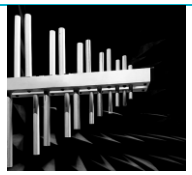
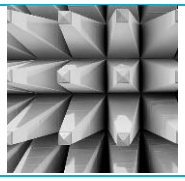

cetecom advanced

Bundesnetzagentur

BNetzA-CAB-02/21-102

# TEST REPORT

**Test Report No.: 1-6184_23-01-11_TR1-R01**

ilac-MRA

DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-00

## Testing Laboratory


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CAB identifier: DE0001

**Accredited Test Laboratory:**
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate starting with the registration number: D-PL-12047-01-00.

## Applicant


**Sphinx Electronics GmbH & Co KG**
Tullastraße 3
79341 Kenzingen / Germany
Contact: Dominik Grolle
e-mail: Dominik.grolle@sphinx-electronics.de


## Manufacturer

same as applicant

## Test Standard/s

| | |
|---|---|
| FCC - Title 47 CFR Chapter I - Subchapter I §1.1310 | Radiofrequency radiation exposure limits |

For further applied test standards please refer to section 3 of this test report.

## Test Item

| | |
|---|---|
| Kind of test item: | Terminal |
| Device type: | fixed device |
| **Model name:** | **LL300** |
| S/N serial number: | prototype |
| FCC-ID: | TCN025 |
| Hardware status: | SLS-40 |
| Frequency: | RFID 13.56 MHz |
| Antenna: | integrated antenna |
| Power Supply: | 6 V DC by battery |
| Test sample status: | identical prototype |
| Exposure category: | general population / uncontrolled environment |

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Test Report authorised:

cn=Alexander Hnatovskiy, o=cetecom advanced GmbH, ou=HNA-230601, email=alexander.hnatovskiy@cetecomadvanced.com, c=DE
2024.04.09 08:41:42 +02'00'

Alexander Hnatovskiy
Lab Manager
Radio Labs

## Test performed:

cn=Marco Scigliano, o=cetecom advanced GmbH, ou=SCI-230601, email=Marco.Scigliano@cetecomadvanced.com, c=DE
2024.04.09 09:24:13 +02'00'

Marco Scigliano
Testing Manager
Radio Labs

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# 2 General information

## 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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In no case this test report can be considered as a Letter of Approval.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2023-08-01 |
| Date of receipt of test item: | 2024-03-18 |
| Start of test: | 2024-03-21 |
| End of test: | 2024-03-21 |

## 2.3 Statement of compliance

The EMF values found for the LL300 Terminal are below the maximum allowed levels according to the standards listed in section 3.

# 3 Test standard/s:

| Test Standard | Version | Test Standard Description |
|---|---|---|
| FCC - Title 47 CFR Chapter I - Subchapter I §1.1310 | 04.06.2013 | Radiofrequency radiation exposure limits |

