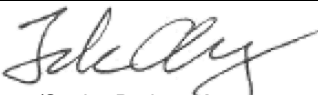



Prüfbericht-Nr.: <i>Test Report No.:</i>	50135963 001	Auftrags-Nr.: <i>Order No.:</i>	114074050	Seite 1 von 24 <i>Page 1 of 24</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	1-Feb-2018	
Auftraggeber: <i>Client:</i>	N.V. Nederlandsche Apparatenfabriek "Nedap" , Parallelweg 2, 7141 DC Groenlo, The Netherlands			
Prüfgegenstand: <i>Test item:</i>	Reader for 13.56 MHz NFC cards and also BT			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	MACE READER SMART			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C / ISED RSS-210 Test report (NFC)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.225 RSS-210 (08-2016) B.6			
Wareneingangsdatum: <i>Date of receipt:</i>	19-Mar-2018			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000701256-002			
Prüfzeitraum: <i>Testing period:</i>	23-Mar-2018 - 29-Mar-2018			
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:		
				
2018-04-18	Jack H. C. Chang/Senior Project Manager	2018-04-18	Arvin Ho/Vice General 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:				
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		
<p>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.</p> <p><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></p>				

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 MAINS CONDUCTED EMISSIONS

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: 50135963APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50135963APPENDIX 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

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.: 340738
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	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2017/05/02	2018/05/01
Spectrum Analyzer	Agilent	N9010A	MY53470241	2017/05/23	2018/05/22
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2017/08/14	2018/08/14
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2018/01/18	2019/01/18
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60558	2017/11/21	2018/11/21
Bilog Antenna	TESEQ	CBL6111D	29804	2017/08/18	2018/08/18
Horn Antenna	ETS-Lindgren	3117	201918	2017/08/18	2018/08/18
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2017/11/28	2018/11/28
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2017/06/14	2018/06/14
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSL3	101943	2015/09/07	2018/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
LISN (1 phase)	R&S	ENV216	101243	2017/06/18	2018/06/18
LISN	R&S	ENV216	101262	2017/06/22	2018/06/21
Test Software	Audix	e3	Ver. 9	N/A	N/A

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	$\pm 1.5 \text{ dB}$
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, operating on 13.56 MHz. The scope of this test report is the 13.56 MHz inductive reader interfaces.

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 13.56 MHz NFC cards and also BT
Type Identification	MACE READER SMART
FCC ID	CGDMACESMART
Canada ID	1444A-MACESMART
Canda HVIN	MACE READER SMART

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	13.56 MHz and Bluetooth
Operation Voltage	12 - 24 Vdc
Extreme Voltage Range	10.8~26.4 V
Modulation	ASK and GFSK
Antenna Type	RFID: Printed PCB Coil ,BLE:-0.23 dBi

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 reader is permanently on

4.3 Special Accessories and Auxiliary Equipment

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

Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

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

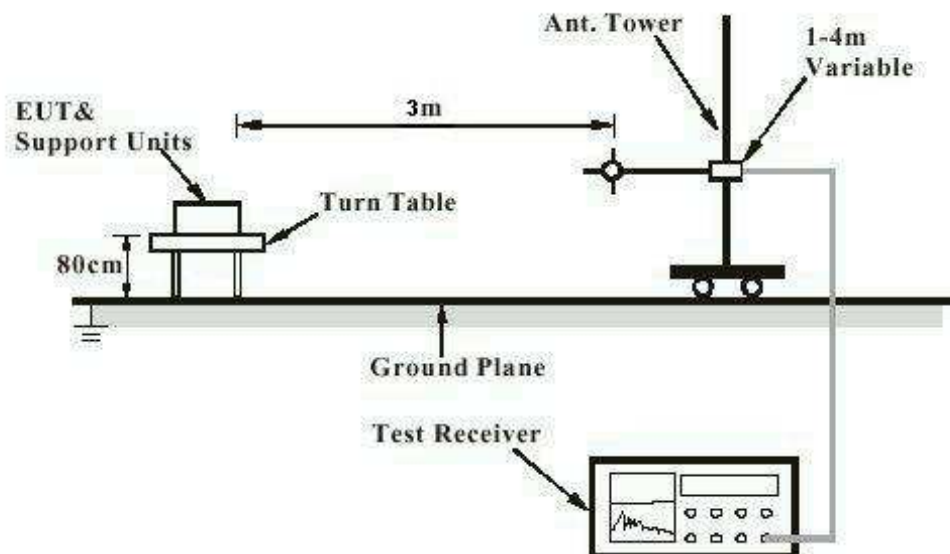
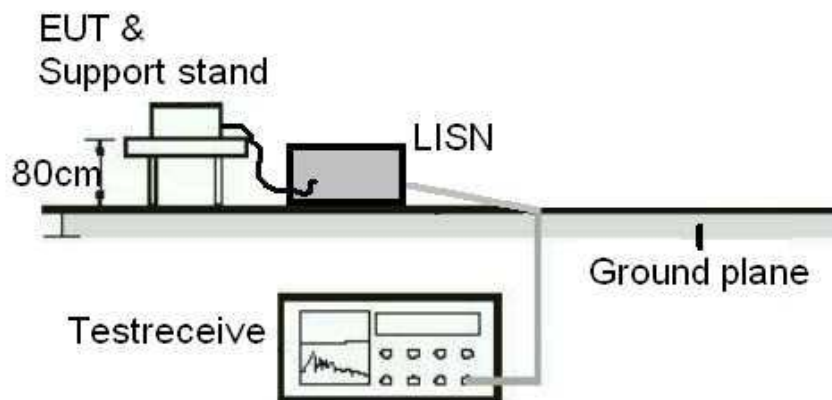


