
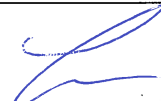


| | | | | |
|--|---|--|-----------------------------|--|
| Prüfbericht-Nr.: <i>Test Report No.:</i> | 50050029 001 | Auftrags-Nr.: <i>Order No.:</i> | 114052380 | Seite 1 von 25 <i>Page 1 of 25</i> |
| Kunden-Referenz-Nr.: <i>Client Reference No.:</i> | N/A | Auftragsdatum: <i>Order date:</i> | 21-Jun-2016 | |
| Auftraggeber: <i>Client:</i> | N.V. Nederlandsche Apparatenfabriek "Nedap" , Parallelweg 2, 7141 DC Groenlo, The Netherlands | | | |
| Prüfgegenstand: <i>Test item:</i> | Reader for 120 kHz and 13.56 MHz cards and also NFC, QR and BT | | | |
| Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i> | MACE READER MM QR, MACE READER MM | | | |
| Auftrags-Inhalt: <i>Order content:</i> | FCC/ISED Test Report | | | |
| Prüfgrundlage: <i>Test specification:</i> | FCC 47CFR Part 15: Subpart C Section 15.225 RSS-210 (08-2016) B.6 NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2011) | | | |
| Wareneingangsdatum: <i>Date of receipt:</i> | 1-Jul-2016 | | | |
| Prüfmuster-Nr.: <i>Test sample No.:</i> | A000386950-003 | | | |
| Prüfzeitraum: <i>Testing period:</i> | 7-Jul-2016 - 28-Jul-2016 | | | |
| Ort der Prüfung: <i>Place of testing:</i> | EMC/RF Laboratory Taipei | | | |
| Prüflaboratorium: <i>Testing laboratory:</i> | TUV Rheinland Taiwan Ltd. | | | |
| Prüfergebnis*: <i>Test result*:</i> | Pass | | | |
| geprüft von / tested by:  | | kontrolliert von / reviewed by:  | | |
| 02-Sept-2016 Ryan W. T. Chen / Project Engineer | | 02-Sept-2016 Rene Charton / Senior Project Manager | | |
| Datum <i>Date</i> | Name / Stellung <i>Name / Position</i> | Unterschrift <i>Signature</i> | Datum <i>Date</i> | Name / Stellung <i>Name / Position</i> |
| | | | | Unterschrift <i>Signature</i> |
| Sonstiges / Other: | | Worst case situation has been tested being MACE READER MM QR | | |
| Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i> | | Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i> | | |
| * Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet | | | | |
| Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested | | | | |
| Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i> | | | | |

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 FIELD STRENGTH OF FUNDAMENTAL

RESULT: Passed

5.1.3 FREQUENCY STABILITY

RESULT: Passed

5.1.4 99% BANDWIDTH

RESULT: Passed

5.1.5 SPURIOUS EMISSION

RESULT: Passed

5.2.1 CONDUCTED EMISSIONS LINE AND NEUTRAL

RESULT: Passed

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1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix P: Photo Documentation

(File Name: 50050029APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50050029APPENDIX D)

Test Specifications

The following standards were applied (in bold: product standards, otherwise: basic standards).

Table 1: Applied Standard and Test Levels

| Radio |
|--|
| FCC CFR47 Part 15: Subpart C Section 15.225 RSS-210 Issue 9 August 2016 RSS-Gen, Issue 4, November 2014 ANSI C63.10:2013 LP0002(2011)(100年6月28日) |

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC Registration No.: 365730
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th



Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

| Kind of Equipment | Manufacturer | Type | S/N | Last Calibration | Next Calibration |
|-------------------------------|----------------|-----------|-------------|------------------|------------------|
| Test Software | Farad | EZ_EMG | Ver. TUV3A1 | N/A | N/A |
| EMI Test Receiver | R&S | ESR7 | 101062 | 2015/09/10 | 2016/09/10 |
| Spectrum Analyzer | R&S | FSV 40 | 100921 | 2016/04/21 | 2017/04/21 |
| Spectrum Analyzer | Agilent | N9010A | MY53470241 | 2016/04/25 | 2017/04/24 |
| Preamplifier (30MHz -1GHz) | HP | 8447F | 2805A03335 | 2015/08/31 | 2016/08/31 |
| Preamplifier (18 GHz -40 GHz) | COM-POWER | PAM-840 | 461257 | 2015/11/19 | 2016/11/19 |
| Pre-Amplifier (1GHz~18GHz) | EM Electronics | EM01G18G | 060558 | 2015/11/19 | 2016/11/19 |
| Bilog Antenna | TESEQ | CBL6111D | 29802 | 2014/07/04 | 2016/08/04 |
| Horn Antenna | ETS-Lindgren | 3117 | 138160 | 2016/05/03 | 2017/05/03 |
| Horn Antenna (18GHz~40GHz) | COM-POWER | AH840 | 101031 | 2015/11/02 | 2016/11/02 |
| Loop Antenna | Schwarzbeck | FMZB 1513 | 1513-076 | 2016/05/11 | 2017/05/11 |
| EMI Test Receiver | R&S | ESC17 | 100797 | 2015/12/28 | 2016/12/27 |
| Spectrum Analyzer | R&S | FSL3 | 101943 | 2015/09/07 | 2016/09/07 |
| LISN (1 phase) | R&S | ENV216 | 101243 | 2016/06/02 | 2017/06/02 |

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are $\pm 3\text{dB}$.

Table 3: Emission Measurement Uncertainty

| Parameter | Uncertainty |
|--|--------------------------------|
| Radio Frequency | $\pm 1 \times 10^{-7}$ |
| RF power, conducted | $\pm 1.5 \text{ dB}$ |
| Adjacent channel power | $\pm 3 \text{ dB}$ |
| Radiated emission of transmitter, valid up to 26 GHz | $\pm 6 \text{ dB}$ |
| Radiated emission of receiver, valid up to 26 GHz | $\pm 6 \text{ dB}$ |
| Temperature | $\pm 2 \text{ }^\circ\text{C}$ |
| Humidity | $\pm 10 \%$ |

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a SRD system that reads access codes from NFC or BT enabled mobile telephones or Access cards, operating on 13.56 MHz. Additionally, there is a 120 kHz Card reader implemented. The scope of this test report are the two 13.56 MHz and 120kHz inductive reader interfaces. The two model listed differ in the Optical QR reader which is not implemented in the model MACE READER MM. Testing was done on Model MACE READER MM QR. For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 Ratings and System Details

Table 4: Basic Information of EUT

| Item | EUT information |
|-----------------------------|--|
| Kind of Equipment/Test Item | Reader for 120 kHz and 13.56 MHz cards and also NFC, QR and BT |
| Type Identification | MACE READER MM QR, MACE READER MM |
| FCC ID | CGDMACER1 |
| Canada ID | 1444A-MACER1 |

Table 5: Technical Specification of EUT

| Technical Specification | Value |
|-------------------------|-----------------------|
| Operating Frequency | 13.56 MHz and 120 kHz |
| Operation Voltage | 12-24 Volt DC |
| Extreme Voltage Range | 10.2~27.6 V |
| Modulation | ASK and CW |
| Antenna Type | Printed PCB Coil |

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum emission level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: The EUT has a serial interface which makes it possible to read data from the RFID reader. The RFID readers, both for 13.56 MHz and 120 kHz are permanently on.

Tests were performed in two configurations:

- 1.) RFID mode, with a Combi-RFID card in close proximity to the Reader.
- 2.) NFC mode, with a NFC enabled Mobile Phone in close proximity to the Reader.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

| Kind of Equipment | Manufacturer | Model Name | S/N |
|-------------------|--------------|------------|-----|
| -- | -- | -- | -- |

