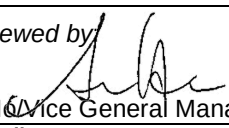


Prüfbericht-Nr.: <i>Test Report No.:</i>	50122699 001	Auftrags-Nr.: <i>Order No.:</i>	11472249	Seite 1 von 24 Page 1 of 24
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	December 8, 2017	
Auftraggeber: <i>Client:</i>	Vodafone Automotive S.p.A., Via Astico,41 21100 Varese(VA) ITALY			
Prüfgegenstand: <i>Test item:</i>	7777 (with 434MHz function)			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	7777			
Auftrags-Inhalt: <i>Order content:</i>	NCC LP0002 Test report			
Prüfgrundlage: <i>Test specification:</i>	NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2018)			
Wareneingangsdatum: <i>Date of receipt:</i>	11-Jan-2018			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000682684-002 A000682684-003			
Prüfzeitraum: <i>Testing period:</i>	11-Jan-2018 - 11-Jan-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			
Report date / tested by:		kontrolliert von / reviewed by:		
2018-02-02 Sam C.J. Kuo/Engineer		2018-02-02 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>
				
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				
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 FIELD STRENGTH OF HARMONICS

RESULT: *Passed*

5.1.4 PULSE WIDTH/TX GAP

RESULT: *Passed*

5.1.5 SPURIOUS EMISSION

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: 50122699APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50122699APPENDIX D)

Test Specifications

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

Table 1: Applied Standard and Test Levels

Radio
NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2018)

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

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 Remote control. It contains a 433.9MHz compatible module enabling the user to communicate data through a Wireless interface.
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	7777 (with 434MHz function)
Type Designation	7777
Brand Name	VOLVO

Table 5: Technical Specification of EUT

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

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. 433.9MHz
- 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 modified firmware which makes it possible to transmit continuously when the device is powered on.

It was used to enable the operation modes listed in section 3.3 as appropriate.

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

4.3 Special Accessories and Auxiliary Equipment

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

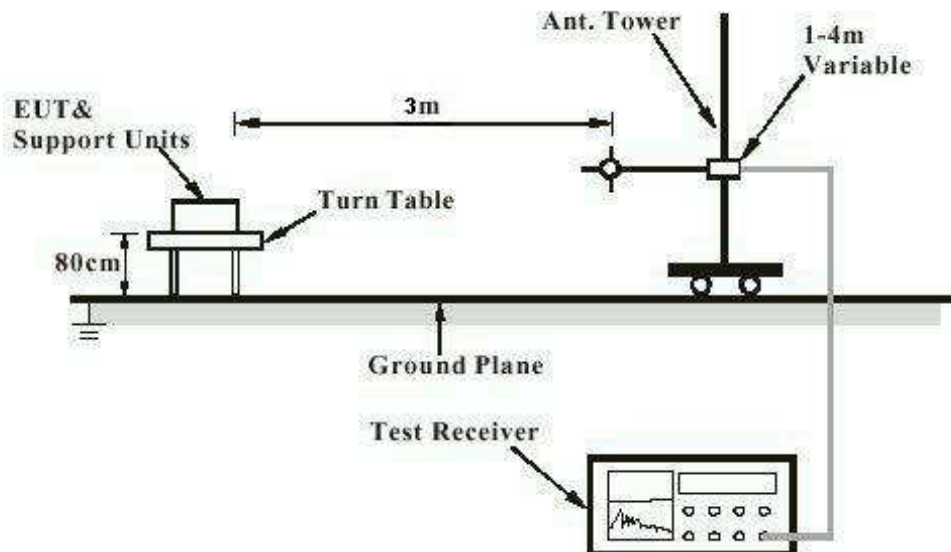
None.

