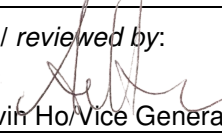


Prüfbericht-Nr.: <i>Test Report No.:</i>	50105679 001	Auftrags-Nr.: <i>Order No.:</i>	114069439	Seite 1 von 28 <i>Page 1 of 28</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	4-Sep-2017	
Auftraggeber: <i>Client:</i>	CUBTEK. INC. 7, 6F, No.38., Taiyuan St., Zhubei City, Hsinchu County, Taiwan(R.O.C.)			
Prüfgegenstand: <i>Test item:</i>	24GHz BSD Radar			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	Please refer page9 for applied model list			
Auftrags-Inhalt: <i>Order content:</i>	FCC/IC Test report			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.249 RSS-310			
Wareneingangsdatum: <i>Date of receipt:</i>	13-Oct-2017			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000629461-001 – A000629461-004			
Prüfzeitraum: <i>Testing period:</i>	19-Oct-2017 - 14-Nov-2017			
Ort der Prüfung: <i>Place of testing:</i>	EMC 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:		
2017-11-14 SamC.J. Kuo/Engineer		2017-11-14 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: There are 4 types of this 24G radar system, two sets of Master and Slave Radar. Master and Slave Radar have identical PCBs and RF circuits, the Master Radar has an additional control circuit to coordinate Master and Slave. The 4 types have almost identical enclosures, two sets differ in connection socket orientation.. Please refer the APPENDIX for detailed information.				
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 99% BANDWIDTH

RESULT: Passed

5.1.4 20dB BANDWIDTH

RESULT: Passed

5.1.5 SPURIOUS EMISSION

RESULT: Passed

5.2.1 SPURIOUS EMISSION

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

Contents

1.	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS.....	5
2.	TEST SITES	6
2.1	TEST FACILITIES	6
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	7
2.3	TRACEABILITY	8
2.4	CALIBRATION	8
2.5	MEASUREMENT UNCERTAINTY	8
3.	GENERAL PRODUCT INFORMATION.....	9
3.1	PRODUCT FUNCTION AND INTENDED USE	9
3.2	RATINGS AND SYSTEM DETAILS.....	9
3.3	INDEPENDENT OPERATION MODES	11
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	11
3.5	SUBMITTED DOCUMENTS.....	11
4.	TEST SET-UP AND OPERATION MODES.....	12
4.1	PRINCIPLE OF CONFIGURATION SELECTION	12
4.2	TEST OPERATION AND TEST SOFTWARE.....	12
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	12
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	13
4.5	TEST SETUP DIAGRAM	13
5.	TEST RESULTS	15
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	15
5.1.1	<i>Antenna Requirement</i>	<i>15</i>
5.1.2	<i>Field strength of fundamental.....</i>	<i>16</i>
5.1.3	<i>99% Bandwidth</i>	<i>18</i>
5.1.4	<i>20dB Bandwidth</i>	<i>19</i>
5.1.5	<i>Spurious Emission</i>	<i>21</i>
5.2	RECEIVER REQUIREMENT	22
5.2.1	<i>Spurious Emission</i>	<i>22</i>
6.	SAFETY HUMAN EXPOSURE	23
6.1	RADIO FREQUENCY EXPOSURE COMPLIANCE	23
6.1.1	<i>Electromagnetic Fields.....</i>	<i>23</i>

Prüfbericht - Nr.: 50105679 001
Test Report No.

