



<b>Prüfbericht-Nr.:</b> <i>Test report no.:</i>	60362825 002	<b>Auftrags-Nr.:</b> <i>Order no.:</i>	238042932	Seite 1 von 17 Page 1 of 17
<b>Kunden-Referenz-Nr.:</b> <i>Client reference no.:</i>	N/A	<b>Auftragsdatum:</b> <i>Order date:</i>	11-Feb-2020	
<b>Auftraggeber:</b> <i>Client:</i>	Nedap N.V. Parallelweg 2, 7141 DC Groenlo, The Netherlands			
<b>Prüfgegenstand:</b> <i>Test item:</i>	Long-range vehicle and driver identification tag			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	LEGIC BOOSTER ULTIMATE			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	FCC Part 15C/ISED RSS-210 Test report (13.56MHz portion)			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.203, 15.205, 15.209 and 15.225 ISED RSS-210 Issue 10, December 2019 ISED RSS-Gen Issue 5, March 2019			
<b>Wareneingangsdatum:</b> <i>Date of sample receipt:</i>	13-Feb-2020			
<b>Prüfmuster-Nr.:</b> <i>Test sample no.:</i>	A001076553-001			
<b>Prüfzeitraum:</b> <i>Testing period:</i>	27-Feb-2020- 28-Sep-2020			
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	EMC/RF Laboratory Taipei			
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	Taipei Testing laboratories			
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Pass			
<b>überprüft von:</b> <i>reviewed by:</i>	<b>genehmigt von:</b> <i>authorized by:</i>			
<b>Datum:</b> 05-Oct-2020 <i>Date:</i>	 R y a n W . T . C h e n		<b>Datum:</b> 05-Oct-2020 <i>Date:</i>	 B r e n d a S . H . C h e n
<b>Stellung / Position:</b>	Project Manager		<b>Stellung / Position:</b>	Project Manager
<b>Sonstiges / Other:</b>	This report is added RSE test for 1GHz to 6GHz. All other test items are referred to TUV test report no. 60362825 001.			
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
<p><b>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.</b> <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*

## Contents

<b>1.</b>	<b>GENERAL REMARKS .....</b>	<b>4</b>
<b>1.1</b>	<b>COMPLEMENTARY MATERIALS.....</b>	<b>4</b>
<b>1.2</b>	<b>COMPLEMENTARY MATERIALS.....</b>	<b>4</b>
<b>2.</b>	<b>TEST SITES .....</b>	<b>5</b>
<b>2.1</b>	<b>TEST LABORATORY .....</b>	<b>5</b>
<b>2.2</b>	<b>TEST FACILITY.....</b>	<b>5</b>
<b>2.3</b>	<b>LIST OF TEST AND MEASUREMENT INSTRUMENTS.....</b>	<b>6</b>
<b>2.4</b>	<b>TRACEABILITY .....</b>	<b>7</b>
<b>2.5</b>	<b>CALIBRATION .....</b>	<b>7</b>
<b>2.6</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>7</b>
<b>3.</b>	<b>GENERAL PRODUCT INFORMATION.....</b>	<b>8</b>
<b>3.1</b>	<b>PRODUCT FUNCTION AND INTENDED USE .....</b>	<b>8</b>
<b>3.2</b>	<b>RATINGS AND SYSTEM DETAILS.....</b>	<b>8</b>
<b>3.3</b>	<b>INDEPENDENT OPERATION MODES.....</b>	<b>9</b>
<b>3.4</b>	<b>NOISE GENERATING AND NOISE SUPPRESSING PARTS .....</b>	<b>9</b>
<b>3.5</b>	<b>SUBMITTED DOCUMENTS.....</b>	<b>9</b>
<b>4.</b>	<b>TEST SET-UP AND OPERATION MODES.....</b>	<b>10</b>
<b>4.1</b>	<b>PRINCIPLE OF CONFIGURATION SELECTION .....</b>	<b>10</b>
<b>4.2</b>	<b>TEST OPERATION AND TEST SOFTWARE.....</b>	<b>10</b>
<b>4.3</b>	<b>SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT .....</b>	<b>10</b>
<b>4.4</b>	<b>COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....</b>	<b>11</b>
<b>4.5</b>	<b>TEST SETUP DIAGRAM .....</b>	<b>11</b>
<b>5.</b>	<b>TEST RESULTS .....</b>	<b>12</b>
<b>5.1</b>	<b>TRANSMITTER REQUIREMENT &amp; TEST SUITES.....</b>	<b>12</b>
<b>5.1.1</b>	<i>Antenna Requirement .....</i>	<b>12</b>
<b>5.1.2</b>	<i>Field strength of fundamental.....</i>	<b>13</b>
<b>5.1.3</b>	<i>Frequency Stability.....</i>	<b>14</b>
<b>5.1.4</b>	<i>99% Bandwidth .....</i>	<b>15</b>
<b>5.1.5</b>	<i>Spurious Emission .....</i>	<b>16</b>
<b>6.</b>	<b>LIST OF TABLES .....</b>	<b>17</b>

