

<b>Prüfbericht-Nr.:</b> <i>Test Report No.:</i>	<b>19111401.f01</b>	<b>Auftrags-Nr.:</b> <i>Order No.:</i>	<b>89003296</b>	Seite 1 von 24 Page 1 of 24
<b>Kunden-Referenz-Nr.:</b> <i>Client Reference No.:</i>	<b>19KLC00467</b>	<b>Auftragsdatum:</b> <i>Order date:</i>	<b>04-12-2019</b>	
<b>Auftraggeber:</b> <i>Client:</i>	<b>Nedap NV Light Controls, Parallelweg 2, Groenlo, The Netherlands, 7141DC</b>			
<b>Prüfgegenstand:</b> <i>Test item:</i>	<b>4kW Lamp Driver</b>			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type No.:</i>	<b>4kW Lamp Driver</b>			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	<b>Testing EMC</b>			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	<ul style="list-style-type: none"> <li>- FCC 47 CFR Part 15B (US) INCL. ICES-003 (Canada)</li> <li>- FCC 47 CFR PART 18: (10-1-18 Edition)</li> </ul>			

<b>Wareneingangsdatum:</b> <i>Date of receipt:</i>	<b>06-12-2019</b>	
<b>Prüfmuster-Nr.:</b> <i>Test sample No.:</i>	<b>EMC Sample 2</b>	
<b>Prüfzeitraum:</b> <i>Testing period:</i>	<b>06-12-2019 – 09-12-2019</b>	
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	<b>Leek</b>	
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	<b>TÜV Rheinland Nederland B.V. Leek Laboratory</b>	
<b>Prüfergebnis*:</b> <i>Test result*:</i>	<b>Pass</b>	

<b>Gepüft von / tested by:</b>			<b>Kontrolliert von / reviewed by:</b>		
13-12-2019	W. Brouwer / EMC Test Engineer		13-01-2020	K.F. van der Molen / Senior Expert EMC	
<b>Datum</b> <i>Date</i>	<b>Name / Stellung</b> <i>Name / Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name / Stellung</b> <i>Name / Position</i>	<b>Unterschrift</b> <i>Signature</i>

<b>Sonstiges / Other:</b>	<b>None</b>
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<b>Zustand des Prüfgegenstandes be Anlieferung: 1</b> <i>Condition of the test item at delivery: 1</i>	<b>Prüfmuster vollständig und unbeschädigt</b> <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) a.m. test specification(s) N/A = not applicable N/T = not tested</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.**  
*This test report only relates to the a.m. testsample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This report does not entitle to carry any test mark*

