

Report on the FCC and IC Testing of the
Sirona Dental Systems GmbH
Dental device for cleaning lubrication and
disinfection and sterilization.
Model: Model: DAC Universal; Type: MK IV



Product Service

Choose certainty.
Add value.

In accordance with FCC 47 CFR Part 15C and
Industry Canada RSS-210 and
Industry Canada RSS-GEN

Prepared for: Sirona Dental Systems GmbH
Fabrikstr. 31
64625 Bensheim
Germany

FCC ID:2AD7W-DACUNIMK4,
IC: 12730A-DACUNIMK4

COMMERCIAL-IN-CONFIDENCE

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2019-04-01	
Authorised Signatory	Matthias Stumpe	2019-04-01	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C:2017, Industry Canada RSS-210 Issue 9 (2017-06) and Industry Canada RSS-GEN Issue 4 (2014-11). The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Martin Steindl	2019-04-01	

Laboratory Accreditation
DAkkS Reg. No. D-PL-11321-11-02 Laboratory recognition
Registration No. BNetzA-CAB-16/21-15 Industry Canada test site registration
3050A-2

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C and Industry Canada RSS-GEN:2016, Issue 04 (2015-07) and Issue 04 (2014-11), FCC 47 CFR Part 15C:2017, Industry Canada RSS-210 Issue 9 (2017-06) and Industry Canada RSS-GEN Issue 04 (11-2014).

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2018-12-11
2	Added RF exposure for FCC (KDB 447498 D01 V06) Added information	2019-04-01

Table 1

1.2 Introduction

Applicant	Sirona Dental Systems GmbH
Manufacturer	Sirona Dental Systems GmbH
Model Number(s)	Model: DAC Universal; Type: MK IV
Serial Number(s)	1044
Hardware Version(s)	PU: 200/201; IU: 200/200; WTSU: 300/200
Software Version(s)	JU: 0E5581; PU: 0E5552
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C:2017, Industry Canada RSS-210, Issue 04 (11-2014) and Industry Canada RSS-GEN, Issue 09 (08-2016)
Test Plan/Issue/Date	EMC Test Plan / 18-10-22
Order Number	4501173503/025
Date	2018-03-02
Date of Receipt of EUT	2018-11-15
Start of Test	2018-11-20
Finish of Test	2018-11-29
Name of Engineer(s)	Martin Steindl
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
Configuration and Mode: Instrument carrier "Blue" Radio Test Mode						
2.1	15.209	4.4	6.6	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.2		4.4	6.11	Frequency Tolerance Under Temperature Variations	Pass	ANSI C63.10 (2013)
2.3	15.209	4.4	2.6, 6.13	Transmitter Emissions	Pass	ANSI C63.10 (2013)
2.4	15.207	4.4	6.2	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.5	15.205	4.4	4.1	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.6		4.4	3.2	Exposure of Humans to RF fields	Pass	
2.7				SAR exclusion threshold	Pass	KDB 447498 D01 V06

Table 2

1.4 Application Form

Testsample Questionnaire

Data for the Test Report		
Language	<input type="checkbox"/> german	<input checked="" type="checkbox"/> english
Order number (your formal order)	Order number by Sirona Dental Systems: 450117353/25 Order confirmation by TÜV Süd: 713129315	
Applicant: (incl. address / department / contact person):	Company address: Sirona Dental Systems GmbH Fabrikstr.31 64625 Bensheim Contact person: Christian Kulhanek, R&D Instruments Division E-Mail: Christian.Kulhanek@dentsplysirona.com Phone: +49 (0)6251 16 - 2213	

Table 3

Description of the Equipment Under Test	
Type of equipment:	Dental device for cleaning, lubrication, disinfection and sterilization
Type designation:	Model: DAC Universal Type: MK IV
Parts of the system:	<ul style="list-style-type: none">- Main device- Instruments carrier ("Blue" or "Green")- Mains supply cable (inlet connector for non-heating apparatus)- Ethernet cable
Manufacturer:	Manufacturer: Sirona Dental Systems GmbH Fabrikstr.31 64625 Bensheim Production site: Sirona Dental A/S Rho 10 8382 Hinnerup



Serial number:	S/N 1044			
Internal clock rate(s):	<p>PCBA Interface Unit:</p> <ul style="list-style-type: none">- 12MHz (Resonator for microcontroller)- 168MHz (internal PLL inside microcontroller IC)- 50MHz (Resonator for Ethernet Controller) <p>PCBA Process Unit:</p> <ul style="list-style-type: none">- 16MHz (Resonator for microcontroller)			
Power supply:	<input checked="" type="checkbox"/> 230V/50Hz	<input type="checkbox"/> 12 VDC	<input checked="" type="checkbox"/> 115V/60Hz	<input type="checkbox"/> 24 VDC
Version of EUT (HW / SW):	<p><u>HW:</u></p> <ul style="list-style-type: none">- PCBA "Process Unit":<ul style="list-style-type: none">o Layout: revision 200o BOM: revision 201- PCBA "Interface Unit":<ul style="list-style-type: none">o Layout: revision 200o BOM: revision 200- PCBA "Water Tank Sensor Unit":<ul style="list-style-type: none">o Layout: revision 300o BOM: revision 200 <p><u>SW:</u></p> <ul style="list-style-type: none">- JU: 0E5581- PU: 0E5552			

Table 4

Methods of Observation			
<i>Function</i>	<i>Observed size</i>	<i>Permissible range</i>	<i>Observation method</i>
- Hygiene reprocessing cycle	Completion	Without error codes	Reading display
- No unintended activation of solenoid valves, pumps and motor (during reprocessing cycle and standby)	Activation	No unintended activation	Acoustically
- Availability of display	Content	May flicker or black-out, but shall recover within 3 seconds.	Reading display

Table 5



Operation Mode(s)

1. Stand by (Used for some immunity tests. See test plan.)
2. Hygiene reprocessing cycle with instrument carrier "blue" (Used for emission tests and some immunity tests. Most comprehensive functionality covering all device components. See test plan.)