Seite 4 von 28
Page 4 of 28

7.	PHOTOGRAPHS OF THE TEST SET-UP.....	24
8.	LIST OF TABLES	28
9.	LIST OF PHOTOGRAPHS.....	28

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: 50105679APPENDIXP)

Appendix D: Test Result of Radiated Emissions

(File Name: 50105679APPENDIXD)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.249 ANSI C63.10:2013 KDB 447498 D01 RSS-310 RSS-102

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	Manufacturer	Type	S/N	Last Calibration	Next Calibration
Spectrum Analyzer	Keysight	N9010A	MY52221334	2016/06/01	2018/06/01
Harm. Mixer, 40-60 GHz	OML	WR-19	1601 1801	NCR	NCR
Harm. Mixer, 50-75 GHz	Keysight / VDI	N9029AV15	US54250104	NCR	NCR
Harm. Mixer, 75-110 GHz	Keysight / VDI	N9029AV10	US53250005	NCR	NCR
Harm. Mixer, 90-140 GHz	Keysight / VDI	N9029AV08	US53250003	NCR	NCR
Harm. Mixer, 140-220 GHz	Keysight / VDI	N9029AV05	US53250002	NCR	NCR
RF Detector	Millitech	DET-15RPFW0	065	NCR	NCR
Low Pass Filter, 10 MHz	Woken	WFIL-L10F	WR366WC2B1	NCR	NCR
Pre-Amplifier	Spacek Labs	SLV-20-4	16E12	NCR	NCR
Oscilloscope	Tektronix	TDS430A	B060509	NCR	NCR
Power Meter	Keysight	N1911A	MY56020004	2016/06/14	2018/06/14
Power Sensor coax 50GHz	Keysight	8487D	MY55500010	2016/06/14	2018/06/14
Power Sensor Waveguide 50-75 GHz	Keysight	V8486A	MY56110003	2016/06/14	2018/06/14
Signal Generator	Keysight	E8257D	SG53400472	2016/06/08	2018/06/18
Source 50-75 GHz	Keysight / VDI	E8257DV15	US54250110	NCR	NCR
Source 75-110 GHz	Keysight / VDI	E8257DV10	US53250015	NCR	NCR
Source 90-140 GHz	Keysight / VDI	E8257DV08	US53250005	NCR	NCR
Source 140-220 GHz	Keysight / VDI	E8257DV05	US53250004	NCR	NCR
Power Meter 75GHz -220 GHz	VDI	PM5	361V	2016/06/13	2018/06/13
Test Software	Farad	EZ EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESCI 7	100797	2016/12/30	2017/12/30
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	8447D	2944A06641	2016/12/28	2017/12/28
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2016/12/01	2017/12/01
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	060558	2016/11/17	2017/11/17
Bilog Antenna	TESEQ	CBL6111D	29804	2017/08/18	2018/08/18
Horn Antenna	ETS-Lindgren	3117	138160	2017/05/25	2018/05/25
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101031	2016/11/22	2017/11/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2017/06/14	2018/06/14
EMI Test Receiver	R&S	ESCI7	100797	2016/12/30	2017/12/30
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
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	$\pm 10 \text{ \%}$

3. General Product Information

3.1 Product Function and Intended Use

The EUT is Vehicle Blind Spot Detection. It is designed to aid in detecting vehicles that may entered the blind spot zone.
 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	24GHz BSD Radar
Type Designation	VS-91A001
FCC ID	2AN3BVS91A001
IC	
HVIN	VS-91A001

All models electrical constructions are similar, as described on the cover page, with various models numbers for different marketing purpose. The suffix "X" can be 0-9, A-Z, a-z, "-", ",", or blank, which is for difference marketing purpose.

One representative set of samples with model "VS-91A001" was tested and recorded in this report.

Applied model list:

VS-92XXXX	VS-92XXXXX	VS-92XXXXXX
VS-92XXXXXXX	VS-92XXXX-X	VS-92XXXXX-X
VS-92XXXXXX-X	VS-92XXXXXXX-X	VS-92XXXX-XX
VS-92XXXXXX-XX	VS-92XXXXXX-XX	VS-92XXXXXXX-XX
VS-92XXXX-XXXX	VS-92XXXXX-XXXX	VS-92XXXXXX-XXXX
VS-92XXXXXXX-XXXX		
VS-95XXXX	VS-95XXXXX	VS-95XXXXXX
VS-95XXXXXXX	VS-95XXXX-X	VS-95XXXXX-X
VS-95XXXXXX-X	VS-95XXXXXXX-X	VS-95XXXX-XX
VS-95XXXXXX-XX	VS-95XXXXXX-XX	VS-95XXXXXXX-XX
VS-95XXXX-XXXX	VS-95XXXXX-XXXX	VS-95XXXXXX-XXXX
VS-95XXXXXXX-XXXX		