## 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**  
**Appendix D: Test Result of Radiated Emissions**  
**Appendix X: Photographs of the Test Set-Up**

#### Test Specifications

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

**Table 1: Applied Standard and Test Levels**

<b>Radio</b>
FCC 47CFR Part 15: Subpart C Section 15.203, 15.205, 15.209 and 15.225
ISED RSS-210 Issue 10, December 2019
ISED RSS-Gen Issue 5, March 2019
ANSI C63.10:2013

### 1.2 Complementary Materials

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

## 2. Test Sites

### 2.1 Test Laboratory

Taipei Testing laboratories

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

### 2.2 Test Facility

Taipei Testing laboratories

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

FCC Registration No.: TW3567  
IC Canada Registration No.: 9465A  
CABID:TW3567  
TAF Accredited NCC Test Lab. No.:3567  
TAF ISO17025 Certification effective period: 6<sup>th</sup>-May-2019 to 05<sup>th</sup>-May-2022



## 2.3 List of Test and Measurement Instruments

**Table 2: List of Test and Measurement Equipment**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal. Date</b>	<b>Cal. Due Date</b>
EMI Test Receiver	Rohde & Schwarz	ESR 7	101062	2019/10/15	2020/10/15
Spectrum Analyzer	Rohde & Schwarz	FSV-40	100921	2020/04/27	2021/04/27
Pre-Amplifier	Hewlett Packard	8447D	2944A06641	2020/01/15	2021/01/15
Pre-Amplifier	EM Electronics	EM01G18G	060558	2019/12/24	2020/12/24
Pre-Amplifier	EMC Instruments	EMC184045SE	980609(980408)	2020/06/30	2021/06/30
Bilog Antenna	TESEQ	CBL 6111D	29804	2020/08/06	2021/08/06
Horn Antenna	ETS-Lindgren	3117	00138160	2020/07/08	2021/07/08
Horn Antenna	Com-Power	AH-840	101029	2020/01/06	2021/01/16
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2020/09/17	2021/09/17
Test Software	Audix	e3	Ver. 9	N/A	N/A

## 2.4 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.

## 2.5 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.

## 2.6 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 Long-range vehicle and driver identification tag ,operating on 13.56 MHz and 433MHz. 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	Long-range vehicle and driver identification tag
Type Identification	LEGIC BOOSTER ULTIMATE
FCC ID	CGDBOOSTER11
IC ID	1444A-BOOSTER11
HVIN	LEGIC BOOSTER ULTIMATE

**Table 5: Technical Specification of EUT**

Technical Specification	Value
Operating Frequency	13.56 MHz
Operation Voltage	3Vdc
Modulation	ASK
Antenna Type	Built-in Loop antenna



### **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: Test samples are provided with a test mode firmware which makes it possible to transmit signal when switched on the power.

The samples were used as follows:

A001076553-001

Full test was applied on all test modes, and three antenna orientations (parallel, perpendicular, and ground-parallel) have been evaluated, but only worst case was shown. Regarding magnetic loop antenna testing, the antenna was orientated as required by ANSI C63.10 clause 6.5.7 (6.4.6).

Since this is battery operated equipment the equipment tests are performed using a new battery.

### 4.3 Special Accessories and Auxiliary Equipment

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

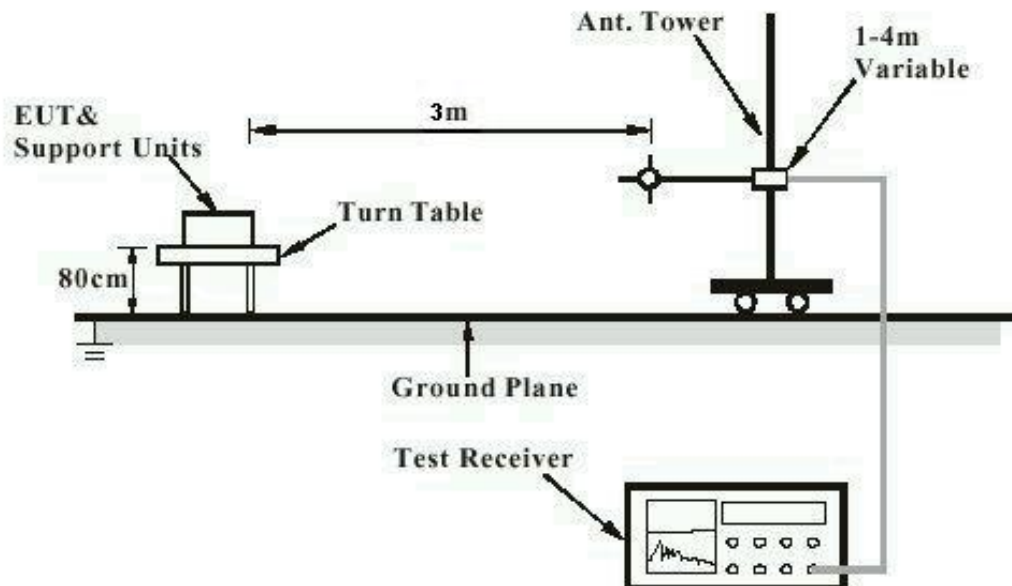
N/A

## 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



## 5. Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:****Passed**

Standard : Part 15.203 and ISED RSS-Gen 6.8  
Requirement : use of approved antennas only

The antenna is Built-in Loop Antenna 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.

