

**VECOW CO., LTD**

3F., NO.10, JIANKANG RD., ZHONGHE DIST., NEW TAIPEI CITY 23586, TAIWAN

**Sample Description:** High Performance Fanless Embedded System

**SGS Ref No.:** XMIN2401000064CM01

**Model No.:** IVH-9204MX-ICY

The above sample(s) was / were submitted and identified on behalf of the client. SGS is not responsible for the authenticity, integrity and results of the data and information and / or the validity of the conclusion arising therefrom. Results apply to the sample as received.

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**TEST(S) REQUESTED:**

Assessment on the fire performance of “Compliant HL2”, which defined in EN 45545-2:2020+A1:2023 Railway applications—Fire protection on railway vehicles Part 2: Requirements for fire behaviour of materials and components, for the “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY”.

**TEST RESULT(S):** -- See attached sheet --

**Test Period:**

Sample Receiving Date : JAN.12, 2024

Test Performing Date : JAN.12, 2024 TO JUN.04, 2024

Signed for and on behalf of  
SGS-CSTC Standards Technical Services Co., Ltd. Anji Branch

Allen Zou  
Approved Signatory

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**I. INTRODUCTION**

This assessment report is for appraisal on “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY”.

This assessment report presents an assessment of the ability of the “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY” and whether it is acceptable applied in the scope which required the fire performance HL3, as the product used in railway vehicles, specified in EN 45545-2:2020 A1:2023.

**II. REFERENCES**

In this document the “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY” applied by **VECOW CO., LTD** will be evaluated in respect of conformity to the generally recognized codes of practice. The assessment is based on the following standards;

1. EN 45545-1:2013 Railway applications - Fire protection on railway vehicles – Part 1: General;
2. EN 45545-2:2020+A1:2023 Railway applications—Fire protection on railway vehicles Part 2: Requirements for fire behaviour of materials and components;
3. 96/603/EC Commission decision of 4 October 1996, establishing the list of products to Class A “No contribution to fire” provided for in Decision 94/611/EC implementing Article 20 of Council Directive 89/106/EEC on construction products.
4. EN ISO 4589-2:2017, Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient temperature test.
5. EN 60695-11-10:2013 Fire hazard testing –Part 11-10: Test flames – 50 W horizontal and vertical flame test methods.
6. EN 60695-2-11:2014, Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products (GWEPT) (IEC 60695-2-11:2014).
7. ISO 5658-2:2006, Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration

**III. PRODUCT DETAILS OF ASSESSED**

Part 1, General

The details of the tested specimen given below have been prepared from information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.



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General description	High Performance Fanless Embedded System
Model No*	IVH-9204MX-ICY
Trade Mark	VECOW
SN	Not provided
I/P	Not provided
Overall Size	260mm (W) × 155mm (H) × 215mm (T)
Weight	About 8955.4g
Manufacturer	Not provided
Address:	Not provided
Factory	Not provided
Address:	Not provided
End use	Railway Vehicle

\* Provided by client.

The “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY” basically consists of High Performance Fanless Embedded System device. The construction combines elements made of several non-metal combustible parts and metallic parts. The major mass of non-metal combustible material is used for the PCB, technical equipment attached on the PCB, Coating for enclosure outside surface, interior connector wire, terminals, thermal pads, slide and cover for hard-disk box and miscellaneous.

General, the “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY” is low power electrical equipment.



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A list of materials is shown in the follow materials table provided by the manufacturer.