4.4 Countermeasures to achieve EMC Compliance

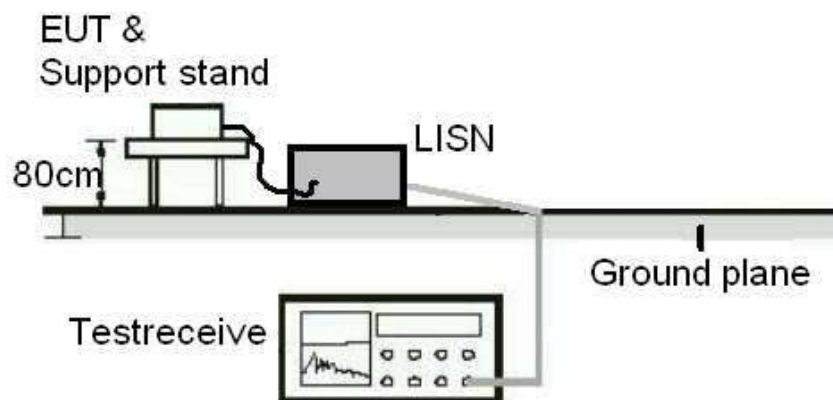
The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

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

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	:	Part 15.203,RSS-Gen 8.3 and LP0002 2.2
Requirement	:	Manufacturer must ensure approved antenna is used

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	:	FCC Part 15. 231(a) RSS-210 A1.1, Table A1 LP0002 3.4.2.5 (1)
Basic standard	:	ANSI C63.10:2013 LP0002
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

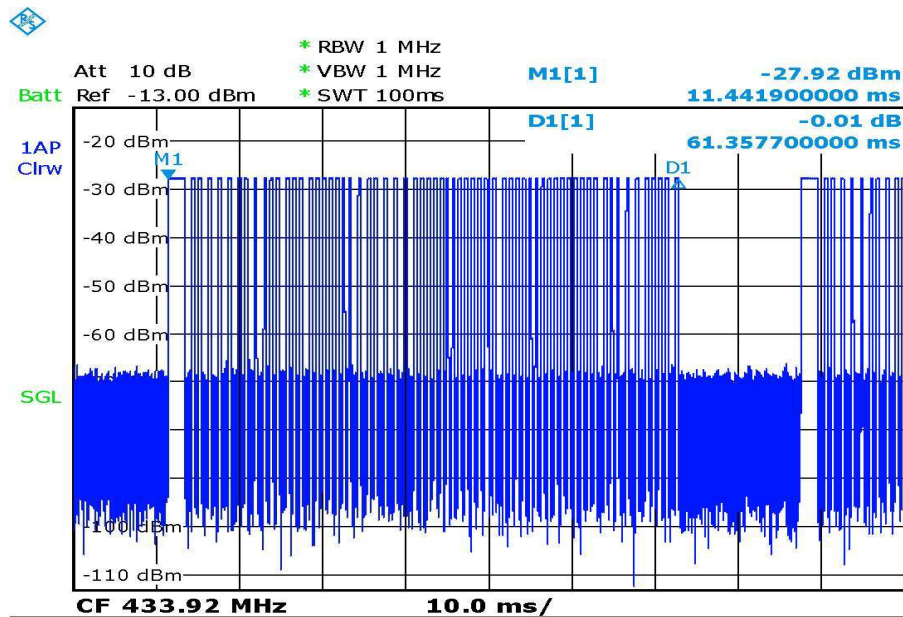
The EUT employs pulsed operation.
The pulse width is: 11.44 + 12.36 msec.

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

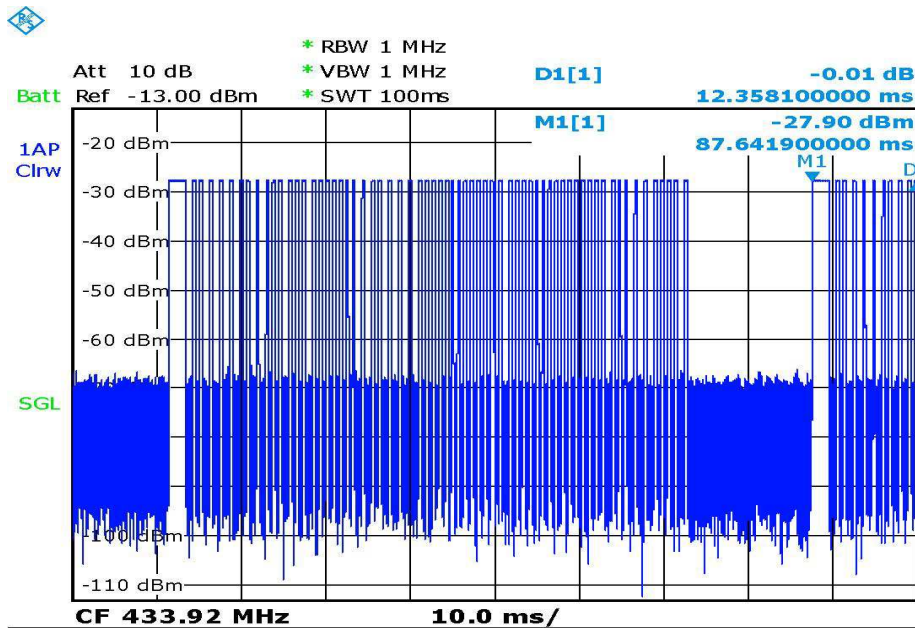
The average values noted are calculated through the application of a duty cycle correction, according to part 15.35c