Prüfbericht-Nr: 19111401.f01  
Test report No: 19111401.f01

Seite 2 von 24  
Page 2 of 24

**Liste der verwendeten Prüfmittel**  
**List of used test equipment**

Prüfmittel Nr. / ID-Nr. Equipment No. / ID-No.	Prüfmittel Test equipment			Nächste Kalibrierung Next calibration
<b>Conducted emission</b>				
A00726 / 2789421	Rohde & Schwarz	ESCS30	Measurement Receiver	1-11-2020
A01978 / 2790495	Rohde & Schwarz	ESH3-Z2	Impulse Limiter	14-6-2020
A00051 / 2788823	Rohde & Schwarz	ESH3-Z2	Impulse Limiter	23-9-2020
A01980 / 2790497	Rohde & Schwarz	ESCS 30	Test Receiver.	17-7-2020
A00023 / 2788795	Emco	3625/2	LISN 5 uH / 50 ohm	23-9-2020
A00354 / 2789124	Rohde & Schwarz	ESH2-Z5	LISN- artificial Network	19-8-2020
A00019 / 2788791	Rohde & Schwarz	ESH2-Z5	LISN- artificial Network	30-6-2020
A00093 / 2788866	COMTEST	1415	Conducted Reference Source 9kHz-50MHz	4-6-2020
A02011 / 2790528	Rohde & Schwarz	ESH 3-Z5	LISN	23-9-2020
<b>Radiated emission</b>				
A00314 / 2789083	Rohde & Schwarz	ESCI	Measurement Receiver (9kHz-3GHz)	20-3-2020
A00337 / 2789106	R&S	FSV30	Signal Analyzer/Spectrum Analyzer	1-8-2020
A00077 / 2788849	Chase	CBL6111B	Biconilog	29-10-2021
A00029 / 2788801	Emco	4610	Gen. field source	30-1-2020
A00235 / 2789009	Siepel	FCC	FCC Test Site Registration nr 786213	15-3-2020
A00313 / 2789082	Comtest		Site registration filing Industry Canada	20-11-2020
A00436 / 2789206	Siepel		S-AR	28-9-2020
A00447 / 2789217	Gigalink	APG0500	RF Cable S-AR	4-3-2020
A00466 / 2789237	Teseq	CBL 6111D	Antenne S-AR, BiLog 30MHz-1GHz	6-11-2020
A01982 / 2790499	Rohde & Schwarz	ESR7	EMI Test Receiver 7GHz	16-8-2020
A00008 / 2788776	Emco	3115	Guide ant. 1-18GHz	19-12-2020
A00009 / 2788777	Emco	3115	Guide ant. 1-18GHz	26-2-2022
A00011 / 2788779	Emco	3116	Guide ant. 18-40GHz	12-2-2022
A00012 / 2788780	Emco	3160-09	Gain horn 18-26.5GHz	12-2-2022
A00209 / 2788982	Emco	3160-09	Gain horn 18-26.5GHz	12-2-2022
A00210 / 2788983	Emco	3160-10	Gain horn 26.5-40GHz	12-2-2022
A00339 / 2789108	H&S	Sucotest 18/Sucoflex 102	Cable RF S-AR >1G setup	23-7-2020
A00340 / 2789109	H&S	Sucotest 18/Sucoflex 102	Cable RF	23-7-2020
A00341 / 2789110	H&S	Sucotest 18/Sucoflex 102	Cable RF	23-7-2020

Prufbericht-Nr: 19111401.f01  
Test report No: 19111401.f01

Seite 3 von 24  
Page 3 of 24

1	<b>Produktdetails</b> <i>Product details</i>	4kW Lamp Driver
2	<b>Bedienelemente</b> <i>Operating elements</i>	None
3	<b>Ausstattung / Zubehör</b> <i>Equipment / Accessories</i>	Laptop, RS485/232 to USB converter, 4kW Load
4	<b>Verwendete Materialien</b> <i>Used materials</i>	Cables
5	<b>Sonstiges</b> <i>Other</i>	None
6	<b>Dieser raport betrifft:</b> <i>This report concerns:</i>	<b>EMC Verification</b>



**Prüfbericht-Nr: 19111401.f01**  
Test report No: 19111401.f01

Seite 4 von 24  
Page 4 of 24

Absatz	Anforderungen – Prüfungen / Requirements - Tests		
Clause			
1	47 CFR Part 15 (10-1-17 Edition) - 15.107(a) ICES-003 (Issue 6, January 2016) – Section 6.1 Table 2  And: 47 CFR Part 18 Subpart C - 18.307	AC Power Line Conducted Emissions  (Lowest limits were used)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
2	47 CFR Part 15 (10-1-17 Edition) - 15.109 ICES-003 (Issue 6, January 2016) – Section 6.2.1 Table 5  And: 47 CFR Part 18 Subpart C - 18.305	Radiated unwanted emissions  (Lowest limits were used)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>

**Zusammenfassung der Prüfergebnisse**  
**Summary of test results**

Prüfung Test	Anwendbar Applicable	Prüfergebnis Test result	Paragraf Paragraph	Messungen unter Akkreditierung ausgeführt under accreditation	Kommentar Remark
Radiated emission < 1000 MHz	Yes	Pass	3.1	Yes	
Radiated emission > 1000 MHz	Yes	Pass	3.2	Yes	
Conducted emission AC port	Yes	Pass	3.3	Yes	

## Table of contents

1	General test configuration.....	7
1.1	Tested system auxiliary details.....	8
1.2	Test methodology.....	9
1.3	Test facility.....	9
1.4	Test conditions.....	9
2	System test configuration.....	9
2.1	Justification.....	9
2.2	EUT mode of operation.....	9
2.3	Special accessories.....	9
2.4	Equipment modifications.....	9
3	Test results Emission according to FCC CRF47 Part 15B and Part 18.....	10
3.1	Enclosure Radiated Emission 30-1000 MHz.....	10
3.2	Enclosure Radiated emission 1000 MHz – 15000 MHz.....	15
3.3	AC Mains Conducted Emission 0.15-30 MHz.....	20

