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-A6018-CB-1
Date of issue.....:	2019-12-27 ; Amendment 4 : 2024-01-16
Total number of pages .....:	23
Name of Testing Laboratory preparing the Report .....:	UL International Polska sp. z o.o.
Applicant's name.....:	**TDK-LAMBDA UK LTD**
Address .....:	**KINGSLEY AVE** **ILFRACOMBE** **EX34 8ES UNITED KINGDOM**
Test specification:	
Standard.....:	IEC 62368-1:2014
Test procedure .....:	CB Scheme
Non-standard test method.....:	N/A
TRF template used .....:	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.....:	IEC62368_1D
Test Report Form(s) Originator .....:	UL(US)
Master TRF.....:	Dated 2022-04-14

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 .....:	AC-DC Power Supply
Trade Mark(s) .....:	TDK-Lambda
Manufacturer .....:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM
Model/Type reference .....:	EFE300 Series or EFE-300 Series: May be prefixed by NS-# or SP followed by / or – (where # may be any number of characters indicating non-safety related model differences, e.g. extra labels on the unit, SP represents a sales code). Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences. Followed by x-a-bcde-f-g-hij. See test report model differences for details of models and nomenclature.
Ratings .....:	100-240Vac, 4.7Arms max, 45-440Hz 133-318Vdc, 3.8Adc max (Ratings are optional for open frame units; See model differences for details of ratings)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	CB Testing Laboratory:		
Testing location/ address .....:		UL International Polska sp. z o.o. Równoległa 4, PL-02-235 Warszawa, Poland	
Tested by (name, function, signature).....:		Kamil Janeczek / Project Handler	Janeczek Kamil
Approved by (name, function, signature).....:		Krzysztof Rycharski / Reviewer	Rycharski Krzysztof
☐	Testing procedure: CTF Stage 1:		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature).....:			
☐	Testing procedure: CTF Stage 2:		
Testing location/ address.....:			

Tested by (name, function, signature) .....:		
Witnessed by (name, function, signature) ...:		
Approved by (name, function, signature).....:		
☒ Testing procedure: CTF Stage 3:		
☐ Testing procedure: CTF Stage 4:		
Testing location/ address.....:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM	
Tested by (name, function, signature) .....:	K.Laffey, M.Carter / Test Engineer	see prior report CBTR for signatures
Witnessed by (name, function, signature) ...:	Jan J. Jensen / Project Engineer	see prior report CBTR for signatures
Approved by (name, function, signature).....:	Kamil Janeczek / Project Handler	see prior report CBTR for signatures
Supervised by (name, function, signature) ..:	Krzysztof Rycharski / Reviewer	see prior report CBTR for signatures

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

National Differences (0 pages)
Enclosures (3 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 - AU, New Zealand - NZ, EU Group Differences, Japan - JP, United States of America - US, Canada - CA

United Kingdom (per customer's request shown separately), BS EN 62368-1:2014 + A11:2017

☒ **The product fulfils the requirements of:** EN 62368-1:2014 + A11:2017, CSA/UL 62368-1: 2014, AS/NZS 62368.1:2018, J62368-1 (2020)

Use of uncertainty of measurement for decisions on conformity (decision rule) :

☒ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty (“simple acceptance” decision rule, previously known as “accuracy method”).