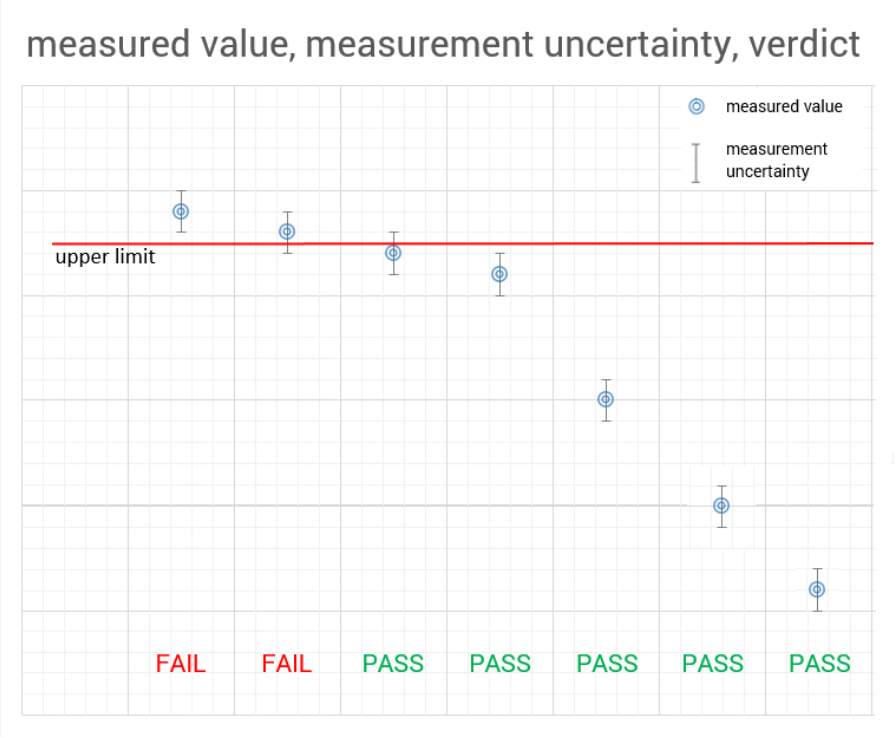
## 3.1 RF exposure limits

Reference levels for general public (uncontrolled environment) exposure to time-varying electric and magnetic fields

| According to: CFR47, Subpart I - §1.1310 Radiofrequency radiation exposure limits | | | | |
|---|---|---|---|---|
| **Frequency Range** (MHz) | **Electric Field** (V/m) | **Magnetic Field** (A/m) | **Power density** (mW/cm$^2$) | **Averaging time** (minutes) |
| Occupational / Controlled Exposure | | | | |
| 0.3-3.0 | 614 | 1.63 | *100 | 6 |
| 3.0-30 | 1842/f | 4.89/ $f$ | *900/f$^2$ | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | -- | -- | f/300 | 6 |
| 1500-100000 | -- | -- | 5 | 6 |
| General Population / Uncontrolled Exposure | | | | |
| 0.3-1.34 | 614 | 1.63 | *100 | 30 |
| **1.34-30** | **824/f** | **2.19/f** | ***180/f$^2$** | **30** |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | -- | -- | f/1500 | 30 |
| 1500-100000 | -- | -- | 1.0 | 30 |

## 4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."




## 5 Summary of Measurement Results

| | |
|---|---|
| ☒ | **No deviations from the technical specifications ascertained** |
| ☐ | Deviations from the technical specifications ascertained |

At the customer declared safety distance of **20 cm** from the human body to the antenna, the exposure from the EUT is below the legal limitations, while RFID scanning.

## 6 Test Environment

| | |
|---|---|
| Ambient temperature: | 20 – 24 °C |
| Relative humidity content: | 40 – 50 % |
| Air pressure: | not relevant for this kind of testing |
| Power supply: | 230 V / 50 Hz |

# 7 Test Set-up

## 7.1 Measurement system

### 7.1.1 Broadband Electromagnetic Field Test system

A state of the art Broadband Electromagnetic Field Test system was used. The probes of the system are fitted with three sensors which measure the field strength of the X, Y and Z plane directions separately. The field strength is calculated by the instrument's processor by summing the squares of the three measured values.

The frequency range 5 Hz to 60 GHz is covered.
Depending on the used probe type Electric and Magnetic Field or Electric Field only is detectable.

- EHP-50D 5 Hz to 100 kHz Electric and Magnetic Field
- EHP-50F 5 Hz to 400 kHz Electric and Magnetic Field
- HF 3061 300 kHz to 30 MHz Magnetic Field
- EF 0691 100 kHz to 6 GHz Electric Field
- EF 6092 100 MHz to 60 GHz Electric Field
- ELT 400 3cm² 1 Hz to 400 kHz Magnetic Field