High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY				
NO.	Description	Material	Mass, g	Remark
1	Enclosure (contain the metal parts within the device)	Metal	About 7680.8	/
2	Coating for enclosure outside surface	Non-metal	42.2	/
3	Interior connector wire 1#	Non-metal	47.5	Contain the metal conductor and Terminals, total weight for 6 pieces
4	Interior connector wire 2#	Non-metal	0.6	Contain the metal conductor
5	Interior connector wire 3#	Non-metal	17.3	Contain the metal conductor
6	Interior connector wire 4#	Non-metal	30.7	Contain the metal conductor and Terminals, total weight for 3 pieces
7	Terminals 1#	Non-metal	4.5	Transparency, total weight for 3 pieces
8	Terminals 2#	Non-metal	1.5	White, total weight for 3 pieces
9	Terminals 3#	Non-metal	5.8	Green, total weight for 2 pieces
10	Terminal 4#	Non-metal	2.5	Black
11	Thermal pad 1#	Non-metal	5.4	Not touching contact with a product not compliant to Table 2 and Table 3 of EN 45545-2.
12	Interior connector wire 5#	Non-metal	0.9	Contain the metal conductor and Terminals
13	Flat connector wire	Non-metal	4.9	Contain the metal conductor and Terminals, total weight for 2 pieces
14	Plug for openings	Non-metal	0.6	Not touching contact with a product not compliant to Table 2 and Table 3 of EN 45545-2.
15	PCB1#	Non-metal	217.5	With the technical equipment on the PCB, Thick 2.0mm
16	PCB2#	Non-metal	6.5	With the technical equipment on the PCB, Thick 1.0mm
17	PCB3#	Non-metal	4.9	With the technical equipment on the PCB, Thick 1.6mm
18	PCB4#	Non-metal	52.9	With the technical equipment on the PCB, Thick 1.6mm
19	PCB5#	Non-metal	492.0	With the technical equipment on the PCB, Thick 1.6mm
20	Thermal pad 2#	Non-metal	36.5	Thick 4.0mm
21	Thermal pad 3#	Non-metal	3.5	Thick 1.6mm
22	Hard-disk box	-	-	-
22-1	PCB6#	Non-metal	66.8	With the technical equipment on the PCB, Thick 1.6mm, total weight for 6



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High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY				
NO.	Description	Material	Mass, g	Remark
				pieces
22-2	Slide and cover	Non-metal	116.1	Thick 1.2mm-1.8mm, total weight for 6 pieces
23	Miscellaneous	Non-metal	5.2	/



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High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY



