

Output Terminals

J4

CLASS

1 2 3

CLASS

1 2 3

Notes:

1. J3 = PS2/LPS
2. J4 = PS1/LPS

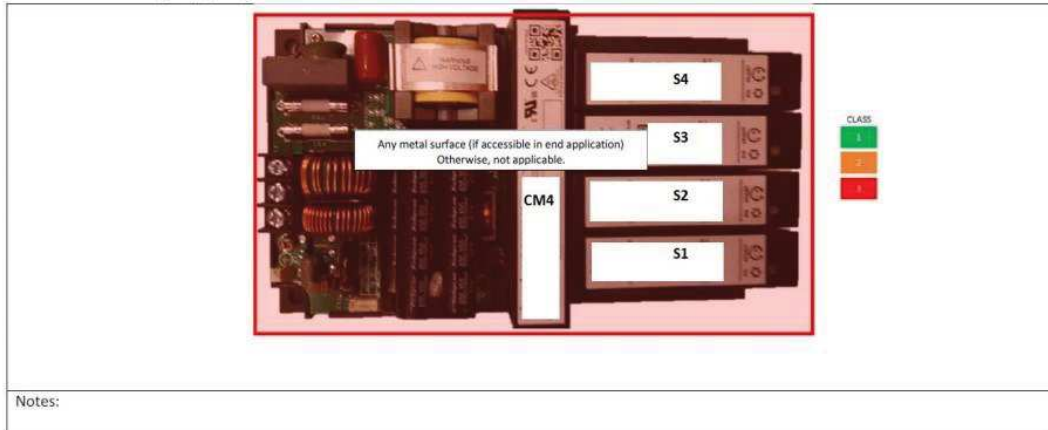
Injury caused by Hazardous Substances

None

Mechanically caused injury (MSx)

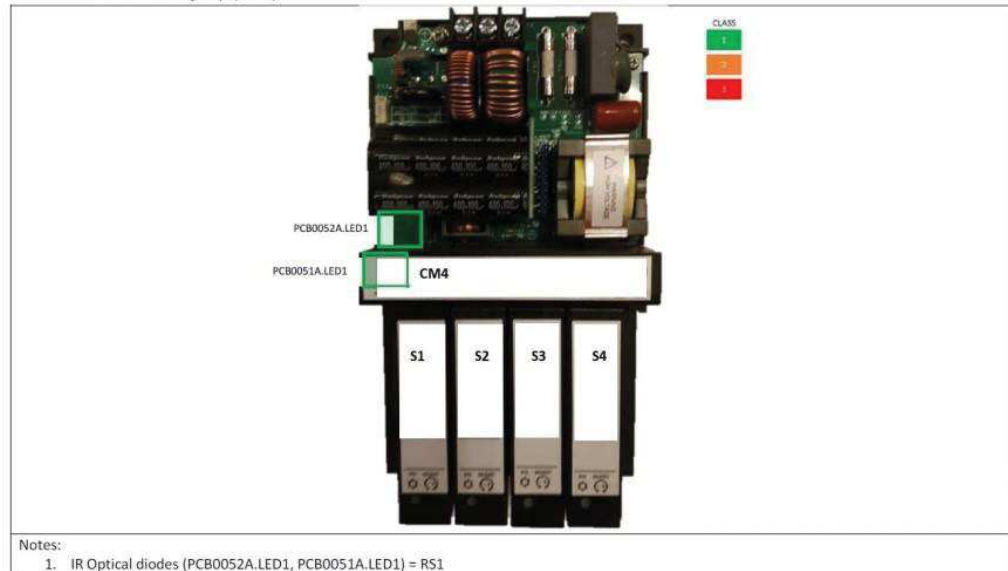
Unit for building in. Only edges and corners considered. Class 1

Thermal burn Injury (TSx)



Notes:

Radiation caused Injury (RSx)



OVERVIEW OF EMPLOYED SAFEGUARDS				
Clause	Possible Hazard			
5.1	Electrically-caused injury			
Body Part (e.g. Ordinary)	Energy Source (ES3: Primary Filter circuit)	Safeguards		
		Basic	Supplementary	Reinforced (Enclosure)
Ordinary Person	ES3: Filter board, power board, planar transformer primary winding	Basic Insulation to earthed chassis	N/A	Reinforced Insulation between AC Mains circuits and output circuits. Additional evaluation in end-product necessary.
Ordinary Person	ES2: Planar transformer secondary windings, XFMR distribution board PCB0051A.J1-4 with OPD module fitted	Circuit not intended to be accessible in end-product. Accessibility to be evaluated in end-product.	N/A	N/A
Ordinary Person	ES2: Output module OPD and all modules connected in series (ES3)	Access to OPD outputs or when all outputs are connected in series shall be evaluated in end product	N/A	Additional evaluation may be needed in end-product when output modules connected in series.
6.1	Electrically-caused fire			
Material part (e.g. mouse enclosure)	Energy Source (PS2: 100 Watt circuit)	Safeguards		
		Basic	Supplementary	Reinforced
All components	PS3: All circuits except connector J3 Global signals (PCB0051A.J3) and J4 Output Signals (on all output modules)	No ignition occurred. No parts exceeding 300°C or 90% of its spontaneous ignition	All components meet cl. 6.4.5.2 requirements. Fire enclosure to be provided in end-product	N/A

		temperatu re - see cl. 6.3		
J3 connectors	PS2: output connectors J3 Global signals (PCB0051A.J3)	No ignition occurred. No parts exceeding 300°C or 90% of its spontaneo us ignition temperatu re - see cl. 6.3	Connectors meet 6.4.5.2 requirements	N/A
J4 connectors	PS1: J4 Output Signals (on all output modules)	No ignition occurred. No parts exceeding 300°C or 90% of its spontaneo us ignition temperatu re - see cl. 6.3	N/A	N/A
7.1	Injury caused by hazardous substances			
Body Part (e.g., skilled)	Energy Source (hazardous material)	Safeguards		
		Basic	Supplementary	Reinforced
N/A	--	--	--	--
8.1	Mechanically-caused injury			
Body Part (e.g. Ordinary)	Energy Source (MS3:High Pressure Lamp)	Safeguards		
		Basic	Supplementary	Reinforced (Enclosure)
Ordinary Person	MS1: Mass	N/A (≤ 7kg)	N/A	--
9.1	Thermal Burn			
Body Part (e.g., Ordinary)	Energy Source (TS2)	Safeguards		
		Basic	Supplementary	Reinforced
Ordinary Person	TS3 declared for all surfaces	unit for building- in, to be evaluated in end- product	unit for building-in, to be evaluated in end-product	--
10.1	Radiation			
		Safeguards		

Body Part (e.g., Ordinary)	Energy Source (Output from audio port)	Basic	Supplementary	Reinforced
Ordinary Person	RS1: LED indicator	N/A (within exempt group)	N/A	--
Supplementary Information:				
(1) See attached energy source diagram for additional details. (2) "N" – Normal Condition; "A" – Abnormal Condition; "S" Single Fault				