☐ Other:… (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

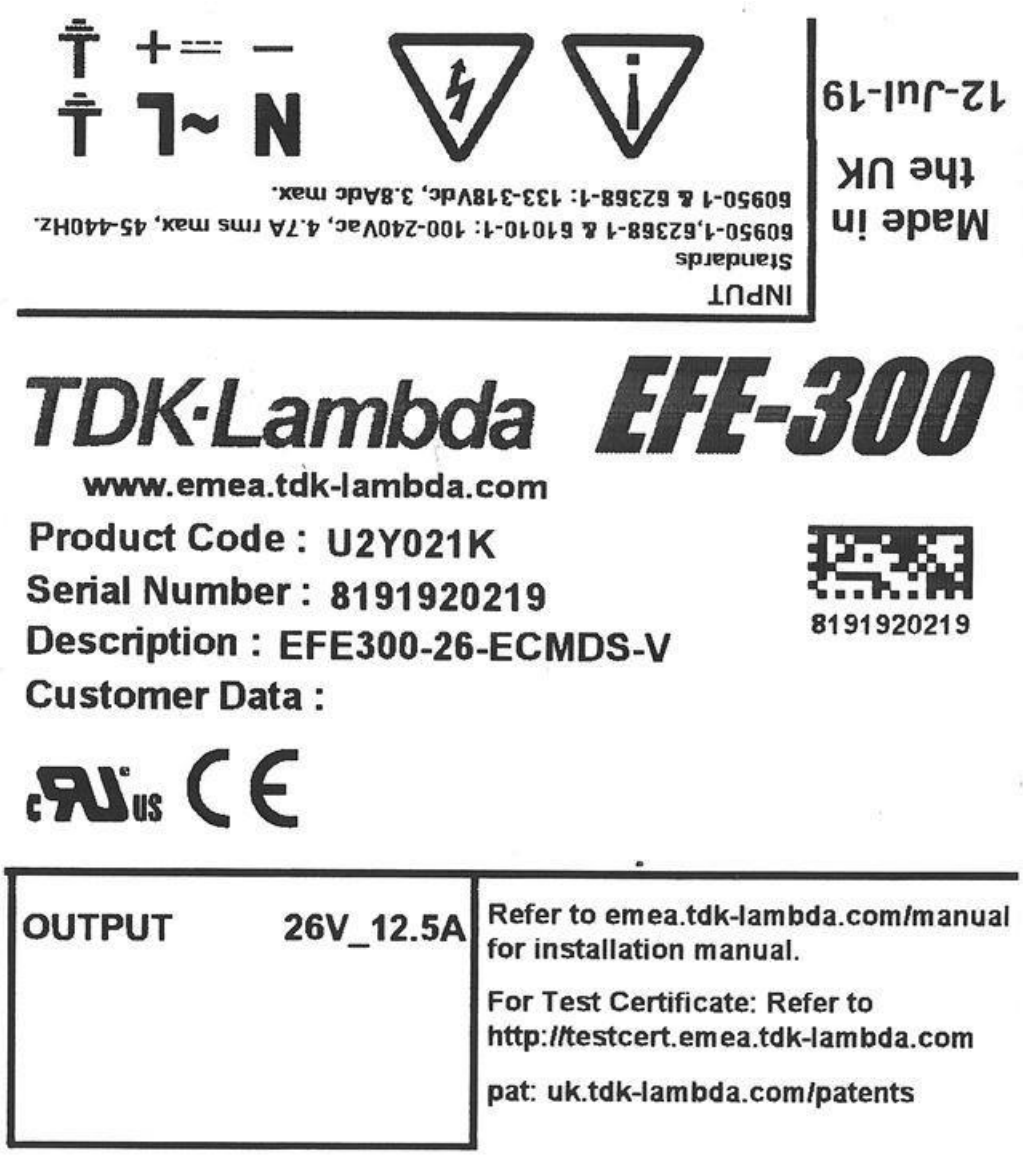
Information on uncertainty of measurement:

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE. IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

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	Skilled person
Supply Connection	AC Mains DC Mains External Circuit - not Mains connected ES3 (for models with abbreviation b = CN for Open Frame with Fan Output)
Supply % Tolerance	+10%/-10%
Supply Connection – Type	mating connector
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)	50°C (Full Load); 70°C (Output power decreased linearly by 2.5%/°C above 50°C)
IP protection class	IPX0
Power Systems	TN
Altitude during operation (m)	3000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	< 1kg
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..... :	N/A
Date (s) of performance of tests..... :	N/A
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 UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM Panyu Trio Microtronics Co Ltd SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA GUANGZHOU GUANGDONG 511453 CHINA TDK-LAMBDA CORP 2704-1 SETTAYA-MACHI NAGAOKA-SHI NIIGATA-KEN 940-1195 JAPAN Trio-Tronics (Thailand) Ltd 7/295 Mu. 6 Map Yang Phon Sub-District Pluak Daeng District Rayong Province THAILAND