Duty cycle calculation:
Duty cycle correction (dB) = $20 \log (23.8\text{msec} / 100 \text{ msec}) = - 12.47 \text{ dB}$.

Test Plot pulse width



Date: 23.JAN.2018 09:20:18



Date: 23.JAN.2018 09:21:30

Table 6: Test result of Field strength of fundamental

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
433.6	66.15	92	Horizontal	Peak
433.6	53.68	72		Average
433.6	74.73	92	Vertical	Peak
433.6	62.26	72		Average

5.1.3 Field strength of harmonics

RESULT:
Passed

Test standard : FCC Part 15. 231(a)
 RSS-210 A1.2, Table A
 LP0002 3.4.2.5 (1)

Basic standard : ANSI C63.10:2013
 LP0002

Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : 433.9MHz
 Operation Mode : A

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

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

Frequency (MHz)	Test result			
	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector
868.0800	40.8	69.01	Horizontal	Peak
868.0800	<40.8	49.01		Average
868.0800	39.8	58.90	Vertical	Peak
868.0800	<39.8	38.90		Average
1736	44.11	74	Horizontal	Peak
1736	<44.11	54		Average
1736	47.66	74	Vertical	Peak
1736	<47.66	54		Average

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

5.1.4 Pulse Width/TX gap

RESULT:**Passed**

Test standard : FCC Part 15.231(b), RSS-210 (Annex A1.4(b)),
LP0002(2018) 3.4.2.4 (1)(A)
Basic standard : ANSI C63.10:2013
LP0002
Kind of test site : Anechoic Chamber

Test setup

Test Channel : 433.9 MHz
Operation Mode : E

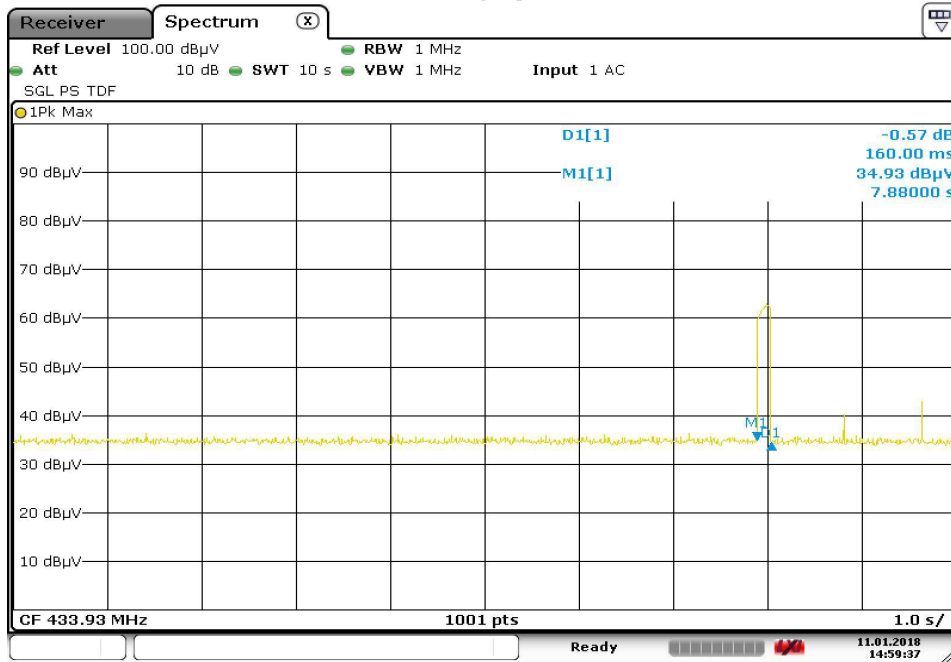
Ambient temperature : 22-26 °C
Relative humidity : 50-65 %
Atmospheric pressure : 100-103 kPa