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Standard : LP0002(2018): 2.2
Part 15.203 and RSS-Gen 7.1.4
Requirement : use of approved antennas only

The antenna is a printed PCB trace 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(2018) 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

Ambient temperature : see Appendix D
 Relative humidity : see Appendix D
 Atmospheric pressure : see Appendix D

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

Frequency (MHz)	Meas. Result	Detector	Test Result	Limits (QP)		Pass/Fail
	$\text{dB}\mu\text{V}/\text{m}$ @1.2m		$\text{dB}\mu\text{V}/\text{m}$ @30m	$\text{dB}\mu\text{V}/\text{m}$ @1.2m	$\text{dB}\mu\text{V}/\text{m}$ @30m	
13.110–13.410	<74.55	QP	<18.65	96.4	40.5	Pass
13.410–13.553	<74.55	QP	<18.65	106.4	50.5	Pass
13.560	74.55	QP	18.65	139.9	84.0	Pass
13.567–13.710	<74.55	QP	<18.65	106.4	50.5	Pass
13.710–14.010	<74.55	QP	<18.65	96.4	40.5	Pass

For details refer to Appendix D.

5.1.3 Frequency Stability

RESULT:**Passed**

Test standard : LP0002(2018) 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

Ambient temperature : N/A
Relative humidity : 50-65 %
Atmospheric pressure : 100-103 kPa

Table 7: Test result of Frequency Stability

Frequency Stability Measurement					
Fundamental frequency (MHz)	Temperature (°C)	Voltage	Measurement frequency (MHz)	Frequency Error (ppm)	Limit ±0.01%
13.56	-20	Normal	13.559480	-38.35	±100ppm
	-10	Normal	13.559450	-40.56	
	0	Normal	13.559420	-42.77	
	10	Normal	13.559416	-43.07	
	20	85%	13.559410	-43.51	
	20	Normal	13.559410	-43.51	
	20	115%	13.559103	-66.15	
	30	Normal	13.559400	-44.25	
	40	Normal	13.559380	-45.72	
	50	Normal	13.559360	-47.20	

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(2018) 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: 12Vdc

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	601.64

Test Plot of 99% Bandwidth



5.1.5 Spurious Emission

RESULT:**Passed**

Test standard	:	LP0002(2018) 3.2.1(2) 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
Ambient temperature	:	see Appendix D
Relative humidity	:	see Appendix D
Atmospheric pressure	:	see Appendix D

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

For details refer to Appendix D.

5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard : FCC Part 15.207
FCC Part 15.107
RSS-Gen 8.8
LP0002: 2.3

Limits : Mains Conducted emissions as defined in
above test standards must comply with the
mains conducted emission limits specified

