Test Report issued under the responsibility of:

TEST REPORT
IEC 62368-1
Audio/video, information and communication technology equipment
Part 1: Safety requirements

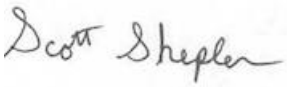
Report Number .....:	E220248-A6020-CB-1
Date of issue.....:	2020-10-22
Total number of pages .....:	56
Applicant's name.....:	**TDK-LAMBDA AMERICAS INC**
Address .....:	**SUITE 100** **3320 MATRIX DR** **RICHARDSON TX 75082** **UNITED STATES**
Name of Test Laboratory preparing the Report .....:	UL RTP 12 Laboratory Drive, Research Triangle Park , NC, 27709, USA
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

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory.
The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test Item description :	DC-To-DC Converters	
Trade Mark .....:	TDK	
Manufacturer .....:	TDK-LAMBDA AMERICAS INC SUITE 100 3320 MATRIX DR RICHARDSON TX 75082 UNITED STATES	
Model/Type reference .....:	FQA020ADC-XXX-(S) or -(M) FQB020ADC-XXX(-S) or (-M) Where "XXX" may be any alphanumeric character representing non safety features.	
Ratings .....:	Not required: Input: 28VDC Nominal, range 10 - 40 VDC Output: 28VDC Nominal, range 10 - 40 VDC	
Testing procedure and testing location:		
☒ CB Testing Laboratory:		
Testing location/ address .....:	UL RTP, 12 Laboratory Drive, Research Triangle Park , NC, 27709, USA	
Tested by (name + signature).....:	Mengis Tesfay / Project Handler	Mengis Tesfay
Approved by (name + signature) .....:	Scott Shepler / Reviewer	Scott Shepler
☐ Testing procedure: CTF Stage 1		
Testing location/ address..... :		
Tested by (name + signature).....:		
Approved by (name + signature) .....:		
☒ Testing procedure: CTF Stage 2		
Testing location/ address.....:	TDK-LAMBDA AMERICAS INC SUITE 100 3320 MATRIX DR RICHARDSON TX 75082 UNITED STATES	

Tested by (name + signature).....:	Tim Fellowes / Tester	
Witnessed by (name + signature).....:	Mengis Tesfay / Project Handler	
Approved by (name + signature) .....:	Scott Shepler / Reviewer	
☐ Testing procedure: CTF Stage 3		
☐ 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 (40 pages)	
Summary of testing:	
Tests performed (name of test and test clause):	**Testing Location:** **CTF Stage 2: TDK-LAMBDA AMERICAS INC** **SUITE 100** **3320 MATRIX DR** **RICHARDSON TX 75082** **UNITED STATES**
ELECTRIC STRENGTH TEST (5.4.9)	5.2.2 – Electric Strength Test - Testing conducted under IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013 evaluation was considered equivalent. Testing conducted under CB report, E220248-A41-CB-1, E220248-A41 (UL) and corresponding CB Test Certificate Ref. US-31662-UL respectively in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Additional Electric Strength test per IEC 62368-1 was conducted as part of this evaluation. Testing correlation explanation is provided in Enclosure.
INPUT TEST: SINGLE PHASE (B.2.5)	INPUT TEST (1.6.2). Testing conducted under IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013 evaluation was considered equivalent. Testing conducted under CB report, E220248-A41-CB-1, E220248-A41 (UL) and corresponding CB Test Certificate Ref. US-31662-UL respectively in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Testing correlation explanation is provided in Enclosure.
NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT (B.2.6)	HEATING TEST. 4.5. Testing conducted under IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013 evaluation was considered equivalent. Testing conducted under CB report, E220248-A41-CB-1, E220248-A41 (UL) and corresponding CB Test Certificate Ref. US-31662-UL respectively in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1,

	2014. Testing correlation explanation is provided in Enclosure.
SIMULATED ABNORMAL OPERATING CONDITIONS (B.3)	Abnormal Operation (5.3.1 - 5.3.9). Testing conducted under IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013 evaluation was considered equivalent. Testing conducted under CB report, E220248-A41-CB-1, E220248-A41 (UL) and corresponding CB Test Certificate Ref. US-31662-UL respectively in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Testing correlation explanation is provided in Enclosure.
SIMULATED SINGLE FAULT CONDITIONS (B.4)	FAULT CONDITION TEST (5.3); Power Supply Output Short-Circuit/Overload (5.3.7)
	Component Failure (5.3.1, 5.3.4, 5.3.7). Testing conducted under CB report, E220248-A41-CB-1, E220248-A41 (UL) and corresponding CB Test Certificate Ref. US-31662-UL respectively in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Testing correlation explanation is provided in Enclosure.
TEST FOR THE PERMANENCE OF MARKINGS (ANNEX F.3.10)	Test was covered under E220248-A6002-CB. Testing conducted under IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013 evaluation was considered equivalent. Test was covered under E220248-A6002-CB. Testing conducted in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Testing correlation explanation is provided in Enclosure.

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.

