



TESTING CERT #1136.04

Chemitox

TEST REPORT

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Report to:

Hanwha Techwin Co., Ltd.

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Reported by:

Chemitox, Inc., Yamanashi Testing Center

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A handwritten signature in black ink, appearing to read 'K. Sakamoto'.

Responsible Officer
Kiyohiko Sakamoto
Director

A handwritten signature in black ink, appearing to read 'Mitsuya Mochizuki'.

Authorized
Mitsuya Mochizuki
Engineering Leader

- (1) Chemitox is accredited by the following agency to ISO/IEC 17025.
American Association for Laboratory Accreditation (A2LA) — Certificated No: 1136.04
- (2) This TEST REPORT refers only to the sample tested, unless stated otherwise.

Hanwha Techwin Co., Ltd.

6, Pangyo-ro 319 Beon-gil, Bundang-gu,
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Glow-wire Flammability Test Method for End Products (GWEPT) Test Report

1. Objective

To conduct Glow-wire flammability test for end-products based on BS EN 60695-2-11 for the samples described in Item 3 to confirm that the samples comply with the requirement of BS EN-45545-2.

2. Date of Test

August 21, 2020

3. Description of Test Specimens

The description of the specimens given in Table 1 has been prepared from information provided by Hanwha Techwin Co., LTD. This information has not been independently verified by Chemitox. All values quoted are nominal, unless specified:

Table 1 Description of Specimens

Material Composition	Product Name	Color	Thickness (mm)	Qty.	Received on
PCB	ASSY, PCB-TRM-810S; MAIN PBA	Green	1.6	5	August 17, 2020

4. Test Method and Conditioning

Test Method and Conditioning is indicated in Table 2.

Table 2 Test Method and Conditioning

Test name	Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products (GWEPT)
Test method	BS 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)"
Classification method	BS EN 45545-2: 2013+A1: 2015 "Railway applications - Fire protection on railway vehicles Part 2: Requirements for fire behavior of materials and components"
Glow wire temperature	850°C (as stipulated in BS EN 45545-2, R25)
Sample conditioning	The test specimens were conditioned for at least 24 hours in an atmosphere having a temperature between 15°C and 35°C and a relative humidity between 45% and 75%

5. Test Results

Summarized test results are shown in Table 3. See Appendix for details.

Table 3 Summarized test results

Product Name	Contact point*	Test Result (°C)
ASSY, PCB-TRM-810S; MAIN PBA	1-6	GWEPT: 850

*: The application points were determined by the instruction of the client, with taking into consideration of the requirement in Clause 8.1, BS EN 60695-2-11. See Photos of Setting status in Appendix for the actual location on the specimen.

6. Conclusion

Applicable criteria stipulated in BS EN 45545-2 is shown in Table 4.

Table 4 Applicable criteria

Requirement Set	Test Method Reference	Parameter and Unit	Maximum or Minimum	HL1	HL2	HL3
R25	BS EN 60695-2-11	Glow Wire Temperature °C	Minimum	850	850	850

The glow wire temperature of the tested specimens was 850°C and therefore satisfies the requirement given in BS EN 45545-2 Table 5, R25 for HL1, HL2 and HL 3.

7. Test Location

Chemitox, Inc., Yamanashi Testing Center
18349 Egusa, Sutama-cho, Hokuto-shi, Yamanashi-ken 408-0103

8. Performed by



Masaru Sakamoto, Engineer (Level 2)

9. Reported by



Masaru Sakamoto, Engineer (Level 2)

10. Reviewed by



Hitoshi Watanabe, Implementation Project Manager (Level 3)

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Appendix

(6 Pages)