Kind of test site : Shielded Room

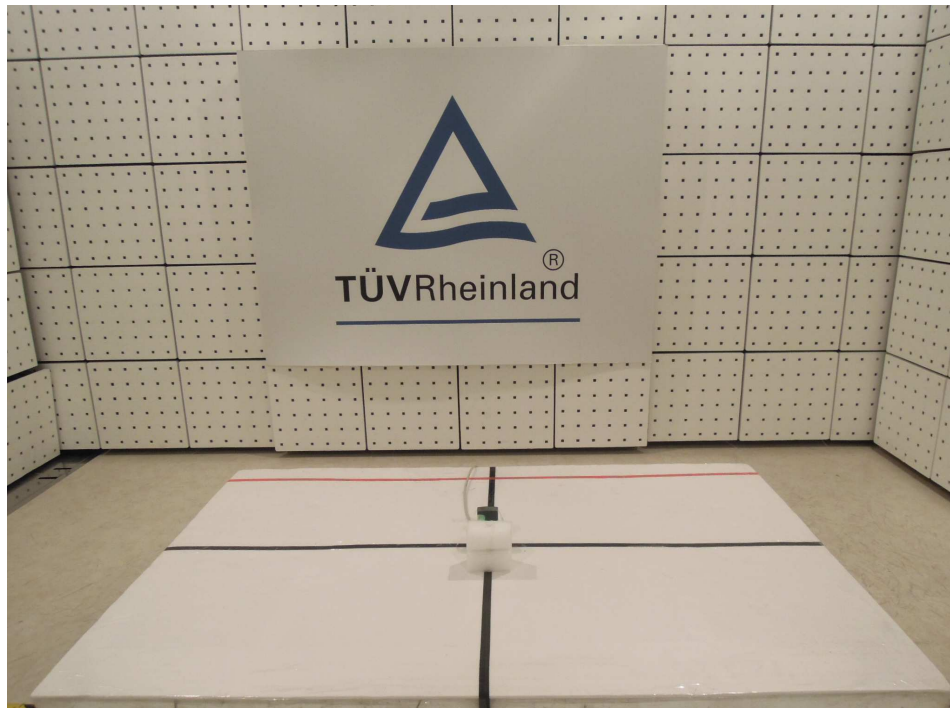
Test setup

Test Channel : 13.56MHz
Operation mode : A

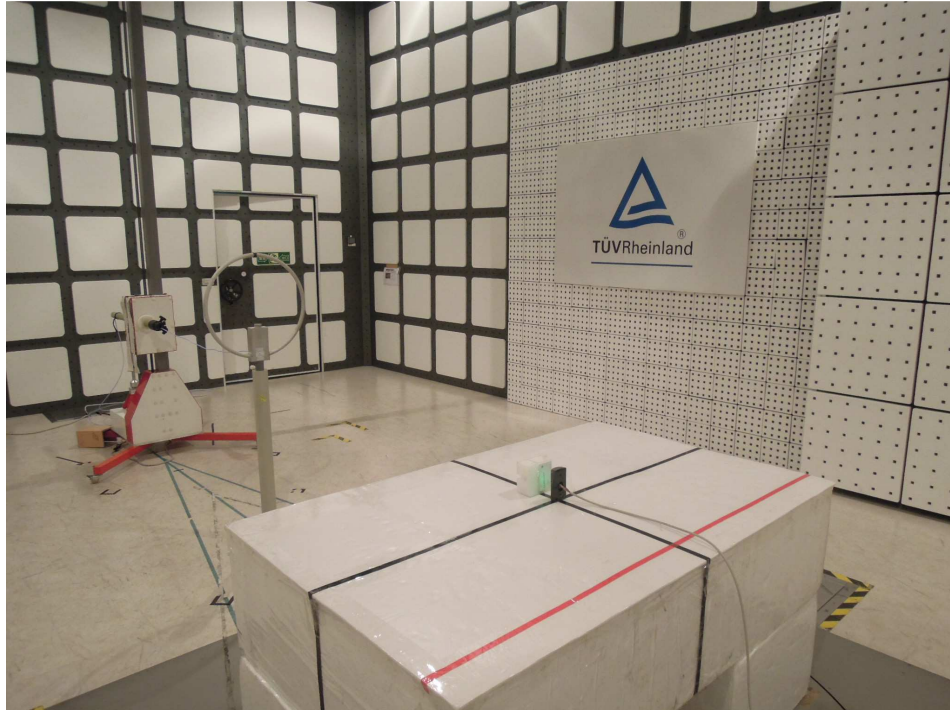
Remark: For details refer to Appendix D.

6. Photographs of the Test Set-Up

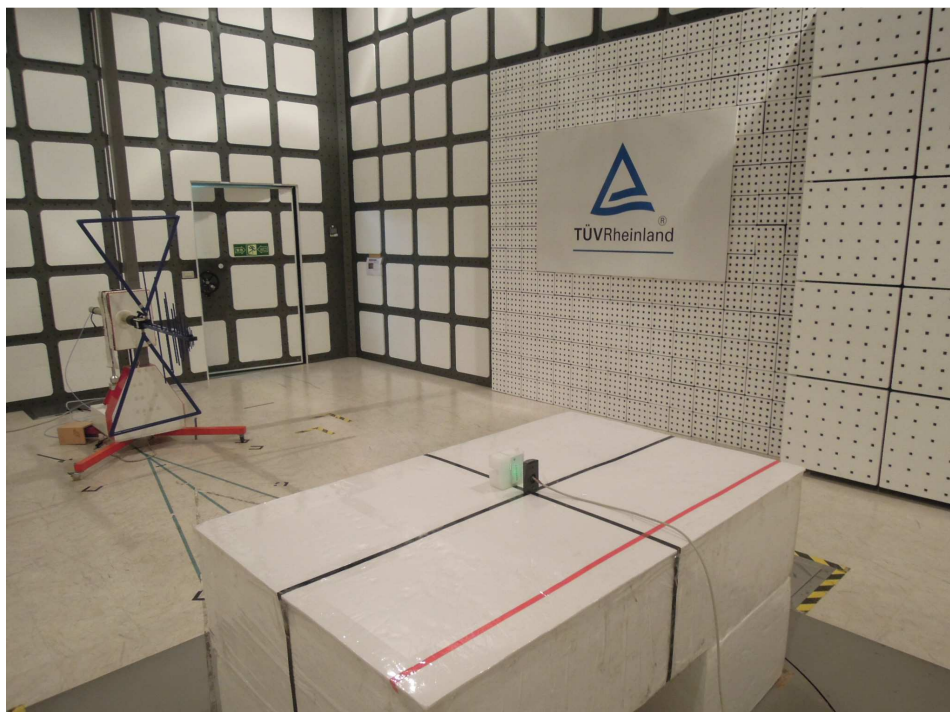
Photograph 1: Set-up for Radiated Emissions TX (Front View)



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



Photograph 3: Set-up for Radiated 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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