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test

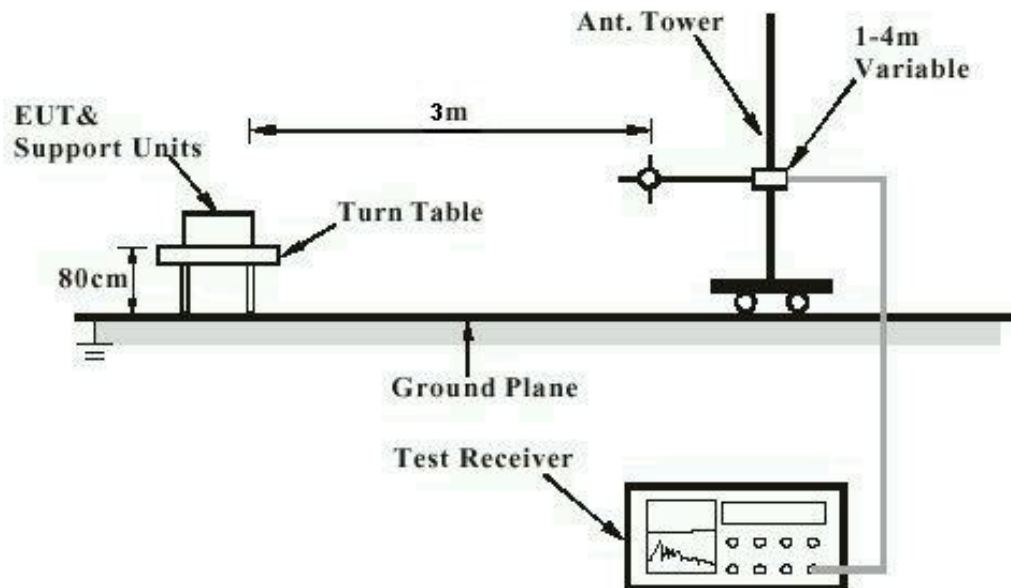
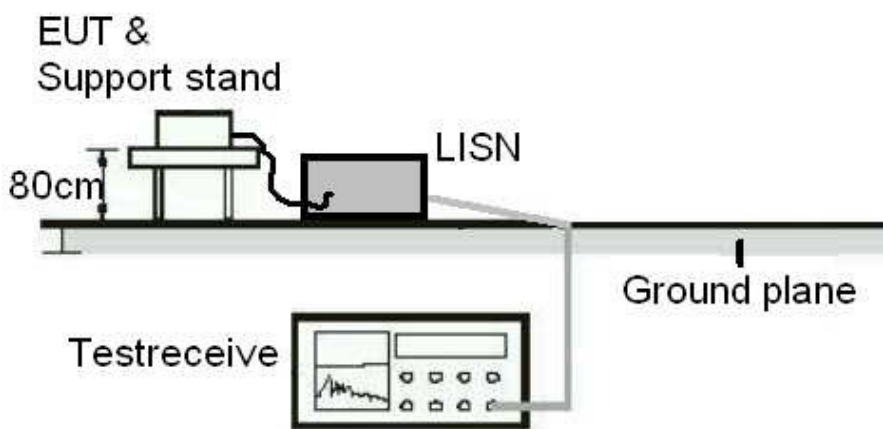


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Passed**

Standard : LP0002(2011): 2.2
Part 15.203 and RSS-Gen 7.1.4
Requirement : use of approved antennas only

The antenna is Coil inside the enclosure, soldered to the PCB with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Field strength of fundamental

RESULT:
Passed

Test standard : LP0002(2011) 3.2
 FCC Part 15. 225
 RSS-210 B.6

Basic standard : ANSI C63.10:2013

Test setup

Test Frequency : 13.56 MHz
 Operation Mode : A

Table 6: Test result of Field strength of fundamental and modulation sidebands

| Frequency (MHz) | Meas. Result | Detector | Test Result | Limits (QP) | | Pass/Fail |
|-----------------|--------------------|----------|-------------------|------------------|------------------|-----------|
| | dB μ V/m @1.2m | | dB μ V/m @30m | dB μ V/m @3m | dB μ V/m@30m | |
| 13.110–13.410 | <77.08 | Pk | <21.18 | 80.5 | 40.5 | Pass |
| 13.410–13.553 | <77.08 | Pk | <21.18 | 90.5 | 50.5 | Pass |
| 13.560 | 77.08 | Pk | 21.18 | 124.0 | 84.0 | Pass |
| 13.567–13.710 | <77.08 | Pk | <21.18 | 90.5 | 50.5 | Pass |
| 13.710–14.010 | <77.08 | Pk | <21.18 | 80.5 | 40.5 | Pass |

For details refer to Appendix D.

