

Prüfbericht-Nr.: <i>Test Report No.:</i>	10048914 001	Auftrags-Nr.: <i>Order No.:</i>	114036404	Seite 1 von 20 <i>Page 1 of 20</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	22-May-2015	
Auftraggeber: <i>Client:</i>	N.V. Nederlandsche Apparatenfabriek "Nedap" , Parallelweg 2, NL-7141 DC, Groenlo, The Netherlands			
Prüfgegenstand: <i>Test item:</i>	Long-range vehicle and driver identification tag			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	SMARTCARD BOOSTER ULTIMATE			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report RSS-210 Test report			
Prüfgrundlage: <i>Test specification:</i>	FCC CFR47 Part 15: Subpart C Section 15. 231 RSS-210 Issue 8, December 2010			
Wareneingangsdatum: <i>Date of receipt:</i>	5-Jun-2015			
Prüfmuster-Nr.: <i>Test sample No.:</i>	Please refer to report item 4.2 Test Operation			
Prüfzeitraum: <i>Testing period:</i>	10-Jun-2015 - 10-Aug-2015			
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: 26-Aug-2015 Ryan W. T. Chen / Project Engineer <i>Datum Name / Stellung Unterschrift</i> <i>Date Name / Position Signature</i>		kontrolliert von / reviewed by: 26-Aug-2015 Rene Charton / Senior Project Manager <i>Datum Name / Stellung Unterschrift</i> <i>Date Name / Position 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>		
<p>* 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</p> <p>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>				
<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. <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 FIELD STRENGTH OF HARMONICS

RESULT: Passed

5.1.4 20dB BANDWIDTH AND 99% BANDWIDTH

RESULT: Passed

5.1.5 SPURIOUS EMISSION

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

Contents

1.	GENERAL REMARKS	4
1.1	COMPLEMENTARY MATERIALS.....	4
2.	TEST SITES	5
2.1	TEST FACILITIES	5
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	6
2.3	TRACEABILITY	7
2.4	CALIBRATION	7
2.5	MEASUREMENT UNCERTAINTY	7
3.	GENERAL PRODUCT INFORMATION.....	8
3.1	PRODUCT FUNCTION AND INTENDED USE	8
3.2	SYSTEM DETAILS AND RATINGS.....	8
3.3	INDEPENDENT OPERATION MODES.....	9
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	9
3.5	SUBMITTED DOCUMENTS.....	9
4.	TEST SET-UP AND OPERATION MODES.....	10
4.1	PRINCIPLE OF CONFIGURATION SELECTION	10
4.2	TEST OPERATION AND TEST SOFTWARE.....	10
4.3	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	10
5.	TEST RESULTS	11
5.1	TRANSMITTER REQUIREMENT & TEST SUITES.....	11
5.1.1	<i>Antenna Requirement</i>	<i>11</i>
5.1.2	<i>Field strength of fundamental.....</i>	<i>12</i>
5.1.3	<i>Field strength of harmonics.....</i>	<i>15</i>
5.1.4	<i>20dB Bandwidth and 99% Bandwidth.....</i>	<i>16</i>
5.1.5	<i>Spurious Emission</i>	<i>19</i>
6.	SAFETY HUMAN EXPOSURE	20
6.1	RADIO FREQUENCY EXPOSURE COMPLIANCE	20
6.1.1	<i>Electromagnetic Fields.....</i>	<i>20</i>

1. General Remarks

1.1 Complementary Materials

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

Appendix S: Test Setup Photo Documentation
(File Name: 10048914APPENDIX S)

Appendix D: Test Result of Radiated Emissions
(File Name: 10048914APPENDIX 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. 231(a) RSS-210 Issue 8, December 2010 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.: 365730
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2013-Jul-1st to 2016-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
EMI Test Receiver	R&S	ESR7	101062	31-Aug-14	30-Aug-15
Bilog Antenna	TESEQ	CBL6111D	29802	4-Jul-14	3-Jul-16
Spectrum Analyzer	R&S	FSV 40	100921	17-Dec-14	16-Dec-15
Spectrum Analyzer	Agilent	N9010A	MY53470241	1-Apr-15	30-Mar-16
Horn Antenna	ETS-Lindgren	3117	138160	12-Jan-15	11-Jan-17
Horn Antenna (18GHz~40GHz)	COM-POWER	AH840	101031	30-Oct-13	29-Oct-15
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	23-Aug-14	22-Aug-15
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	26-Aug-14	25-Aug-15
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM30180	60558	4-Nov-14	3-Nov-15
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	22-Oct-14	21-Oct-15
EMI Test Receiver	R&S	ESC17	100797	28-Dec-14	27-Dec-15
LISN (1 phase)	R&S	ENV216	101243	31-May-14	30-May-15
LISN	Rolf Heine	NNB-2/16Z	99080	26-Aug-14	25-Aug-15
Spectrum Analyzer	R&S	FSL3	101943	9/14/2014	14-Sep-15

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 ± 3 dB.

