



BUREAU  
VERITAS

# Test Report

Applicant	OmniPreSense Corporation 1650 Zanker Road Suite 222 San Jose, CA 95112 USA	
Manufacturer	Same as above	
Factory	OmniPreSense Corporation (SNA Computer for PCB assembly)	
Items tested	<b>OPS243-A Radar Sensor</b>	
Specifications	EN 62368-1:2014	
Results	As detailed in attached report	
Prepared by		<b>Thomas Tu</b> Product Safety Engineer
Authorized by		<b>Bishow Gopali</b> Product Safety Engineer - Supervisor
Issued Date	2022-Mar-01	
Conditions of issue	This Test Report is issued subject to the conditions stated in 'Conditions of Testing' section of this report	

## Cover Letter

Rob Frizzell  
**OmniPreSense Corporation**  
1650 Zanker Road, Suite 222  
San Jose, CA 95112, USA

Dear Mr. Rob Frizzell,

The following summarizes the investigation of the product **Model OP243-A Radar Sensor** which was evaluated in accordance with the standard EN 62368-1:2014.

The above mentioned product was found to meet the requirements without exception. This conclusion was reached after examination of the submitted sample.

If you have any questions feel free to contact me at 408-526-1188.

Sincerely,



**Thomas Tu**  
Engineer - Product Safety  
Electrical/Electronics, Automotive & Wireless  
Bureau Veritas Consumer Products Services Inc.  
  
Tel: +1 408-526-1188  
Email: [thomas.tu@bureauveritas.com](mailto:thomas.tu@bureauveritas.com)  
Website: <https://www.cps.bureauveritas.com>  
Address: 775 Montague Expressway  
Milpitas, CA 95035, USA

**Test Report issued under the responsibility of:****TEST REPORT****IEC 62368-1**
**Audio/video, information and communication technology equipment**  
**Part 1: Safety requirements**

<b>Report Number</b> .....	<b>OPS121421_CE 62368</b>
<b>Date of issue</b> .....	<b>2022-Mar-01</b>
<b>Total number of pages</b> .....	<b>93</b>
<b>Applicant's name</b> .....	<b>OmniPreSense Corp.</b>
<b>Address</b> .....	<b>1650 Zanker Road, Suite 222 San Jose, CA 95112, USA</b>
<b>Test specification:</b>	
<b>Standard</b> .....	<b>IEC 62368-1:2014</b>
<b>Test procedure</b> .....	<b>EN Informative</b>
<b>Non-standard test method</b> .....	<b>N/A</b>
<b>TRF template used</b> .....	<b>IECEE OD-2020-F1:2020, Ed.1.3</b>
<b>Test Report Form No</b> .....	<b>IEC62368_1D</b>
<b>Test Report Form(s) Originator</b> ....	<b>UL(US)</b>
<b>Master TRF</b> .....	<b>Dated 2021-02-04</b>
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The IECEE/IEC logo and the reference to the CB Scheme procedure has been removed from the original IECEE/IEC TRF as the test report is not used for the CB Scheme.	
<b>General disclaimer:</b>	
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 CE Testing Laboratory.	
<b>Test item description</b> .....	OPS243-A radar sensor is a single board Doppler radar sensor which actively pulses and receives signals at 24GHz frequency, processes the data, and reports the speed of objects in the sensor field of view. Additional processing may provide information such as the count of objects detected or provide flexible reporting.

<b>Trade Mark .....</b>	Omni <i>PreSense</i>	
<b>Manufacturer.....</b>	OmniPreSense Corp.	
<b>Model/Type reference.....</b>	OPS243-A	
<b>Ratings .....</b>	4.75 - 5.25 VDC via USB interface, or 4.75 - 24 VDC via J3 10-pins Header	
<b>Testing procedure and testing location:</b>		
<input checked="" type="checkbox"/> <b>CE Testing Laboratory:</b>	Bureau Veritas Consumer Products Services Inc.	
<b>Testing location/ address .....</b>	775 Montague Expressway, Milpitas 95035, USA	
<b>Tested by (name, function, signature) .....</b>		Thomas Tu Engineer - Product Safety
<b>Approved by (name, function, signature) .. :</b>		Bishow Gopali Engineer - Product Safety, Supervisor
<input type="checkbox"/> <b>Testing procedure: CTF Stage 1:</b>		
<b>Testing location/ address .....</b>		
<b>Tested by (name, function, signature) .. :</b>		
<b>Approved by (name, function, signature) .. :</b>		
<input type="checkbox"/> <b>Testing procedure: CTF Stage 2:</b>		
<b>Testing location/ address .....</b>		
<b>Tested by (name, function, signature) .. :</b>		
<b>Witnessed by (name, function, signature) . :</b>		
<b>Approved by (name, function, signature) .. :</b>		
<input type="checkbox"/> <b>Testing procedure: CTF Stage 3:</b>		
<input type="checkbox"/> <b>Testing procedure: CTF Stage 4:</b>		
<b>Testing location/ address .....</b>		
<b>Tested by (name, function, signature) .. :</b>		
<b>Witnessed by (name, function, signature) . :</b>		
<b>Approved by (name, function, signature) .. :</b>		
<b>Supervised by (name, function, signature) :</b>		

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

Attachment 1: National Differences (14 pages)

Attachment 2: Supplementary Test Data / Test Equipment / Measurement Uncertainty (6 pages)

Attachment 3: Certificates / Component Information / Instructions (13 pages)

Attachment 4: Illustrations / Photographs (2 pages)

Conditions of Testing (2 pages)

**Summary of testing:****Tests performed (name of test and test clause):**

**Test Report: OPS121421\_CE 62368, WO# OPS121421**

**Sample: Model OPS243-A**

- 5.2 Classification of electrical energy source
- 5.4.1.4, 6.3.2, 9.2, B.2.6 Temperature measurements
- 6.2.2 Power source measurement for worst-case fault
- 6.2.3.1 Determination of potential ignition sources (Arcing PIS)
- 6.2.3.2 Determination of potential ignition sources (Resistive PIS)
- B.2.5 Input test
- B.3 Abnormal operating condition tests
- F.3.10 Permanence of markings

**Testing location:**

Bureau Veritas Consumer Products Services Inc.

775 Montague Expressway

Milpitas, CA 95035 USA

Original test results are kept on file at the address above.

**Summary of compliance with National Differences (List of countries addressed):**

DE, DK, FI, IE, NO, SE, UK, IT

List of countries addressed: EU-European Group and National Differences to include DE-Germany, DK-Denmark, FI-Finland, IE-Ireland, NO-Norway, SE-Sweden, UK-United Kingdom, IT-Italy.

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

**Statement concerning the uncertainty of the measurement systems used for the tests**

(may be required by the product standard or client)

**Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

**Procedure number, issue date and title:** LIT-SOP-0005, April 12, 2020, Measurement Uncertainty.

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

**Statement not required by the standard used for type testing**

(Note: When IEC or ISO standard requires a statement concerning the uncertainty of the measurement systems used for tests, this should be reported above. The informative text in parenthesis should be delete in both cases after selecting the applicable option)

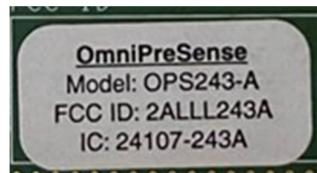
**Copy of marking plate:**

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.

Permanent marking on top side of PCB



Adhesive-backed label affixed on bottom side



<b>Test item particulars.....</b>	
<b>Classification of use by.....</b> : <input checked="" type="checkbox"/> Ordinary person <input checked="" type="checkbox"/> Instructed person <input type="checkbox"/> Skilled person <input type="checkbox"/> Children likely to be present	
<b>Supply Connection .....</b> : <input type="checkbox"/> AC Mains <input type="checkbox"/> DC Mains <input type="checkbox"/> External Circuit - not Mains connected <input checked="" type="checkbox"/> ES1 <input type="checkbox"/> ES2 <input type="checkbox"/> ES3	
<b>Supply % Tolerance .....</b> : <input type="checkbox"/> +10%/-10% <input type="checkbox"/> +20%/-15% <input type="checkbox"/> + _____ % / - _____ % <input checked="" type="checkbox"/> None	
<b>Supply Connection – Type .....</b> : <input type="checkbox"/> pluggable equipment type A - <input type="checkbox"/> non-detachable supply cord <input type="checkbox"/> appliance coupler <input type="checkbox"/> direct plug-in <input type="checkbox"/> mating connector <input type="checkbox"/> pluggable equipment type B - <input type="checkbox"/> non-detachable supply cord <input type="checkbox"/> appliance coupler <input type="checkbox"/> permanent connection <input type="checkbox"/> mating connector <input checked="" type="checkbox"/> other: <u>Micro USB-A or 10-pins-Header</u>	
<b>Considered current rating of protective device as part of building or equipment installation .....</b> : <u>  A (N/A, class III equipment)</u> Installation location: <input type="checkbox"/> building; <input type="checkbox"/> equipment	
<b>Equipment mobility .....</b> : <input type="checkbox"/> movable <input type="checkbox"/> hand-held <input type="checkbox"/> transportable <input type="checkbox"/> stationary <input checked="" type="checkbox"/> for building-in <input type="checkbox"/> direct plug-in <input type="checkbox"/> rack-mounting <input type="checkbox"/> wall-mounted	
<b>Over voltage category (OVC) .....</b> : <input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV <input type="checkbox"/> other: _____	
<b>Class of equipment .....</b> : <input type="checkbox"/> Class I <input type="checkbox"/> Class II <input checked="" type="checkbox"/> Class III <input type="checkbox"/> Class II with functional earthing <input type="checkbox"/> Not classified	
<b>Access location .....</b> : <input type="checkbox"/> restricted access location <input checked="" type="checkbox"/> N/A	
<b>Pollution degree (PD) .....</b> : <input type="checkbox"/> PD 1 <input checked="" type="checkbox"/> PD 2 <input type="checkbox"/> PD 3	
<b>Manufacturer's specified maximum operating ambient.....</b> : <u>85 °C</u>	
<b>IP protection class .....</b> : <input checked="" type="checkbox"/> IPX0 <input type="checkbox"/> IP _____	
<b>Power Systems .....</b> : <input type="checkbox"/> TN <input type="checkbox"/> TT <input type="checkbox"/> IT - _____ V L-L; <input type="checkbox"/> dc mains <input checked="" type="checkbox"/> N/A (class III equipment)	
<b>Altitude during operation (m) .....</b> : <input checked="" type="checkbox"/> 2000 m or less <input type="checkbox"/> _____ m	
<b>Altitude of test laboratory (m) .....</b> : <input checked="" type="checkbox"/> 2000 m or less <input type="checkbox"/> _____ m	
<b>Mass of equipment (kg) .....</b> : <input checked="" type="checkbox"/> 0.023 kg	

<b>Possible test case verdicts:</b>	
- 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)
<b>Testing .....</b> :	<b>Sample of model OPS243-A used for testing was received in new and good condition.</b>
<b>Date of receipt of test item.....:</b>	2022-Jan-26
<b>Date (s) of performance of tests .....</b> :	2022-Feb-07 to 2022-Feb-18
<b>General remarks:</b>	
<p>"(See Enclosure #)" refers to additional information appended to the report.            "(See appended table)" refers to a table appended to the report.</p>	
<b>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</b>	
<b>Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:</b>	
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 type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
<b>When differences exist; they shall be identified in the General product information section.</b>	
<b>Name and address of factory (ies) .....</b> :	OmniPreSense Corporation (SMA computer for PCB assembly) 1650 Zanker Road Suite 222, San Jose, CA 95112, USA

**General product information and other remarks:****Product Description:**

The OPS243-A is a complete short-range radar (SRR) solution providing motion detection, speed, direction, and range reporting. All radar signal processing is done on board and a simple API reports the processed data. Flexible control over the reporting format, sample rate, and module power level is provided. The OPS243-A sensor outputs data over USB, UART, RS-232, or Wi-Fi interfaces for simple connection to any embedded processor (Arduino, Raspberry Pi, PC) or directly to the cloud via Wi-Fi.

**Model Differences: N/A****Additional application considerations – (Considerations used to test a component or sub-assembly) –****Engineering Considerations:**

A DC power source used to power the Board via pin 9 of the 10-pins header shall be 3 Amp maximum that is the current limit of the header. The condition also limits the available power source at PS2 level.

**Conditions of Acceptability: N/A****History:**

Project Number	Date	Description	Engineer
OPS121421	2022-Feb-28	Original Report	Thomas Tu

**Note to Inspector** (insert all applicable explanatory comments to ensure factory inspections are carried out correctly. For example: if non-certified components were evaluated as part of this report specify if PVT is required on an annual basis. Also specify the make, type and ratings of the component that must be obtained for PVT. Or, if factory inspections are carried out at more than one factory but production line testing is not required at all locations, provide specifics): **N/A**

**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)
5 VDC via micro USB-A	ES1
4.75 - 24 VDC via pin 9 of 10-pins Header	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)
5 VDC via micro USB-A	PS1
4.75 - 24 VDC via pin 9 of 10-pins Header, 3A maximum	PS2

**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
None	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)
No mechanically-caused injury	MS1

**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)
No thermal burns on external surface	TS1

**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

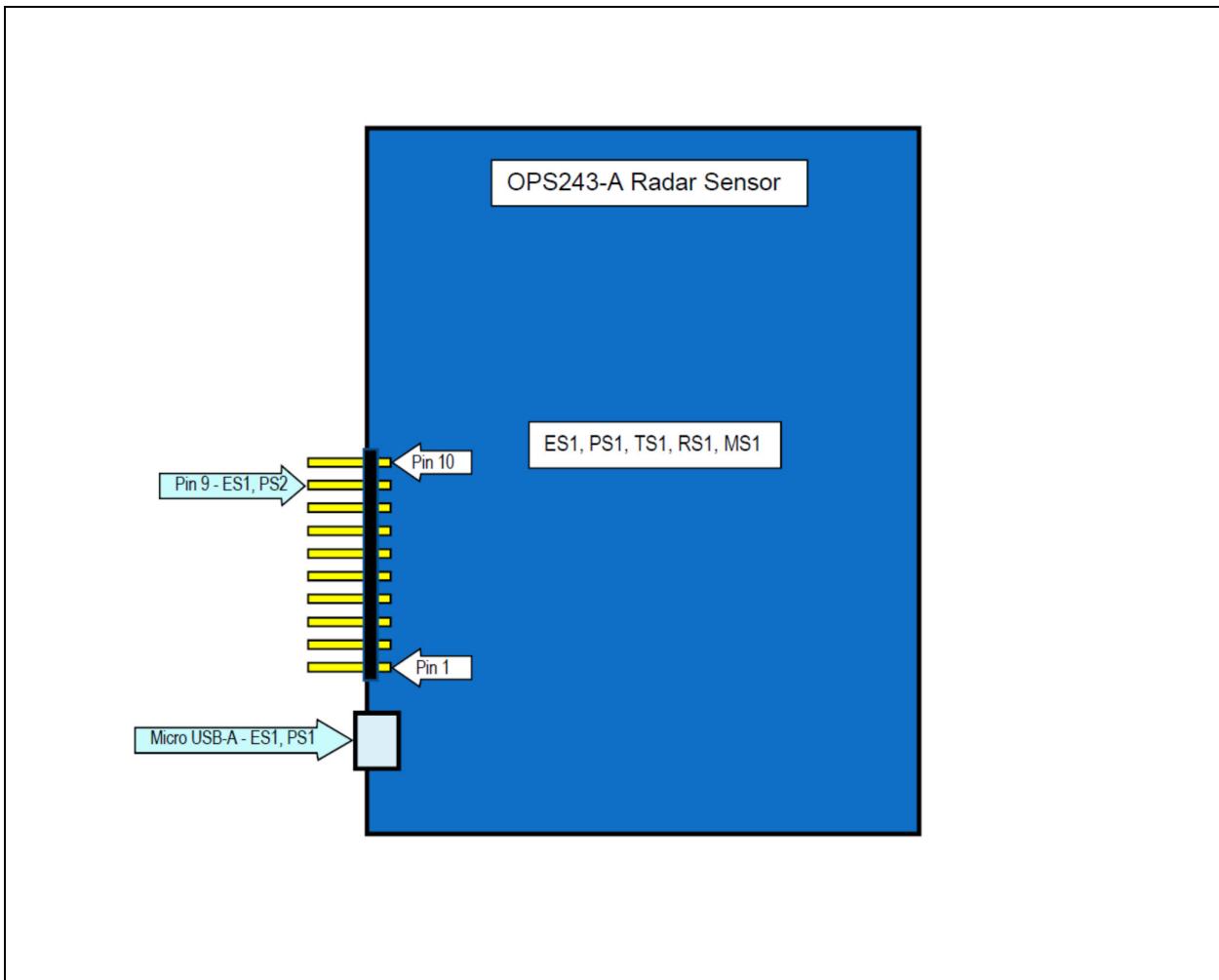
RS1

Type of radiation	Corresponding classification (RS)
Indicating LEDs	RS1

**ENERGY SOURCE DIAGRAM**

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

X ES    X PS    X MS    X TS    X RS



<b>OVERVIEW OF EMPLOYED SAFEGUARDS</b>				
<b>Clause</b>	<b>Possible Hazard</b>			
5.1	Electrically-caused injury			
Body Part (e.g. Ordinary)	Energy Source (ES3: Primary Filter circuit)	Safeguards		
		Basic	Supplementary	Reinforced (Enclosure)
Ordinary (from Micro USB-A 5 VDC)	ES1	Micro USB housing	N/A	N/A
Ordinary (from pin 9 of 10-pins Header)	ES1	Connector mating to Header	N/A	N/A
6.1	Electrically-caused fire			
Material part (e.g. mouse enclosure)	Energy Source (PS2: 100 Watt circuit)	Safeguards		
		Basic	Supplementary	Reinforced
USB 5 VDC	PS1	USB Header	N/A	N/A
Pin 9 of 10-pins Header and PS2 parts	PS2	10-pins Header & PS2 parts soldered on PCB	Header and PS2 parts mounted on minimum V-1 PCB	N/A
7.1	Injury caused by hazardous substances			
Body Part (e.g., skilled)	Energy Source (hazardous material)	Safeguards		
		Basic	supplementary	Reinforced
Ordinary	None	N/A	N/A	N/A
8.1	Mechanically-caused injury			
Body Part (e.g. Ordinary)	Energy Source (MS3:High Pressure Lamp)	Safeguards		
		Basic	supplementary	Reinforced (Enclosure)
Ordinary	MS1	None	N/A	N/A
9.1	Thermal Burn			
Body Part (e.g., Ordinary)	Energy Source (TS2)	Safeguards		
		Basic	supplementary	Reinforced
Ordinary	TS1	None	N/A	N/A
10.1	Radiation			
Body Part (e.g., Ordinary)	Energy Source (Output from audio port)	Safeguards		
		Basic	supplementary	Reinforced
Ordinary	RS1	None	N/A	N/A

<p>Supplementary Information:</p> <p>(1) See attached energy source diagram for additional details.</p> <p>(2) "N" – Normal Condition; "A" – Abnormal Condition; "S" Single Fault</p>				

IEC 62368-1			
Clause	Requirement + Test	Result - Remark	Verdict
<b>4</b>	<b>GENERAL REQUIREMENTS</b>		P
4.1.1	Acceptance of materials, components and subassemblies		P
4.1.2	Use of components	See Table 4.1.2 for components related to safety	P
4.1.3	Equipment design and construction	Equipment design and construction have been checked, tested, and verified	P
4.1.15	Markings and instructions.....:	See Annex F	P
4.4.4	Safeguard robustness		P
4.4.4.2	Steady force tests.....:	For built-in	N/A
4.4.4.3	Drop tests.....:	For built-in	N/A
4.4.4.4	Impact tests.....:	For built-in	N/A
4.4.4.5	Internal accessible safeguard enclosure and barrier tests .....	For built-in	N/A
4.4.4.6	Glass Impact tests.....:	No glass	N/A
4.4.4.7	Thermoplastic material tests.....:	PCB and 10-pins Header are recognized parts	N/A
4.4.4.8	Air comprising a safeguard.....:	No air comprising safeguard	N/A
4.4.4.9	Accessibility and safeguard effectiveness	No such safeguards	N/A
4.5	Explosion	Explosion is unlikely	N/A
4.6	Fixing of conductors		P
4.6.1	Fix conductors not to defeat a safeguard	Connectors are sufficiently soldered to the PCB	P
4.6.2	10 N force test applied to .....	10N force waived by inspection	N/A
4.7	Equipment for direct insertion into mains socket - outlets	No connection to a.c. mains	N/A
4.7.2	Mains plug part complies with the relevant standard .....		N/A
4.7.3	Torque (Nm).....:		N/A
4.8	Products containing coin/button cell batteries	No coin/button cell batteries used	N/A
4.8.2	Instructional safeguard		N/A
4.8.3	Battery Compartment Construction		N/A
	Means to reduce the possibility of children removing the battery.....:	No such batteries	—
4.8.4	Battery Compartment Mechanical Tests.....:	No such batteries	N/A
4.8.5	Battery Accessibility	No such batteries	N/A
4.9	Likelihood of fire or shock due to entry of conductive object.....:	To be considered in final end use installation	N/A