Table 6

List of ports and cables

No.	Description	Classification	Cable type	Cable length used	Cable length maximum
A1	Inlet connector for non-heating apparatus	ac power	Unshielded	2m	2m
D1	n.a.	dc power	Unshielded	n.a.	n.a.
S1	Ethernet cable, CAT 5	signal/control port	Unshielded	5m	5m

Table 7

List of devices connected to EUT

No.	Description	Type designation	Serial no. or ID	Manufacturer
1	PC for serving Ethernet interface	LIFEBOOK E Series	BHMC0660	Fujitsu
2				
3				
4				

Table 8

List of support devices

No.	Description	Type designation	Serial no. or ID	Manufacturer
1				
2				
3				
4				

Table 9

1.5 Product Information

1.5.1 Technical Description

The DAC Universal MK IV is a device for performing hygiene reprocessing and maintenance of dental equipment using saturated steam for germ reduction.

The device mainly consists of the following components:

- a chamber,
- an instruments carrier (which additionally serves as a lid for closing the chamber),
- a motor-driven mechanical system for closing the chamber by lowering the instrument carrier,
- pumps and valves for water and steam management,
- a steam generator for storing electrical energy and transforming applied water into steam and
- PCBAs for process control and communication with user and periphery.

When using the DAC Universal MK IV the user can – depending on his needs – choose from different instruments carriers which can hold different types of dental equipment. As soon as the instruments carrier is lowered for closing the chamber its RFID transponder will be read by the device. Then the device will choose a subset of process steps that is suitable for the recognized instruments carrier type and thereby for the related type of instruments attached. The following process steps are available in total:

- Lubrication
- Drive channel cleaning
- Spray channel cleaning
- Cleaning of outer surface
- Disinfection
- Sterilization
- Drying
- Cooling

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable

Table 10

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Instrument carrier "Blue" Radio Test Mode	
Emission Bandwidth	Martin Steindl
Frequency Tolerance Under Temperature Variations	Martin Steindl
Transmitter Emissions	Martin Steindl
AC Power Line Conducted Emissions	Martin Steindl
Restricted Band Edges	Martin Steindl
Exposure of Humans to RF Fields	Martin Steindl
SAR exclusion threshold	Martin Steindl

Table 11

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany



2 Test Details

2.1 Emission Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15C, paragraph 15.209
Industry Canada RSS-210, Section 4.4 and
Industry Canada RSS-GEN, section 6.6

2.1.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.1.3 Date of Test

2018-11-29

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.9.1 and
Industry Canada RSS-Gen clause 6.6.

2.1.5 Environmental Conditions

Ambient Temperature 24.0 °C
Relative Humidity 33.0 %

2.1.6 Test Results

Instrument carrier „Blue“ Radio Test Mode

Frequency (kHz)	99% Occupied Bandwidth (kHz)
125	0.158

Table 12 - Occupied Bandwidth Result

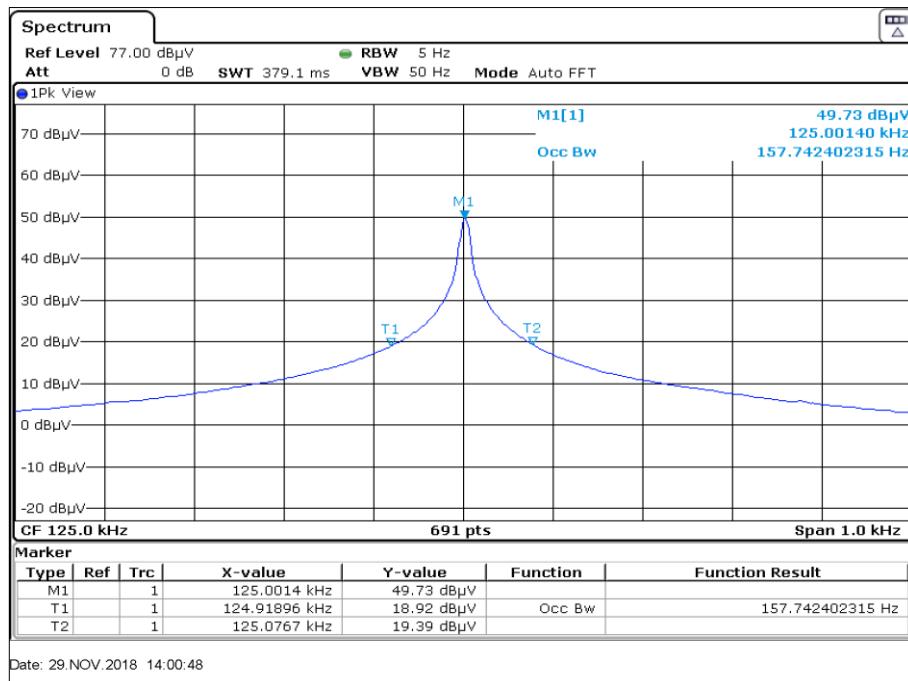


Figure 1 - Emission Bandwidth

FCC and Industry Canada RSS-Gen Limit Clause

None specified.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic test chamber	ESPEC Corp.	PL-2J	18843	36	2020-03-31
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2019-01-31

Table 13

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.2 Frequency Tolerance Under Temperature Variations

2.2.1 Specification Reference

Industry Canada RSS-GEN, Clause 6.11

2.2.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.2.3 Date of Test

2018-11-28

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.8 and Industry Canada RSS-Gen clause 6.11.