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5.1.3 Frequency Stability

RESULT:**Passed**

Test standard : LP0002(2011) 3.2.1(3)
FCC Part 15. 225(e)
RSS-210 B.6

Basic standard : ANSI C63.10:2013
Kind of test site : Shielded room

Test setup

Test Frequency : 13.56 MHz
Operation Mode : A

Relative humidity : 50-65 %
Atmospheric pressure : 100-103 kPa

Table 7: Test result of Frequency Stability

| Fundamental frequency (MHz) | Temperature (°C) | Voltage | Measurement frequency (MHz) | Frequency Error (ppm) | Limit ±0.01% |
|-----------------------------|------------------|--------------|-----------------------------|-----------------------|--------------|
| 13.56 | -20 | 12V | 13.560620 | 45.72 | ±100ppm |
| | -10 | 12V | 13.560620 | 45.72 | |
| | 0 | 12V | 13.560610 | 44.99 | |
| | 10 | 12V | 13.560610 | 44.99 | |
| | 20 | 10.2V (85%) | 13.560610 | 44.99 | |
| | 20 | 12V | 13.560600 | 44.25 | |
| | 20 | 27.6V (115%) | 13.560600 | 44.25 | |
| | 30 | 12V | 13.560610 | 44.99 | |
| | 40 | 12V | 13.560600 | 44.25 | |
| | 50 | 12V | 13.560600 | 44.25 | |

The Temperature Stability Test was done with changed temperature at the normal voltage of 12V.

Voltage stability test was done at normal voltage of 12V, normal voltage -15% and maximum rated voltage +15%.

The Fundamental Frequency of the device is crystal stabilized, therefore no substantial Frequency Deviation was found.