IEC 62368-1			
Clause	Requirement + Test	Result - Remark	Verdict

<b>5</b>	<b>ELECTRICALLY-CAUSED INJURY</b>		P
5.2.1	Electrical energy source classifications .....	See appended table 5.2	P
5.2.2	ES1, ES2 and ES3 limits	ES1 only	P
5.2.2.2	Steady-state voltage and current .....	No steady-state voltage or current	N/A
5.2.2.3	Capacitance limits .....	No capacitive voltages	N/A
5.2.2.4	Single pulse limits.....	No pulse voltages	N/A
5.2.2.5	Limits for repetitive pulses .....	No pulse voltages	N/A
5.2.2.6	Ringing signals .....	No ringing signals	N/A
5.2.2.7	Audio signals .....	No audio outputs	N/A
5.3	Protection against electrical energy sources		P
5.3.1	General Requirements for accessible parts to ordinary, instructed and skilled persons	Only basic safeguard provided for ES1 parts	P
5.3.2.1	Accessibility to electrical energy sources and safeguards	Access is allowed to ES1 parts and circuits on the Board	P
5.3.2.2	Contact requirements		N/A
	a) Test with test probe from Annex V .....	ES1 only	N/A
	b) Electric strength test potential (V) .....	ES1 only	N/A
	c) Air gap (mm) .....	ES1 only	N/A
5.3.2.4	Terminals for connecting stripped wire	No such terminals	N/A
5.4	Insulation materials and requirements		P
5.4.1.2	Properties of insulating material	Insulating materials are for functional insulation only	P
5.4.1.3	Humidity conditioning .....	Insulation materials are not hygroscopic	N/A
5.4.1.4	Maximum operating temperature for insulating materials .....	See Table 5.4.1.4 for temperature rises on plastic materials	P
5.4.1.5	Pollution degree .....	Pollution degree 2	P
5.4.1.5.2	Test for pollution degree 1 environment and for an insulating compound		N/A
5.4.1.5.3	Thermal cycling		N/A
5.4.1.6	Insulation in transformers with varying dimensions	No transformers	N/A
5.4.1.7	Insulation in circuits generating starting pulses	No starting pulses	N/A
5.4.1.8	Determination of working voltage	24 VDC maximum	P
5.4.1.9	Insulating surfaces	No ES2 or ES3 parts or circuits	N/A

IEC 62368-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.4.1.10	Thermoplastic parts on which conductive metallic parts are directly mounted	Metallic conductive parts are mounted on recognized PCB rated V-1 minimum and 130°C	P
5.4.1.10.2	Vicat softening temperature .....	Considered not needed	N/A
5.4.1.10.3	Ball pressure .....	Considered not needed	N/A
5.4.2	Clearances		P
5.4.2.2	Determining clearance using peak working voltage	See Table 5.4.2.2	P
5.4.2.3	Determining clearance using required withstand voltage .....	No testing for ES1	N/A
	a) a.c. mains transient voltage.....	No a.c. mains	—
	b) d.c. mains transient voltage .....	No d.c. mains	—
	c) external circuit transient voltage.....	No external transient voltage	—
	d) transient voltage determined by measurement... :	No transient voltage	—
5.4.2.4	Determining the adequacy of a clearance using an electric strength test	No electric strength test for ES1	N/A
5.4.2.5	Multiplication factors for clearances and test voltages .....	No electric strength test for ES1	N/A
5.4.3	Creepage distances .....		P
5.4.3.1	General	See Table 5.4.3	P
5.4.3.3	Material Group .....	Group I (of PCB)	—
5.4.4	Solid insulation		P
5.4.4.2	Minimum distance through insulation .....	No requirements for ES1 circuits	N/A
5.4.4.3	Insulation compound forming solid insulation	ES1 parts	N/A
5.4.4.4	Solid insulation in semiconductor devices	ES1 parts	N/A
5.4.4.5	Cemented joints	No cement joints	N/A
5.4.4.6	Thin sheet material	No thin sheet materials	N/A
5.4.4.6.1	General requirements		N/A
5.4.4.6.2	Separable thin sheet material		N/A
	Number of layers (pcs) .....	See above	N/A
5.4.4.6.3	Non-separable thin sheet material		N/A
5.4.4.6.4	Standard test procedure for non-separable thin sheet material..... :	See above	N/A
5.4.4.6.5	Mandrel test		N/A
5.4.4.7	Solid insulation in wound components	No wound components	N/A
5.4.4.9	Solid insulation at frequencies >30 kHz..... :	ES1 parts	N/A
5.4.5	Antenna terminal insulation	No antenna terminals	N/A
5.4.5.1	General		N/A

IEC 62368-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.4.5.2	Voltage surge test		N/A
	Insulation resistance ( $M\Omega$ )..... :		—
5.4.6	Insulation of internal wire as part of supplementary safeguard .....	No internal wirings	N/A
5.4.7	Tests for semiconductor components and for cemented joints	No cemented joints used for semiconductor parts or on PCB	N/A
5.4.8	Humidity conditioning	See above	N/A
	Relative humidity (%) ..... :	See above	—
	Temperature (°C) ..... :	See above	—
	Duration (h) ..... :	See above	—
5.4.9	Electric strength test..... :	ES1 parts or circuits only	N/A
5.4.9.1	Test procedure for a solid insulation type test		N/A
5.4.9.2	Test procedure for routine tests		N/A
5.4.10	Protection against transient voltages between external circuit		N/A
5.4.10.1	Parts and circuits separated from external circuits	No transient voltages from external circuits	N/A
5.4.10.2	Test methods	See above	N/A
5.4.10.2.1	General		N/A
5.4.10.2.2	Impulse test..... :	See above	N/A
5.4.10.2.3	Steady-state test ..... :	See above	N/A
5.4.11	Insulation between external circuits and earthed circuitry..... :	See above	N/A
5.4.11.1	Exceptions to separation between external circuits and earth	Class III equipment has no earth	N/A
5.4.11.2	Requirements		N/A
	Rated operating voltage $U_{op}$ (V)..... :	See above	—
	Nominal voltage $U_{peak}$ (V)..... :	See above	—
	Max increase due to variation $U_{sp}$ ..... :	See above	—
	Max increase due to ageing $\Delta U_{sa}$ ..... :	See above	—
	$U_{op} = U_{peak} + \Delta U_{sp} + \Delta U_{sa}$ ..... :	See above	—
5.5	Components as safeguards		N/A
5.5.1	General	No electronic components used for safeguards as there are ES1 circuits only	N/A
5.5.2	Capacitors and RC units	See above	N/A
5.5.2.1	General requirement		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5.5.2.2	Safeguards against capacitor discharge after disconnection of a connector.....:		N/A
5.5.3	Transformers	See above	N/A
5.5.4	Optocouplers	See above	N/A
5.5.5	Relays	See above	N/A
5.5.6	Resistors	See above	N/A
5.5.7	SPD's	See above	N/A
5.5.7.1	Use of an SPD connected to reliable earthing		N/A
5.5.7.2	Use of an SPD between mains and protective earth		N/A
5.5.8	Insulation between the mains and external circuit consisting of a coaxial cable.....:	See above	N/A
5.6	Protective conductor		N/A
5.6.2	Requirement for protective conductors	Class III equipment has no protective conductors nor touch currents	N/A
5.6.2.1	General requirements		N/A
5.6.2.2	Colour of insulation		N/A
5.6.3	Requirement for protective earthing conductors	See above	N/A
	Protective earthing conductor size ( $\text{mm}^2$ ) .....	—	—
5.6.4	Requirement for protective bonding conductors	See above	N/A
5.6.4.1	Protective bonding conductors		N/A
	Protective bonding conductor size ( $\text{mm}^2$ ).....:	See above	—
	Protective current rating (A) .....	See above	—
5.6.4.3	Current limiting and overcurrent protective devices		N/A
5.6.5	Terminals for protective conductors	See above	N/A
5.6.5.1	Requirement		N/A
	Conductor size ( $\text{mm}^2$ ), nominal thread diameter (mm).....:	See above	—
5.6.5.2	Corrosion		N/A
5.6.6	Resistance of the protective system	See above	N/A
5.6.6.1	Requirements		N/A
5.6.6.2	Test Method Resistance ( $\Omega$ ).....:		N/A
5.6.7	Reliable earthing	See above	N/A
5.7	Prospective touch voltage, touch current and protective conductor current		N/A
5.7.2	Measuring devices and networks	Class III equipment has no touch voltages nor touch currents	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5.7.2.1	Measurement of touch current.....:	See above	N/A
5.7.2.2	Measurement of prospective touch voltage		N/A
5.7.3	Equipment set-up, supply connections and earth connections	See above	N/A
	System of interconnected equipment (separate connections/single connection) .....	See above	N/A
	Multiple connections to mains (one connection at a time/simultaneous connections) .....	See above	N/A
5.7.4	Earthed conductive accessible parts .....	See above	N/A
5.7.5	Protective conductor current	See above	N/A
	Supply Voltage (V) .....	See above	—
	Measured current (mA) .....	See above	—
	Instructional Safeguard .....		N/A
5.7.6	Prospective touch voltage and touch current due to external circuits	Connections to external equipment do not create ES2 circuit levels	N/A
5.7.6.1	Touch current from coaxial cables		N/A
5.7.6.2	Prospective touch voltage and touch current from external circuits		N/A
5.7.7	Summation of touch currents from external circuits	See above	N/A
	a) Equipment with earthed external circuits Measured current (mA) .....	See above	N/A
	b) Equipment whose external circuits are not referenced to earth. Measured current (mA).....	See above	N/A

6	ELECTRICALLY- CAUSED FIRE	P
6.2	Classification of power sources (PS) and potential ignition sources (PIS)	P
6.2.2	Power source circuit classifications	P
6.2.2.1	General	P
6.2.2.2	Power measurement for worst-case load fault....:	PS1 and PS2. See Table 6.2.2
6.2.2.3	Power measurement for worst-case power source fault.....:	Power source is external, or there's no control on power source fault.
6.2.2.4	PS1 .....	See Table 6.2.2
6.2.2.5	PS2 .....	See Table 6.2.2
6.2.2.6	PS3 .....	No PS3
6.2.3	Classification of potential ignition sources	N/A
6.2.3.1	Arcing PIS .....	No arcing. See Table 6.3.2.1
6.2.3.2	Resistive PIS .....	See Table 6.2.3.2

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Clause	Requirement + Test	Result - Remark	Verdict
6.3	Safeguards against fire under normal operating and abnormal operating conditions		P
6.3.1 (a)	No ignition and attainable temperature value less than 90 % defined by ISO 871 or less than 300 °C for unknown materials .....	See 5.4.1.4 and B.3	P
6.3.1 (b)	Combustible materials outside fire enclosure	Open board for built-in	N/A
6.4	Safeguards against fire under single fault conditions		P
6.4.1	Safeguard Method	Control fire spread is employed for fire safeguard. See Clauses 6.4.4, 6.4.5 and 6.4.6.	P
6.4.2	Reduction of the likelihood of ignition under single fault conditions in PS1 circuits	Basic safeguard provided for PS1	P
6.4.3	Reduction of the likelihood of ignition under single fault conditions in PS2 and PS3 circuits	Method to prevent ignition not employed	N/A
6.4.3.1	General		N/A
6.4.3.2	Supplementary Safeguards		N/A
	Special conditions if conductors on printed boards are opened or peeled		N/A
6.4.3.3	Single Fault Conditions .....	See above	N/A
	Special conditions for temperature limited by fuse		N/A
6.4.4	Control of fire spread in PS1 circuits	Basic safeguard provided for PS1 circuits	P
6.4.5	Control of fire spread in PS2 circuits		P
6.4.5.2	Supplementary safeguards .....	All electronic parts are mounted on V-1 minimum PCB	P
6.4.6	Control of fire spread in PS3 circuit	No PS3 circuits	N/A
6.4.7	Separation of combustible materials from a PIS	Method to prevent ignition not employed	N/A
6.4.7.1	General .....	See above	N/A
6.4.7.2	Separation by distance		N/A
6.4.7.3	Separation by a fire barrier		N/A
6.4.8	Fire enclosures and fire barriers	PCB is employed for fire barrier	P
6.4.8.1	Fire enclosure and fire barrier material properties	PCB adequately prevents fire spread	P
6.4.8.2.1	Requirements for a fire barrier	PCB is V-1 minimum	P
6.4.8.2.2	Requirements for a fire enclosure	Open board to integrate to a larger system	N/A
6.4.8.3	Constructional requirements for a fire enclosure and a fire barrier	No fire enclosure required	N/A
6.4.8.3.1	Fire enclosure and fire barrier openings		N/A
6.4.8.3.2	Fire barrier dimensions		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
6.4.8.3.3	Top Openings in Fire Enclosure: dimensions (mm) ..... :	See above	N/A
	Needle Flame test		N/A
6.4.8.3.4	Bottom Openings in Fire Enclosure, condition met a), b) and/or c) dimensions (mm) ..... :	See above	N/A
	Flammability tests for the bottom of a fire enclosure ..... :	See above	N/A
6.4.8.3.5	Integrity of the fire enclosure, condition met: a), b) or c)..... :	See above	N/A
6.4.8.4	Separation of PIS from fire enclosure and fire barrier distance (mm) or flammability rating.....:	See above	N/A
6.5	Internal and external wiring		N/A
6.5.1	Requirements	No wirings on the Board	N/A
6.5.2	Cross-sectional area (mm <sup>2</sup> ) ..... :	See above	—
6.5.3	Requirements for interconnection to building wiring ..... :	See above	N/A
6.6	Safeguards against fire due to connection to additional equipment	The Board does not supply power to other devices	N/A
	External port limited to PS2 or complies with Clause Q.1		N/A

7	INJURY CAUSED BY HAZARDOUS SUBSTANCES		N/A
7.2	Reduction of exposure to hazardous substances	No hazardous substances	N/A
7.3	Ozone exposure		N/A
7.4	Use of personal safeguards (PPE)		N/A
	Personal safeguards and instructions.....:	See above	N/A
7.5	Use of instructional safeguards and instructions		N/A
	Instructional safeguard (ISO 7010).....:	See above	N/A
7.6	Batteries ..... :	See above	N/A

8	MECHANICALLY-CAUSED INJURY		P
8.1	General		P
8.2	Mechanical energy source classifications	MS1 only	P
8.3	Safeguards against mechanical energy sources	No safeguard required for MS1	N/A
8.4	Safeguards against parts with sharp edges and corners	No sharp edges or corners	N/A
8.4.1	Safeguards		N/A
8.5	Safeguards against moving parts	No moving parts	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.5.1	MS2 or MS3 part required to be accessible for the function of the equipment		N/A
8.5.2	Instructional Safeguard ..... : MS1 only	MS1 only	N/A
8.5.4	Special categories of equipment comprising moving parts	No moving parts	N/A
8.5.4.1	Large data storage equipment	No large storage equipment	N/A
8.5.4.2	Equipment having electromechanical device for destruction of media	No means for destruction of media	N/A
8.5.4.2.1	Safeguards and Safety Interlocks ..... : See above	See above	N/A
8.5.4.2.2	Instructional safeguards against moving parts		N/A
	Instructional Safeguard ..... : See above	See above	N/A
8.5.4.2.3	Disconnection from the supply		N/A
8.5.4.2.4	Probe type and force (N) ..... : See above	See above	N/A
8.5.5	High Pressure Lamps	No high pressure lamps	N/A
8.5.5.1	Energy Source Classification		N/A
8.5.5.2	High Pressure Lamp Explosion Test..... : See above	See above	N/A
8.6	Stability		N/A
8.6.1	Product classification	MS1 only	N/A
	Instructional Safeguard ..... : Not required to MS1	Not required to MS1	N/A
8.6.2	Static stability	Not required to MS1	N/A
8.6.2.2	Static stability test		N/A
	Applied Force ..... : See above	See above	—
8.6.2.3	Downward Force Test		N/A
8.6.3	Relocation stability test		N/A
	Unit configuration during 10° tilt ..... : See above	See above	—
8.6.4	Glass slide test	No glass	N/A
8.6.5	Horizontal force test (Applied Force)..... : See above	See above	—
	Position of feet or movable parts..... : See above	See above	—
8.7	Equipment mounted to wall or ceiling	Open board for built-in	N/A
8.7.1	Mounting Means (Length of screws (mm) and mounting surface) ..... : See above	See above	N/A
8.7.2	Direction and applied force..... : See above	See above	N/A
8.8	Handles strength	No handles	N/A
8.8.1	Classification		N/A
8.8.2	Applied Force ..... : See above	See above	—
8.9	Wheels or casters attachment requirements	No wheels or casters	N/A
8.9.1	Classification		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.9.2	Applied force..... : See above		N/A
8.10	Carts, stands and similar carriers	No Carts or stands	N/A
8.10.1	General		N/A
8.10.2	Marking and instructions	See above	N/A
	Instructional Safeguard ..... : See above		N/A
8.10.3	Cart, stand or carrier loading test and compliance		N/A
	Applied force..... : See above		—
8.10.4	Cart, stand or carrier impact test		N/A
8.10.5	Mechanical stability		N/A
	Applied horizontal force (N)..... : See above		—
8.10.6	Thermoplastic temperature stability (°C)..... : See above		N/A
8.11	Mounting means for rack mounted equipment	Open board for built-in	N/A
8.11.1	General		N/A
8.11.2	Product Classification		N/A
8.11.3	Mechanical strength test, variable N ..... : See above		N/A
8.11.4	Mechanical strength test 250N, including end stops		N/A
8.12	Telescoping or rod antennas.....	No telescoping or rod antennas	N/A
	Button/Ball diameter (mm)..... : See above		—

9	THERMAL BURN INJURY	P
9.2	Thermal energy source classifications	TS1 only. See Table 5.4.1.4.
9.3	Safeguard against thermal energy sources	Only basic safeguard provided for PS1
9.4	Requirements for safeguards	N/A
9.4.1	Equipment safeguard	TS1 only
9.4.2	Instructional safeguard ..... : TS1 only	N/A

10	RADIATION	P
10.2	Radiation energy source classification	P
10.2.1	General classification	RS1 from low light indicating LEDs
10.3	Protection against laser radiation	No laser radiation
	Laser radiation that exists equipment:	N/A
	Normal, abnormal, single-fault..... :	N/A
	Instructional safeguard ..... :	N/A
	Tool ..... : See above	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10.4	Protection against visible, infrared, and UV radiation	Visible low light from indicating LEDs only, no infrared nor UV radiation.	N/A
10.4.1	General		N/A
10.4.1.a)	RS3 for Ordinary and instructed persons ..... :	No RS3	N/A
10.4.1.b)	RS3 accessible to a skilled person..... :	See above	N/A
	Personal safeguard (PPE) instructional safeguard ..... :	See above	N/A
10.4.1.c)	Equipment visible, IR, UV does not exceed RS1 .. :	See above	N/A
10.4.1.d)	Normal, abnormal, single-fault conditions ..... :	See above	N/A
10.4.1.e)	Enclosure material employed as safeguard is opaque .....	See above	N/A
10.4.1.f)	UV attenuation ..... :	See above	N/A
10.4.1.g)	Materials resistant to degradation UV..... :	See above	N/A
10.4.1.h)	Enclosure containment of optical radiation ..... :	See above	N/A
10.4.1.i)	Exempt Group under normal operating conditions :	See above	N/A
10.4.2	Instructional safeguard .....	See above	N/A
10.5	Protection against x-radiation	No x-radiation	N/A
10.5.1	X- radiation energy source that exists equipment :	See above	N/A
	Normal, abnormal, single fault conditions		N/A
	Equipment safeguards .....	See above	N/A
	Instructional safeguard for skilled person .....	See above	N/A
10.5.3	Most unfavourable supply voltage to give maximum radiation .....	See above	N/A
	Abnormal and single-fault condition..... :	See above	N/A
	Maximum radiation (pA/kg)..... :	See above	N/A
10.6	Protection against acoustic energy sources	No acoustic energy source	N/A
10.6.1	General		N/A
10.6.2	Classification	None or RS1 only	N/A
	Acoustic output, dB(A)..... :	See above	N/A
	Output voltage, unweighted r.m.s..... :	See above	N/A
10.6.4	Protection of persons	See above	N/A
	Instructional safeguards .....	See above	N/A
	Equipment safeguard prevent ordinary person to RS2 .....	See above	N/A
	Means to actively inform user of increase sound pressure .....	See above	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	Equipment safeguard prevent ordinary person to RS2 ..... :	See above	N/A
10.6.5	Requirements for listening devices (headphones, earphones, etc.)		N/A
10.6.5.1	Corded passive listening devices with analog input		N/A
	Input voltage with 94 dB(A) $L_{Aeq}$ acoustic pressure output ..... :	See above	N/A
10.6.5.2	Corded listening devices with digital input		N/A
	Maximum dB(A)..... :	See above	N/A
10.6.5.3	Cordless listening device		N/A
	Maximum dB(A)..... :	See above	N/A