2.2.5 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	33.0 %

2.2.6 Test Results

Instrument carrier „Blue“ Radio Test Mode

Temperature	Voltage	Measured Frequency (kHz)	Frequency Error (Hz)
-20.0 °C	120.0 V	125.0001	-1.6
-10.0 °C	120.0 V	125.0011	-0.6
0.0 °C	120.0 V	125.0016	-0.1
+10.0 °C	120.0 V	125.0017	0.0
+20.0 °C	102.0 V	125.0017	0.0
+20.0 °C	108.0 V	125.0017	0.0
+20.0 °C	114.0 V	125.0017	0.0
+20.0 °C	120.0 V	125.0017	0.0
+20.0 °C	126.0 V	125.0017	0.0
+20.0 °C	132.0 V	125.0017	0.0
+20.0 °C	138.0 V	125.0017	0.0
+20.0 °C	195.5 V	125.0017	0.0
+20.0 °C	207.0 V	125.0017	0.0
+20.0 °C	218.5 V	125.0017	0.0
+20.0 °C	230.0 V	125.0017	0.0
+20.0 °C	241.5 V	125.0017	0.0
+20.0 °C	253.0 V	125.0017	0.0
+20.0 °C	264.5 V	125.0017	0.0
+30.0 °C	120.0 V	125.0016	-0.1
+40.0 °C	120.0 V	125.0015	-0.2
+50.0 °C	120.0 V	125.0015	-0.2

Table 14 - Frequency Tolerance Results

Industry Canada RSS-Gen, Limit Clause 8.11

Transmitter frequency stability for licence-exempt radio apparatus shall be measured in accordance with Section 6.11. For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F) instead of at the temperatures specified in Section 6.11.

If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz.

2.2.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic test chamber	ESPEC Corp.	PL-2J	18843	36	2020-03-31
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2019-01-31

Table 15

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.3 Transmitter Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.209 and
Industry Canada RSS-GEN, Clauses 2.6 and 6.13

2.3.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.3.3 Date of Test

2018-11-22 to 2018-11-29

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5.
and Industry Canada RSS-Gen clause 6.13.

2.3.5 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	29.0 %

2.3.6 Test Results

Instrument carrier „Blue“ Radio Test Mode

Frequency (MHz)	Quasi-Peak Level (dB μ V/m) at 10m	Extrapolation distance (m)	Quasi-Peak Level (dB μ V/m) at Extrapolation distance	Limit Level (dB μ V/m) at Extrapolation distance
0.125	50.6	300	-8.5	25.7
0.654	28.0	30	8.9	31.3

Table 16 - Emissions Results - 9 kHz to 30 MHz

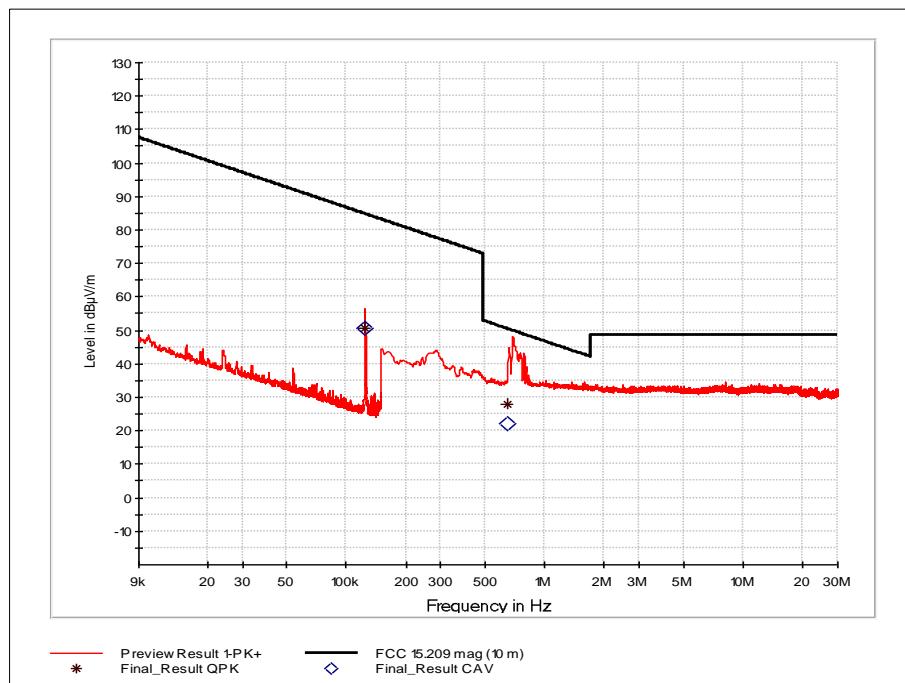


Figure 2 - Test Frequency Range 9 kHz to 30 MHz

Frequency (MHz)	Quasi Peak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
148.115	40.1	43.5	3.4	1000	120	110	H	-71	9.9
167.970	35.7	43.5	7.8	1000	120	154	V	30	10.9
183.720	37.0	43.5	6.5	1000	120	106	H	-101	11.8
199.910	22.8	43.5	20.7	1000	120	158	V	80	12.5
308.725	38.9	46.0	7.1	1000	120	113	V	-170	15.5
351.900	41.3	46.0	4.7	1000	120	105	V	137	17.3
354.750	38.8	46.0	7.2	1000	120	107	V	138	17.2
356.725	37.8	46.0	8.2	1000	120	100	V	79	17.1
420.030	37.0	46.0	9.0	1000	120	100	H	-64	18.8
476.880	37.8	46.0	8.2	1000	120	103	V	-178	19.2