**Prüfbericht-Nr: 19111401.f01**  
*Test report No: 19111401.f01*

Seite 6 von 24  
Page 6 of 24

<b>Revisions</b> <i>Revisions</i>			
<b>Revision</b> Revision	<b>Datum</b> Date	<b>Anmerkung</b> Remark	<b>Verfasser</b> Author
00	13-12-2019	First Release	W. Brouwer

Note: Latest revision report will replace all previous reports

**Prufbericht-Nr: 19111401.f01**  
*Test report No: 19111401.f01*

Seite 7 von 24  
 Page 7 of 24

## CONDITIONS FOR TESTING

### 1 General test configuration.

EUT is switched on to deliver 4kW with the software on the Laptop via the “ Modbus input” connector. A 4kW heater with fan was used as a load.

Remarks

All EMC Emission and Immunity testing has taken place:

- 1) within an environmental temperature range between 15 and 35 degrees Celsius
- 2) within an environmental relative humidity range between 20 and 85%
- 3) within an environmental air pressure range between 860 and 1060 mbar

#### List of used cables

Number	Function	From	To	Length	Remarks
1	AC	EUT	Mains	< 3m	
1	AC	EUT	AUX1 (Load)	< 30m	
1	AC	Mains	AUX1 (Fan)	< 3m	
1	Signal	EUT	AUX2 (USB converter)	< 30m	
1	USB	AUX2 (USB Converter)	AUX3 (PC)	< 3m	

### 1.1 Tested system auxiliary details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

EUT : 4kW Lamp Driver  
Manufacturer : Nedap NV  
Brand : Nedap  
Model : 4kW Lamp Driver  
Serial number : EMC Sample 2  
Voltage input rating : 400 - 480Vrms / L1-L2 + PE, 48 – 63 Hz  
Voltage output rating : 279 - 500V / 14.3 – 9.3A  
Current input rating : 22A max.

AUX1 : Heater 400V  
Manufacturer : Eurom Powerful Products  
Brand : EUROM  
Model : EK 15002  
Serial number : AI0151

AUX2 : USB To RS232/422/485 Converter  
Manufacturer : Trycom Technology Co Ltd  
Brand : TRYCOM  
Model : TRP-C08  
Serial number : -

AUX3 : Laptop  
Manufacturer : Hewlett Packard  
Brand : Hewlett Packard  
Model : EliteBook 820

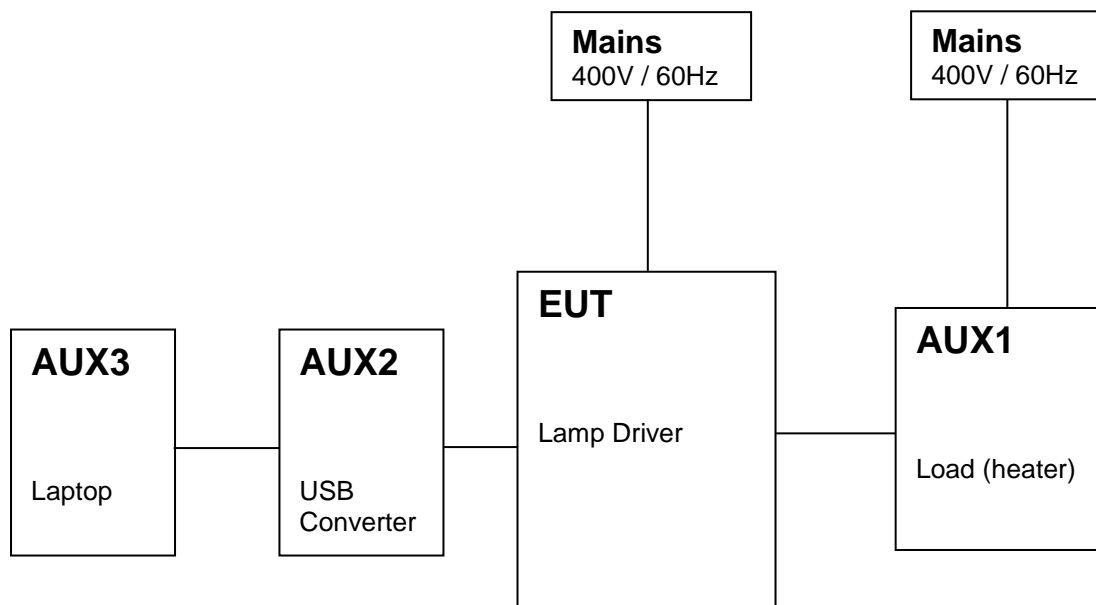


Fig. 1 Test setup



## 1.2 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-17 Edition), sections 15.31, 15.107 and 15.109 and ICES-003 Issue 6 (January 2016) Sections 6.1 and 6.2 and on the requirements of 47 CFR Part 18, sections 18.305, 18.307 and 18.309. The EUT was tested in horizontal position only and is regarded as table top equipment.