B	<b>NORMAL OPERATING CONDITION TESTS, ABNORMAL OPERATING CONDITION TESTS AND SINGLE FAULT CONDITION TESTS</b>		P
B.2	Normal Operating Conditions		P
B.2.1	General requirements..... :	See Test Item Particulars and appended Tables	P
	Audio Amplifiers and equipment with audio amplifiers..... :	No audio outputs	N/A
B.2.3	Supply voltage and tolerances	USB: 4.75-5.25VDC; 10-pins Header: 4.57-24VDC. No tolerances	P
B.2.5	Input test ..... :	See Table B.2.5	P
B.3	Simulated abnormal operating conditions		P
B.3.1	General requirements..... :	See Table B.3	P
B.3.2	Covering of ventilation openings	No ventilations	N/A
B.3.3	D.C. mains polarity test	Board is for system connectivity with end use costumed connector consideration	N/A
B.3.4	Setting of voltage selector ..... :	No voltage selector	N/A
B.3.5	Maximum load at output terminals..... :	No supply outputs from the Board	N/A
B.3.6	Reverse battery polarity	No batteries	N/A
B.3.7	Abnormal operating conditions as specified in Clause E.2.	No audio outputs	N/A
B.3.8	Safeguards functional during and after abnormal operating conditions	See Table B.3	P
B.4	Simulated single fault conditions		N/A
B.4.2	Temperature controlling device open or short-circuited..... :	No temperature controlling devices	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

B.4.3	Motor tests	No Motors	N/A
B.4.3.1	Motor blocked or rotor locked increasing the internal ambient temperature ..... :	See above	N/A
B.4.4	Short circuit of functional insulation	Safety recognized PCB	N/A
B.4.4.1	Short circuit of clearances for functional insulation		N/A
B.4.4.2	Short circuit of creepage distances for functional insulation		N/A
B.4.4.3	Short circuit of functional insulation on coated printed boards	Safety recognized PCB	N/A
B.4.5	Short circuit and interruption of electrodes in tubes and semiconductors	No such parts	N/A
B.4.6	Short circuit or disconnect of passive components	No passive components employed	N/A
B.4.7	Continuous operation of components	No short time operating components employed	N/A
B.4.8	Class 1 and Class 2 energy sources within limits during and after single fault conditions	See above	N/A
B.4.9	Battery charging under single fault conditions ... :	No batteries	N/A

C	UV RADIATION		N/A
C.1	Protection of materials in equipment from UV radiation	No UV radiation	N/A
C.1.2	Requirements		N/A
C.1.3	Test method		N/A
C.2	UV light conditioning test		N/A
C.2.1	Test apparatus		N/A
C.2.2	Mounting of test samples		N/A
C.2.3	Carbon-arc light-exposure apparatus		N/A
C.2.4	Xenon-arc light exposure apparatus		N/A

D	TEST GENERATORS		N/A
D.1	Impulse test generators	No impulses	N/A
D.2	Antenna interface test generator		N/A
D.3	Electronic pulse generator		N/A
E TEST CONDITIONS FOR EQUIPMENT CONTAINING AUDIO AMPLIFIERS			
E.1	Audio amplifier normal operating conditions	No audio amplifiers	N/A
	Audio signal voltage (V) ..... :	See above	N/A
	Rated load impedance ( $\Omega$ ) ..... :	See above	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
E.2	Audio amplifier abnormal operating conditions		N/A

F	<b>EQUIPMENT MARKINGS, INSTRUCTIONS, AND INSTRUCTIONAL SAFEGUARDS</b>		P
F.1	General requirements		P
	Instructions – Language ..... :	Manual reviewed in English only	P
F.2	Letter symbols and graphical symbols		P
F.2.1	Letter symbols according to IEC60027-1	Letter symbols on labels and in instructions are in accordance with IEC 60027-1	P
F.2.2	Graphic symbols IEC, ISO or manufacturer specific	Graphic symbols on labels and in instructions are in accordance with IEC 60417	P
F.3	Equipment markings		P
F.3.1	Equipment marking locations	Permanent marking is on top side. Adhesive label is on bottom side.	P
F.3.2	Equipment identification markings		P
F.3.2.1	Manufacturer identification ..... :	See Copy of marking plate	P
F.3.2.2	Model identification ..... :	See Copy of marking plate (adhesive label on bottom side)	P
F.3.3	Equipment rating markings	Board has no connections to mains, marking for supply rating is optional.	N/A
F.3.3.1	Equipment with direct connection to mains		N/A
F.3.3.2	Equipment without direct connection to mains		N/A
F.3.3.3	Nature of supply voltage ..... :	See above	N/A
F.3.3.4	Rated voltage..... :	See above	N/A
F.3.3.4	Rated frequency ..... :	See above	N/A
F.3.3.6	Rated current or rated power ..... :	See above	N/A
F.3.3.7	Equipment with multiple supply connections		N/A
F.3.4	Voltage setting device	No such device	N/A
F.3.5	Terminals and operating devices	No such terminal	N/A
F.3.5.1	Mains appliance outlet and socket-outlet markings ..... :	No outlets	N/A
F.3.5.2	Switch position identification marking.....:	No switches	N/A
F.3.5.3	Replacement fuse identification and rating markings ..... :	No fuses	N/A
F.3.5.4	Replacement battery identification marking .....:	No batteries	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
F.3.5.5	Terminal marking location	No terminals	N/A
F.3.6	Equipment markings related to equipment classification		N/A
F.3.6.1	Class I Equipment	Board is class III equipment	N/A
F.3.6.1.1	Protective earthing conductor terminal	No earthing conductor	N/A
F.3.6.1.2	Neutral conductor terminal	No neutral conductor	N/A
F.3.6.1.3	Protective bonding conductor terminals	No protective bonding conductor	N/A
F.3.6.2	Class II equipment (IEC60417-5172)	Board is class III equipment	N/A
F.3.6.2.1	Class II equipment with or without functional earth	See above	N/A
F.3.6.2.2	Class II equipment with functional earth terminal marking	See above	N/A
F.3.7	Equipment IP rating marking ..... :	IPX0	N/A
F.3.8	External power supply output marking	No supply outputs	N/A
F.3.9	Durability, legibility and permanence of marking	Top marking is permanently marked. Bottom marking is adhesive-backed printed label.	P
F.3.10	Test for permanence of markings	See Table F.3.10	P
F.4	Instructions		P
	a) Equipment for use in locations where children not likely to be present - marking	End use system application	N/A
	b) Instructions given for installation or initial use	Instructions provided	P
	c) Equipment intended to be fastened in place	End use system application	N/A
	d) Equipment intended for use only in restricted access area	End use system application	N/A
	e) Audio equipment terminals classified as ES3 and other equipment with terminals marked in accordance F.3.6.1	No audio output terminals	N/A
	f) Protective earthing employed as safeguard	No protective earthing	N/A
	g) Protective earthing conductor current exceeding ES 2 limits	No protective earthing	N/A
	h) Symbols used on equipment		N/A
	i) Permanently connected equipment not provided with all-pole mains switch	No connections to mains	N/A
	j) Replaceable components or modules providing safeguard function	No such parts for providing safeguard function	N/A
F.5	Instructional safeguards	No instructional safeguards required or provided	N/A
	Where "instructional safeguard" is referenced in the test report it specifies the required elements, location of marking and/or instruction		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

G	COMPONENTS	P
G.1	Switches	—
G.1.1	General requirements	N/A
G.1.2	Ratings, endurance, spacing, maximum load	N/A
G.2	Relays	—
G.2.1	General requirements	N/A
G.2.2	Overload test	N/A
G.2.3	Relay controlling connectors supply power	N/A
G.2.4	Mains relay, modified as stated in G.2	N/A
G.3	Protection Devices	—
G.3.1	Thermal cut-offs	N/A
G.3.1.1a) &b)	Thermal cut-outs separately approved according to IEC 60730 with conditions indicated in a) & b)	N/A
G.3.1.1c)	Thermal cut-outs tested as part of the equipment as indicated in c)	N/A
G.3.1.2	Thermal cut-off connections maintained and secure	N/A
G.3.2	Thermal links	—
G.3.2.1a)	Thermal links separately tested with IEC 60691	N/A
G.3.2.1b)	Thermal links tested as part of the equipment	N/A
	Aging hours (H) .....	N/A
	Single Fault Condition .....	N/A
	Test Voltage (V) and Insulation Resistance ( $\Omega$ ).:	N/A
G.3.3	PTC Thermistors	N/A
G.3.4	Overcurrent protection devices	No overcurrent protection devices
G.3.5	Safeguards components not mentioned in G.3.1 to G.3.5	—
G.3.5.1	Non-resettable devices suitably rated and marking provided	Not safeguards components
G.3.5.2	Single faults conditions.....:	See above
G.4	Connectors	—
G.4.1	Spacings	ES1 connectors only
G.4.2	Mains connector configuration .....	No mains connectors
G.4.3	Plug is shaped that insertion into mains socket-outlets or appliance coupler is unlikely	No plugs
G.5	Wound Components	—
G.5.1	Wire insulation in wound components .....	No wound components

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Clause	Requirement + Test	Result - Remark	Verdict
G.5.1.2 a)	Two wires in contact inside wound component, angle between 45° and 90°		N/A
G.5.1.2 b)	Construction subject to routine testing		N/A
G.5.2	Endurance test on wound components	See above	N/A
G.5.2.1	General test requirements		N/A
G.5.2.2	Heat run test		N/A
	Time (s) ..... : .....	See above	N/A
	Temperature (°C) ..... : .....	See above	N/A
G.5.2.3	Wound Components supplied by mains		N/A
G.5.3	Transformers		—
G.5.3.1	Requirements applied (IEC61204-7, IEC61558-1/-2, and/or IEC62368-1) ..... : .....	No transformers	N/A
	Position ..... : .....	See above	N/A
	Method of protection ..... : .....	See above	N/A
G.5.3.2	Insulation		N/A
	Protection from displacement of windings ..... : .....	See above	N/A
G.5.3.3	Overload test ..... : .....	See above	N/A
G.5.3.3.1	Test conditions		N/A
G.5.3.3.2	Winding Temperatures testing in the unit		N/A
G.5.3.3.3	Winding Temperatures - Alternative test method		N/A
G.5.4	Motors		—
G.5.4.1	General requirements	No motors	N/A
	Position ..... : .....	See above	N/A
G.5.4.2	Test conditions		N/A
G.5.4.3	Running overload test		N/A
G.5.4.4	Locked-rotor overload test		N/A
	Test duration (days) ..... : .....	See above	N/A
G.5.4.5	Running overload test for d.c. motors in secondary circuits		N/A
G.5.4.5.2	Tested in the unit		N/A
	Electric strength test (V) ..... : .....	See above	N/A
G.5.4.5.3	Tested on the Bench - Alternative test method; test time (h) ..... : .....	See above	N/A
	Electric strength test (V) ..... : .....	See above	N/A
G.5.4.6	Locked-rotor overload test for d.c. motors in secondary circuits		N/A
G.5.4.6.2	Tested in the unit		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Maximum Temperature .....: .....	See above	N/A
	Electric strength test (V) .....: .....	See above	N/A
G.5.4.6.3	Tested on the bench - Alternative test method; test time (h).....: .....	See above	N/A
	Electric strength test (V) .....: .....	See above	N/A
G.5.4.7	Motors with capacitors		N/A
G.5.4.8	Three-phase motors		N/A
G.5.4.9	Series motors		N/A
	Operating voltage .....: .....	See above	N/A
<b>G.6</b>	<b>Wire Insulation</b>		—
G.6.1	General	No wirings	N/A
G.6.2	Solvent-based enamel wiring insulation		N/A
G.7	Mains supply cords		—
G.7.1	General requirements	No mains supply cords	N/A
	Type .....: .....	See above	N/A
	Rated current (A).....: .....	See above	N/A
	Cross-sectional area (mm <sup>2</sup> ), (AWG) ..... : .....	See above	N/A
G.7.2	Compliance and test method		N/A
G.7.3	Cord anchorages and strain relief for non-detachable power supply cords		N/A
G.7.3.2	Cord strain relief		N/A
G.7.3.2.1	Requirements		N/A
	Strain relief test force (N).....: .....	See above	N/A
G.7.3.2.2	Strain relief mechanism failure		N/A
G.7.3.2.3	Cord sheath or jacket position, distance (mm)....: .....	See above	N/A
G.7.3.2.4	Strain relief comprised of polymeric material		N/A
G.7.4	Cord Entry ..... : .....	See above	N/A
G.7.5	Non-detachable cord bend protection		N/A
G.7.5.1	Requirements		N/A
G.7.5.2	Mass (g) ..... : .....	See above	N/A
	Diameter (m) ..... : .....	See above	N/A
	Temperature (°C) ..... : .....	See above	N/A
G.7.6	Supply wiring space		N/A
G.7.6.2	Stranded wire		N/A
G.7.6.2.1	Test with 8 mm strand		N/A
G.8	Varistors		—

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Clause	Requirement + Test	Result - Remark	Verdict
G.8.1	General requirements	No Varistors	N/A
G.8.2	Safeguard against shock		N/A
G.8.3	Safeguard against fire		—
G.8.3.2	Varistor overload test .....	See above	N/A
G.8.3.3	Temporary overvoltage .....	See above	N/A
<b>G.9</b>	<b>Integrated Circuit (IC) Current Limiters</b>		N/A
G.9.1 a)	Manufacturer defines limit at max. 5A.	No IC current limiters	N/A
G.9.1 b)	Limiters do not have manual operator or reset		N/A
G.9.1 c)	Supply source does not exceed 250 VA .....	See above	N/A
G.9.1 d)	IC limiter output current (max. 5A).....	See above	—
G.9.1 e)	Manufacturers' defined drift .....	See above	—
G.9.2	Test Program 1		N/A
G.9.3	Test Program 2		N/A
G.9.4	Test Program 3		N/A
<b>G.10</b>	<b>Resistors</b>		N/A
G.10.1	General requirements	No resistors used for safeguards	N/A
G.10.2	Resistor test		N/A
G.10.3	Test for resistors serving as safeguards between the mains and an external circuit consisting of a coaxial cable		N/A
G.10.3.1	General requirements	See above	N/A
G.10.3.2	Voltage surge test	See above	N/A
G.10.3.3	Impulse test	See above	N/A
G.11	Capacitor and RC units		—
G.11.1	General requirements	No capacitors or RC units used for safeguards	N/A
G.11.2	Conditioning of capacitors and RC units	See above	N/A
G.11.3	Rules for selecting capacitors	See above	N/A
G.12	Optocouplers		—
	Optocouplers comply with IEC 60747-5-5:2007 Spacing or Electric Strength Test (specify option and test results).....	No Optocouplers	N/A
	Type test voltage V <sub>ini</sub> .....	See above	—
	Routine test voltage, V <sub>ini,b</sub> .....	See above	—
G.13	Printed boards		P

IEC 62368-1			
Clause	Requirement + Test	Result - Remark	Verdict
G.13.1	General requirements	PCB is safety recognized part to the appropriate Standards. No further testing per Clause G is needed.	P
G.13.2	Uncoated printed boards		N/A
G.13.3	Coated printed boards		N/A
G.13.4	Insulation between conductors on the same inner surface		N/A
	Compliance with cemented joint requirements (Specify construction).....:	See above	—
G.13.5	Insulation between conductors on different surfaces		N/A
	Distance through insulation .....	See above	N/A
	Number of insulation layers (pcs) .....	See above	—
G.13.6	Tests on coated printed boards		N/A
G.13.6.1	Sample preparation and preliminary inspection		N/A
G.13.6.2a)	Thermal conditioning		N/A
G.13.6.2b)	Electric strength test		N/A
G.13.6.2c)	Abrasion resistance test		N/A
G.14	Coating on components terminals		—
G.14.1	Requirements .....	No coatings on component terminals	N/A
G.15	Liquid filled components		—
G.15.1	General requirements	No pressurized liquid filled components	N/A
G.15.2	Requirements		N/A
G.15.3	Compliance and test methods		N/A
G.15.3.1	Hydrostatic pressure test		N/A
G.15.3.2	Creep resistance test		N/A
G.15.3.3	Tubing and fittings compatibility test		N/A
G.15.3.4	Vibration test		N/A
G.15.3.5	Thermal cycling test		N/A
G.15.3.6	Force test		N/A
G.15.4	Compliance		
G.16	IC including capacitor discharge function (ICX)		—
a)	Humidity treatment in accordance with sc5.4.8 – 120 hours	No ICX components	N/A
b)	Impulse test using circuit 2 with Uc = to transient voltage .....	See above	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

C1)	Application of ac voltage at 110% of rated voltage for 2.5 minutes		N/A
C2)	Test voltage .....:	See above	—
D1)	10,000 cycles on and off using capacitor with smallest capacitance resistor with largest resistance specified by manufacturer	See above	N/A
D2)	Capacitance .....:	See above	—
D3)	Resistance .....:	See above	—

H	CRITERIA FOR TELEPHONE RINGING SIGNALS		N/A
H.1	General	No telephone ringing signals provided	N/A
H.2	Method A		N/A
H.3	Method B		N/A
H.3.1	Ringing signal		N/A
H.3.1.1	Frequency (Hz) .....	See above	N/A
H.3.1.2	Voltage (V) .....	See above	N/A
H.3.1.3	Cadence; time (s) and voltage (V) .....	See above	N/A
H.3.1.4	Single fault current (mA):.....	See above	N/A
H.3.2	Tripping device and monitoring voltage .....	See above	N/A
H.3.2.1	Conditions for use of a tripping device or a monitoring voltage complied with		N/A
H.3.2.2	Tripping device		N/A
H.3.2.3	Monitoring voltage (V) .....	See above	N/A

J	INSULATED WINDING WIRES FOR USE WITHOUT INTERLEAVED INSULATION		N/A
	General requirements	No such wires	N/A

K	SAFETY INTERLOCKS		N/A
K.1	General requirements	Safety interlocks not provided	N/A
K.2	Components of safety interlock safeguard mechanism .....	See above	N/A
K.3	Inadvertent change of operating mode		N/A
K.4	Interlock safeguard override		N/A
K.5	Fail-safe		N/A
	Compliance .....	See above	N/A
K.6	Mechanically operated safety interlocks		N/A
K.6.1	Endurance requirement		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

K.6.2	Compliance and Test method..... :	See above	N/A
K.7	Interlock circuit isolation		N/A
K.7.1	Separation distance for contact gaps & interlock circuit elements (type and circuit location) ..... :	See above	N/A
K.7.2	Overload test, Current (A) ..... :	See above	N/A
K.7.3	Endurance test		N/A
K.7.4	Electric strength test ..... :	See above	N/A

L	DISCONNECT DEVICES		N/A
L.1	General requirements	Disconnect devices not provided	N/A
L.2	Permanently connected equipment		N/A
L.3	Parts that remain energized		N/A
L.4	Single phase equipment		N/A
L.5	Three-phase equipment		N/A
L.6	Switches as disconnect devices		N/A
L.7	Plugs as disconnect devices		N/A
L.8	Multiple power sources		N/A