Table 17- Emissions Results - 30 MHz to 1 GHz

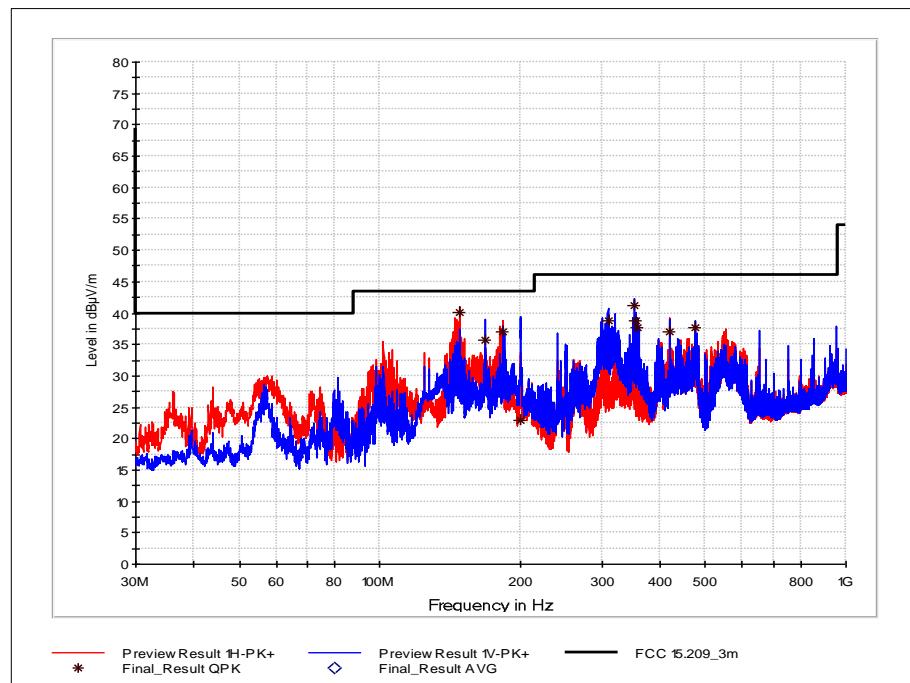


Figure 3 - Test Frequency Range: 30 MHz to 1 GHz

Frequency MHz	MaxPeak dB μ V/m	CAverage dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
1412.250		25.8	54.0	28.2	1000	1000	239.0	V	-145.0	29.2
1412.250	40.6		74.0	33.4	1000	1000	239.0	V	-145.0	29.2
1430.750		25.6	54.0	28.3	1000	1000	244.0	V	-158.0	29.3
1430.750	48.3		74.0	25.7	1000	1000	244.0	V	-158.0	29.3
1450.000	43.0		74.0	31.0	1000	1000	400.0	H	88.0	29.6
1450.000		34.0	54.0	20.0	1000	1000	400.0	H	88.0	29.6
1594.000	46.0		74.0	28.0	1000	1000	394.0	V	18.0	30.9
1594.000		27.8	54.0	26.2	1000	1000	394.0	V	18.0	30.9

Table 18 - Emissions Results - 1 GHz to 2 GHz

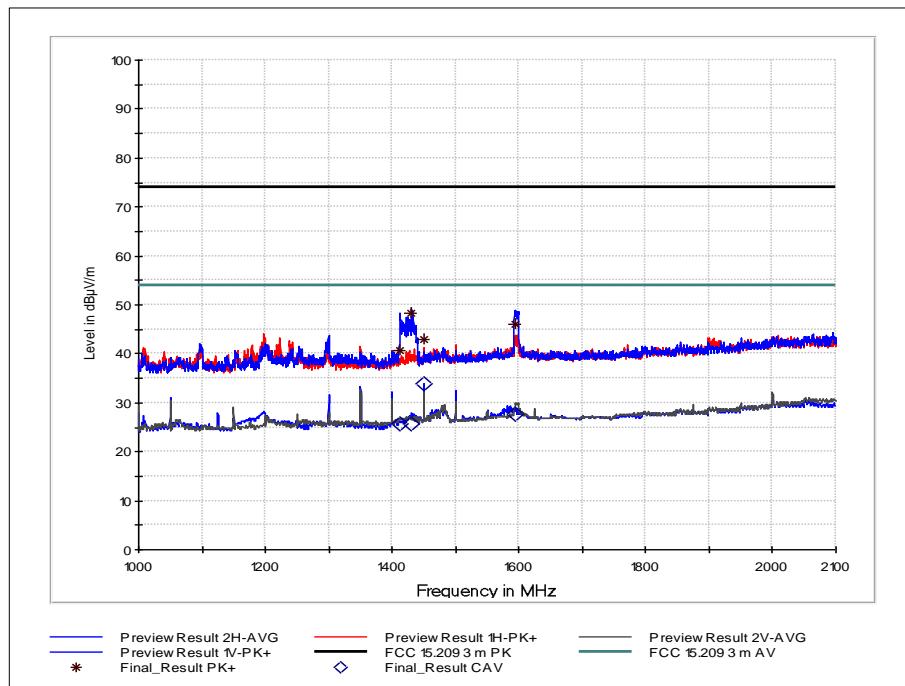


Figure 4 - Test Frequency Range: 1 GHz to 2 GHz - Polarity Horizontal and Vertical



FCC 47 CFR Part 15, Limit Clause 15.209 and Industry Canada RSS-Gen, Limit Clause 8.9

Frequency (MHz)	Field Strength (μ V/m)	Measurement Distance (m)
0.009 to 0.490	2400/F (kHz)	300
0.490 to 1.705	24000/F (kHz)	30
1705 to 30	30	30
30 to 88	100**	3
88 to 216	150**	3
216 to 960	200**	3
Above 960	500	5