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	Instructed person
Supply Connection	External Circuit - not Mains connected ES1
Supply % Tolerance	None
Supply Connection – Type	Not connected to Mains. For building in
Considered current rating of protective device as part of building or equipment installation	N/A (For building in) A; equipment
Equipment mobility	for building-in
Over voltage category (OVC)	other: Not directly connected to Mains
Class of equipment	Class III
Access location	N/A
Pollution degree (PD)	PD 2
Manufacturer's specified maximum operating ambient (°C)	25°C
IP protection class	IPX0
Power Systems	N/A
Altitude during operation (m)	2000 m or less
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	<1
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..... :	2018-03-20, 2020-10-02
Date (s) of performance of tests..... :	2018-03-28, 2020-10-02
GENERAL REMARKS:	
"(See Enclosure #)" refers to additional information appended to the report. **"(See appended table)" refers to a table appended to the report.** **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	

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 ..... :	☒ **Yes** ☐ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ..... :	TDK-LAMBDA AMERICAS INC SUITE 100 3320 MATRIX DR RICHARDSON TX 75082 UNITED STATES TDK-LAMBDA MALAYSIA SDN BHD PLO33 KAWASAN PERINDUSTRIAN SENAI 81400 SENAI JOHOR MALAYSIA

GENERAL PRODUCT INFORMATION:

Report Summary

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

Product Description

The units are DC-DC power filter modules for building in designed to help reduce differential and common mode conducted emissions from dc-dc switching power supplies.

Model Differences

Models FQA020ADC-XXX-(S) and FQB020ADC-XXX(-S) modules are identical in construction except Q12 is not populated on model FQA020ADC-XXX-(S).

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

This report is based on CB report, E220248-A41-CB-1, and corresponding CB Test Certificate Ref. US-31662-UL respectively, which was previously evaluated to UL/CSA/IEC 60950-1, 2nd edition, + Amendment 1, and Amendment 2. Testing conducted in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Testing correlation explanation is provided in Enclosure.

Additional Electric Strength test per IEC 62368-1 was conducted as part of this evaluation.

The nameplate included in the report is representative of all models covered under this report.

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of : 25°C
- The product is intended for use on the following power systems : No direct connection

- Considered current rating of protective device as part of the building installation (A) : For building in. The filter modules are not internally fused. An external fuse of 30A is recommended. See manufacturer's data sheet for additional information.
- Mains supply tolerance (%) or absolute mains supply values : No direct connection
- The equipment disconnect device is considered to be : N/A
- 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 : Electric Strength
- The following output circuits are at ES1 energy levels : All
- The following output circuits are at PS3 energy levels : Output Terminal
- The maximum investigated branch circuit rating is : EUT is for building in.
- The investigated Pollution Degree is : 2
- An investigation of the protective bonding terminals has : not been conducted
- The following end-product enclosures are required : Electrical, Fire
- The power supply was evaluated to be used at altitudes up to : "2,000 m"
- Heating Test shall be considered in end product.
- This component has been evaluated in 'control of fire spread' method assuming appropriate fire enclosure is provided in end product. Unless the fire enclosure is made of non-combustible or V-0 material, the separation from the PIS shall be considered
- Classification of PIS has not been conducted. Therefore, all electrical components and conductors including printed wirings were assumed to be arcing/resistive PIS.
- Unit intended for building-in and supplied power from secondary circuit which is isolated from primary circuit by double or reinforced insulation.
- The Quarter brick package filter modules come with through hole pins with 4.57mm tail length are used for mounting the modules in the end user application.
- Input test Measurements were made in fixture on lab bench with Fan, rated: 14Vdc, 0.3Adc.
- The following Production-Line tests are conducted for this product: Electric Strength as follows: 2250Vdc Input to Ground

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)**
Instructed Person (Models FQA020ADC-XXX-(S) and FQB020ADC-XXX(-S). All circuits.	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)**
Input, Internal, Output (Models FQA020ADC-XXX-(S) and FQB020ADC-XXX(-S)	PS3 (For building in.)
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)**
N/A	--
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)**
PWB and Components (All Models)	TS3 (for building in, to be addressed in the end product)
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)**
N/A	--

ENERGY SOURCE DIAGRAM
Indicate which energy sources are included in the energy source diagram. Insert diagram below
☒ **ES** ☒ **PS** ☐ **MS** ☒ **TS** ☐ **RS**

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)
Instructed Person (Models FQA020ADC-XXX-(S) and FQB020ADC-XXX(-S)	ES1: Input, Internal, Output	Instructed Person	--	For building in. Enclosure to be provided in an end product.
6.1	Electrically-caused fire			
Material part (e.g. mouse enclosure)	Energy Source (PS2: 100 Watt circuit)	Safeguards		
		Basic	Supplementary	Reinforced
Input, Internal, Output (Models FQA020ADC-XXX-(S) and FQB020ADC-XXX(-S)	PS3	Do not ignite	PWB: Rated V1	For building in. Enclosure to be provided in an end product.
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)
N/A	--	--	--	--
9.1	Thermal Burn			
Body Part (e.g., Ordinary)	Energy Source (TS2)	Safeguards		
		Basic	Supplementary	Reinforced
PWB and Components (Models FQA020ADC-XXX-(S) and FQB020ADC-XXX(-S)	TS3	--	--	EUT is for building in. Enclosure to be provided in end product.
10.1	Radiation			
Body Part (e.g., Ordinary)	Energy Source (Output from audio port)	Safeguards		
		Basic	Supplementary	Reinforced

N/A	--	--	--	--
Supplementary Information:				
(1) See attached energy source diagram for additional details. (2) “N” – Normal Condition; “A” – Abnormal Condition; “S” Single Fault				