5.1.4 99% Bandwidth

RESULT:**Passed**

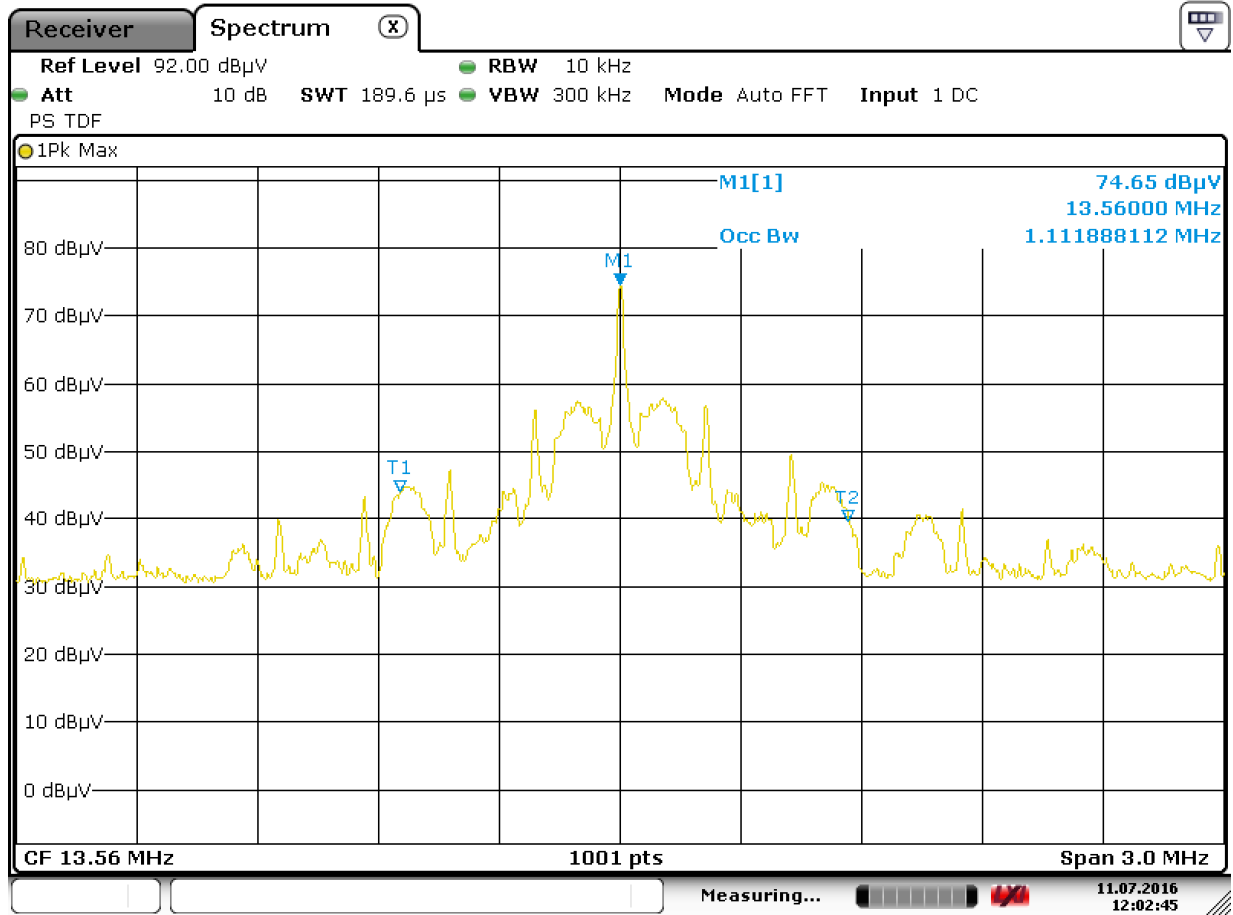
Test standard : LP0002(2011) 3.1
RSS-Gen
Basic standard : ANSI C63.10:2013, KDB558074
Kind of test site : Shielded room

Test setup

Operation Mode : A
Ambient temperature : 22-26 °C
Relative humidity : 50-65 %
Atmospheric pressure : 100-103 kPa
Supply Voltage: 24Vdc
Setup: RFID Tag in Front of Reader (worst case)

Table 8: Test result of 99% Bandwidth

| Channel | Frequency (MHz) | 99% Bandwidth (kHz) | |
|---------|-----------------|---------------------|--|
| 1 | 13.56 | 1112 | |

Test Plot of 99% Bandwidth


Date: 11.JUL.2016 12:02:44

5.1.5 Spurious Emission

RESULT:**Passed**

| | | |
|-------------------|---|---|
| Test standard | : | LP0002(2011) 3.2.1(2) FCC part 15.207 FCC part 15.209 FCC part 15.225 RSS-210 B.6 |
| Basic standard | : | ANSI C63.10:2013 |
| Limits | : | The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209. RSS-210: RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz. |
| Kind of test site | : | 3m Semi-Anechoic Chamber |

Test setup

Operation mode : A

Remark: Testing was carried out within frequency range 9kHz 30MHz to the tenth harmonic.

For details refer to Appendix D.

5.2 Mains Conducted Emissions

5.2.1 Conducted Emissions Line and Neutral

RESULT:**Passed**

Test standard : LP0002: 2.3
FCC Part 15.207
FCC Part 15.107
RSS-Gen

Limits : Mains Conducted emissions as defined in
LP0002: 2.3 , must comply with the mains
conducted emission limits specified in LP0002:
2.3