Table 19

2.3.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2019-07-31
TRILOG broadband antenna	Schwarzbeck	VULB 9163	19918	36	2019-07-31
Double ridged horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06-30

Table 20

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.4 AC Power Line Conducted Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207 and
Industry Canada RSS-GEN, Clause, 6.2

2.4.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.4.3 Date of Test

2018-11-20

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5. and
Industry Canada RSS-Gen clause 8.8

2.4.5 Environmental Conditions

Ambient Temperature	23.0 °C
Relative Humidity	30.0 %

2.4.6 Test Results

Instrument carrier „Blue“ Radio Test Mode

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

- Live Line Emissions Results

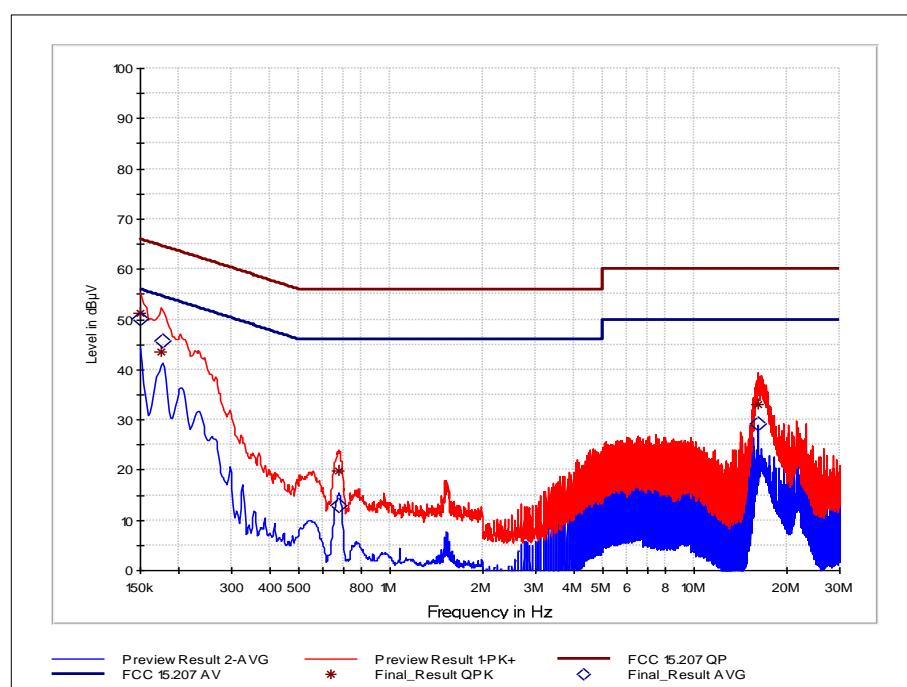


Figure 5 - Live Line - 150 kHz to 30 MHz

- Neutral Line Emissions Results

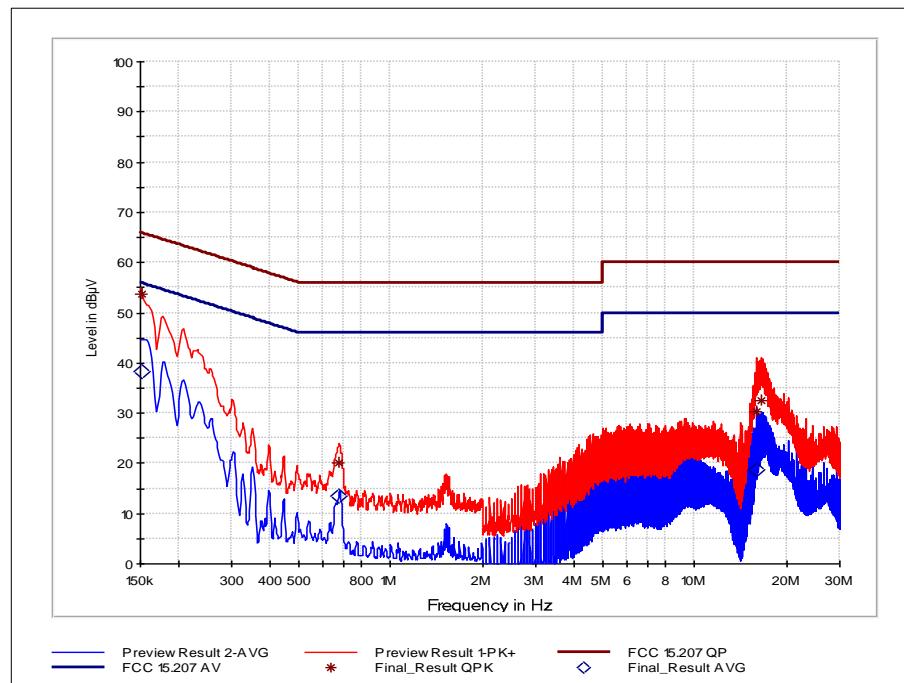


Figure 6 - Neutral Line - 150 kHz to 30 MHz



FCC 47 CFR Part 15, Limit Clause 15.207 and Industry Canada RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 21

*Decreases with the logarithm of the frequency.

