



valid until: November 18, 2027

Fraunhofer
TESTED[®]
DEVICE
LAPPKOREA LLC
CR 8211 MC 3X0.14SQ
Report No. LA 2208-1345

DUPPLICATE

Statement of
Qualification

Single product
Particle Emission

Statement of Qualification • Single product

Customer

LAPPKOREA LLC
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18579 JANGAN-MYEON, HWASEONG-SI, GYEONGGI-DO
Korea

Test result / Classification

When operated under the specified test conditions, the cable UNITRONIC CLEANROOM FD 8211 MC 3 X 0.14SQ is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Component tested

Category: Energy Supply
Subcategory: Cable Systems
Product name: UNITRONIC CLEANROOM FD 8211 MC 3 X 0.14SQ
(manufacturing date: 6/24/2022; color: black; batch number: C/25; serial number: 85132401)

| Test parameter(s) | Air Cleanliness Class |
|--|-----------------------|
| $v_1 = 0.5 \text{ m/s}; a_1 = 1.0 \text{ m/s}^2$ | 1 |
| $v_2 = 1.0 \text{ m/s}; a_2 = 2.0 \text{ m/s}^2$ | 1 |
| $v_3 = 2.0 \text{ m/s}; a_3 = 4.0 \text{ m/s}^2$ | 1 |
| Overall result | 1 |

Please note: Transport damages, incorrect installation, aging behavior, etc. can influence the test result.

Random sampling of particle emissions (airborne) at representative sites

Standards/Guidelines:

ISO 14644-1, -14

The norms stated generally refer to the version valid at the time of the tests.

Test devices:

Optical particle counter:

LasAir II 110 and LasAir III 110 with measuring ranges $\geq 0.1 \mu\text{m}$, $\geq 0.2 \mu\text{m}$, $\geq 0.3 \mu\text{m}$, $\geq 0.5 \mu\text{m}$, $\geq 1.0 \mu\text{m}$ and $\geq 5.0 \mu\text{m}$

Test environment parameters:

- Cleanroom Air Cleanliness Class (according to ISO 14644-1):..... ISO 1
- Airflow velocity:..... 0.45 m/s
- Airflow pattern:..... vertical laminar flow
- Temperature: $22^\circ\text{C} \pm 0.5^\circ\text{C}$
- Relative humidity: 45 % ± 5 %

Test procedure parameters:

- Energy chain: Igus E61.29.02.150
- Bending radius: $r = 150 \text{ mm}$
- Stroke length: $s = 820 \text{ mm}$
- Parameter Set 1: $v_1 = 0.5 \text{ m/s}; a_1 = 1.0 \text{ m/s}^2$
- Parameter Set 2: $v_2 = 1.0 \text{ m/s}; a_2 = 2.0 \text{ m/s}^2$
- Parameter Set 3: $v_3 = 2.0 \text{ m/s}; a_3 = 4.0 \text{ m/s}^2$

The measuring devices used for the qualification tests are calibrated at regular intervals; their results can be traced back to national and international standards. In cases where no national standards exist, the test procedure implemented complies with the technical regulations and norms applicable at the time of the test. The relevant documentation can be viewed on request at any time.

Detailed information and parameters of the test environment can be found in the Fraunhofer IPA test report.

Fraunhofer Institute for Manufacturing
Engineering and Automation IPA

Department of Ultraclean Technology
and Micromanufacturing

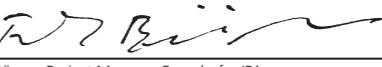
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Stuttgart, November 18, 2022
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Place, current date

on behalf of 
Dr.-Ing. Frank Bürger, Project Manager Fraunhofer IPA

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