**Prüfbericht - Nr.: 60362825 002***Test Report No.***Seite 13 von 17***Page 13 of 17*

## 5.1.2 Field strength of fundamental

**RESULT:****Passed**

Test standard : FCC Part 15.225, ISED RSS-210 B.6  
Basic standard : ANSI C63.10:2013

**Test setup**

Test Frequency : 13.56 MHz  
Operation Mode : A  
Ambient temperature : 22-26 °C  
Relative humidity : 50-65 %  
Atmospheric pressure : 100-103 kPa

For details refer to Appendix D.

### 5.1.3 Frequency Stability

**RESULT:**
**Passed**

Test standard : FCC Part 15. 225(e), ISED 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 6: Test result of Frequency Stability**

Fundamental frequency (MHz)	Temperature (°C)	Voltage	Measurement frequency (MHz)	Frequency Error (ppm)	Limit ±0.01%
13.5630	-20	Normal	13.5620	-73.73	±100ppm
	-10	Normal	13.5640	73.73	
	0	Normal	13.5640	73.73	
	10	Normal	13.5620	-73.73	
	20	85%	13.5630	0.00	
	20	Normal	13.5630	0.00	
	20	115%	13.5630	0.00	
	30	Normal	13.5640	73.73	
	40	Normal	13.5620	-73.73	
	50	Normal	13.5620	-73.73	

### 5.1.4 99% Bandwidth

**RESULT:**
**Passed**

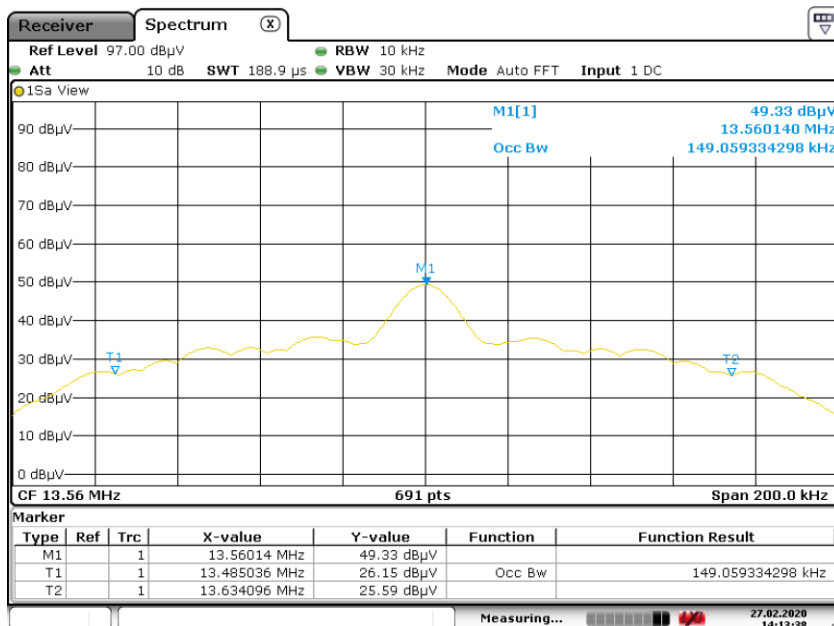
Test standard : ISED RSS-Gen  
 Basic standard : ANSI C63.10:2013  
 Kind of test site : Shielded room

**Test setup**

Operation Mode : A  
  
 Ambient temperature : 22-26 °C  
 Relative humidity : 50-65 %  
 Atmospheric pressure : 100-103 kPa

**Table 7: Test result of 99% Bandwidth**

Frequency (MHz)	99% Bandwidth (kHz)
13.56	149.059

**Test Plot of 99% Bandwidth**


### 5.1.5 Spurious Emission

**RESULT:****Passed**

Test standard : FCC part 15.209, FCC part 15.225,  
ISED RSS-210 B.6

Basic standard : ANSI C63.10:2013

Kind of test site : 3m Semi-Anechoic Chamber

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.  
ISED RSS-210:  
ISED RSS-Gen general field strength limits for  
frequencies outside the band 13.110-14.010 MHz.

**Test setup**

Operation mode : A

Ambient temperature : 22-26 °C

Relative humidity : 50-65 %

Atmospheric pressure : 100-103 kPa

Factor (dB/m)=Antenna Factor(dB/m)+Cable loss (dB)

Level(dBuV/m)=Reading(dBuV)+ Factor(dB/m)

Testing was carried out within frequency range 9kHz to the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.



## 6. List of Tables

Table 1: Applied Standard and Test Levels .....	4
Table 2: List of Test and Measurement Equipment .....	6
Table 3: Emission Measurement Uncertainty.....	7
Table 4: Basic Information of EUT .....	8
Table 5: Technical Specification of EUT .....	8
Table 6: Test result of Frequency Stability .....	14
Table 7: Test result of 99% Bandwidth.....	15