The test methods, which have been used, are based on ANSI C63.4-2014 and/or FCC/OST MP-5.

Radiated emission tests were performed at a measurement distance of 3 meters.

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

## 1.3 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located at Eiberkamp 10, 9351 VT Leek, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 786213. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

## 1.4 Test conditions.

Normal test conditions:

Temperature (\*) : +15°C to +35°C  
Relative humidity(\*) : 20 % to 75 %  
Supply voltage : 400 Vac / 60 Hz

# 2 System test configuration.

## 2.1 Justification.

The system was configured for testing in a typical situation as a customer would normally use it. The test sample was configured by the applicant to enable continuous transmit.

The justification and manipulation of cables and equipment in order to simulate a worst-case behaviour of the test setup has been carried out as prescribed in ANSI C63.4-2014 and/or FCC/OST MP-5.

## 2.2 EUT mode of operation.

The unintentional radiator tests have been performed with a complete functioning EUT.

## 2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

## 2.4 Equipment modifications.

No modifications have been made to the equipment.

### 3 Test results Emission according to FCC CRF47 Part 15B and Part 18

#### 3.1 Enclosure Radiated Emission 30-1000 MHz

##### 3.1.1 Definition

Result of the measurements concerning radiated electromagnetic fields (electric component) emitted by the total set-up of the EUT.

##### 3.1.2 Basic standard

The test is performed according to FCC CRF 47 Part 15B § 15.109 and FCC CRF 47 Part 18 § 18.305

##### 3.1.3 Limit

Except for Class A digital devices, the field strength of radiated emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (dB $\mu$ V/m)	Measurement distance (meters)
30-88	40.0	3
88-216	43.5	3
216-960	46.0	3
Above 960	54.0	3

FCC 18.305(c)

Except for Class A digital devices, the field strength of radiated emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (dB $\mu$ V/m)	Measurement distance (meters)
30-88	59.5	3
88-216	54.0	3
216-1000	56.9	3

Table of applicable limits

### **3.1.4 Test procedures**

ANSI C63.4-2014.  
(and FCC/OST MP-5).

Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to 15 GHz, the fifth harmonic of the highest intentional generated frequency. Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit.

### **3.1.5 Test deviation**

There is no deviation with the original standard

**Prufbericht-Nr: 19111401.f01**  
Test report No: 19111401.f01

Seite 12 von 24  
Page 12 of 24

### 3.1.6 Test results

Test conditions			
Applied Standard(s)	FCC CRF 47 Part 15B § 15.109 And: FCC CRF 47 Part 18 § 18.305	Test location	Leek
Test engineer	W. Brouwer	Test result	Pass
Test date	06-12-2019		

Results and limits (Lowest limit used of part 15 or 18)						
Frequency (MHz)	Result (dB $\mu$ V/m)	Antenna polarization	Limit (dB $\mu$ V/m)	Margin	Height (cm)	Angle (deg)
48.53	39.7	Vertical	49.5	9.8	99.6	270.2
55.03	34.7	Vertical	49.5	14.8	100.1	295.6
69.08	39.2	Vertical	49.5	10.3	203.6	18.8
121.90	30.6	Vertical	50.0	19.4	99.6	42.9
415.73	22.0	Horizontal	56.9	34.9	99.6	295.3
731.40	24.9	Vertical	56.9	32.0	99.8	264.8