Table 3: Emission Measurement Uncertainty

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

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Device which can read Data from a 13.56 MHz Near Field RFID tag and transfer these Data it to a 2.4 GHz writable Tag inside the device. Additionally it contains a 433 MHz RF interface to exchange control signals with an external 2.4 GHz RFID reader. This report covers the 433 MHz portion of the device
 For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Long-range vehicle and driver identification tag
Type Designation	SMARTCARD BOOSTER ULTIMATE
FCC ID	CGDBOOSTER10
Canada ID	1444A-BOOSTER10
Canada HVIN	SMARTCARD BOOSTER ULTIMATE

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	433.62 MHz, 434.22 MHz
Channel Spacing	600 kHz, continuously switches between two channels
Channel number	2
Operation Voltage	3 Vdc
Modulation	GFSK, Pulse

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. High channel
- B. Receiving
- C. Standby
- D. Off

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 special firmware which provides the test modes for the radiated test modes

Full test was applied on all test modes, but only worst case was shown.

4.3 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.

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Standard : Part 15.203 and RSS-Gen 8.3
Requirement : Manufacturer must ensure approved antenna is used

The antenna is a Chip Antenna 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**

Date of Testing : 6/12/2015
Test standard : FCC Part 15. 231(e)
RSS-210 A1.1, Table B
Basic standard : ANSI C63.10:2013

Test setup

Test Channel : 433.62 MHz
Operation Mode : Pulse Transmission
Atmospheric pressure : 100-103 kPa

The EUT employs pulsed operation.
The pulse width is: 629 usec.

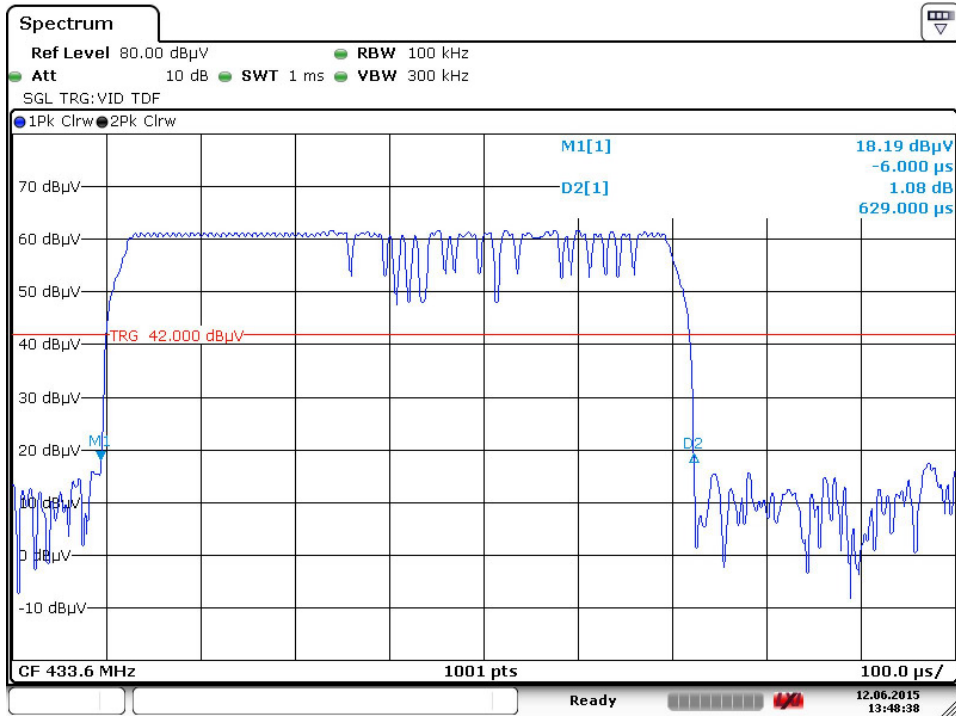
The Tables below show calculated average values from the pulsed emissions measurement data, corrected with the worst case duty cycle factor over 100 msec.