GENERAL PRODUCT INFORMATION:

Report Summary

The original report was modified on 2024-01-16 to include the following changes/additions:
Technical amendment 3: This is a technical amendment of CBTR Ref. No. E135494-A6018-CB-1-Original, including Correction 1, Amendment 1, Amendment 2, Amendment 3 issued on 2023-11-16, CBTC Ref. No. DK-91579-M2-UL issued on 2023-11-16 (Original Issue Date: 2019-12-30).

The report was issued to include the following modifications:
- update of model name
- change of CCN for L4 output choke from QMFZ2 to "QMFZ2 or QMTS2"
- small corrections on CCL.

No testing was considered necessary.

Product Description

EFE300 or EFE-300 Series. Switch mode power supplies for building into end equipment

May be prefixed by NS-# or SP followed by / or – (where # may be any number of characters indicating non-safety related model differences, e.g. extra labels on the unit, SP represents a sales code).

Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences. Followed by x-a-bcde-f-g-hij. See test report model differences for details of models and nomenclature.

Model Differences

Model Differences –

Nominal Input Voltage Range 100 – 240Vac or 133 – 318Vdc (conditioned)

Maximum Input Voltage Range 90* – 264Vac or 120 – 350Vdc

Input Frequency 45 – 440*Hz Maximum or DC

Maximum Input Current 4.7A rms or 3.8A dc

*Channel 1 output is linearly derated from 90Vac to 85Vac, 4W/Volt to 280W

All ratings apply for ambient temperatures up to 50°C. From 50 to 70°C the output power is derated at 2.5% per °C.

Unit Configuration Code:

EFE300 or EFE-300x-a-bcde-f-g-hij

(may be prefixed by NS - # / where # may be any number of characters indicating non-safety related model differences). Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences.

May be prefixed by SP followed by / or – (SP represents a sales code)

Where:

x = Nothing or J for Japanese models (may have non-safety differences)

a = Channel 1 output voltage: any voltage within the adjustment range for the Vout (nom) from the Output Table below e.g. 12.8 for 12.8V output (12Vout nom), 24.6 for 24.6V output (24Vout nom).

b = CN for Open Frame with Fan Output

CU for U-Chassis with Fan Output

CC for U-Chassis and Cover with Fan Output

EC for U-Chassis and Cover with Fan

c = M for Molex input connector, J for JST connector or equivalent

d = D for Dual Fused Input or L for Single Fuse in the live line

e = S for Standard Leakage, L for Low Leakage, R for Reduced Leakage, T for Tiny Leakage*

f = Nothing for Horizontal Output Connector, V for Vertical Output Connector

g = Nothing for standard channel 1 output voltage. xD or xPD where D is for units with programmed negative load regulation. PD is for units with programmed positive load regulation. x is the voltage of the regulation in 100mV and is within the Output Adjustment Range (example: 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation)

hij = Three numbers from 0 to 9 which denotes various output voltage/current settings within the specified ranges of each output for a particular unit or blank for the standard output settings (may define non-safety related parameters/features e.g. reduced primary current limit, reduced OVP)

* At 440Hz leakage current is > 3.5mA and therefore must be assessed in the end use application

* L = < 300µA leakage, R = < 150µA Leakage and T = <75µA Leakage

Output Parameters:

O/P Channel Vout nom (V) Range (V) Max O/P (A) Max O/P (W)
CH1 12 11.4 – 13.2* 25 300 (400**)
24 22.8 – 26.4* 12.5 300 (400**)
Fan output 12 Fixed 0.25 3

* Can be adjusted from nominal at the factory only
** Peak power of 400W for 10 seconds maximum, maximum RMS power of 300W

Maximum continuous power output 300W (excluding fan output)

Output Limitations:

All outputs are ES1.
All outputs have functional spacing's to earth and due consideration must be given to this in the end product.