M	EQUIPMENT CONTAINING BATTERIES AND THEIR PROTECTION CIRCUITS		N/A
M.1	General requirements	No batteries	N/A
M.2	Safety of batteries and their cells	See above	N/A
M.2.1	Requirements		N/A
M.2.2	Compliance and test method (identify method) ..:		N/A
M.3	Protection circuits	See above	N/A
M.3.1	Requirements		N/A
M.3.2	Tests		N/A
	- Overcharging of a rechargeable battery	See above	N/A
	- Unintentional charging of a non-rechargeable battery	See above	N/A
	- Reverse charging of a rechargeable battery	See above	N/A
	- Excessive discharging rate for any battery	See above	N/A
M.3.3	Compliance .....:	See above	N/A
M.4	Additional safeguards for equipment containing secondary lithium battery	See above	N/A
M.4.1	General		N/A
M.4.2	Charging safeguards		N/A
M.4.2.1	Charging operating limits		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
M.4.2.2a)	Charging voltage, current and temperature ..... :		N/A
M.4.2.2 b)	Single faults in charging circuitry ..... :		N/A
M.4.3	Fire Enclosure		N/A
M.4.4	Endurance of equipment containing a secondary lithium battery		N/A
M.4.4.2	Preparation		N/A
M.4.4.3	Drop and charge/discharge function tests		N/A
	Drop		N/A
	Charge		N/A
	Discharge		N/A
M.4.4.4	Charge-discharge cycle test		N/A
M.4.4.5	Result of charge-discharge cycle test		N/A
M.5	Risk of burn due to short circuit during carrying	See above	N/A
M.5.1	Requirement		N/A
M.5.2	Compliance and Test Method (Test of P.2.3)		N/A
M.6	Prevention of short circuits and protection from other effects of electric current	See above	N/A
M.6.1	Short circuits		N/A
M.6.1.1	General requirements		N/A
M.6.1.2	Test method to simulate an internal fault		N/A
M.6.1.3	Compliance (Specify M.6.1.2 or alternative method) .....	See above	N/A
M.6.2	Leakage current (mA) .....:	See above	N/A
M.7	Risk of explosion from lead acid and NiCd batteries	See above	N/A
M.7.1	Ventilation preventing explosive gas concentration		N/A
M.7.2	Compliance and test method		N/A
M.8	Protection against internal ignition from external spark sources of lead acid batteries	See above	N/A
M.8.1	General requirements		N/A
M.8.2	Test method		N/A
M.8.2.1	General requirements		N/A
M.8.2.2	Estimation of hypothetical volume $V_z$ ( $m^3/s$ ).....:	See above	N/A
M.8.2.3	Correction factors .....	See above	N/A
M.8.2.4	Calculation of distance $d$ (mm) .....	See above	N/A
M.9	Preventing electrolyte spillage	See above	N/A
M.9.1	Protection from electrolyte spillage		n/A

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Clause	Requirement + Test	Result - Remark	Verdict
M.9.2	Tray for preventing electrolyte spillage		N/A
M.10	Instructions to prevent reasonably foreseeable misuse (Determination of compliance: inspection, data review; or abnormal testing) .....	See above	N/A
<b>N ELECTROCHEMICAL POTENTIALS</b>			P
	Metal(s) used .....	Gold plated on connector and header pin surfaces	P
<b>O MEASUREMENT OF CREEPAGE DISTANCES AND CLEARANCES</b>			P
	Figures O.1 to O.20 of this Annex applied .....	Applies Tables 5.4.2.3 and 5.4.2.4	P
<b>P SAFEGUARDS AGAINST ENTRY OF FOREIGN OBJECTS AND SPILLAGE OF INTERNAL LIQUIDS</b>			N/A
P.1	General requirements	Open board for built-in	N/A
P.2.2	Safeguards against entry of foreign object		N/A
	Location and Dimensions (mm) .....		N/A
P.2.3	Safeguard against the consequences of entry of foreign object		N/A
P.2.3.1	Safeguards against the entry of a foreign object		N/A
	Openings in transportable equipment		N/A
	Transportable equipment with metallized plastic parts .....		N/A
P.2.3.2	Openings in transportable equipment in relation to metallized parts of a barrier or enclosure (identification of supplementary safeguard) .....		N/A
P.3	Safeguards against spillage of internal liquids		N/A
P.3.1	General requirements		N/A
P.3.2	Determination of spillage consequences		N/A
P.3.3	Spillage safeguards		N/A
P.3.4	Safeguards effectiveness		N/A
P.4	Metallized coatings and adhesive securing parts		N/A
P.4.2 a)	Conditioning testing		N/A
	Tc (°C).....:	N/A	N/A
	Tr (°C) .....	N/A	N/A
	Ta (°C) .....	N/A	N/A
P.4.2 b)	Abrasion testing .....	N/A	N/A
P.4.2 c)	Mechanical strength testing.....:	N/A	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

Q	CIRCUITS INTENDED FOR INTERCONNECTION WITH BUILDING WIRING	N/A
Q.1	Limited power sources	No output supply from the Board
Q.1.1 a)	Inherently limited output	
Q.1.1 b)	Impedance limited output	
	- Regulating network limited output under normal operating and simulated single fault condition	
Q.1.1 c)	Overcurrent protective device limited output	
Q.1.1 d)	IC current limiter complying with G.9	
Q.1.2	Compliance and test method	
Q.2	Test for external circuits – paired conductor cable	
	Maximum output current (A) .....: See above	N/A
	Current limiting method .....: See above	N/A

R	LIMITED SHORT CIRCUIT TEST	N/A
R.1	General requirements	No connections to mains, nor protective bonding conductors
R.2	Determination of the overcurrent protective device and circuit	
R.3	Test method Supply voltage (V) and short-circuit current (A)). .....:	See above

S	TESTS FOR RESISTANCE TO HEAT AND FIRE	N/A
S.1	Flammability test for fire enclosures and fire barrier materials of equipment where the steady state power does not exceed 4 000 W	PCB used for fire barrier is recognized part to appropriate Standards. No further testing per Clause S is needed.
	Samples, material.....: See above	N/A
	Wall thickness (mm).....: See above	N/A
	Conditioning (°C).....: See above	N/A
	Test flame according to IEC 60695-11-5 with conditions as set out	
	- Material not consumed completely	
	- Material extinguishes within 30s	
	- No burning of layer or wrapping tissue	
S.2	Flammability test for fire enclosure and fire barrier integrity	
	Samples, material.....: See above	N/A
	Wall thickness (mm).....: See above	N/A
	Conditioning (°C).....: See above	N/A

IEC 62368-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Test flame according to IEC 60695-11-5 with conditions as set out		N/A
	Test specimen does not show any additional hole		N/A
S.3	Flammability test for the bottom of a fire enclosure		N/A
	Samples, material.....: See above	See above	N/A
	Wall thickness (mm).....: See above	See above	N/A
	Cheesecloth did not ignite		N/A
S.4	Flammability classification of materials		N/A
S.5	Flammability test for fire enclosures and fire barrier materials of equipment where the steady state power does not exceed 4 000 W		N/A
	Samples, material.....: See above	See above	N/A
	Wall thickness (mm).....: See above	See above	N/A
	Conditioning (test condition), (°C).....: See above	See above	N/A
	Test flame according to IEC 60695-11-20 with conditions as set out		N/A
	After every test specimen was not consumed completely		N/A
	After fifth flame application, flame extinguished within 1 min		N/A
T	<b>MECHANICAL STRENGTH TESTS</b>		N/A
T.1	General requirements	No mechanical testing required or performed	N/A
T.2	Steady force test, 10 N .....	See above	N/A
T.3	Steady force test, 30 N .....	See above	N/A
T.4	Steady force test, 100 N .....	See above	N/A
T.5	Steady force test, 250 N .....	See above	N/A
T.6	Enclosure impact test		N/A
	Fall test		N/A
	Swing test		N/A
T.7	Drop test .....	See above	N/A
T.8	Stress relief test.....: See above	See above	N/A
T.9	Impact Test (glass)		N/A
T.9.1	General requirements		N/A
T.9.2	Impact test and compliance		N/A
	Impact energy (J) .....	See above	N/A
	Height (m).....: See above	See above	N/A
T.10	Glass fragmentation test .....	See above	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
T.11	Test for telescoping or rod antennas		N/A
	Torque value (Nm) ..... : .....	See above	N/A
<b>U</b>	<b>MECHANICAL STRENGTH OF CATHODE RAY TUBES (CRT) AND PROTECTION AGAINST THE EFFECTS OF IMPLOSION</b>		
U.1	General requirements	No cathode ray tubes	N/A
U.2	Compliance and test method for non-intrinsically protected CRTs		N/A
U.3	Protective Screen ..... : .....	See above	N/A
<b>V</b>	<b>DETERMINATION OF ACCESSIBLE PARTS (FINGERS, PROBES AND WEDGES)</b>		
V.1	Accessible parts of equipment	No ES2 parts	N/A
V.2	Accessible part criterion	See above	N/A

<b>4.1.2 TABLE: List of critical components</b>						P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity <sup>1)</sup>	
PCB	Cheer Time Enterprise Co. Ltd.	66H	90 x 75 mm, 1.20 mm thickness, V-0, 130°C	UL 94, UL 796, CAN/CSA-22.2 No. 0.17	cUR (E142470)	
PCB (alternative)	Interchangeable	Interchangeable	90 x 75 mm, 1.20 mm thickness, V-1 minimum, 105°C minimum	UL 94, UL 796 or CAN/CSA-22.2 No. 0.17	UL and/or CSA recognized	
Micro USB Connector/Port (J1)	Hirose	ZX62D-B-5P8	5 nickel plating contacts, 30VAC 1A per contact, V-0 plastic, 95°C	IEC 62368-1:2014	Test in the product	
10-pin Header (J3)	Sullins Connector Solutions (Plastic manufacturer is Shinkong Synthetic)	PRPC010SBA N-M71RC (Plastic type is E202G15)	10 gold plating male pins, 2.54mm pitch, 3A per contact, 1000VAC dielectric, UL94 V-0 plastic, 105°C	UL 94, IEC 60695-11-10, CSA-C22.2 No. 0.17 for plastic material	cUR (E107536) (for plastic material)	
Label stock	FLEXcon	55285SL	25.2 x 13.0 mm, 0.035mm film + 0.022mm adhesive + 0.008mm liner thickness, 150°C service	IEC 62368-1:2014	Tested per F.3.10	
Supplementary information:						
<sup>1)</sup> Provided evidence ensures the agreed level of compliance. See OD-CB2039.						

<b>4.8.4, 4.8.5</b>	<b>TABLE: Lithium coin/button cell batteries mechanical tests</b>			<b>WO#</b>	<b>N/A</b>		
(The following mechanical tests are conducted in the sequence noted.)							
<b>4.8.4.2</b>	<b>TABLE: Stress Relief test</b>			—			
<b>Part</b>		<b>Material</b>	<b>Oven Temperature (°C)</b>	<b>Comments</b>			
<b>4.8.4.3</b>	<b>TABLE: Battery replacement test</b>			—			
Battery part no. .... :				—			
Battery Installation/withdrawal			Battery Installation/Removal Cycle	<b>Comments</b>			
			1				
			2				
			3				
			4				
			5				
			6				
			8				
			9				
			10				
<b>4.8.4.4</b>	<b>TABLE: Drop test</b>			—			
<b>Impact Area</b>		<b>Drop Distance</b>	<b>Drop No.</b>	<b>Observations</b>			
<b>4.8.4.5</b>	<b>TABLE: Impact</b>			—			
<b>Impacts per surface</b>		<b>Surface tested</b>	<b>Impact energy (Nm)</b>	<b>Comments</b>			
<b>4.8.4.6</b>	<b>TABLE: Crush test</b>			—			
<b>Test position</b>		<b>Surface tested</b>	<b>Crushing Force (N)</b>	<b>Duration force applied (s)</b>			
Supplementary information:							
<b>4.8.5</b>	<b>TABLE: Lithium coin/button cell batteries mechanical test result</b>			<b>WO#</b>	<b>N/A</b>		

Test position	Surface tested	Force (N)	Duration force applied (s)
<b>Supplementary Information:</b>			

5.2		Table: Classification of electrical energy sources			WO# OPS121421	P		
5.2.2.2 – Steady State Voltage and Current conditions								
No.	Supply Voltage	Location (e.g. circuit designation)	Test conditions	Parameters				
1	5VDC of micro USB	5VDC pin to metal enclosure of connector	Normal	U (Vrms or Vpk)	I (Apk or Arms)	Hz		
			Abnormal	5.5 VDC	0.0 A	---		
			Single fault – SC/OC	5.5 VDC	0.0 A	---		
2	24VDC of 10-pins Header	Pin 9 to metal enclosure of USB connector	Normal	24.0 VDC	0.0 A	---		
			Abnormal	24.0 VDC	0.0 A	---		
			Single fault – SC/OC	24.0 VDC	0.0 A	---		
<b>Supplementary information:</b>								
Test Instruments: 10SL0279, 10SL0320A								
Test environment: 22.5°C, 31.3% RH								
Tested by: Thomas Tu			Test Date: Feb/17/2022					

5.2.2.3 - Capacitance Limits						
No.	Supply Voltage	Location (e.g. circuit designation)	Test conditions	Parameters		ES Class
			Normal			ES1
			Abnormal			
			Single fault – SC/OC			
5.2.2.4 - Single Pulses						
No.	Supply Voltage	Location (e.g. circuit designation)	Test conditions	Parameters		ES Class
			Normal	Duration (ms)	Upk (V)	ES1
			Abnormal			
			Single fault – SC/OC			

5.2.2.5 - Repetitive Pulses										
No.	Supply Voltage	Location (e.g. circuit designation)	Test conditions	Parameters			ES Class			
				Off time (ms)	Upk (V)	Ipk (mA)				
			Normal							
			Abnormal							
			Single fault – SC/OC							
Test Conditions:										
Normal –										
Abnormal –										
Supplementary information: SC=Short Circuit, OC=Open Circuit										

5.4.1.4, 6.3.2, 9.0, B.2.6	TABLE: Temperature measurements				WO# OPS121421	P
	Supply voltage (V) .....	5.0 VDC (via Micro USB)	Shtft to Tma			—
	Ambient T <sub>min</sub> (°C) .....	20.2	--			—
	Ambient T <sub>max</sub> (°C) .....	23.1	--			—
	Tma (°C) .....	25.0	85.0			—
Maximum measured temperature T of part/at:		T (°C)			Allowed T <sub>max</sub> (°C)	
1) Ambient		25.0	85.0			85
2) U1 (Infineon XCM 4500)		41.0	101.0			125
3) U24 (MAX3221)		32.4	92.4			150
4) UU9 (TI 05 IPSI)		36.5	96.5			125
5) U10 (K1H8920)		36.2	96.2			125
6) U11 (TI 05 IPSI)		35.3	95.3			125
7) U6 (BGT24MTR11)		45.0	105.0			150
8) Micro USB on J1		33.1	93.1			95
9) 10-pins Header on J3		33.5	93.5			105
Supplementary Information: Board was sensing continuous movements and sending data to a laptop computer on PuTTY for maximum normal load condition.						
Test Instruments: 10SL0279, 10SL0311C, 10SL0311D, 10SL0328A						
Test environment: 23.0°C, 30.1% RH						
Tested by: Thomas Tu		Test Date: Feb/08/2022				
Temperature T of winding:		t <sub>1</sub> (°C)	R <sub>1</sub> (Ω)	t <sub>2</sub> (°C)	R <sub>2</sub> (Ω)	T (°C)
						Allowed T <sub>max</sub> (°C)
						Insulation class


Note 1: Tma should be considered as directed by applicable requirement

Note 2: Tma is not included in assessment of Touch Temperatures (Clause 9)

5.4.1.4, 6.3.2, 9.0, B.2.6	TABLE: Temperature measurements				WO# OPS121421	P
	Supply voltage (V) .....: 4.75 VDC (pin 9 of 10-pin Header)	Shtft to Tma	24.0 VDC (pin 9 of 10-pin Header)	Shift to Tma	—	—
	Ambient T <sub>min</sub> (°C) .....: 21.0	--	22.8	--	—	—
	Ambient T <sub>max</sub> (°C) .....: 23.4	--	24.6	--	—	—
	Tma (°C) .....: 25.0	85.0	25.0	85.0	—	—
Maximum measured temperature T of part/at:		T (°C)			Allowed T <sub>max</sub> (°C)	
1) Ambient	25.0	85.0	25.0	85.0	85	
2) U1 (Infeneon XCM 4500)	41.7	101.7	41.6	101.6	125	
3) U24 (MAX3221)	33.4	93.4	31.8	91.8	150	
4) UU9 (TI 05 IPSI)	37.5	97.5	37.1	97.1	125	
5) U10 (K1H8920)	37.0	97.0	37.0	97.0	125	
6) U11 (TI 05 IPSI)	36.4	96.4	36.7	96.7	125	
7) U6 (BGT24MTR11)	44.8	104.8	44.9	104.9	150	
8) Micro USB on J1	34.7	94.7	33.8	93.8	95	
9) 10-pins Header on J3	36.1	96.1	33.7	93.7	105	
Supplementary Information: Board was sensing continuous movements and sending data to laptop computer on PuTTY for maximum normal load condition.						
Test Instruments: 10SL0279, 10SL0311C, 10SL0311D, 10SL0328A5.						
Test environment: 23.4°C, 29.2% RH						
Tested by: Thomas Tu	Test Date: Feb/09/2022					
Temperature T of winding:	t <sub>1</sub> (°C)	R <sub>1</sub> (Ω)	t <sub>2</sub> (°C)	R <sub>2</sub> (Ω)	T (°C)	Allowed T <sub>max</sub> (°C)
Note 1: Tma should be considered as directed by applicable requirement						
Note 2: Tma is not included in assessment of Touch Temperatures (Clause 9)						

5.4.1.4, 6.3.2, 9.0, B.2.6	TABLE: Temperature measurements				WO# OPS121421	P
	Supply voltage (V) .....:	5VDC Micro USB & 4.75V 10- pin Header	Shtft to Tma	5VDC Micro USB & 24V 10- pin Header	Shift to Tma	—
	Ambient T <sub>min</sub> (°C) .....	20.8	--	22.1	--	—
	Ambient T <sub>max</sub> (°C) .....	23.8	--	23.1	--	—
	Tma (°C) .....	25.0	85.0	25.0	85.0	—
Maximum measured temperature T of part/at:		T (°C)				Allowed T <sub>max</sub> (°C)
1) Ambient		25.0	85.0	25.0	85.0	85
2) U1 (Infeneon XCM 4500)		41.2	101.2	40.6	100.6	125
3) U24 (MAX3221)		30.1	90.1	31.1	91.1	150
4) UU9 (TI 05 IPSI)		36.5	96.5	36.2	96.2	125
5) U10 (K1H8920)		35.7	95.7	36.2	96.2	125
6) U11 (TI 05 IPSI)		34.5	94.5	35.1	95.1	125
7) U6 (BGT24MTR11)		43.6	103.6	44.6	104.6	150
8) Micro USB on J1		34.4	94.4	32.6	92.6	95
9) 10-pins Header on J3		34.6	94.6	32.9	92.9	105
Supplementary Information: Board was incorrectly powered simultaneously by 5VDC micro USB and 4.75/24VDC 10-pins Header, and sensing continuous movement for the maximum abnormal load condition.						
Test Instruments: 10SL0279, , 10SL0311C, 10SL0311D, 10SL0328A						
Test environment: 23.8°C, 29.2% RH						
Tested by: Thomas Tu	Test Date: Feb/09/2022					
Temperature T of winding:	t <sub>1</sub> (°C)	R <sub>1</sub> (Ω)	t <sub>2</sub> (°C)	R <sub>2</sub> (Ω)	T (°C)	Allowed T <sub>max</sub> (°C)
Note 1: Tma should be considered as directed by applicable requirement						
Note 2: Tma is not included in assessment of Touch Temperatures (Clause 9)						

<b>5.4.1.10.2</b>	<b>TABLE: Vicat softening temperature of thermoplastics</b>	<b>WO#</b>	<b>N/A</b>
Penetration (mm) .....	.....		—
Object/ Part No./Material	Manufacturer/t rademark	T softening (°C)	
Supplementary Information:			