### 7.1.2 Test equipment list

| | Manufacturer | Device | Type | Serial number | Last Calibration | Calibration cycle (months) |
|---|---|---|---|---|---|---|
| ☒ | Narda | Electric and Magnetic Field Meter | NBM-550 | F-0319 | 2023-04-12 | 24 |
| ☒ | Narda | Electric Field Probe (100 kHz - 6 GHz) | EF 0691 | G-0027 | 2023-04-12 | 24 |
| ☒ | Narda | Magnetic Field Probe (300 kHz to 30 MHz) | HF 3061 | D-0404 | 2023-04-12 | 24 |

☒ Devices used during the test ☐ Devices not used during the test

### 7.1.3 Averaging

For time efficient testing an average of 8 seconds was used. With some spot checks was verified, that caused by the time structure of the measured responses, the results did not change with a 30-minute-averaging.

### 7.1.4 Uncertainties

The probe uncertainties stated by the manufacturer are considered to be the main relevant and dominant issues.

#### 7.1.4.1 Typical uncertainty of HF3061

| | | |
|---|---|---|
| Flatness of frequency response[a]<br>Calibration uncertainty not included | 0/-1 dB (500 to 800 kHz)<br>+0.1/ -0.5 dB (800 kHz to 30 MHz) | |
| Calibration uncertainty[b]<br>@ 0.59 mW/cm² (0.125 A/m) | 1.3 dB | |
| Linearity<br>Referred to 0.59 mW/cm² (0.125 A/m) | ±3 dB (0.017 to 0.033 A/m)<br>±1 dB (0.033 to 0.068 A/m)<br>±0.5 dB (0.068 to 3 A/m)<br>±1 dB (3 to 16 A/m) | ±3 dB (10 to 40 µW/cm²)<br>±1 dB (40 to 175 µW/cm²)<br>±0.5 dB (175 µW/cm² to 340 mW/cm²)<br>±1 dB (0.34 to 10 W/cm²) |
| Isotropic response[C] | ±1 dB | |
| Temperature response | +0.2/ -0.8 dB (±0.025 dB/K @ 10 to 50 °C) | |

(a) Frequency response can be compensated for by the use of correction factors stored in the probe memory
(b) Accuracy of the fields generated to calibrate the probes
(c) Uncertainty due to varying polarization (verified by type approval test for meter with probe). Ellipse ratio included and calibrated for each probe

#### 7.1.4.2 Typical uncertainty of EF0691

| | | |
|---|---|---|
| Flatness of frequency response[a]<br>Calibration uncertainty not included | ±1.0 dB (1 MHz to 4 GHz) ±1.5 dB (0.3 MHz to 5 GHz) -2.5 dB typ. @ 0.15 MHz | |
| Calibration uncertainty[b]<br>@ 0.2 mW/cm² (27.5 V/m) | 0.8 dB (≤ 300 MHz)<br>1.5 dB (300 MHz to 1.2 GHz)<br>1.3 dB (≥ 1.2 GHz) | |
| Linearity<br>Referred to 0.2 mW/cm² (27.5 V/m) | ±0.5 dB (2.2 to 316 V/m) | ±0.5 dB (0.0013 to 26.5 mW/cm²) |
| Isotropic response[C] | ±1 dB | |
| Temperature response | +0.2/ -1 dB (0 °C to 50 °C, related to 23 °C) | |

(a) Frequency response can be compensated for by the use of correction factors stored in the probe memory
(b) Accuracy of the fields generated to calibrate the probes
(c) Uncertainty due to varying polarization (verified by type approval test for meter with probe). Ellipse ratio included and calibrated for each probe

### 7.1.5 Validation procedure

Before performing the tests the empty test chamber was checked for system immanent frequency responses. The following background signal level was detected. All levels are small enough to allow accurate proof of the limits to be considered.

| Probe | Frequency Range | Magnetic Flux Density (B) in µT | Magnetical Field Strength in A/m | Electrical Field Strength in V/m | Remark |
|---|---|---|---|---|---|
| HF 3061 | 300 kHz – 30 MHz | 0.0016 | 0.0013 | -- | |
| EF 0691 | 100 kHz – 6 GHz | -- | -- | 0.15 | |