The average values noted are calculated through the application of a duty cycle correction, according to part 15.35c

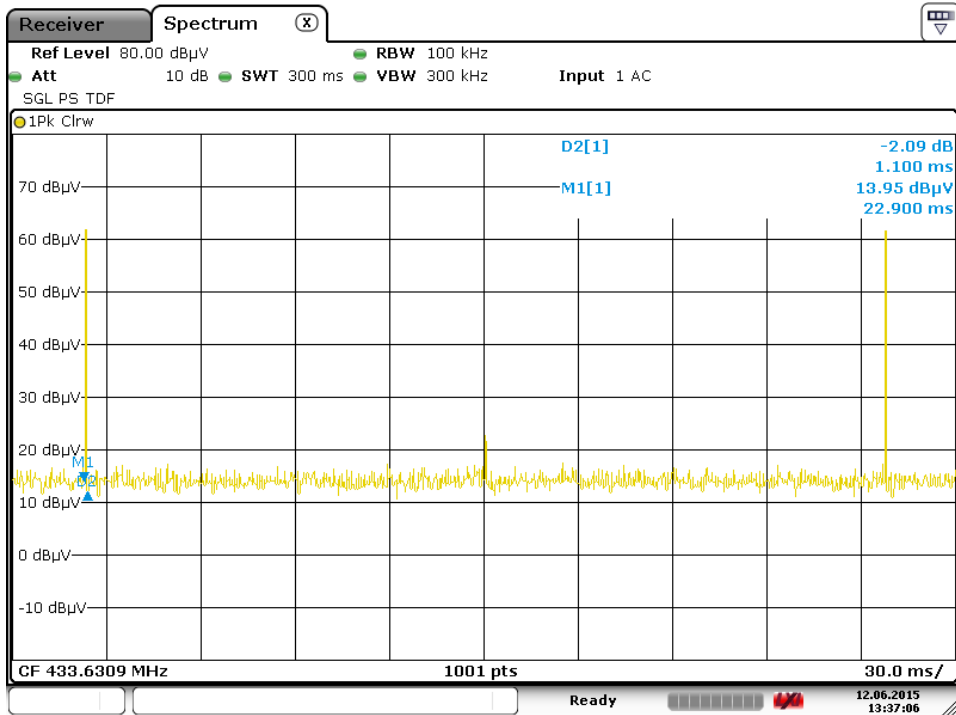
Duty cycle calculation:

Duty cycle correction (dB) = $20 \log (0.63 \text{ msec} / 100 \text{ msec}) = - 44 \text{ dB}$.

Test Plot pulse width



Date: 12.JUN.2015 13:48:38



Date: 12.JUN.2015 13:37:06

Table 6: Test result of Field strength of fundamental

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
433.62	72.59	92	Horizontal	Peak
433.62	28.59	72		Average
433.62	64.84	92	Vertical	Peak
433.62	20.84	72		Average

5.1.3 Field strength of harmonics

RESULT: **Passed**

Test standard : FCC Part 15. 231(e)
 RSS-210 A1.1, Table B

Basic standard : ANSI C63.10:2013

Test setup

Test Channel : 433.6 MHz, 433.8 MHz, 434.0 MHz, 434.2 MHz
 Operation Mode : Pulse Transmission

Atmospheric pressure : 100-103 kPa

Table 7: Test result of Field strength of harmonics, maximum

Fundamental: 433.62 MHz
 8th Harmonic: 3469 MHz

Frequency (MHz)	Test result			
	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector
<u>867.24</u>	<u>37.81</u>	72	<i>Horizontal</i>	<i>Peak</i>
<u>867.24</u>	<u><37.81</u>	52		<i>QP</i>
867.24	33.57	72	Vertical	Peak
867.24	<33.57	52		<i>QP</i>
<u>3469</u>	<u>53.08</u>	74	<i>Horizontal</i>	<i>Peak</i>
<u>3469</u>	<u>32.87</u>	54		<i>Average</i>
3469	48.17	74	Vertical	Peak
3469	<48.17	54		<i>Average</i>

Remark: The maximum results found are reported. For detailed results of all frequencies tested, please refer to Appendix D.

5.1.4 20dB Bandwidth and 99% Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.231(c), A1.1.3, RSS Gen
 Basic standard : ANSI C63.10:2013,
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ High (20dB BW)
 Low (99% OBW)
 Operation Mode : A

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier..