5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	24.03 to 24.23 GHz
Channel number	1
Operation Voltage	12Vdc
Modulation	FMCW
Antenna Gain	14dBi

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Receiving
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel

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: Continuous transmit by a switch

This software was running on the laptop computer connected to the EUT. 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:

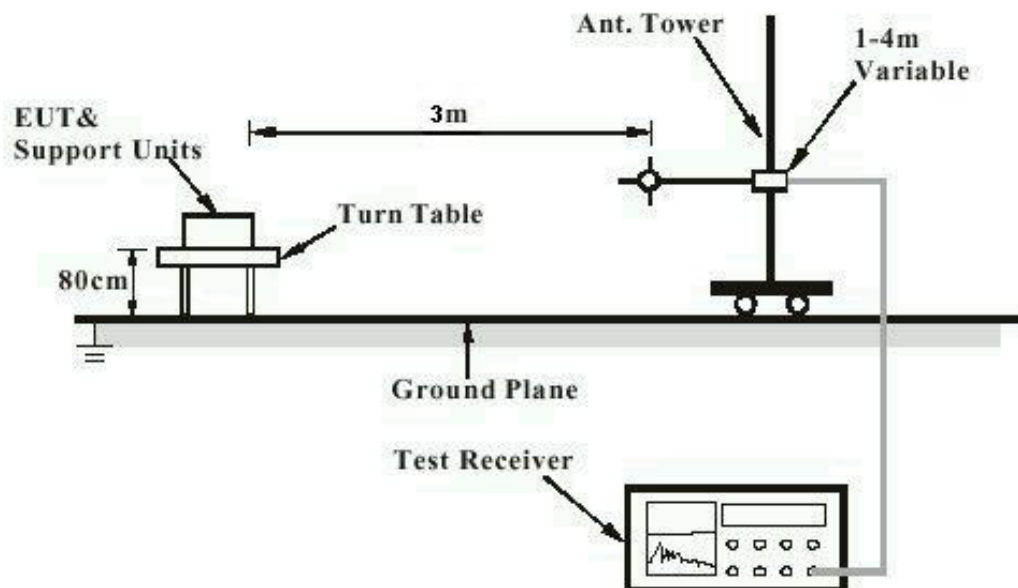
None

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

40G-110G spurious emissions measurement:

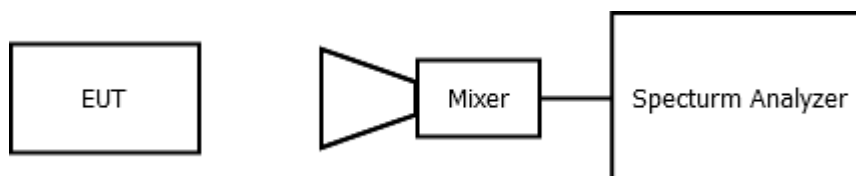
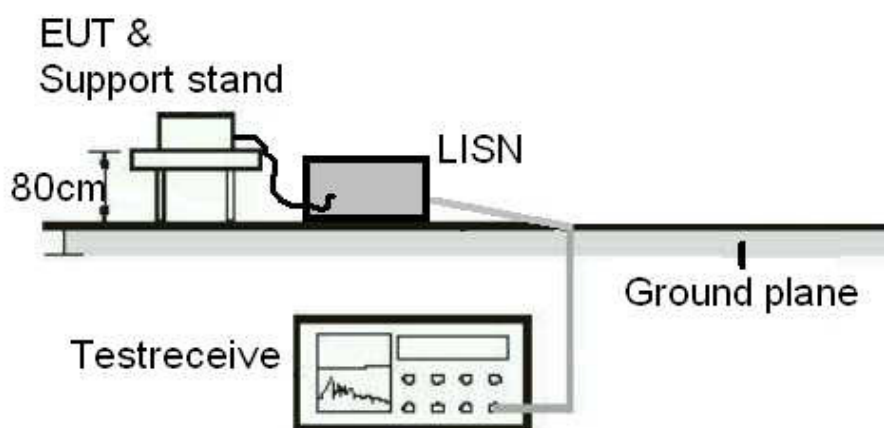