- Detailed Test Results
 - Test Method

Reference: 200941

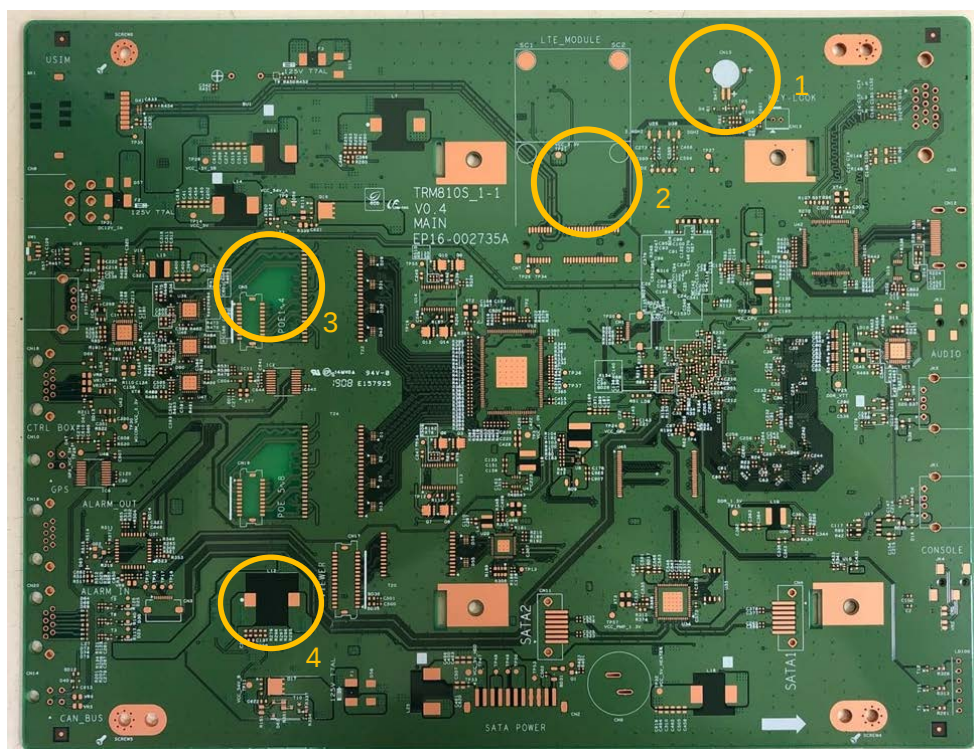


Photo 1 Specimen before testing

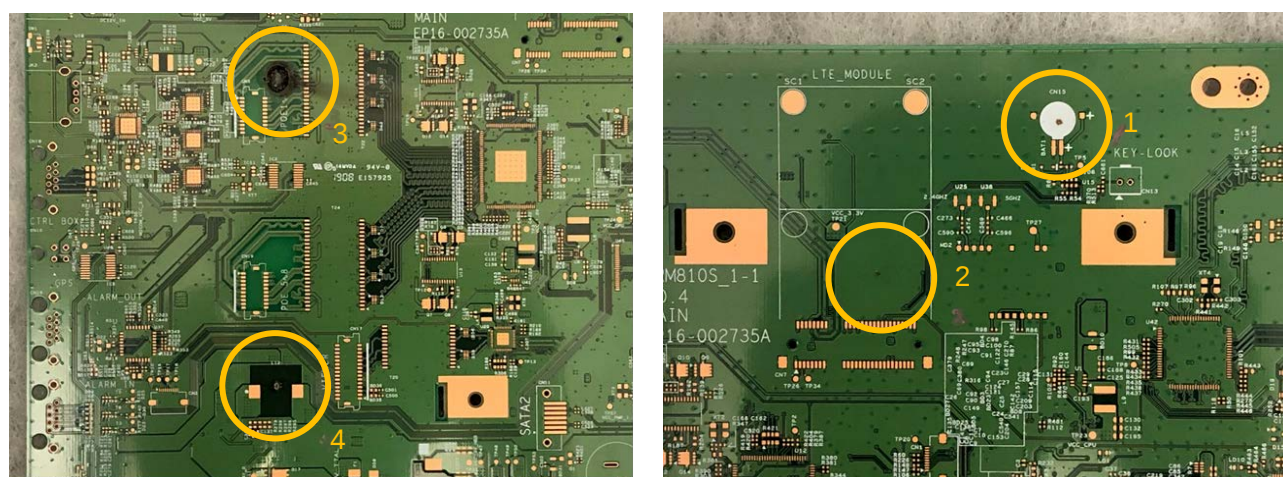


Photo 2 Specimen after testing

Photo1 to 2 Contact point 1-4 of ASSY, PCB-TRM-810S; MAIN PBA

Reference: 200941

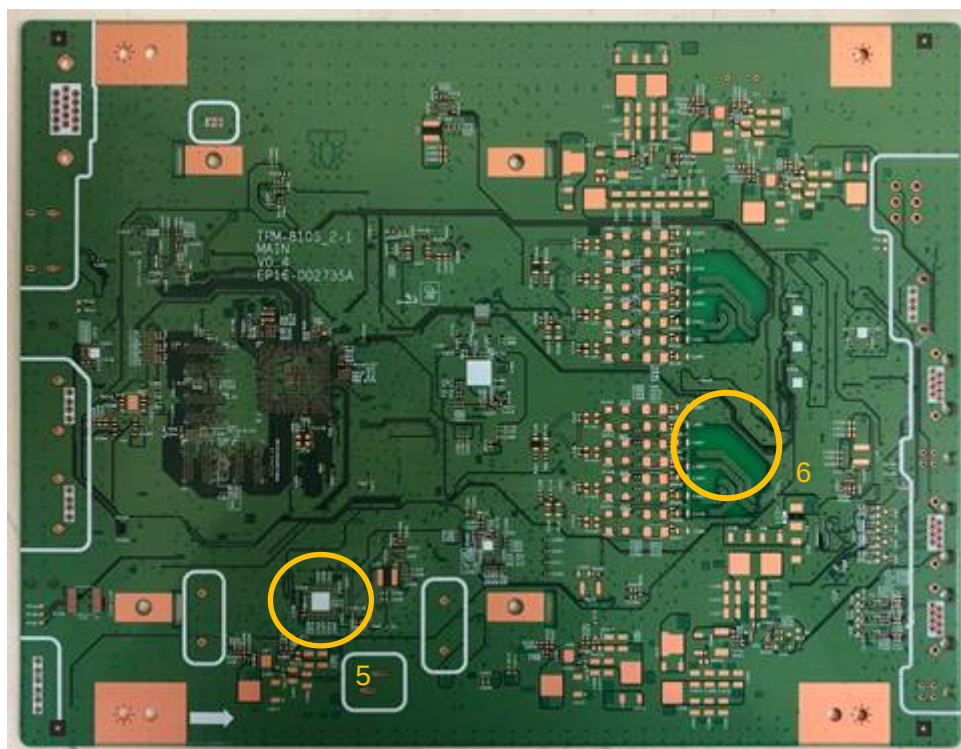


Photo 3 Specimen before testing

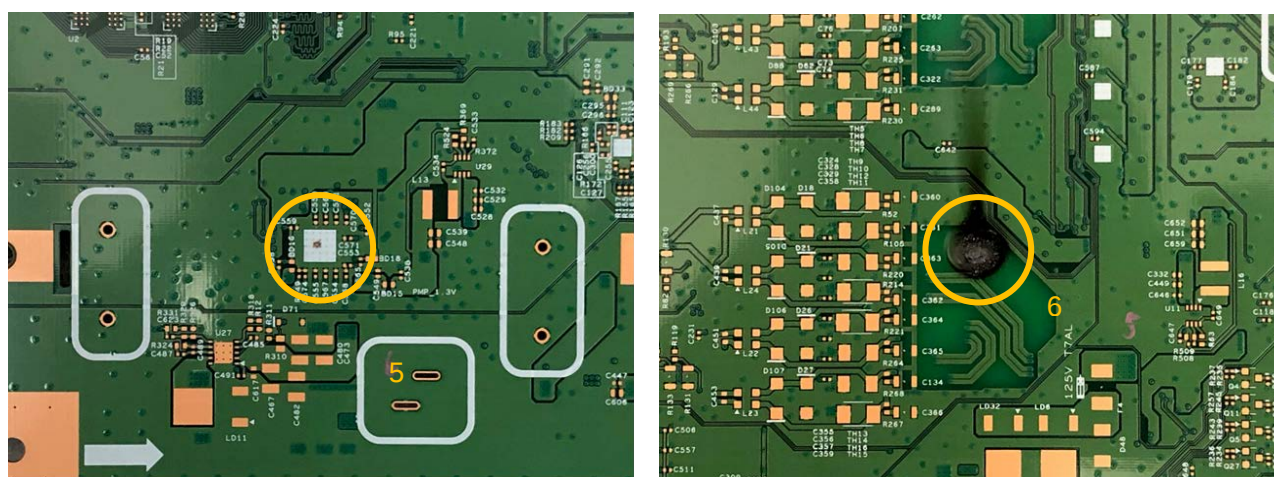


Photo 4 Specimen after testing

Photo3 to 4 Contact point 5-6 of ASSY, PCB-TRM-810S; MAIN PBA

Test Method**Glow-Wire Test Method for End-Product**

1. Applicable standard: BS EN 60695-2-11 (Edition 2.0: 2014) "Glow Wire Flammability Test for End-Product Test"
2. Sample:

It is preferred that the test specimen should be a complete end product.

If the test cannot be made on a complete end product then, or unless otherwise specified by the relevant product standard, it is acceptable to

 - a) cut a piece containing the part under examination from a complete and assembled end product, or
 - b) cut an aperture in the complete end product to allow the glow-wire access, or
 - c) remove the part under examination in its entirety and test it separately.

Note: The glow-wire flammability test method for end products shall not be used for testing small parts. The following are considered to be small parts:

- a) where each surface lies completely within a circle of 15 mm in diameter; or*
- b) where it is not possible to fit a circle of 8 mm in diameter completely on at least one of the surfaces while, at least one part dimension is > 15 mm.*