Table 1 Results Enclosure Radiated Emission 30.0 – 1000 MHz

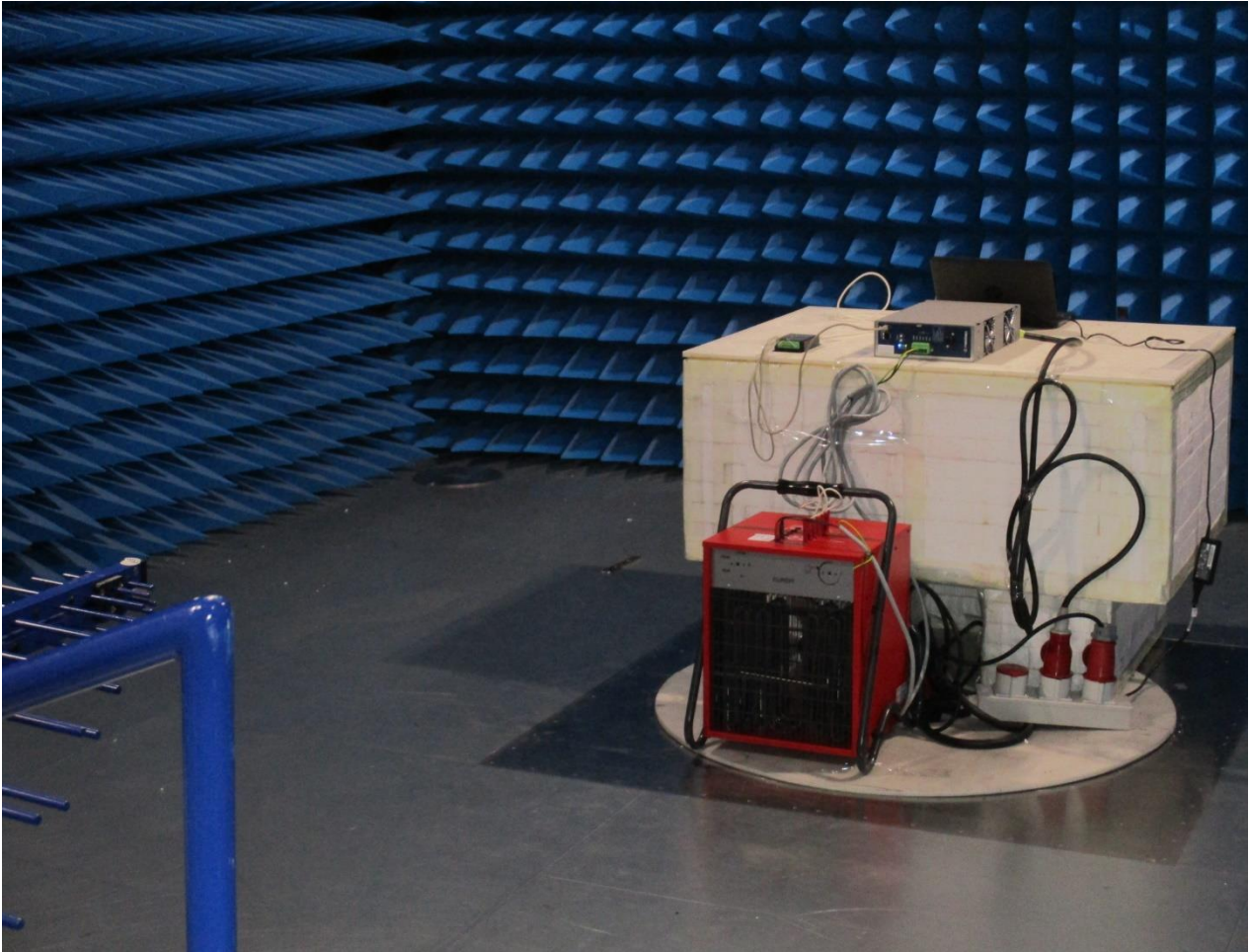
#### Used Equipment

A01982	A00029	A00235	A00313	A00447	A00466				
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#### Notes:

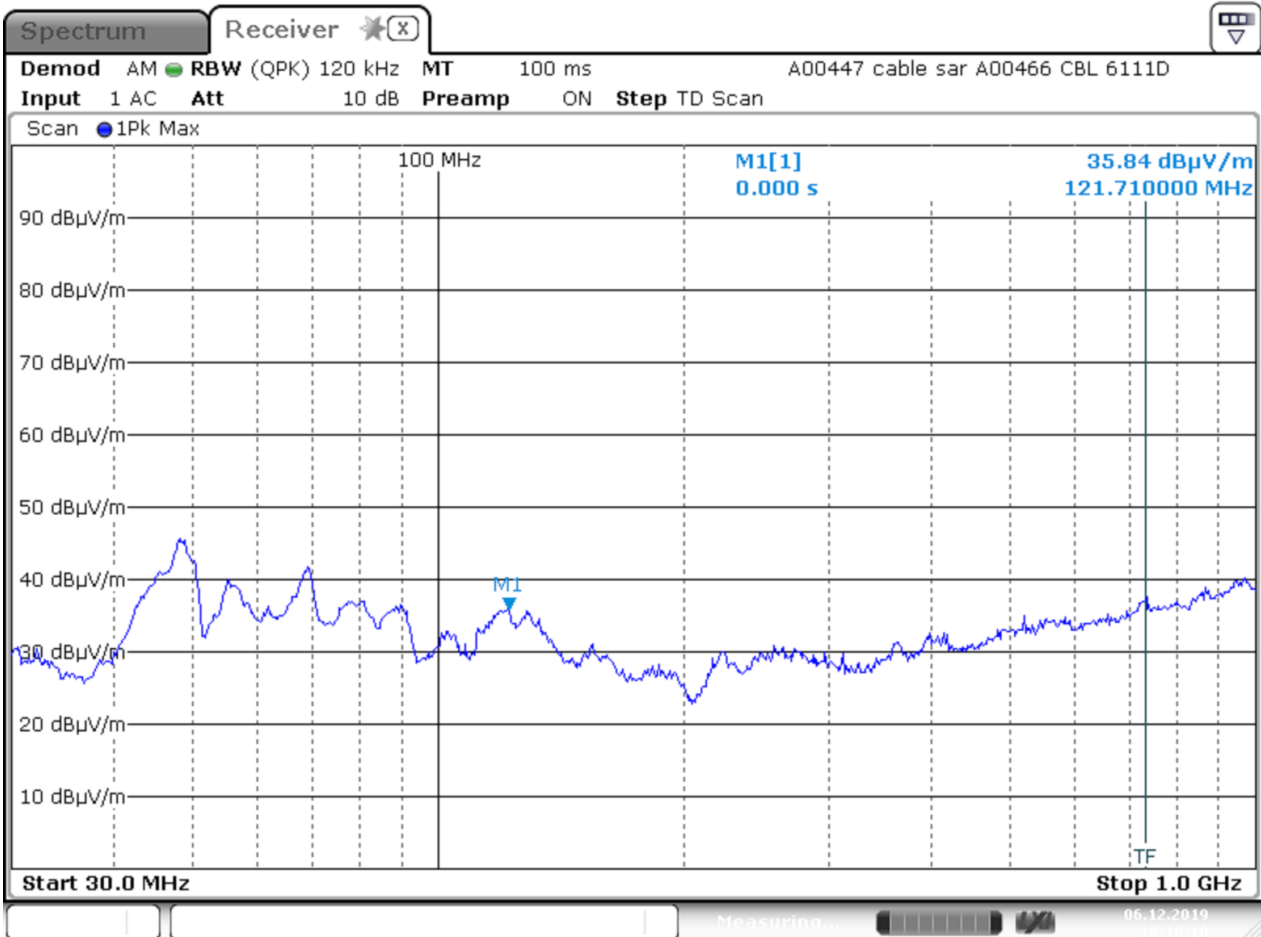
- Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
- Measurement uncertainty is 5.22 dB
- The EUT was tested in horizontal orientation only-it's normal operation orientation, the measuring antenna was varied in horizontal and vertical orientations and also around its axis and height. The reported value is the worst case found at the reported frequency.
- A selection of Photos and Graphical Displays is provided on the next pages.

### 3.1.7 Photograph test setup



*Photo 1 Photograph test setup radiated emissions 30-1000 MHz*

### 3.1.8 Spectrum plot 30 MHz – 1 GHz



Date: 6.DEC.2019 10:16:10

Plot 1: Pre-scan plot with peak detector. Radiated emissions from 30 MHz to 1000 MHz.