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Standard : LP0002(2016): 2.2
Part 15.203 and RSS-Gen 7.1.4
Requirement : use of approved antennas only

The antenna is Antenna Array 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 15.249(a), RSS-310 3.10, LP0002(2016) 3.10.2.2
Basic standard	:	ANSI C63.10:2013
Kind of test site	:	Semi-Anechoic Chamber

Test setup

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

In the table below the maximum results found are reported.

For detailed results of all frequencies tested, please refer to Appendix D.

Table 6: Test result of Field strength of fundamental

Channel Frequency (MHz)	Test result			
	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector
24044.000	97.36	128.00	Horizontal	Peak
24044.000	83.33	108.00		Average
24180.800	82.66	128.00	Vertical	Peak
24180.800	79.97	108.00		Average

Remark: For details refer to Appendix D.

5.1.3 99% Bandwidth

RESULT:

Passed

Test standard : RSS-Gen
 Basic standard : ANSI C63.10:2013

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 (MHz)
24125	202.3

Test Plot of 99% Bandwidth



Date: 24.OCT.2017 20:14:28

5.1.4 20dB Bandwidth**RESULT:****Passed**

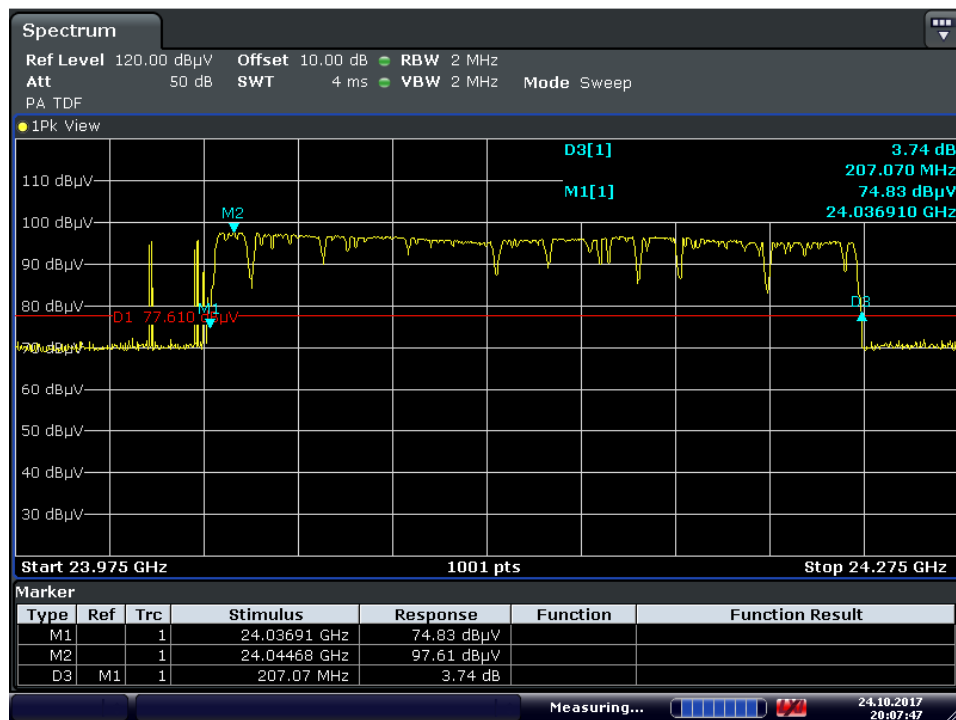
Test standard : FCC Part 15.249 (e), RSS-310 3.10