Kind of test site : Shielded Room

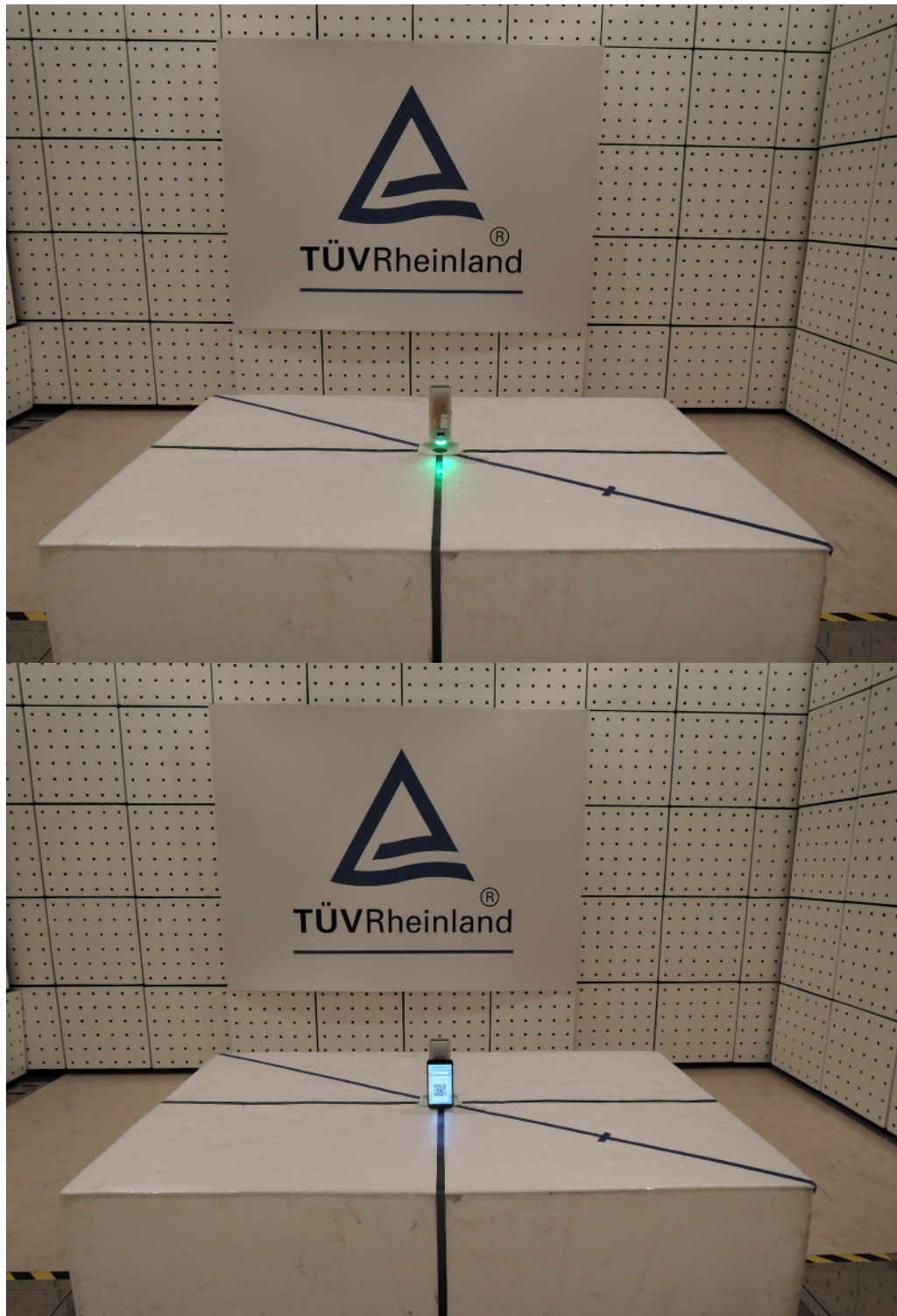
Test setup

Operation mode : A

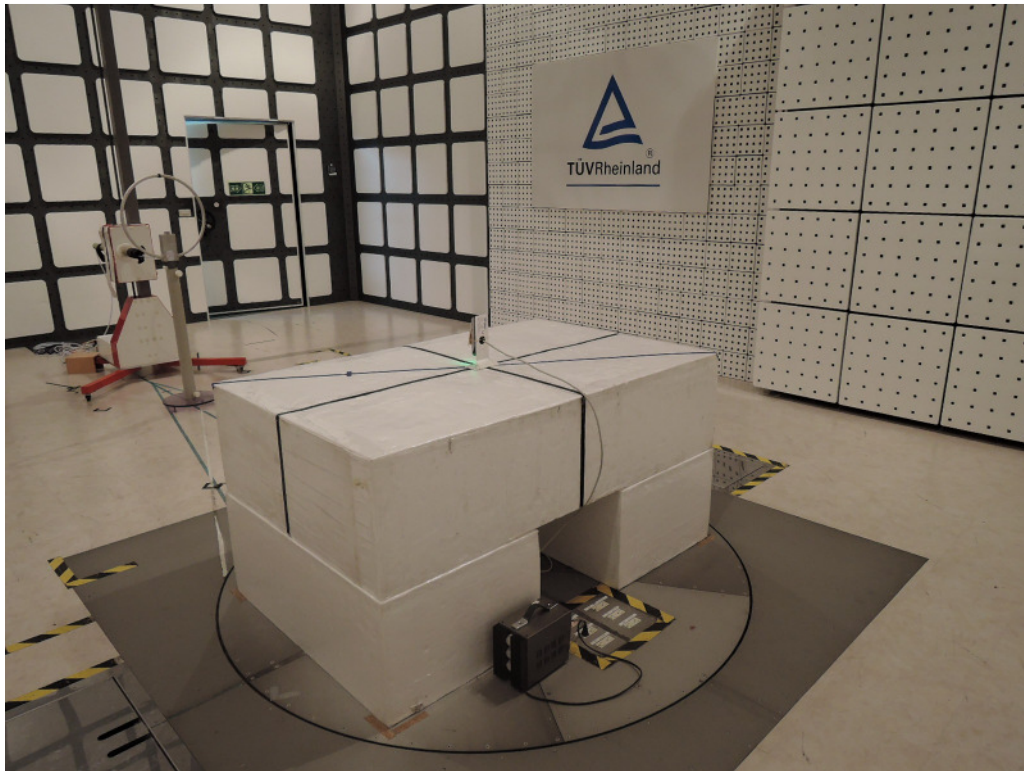