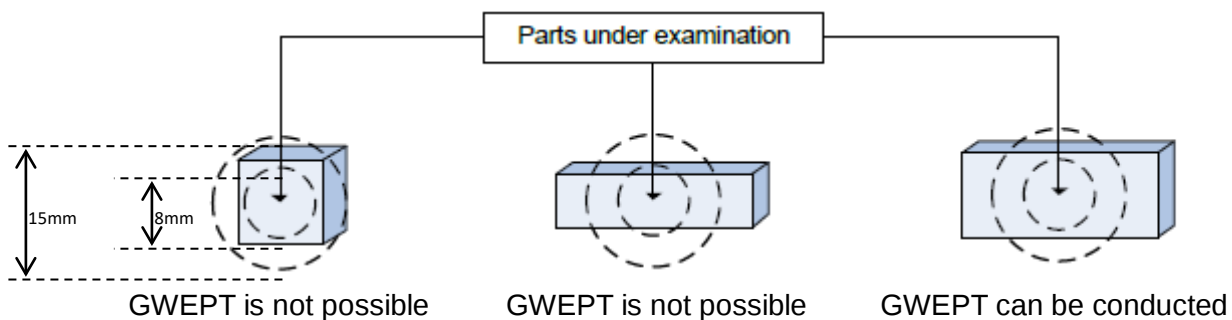


Figure 1 Definition of small parts

3. Conditioning: Conditioned for 24 hours in an atmosphere having a temperature at $25 \pm 10^\circ\text{C}$ and relative humidity $60 \pm 15\%$.

4. Test:

A. Test equipment:

Glow-wire:

Nichrome wire (nominal >77% nickel/ 20% chromium) with a nominal 4.0mm diameter formed not to break on the tip

Thermocouples to measure the temperature:

A sheathed fine-wire thermocouple, having an overall nominal diameter of 1.0mm and Type K wire of NiCr and NiAl.

Applying force: $0.95 \pm 0.10 \text{ N}$

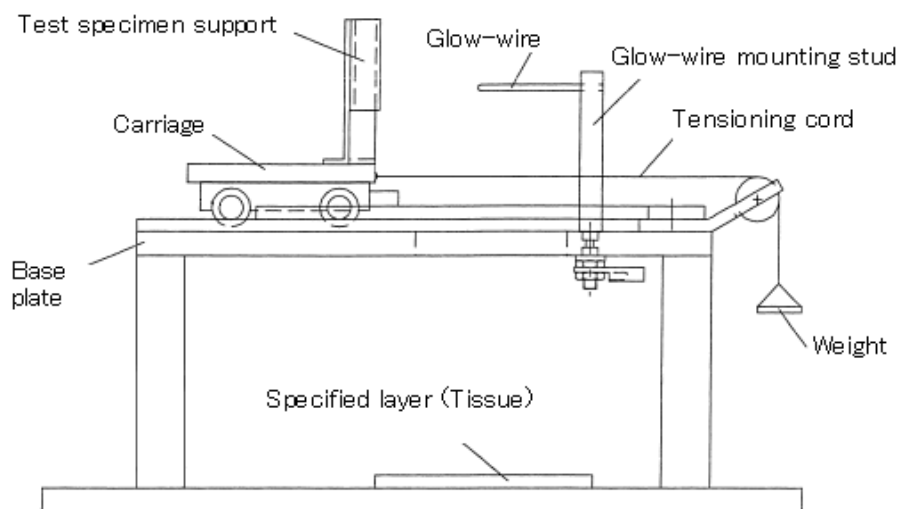


Figure 2 Image of testing apparatus

B. Procedure:

The tip of glow-wire is applied to the sample with a force of $0.95 \pm 0.10 \text{ N}$ for 30 seconds.

Test Temperature (°C)	Tolerances (°C)	Test Temperature (°C)	Tolerances (°C)
550	± 10	800	± 15
600	± 10	850	± 15
650	± 10	900	± 15
700	± 10	960	± 15
750	± 10		

The test temperature shall be chosen from the values indicated in table above.

C. Observation:

During the time of application of the glow-wire, $T_A(30 \text{ s} \pm 1 \text{ s})$, and during a further period of 30 s, the test specimen, the parts surrounding the test specimen and the specified layer placed below it is observed and the following is reported:

- a) whether there is no ignition; or, if there is ignition, the duration, T_i (to the nearest 0,5 s), from the beginning of tip application up to the time at which the test specimen or the specified layer placed below it ignites;
- b) the duration, T_E , (to the nearest 0,5 s) from the beginning of tip application up to the time when all flames extinguish, during or after the period of application;
- c) whether the test specimen extinguishes by virtue of most of the flaming material being withdrawn with the glow-wire;
- d) whether the test specimen is totally burned; and
- e) whether there is any ignition of the specified layer placed underneath the test specimen.

5. Criteria: The test specimen is considered to have a GWEPT of T if at a test temperature of T °C,

- a) there is no ignition, or
- b) all of the following situations apply when ignition has occurred:
 - i) if flames or glowing combustion of the test specimen extinguish within 30 s after removal of the glow wire, i.e. $T_E \leq T_A + 30 \text{ s}$; and
 - ii) the specified layer placed underneath the test specimen does not ignite.