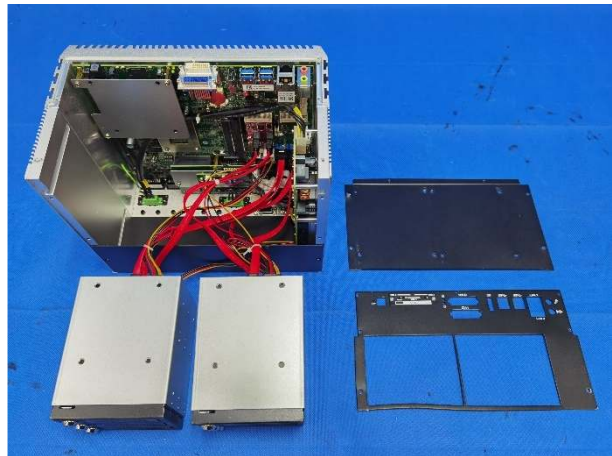
Front side



Back side



Inside



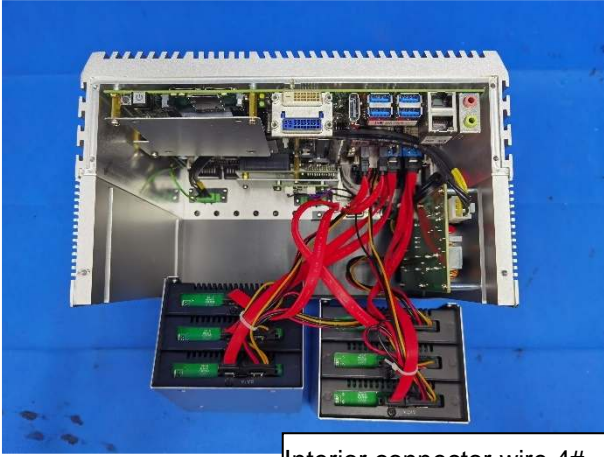
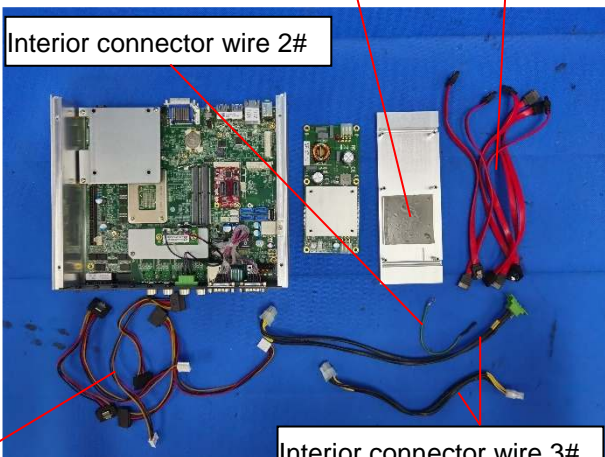
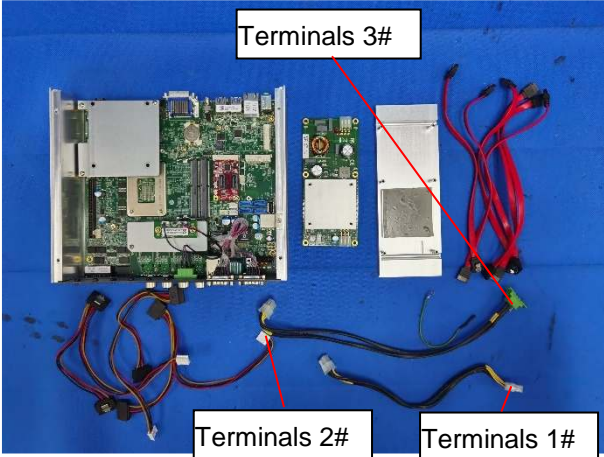
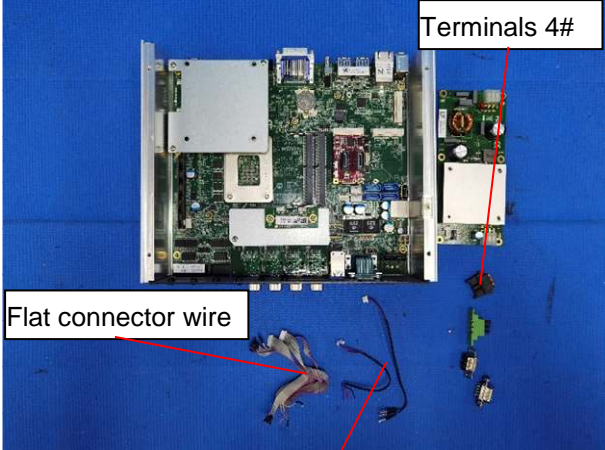
Inside



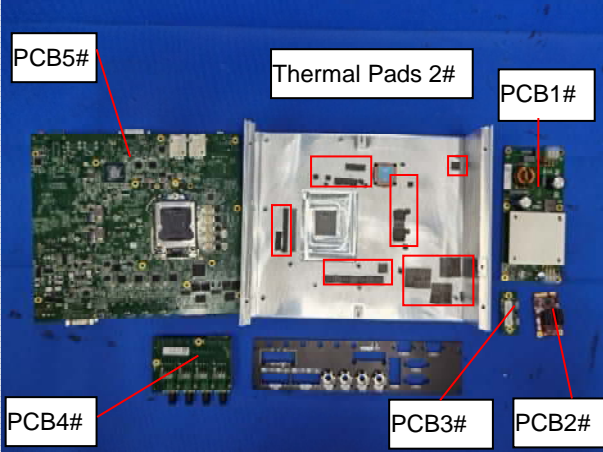
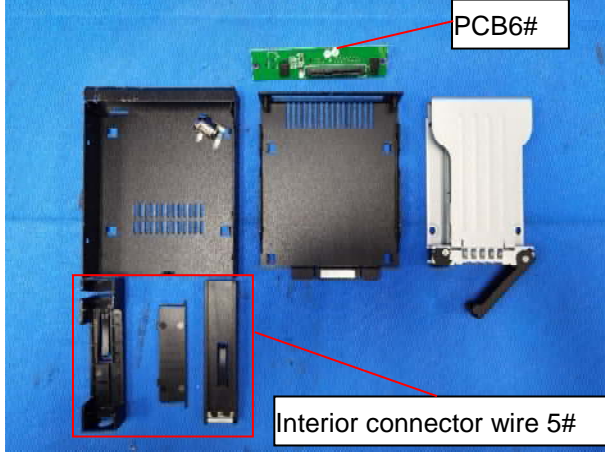
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High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY

 <p>Interior connector wire 4#</p>	 <p>Interior connector wire 1#</p> <p>Thermal pad1#</p> <p>Interior connector wire 2#</p> <p>Interior connector wire 3#</p>
<p>Inside</p>	<p>Inside</p>
 <p>Terminals 3#</p> <p>Terminals 2#</p> <p>Terminals 1#</p>	 <p>Terminals 4#</p> <p>Flat connector wire</p> <p>Interior connector wire 5#</p>
<p>Inside</p>	<p>Inside</p>



High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY	
 <p>PCB5# Thermal Pads 2# PCB1# PCB4# PCB3# PCB2#</p>	 <p>PCB6# Interior connector wire 5#</p>
Inside	Inside, Hard-disk Box

**Part 2: Installation**

The High Performance Fanless Embedded System is designed for installation interior vehicles (e.g. in the cab area, technical equipment compartment), It is not accessible for passengers. At the same time, the product, used for assessment of this documents, not consider any unclassified combustible products accessories used together with this High Performance Fanless Embedded System installed in the vehicle.

As specified in EN 45545-2:2020 clause 4.3.1 General, all unclassified combustible components within this device were assigned as same group (Group 1#).





Part 3, Materials/components list

The evaluation is based on the combustible mass of materials. Therefore all combustible materials (plastic, rubber, etc.) will be considered. Metallic materials and inorganics are not combustible and therefore they will not be taken into account.

According to the sample details and the specification of EN 45545-2, the following materials are relevant for evaluation:

High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY				
NO.	Description	Requirement	Results	Remark
1	Enclosure (contain the metal parts within the device)	R22	A	96/603/EC, A1 *
2	Coating for enclosure outside surface	R1 ISO 5658-2	R1 HL3**	Test report: AJFS2403001946FF Coating for enclosure outside surface, 1.0mm Aluminum plate+Paint (about 58.2um), total thickness about 1.1mm, exposed surface, black paint EN 45545-2:2020+A1:2023 T02 ISO 5658-2 CFE=50kW/m <sup>2</sup>
3	Interior connector wire 1#	No requirements	/	EN 45545-2, Clause 4.3, Total combustible Mass < 100g for grouped products, No requirement
4	Interior connector wire 2#	No requirements	/	
5	Interior connector wire 3#	R24	R24 HL3	Cable insulation materials GZMR240501202701 EN 45545-2 R24 EN ISO 4589-2:2017 OI=28.9% thick 1.5mm
6	Interior connector wire 4#	R24	R24 HL3	
7	Terminals 1#	No requirements	/	EN 45545-2, Clause 4.3, Total combustible Mass < 100g for grouped products, No requirement
8	Terminals 2#	No requirements	/	
9	Terminals 3#	No requirements	/	
10	Terminal 4#	No requirements	/	
11	Thermal pad 1#	No requirements	/	EN 45545-2, Clause 4.3, combustible mass of < 10 g not in touching contact with another unclassified product, No requirement
12	Interior connector wire 5#	No requirements	/	EN 45545-2, Clause 4.3, Total combustible Mass < 100g for grouped products, No requirement
13	Flat connector wire	No requirements	/	
14	Plug for openings	No requirements	/	EN 45545-2, Clause 4.3, combustible mass of < 10 g not in touching contact with another



