Prüfbericht-Nr.: *Test report no.:*	60362823 002	**Auftrags-Nr.:** *Order no.:*	238493504	Seite 1 von 21 *Page 1 of 21*
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2020-11-03	
Auftraggeber: *Client:*	Nedap N.V. Parallelweg 2, 7141 DC Groenlo, The Netherlands			
Prüfgegenstand: *Test item:*	Long-range vehicle and driver identification tag			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	LEGIC BOOSTER ULTIMATE			
Auftrags-Inhalt: *Order content*:	FCC Part 15C/ ISED RSS-210 Test report (433MHz)			
Prüfgrundlage: *Test specification:*	FCC CFR47 Part 15: Subpart Section 15.203, 15.205, 15.209 and 15.231 ISED RSS-210 Issue 10, December 2019 ISED RSS-Gen, Issue 5, March 2019			
Wareneingangsdatum: *Date of sample receipt:*	2020-02-13			
Prüfmuster-Nr.: *Test sample no:*	A001063688-003			
Prüfzeitraum: *Testing period:*	2020-02-26 – 2020-06-10			
Ort der Prüfung: *Place of testing:*	EMC/RF Laboratory Taipei			
Prüflaboratorium: *Testing laboratory:*	Taipei Testing laboratories			
Prüfergebnis*: *Test result*:*	Pass			

überprüft von: reviewed by:		**genehmigt von:** authorized by:	
Datum: 2020-11-10 *Date:*	M a r s L i n	**Datum:** 2020-11-10 *Date:*	R y a n C h e n
Stellung / *Position:*	Senior Project Engineer	**Stellung** / *Position:*	Senior Project Manager

Sonstiges / *Other:*	This report has been modified the description for the certification purpose. The test report No. 60362823 001 is replaced by this new test report No. 60362823 002. Test report No. 60362823 001 becomes invalid since 2020-11-04.

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:*	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* 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*

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 PULSE WIDTH/TX GAP
RESULT: Passed

5.1.6 SPURIOUS EMISSION
RESULT: Passed

Contents

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
60362823 001	Original Release	2020-06-11
60362823 002	Modified the description in section 2.2 and 4.2	2020-11-10

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

Radio
FCC 47CFR Part 15: Subpart C Section 15.203, 15.205, 15.209 and 15.231
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: 6th-May-2019 to 05th-May-2022

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESR 7	101062	2019/10/15	2020/10/15
Spectrum Analyzer	Rohde & Schwarz	FSV-40	100921	2019/04/30	2020/04/30
Pre-Amplifier	Hewlett Packard	8447F	2805A03335	2019/09/11	2020/09/11
Pre-Amplifier	EM Electronics	EM01G18G	060558	2019/12/24	2020/12/24
Pre-Amplifier	EMC Instruments	EMC184045SE	980609(980408)	2019/06/14	2020/06/14
Bilog Antenna	TESEQ	CBL 6111D	29802	2019/09/10	2020/09/10
Horn Antenna	ETS-Lindgren	3117	00138160	2019/06/24	2020/06/24
Horn Antenna	Schwarzbeck	BBHA 9170	00907	2019/04/12	2020/04/12
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2019/07/11	2020/07/11
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 basics using in house standards or comparisons.

2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are ±3dB.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 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 ºC
Humidity	± 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 433 MHz inductive reader interfaces.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Technical Specification of EUT

Item	EUT information
Kind of Equipment	Long-range vehicle and driver identification tag
Type Designation	LEGIC BOOSTER ULTIMATE
FCC ID	CGDBOOSTER11
Canada ID	1444A-BOOSTER11
HVIN	LEGIC BOOSTER ULTIMATE

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	433.9MHz
Channel number	1
Operation Voltage	3Vdc
Modulation	FSK

3.3 Independent Operation Modes

Basic operation modes are:

A. Transmitting
B. Receiving
C. Standby
D. Off
E. Normal operation

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:

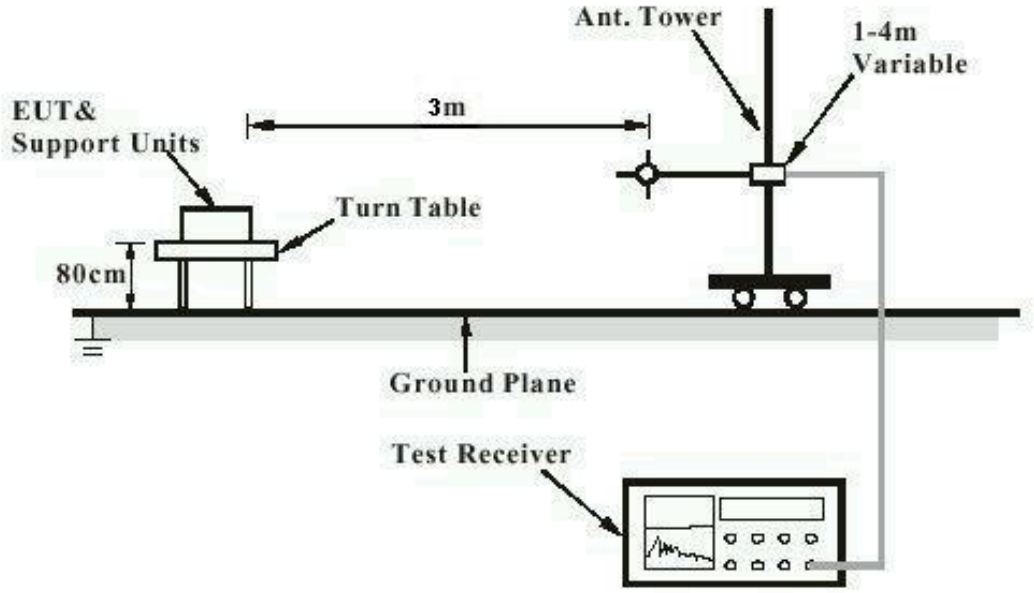
None.

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



Note: Measurements above 1 GHz are done with a table height of 1.5m

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Passed**

Standard	:	FCC Part 15.203 and ISED RSS-Gen 6.8
Requirement	:	Manufacturer must ensure approved antenna is used

The antenna is a chip 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.

5.1.2 Field strength of fundamental

RESULT: **Passed**

Test standard	:	FCC Part 15. 231(b), ISED RSS-210 A1.1 and A1.2 Table A1
Basic standard	:	ANSI C63.10:2013
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	433.9MHz
Operation Mode	:	Field strength : A ,Duty Cycle:E
Ambient temperature	:	22-26 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103 kPa

The EUT employs pulsed operation.
The pulse width is: 628 µsec.

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 msec / 100 msec) = - 44 dB.

Table 6: Test result of Field strength of fundamental

Frequency (MHz)	Level (dBuV/m	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
433.63	78.9	100.80	Horizontal	Peak
433.63	34.9	80.80		Average
433.63	87.2	100.80	Vertical	Peak
433.63	43.2	80.80		Average

5.1.3 Field strength of harmonics

RESULT: **Passed**

Test standard	:	FCC Part 15. 231(b), ISED RSS-210 A1.2, Table A1
Basic standard	:	ANSI C63.10:2013

Test setup

Test Channel	:	433.9 MHz
Operation Mode	:	A

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

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), A1.3, ISED RSS Gen A1.3
Basic standard	:	ANSI C63.10:2013
Kind of test site	:	Shielded room

Test setup

Test Channel	:	433 MHz (20dB BW) 433 MHz (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..