<b>5.4.1.10.3</b>	<b>TABLE: Ball pressure test of thermoplastics</b>	<b>WO#</b>	<b>N/A</b>
Allowed impression diameter (mm) .....	$\leq 2$ mm		—
Object/Part No./Material	Manufacturer/trademark	Test temperature (°C)	Impression diameter (mm)
Supplementary information:			

<b>5.4.2.2, 5.4.2.4 and 5.4.3</b>	<b>TABLE: Minimum Clearances/Creepage distance</b>	<b>WO# OPS121421</b>	<b>P</b>				
Clearance (cl) and creepage distance (cr) at/of/between:	Up (V)	U r.m.s. (V)	Frequenc y (kHz) <sup>1</sup>	Required cl (mm)	cl (mm) <sup>2</sup>	Required <sup>3</sup> cr (mm)	cr (mm)
5V pin to GND pin of 5 pins Micro USB Port (J1)	--	5 VDC	--	0.2	1.0	0.4 (IIIb)	1.0
24V pin to GND pin of 10 pins Header (J3)	--	24 VDC	--	0.2	1.9	0.5 (IIIb)	1.9
Supplementary information:							
Test Instruments: 10SL0415							
Test environment: 21.0°C, 28.0% RH							
Tested by: Thomas Tu							
Note 1: Only for frequency above 30 kHz							
Note 2: See table 5.4.2.4 if this is based on electric strength test							
Note 3: Provide Material Group							

<b>5.4.2.3</b>	<b>TABLE: Minimum Clearances distances using required withstand voltage</b>			<b>WO#</b>	<b>N/A</b>
	<b>Overvoltage Category (OV):</b>				
	<b>Pollution Degree:</b>				
Clearance distanced between:		Required withstand voltage	Required cl (mm)	Measured cl (mm)	
Supplementary information:					

<b>5.4.2.4</b>	<b>TABLE: Clearances based on electric strength test</b>			<b>WO#</b>	<b>N/A</b>
Test voltage applied between:		Required cl (mm)	Test voltage (kV) peak/ r.m.s. / d.c.	Breakdown Yes / No	
Supplementary information:					

<b>5.4.4.2, 5.4.4.5 c) 5.4.4.9</b>	<b>TABLE: Distance through insulation measurements</b>				<b>WO#</b>	<b>N/A</b>
Distance through insulation di at/of:		Peak voltage (V)	Frequency (kHz)	Material	Required DTI (mm)	DTI (mm)
Supplementary information:						

<b>5.4.9</b>	<b>TABLE: Electric strength tests</b>			<b>WO#</b>	<b>N/A</b>
Test voltage applied between:		Voltage shape (AC, DC)	Test voltage (V)	Breakdown Yes / No	
Functional:					

<b>5.4.9</b>	<b>TABLE: Electric strength tests</b>	<b>WO#</b>	<b>N/A</b>
Test voltage applied between:	Voltage shape (AC, DC)	Test voltage (V)	Breakdown Yes / No
Basic/supplementary:			
Reinforced:			
Routine Tests:			
Supplementary information:			

<b>5.5.2.2</b>	<b>TABLE: Stored discharge on capacitors</b>	<b>WO#</b>	<b>N/A</b>		
Supply Voltage (V), Hz	Test Location	Operating Condition (N, S)	Switch position On or off	Measured Voltage (after 2 seconds)	ES Classification
Supplementary information:					
X-capacitors installed for testing are:					
<input type="checkbox"/> bleeding resistor rating:					
<input type="checkbox"/> ICX:					
Notes:					
A. Test Location:					
Phase to Neutral; Phase to Phase; Phase to Earth; and/or Neutral to Earth					
B. Operating condition abbreviations:					
N – Normal operating condition (e.g., normal operation, or open fuse); S –Single fault condition					

<b>5.6.6.2</b>	<b>TABLE: Resistance of protective conductors and terminations</b>	<b>WO#</b>	<b>N/A</b>	
Accessible part	Test current (A)	Duration (min)	Voltage drop (V)	Resistance (Ω)

5.6.6.2	TABLE: Resistance of protective conductors and terminations				WO#	N/A
	Accessible part	Test current (A)	Duration (min)	Voltage drop (V)	Resistance (Ω)	
Supplementary information:						

5.7.2.2, 5.7.4	TABLE: Earthed accessible conductive part	WO#	N/A
Supply voltage ..... :		—	
Location		Test conditions specified in 6.1 of IEC 60990 or Fault Condition No in IEC 60990 clause 6.2.2.1 through 6.2.2.8, except for 6.2.2.7	Touch current (mA)
		1	
		2*	
		3	
		4	
		5	
		6	
		8	
Supplementary Information:			
Protective Conductor Current:			
Notes: [1] Supply voltage is the anticipated maximum Touch Voltage [2] Earthed neutral conductor [Voltage differences less than 1% or more] [3] Specify method used for measurement as described in IEC 60990 sub-clause 4.3 [4] IEC60990, sub-clause 6.2.2.7, Fault 7 not applicable. [5] (*) IEC60990, sub-clause 6.2.2.2 is not applicable if switch or disconnect device (e.g., appliance coupler) provided.			

6.2.2	Table: Electrical power sources (PS) measurements for classification				WO# OPS121421	P
Source	Description	Measurement	Max Power after 3 s	Max Power after 5 s*)	PS Classification	
5VDC from USB-A	5V pin to GND pin of Micro USB	Power (W) :	5 W	--	PS1	
		V <sub>A</sub> (V) :	5 V	--		
		I <sub>A</sub> (A) :	1 A	--		
4.75V-24V from external DC source	Pin 9 to GND pin of 10-pins Header	Power (W) :	---	72 W	PS2	
		V <sub>A</sub> (V) :	---	24 V		
		I <sub>A</sub> (A) :	---	3 A		
		Power (W) :				

		V <sub>A</sub> (V) : I <sub>A</sub> (A) :			
		Power (W) : V <sub>A</sub> (V) : I <sub>A</sub> (A) :			
<b>Supplementary Information:</b>					
Test Instruments: 10SL0172, 10SL0331 Test environment: 21.2° C, 28.3% RH Tested by: Thomas Tu                                  Test Date: Feb/18/2022 (*) Measurement taken only when limits at 3 seconds exceed PS1 limits					

6.2.3.1	<b>Table: Determination of Potential Ignition Sources (Arcing PIS)</b>				WO# OPS121421	P		
Location		Open circuit voltage After 3 s (V <sub>p</sub> )	Measured r.m.s current (I <sub>rms</sub> )	Calculated value (V <sub>p</sub> x I <sub>rms</sub> )	Arcing PIS? Yes / No			
Micro USB-A, 5V pin to GND pin		5.113 VDC	0.265 A	1.35 W	No			
Pin 9 to GND pin of 10-pins Header (J3)		24.006 VDC	0.0615 A	1.48 W	No			
<b>Supplementary information:</b>								
Test Instruments: 10SL0279, , 10SL0311C, 10SL0311D Test environment: 23.8°C, 29.2% RH Tested by: Thomas Tu                                  Test Date: Feb/09/2022								
An Arcing PIS requires a minimum of 50 V (peak) a.c. or d.c. An Arcing PIS is established when the product of the open circuit voltage (V <sub>p</sub> ) and normal operating condition rms current (I <sub>rms</sub> ) is greater than 15.								

6.2.3.2	<b>Table: Determination of Potential Ignition Sources (Resistive PIS)</b>				WO# OPS121421	P
Circuit Location (x-y)		Operating Condition (Normal / Describe Single Fault)	Measured wattage or VA During first 30 s (W / VA)	Measured wattage or VA After 30 s (W / VA)	Protective Circuit, Regulator, or PTC Operated? Yes / No (Comment)	Resistive PIS? Yes/No
5V pin to GND pin of Micro USB-A Port		Single Fault - Shorting	10.79 W	10.79 W	Yes	No
Pin 9 to GND pin of 10-pins Header (J3)		Single Fault - Shorting	72 W	72 W	--	Yes

Supplementary Information:				
Test Instruments: 10SL0172, 10SL0331				
Test environment: 21.0°C, 27.9% RH				
Tested by: Thomas Tu	Test Date: Feb/18/2022			
<p>A combination of voltmeter, VA and ammeter IA may be used instead of a wattmeter.</p> <p>If a separate voltmeter and ammeter are used, the product of (VA x IA) is used to determine Resistive PIS classification.</p> <p>A Resistive PIS: (a) dissipates more than 15 W, measured after 30 s of normal operation, <u>or</u> (b) under single fault conditions has either a power exceeding 100 W measured immediately after the introduction of the fault if electronic circuits, regulators or PTC devices are used, or has an available power exceeding 15 W measured 30 s after introduction of the fault.</p>				

8.5.5	TABLE: High Pressure Lamp	WO#	N/A
Description		Values	Energy Source Classification
Lamp type .....			—
Manufacturer .....			—
Cat no.....			—
Pressure (cold) (MPa) .....			MS_
Pressure (operating) (MPa) .....			MS_
Operating time (minutes).....			—
Explosion method.....			—
Max particle length escaping enclosure (mm) :			MS_
Max particle length beyond 1 m (mm).....			MS_
Overall result .....			
Supplementary information:			

B.2.5	TABLE: Input test							WO# OPS121421	P
	U (V)	I (A)	I rated (A)	P (W)	P rated (W)	Fuse No	I fuse (A)	Condition/status	
<b>Micro USB (J1)</b>									
	5.113	0.265	None	1.35	1.80	---	---	Maximum normal load	
<b>10-pins Header (J3)</b>									
	4.748	0.279	None	1.32	1.80	---	---	Maximum normal load	
	24.006	.0615	None	1.48	1.80	---	---	Maximum normal load	

B.2.5	TABLE: Input test							WO# OPS121421	P		
U (V)	I (A)	I rated (A)	P (W)	P rated (W)	Fuse No	I fuse (A)	Condition/status				
Supplementary information: Maximum normal load - The unit operated to continuously sensing movements and sending data to a laptop computer that could be observed on PuTTY.											
Test Instruments: 10SL0279, , 10SL0311C, 10SL0311D											
Test environment: 23.8°C, 29.2% RH											
Tested by: Thomas Tu				Test Date: Feb/09/2022							
Equipment may be have rated current or rated power or both. Both should be measured											

B.3	TABLE: Abnormal operating condition tests							WO# OPS121421	P		
Ambient temperature (°C) .....							23.8	—			
Power source for EUT: Manufacturer, model/type, output rating .:							Rigol DP712, 0-50V, 0-3A	—			
Component No.	Abnormal Condition	Supply voltage, (V)	Test time (ms)	Fuse no.	Fuse current, (A)		T-couple	Temp. (°C)	Observation		
5V Micro USB and 4.75V 10-pins Header	Powered simultaneously	5VDC and 4.75VDC	43 minutes	---	---		See Table 5.4.1.4	See Table 5.4.1.4	Normal temerature rises		
5V Micro USB and 24V 10-pins Header	Powered simultaneously	5VDC and 24VDC	64 minutes	---	---		See Table 5.4.1.4	See Table 5.4.1.4	Normal temperature rises		
Supplementary information:											
Test Instruments: 10SL0279, , 10SL0311C, 10SL0311D, 10SL0328A											
Test environment: 23.8°C, 29.2% RH											
Tested by: Thomas Tu				Test Date: Feb/09/2022							
Test table is provided to record abnormal and fault conditions for all applicable energy sources including Thermal burn injury. Column "Abnormal/Fault." Specify if test condition by indicating "Abnormal" then the condition for a Clause B.3 test or "Single Fault" then the condition for Clause B.4.											

B.4	TABLE: Fault condition tests							WO#	N/A
Ambient temperature (°C) .....							—		
Power source for EUT: Manufacturer, model/type, output rating .:							—		
Component No.	Fault Condition	Supply voltage, (V)	Test time (ms)	Fuse no.	Fuse current, (A)		T-couple	Temp. (°C)	Observation

Supplementary information:

<b>Annex M</b>	<b>TABLE: Batteries</b>								N/A
The tests of Annex M are applicable only when appropriate battery data is not available									
Is it possible to install the battery in a reverse polarity position? .....: .....									
Components	Non-rechargeable batteries			Rechargeable batteries					
	Discharging		Un-intentional charging	Charging		Discharging		Reversed charging	
	Meas. current	Manuf. Specs.		Meas. current	Manuf. Specs.	Meas. current	Manuf. Specs.	Meas. current	Manuf. Specs.
Test results:									Verdict
- Chemical leaks									
- Explosion of the battery									
- Emission of flame or expulsion of molten metal									
- Electric strength tests of equipment after completion of tests									
Supplementary information:									

<b>Annex M.4</b>	<b>Table: Additional safeguards for equipment containing secondary lithium batteries</b>					N/A
Battery/Cell No.	Test conditions	Measurements			Observation	
		U	I (A)	Temp (C)		
	Normal					
	Abnormal					
	Single fault –SC/OC					
	Normal					
	Abnormal					
	Single fault – SC/OC					
Supplementary Information:						
Battery identification	Charging at $T_{\text{lowest}}$ ( $^{\circ}\text{C}$ )	Observation		Charging at $T_{\text{highest}}$ ( $^{\circ}\text{C}$ )	Observation	

Battery identification	Charging at $T_{\text{lowest}}$ (°C)	Observation	Charging at $T_{\text{highest}}$ (°C)	Observation
Supplementary Information:				

Annex Q.1	<b>TABLE: Circuits intended for interconnection with building wiring (LPS)</b>				WO#	N/A
Note: Measured UOC (V) with all load circuits disconnected:						
Output Circuit	Components	$U_{\text{oc}}$ (V)	$I_{\text{sc}}$ (A)		S (VA)	
			Meas.	Limit	Meas.	Limit
Supplementary Information:						
SC=Short circuit, OC=Open circuit						

T.2, T.3, T.4, T.5	<b>TABLE: Steady force test</b>				WO#	N/A
Part/Location		Material	Thickness (mm)	Force (N)	Test Duration (sec)	Observation
Supplementary information:						

T.6, T.9	<b>TABLE: Impact tests</b>				WO#	N/A		
Part/Location		Material	Thickness (mm)	Vertical distance (mm)	Observation			
Top and bottom sides		Cast aluminum	2.60 mm	1,300 mm	No cracks or bending of enclosure			
Supplementary information:								

T.7	<b>TABLE: Drop tests</b>				WO#	N/A
Part/Location	Material	Thickness (mm)	Drop Height (mm)	Observation		
Supplementary information:						

T.8	<b>TABLE: Stress relief test</b>				WO#	N/A
Part/Location	Material	Thickness (mm)	Oven Temperature (°C)	Duration (h)	Observation	
Supplementary information:						

## Attachment 1: National Differences

<b>ATTACHMENT TO TEST REPORT</b>																																										
<b>IEC 62368-1</b>																																										
<b>EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES</b>																																										
(Audio/video, information and communication technology equipment - Part 1: Safety requirements)																																										
<b>Differences according to.....</b> : EN 62368-1:2014+A11:2017																																										
<b>Attachment Form No.</b> : EU_GD_IEC62368_1B_II																																										
<b>Attachment Originator</b> : Nemko AS																																										
<b>Master Attachment</b> : Date 2021-02-04																																										
<b>Copyright © 2017 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</b>																																										
	<b>CENELEC COMMON MODIFICATIONS (EN)</b>					P																																				
	Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 62368-1:2014 are prefixed "Z".					P																																				
<b>CONTENTS</b>	<b>Add</b> the following annexes: Annex ZA (normative) Normative references to international publications with their corresponding European publications Annex ZB (normative) Special national conditions Annex ZC (informative) A-deviations Annex ZD (informative) IEC and CENELEC code designations for flexible cords					P																																				
	<b>Delete</b> all the "country" notes in the reference document (IEC 62368-1:2014) according to the following list: <table border="1"> <tr> <td>0.2.1</td><td>Note</td><td>1</td><td>Note 3</td><td>4.1.15</td><td>Note</td></tr> <tr> <td>4.7.3</td><td>Note 1 and 2</td><td>5.2.2.2</td><td>Note</td><td>5.4.2.3.2.2 Table 13</td><td>Note c</td></tr> <tr> <td>5.4.2.3.2.4</td><td>Note 1 and 3</td><td>5.4.2.5</td><td>Note 2</td><td>5.4.5.1</td><td>Note</td></tr> <tr> <td>5.5.2.1</td><td>Note</td><td>5.5.6</td><td>Note</td><td>5.6.4.2.1</td><td>Note 2 and 3</td></tr> <tr> <td>5.7.5</td><td>Note</td><td>5.7.6.1</td><td>Note 1 and 2</td><td>10.2.1 Table 39</td><td>Note 2, 3 and 4</td></tr> <tr> <td>10.5.3</td><td>Note 2</td><td>10.6.2.1</td><td>Note 3</td><td>F.3.3.6</td><td>Note 3</td></tr> </table>					0.2.1	Note	1	Note 3	4.1.15	Note	4.7.3	Note 1 and 2	5.2.2.2	Note	5.4.2.3.2.2 Table 13	Note c	5.4.2.3.2.4	Note 1 and 3	5.4.2.5	Note 2	5.4.5.1	Note	5.5.2.1	Note	5.5.6	Note	5.6.4.2.1	Note 2 and 3	5.7.5	Note	5.7.6.1	Note 1 and 2	10.2.1 Table 39	Note 2, 3 and 4	10.5.3	Note 2	10.6.2.1	Note 3	F.3.3.6	Note 3	P
0.2.1	Note	1	Note 3	4.1.15	Note																																					
4.7.3	Note 1 and 2	5.2.2.2	Note	5.4.2.3.2.2 Table 13	Note c																																					
5.4.2.3.2.4	Note 1 and 3	5.4.2.5	Note 2	5.4.5.1	Note																																					
5.5.2.1	Note	5.5.6	Note	5.6.4.2.1	Note 2 and 3																																					
5.7.5	Note	5.7.6.1	Note 1 and 2	10.2.1 Table 39	Note 2, 3 and 4																																					
10.5.3	Note 2	10.6.2.1	Note 3	F.3.3.6	Note 3																																					
	For special national conditions, see Annex ZB.					N/A																																				
1	<b>Add</b> the following note: NOTE Z1 The use of certain substances in electrical and electronic equipment is restricted within the EU: see Directive 2011/65/EU.					N/A																																				

4.Z1	<p><b>Add</b> the following new subclause after 4.9:</p> <p>To protect against excessive current, short-circuits and earth faults in circuits connected to an a.c. <b>mains</b>, protective devices shall be included either as integral parts of the equipment or as parts of the building installation, subject to the following, a), b) and c):</p> <ul style="list-style-type: none"> <li>a) except as detailed in b) and c), protective devices necessary to comply with the requirements of B.3.1 and B.4 shall be included as parts of the equipment;</li> <li>b) for components in series with the mains input to the equipment such as the supply cord, appliance coupler, r.f.i. filter and switch, short-circuit and earth fault protection may be provided by protective devices in the building installation;</li> <li>c) it is permitted for <b>pluggable equipment type B</b> or <b>permanently connected equipment</b>, to rely on dedicated overcurrent and short-circuit protection in the building installation, provided that the means of protection, e.g. fuses or circuit breakers, is fully specified in the installation instructions.</li> </ul> <p>If reliance is placed on protection in the building installation, the installation instructions shall so state, except that for <b>pluggable equipment type A</b> the building installation shall be regarded as providing protection in accordance with the rating of the wall socket outlet.</p>		N/A
5.4.2.3.2.4	<p><b>Add</b> the following to the end of this subclause:</p> <p>The requirement for interconnection with <b>external circuit</b> is in addition given in EN 50491-3:2009.</p>		N/A
10.2.1	<p>Add the following to <sup>c)</sup> and <sup>d)</sup> in table 39:</p> <p>For additional requirements, see 10.5.1.</p>		N/A