2.4.7 Test Location and Test Equipment Used

This test was carried out in Shielded room - cabin no. 9.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESU8	19904	24	2018-12-31
V-network	Rohde & Schwarz	ESH 3-Z5	18919	36	2019-10-31
V-network	Rohde & Schwarz	ESH 3-Z5	19078	36	2020-06-30

Table 22

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.5 Restricted Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C 15.205 and
Industry Canada RSS-GEN, Clause 4.1 and 8.10

2.5.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.5.3 Date of Test

2018-11-22

2.5.4 Test Method

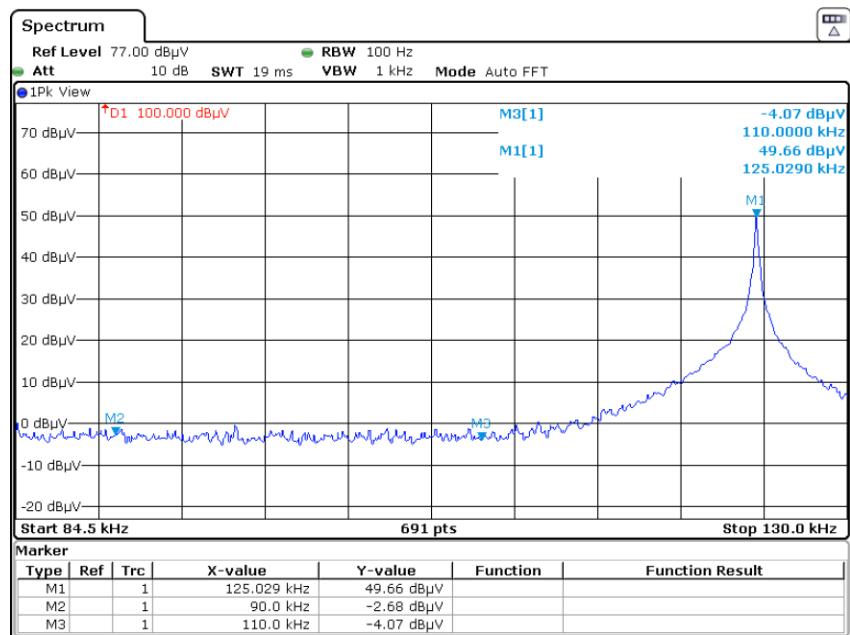
This test was performed in accordance with ANSI C63.10, clause 11.13.1.
Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3.

2.5.5 Environmental Conditions

Ambient Temperature 24.0 °C
Relative Humidity 29.0 %

2.5.6 Test Results

Instrument carrier „Blue“ Radio Test Mode



Date: 29.NOV.2018 14:09:20

Restricted Bands of Operation - Measured Frequency 125 kHz, Peak



FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dB μ V/m)	Average (dB μ V/m)
Restricted Bands of Operation	74	54

Table 23
Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (μ V/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 24

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.5.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2019-01-31

Table 25

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable

2.6 Exposure of Humans to RF Fields

2.6.1 Specification Reference

Industry Canada RSS-GEN Issue 4, section 3.2

2.6.2 Guide

Industry Canada RSS-102 Issue 5, section 2.5 and
Industry Canada SPR-002, Issue 1

2.6.3 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.6.4 Date of Test

2018-11-29

2.6.5 Test Method

This test was performed in accordance with Industry Canada RSS-102, Issue 5, chapter 2.5 and
Industry Canada SPR-002, Issue 1, chapter 6.5

Test according to RSS-102 is based on test results according to section 2.3.6 of this report.

Test according to SPR-002 was performed as worst case measurement with direct contact to EUT.

2.6.6 Test Result

$$EIRP = \frac{(FS \cdot D)^2}{30}$$

In accordance with Industry Canada RSS-102, Issue 5, chapter 2.5:

Maximum Radiated Fields Strength: 50.6 dB μ V/m (at 10 m distance and 125 kHz)
(see chapter 2.3.6 of this test report)

Calculated Equivalent Radiated Power: 382.7 nW (e.i.r.p.)

Minimum separation distance: \leq 5 mm

SAR Evaluation Exemption Limit: 71 mW

In accordance with Industry Canada SPR-002, Issue 1, chapter 6.5:

Test distance: Direct contact to EUT

Tested frequency: 125 kHz

Measured maximum value: 46.40 V/m 0.6678 A/m

Limb Exposure Limit: 83 V/m 90 A/m

Relaxation Factor: 1.0

2.6.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8 and radio lab.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2019-07-31
Electromagnetic radiation meter	EMR-200	AT-0023	19590	36	2019-10-31
Electric field probe	Type 8.3	AU-0008	19591	36	2019-10-31
Magnetic field probe	Type 12.1	W-0018	19592	36	2019-10-31

Table 26

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.7 SAR exclusion threshold

2.7.1 Specification Reference

KDB 447498 D01 V06, section 4.3.1 c) 2)

2.7.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.7.3 Date of Test

2019-04-01

2.7.4 Test Method

Carrier level is based on test result according to section 2.3.6 of this report.

2.7.5 Test Result

Maximum Radiated Fields Strength:
(see chapter 2.3.6 of this test report) 50.6 dB μ V/m (at 10 m distance and 125 kHz)
= 338.84 μ V/m

Calculated Equivalent Radiated Power: 382.7 nW (e.i.r.p.) < 0.1 mW

Minimum separation distance: \leq 5 mm (50 mm)

1-g numeric threshold: $(3.0 \cdot (1 + \log_{10}(100/0.125))) / 2 = 5.85$

SAR test exclusion limit (for 1-g): $5.85 \cdot 50 / \sqrt{0.1} = 925$ mW

Note 1: For test distances below 5 mm according to 4.3.1 a) the test distance is fixed to 5 mm. However, according to 4.3.1 c), the limit is based on a fixed test distance of 50 mm for test distances smaller than 50 mm at frequencies below 100 MHz.