Ratings on marking label
For open frame units (where abbreviation b is CN for Open Frame with Fan Output) no electrical ratings are placed on a marking label. Electrical ratings in the manual must match those in the test report.

Additional application considerations – (Considerations used to test a component or sub-assembly) -
Additional application considerations – (Considerations used to test a component or sub-assembly) –
Customer Air Cooling (CN, CU and CC options):

The following components require special consideration during end-product thermal (heating) tests due to the indicated maximum temperature measurements during component-level testing. The components listed in the following table must not exceed the temperature given. To determine the component temperatures the heating tests must be conducted in accordance with the requirement of the standard concerned. There is no requirement to perform abnormal or single fault testing as this has been considered in the testing of this report.

Test requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification which will result in the highest temperatures in the PSU. To determine the most adverse conditions, consideration should be given to the end use equipment maximum operating ambient, the PSU loading and input voltage, ventilation, end use equipment orientation, the position of doors & covers, etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive, or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilised.

Circuit Reference Description Max. Temperature (°C)
J1 Input connector 75
L1, L2 Common mode choke winding 115 (130)
C7, C8 X Capacitors 100
C9 Reservoir Capacitor (Electrolytic) 60 (105)
L3 Boost Choke Winding 115 (140
TX2 Transformer Winding 120 (130)
TX2 Transformer Core 120 (130)
TX2 Transformer Braid 120 (130)

U2 Opto-coupler 75 (100)
C10, C11 Channel 1 Output Capacitors 80 (105)
L6 Primary Choke (24V model only) 120 (130)
L4 Channel 1 Output Choke 115 (130)
XU2/XU8 Fan Regulator 115 (130)
XQ201 Boost FET (IMS Board) 115 (130)
Q1 Channel 1 Output FET (Adjacent to R4) 115 (130)
XU3 Primary Driver IC 100 (130)
Various All Other Electrolytic Capacitors 80 (105)

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of : 50°C (full load); 70°C (power and output current decreasing linearly by 2.5%/°C above 50°C)
- The product is intended for use on the following power systems : TN
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply values : +10%/-10%
- The equipment disconnect device is considered to be : To be provided in the end equipment
- The following were investigated as part of the protective earthing/bonding : Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- 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, CSA CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014
- Capacitors are rated for 230V due to the IT power system used in Norway. Further evaluation may be required in the end use product.
- • Multi-layer PWB's accepted under CBTR Ref. No. E349607-A23 dated 2014-07-31. Letter report included under Enclosure of this report –
- A maximum of 2 units are permitted to be connected in series
- Series connection of units is not permitted in conjunction with DC input

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, Earthing Continuity
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-Secondary: 392 Vrms, 762 Vpk, Primary – Earthed Dead Metal: 392 Vrms 668 Vpk
- The following output circuits are at ES1 energy levels : All
- The following output circuits are at ES3 energy levels : Series connected outputs
- The following output circuits are at PS3 energy levels : All Outputs
- The maximum investigated branch circuit rating is : 20 A
- The investigated Pollution Degree is : 2
- Proper bonding to the end-product main protective earthing termination is : Required
- An investigation of the protective bonding terminals has : been conducted
- The following end-product enclosures are required : Mechanical, Fire, Electrical
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C) : Transformer TX2 (Class F) – See table 4.1.2 for details of insulation system used.
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : Customer air models require component temperatures to be monitored as detailed in the Additional Application Considerations section under additional information of this report.
- The equipment is suitable for direct connection to : AC and/or DC mains supply
- The power supply was evaluated to be used at altitudes up to : 3000m
- • Fans: The fan provided in this sub-assembly is provided with a fan guard to reduce the risk of contact with the rotor. The fan provided in this sub-assembly is not intended for operator access