Atmospheric pressure : 100-103 kPa

Table 8: Test result of 20 dB Bandwidth,

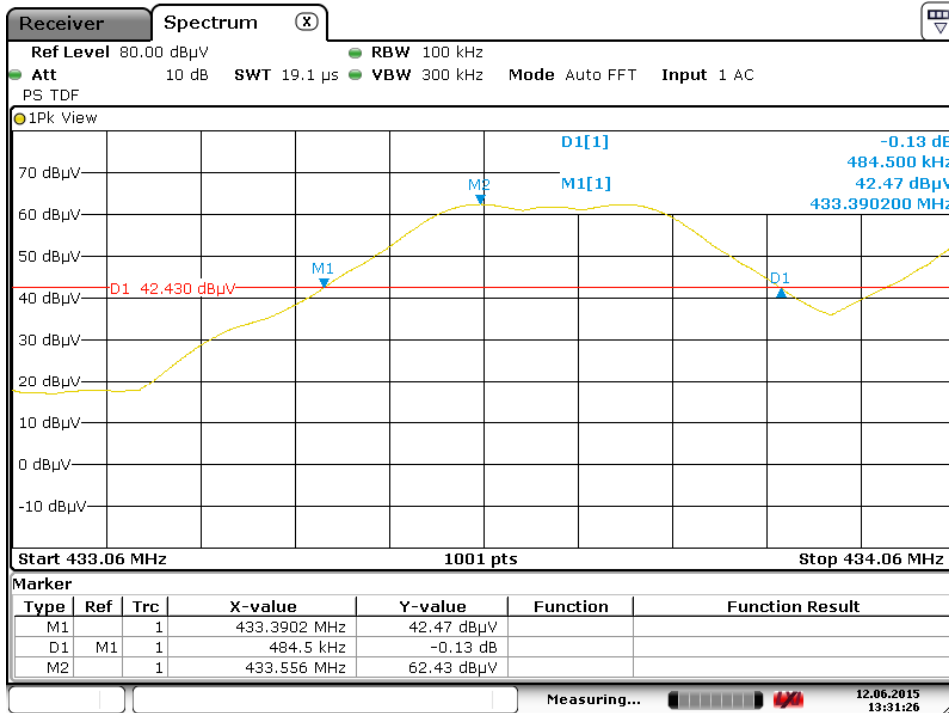
Channel	Channel Frequency (MHz)	-20 dB BW (kHz)	Limit (kHz)	Result
Low Channel	433.62	433	1082.5	Pass
High Channel	434.22	484	1082.5	Pass

Table 9: Test result of 99% Bandwidth

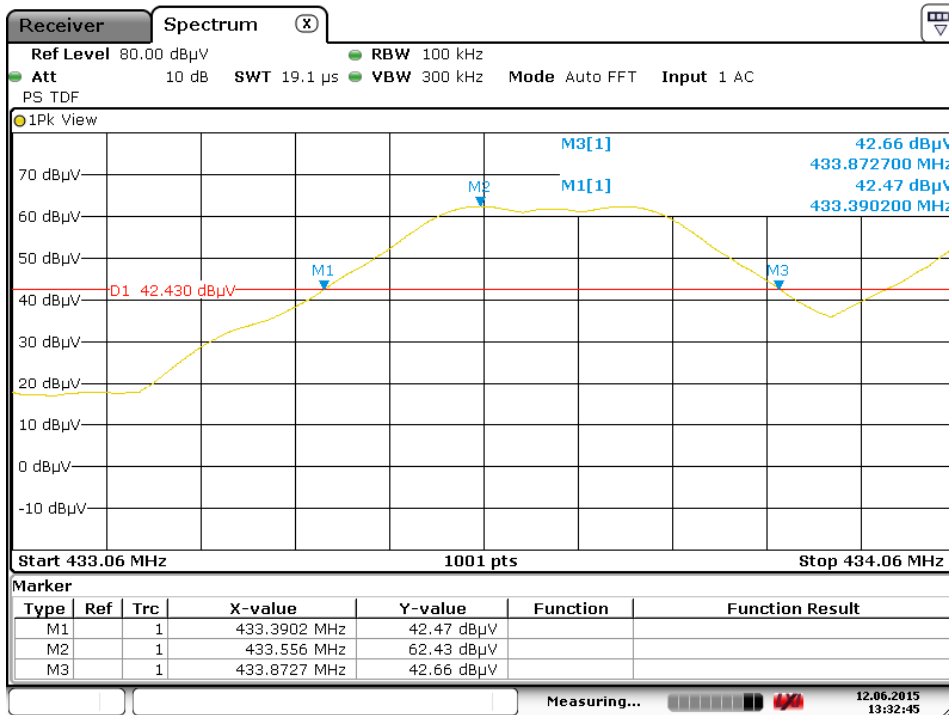
Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Low Channel	433.62	322

Test Plot of -20 dB Point

Channel 1



Date: 12.JUN.2015 13:31:26



Date: 12.JUN.2015 13:32:45

5.1.5 Spurious Emission

RESULT:**Passed**

Test standard : FCC part 15. 231(b) AND FCC 15.205, FCC 15.209, RSS-210 A1.1.5(3) AND RSS-Gen

Basic standard : ANSI C63.10: 2013

Limits : Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a). Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) or FCC 15. 231(b).

Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High

Operation mode : A, C

Remark: Testing was carried out within frequency range 30MHz 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 X Axis orientation is the worst-case and recorded in this test report.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC KDB Publication 447498 D01 v05

Since average peak output power of the transmitter is < 1mW, hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498 D01 v05: Mobile Portable RF Exposure.