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High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY				
NO.	Description	Requirement	Results	Remark
				unclassified product, No requirement
15	PCB1#	R24/25/26	R25 HL3	Test report: AJFS2404004102FF EN 45545-2 R25 PCB1#, 2.0mm R25 PASS
16	PCB2#	R24/25/26	R25 HL3	Test report: AJFS2403002056FF EN 45545-2 R25 Sample B, PCB, 1.0mm R25 PASS
17	PCB3#	R24/25/26	R25 HL3	Test report: AJFS2403002056FF EN 45545-2 R25 Sample A, PCB, 1.7mm R25 PASS
18	PCB4#	R24/25/26	R25 HL3	
19	PCB5#	R24/25/26	R25 HL3	
20	Thermal pad 2#	R24	R24 HL3	Test report: SDFS2403001778FF EN 45545-2 R24 Thermal Pad 2#, 4.0MM, OI>60%
21	Thermal pad 3#	No requirements	/	EN 45545-2, Clause 4.3, Total combustible Mass<100g for grouped products, No requirement
22	Hard-disk box	No requirements	/	EN 45545-2, Clause 4.3, Total combustible Mass<100g for grouped products, No requirement
22-1	PCB6#	R24/25/26	R26 HL3	Test report: AJFS2403002056FF EN 45545-2 R25 Sample C, PCB, 1.6mm R25 PASS
22-2	Slide and cover	R26	R26 HL3	UL File Number: E162823, Tairiloy: AC310(+) V-0@1.0-3.0mm
23	Miscellaneous	No requirements	/	EN 45545-2, Clause 4.3, Total combustible Mass<100g for grouped products, No requirement

\* Based on the specification of 96/603/EC and Amending, 4 October 1996, establishing the list of products belonging to Classes A 'No contribution to fire' provided for in Decision 94/611/EC implementing Article 20 of Council Directive 89/106/EEC on construction products, the metal components are within the list of products belonging to Classes A.



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\*\* For products which are classified in Table 2 as IN2, IN3A, IN3B, IN10, IN11, EX1C, EX5, EX6A, EX6B, EX8, EX11, or EL2, where surfaces have organic coatings applied on metal or glass surfaces, ISO 5658-2 or EN ISO 9239-1 flame spread tests shall be carried out, but other test requirements such as heat release, smoke emission and toxic gas emission tests are not required if the nominal coating thickness, including any surfacing filler for exterior products is < 0,3 mm, or for interior products the nominal thickness of organic coating is < 0,15 mm;

\*\*\* In respect of printed boards (EL9 according to EN 45545-2:2020+A1:2023, Table 2) it shall be noted that only the printed boards without any attached components have to meet the requirements. The attached technical equipment components will be accepted without any testing because of their functional necessity as stated in EN 45545-2:2020+A1:2023, clause 4.7.



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**IV. TEST REPORTS AND TEST RESULTS IN SUPPORT OF THIS ASSESSMENT**

Name of the laboratory	Name of the sponsor	Test report ref.No.	Test methods	Test results
SGS Anji Branch	VECOW CO., LTD	AJFS2403001946FF Date: Mar.12, 2024	EN 45545-2 T02 ISO 5658-2:2006	Coating for enclosure outside surface, 1.0mm Aluminum plate+Paint (about 58.2um), total thickness about 1.1mm, exposed surface, black paint CFE=50 kW/m <sup>2</sup>
SGS Anji Branch	VECOW CO., LTD	AJFS2404004102FF Date: Apr.26, 2024	EN 45545-2 R25 T16 EN 60695-2-11:2014	PCB1# Green, 2.0mm GWEPT/850, R25 Pass
SGS Anji Branch	VECOW CO., LTD	AJFS2403002056FF Date: Mar.25, 2024	EN 45545-2 R25 T16 EN 60695-2-11:2014	PCB Sample A, Green, 1.7mm GWEPT/850, R25 Pass Sample B, Red, 1.0mm GWEPT/850, R25 Pass Sample C, Green, 1.6mm GWEPT/850, R25 Pass
SGS Shunde Branch	VECOW CO., LTD	SDFS2403001778FF Date: Mar.28, 2024	EN 45545-2 R24 EN ISO 4589-2:2017	Therma Pad 2#, Grey 4.0mm OI>60%
UL	FORMOSA CHEMICALS & FIBRE CORP PLASTIC DIV	UL File Number: E162823	IEC 60695-11-10	Tairiloy: AC310(+) V-0@ thickness 1.0-3.0mm
SGS Guangzhou Branch	VECOW CO., LTD	GZMR240501202701 Date: May 21, 2024	EN 45545-2 R24 EN ISO 4589-2:2017	Interior connector wire, Type III, 1.5mm OI=28.9%