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 8: Test result of Pulse Width

Channel	Channel Frequency (MHz)	Pulse Width (ms)	Limit (ms)	Result
Middle Channel	433.9	160	5000	Pass

Test Plot of Pulse Width/TX gap



Date: 11.JAN.2018 14:59:37

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,LP0002 3.4.2.5
Basic standard	:	ANSI C63.10: 2013;LP0002
Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a);LP0002 2.7, must comply with the radiated emission limits specified in FCC 15.209(a),LP0002 2.8. Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a),LP0002 2.8 or FCC 15.231(b),LP0002 3.4.2.5 (1).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	433.9MHz
Operation mode	:	A
Ambient temperature	:	22-26 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103 kPa

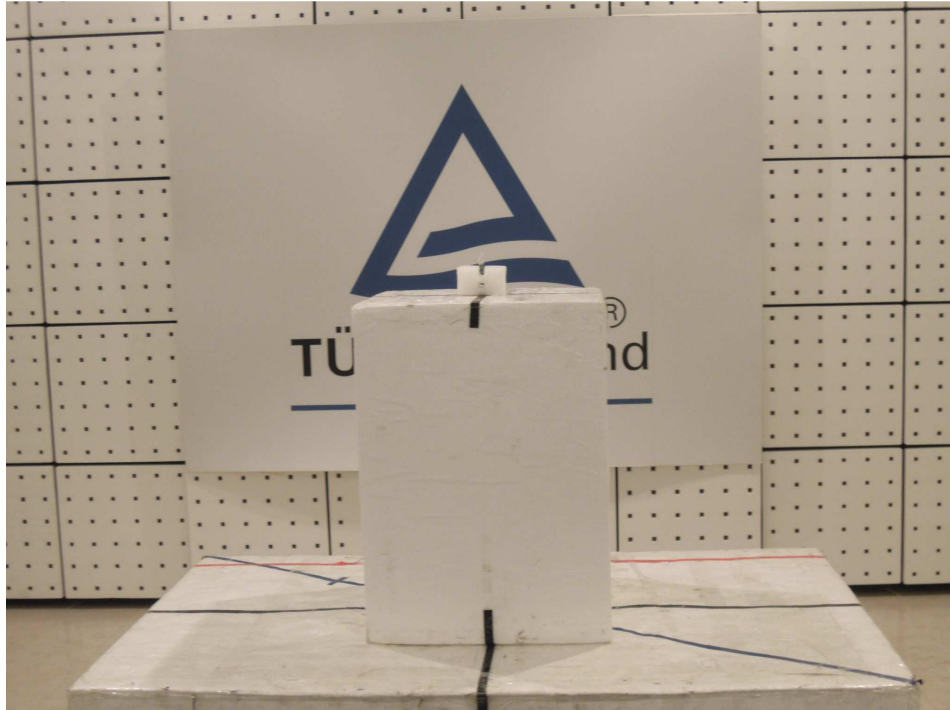
Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic.

For details refer to Appendix D.