Note 2: The calculation of the power limit is based on $f = 100$ MHz and $d = 50$ mm, however, the correction of the numeric threshold is based on the real frequency of $f = 125$ kHz

$$EIRP = \frac{(FS \cdot D)^2}{30}$$
$$Num. Thresh. (f < 100 \text{ MHz}, d < 50 \text{ mm}) = \frac{1}{2} (Num. Thresh. \left(1 + \log_{10} \frac{100 \text{ MHz}}{f} \right))$$
$$P_{lim} = (Num. Thresh.)(d \text{ in mm}) / \sqrt{f \text{ in GHz}}$$

2.7.6 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2019-07-31

Table 27

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable

3 Photographs

3.1 Equipment Under Test (EUT)

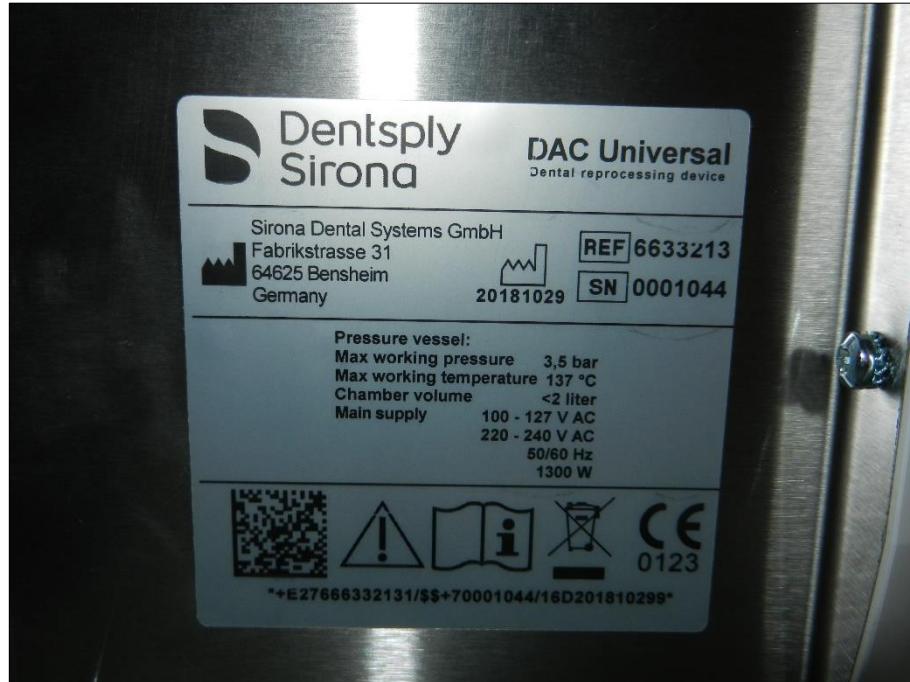


Figure 7 - Photo of Marking Plate of EUT

3.2 Test Setups

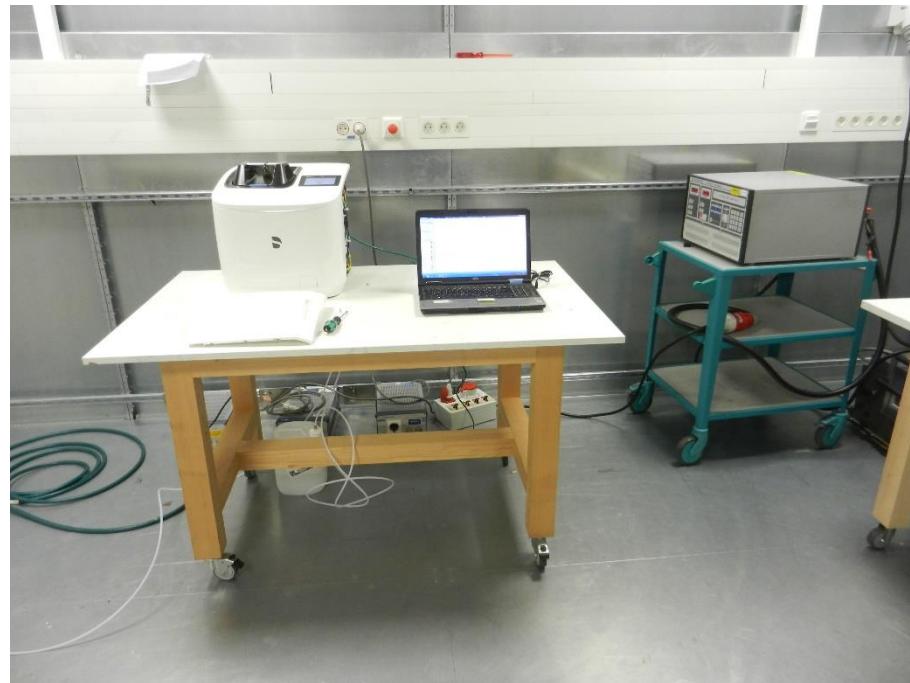


Figure 8 – Conducted AC emissions

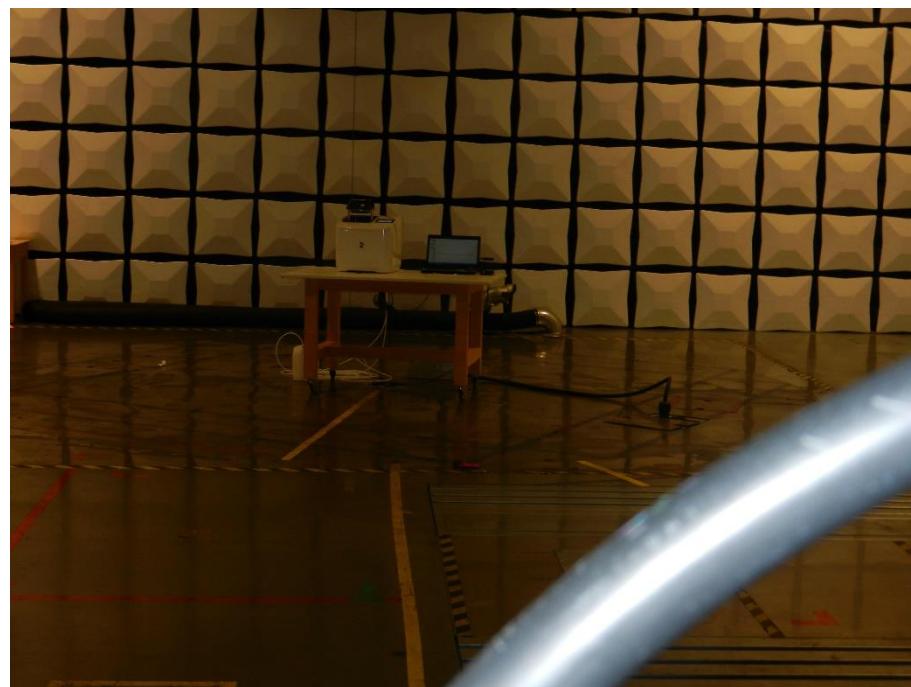


Figure 9 – Radiated Emissions 9 kHz – 30 MHz



Figure 10 - Radiated Emissions 30 MHz – 1 GHz

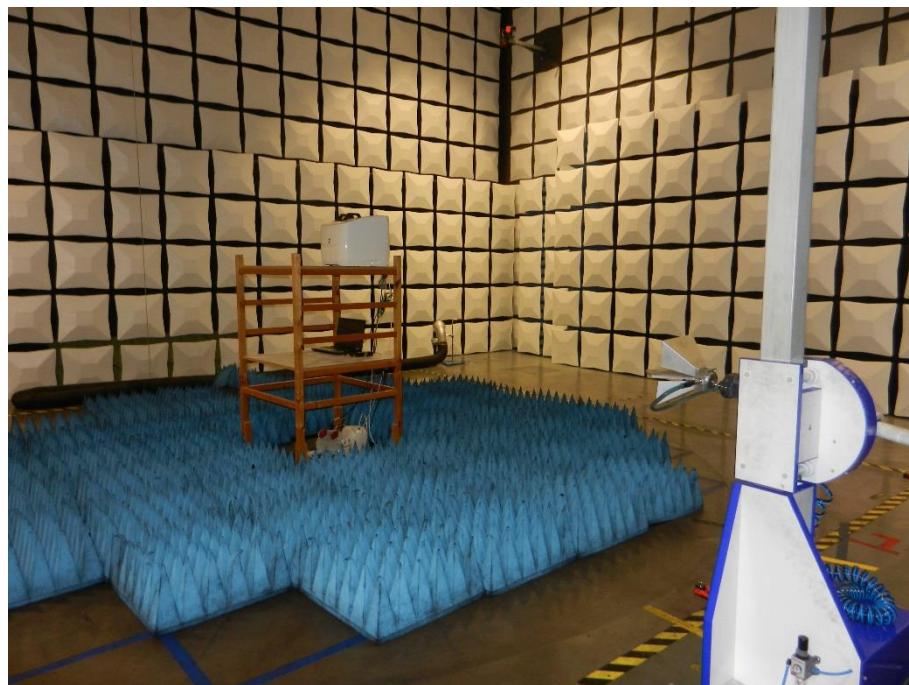


Figure 11 - Radiated Emissions 1 GHz – 2 GHz



Figure 12 – RF Exposure Measurement

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	$\pm 1.14 \%$	2
RF-Frequency error	1.96	$\pm 1 \cdot 10^{-7}$	7
RF-Power, conducted carrier	2	$\pm 0.079 \text{ dB}$	2
RF-Power uncertainty for given BER	1.96	$+0.94 \text{ dB} / -1.05$	7
RF power, conducted, spurious emissions	1.96	$+1.4 \text{ dB} / -1.6 \text{ dB}$	7
RF power, radiated			
25 MHz – 4 GHz	1.96	$+3.6 \text{ dB} / -5.2 \text{ dB}$	8
1 GHz – 18 GHz	1.96	$+3.8 \text{ dB} / -5.6 \text{ dB}$	8
18 GHz – 26.5 GHz	1.96	$+3.4 \text{ dB} / -4.5 \text{ dB}$	8
40 GHz – 170 GHz	1.96	$+4.2 \text{ dB} / -7.1 \text{ dB}$	8