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**V. BASIS OF THIS ASSESSMENT**

The basis for the evaluation of fire safety is the classification of vehicle types where the High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY will be installed.

Following classifications are taken as basis:

EN 45545-2:2020+A1:2023 Railway applications—Fire protection on railway vehicles Part 2: Requirements for fire behaviour of materials and components, Hazard Level HL3.

**VI. ASSESSMENT ACCORDING TO EN 45545-2**

Based on the requirements of EN 45545-2, the fire safety requirements for materials of electrical and electronic devices are defined in according to the installation location.

Clause 4.2 General

The following principles are applicable to all products:

a) products which comply with the highest level of reaction to fire performance and therefore need no further testing are:

- products classified A1 according to EN 13501-1;
- all products described in commission decision 96/603/EC (as amended);
- laminated glass where the internal organic layers are not exposed and the percentage mass of organic material is less than or equal to 6 %.

l) for organic coatings applied to products conforming to 4.2 a), ISO 5658-2 or EN ISO 9239-1 flame spread tests shall be carried out, but other test requirements such as heat release, smoke emission and toxic gas emission tests are not required if the nominal coating thickness, including any surfacing filler for exterior products is < 0,3 mm, or for interior products the nominal thickness of organic coating is < 0,15 mm;

Considering the mass of combustible material of the High Performance Fanless Embedded System, EN 45545-2 clause 4.2 m) if listed products are used in an application below the mass and area thresholds given in 4.3, they may be treated as non-listed products” is applicable.

Therefore, the requirements of clause 4.3 “Grouping rules” will be assessed.

Key applicable grouping rules:

- No requirements apply to products with a combustible mass of  $\leq 10$  g in touching contact only with a product compliant to Table 2 and Table 3.
- If fully separated by a plate compliant with the fire integrity requirement of 5.3.7, then assign as different group.



- 4.3.2 Rule 1

If the total combustible mass of the grouped products is

- ≤ 100 g for interior grouped products; or
- ≤ 400 g for exterior grouped products;

no requirements apply to the products of this group. This principle also applies to single products that meet the requirements of 4.3.1.

- 4.3.3 Rule 2

If the total combustible mass of the grouped products is

- ≤500 g for interior grouped products; or
- ≤2000 g for exterior grouped products;

one combustible product of this group has to be tested according to R24. If this product is compliant to R24 it shall not be considered for further assessment of this group. The remaining products in this group shall be assessed starting with 4.3.1 again.

This principle also applies to single products that exceed the mass limits of Rule 1.

- 4.3.4 Rule 3

If the combustible mass of the grouped products exceeds the limits stated in Rule 2, one product of the group shall be tested according to the requirements of non-listed products given in 4.5, Table 3.

If this product is compliant to the requirements of Table 3 it shall not be considered for further assessment of this group. The remaining products in this group shall be assessed starting with 4.3.1.



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**ASSESSMENT:**

**Part 1, for Listed Products**

As specified in table 2 of EN 45545-2, below products belong to Listed product and comply with the fire behavior requirements.

- PCB1#

As showed within the test report AJFS2404004102FF, the results of the product PCB1# pass R25 HL3, complies with the requirements of HL3 defined in EN 45545-2:2020.

- PCB2#, 3#, 4#, 5# and 6#

As showed within the test report AJFS2404004102FF, the results of the product Sample A, Sample B and Sample C pass R25 HL3, complies with the requirements of HL3 defined in EN 45545-2:2020.

