

SEMI FH1-0323

TEST METHOD OF LINE IMPEDANCE FOR ELECTRONIC TEXTILES

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NOTICE: Paragraphs entitled ‘NOTE:’ are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

1 Purpose

- 1.1 The conductive traces, paths or wires are an important configuration for the circuit layout and signal processing, and that are applied to electronic textiles. A new kind of textile transmission line that might be widely used, among others, in smart clothing.
- 1.2 This line consists of a flexible substrate with conductive traces, paths or wires. The line impedance measurement is an important method for ensuring the fabric wire quality in incoming quality control and out-going quality control, and improved further the productivity and efficiency.
- 1.3 This Test Method aims to implement four-terminal measurement and elucidate the measurement of impedance for the specific fabric materials. This Standard is a test method of applying the four-terminal measurement with operating frequency to measure the impedance.

2 Scope

- 2.1 This Standard is the four-terminal measurement method to measure the line impedance of electronic textiles.
- 2.2 This Standard applies to a new kind of textile transmission line in electronic textiles.
- 2.3 This Standard is applied to a line consisting of a flexible substrate with conductive traces, paths or wires of electronic textiles.

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3 Limitations

- 3.1 The frequency range of impedance measurement is limited from 10 Hz to 1 MHz.
- 3.2 The line being evaluated is independent and is not electrically connected to other electronic components or wiring.

4 Referenced Standards and Documents

4.1 ISO® Standards¹

ISO 139 — Textiles – Standard Atmospheres for Conditioning and Testing

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 Abbreviations and Acronyms

- 5.1.1 LCR — inductance, capacitance, resistance
- 5.1.2 H_C — high current

¹ International Organization for Standardization, ISO Central Secretariat, Chemin de Blandonnet 8, CP 401-1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>. ISO trademark is owned by International Organization for Standardization.

5.1.3 H_P — high potential

5.1.4 L_C — low current

5.1.5 L_P — low potential

6 Apparatus

6.1 Inductance, Capacitance, Resistance (LCR) Meter

6.1.1 The LCR meter includes four terminals: H_C , H_P , L_C , L_P .

6.1.2 The measurement accuracy is $\leq 0.1\%$.

6.1.3 The measurement range of resistance is from 0.01 m Ω to 99.99 M Ω .

6.1.4 The measurement range of capacitance is from 0.01 f to 9.99 F.

6.1.5 The inductance range is from 0.01 nH to 99.99 kH.

6.1.6 The frequency range is from 10 Hz to 1 MHz.

6.2 The antistatic mat is grounded and is placed on the flat workbench. The surface shall be larger than the specimen.

6.3 *Insulation Flat* — The material should be mica, rubber mat, vinyl chloride sheet, acrylic board.

7 Test Specimens

7.1 The test specimens consist of flexible substrates with conductive traces, paths or wires.

7.2 The test specimens shall have the electrical or conductive traces, paths or wires to contact.

8 Summary of Test Method

8.1 The four-terminal measurement is used in determining the line impedance of specimens.

8.2 Perform the OPEN/SHORT correction procedure.

8.3 Measure the test specimen.

8.4 Read and record the measurement results.

9 Procedure

9.1 The calibration of LCR meter shall be repeated periodically based on the manufacturer's recommendations or the lab rules and regulations.

9.2 Prepare the test specimens in a suitable testing chamber or conditioning room at a predetermined relative humidity and temperature for the specimens.

9.2.1 The measurement is performed under the conditions of $65 \pm 4\%$ RH and $20 \pm 2^\circ\text{C}$, or $50 \pm 4\%$ RH and $23 \pm 2^\circ\text{C}$ which is followed by ISO 139, or other settings (such as the test conditions comply with the using conditions of end-products). The temperature and humidity should be consistent during measurements.

9.3 Before the measurement, the test specimens are stabilized under the conditions of the measurement conditions.

NOTE 1: 24 hours is recommended for stabilization time.

9.4 The redundant charges of specimens contact surface is removed by grounding.

9.5 The antistatic mat is grounded and is placed on the flat workbench.

9.6 Place the insulation flat (e.g., mica) on the antistatic mat, and put the test specimen on the insulation flat.

9.7 Read the measurement procedures and the calibration steps of LCR meter before the measurement.

9.8 The LCR meter shall be warmed up at least 30 minutes before the measurement.

9.9 The antistatic bracelet and the insulating gloves should be worn.

9.10 The signal path between the LCR meter and the specimen should be as short as possible.