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

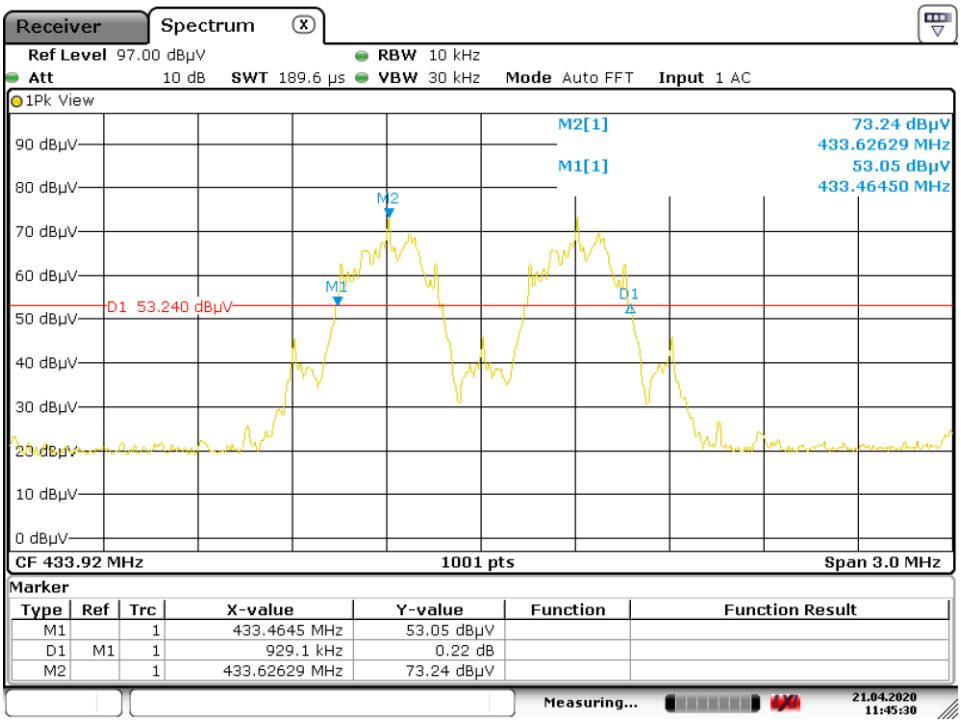
Table 7: Test result of 20 dB Bandwidth

Channel Frequency (MHz)	-20 dB BW (kHz)	Limit (kHz)	Result
433.9	929.1	1082	Pass

Table 8: Test result of 99% Bandwidth

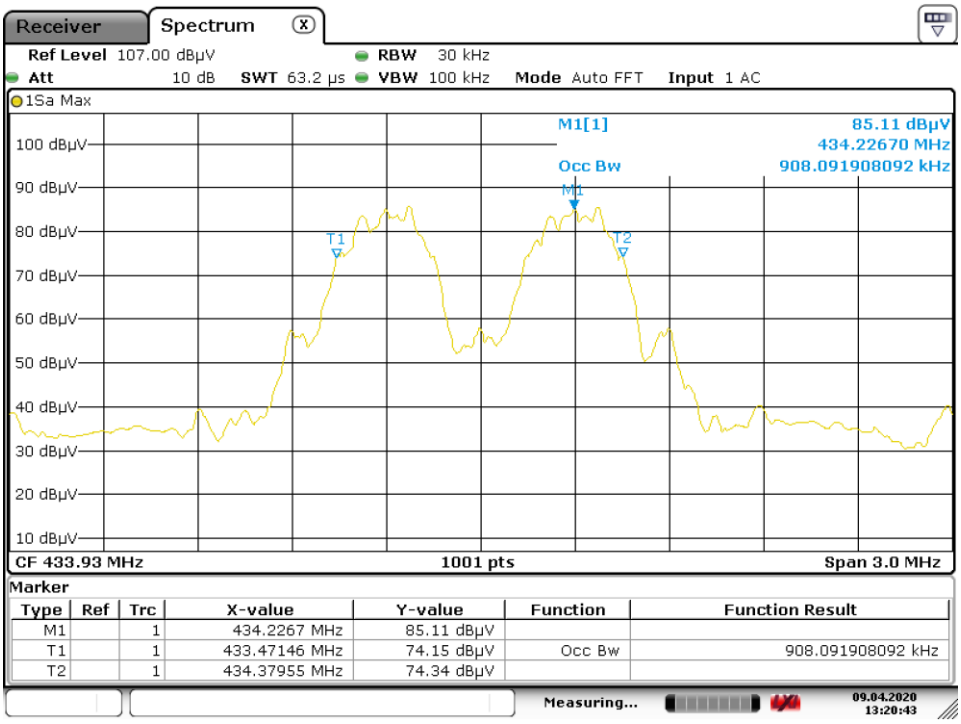
Channel Frequency (MHz)	99% Bandwidth (kHz)
433.9	908.091

Test Plot of 20 dB Point



Date: 21.APR.2020 11:45:30

Test Plot of 99% Bandwidth



Date: 9.APR.2020 13:20:43

5.1.5 Pulse Width/TX gap

RESULT: **Passed**

Test standard : FCC Part 15.231(a), ISED RSS-210 A1.1

Kind of test site : Anechoic Chamber

Test setup

Test Channel : 433.9 MHz
Operation Mode : E

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

For operation in 314-316MHz and 433-435MHz: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds being released. A transmitter activated automatically shall cease transmission within 5 seconds after activation.