### 3.2 Enclosure Radiated emission 1000 MHz – 15000 MHz

Results and limits						
Frequency (GHz)	Peak Results			Average Results		
	Horizontal (dB $\mu$ V/m)	Vertical (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Horizontal (dB $\mu$ V/m)	Vertical (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)
1.20	51.3	48.9	74.0	27.1	25.8	54.0
1.40	41.4	44.0	74.0	26.3	26.2	54.0
1.59	45.8	40.4	74.0	28.8	28.8	54.0
1.77	50.7	52.4	74.0	29.3	28.8	54.0
1.99	51.4	43.7	74.0	30.8	30.0	54.0
6.74	56.4	56.0	74.0	42.7	42.7	54.0
10.67	56.8	56.9	74.0	44.7	44.7	54.0
11.41	65.3	63.7	74.0	52.6	52.5	54.0
14.04	59.0	59.6	74.0	48.1	48.0	54.0

Table 2 Results Enclosure Radiated Emission 1000.0 – 15000 MHz

Notes:

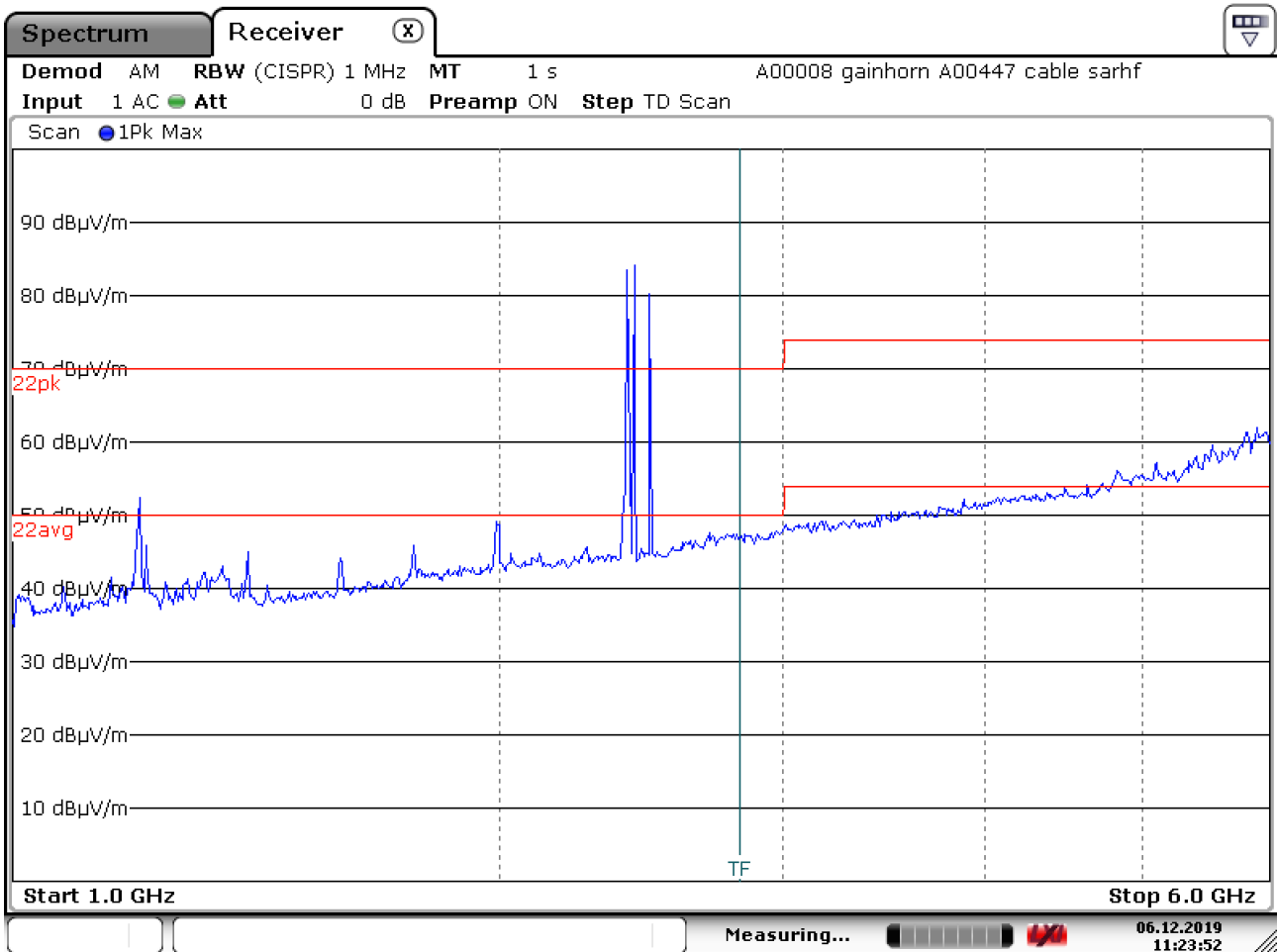
Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.