### 7.1.6 Definition of test position and distances

In absence of an equipment specific regulation with given test distances, all not further noted test positions were measured in “touched” mode, the probe radome touching the DUT at the defined test position.
Due to the mechanical concept of the used probe a distance between DUT surface and electrical centre of the probe antennas remains.

| Probe type | Maximum distance (cm) | |
|---|---|---|
| | Magnetic Field | Electrical Field |
| HF 3061 | 5.5 | -- |
| EF 0691 | -- | 3.5 |

### 7.1.7 Anisotrophical probe behaviour management

As EMF measurements for safety and health aspects are often performed in the nearfield of a radiation source it is important to be aware of the not ideal isotropic performance of a typical probe and how to reproduce reliable results.

During measurements the following steps are performed to get always the highest possible field strength result and validate that the measured results are always the worst case scenario with the highest energy emitted by the source.

Step 1: Finding the position of the highest radiated field source with a basic probe orientation.
Step 2: Turning the probe to all possible orientations to find the orientation that delivers the maximum field strength.

## 7.2 Test results

For considering worst-case conditions all measurements were performed at smallest possible distance from the device under test. Limits shown in the tables below are the lowest ones within the wideband frequency ranges of the field probes applied.

Test positions see photo documentation (Annex A).

During the measurements the DUT was switched on in permanent scanning mode.

| RFID 13.56 MHz | | | | | | | |
|---|---|---|---|---|---|---|---|
| test position | distance (cm) | H (A/m) | Limit (A/m) | **Probe** | E (V/m) | Limit (V/m) | **Probe** |
| front | 20* | 0.054 | **0.161** | **HF3061** | 1.55 | **60.77** | **EF0691** |
| Other sides | 20* | <0.035 | **0.161** | | <1.82 | **60.77** | |

Table 1: Test results E-/ H-f@13.56 MHz RFID

*) measured to the centre of the probe

## 7.3 Final verdict

At the customer declared safety distance of **20 cm** from the human body to the antenna, the exposure from the EUT is below the legal limitations, while RFID scanning.