- Technical equipment on the PCB

Based on the requirements of EN 45545-2 EL9, Printed circuit boards with all varnishes applied but without any attached technical equipment and no more specification for the attached technical equipment within EN 45545-2. The attached technical equipment components will be accepted without any testing because of their functional necessity as stated in EN 45545-2:2020, clause 4.7.

- Coating for enclosure outside surface

As showed within the test report AJFS2403001946FF, the results of the product CFE=50 kW/m<sup>2</sup>. The thickness of the coating less than 0.1mm, based on the clause 4.2 I), only ISO 5658-2 is required for R1. So it complies with the requirements of R1 HL3 defined in EN 45545-2:2020.

- Slide and cover

As showed within the UL Certificate UL File Number: E162823, the results of the product Tairiloy: AC310(+) is V-0 for 1.0mm and 3.0mm, which represent the end use and complies with the requirements of HL3 defined in EN 45545-2:2020.

**Part 2, for Non-listed products**

Total mass of the combustible materials/parts is 1162.2g, and above listed and functional necessity parts mass is 998.9g,

The thermal pad 1# and plug of opening, combustible mass of < 10 g not in touching contact with another unclassified product, no requirement.

Then the mass of remaining unclassified products is 157.3g, and the exposed area of each unclassified product is less than 0.2m<sup>2</sup>. So grouping rules can be suitable for all the remaining unclassified products.

Based on the mass less than 500g for interior grouped products, clause 4.3.3 Rule 2 applied.



- Thermal pads 2#

As showed within the test report SDFS2403001778FF, the results of the product Therma Pad 2# OI>60%, complies with the requirements of HL3 defined in EN 45545-2:2020.

- Interior connector wire 3# and 4# (Insulation material)

As showed within the test report SDFS2403001778FF, the results of the product OI=28.9% with thickness 1.5mm, complies with the requirements of R24 HL2 defined in EN 45545-2:2020.

- Interior connector wire 1#, 2# and 5#, Terminals 1#, 2#, 3# and 4#, Flat connector wire, Thermal pad 3# and Miscellaneous

The total mass of the Interior connector wire 1#, 2# and 5#, Terminals 1#, 2#, 3# and 4#, Flat connector wire, Thermal pad 3# and Miscellaneous is 95.0g, which is belong to the unclassified products based on the mass and area threshold. The total combustible mass is 95.0g (less than 100g) for grouped products. Therefore, under the Clause 4.3 of EN 45545-2, exempt from the fire requirements defined in EN 45545-2:2020.

**Assessment of the ignite risks of the Interior connector wire 1#, 2# and 5#, Terminals 1#, 2#, 3# and 4#, Flat connector wire, Thermal pad 3# and Miscellaneous**

General speaking, an ignition inside the High Performance Fanless Embedded System via a technical defect cannot be fundamentally excluded, but is extremely unlikely and the inside materials also complies with the criteria of fire performance, the ignite risks within the High Performance Fanless Embedded System is very low for passengers and staff protected posture.

Thus, the use of the Interior connector wire 1#, 2# and 5#, Terminals 1#, 2#, 3# and 4#, Flat connector wire, Thermal pad 3# and Miscellaneous, the total combustible weight 95.0g are accepted.

**Assessment of the risks of a further fire development:**

Because of its tight design, low power and limited oxygen, the ignition and fire occurring inside the device are limited. Also, the quantity of the combustion materials is very limited. A fire development and spreading from the High Performance Fanless Embedded System is thus not conceivable.

Based on the test report and evaluation, it shows that the tested product does not have recognizable ignition and fire risks and evaluated as conform to the requirement of EN 45545-2, Clause 4.1 essential fire safety objectives.





**VII. CONCLUSION**

The fire protection documents and limitation are evaluated based on the standards EN 45545-1:2013 and EN 45545-2:2020+A1:2023.