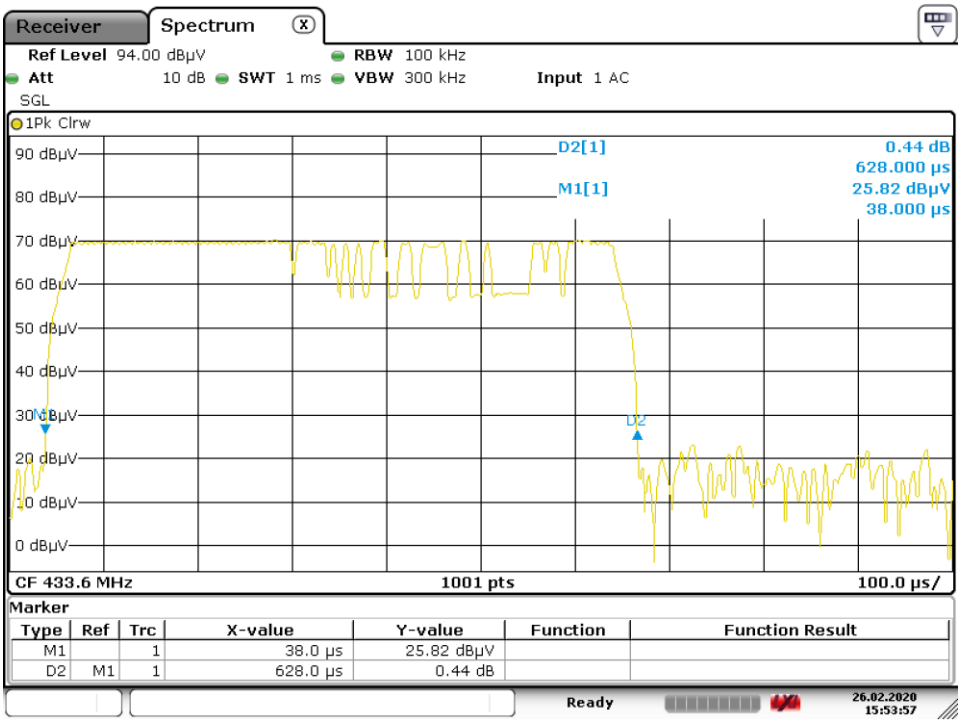
Table 9: Test result of Pulse Width

Channel Frequency (MHz)	Pulse Width (ms)	Limit (ms)	Result
433.9	0.628	<5000	Pass

Table 10: Test result of TX gap

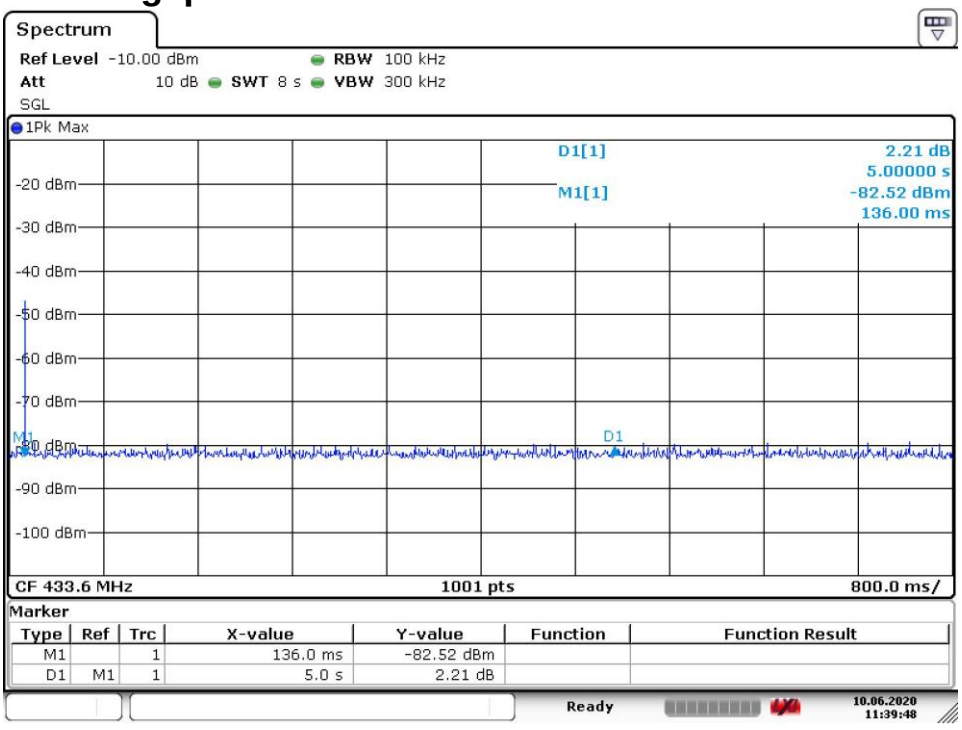
Channel Frequency (MHz)	TX gap (ms)	Limit (ms)	Result
433.9	>5000	>5000	Pass

Test Plot of Pulse Width



Date: 26.FEB.2020 15:53:57

Test Plot of TX gap



Date: 10.JUN.2020 11:39:48

5.1.6 Spurious Emission

RESULT: **Passed**

Test standard	:	FCC part 15. 231(b) AND FCC 15.205, FCC 15.209, ISED RSS-210 A1.2(b) and ISED 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	:	433.9 MHz
Operation mode	:	A

Remark:

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