## Annex A: Photo documentation

Photo 1: EUT - Front side + RFID card

Photo 2: EUT - Left side view

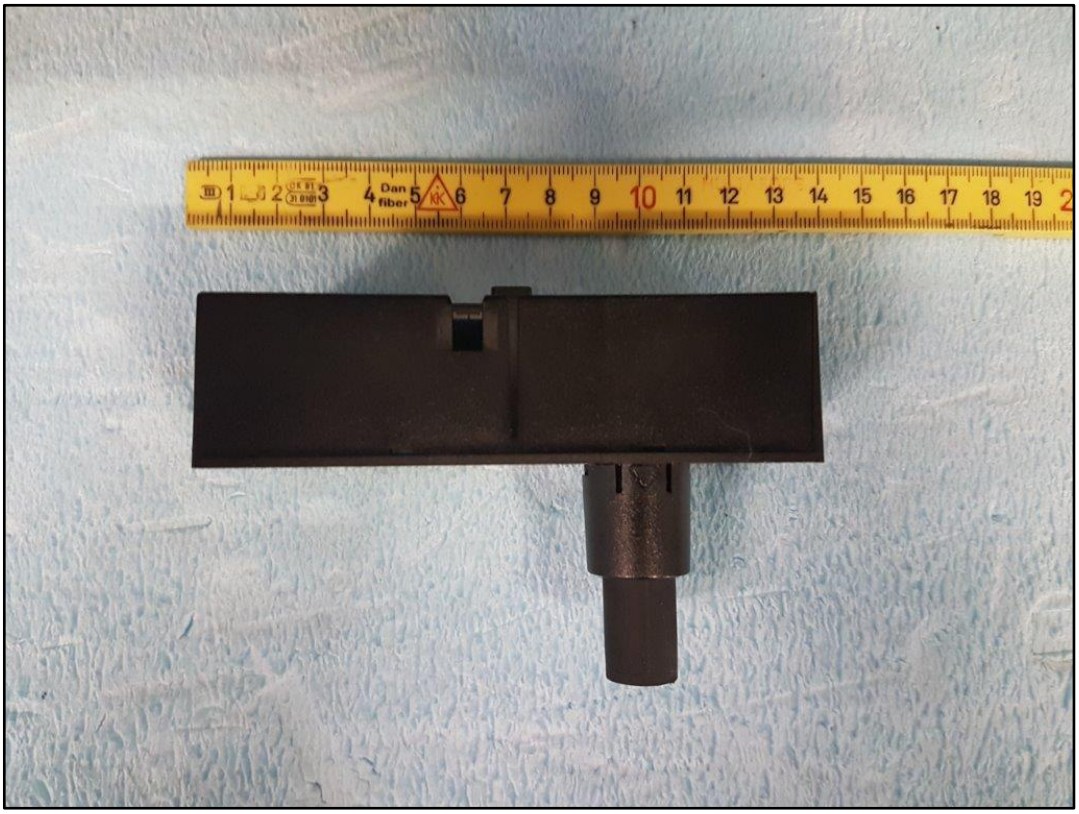


Photo 3: EUT - Bottom side view

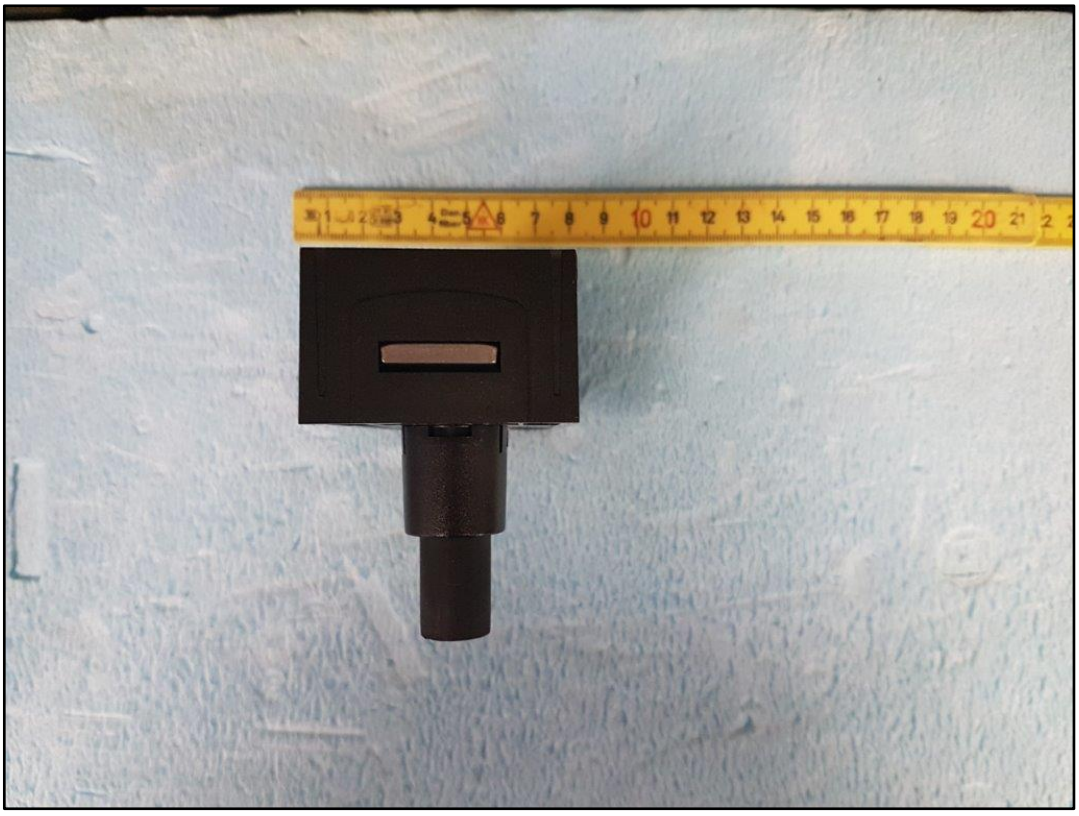
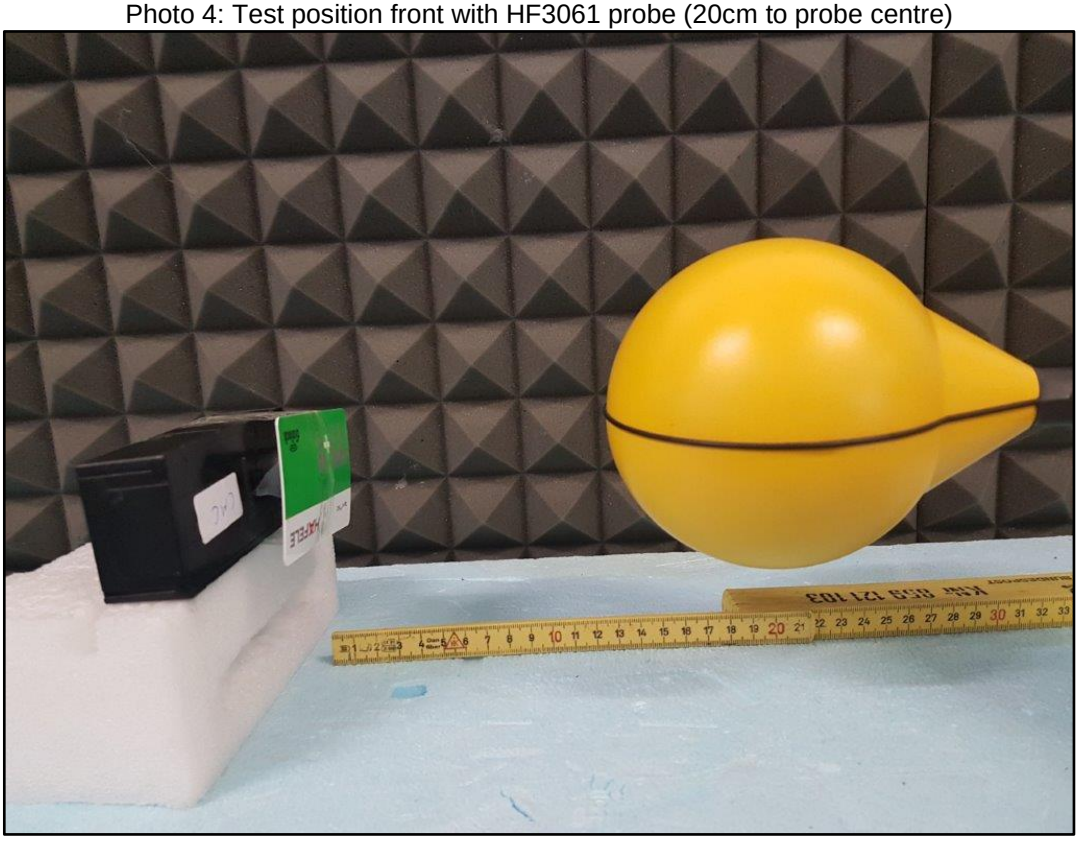


Photo 4: Test position front with HF3061 probe (20cm to probe centre)



## Annex B: Document History

| Version | Applied Changes | Date of Release |
|---|---|---|
| | Initial Release | 2024-04-03 |
| | | |

## Annex C: Further Information

**Glossary**

| | | |
|---|---|---|
| DUT | - | Device under Test |
| EUT | - | Equipment under Test |
| FCC | - | Federal Communication Commission |
| FCC ID | - | Company Identifier at FCC |
| HW | - | Hardware |
| N/A | - | not applicable |
| S/N | - | Serial Number |
| SW | - | Software |