The evaluation of all the presented descriptions and documents show that the construction and material selection of the “High Performance Fanless Embedded System, Model No.: IVH-9204MX-ICY” comply with the requirements HL2 of EN 45545-1:2013 and EN 45545-2:2020+A1:2023.

The evaluation is based on the verified demonstration documents.

**VIII. LIMITATION**

As for fire safety of evaluated product, there are no restrictions and conditions. They can be used in all the operation and construction class in the rail vehicles without restrictions.

The product, used for assessment of this documents, not consider any adjacent unclassified combustible products installed in the vehicle. If there are any unclassified combustible products closed to the High Performance Fanless Embedded System within 20mm for horizontal distance and 200mm for vertical distance, should be re-evaluated based on the requirements of EN 45545-2.

If more accessories were used together with the High Performance Fanless Embedded System, should be re-evaluated based on the requirements of EN 45545-2 and installing conditions.

**STATEMENTS:**

The assess results relate only to the product in the form in which were assessed.

The purpose of the report is to provide a general overview of the evidence currently available and it should be read in conjunction with the specific reports detailed for each product where additional information is required.



**Additional Information (Provide by sponsor)**

Additional Model No.:

IVH-9204MX-ICYXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

As the statement by sponsor, above models are identical with the product with model No. IVH-9204MX-ICY, except from the Naming/Model for marketing purpose and the number of I/O ports. The number of I/O ports for above models is less than the model IVH-9204MX-ICY, that means with less slide and cover for Hard-disk box and wires. Therefore, also under the Clause 4.3.2 of EN 45545-2, exempt from the fire requirements defined in EN 45545-2:2020.

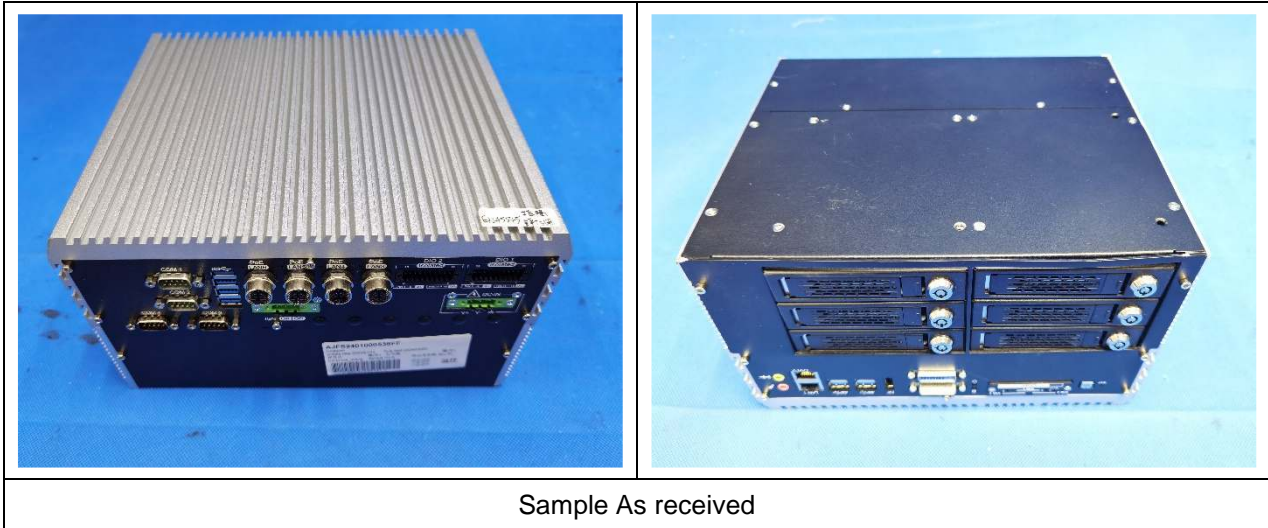
Based on the specification of EN 45545-2, this difference is not relevant to the final conclusion of the product, so the conclusion of this document is also applicable for the products with above additional model No.



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Photo Appendix:



Sample As received

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\*\*\*End of Report\*\*\*



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