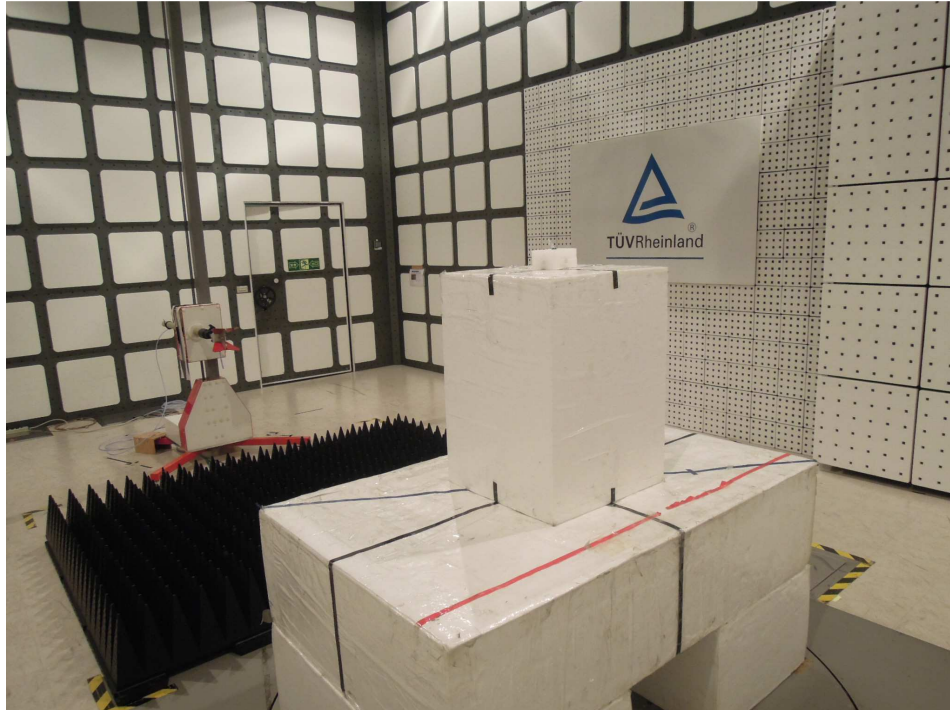
The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

6. Photographs of the Test Set-Up

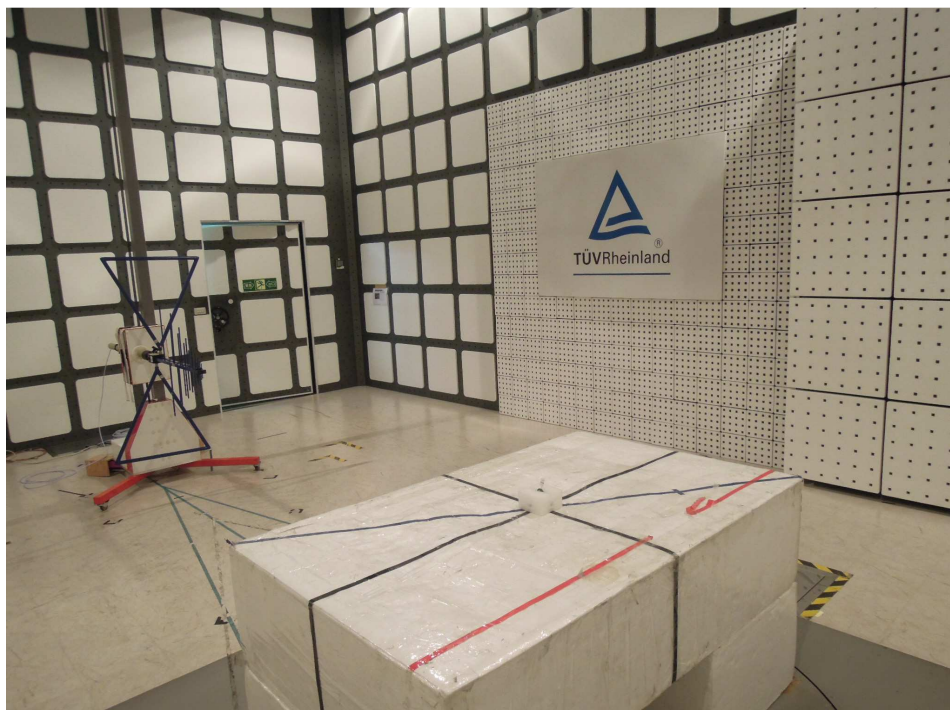
Photograph 1: Set-up for Radiated Emissions (Front View)