10.5.1	<p><b>Add</b> the following after the first paragraph:</p> <p><i>For RS 1 compliance is checked by measurement under the following conditions:</i></p> <p><i>In addition to the normal operating conditions, all controls adjustable from the outside by hand, by any object such as a tool or a coin, and those internal adjustments or presets which are not locked in a reliable manner, are adjusted so as to give maximum radiation whilst maintaining an intelligible picture for 1 h, at the end of which the measurement is made.</i></p> <p>NOTE Z1 Soldered joints and paint lockings are examples of adequate locking.</p> <p><i>The dose-rate is determined by means of a radiation monitor with an effective area of 10 cm<sup>2</sup>, at any point 10 cm from the outer surface of the apparatus.</i></p> <p><i>Moreover, the measurement shall be made under fault conditions causing an increase of the high-voltage, provided an intelligible picture is maintained for 1 h, at the end of which the measurement is made.</i></p> <p><i>For RS1, the dose-rate shall not exceed 1 µSv/h taking account of the background level.</i></p> <p>NOTE Z2 These values appear in Directive 96/29/Euratom of 13 May 1996.</p>		N/A
10.6.1	<p><b>Add</b> the following paragraph to the end of the subclause:</p> <p>EN 71-1:2011, 4.20 and the related tests methods and measurement distances apply.</p>		N/A
10.Z1	<p><b>Add</b> the following new subclause after 10.6.5.</p> <p><b>10.Z1 Non-ionizing radiation from radio frequencies in the range 0 to 300 GHz</b></p> <p>The amount of non-ionizing radiation is regulated by European Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).</p> <p>For intentional radiators, ICNIRP guidelines should be taken into account for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz). For hand-held and body-mounted devices, attention is drawn to EN 50360 and EN 50566</p>		N/A
G.7.1	<p><b>Add</b> the following note:</p> <p>NOTE Z1 The harmonized code designations corresponding to the IEC cord types are given in Annex ZD.</p>		N/A

Bibliography	<p><b>Add the following standards:</b></p> <p><b>Add the following notes for the standards indicated:</b></p> <p>IEC 60130-9 NOTE Harmonized as EN 60130-9.      IEC 60269-2 NOTE Harmonized as HD 60269-2.      IEC 60309-1 NOTE Harmonized as EN 60309-1.      IEC 60364 NOTE some parts harmonized in HD 384/HD 60364 series.      IEC 60601-2-4 NOTE Harmonized as EN 60601-2-4.      IEC 60664-5 NOTE Harmonized as EN 60664-5.      IEC 61032:1997 NOTE Harmonized as EN 61032:1998 (not modified).      IEC 61508-1 NOTE Harmonized as EN 61508-1.      IEC 61558-2-1 NOTE Harmonized as EN 61558-2-1.      IEC 61558-2-4 NOTE Harmonized as EN 61558-2-4.      IEC 61558-2-6 NOTE Harmonized as EN 61558-2-6.      IEC 61643-1 NOTE Harmonized as EN 61643-1.      IEC 61643-21 NOTE Harmonized as EN 61643-21.      IEC 61643-311 NOTE Harmonized as EN 61643-311.      IEC 61643-321 NOTE Harmonized as EN 61643-321.      IEC 61643-331 NOTE Harmonized as EN 61643-331.</p>	N/A
<b>ZB</b>	<b>ANNEX ZB, SPECIAL NATIONAL CONDITIONS (EN)</b>	—
4.1.15	<p><b>Denmark, Finland, Norway and Sweden</b></p> <p>To the end of the subclause the following is added:</p> <p><b>Class I pluggable equipment type A</b> intended for connection to other equipment or a network shall, if safety relies on connection to reliable earthing or if surge suppressors are connected between the network terminals and <b>accessible</b> parts, have a marking stating that the equipment shall be connected to an earthed <b>mains</b> socket-outlet.</p> <p>The marking text in the applicable countries shall be as follows:</p> <p>In <b>Denmark</b>: "Apparatets stikprop skal tilsluttes en stikkontakt med jord som giver forbindelse til stikproppens jord."</p> <p>In <b>Finland</b>: "Laite on liitetävä suojakoskettimilla varustettuun pistorasiaan"</p> <p>In <b>Norway</b>: "Apparatet må tilkoples jordet stikkontakt"</p> <p>In <b>Sweden</b>: "Apparaten skall anslutas till jordat uttag"</p>	N/A
4.7.3	<p><b>United Kingdom</b></p> <p>To the end of the subclause the following is added:</p> <p>The torque test is performed using a socket-outlet complying with BS 1363, and the plug part shall be assessed to the relevant clauses of BS 1363. Also see Annex G.4.2 of this annex</p>	N/A

5.2.2.2	<p><b>Denmark</b></p> <p>After the 2nd paragraph add the following:</p> <p>A warning (marking <b>safeguard</b>) for high <b>touch current</b> is required if the <b>touch current</b> exceeds the limits of 3,5 mA a.c. or 10 mA d.c.</p>		N/A
5.4.11.1 and Annex G	<p><b>Finland and Sweden</b></p> <p>To the end of the subclause the following is added:</p> <p>For separation of the telecommunication network from earth the following is applicable:</p> <p>If this insulation is solid, including insulation forming part of a component, it shall at least consist of either</p> <ul style="list-style-type: none"> <li>• two layers of thin sheet material, each of which shall pass the electric strength test below, or</li> <li>• one layer having a distance through insulation of at least 0,4 mm, which shall pass the electric strength test below.</li> </ul> <p>If this insulation forms part of a semiconductor component (e.g. an optocoupler), there is no distance through insulation requirement for the insulation consisting of an insulating compound completely filling the casing, so that clearances and creepage distances do not exist, if the component passes the electric strength test in accordance with the compliance clause below and in addition</p> <ul style="list-style-type: none"> <li>• passes the tests and inspection criteria of 5.4.8 with an electric strength test of 1,5 kV multiplied by 1,6 (the electric strength test of 5.4.9 shall be performed using 1,5 kV), and</li> <li>• is subject to routine testing for electric strength during manufacturing, using a test voltage of 1,5kV.</li> </ul> <p>It is permitted to bridge this insulation with a capacitor complying with EN 60384-14:2005, subclass Y2.</p> <p>A capacitor classified Y3 according to EN 60384-14:2005, may bridge this insulation under the following conditions:</p> <ul style="list-style-type: none"> <li>• the insulation requirements are satisfied by having a capacitor classified Y3 as defined by EN 60384-14, which in addition to the Y3 testing, is tested with an impulse test of 2,5 kV defined in 5.4.11;</li> <li>• the additional testing shall be performed on all the test specimens as described in EN 60384-14; the impulse test of 2,5 kV is to be performed before the endurance test in EN 60384-14, in the sequence of tests as described in EN 60384-14.</li> </ul>		N/A
5.5.2.1	<p><b>Norway</b></p> <p>After the 3rd paragraph the following is added:</p> <p>Due to the IT power system used, capacitors are required to be rated for the applicable line-to-line voltage (230 V).</p>		N/A

5.5.6	<p><b>Finland, Norway and Sweden</b></p> <p>To the end of the subclause the following is added: Resistors used as <b>basic safeguard</b> or bridging <b>basic insulation</b> in <b>class I pluggable equipment type A</b> shall comply with G.10.1 and the test of G.10.2.</p>		N/A
5.6.1	<p><b>Denmark</b></p> <p><b>Add</b> to the end of the subclause</p> <p>Due to many existing installations where the socket-outlets can be protected with fuses with higher rating than the rating of the socket-outlets the protection for pluggable equipment type A shall be an integral part of the equipment.</p> <p><i>Justification:</i> In Denmark an existing 13 A socket outlet can be protected by a 20 A fuse.</p>		N/A
5.6.4.2.1	<p><b>Ireland and United Kingdom</b></p> <p>After the indent for <b>pluggable equipment type A</b>, the following is added:</p> <ul style="list-style-type: none"> <li>– the <b>protective current rating</b> is taken to be 13 A, this being the largest rating of fuse used in the <b>mains</b> plug.</li> </ul>		N/A
5.6.5.1	<p>To the second paragraph the following is added:</p> <p>The range of conductor sizes of flexible cords to be accepted by terminals for equipment with a rated current over 10 A and up to and including 13 A is: 1,25 mm<sup>2</sup> to 1,5 mm<sup>2</sup> in cross-sectional area.</p>		N/A
5.7.5	<p><b>Denmark</b></p> <p>To the end of the subclause the following is added: The installation instruction shall be affixed to the equipment if the <b>protective conductor current</b> exceeds the limits of 3,5 mA a.c. or 10 mA d.c.</p>		N/A

5.7.6.1	<p><b>Norway and Sweden</b></p> <p>To the end of the subclause the following is added:</p> <p>The screen of the television distribution system is normally not earthed at the entrance of the building and there is normally no equipotential bonding system within the building. Therefore the protective earthing of the building installation needs to be isolated from the screen of a cable distribution system.</p> <p>It is however accepted to provide the insulation external to the equipment by an adapter or an interconnection cable with galvanic isolator, which may be provided by a retailer, for example.</p> <p>The user manual shall then have the following or similar information in Norwegian and Swedish language respectively, depending on in what country the equipment is intended to be used in:</p> <p>“Apparatus connected to the protective earthing of the building installation through the mains connection or through other apparatus with a connection to protective earthing – and to a television distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a television distribution system therefore has to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11)”</p> <p>NOTE In Norway, due to regulation for CATV-installations, and in Sweden, a galvanic isolator shall provide electrical insulation below 5 MHz. The insulation shall withstand a dielectric strength of 1,5 kV r.m.s., 50 Hz or 60 Hz, for 1 min.</p> <p>Translation to Norwegian (the Swedish text will also be accepted in Norway):</p> <p>“Apparater som er koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoplet utstyr – og er tilkoplet et koaksialbasert kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkopling av apparater til kabel-TV nett installeres en galvanisk isolator mellom apparatet og kabel-TV nettet.”</p> <p>Translation to Swedish:</p> <p>”Apparater som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av apparaten till kabel-TV nät galvanisk isolator finnas mellan apparaten och kabel-TV nätet.”.</p>		N/A
5.7.6.2	<p><b>Denmark</b></p> <p>To the end of the subclause the following is added:</p> <p>The warning (marking safeguard) for high touch current is required if the touch current or the protective current exceed the limits of 3,5 mA .</p>		N/A

B.3.1 and B.4	<p><b>Ireland and United Kingdom</b></p> <p>The following is applicable:</p> <p>To protect against excessive currents and short-circuits in the primary circuit of <b>direct plug-in equipment</b>, tests according to Annexes B.3.1 and B.4 shall be conducted using an external miniature circuit breaker complying with EN 60898-1, Type B, rated 32A. If the equipment does not pass these tests, suitable protective devices shall be included as an integral part of the <b>direct plug-in equipment</b>, until the requirements of Annexes B.3.1 and B.4 are met</p>		N/A
G.4.2	<p><b>Denmark</b></p> <p>To the end of the subclause the following is added:</p> <p>Supply cords of single phase appliances having a rated current not exceeding 13 A shall be provided with a plug according to DS 60884-2-D1:2011.</p> <p>CLASS I EQUIPMENT provided with socket-outlets with earth contacts or which are intended to be used in locations where protection against indirect contact is required according to the wiring rules shall be provided with a plug in accordance with standard sheet DK 2-1a or DK 2-5a.</p> <p>If a single-phase equipment having a RATED CURRENT exceeding 13 A or if a poly-phase equipment is provided with a supply cord with a plug, this plug shall be in accordance with the standard sheets DK 6-1a in DS 60884-2-D1 or EN 60309-2.</p> <p>Mains socket outlets intended for providing power to Class II apparatus with a rated current of 2,5 A shall be in accordance DS 60884-2-D1:2011 standard sheet DKA 1-4a.</p> <p>Other current rating socket outlets shall be in compliance with Standard Sheet DKA 1-3a or DKA 1-1c.</p> <p>Mains socket-outlets with earth shall be in compliance with DS 60884-2-D1:2011 Standard Sheet DK 1-3a, DK 1-1c, DK1-1d, DK 1-5a or DK 1-7a</p> <p><i>Justification:</i> Heavy Current Regulations, Section 6c</p>		N/A
G.4.2	<p><b>United Kingdom</b></p> <p>To the end of the subclause the following is added:</p> <p>The plug part of direct plug-in equipment shall be assessed to BS 1363: Part 1, 12.1, 12.2, 12.3, 12.9, 12.11, 12.12, 12.13, 12.16, and 12.17, except that the test of 12.17 is performed at not less than 125 °C. Where the metal earth pin is replaced by an Insulated Shutter Opening Device (ISOD), the requirements of clauses 22.2 and 23 also apply.</p>		N/A

G.7.1	<p><b>United Kingdom</b></p> <p>To the first paragraph the following is added:</p> <p>Equipment which is fitted with a flexible cable or cord and is designed to be connected to a mains socket conforming to BS 1363 by means of that flexible cable or cord shall be fitted with a 'standard plug' in accordance with the Plugs and Sockets etc (Safety) Regulations 1994, Statutory Instrument 1994 No. 1768, unless exempted by those regulations.</p> <p>NOTE "Standard plug" is defined in SI 1768:1994 and essentially means an approved plug conforming to BS 1363 or an approved conversion plug.</p>		N/A
G.7.1	<p><b>Ireland</b></p> <p>To the first paragraph the following is added:</p> <p>Apparatus which is fitted with a flexible cable or cord shall be provided with a plug in accordance with Statutory Instrument 525: 1997, "13 A Plugs and Conversion Adapters for Domestic Use Regulations: 1997. S.I. 525 provides for the recognition of a standard of another Member State which is equivalent to the relevant Irish Standard</p>		N/A
G.7.2	<p><b>Ireland and United Kingdom</b></p> <p>To the first paragraph the following is added:</p> <p>A power supply cord with a conductor of 1,25 mm<sup>2</sup> is allowed for equipment which is rated over 10 A and up to and including 13 A.</p>		N/A
<b>ZC</b>	<b>ANNEX ZC, NATIONAL DEVIATIONS (EN)</b>		N/A
10.5.2	<p><b>Germany</b></p> <p>The following requirement applies:</p> <p>For the operation of any cathode ray tube intended for the display of visual images operating at an acceleration voltage exceeding 40 kV, authorization is required, or application of type approval (Bauartzulassung) and marking.</p> <p><i>Justification:</i></p> <p>German ministerial decree against ionizing radiation (Röntgenverordnung), in force since 2002-07-01, implementing the European Directive 96/29/EURATOM.</p> <p><b>NOTE</b> Contact address: Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig, Tel.: Int +49-531-592-6320, Internet: <a href="http://www.ptb.de">http://www.ptb.de</a></p>		N/A

**ATTACHMENT TO TEST REPORT IEC 62368-1  
DENMARK NATIONAL DIFFERENCES**

Audio/video, information and communication technology equipment –

Part 1: Safety requirements

<b>Differences according to .....</b>	DS/EN 62368-1:2014
<b>Attachment Form No.....</b>	DK_ND_IEC62368_1D
<b>Attachment Originator .....</b>	UL (Demko)
<b>Master Attachment.....</b>	2021-02-04
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	<b>National Differences</b>		
4.1.15	<p>To the end of the subclause the following is added:</p> <p>Class I pluggable equipment type A intended for connection to other equipment or a network shall, if safety relies on connection to reliable earthing or if surge suppressors are connected between the network terminals and accessible parts, have a marking stating that the equipment shall be connected to an earthed mains socket-outlet.</p> <p>The marking text in the applicable countries shall be as follows:</p> <p>“Apparatets stikprop skal tilsluttes en stikkontakt med jord som giver forbindelse til stikproppens jord.”</p>		N/A
5.2.2.2	After the 2nd paragraph add the following: A warning (marking safeguard) for high touch current is required if the touch current exceeds the limits of 3,5 mA a.c. or 10 mA d.c.		N/A
5.6.1	<p>Add to the end of the subclause:</p> <p>Due to many existing installations where the socket-outlets can be protected with fuses with higher rating than the rating of the socket-outlets the protection for pluggable equipment type A shall be an integral part of the equipment.</p> <p>Justification: In Denmark an existing 13 A socket outlet can be protected by a 20 A fuse.</p>		N/A
5.7.5	<p>To the end of the subclause the following is added:</p> <p>The installation instruction shall be affixed to the equipment if the protective conductor current exceeds the limits of 3,5 mA a.c. or 10 mA d.c.</p>		N/A
5.7.6.2	<p>To the end of the subclause the following is added:</p> <p>The warning (marking safeguard) for high touch current is required if the touch current or the protective current exceed the limits of 3,5 mA.</p>		N/A

G.4.2	<p>To the end of the subclause the following is added:</p> <p>Supply cords of single phase appliances having a rated current not exceeding 13 A shall be provided with a plug according to DS 60884-2-D1:2011.</p> <p>CLASS I EQUIPMENT provided with socket-outlets with earth contacts or which are intended to be used in locations where protection against indirect contact is required according to the wiring rules shall be provided with a plug in accordance with standard sheet DK 2-1a or DK 2-5a.</p> <p>If a single-phase equipment having a RATED CURRENT exceeding 13 A or if a poly-phase equipment is provided with a supply cord with a plug, this plug shall be in accordance with the standard sheets DK 6-1a in DS 60884-2-D1 or EN 60309-2.</p> <p>Mains socket outlets intended for providing power to Class II apparatus with a rated current of 2,5 A shall be in accordance DS 60884-2-D1:2011 standard sheet DKA 1-4a.</p> <p>Other current rating socket outlets shall be in compliance with Standard Sheet DKA 1-3a or DKA 1-1c.</p> <p>Mains socket-outlets with earth shall be in compliance with DS 60884-2-D1:2011 Standard Sheet DK 1-3a, DK 1-1c, DK1-1d, DK 1-5a or DK 1-7a</p> <p>Justification: Heavy Current Regulations, Section 6c</p>		N/A
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<b>ATTACHMENT TO TEST REPORT</b> <b>IEC 62368-1</b> <b>ITALY NATIONAL DIFFERENCES</b> (Audio/video, information and communication technology equipment – Part 1: Safety requirements)		
<b>Differences according to.....</b> : CEI EN 62368-1:2016		
<b>Attachment Form No.</b> : IT_ND_IEC62368_1D		
<b>Attachment Originator</b> : IMQ S.p.A.		
<b>Master Attachment</b> : Date 2021-02-04		
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	<b>National Differences</b>	
F.1	<p><b>Italy</b></p> <p>The following requirements shall be fulfilled:</p> <ul style="list-style-type: none"> <li>• The power consumption in Watts (W) shall be indicated on TV receivers and in their instruction for use (Measurement according to EN 60555-2).</li> </ul> <p>Note: <i>EN 60555-2 has since been replaced by IEC 60107-1:1997.</i></p> <ul style="list-style-type: none"> <li>• TV receivers shall be provided with an instruction for use, schematic diagrams and adjustments procedure in Italian language.</li> <li>• Marking for controls and terminals shall be in Italian language. Abbreviation and international symbols are allowed provided that they are explained in the instruction for use.</li> <li>• The ECC manufacturers are bound to issue a conformity declaration according to the above requirements in the instruction manual. The correct statement for conformity to be written in the instruction manual, shall be:</li> </ul> <p><i>Questo apparecchio è fabbricato nella CEE nel rispetto delle disposizioni del D.M. marzo 1992 ed è in particolare conforme alle prescrizioni dell'art. 1 dello stesso D.M.</i></p> <ul style="list-style-type: none"> <li>• The first importers of TV receivers manufactured outside EEC are bound to submit the TV receivers for previous conformity certification to the Italian Post Ministry (PP.TT). The TV receivers shall have on the backcover the certification number in the following form:</li> </ul> <p>D.M. 26/03/1992 xxxx/xxxx/S or T or pT            S for stereo            T for Teletext            pT for retrofittable teletext</p>	N/A

	<p><i>Justification:</i> Ministerial Decree of 26 March 1992 : National rules for television receivers trade.</p> <p><i>NOTE/:</i> Ministerial decree above contains additional, but not safety relevant requirements</p>		
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## Attachment 2: Supplementary Test Data / Test Equipment / Measurement Uncertainty

5.4.1.8	TABLE: Working voltage measurement			N/A
Location	RMS voltage (V)	Peak voltage (VDC)	Comments	
Supplementary information:				
Tested by:	Date:			
Ambient Conditions:				
Test Equipment Used:				

8.6.2.2	TABLE: Static Stability Test				N/A				
Acceptance Criteria:									
Under condition of normal use, units and equipment shall not become physically unstable to the degree that they could become a hazard to an operator or a service person.									
Equipment Type	Test Name	Test Parameters	MS Classification	Comments					
Non-Floor Standing or Fixed	Tilt	10°	MS2	P					
Supplementary information:									
Tested By:	Date:								
Ambient Conditions:									
Test Equipment Used:									

<b>F.3.10</b>	<b>TABLE: Marking Durability; Permanence of Markings</b>			<b>WO# OPS121421</b>	<b>P</b>			
Acceptance Criteria:								
After the rubbing tests, the marking shall be legible; it shall not be possible to remove marking plates easily and they shall show no curling.								
Label tested:	Adhesive-backed label affixed to the bottom side of the Board							
Test Method:	Inspection and rubbing the marking by hand for 15 sec with a piece of cloth soaked with the rubbing agents listed							
Rubbing Agent	Remains Legible	Label Loose	Curled Edges	Comments				
Water	Yes	No	No	Pass				
Petroleum spirit	N/A	N/A	N/A	N/A				
N-Hexane	Yes	No	No	Pass				
Supplementary information:								
Tested By: Thomas Tu			Date: Feb-08-2022					
Ambient Conditions: 23.8°C, 29.2% RH								
Test Equipment Used: 10SL0420, 10SL0421								

<b>V.1</b>	<b>TABLE: Accessible parts of Equipment</b>			<b>N/A</b>
Acceptance Criteria: Determining accessible Parts that can be touched by a body part.				
Clause	Description		Comments	Verdict
Test Method 1:	Surfaces and openings test w/ jointed test probes			
	Test Probe V.1 for equipment likely to be accessible to children			
V.1.2				
Test Probe V.2 for equipment not likely to be accessible to children				
			Test Method 2: Openings tested w/ straight unjointed test probes	
V.1.3	Test Probe V.1 for equipment likely to be accessible to children w/ 30N Force only if accessible by Test method 1			

	Test Probe V.2 for equipment not likely to be accessible to children w/ 30N Force only if accessible by Test method 1		
Test Method 3: Plugs, Jacks, Connectors			
V.1.4	Figure V.3, Blunt Probe		
Test Method 4: Slot Openings			
V.1.5	Figure V.4, Wedge Probe		
Test Method 5: Terminals intended to be used by an ordinary person			
V.1.6	Figure V.5, Terminal Probe		
Supplementary information:			
Tested By:		Date:	
Ambient Conditions:			
Test Equipment Used:			

### List of test Instrument Used List

A completed list of used test equipment shall be provided in the Test Reports when a Customer's Testing Facility according to CTF stage 1 or CTF stage 2 procedure has been used.