Basic standard : ANSI C63.10:2013

Test setupAmbient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103kPa**Table 8: Test result of 20dB Bandwidth**

Frequency(MHz)	20dB Bandwidth (kHz)
24125	207.07

Test Plot of 20dB Bandwidth



Date: 24.OCT.2017 20:07:46

5.1.5 Spurious Emission

RESULT:

Passed

Test standard	:	Part 15.249(a) and Part 15.249(d), FCC 15.209, RSS-310 3.10, LP0002(2016) 3.10.2.2, RSS-Gen 7.2.1 LP0002 (2016): 2.8
Basic standard	:	ANSI C63.10: 2013
Limits	:	Part 15.249(a) and Part 15.249(d), FCC 15.209, RSS-310 3.10, LP0002(2016) 3.10.2.2, RSS-Gen 7.2.1
Kind of test site	:	3m Semi-Anechoic Chamber (9kHz to 40GHz) Semi-Anechoic Shielded Room (40GHz to 110 GHz)

Test setup

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

Remark: Testing was carried out within frequency range 9kHz to 110GHz.

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.

5.2 Receiver Requirement

5.2.1 Spurious Emission

RESULT:**Passed**

Test standard	:	LP0002 (2016): 2.8
Basic standard	:	ANSI C63.10:2013
Limits	:	LP0002 (2016): 2.8
Kind of test site	:	3m Semi-Anechoic Chamber (9kHz to 40GHz) Semi-Anechoic Shielded Room (40GHz to 110 GHz)

Test setup

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

Remark: Testing was carried out within frequency range 9kHz to 110GHz.

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. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:
Passed

Test standard : FCC KDB Publication 447498 D01
 RSS-102 issue 5, Table 4

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied

Maximum Exposure:

Power to Antenna (mW)	0.108 mW
Power to Antenna (dBm)	-9.7 dBm
Antenna Gain	14 dBi
Power+Ant Gain	2.7 mW
Distance	20 cm
S=	0.001 mW/cm ²

This device is operated typically outdoors and facing vehicle traffic lanes. The operating band is 24000-24250MHz. Power is determined from the measured field strength.

Limit FCC: 1 mW/cm²

Limit Canada: 0.16 mW/cm²

FCC:

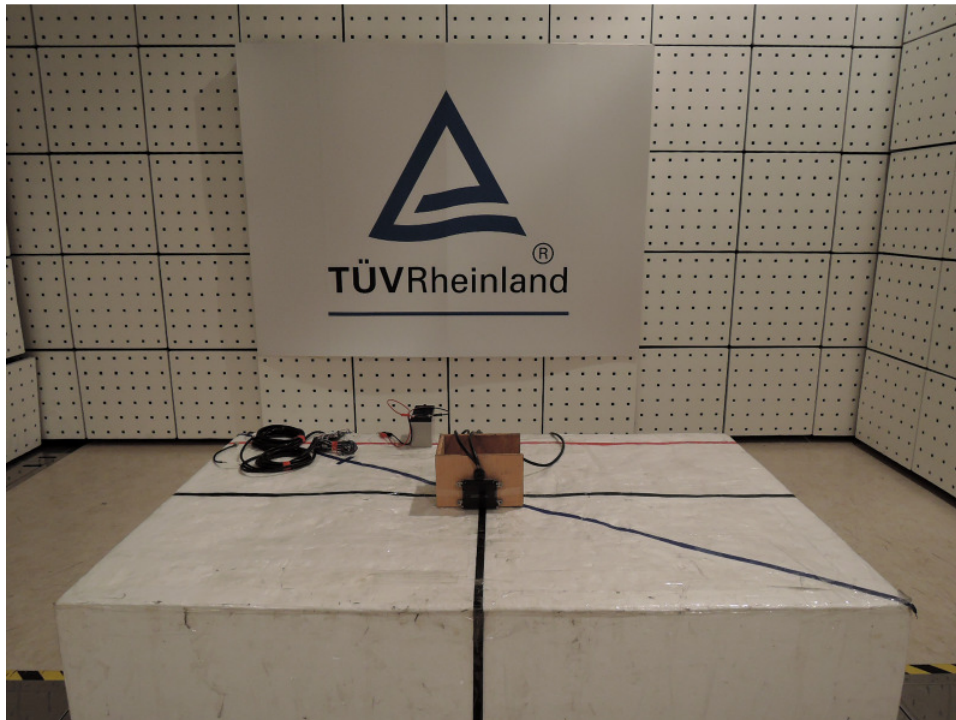
0.3-1.34 MHz	(100) mW/cm ²
1.34-30 MHz	(180/f ²) mW/cm ²
30-300 MHz	0.2 mW/cm ²
300-1500 MHz	f/1500 mW/cm ²
1500-100,000 MHz	1.0 mW/cm²