Spectral Power Density, conducted	2.0	$\pm 0.53 \text{ dB}$	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	$\pm 2.89 \%$	2
6 kHz – 25 kHz	2	$\pm 0.2 \text{ dB}$	2
Maximum frequency deviation for FM	2	$\pm 2.89 \%$	2
Adjacent channel power 25 MHz – 1 GHz	2	$\pm 2.31 \%$	2
Temperature	2	$\pm 0.39 \text{ K}$	4
(Relative) Humidity	2	$\pm 2.28 \%$	2
DC- and low frequency AC voltage			
DC voltage	2	$\pm 0.01 \%$	2
AC voltage up to 1 kHz	2	$\pm 1.2 \%$	2
Time	2	$\pm 0.6 \%$	2

Table 28

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Table 29

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	$\pm 0.9\%$	2
Frequency setting	2	$\pm 0.1\%$	2
Electrical Transient Transmission in Road Vehicles			4

Table 30

Note 1:

The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of $kp = 2$, providing a level of confidence of $p = 95.45\%$

Note 2:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $kp = 2$, providing a level of confidence of $p = 95.45\%$

Note 3:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $kp = 2.05$, providing a level of confidence of $p = 95.45\%$

Note 4:

It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95% confidence.

Note 5:

The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of $kp = 2$, providing a level of confidence of $p = 95.45\%$

Note 6:

The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of $kp = 2$, providing a level of confidence of $p = 95.45\%$

Note 7:

The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of $kp = 1.96$, providing a level of confidence of $p = 95.45\%$

Note 8:



Product Service

The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$