Remark: For details refer to Appendix D.

6. Photographs of the Test Set-Up

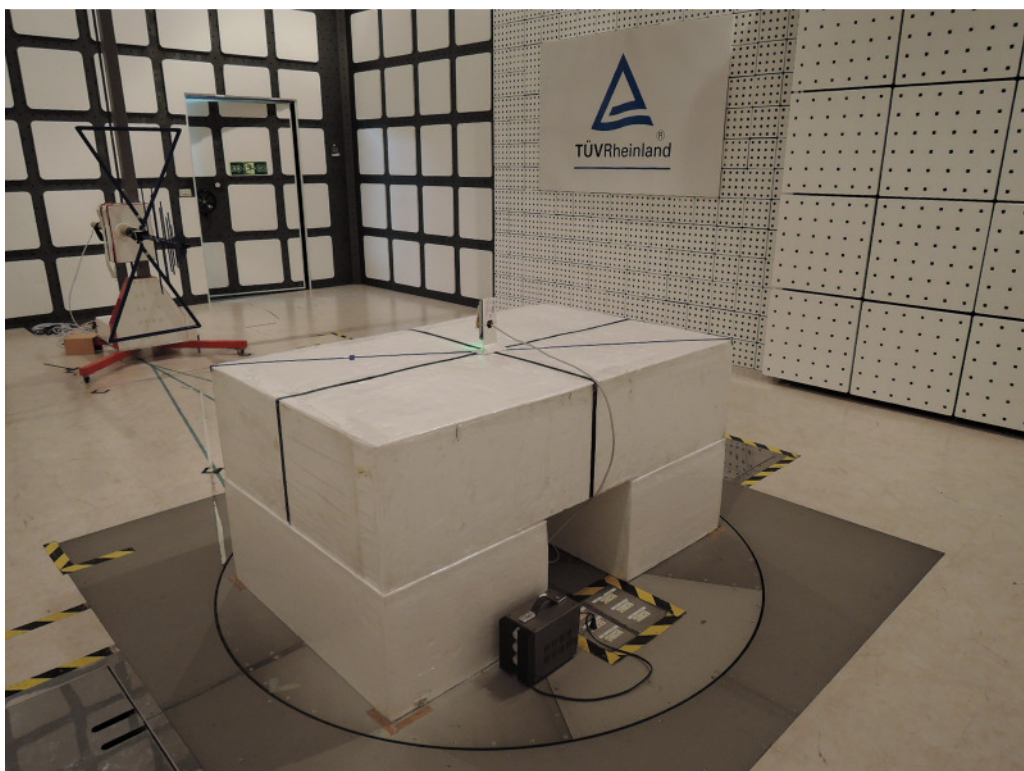
Photograph 1: Set-up for Spurious Emissions TX (Front View)