Canada:

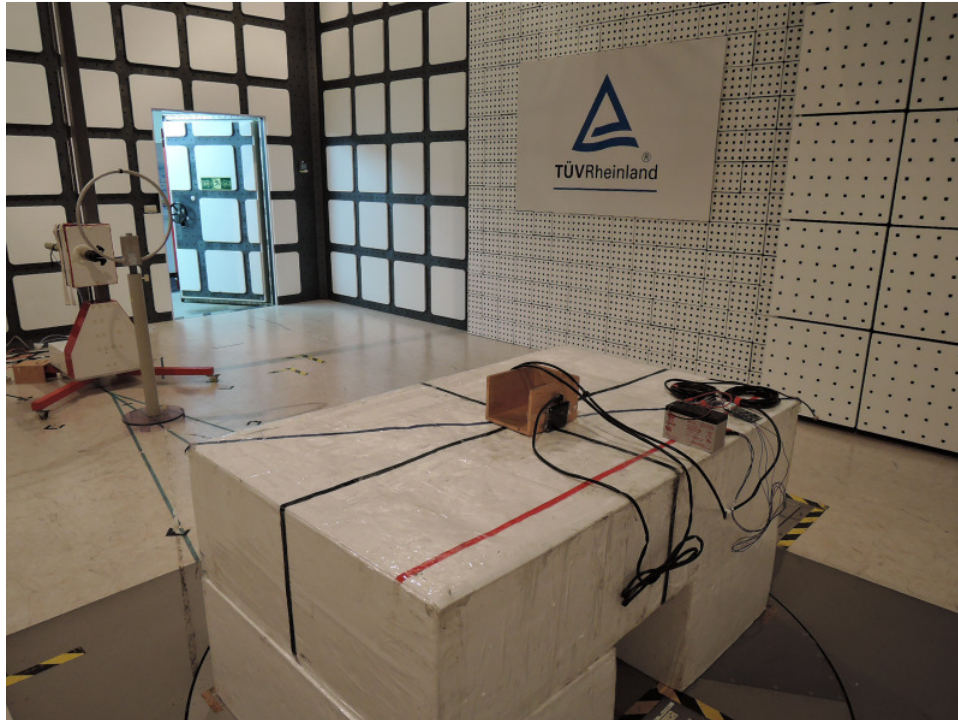
10-20 MHz	0.2 mW/cm ²
20-48 MHz	(0.8944/f ^{0.5}) mW/cm ²
48-300 MHz	0.129 mW/cm ²
300-6000 MHz	(0.002619*f ^{0.6834}) mW/cm ²
6000-15000MHz	1.0 mW/cm ²
15000-150000MHz	1.0 mW/cm²
150000-300000MHz	6.67*10 ⁻⁵ f