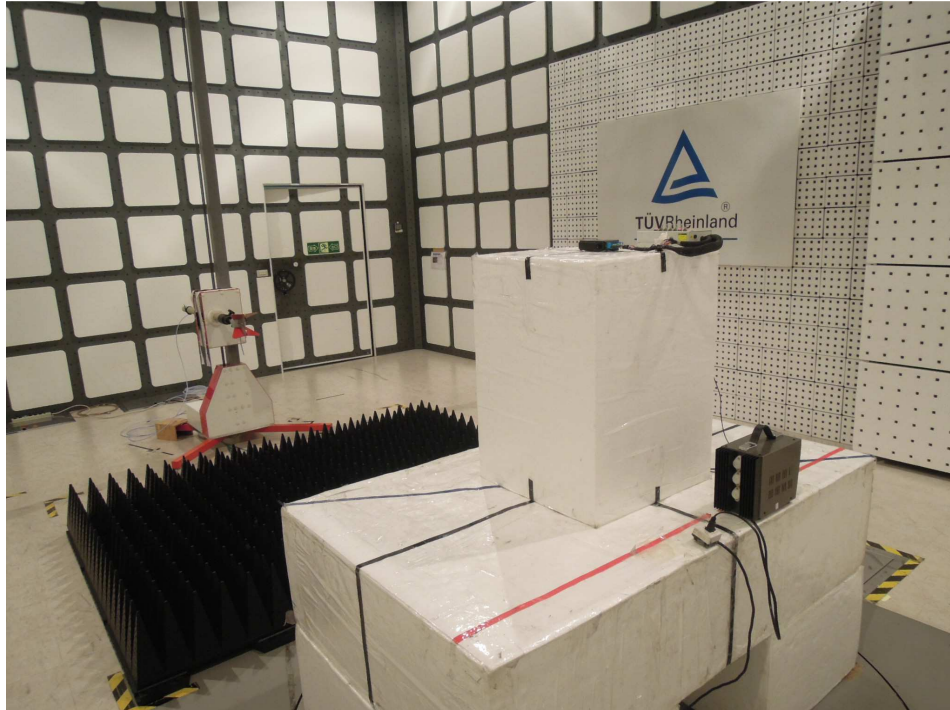
Photograph 2: Set-up for Radiated Emissions (Back View 1 TX)



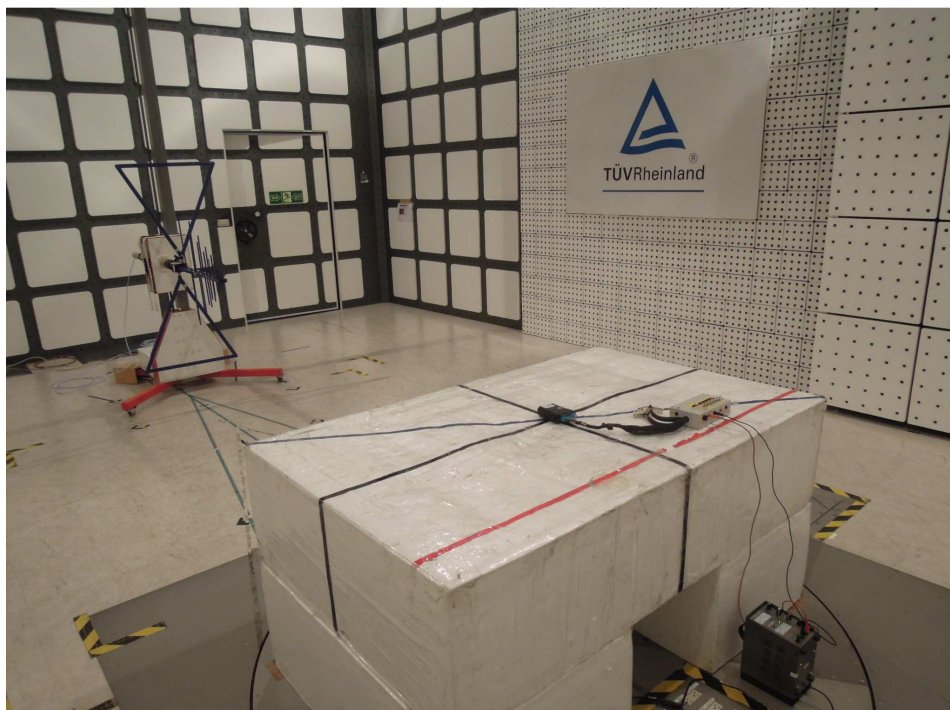
Photograph 3: Set-up for Radiated Emissions (Back View 2 TX)



Photograph 4: Set-up for Radiated Emissions (Back View 1 RX)



Photograph 5: Set-up for Radiated Emissions (Back View 2 RX)



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