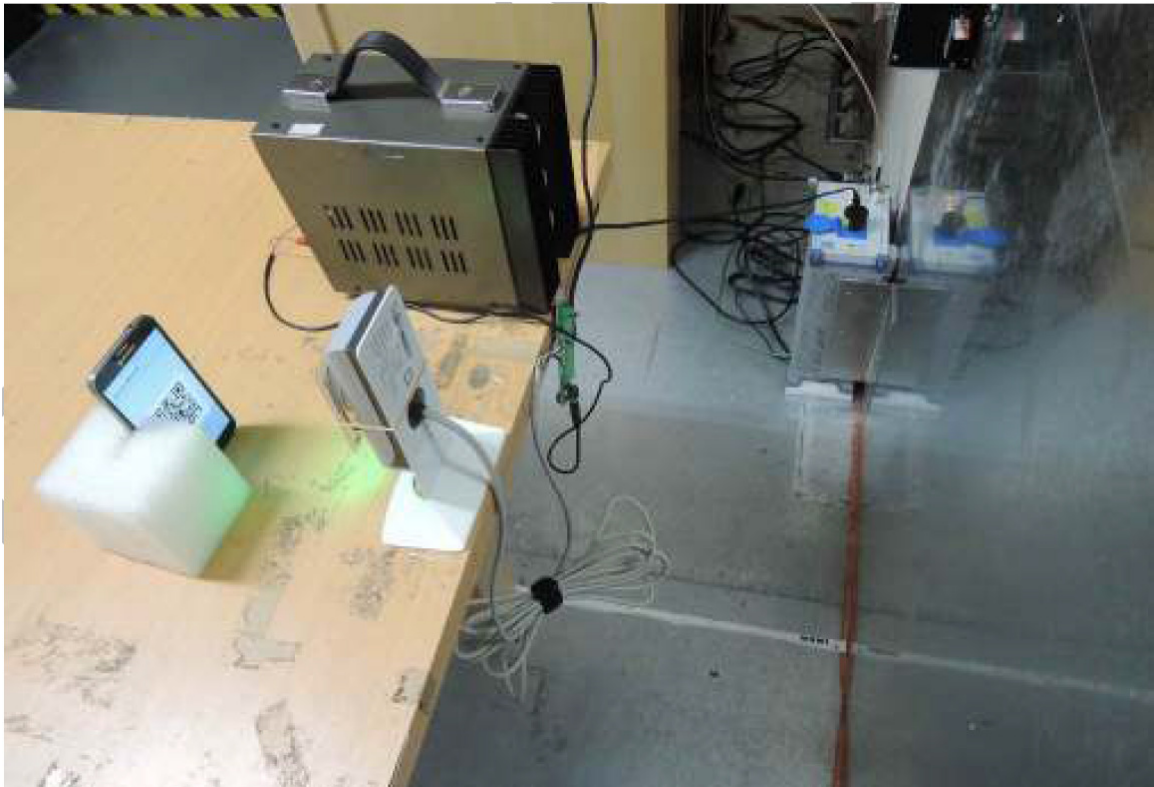
Photograph 2: Set-up for Spurious Emissions (Back View 1)



Photograph 3: Set-up for Spurious Emissions (Back View 2)



Photograph 4: Set-up for for Mains Conducted testing Back



Photograph 5: Set-up for for Mains Conducted testing Front



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