Note: This page may be removed when CTF stage 1 or CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
5.2, 5.4.1.4, 5.4.2.2, 6.2.2, 6.2.3.2, B.2.5, B.3	DC power source	Rigol DP712, 10SL0279, S/N DP7B182100095	0-60VDC, 0-3A	Not required	Not required
5.2	Digital Oscilloscope	Tektronix TDS 2012B, 10SL0320A, S/N C065240	0-50V	2020-11-22	2022-11-20
5.4.1.4, B.2.5, B.3	Multimeter	Fluke 287, 10SL0311C, S/N 4186083	Voltage auto range	2021-09-21	2022-09-21
5.4.1.4, B.2.5, B.3	Multimeter	Fluke 287, 10SL0311D, S/N 4186088	0-400mA	2021-09-21	2022-09-21
5.4.1.4, B.3	Memory Logger	Hioki LR8401-20, 10SL0328A, S/N 180517691	0-100°C	2022-01-25	2023-01-25
5.4.2.4	Digital Calliper	Mitutoyo CD-6" ASX, 10SL0415, S/N A17240674	0-150mm	2022-02-25	2023-02-25
6.2.2, 6.2.3.2	DC Electronic Load	Insteck PEL-2004A, 10SL0331, S/N GER192032	0-60V, 0-3A	2021-09-21	2022-09-21
F.3.10	N-Hexane	PHARMCO-AAPER 95% n-hexane minimum, 10SL0420, S/N C17L05BLK-0000H	95% n-hexane	2017-12-05	2022-12-05
F.3.10	Digital Stopwatch	Traceable Stopwatch 1051, 10SL0421, S/N 192725752	0-60 seconds	2022-02-28	2023-02-28

### Measurement Uncertainty List

**Notes:**

- 1) For "any range" worst case OD-5014 values are used. "Any range" means within the capabilities of the instrument.
- 2) Type T premium thermocouples shall be used
- 3) Worst case OD-5014 accuracy value used across multiple ranges.

indicates that Guide 115 Procedure 1 may be required.

Test Equipment #	Equipment Type	Manufacturer / Model	Range Used	Instrument Accuracy	OD-5014 Required Accuracy (+/-)	MU	Guide 115 Procedure	Notes
10SL0311A	DMM	Fluke 287	Auto Range	Resistance: +/- 0.05 % Voltage (AC/DC): +/- 0.4 % Current (AC/DC): +/- 0.7 % Frequency: +/- 0.005%	3% 1.50% 1.50% 0.01%	n/a n/a n/a n/a	2 2 2 2	1 1 1 1
10SL0311B	DMM	Fluke 287	Auto Range	Resistance: +/- 0.05 % Voltage (AC/DC): +/- 0.4 % Current (AC/DC): +/- 0.7 % Frequency: +/- 0.005%	3% 1.50% 1.50% 0.01%	n/a n/a n/a n/a	2 2 2 2	1 1 1 1
10SL0311C	DMM	Fluke 287	Auto Range	Resistance: +/- 0.05 % Voltage (AC/DC): +/- 0.4 % Current (AC/DC): +/- 0.7 % Frequency: +/- 0.005%	3% 1.50% 1.50% 0.20%	n/a n/a n/a n/a	2 2 2 2	1 1 1 1
10SL0311D	DMM	Fluke 287	Auto Range	Resistance: +/- 0.05 % Voltage (AC/DC): +/- 0.4 % Current (AC/DC): +/- 0.7 % Frequency: +/- 0.005%	3% 1.50% 1.50% 0.20%	n/a n/a n/a n/a	2 2 2 2	1 1 1 1
10SL0238A	Datalogger	HIOKI LR8401-20	0°C to + 200°C	Temperature: +/- 0.6°C	2°C	n/a	2	2, 3
10SL0328B	Datalogger	HIOKI LR8401-20	0°C to + 200°C	Temperature: +/- 0.6°C	2°C	n/a	2	2, 3
10SL0320A	Oscilloscope	Tektronics TDS 2012B	Any Range	Voltage: +/- 3%	1.50%	0.11%	1	3
10SL0320B	Oscilloscope	Tektronics TDS 2012B	Any Range	Voltage: +/- 3%	1.50%	0.11%	1	3
10SL0313	Force Gauge	MARK-10 M7-200	0 - 200Lb / 0 - 1000N	Force: +/- 0.1%	6%	n/a	2	1
10SL0317A	Power Analyzer	Yokogawa WT310E	DC- 100KHz	Voltage: +/- 0.5% Current: +/- 0.5% Active Power: +/- 1%	1.50% 1.50% 3.00%	n/a n/a n/a	2 2 2	1

10SL0317B	Power Analyzer	Yokogawa WT310E	DC-100KHz	Voltage: +/- 0.5% Current: +/- 0.5% Active Power: +/- 1%	1.50% 1.50% 3.00%	n/a n/a n/a	2 2 2	1
10SL0312	Torque Wrench	Mark-10 MTT03-50	0 - 100 in lbs	Torque: +/- 0.5% of full scale	10%	n/a	2	1
10SL0341A	Angle Meter	ED&D AM-1	Any Range	Angle: +/- 1°	1°	n/a	2	1
10SL0341B	Angle Meter	ED&D AM-1	Any Range	Angle: +/- 1°	1°	n/a	2	1
10SL0319A, 10SL0319B, 10SL0319C	High Voltage Probe	Tektronix	1.5 - 20kV pK	Voltage: +/- 3%	3%	n/a	2	1
10SL0415	Digital Caliper	Mitutoyo CD-6" ASX	0-150 mm	Linear dimension: +/- 0.02mm / 0.001"	0.02mm	0.50%	2	3
10SL0334	Ground Bond Tester	Slaughter 266	0 - 200mA 0 - 60A 50/60Hz	Resistance: +/- 2.0% Current: +/- 3.0% Frequency: +/- 0.1%	3% 2.50% 0.20%	n/a n/a n/a	2 2 2	1 3 1
10SL0422	Digital Scale	Industry Electronic Balance 457	100 - 2500 g	0.3% @ 100g 0.05% @ 1000g 0.03% @ 2500g	2%	0.30% 0.05% 0.03%	2	3
10SL0421	Digital Stop Watch	Control Company 1051	0.01sec - 23hrs 59mins 59 secs	Timer: +/- 0.041%	1%	n/a	2	3
10SL0412s	8x Eye Piece	ED&D OC-20	0 - 15mm	6.5um	0.1mm	n/a	1	3
10SL0416	Digital Micrometer	Mitutoyo 293-340-30	0 - 25.4mm	Linear dimension +/- 0.0013mm	0.1mm	n/a	2	1
10SL0322	Leakage Current Meter	Simpson 228	0 - 10 mA	Current: +/- 2%	3.50%	n/a	2	1
10SL0418s	Scale	Rubbermaid 4040-88	0 - 400Lbs (actual cal to 235lbs)	Mass: +/- 0.2%	5%	0.20%	2	3
10SL0324	ACW/ACW/IR/GB Tester	Slaughter 4320	0-5KV 20mAAC 0-6KV 5mADC 0.1-999.9 secs	AC/DC Voltage: +/- 2% AC/DC Current: +/- 2% Timer: +/- 0.1%	3% 1.5% 1%	n/a 0.30% n/a	2 2 2	1 3 3
10SL0331	DC Electronic Load	GW Instek PEL-2004	0-16V / 0-80V 0-70A / 0-10A	Voltage: +/- 0.1% Current: +/- 0.2% Resistance: +/- 0.2%	1.5% 1.5% 3%	n/a n/a n/a	2 2 2	1 1 1
10SL0332	Mega Pulse Impulse Tester	Compliance West 10X700-7Pf	0-7KV peak 9.13μsec rise 716μ duration	Voltage: +/- 3% Rise time: +/- 30% Duration time: +/- 20%	5% 5% 5%	n/a 0.9% 0.02%	2 2 2	1 3 3
10SL0333	Mega Pulse Impulse Tester	Compliance West 1.2X50-12Pf	0-12KV peak 1.2μsec rise 50μ duration	Voltage: +/- 3% Rise time: +/- 30% Duration time: +/- 20%	5% 5% 5%	n/a 3.3% 4.3%	2 2 2	1 3 3
10SL0315A	Leakage Current Configuration	Compliance West Configuration 2	Vout/Vin	Ratio: @ 20Hz, @ 50Hz, @ 60Hz Ratio: @ 1KHz Ratio: @ 10KHz, @ 100KHz, @ 1MHz	3.50% 5% 10%	1.6% 1.4% 5.3%	2 2 2	3 3 3
10SL0428	Leakage Current Configuration	Compliance West Configuration 3	Vout/Vin	Ratio: @ 20Hz, @ 50Hz, @ 60Hz Ratio: @ 1KHz Ratio: @ 10KHz, @ 100KHz, @ 1MHz	3.50% 5% 10%	1.2% 0.5% 1.2%	2 2 2	3 3 3
10SL0413	Measuring Tape	ED&D CTM-01	1 - 300 in	Dimension: @ 1in, @ 12in, @ 24in Dimension: @ 60in, @ 180in, @ 300in	0.5% 0.5%	0.10% 0.04%	2 2	3 3

## Attachment 3: Certificates / Component Information

### UL Yellow Card for the Circuit Wiring board

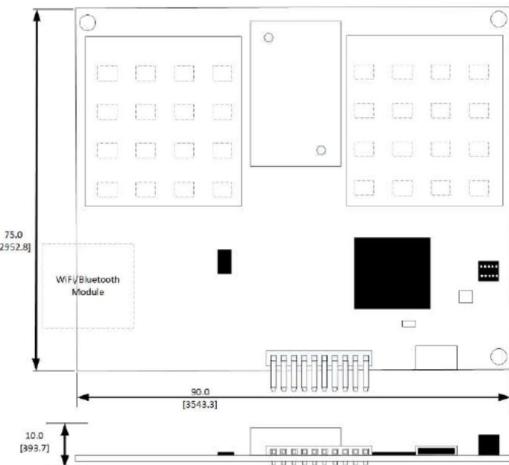
Wiring, Printed - Component													E142470
Guide Information													
<b>CHEER TIME ENTERPRISE CO LTD</b>													
2 Lane 305 Chyong Lin S Rd, Hsin Chuang Taipei 242 TW													
<b>Type dsg: 66H</b>													
Single layer printed wiring boards													
<u>Cond Width</u>	<u>Cond Width</u>	<u>Cond Thk</u>	<u>Cond Thk</u>	<u>Cond Thk</u>	<u>SS/ DS/ DSO</u>	<u>Max Area</u>	<u>Assembly Solder Process Temp (°C)</u>	<u>Assembly Solder Process Cycles</u>	<u>Solder Limits Temp (°C)</u>	<u>Solder Limits Time (sec)</u>	<u>Max Oper Temp (°C)</u>	<u>Flame Class</u>	<u>Meets UL796 DSR CTI</u>
Min (mm)	Edge (mm)	Min (mic)	Max Int (mic)	Max Ext (mic)	DSO	Diam (mm)			280	20	130	V-0	All 1
0.15	0.20	17	-	102	DS	76.2	-	-					
Report Date: 1992-02-07													
Last Revised: 2020-12-03													
© 2022 UL LLC													
 Tradenames/Trademarks for File E142470: "CHEER TIME", G													

**OPS243 Datasheet (Partially attached)**

## OPS243 Short Range Radar Sensor

### Feature Set

- 1-100m (3-328') detection range
- Speed reporting in excess of 222 kph (138mph)
- Speed accurate to within  $\pm 0.5\%$
- Direction reporting (Inbound/Outbound)
- Range reporting from 1-60m (3-197")
- Narrow 20° (horizontal) or 24° (vertical) beam width (-3 dB)
- Simple API control
- Coding required
- WiFi/Bluetooth Wireless interface to Cloud
- FCC modular approval (OPS243-C pending)
- Wide operating input voltage, 5-24V
- 1.8W Active, 0.8W Idle, and 0.2W Hibernate power
- Wide temperature operating range, -40°C to +85°C
- Small form factor 75 x 90 x 12 mm, 15g



The OPS243 is a small form factor, single board radar sensor capable of detecting objects up to 100m away. The sensor is ideal for applications such as security, traffic monitoring, drone collision avoidance, robotics, and as an IoT sensor. All radar signal processing is embedded in the sensor and a simple API eases system integration. Data is communicated over wired interfaces such as USB, UART, and RS-232. A wireless interface is also available for communication to the cloud and remote sensing. A simple API provides control over the output format of the data (units, digits, etc.). Data reported includes motion detection, speed, direction (inbound/outbound), and range. Speed data is accurate to within  $\pm 1$  mph, meeting police radar gun standards. Range information is accurate to within  $\pm 10\%$  of actual distance.

Two versions of the OPS243 are available, a speed reporting Doppler sensor (OPS243-A) or a combined Doppler and FMCW (range reporting) sensor (OPS243-C). The OPS243-C uses additional circuitry with a tighter frequency lock to measure both the speed and range information.

Table 1. OPS243 Sensors

Sensor	Type	Motion	Speed	Direction	Range
OPS243-A	Doppler	•	•	•	
OPS243-C	Doppler & FMCW	•	•	•	•

The detection range of the OPS243 covers a narrow 20° azimuth (horizontal) and 24° altitude (vertical) beam width (measured at -3dB point). Detection range is 10-20 m (82 ft) for a person and 50-100 m (328 ft) for large metal objects such as a vehicle. The API provides control over the transmit power which enables custom control over the detection range. Control over the transmit duty cycle is also provided enabling lower power operation. At full continuous power the module consumes 1.7W and idle power (RF disabled) is 0.8W. Duty cycling can enable active modes with power consumption in between these values. A very low power Hibernate mode can reduce power to an average of 100-300mW.

Connecting an OPS243 to a PC (Windows or Mac), Android phone/tablet, Arduino, Raspberry Pi, or other embedded processor is easily managed. By default, data is sent as a number in ASCII characters. All other messages are provided in JSON format for easy parsing and manipulation (speed or range can also be sent by JSON). The JSON output is compatible with emerging IoT standards and technologies such as Node-RED which is standard on Raspberry Pi distributions. This makes the module ready to plug into hybrid solutions that use multiple sensors and inter-operate with IoT cloud-based solutions.

The WiFi version of the OPS243 allows for directly sending data to the cloud for visualization, storage, or processing. An app (download from [Google Playstore](#)) is provided to configure the wireless connection, configure the sensor, and see the data.

The sensor comes in a very small form factor of 75 x 90 x 12 mm (96mm for WiFi version). Utilizing the 24GHz millimeter spectrum, the module can easily be placed behind plastic enclosures and still function properly.

## Description

### Operating Principle

The OPS243 is a simple, short range radar sensor which provides motion detection, speed, direction, and range information. All radar signal processing is handled by the on-board ARM processor. The basic principle of the sensor utilizes the Doppler frequency shift to detect speed and direction and FMCW time of flight (TOF) to detect range.

On power-up, the embedded firmware initializes the sensor for radar signal processing. After initialization is completed, the green LED will start to blink on a 1 second duty cycle. The default operation is set for data streaming over the UART or RS-232 interface (rev D boards allow for selection via API). If the sensor is connected to a USB interface, it will complete the enumeration triggered by the host and data on the UART or RS-232 data will be turned off. The red LED will be lit until the enumeration is complete. If the USB enumeration has not been successful, the red LED will stay lit.

The WiFi version of the OPS243 powers up with the Bluetooth active and looking for a smartphone or tablet to pair with. The app can then be used to connect it to a WiFi network. If it had been connected to an available WiFi network in the past the connection will be made automatically. Once connected to WiFi, the sensor will stream its data to the cloud and to the app for visualization.

When initialization is complete, the firmware will enable the RF device to start generating the appropriate transmit signal. Two modes of controlling the transmit frequency are used. On the OPS243-A, an internal algorithm in the ARM processor is used to sense the VCO frequency and make adjustments to the VCO Control signal. On the OPS243-C, an on board PLL is used to control the VCO frequency.

The ARM processor controls the RF device signal transmission through on-board transmit patch antennas. If an object is detected in the field of view, the transmitted signal will bounce back and be detected by the on-board receive patch antennas. The received signal is mixed with the transmitted signal to down convert to an IF signal which represents either the Doppler frequency of the moving object or a time shift based on the distance to the object. This signal is filtered and provided to the internal A/D converter of the ARM processor. The radar signal processing converts this signal into speed, direction, or range information which is then output over the appropriate interface. If the object is moving towards the module, the red LED will light, and if away, the blue LED. If direction has been turned off via the API, the green LED will light whenever motion is detected.

A simple interrupt can be used to monitor motion detection or object detection. The API provides a means of filtering detected speed, range, and signal magnitude to trigger the interrupt. See the [AN-10 API Interface](#) for more information.

A watchdog timer is implemented in firmware. The timer is serviced every 1 second. Upon 2 missed services, the third miss will trigger a board reset. The sensor can be queried for the reason for the reset.

A simple API allows control of the sensor and information that it provides. See Application Note [AN-010 API Interface](#) for full details on using the API. The default settings of the OPS243-A provide speed/direction readings at approximately 5-6 per second. The OPS243-C provides speed and range information at approximately 13-14 reports per second. Faster reporting can be achieved by increasing the sample frequency or reducing the buffer size.

Note the speed reported by the OPS243 is not compensated for the cosine error. See [AN-011 Cosine Error Adjustment](#) to understand how to correct the speed for the angle to the detected object.

### Block Diagram

The block diagram of the OPS243 is shown in Figure 1. The key components shown are the RF, IF filtering, ARM processor, and interface for communication.