7. Photographs of the Test Set-Up

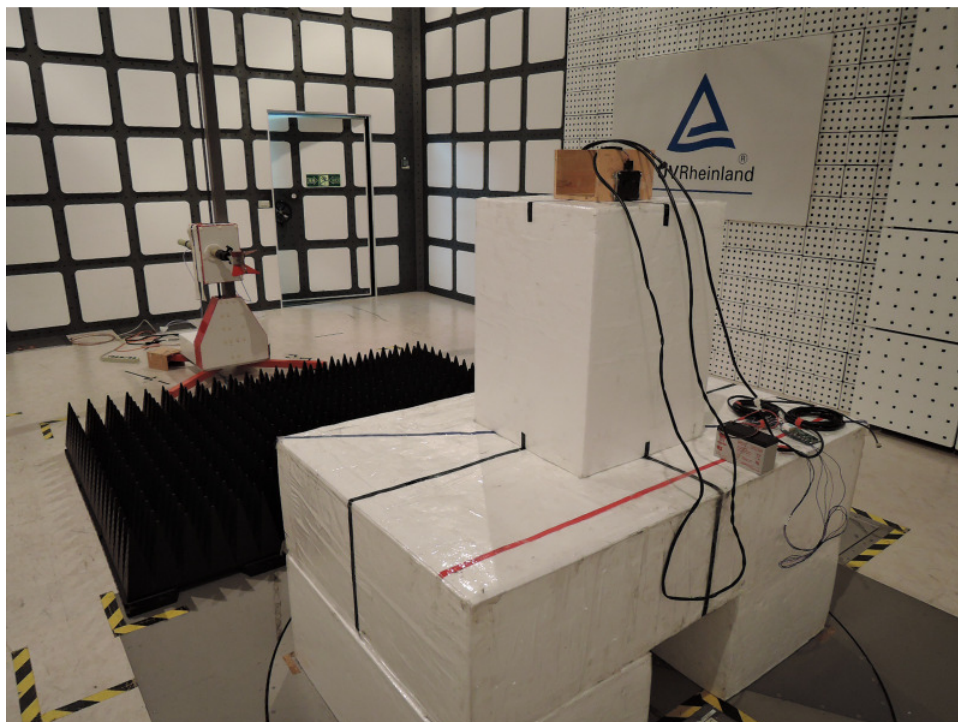
Photograph 1: Set-up for Spurious Emissions (Front View)



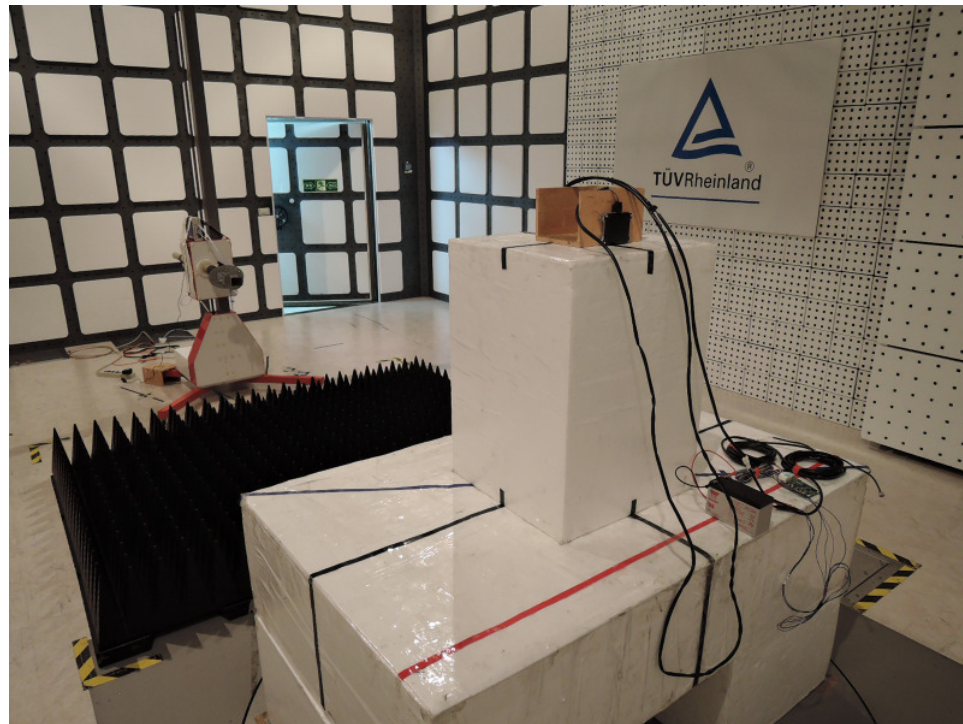
Photograph 2: Set-up for Spurious Emissions (Back View 1 TX)



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



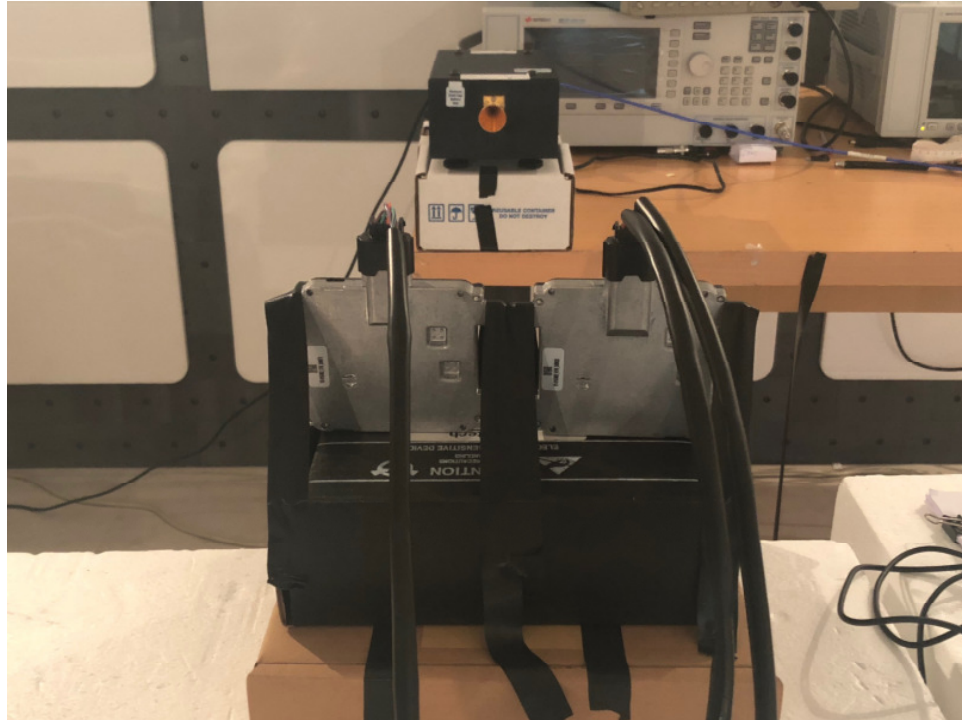
Photograph 4: Set-up for Spurious Emissions (Back View 3 TX)



Photograph 5: Set-up for Spurious Emissions (Front View TX, 40-110GHz)



Photograph 6: Set-up for Spurious Emissions (Back View 1 TX, 40-110GHz)



8. List of Tables

Table 1: Applied Standard and Test Levels	5
Table 2: List of Test and Measurement Equipment	7
Table 3: Emission Measurement Uncertainty.....	8
Table 4: Basic Information of EUT	9
5: Technical Specification of EUT	10
Table 6: Test result of Field strength of fundamental	17
Table 7: Test result of 99% Bandwidth,.....	18
Table 8: Test result of 20dB Bandwidth	19

9. List of Photographs

Photograph 1: Set-up for Spurious Emissions (Front View).....	24
Photograph 2: Set-up for Spurious Emissions (Back View 1 TX)	25
Photograph 3: Set-up for Spurious Emissions (Back View 2 TX)	25
Photograph 4: Set-up for Spurious Emissions (Back View 3 TX)	26
Photograph 5: Set-up for Spurious Emissions (Front View TX, 40-110GHz)	26
Photograph 6: Set-up for Spurious Emissions (Back View 1 TX, 40-110GHz).....	27