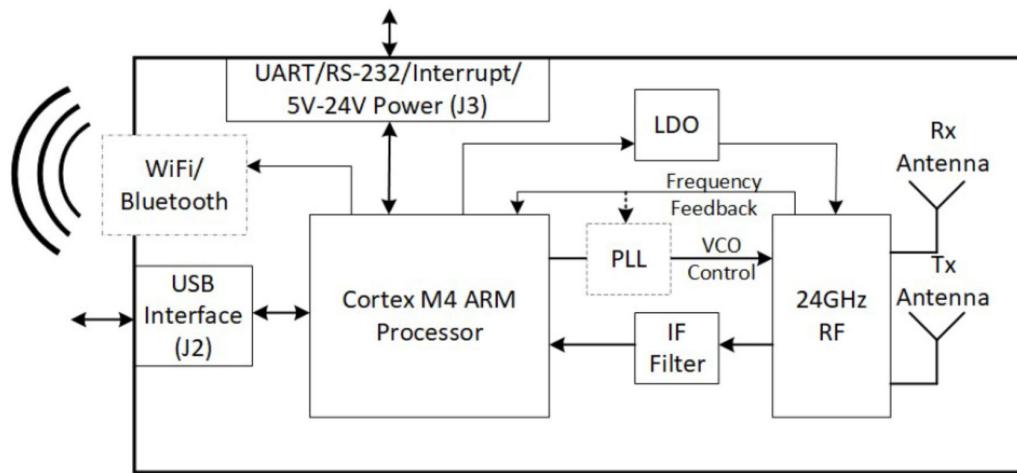


Figure 1. OPS243 Block Diagram

### Interface

The OPS243 sensor provides five interfaces, USB, UART, RS-232, WiFi/Bluetooth, simple interrupt, and LEDs. The USB, UART, RS-232, and WiFi interfaces provide detailed information and control of the sensor via the API, while the simple interrupt and LEDs provide a quick check as to how the sensor is functioning or presence of a detected object.

### USB

The sensor has a USB 2.0 interface for providing the processed radar information and control over the sensor via the API. A standard micro USB connector is used (J1). The USB interface is also used to power the sensor. An alternate means of providing 5V power to the module is through header J3 which should be used when using UART or RS-232 interfaces.

### UART

The sensor provides a 3.3V UART interface over the J3 header. Table 2 lists the pin assignment for the TxD and RxD. The detected speed values stream out over the UART pins upon power-on and can be configured using the same API that is utilized for USB. The default baud rate is 19,200 with options for 9,600 through 115,200. The default configuration is 8-bit, no parity, one stop bit.

### RS-232

An RS-232 interface option is available for applications that need the sensor placed far from the embedded processor consuming the data. Distances as far as 15m (50 ft.) between the sensor

and embedded processor and data rates up to 250kbps are supported. The default baud rate is 19,200 with options for 9,600 through 115,200. The default configuration is 8-bit, no parity, one stop bit. The signal levels used are  $\pm$  5V. Note the position of the RS-232 interface has been changed between the revision C and D board versions. Execute the ?P command to confirm the version of board. In revision D boards, the UART is the default interface and RS-232 can be selected by setting the IS command (Is to set UART). Use the persistent memory command, AI, to save the RS-232 setting if so desired.

**Table 2. J3 Header Pins Revision A, B and C Boards**

(all signals 3.3V except for RS-232, Power, and Ground)

Pin	Direction	Pin Name	Pin Description
1	Input/Output	GPIO	General purpose I/O
2	Input/Output	GPIO	General purpose I/O
3	Output	Host Interrupt	Interrupt from OPS243 to system
4	Input	/Reset	System reset of OPS243 (active low)
5	Input	SPI SEL	SPI device select
6	Input	RxD/SPI MOSI	UART or RS-232 receive/SPI input
7	Output	TxD/SPI MISO/SDA	UART or RS-232 transmit/SPI data output/I <sup>2</sup> C data
8	Input	SCL/SCK	SPI/I <sup>2</sup> C clock
9	-	5-24V*	Power
10	-	Ground	Ground

\*Rev C sensors support 24V, earlier revision A and B sensors are limited to 12V. Issue the P? API command to check the sensor version.

**Table 3. J3 Header Pins Revision D Board**

(all signals 3.3V except for RS-232, Power, and Ground)

Pin	Direction	Pin Name	Pin Description
1	Input/Output	GPIO	General purpose I/O
2	Input/Output	GPIO	General purpose I/O
3	Output	Host Interrupt	Interrupt from OPS243 to system
4	Input	/Reset	System reset of OPS243 (active low)
5	Input	RS2_RxD	RS-232 RxD (non -WB sensors)
6	Input	UART_RxD	UART RxD (non -WB sensors)
7	Output	UART_TxD	UART TxD (non -WB sensors)
8	Output	RS2_TxD	RS-232 TxD (non -WB sensors)
9	-	5-24V"	Power
10	-	Ground	Ground

\*Rev D sensors support 24V, earlier revision A and B sensors are limited to 12V. Issue the P? API command to check the sensor version.

### WiFi/Bluetooth

A WiFi/Bluetooth option is available with the OPS243. Data is automatically sent to the WiFi module for communication to a nearby network. An [app](#) is available to connect the sensor to the WiFi network. Data is automatically routed to the cloud and available on the app for visualization. See AN-20 IoT Radar Sensor with WiFi Interface for further information. The WiFi interface supports

802.11b/g/n (802.11n 2.4GHz). The Bluetooth interface is compliant with Bluetooth v4.2 BR/EDR and BLE specifications.

#### Simple Motion Interrupt

A simple interrupt is provided for motion detection. The signal comes out to pin 3 (Host Interrupt) on the J3 header and is 3.3V tolerant. It is enabled by the API command "IG". The signal is high when no object is detected and low when an object is detected. See [AN-16 Simple Motion Detection Interrupt](#) for further explanation of the usage of this signal and how to filter speed and magnitude.

#### Reset

A Reset pin is provided on the J3 header to reset the OPS243 radar sensor. The pin is active low with a required low time of 200ns to be active. After releasing the pin, the processor will start up within 2μs. The code will start to execute and in default mode initial data will be available to start streaming after 300ms.

#### GPIO

Two general purpose I/O pins are provided on the OPS243. These are reserved for future use.

#### Host Interrupt

A Host Interrupt pin is provided for the OPS243 to signal the host system there is data to pull from the sensor. This feature is planned for future firmware update.

#### LED

LEDs are provided to give a quick understanding of the module operation. There are four LEDs on the module, red, green, orange, and an RGB LED. The LEDs functions are listed in Table 4. Some variations on the LED operation may be made based on the version of code used. Check the API application note AN-10 for the latest descriptions.

**Table 4. LED Functions**

LED	Function	Reference	Notes
Green	Heartbeat timer	D2	1 second duty cycle
RGB	Red – Inbound direction Blue – Outbound direction Green – Motion detection	D10	Green only used if direction detection turned off via API

#### Power

Power is provided either from the USB interface or separate pins on the J3 header if UART or RS-232 is used. If UART or RS-232 is used, pin 9 on header J3 can accept a 5-24V (12V for sensors shipped from OmniPreSense before August 2020) to power the sensor. On-board regulators provide the appropriate power for the sensor operation.

#### Hibernate Mode

Starting with v1.0.5 for the OPS243-A and v1.1.1 for the OPS243-C, a special low power Hibernate mode has been enabled. In this mode, overall power consumption is reduced by 83% from full active power consumption. This allows use in battery backed applications.

Hibernate mode is only available when using the UART or RS-232 interface. In Hibernate mode, the sensor spends the majority of its time in a very low power state to minimize current consumption. At a set programmable time period, the sensor wakes up, scans for any objects in its field of view, and if nothing is detected goes back down into its low power state. If an object is detected, the sensor will stay awake reporting information until the object is no longer in its field of view. In the default configuration, the sensor hibernates for 1 second. This value is programmable via the API.

#### Antenna Pattern

The OPS243 antenna designs provides a narrow beam width of 20° (-3 dB point) in the azimuth (horizontal) and 24° (-3 dB point) in altitude (vertical). Minimal signal is transmitted behind the module due to its construction which helps eliminate false detections. The narrow antenna pattern coverage is shown in Figure 2.

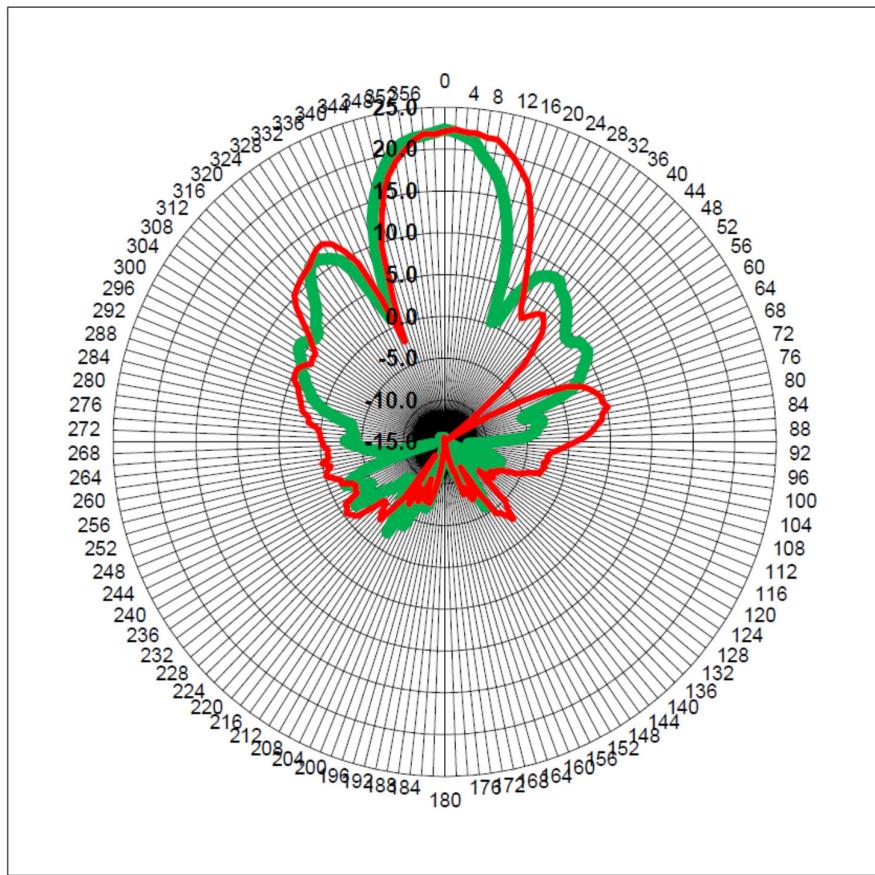


Figure 2. Antenna Pattern

#### Detection Range

The detection range of the OPS243 is dependent on the object to be detected and its RCS (radar cross section). Generally, the OPS243 will detect human movement up to 10-20m out and a large

object (higher RCS value) such as a vehicle at 75-100m for the OPS243-A and 50-60m out for the OPS243-C. As the object moves more to the right or left of the module center, the detection range will decrease.

## Electrical Specifications

### Absolute Maximum Ratings

$T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Notes
Supply Voltage	$V_{dd}$	4.75		5.25	V	USB interface, per USB specification
Supply Voltage	$V_{dd}$	4.75		24.0*	V	Pin 9 on header J3
Power Dissipation	$P_{max}$			1.8	W	
Operating Temperature	$T_a$	-40		85	$^{\circ}\text{C}$	
Storage Temperature	$T_{stg}$	-40		105	$^{\circ}\text{C}$	

\*Rev C and D sensors. Check the board version with the P? command. Prior sensors are limited to 13.2V max.

**Operating Metrics**

$T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Notes
Transmit Frequency	$F_{tx}$	24		24.25	GHz	
Transmit Power	$P_{tx}$	6	11	15	dBm	$24\text{GHz} \leq F_{tx} \leq 24.25\text{GHz}$
Transmit Power Adjustment	$P_{txadj}$	3	9		dB	Adjustable via API
Idle Transmit Power	$P_{txadj}$			-30	dBm	Not transmitting
Antenna Gain	$G_{ant}$		11		dBi	
Transmit Antenna Azimuth	$RA_{azi}$		20		°	-3 dB beam width
Transmit Antenna Altitude	$RA_{alt}$		24		°	-3 dB beam width
Active Current Consumption (OPS243-A)	$I_{cc}$		300	338	mA	5V input
			65	72	mA	24V input
Active Current Consumption (OPS243-C)	$I_{cc}$		330	375	mA	5V input
			390	450	mA	5V input, WiFi
			70	85	mA	24V input
			90	105	mA	24V input, WiFi
Idle Current Consumption	$I_{idl}$		140	158	mA	5V input
			180	200	mA	5V input, WiFi
			30	35	mA	24V input
Hibernate Current Consumption (OPS243-A)	$I_{hib}$		19		mA	1 second duty cycle*, 5V input
Hibernate Current Consumption (OPS243-C)	$I_{hib}$		34		mA	1 second duty cycle*, 5V input
			24		mA	1 second duty cycle*, 24V input
Reset Time	$T_{RST}$	200			ns	
Startup Time	$T_{SRT}$			2	μs	Processor startup time after release of $T_{RST}$

\*Average current consumption based on default sample rate, buffer size

## Mechanical Specifications

The mechanical outline drawing for the OPS243 is shown in Figure 4. All units are in mm [mils].

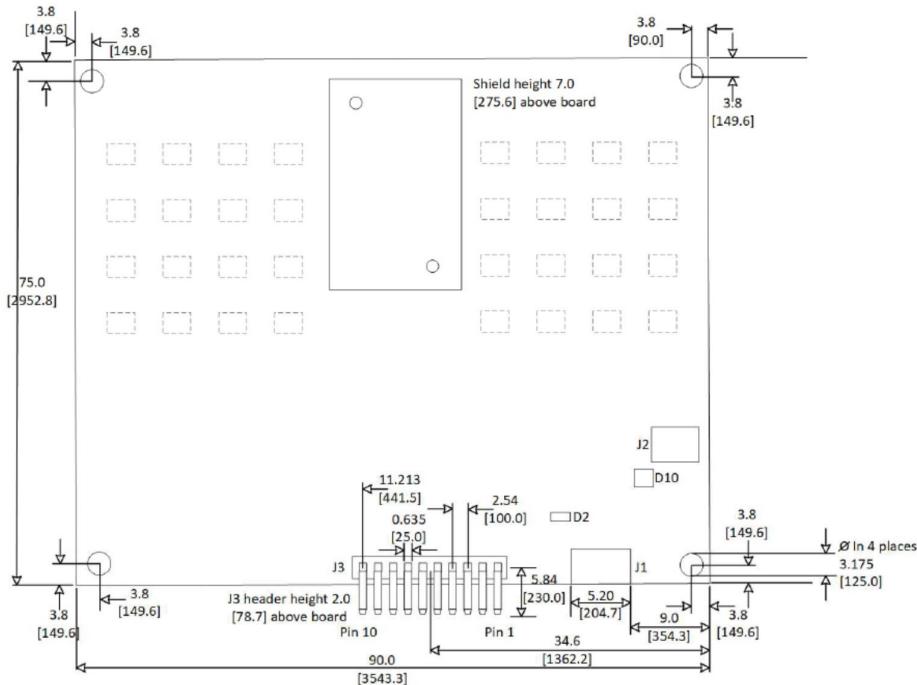


Figure 4. Mechanical Specifications

## Ordering Information

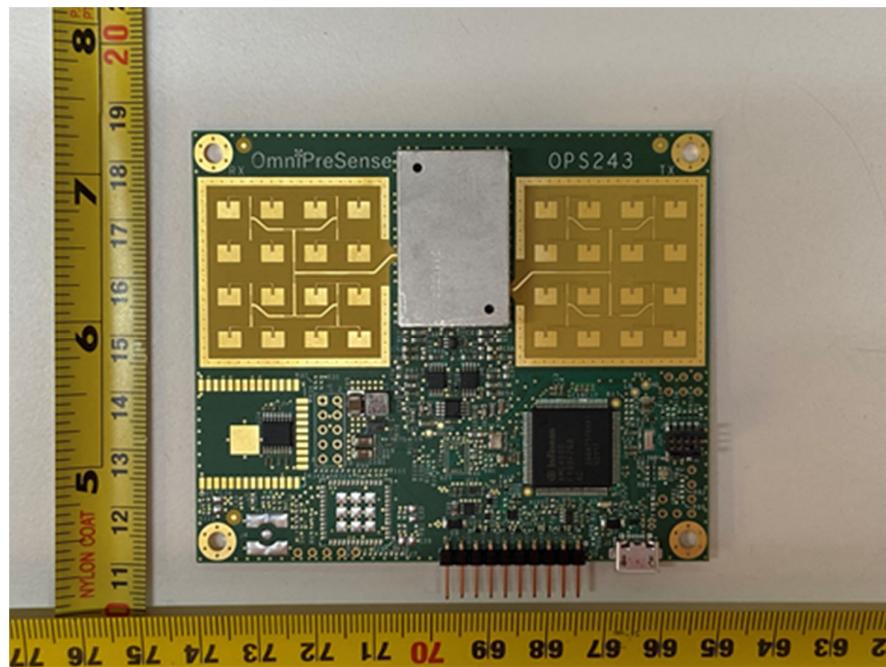
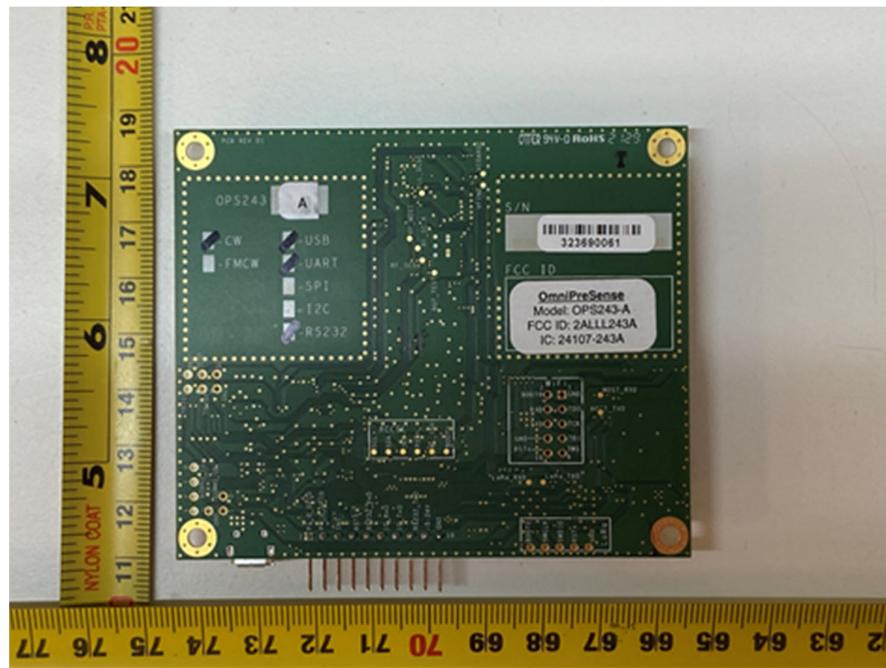
The full part numbers for the OPS243 module is listed in Table 5. Please use these part numbers when submitting orders.

A 3D printed enclosure is available for the OPS243. Order part number OPS243-A-CW-ENC.

Table 5. Ordering Part Numbers

Sensor	Interface	Ordering Part Number
OPS243-A	UART, USB	OPS243-A-CW-RP
OPS243-A	WiFi/Bluetooth, USB	OPS243-A-CW-WB
OPS243-C	UART, RS-232, USB	OPS243-C-FC-RP
OPS243-C	WiFi/Bluetooth, USB	OPS243-C-FC-WB

Attachment 4: Illustrations / Photographs

**WO# OPS121421 - OPS243-A – Top View****WO# OPS121421 - OPS243-A – Bottom View****Conditions Of Testing**

Bureau Veritas Consumer Products Services Inc.  
775 Montague Expressway, Milpitas CA 95035 USA - TEL (408) 526-1188

- [Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation], and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("Client"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "Conditions"):
1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("Test Report") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
  2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
  3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
  4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
  5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS**," "**BUREAU VERITAS CONSUMER PRODUCTS SERVICES**," "**BVCPS**," "**MTL**," "**ACTS**," "**MTL-ACTS**" and **CURTIS-STRAUS** (collectively, the "Marks") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
  6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
  7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
  8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
  9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
  10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
  11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only were such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
  12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.
  13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.
  14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.
  15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.
  - (B) NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.\$10,000, WHICHEVER IS THE LESSER AMOUNT.
  16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder. The complete list of the Approved Subcontractors Curtis-Straus may use to delegate the performance of work can be provided upon request. Rev.160009121(2)\_#684340 v14CS

**— END OF TEST REPORT —**