1. Measurement uncertainty is +/- 5.1 dB
2. The reported field strength values are the worst case values at the indicated frequency. The receiving antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
3. A Peak and Average detector was used with a resolution bandwidth of 1MHz.

Used Equipment

A01982	A00337	A00338	A00235	A00313	A00447	A00008			
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### 3.2.1 Spectrum plot 1 – 6 GHz



Date: 6.DEC.2019 11:23:52

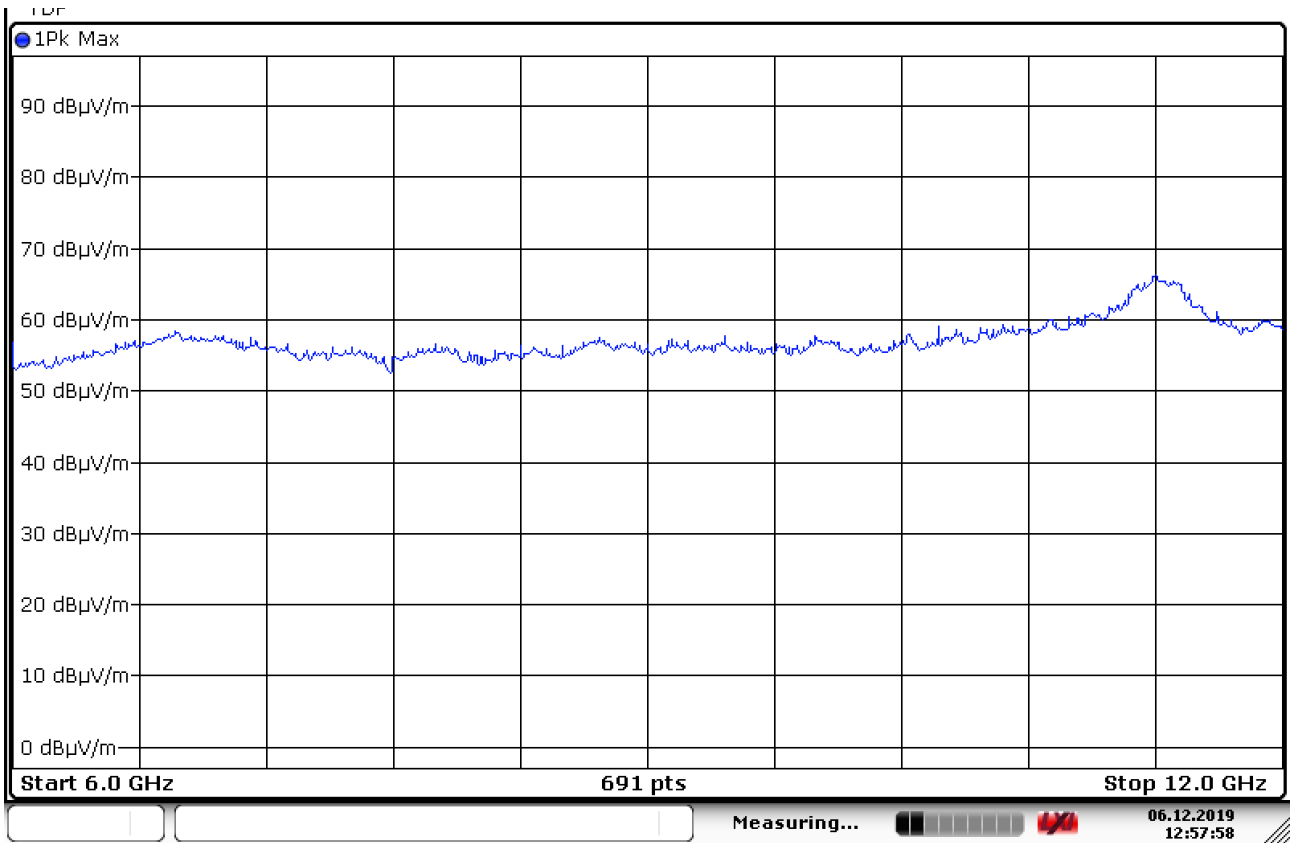
Plot 2: Pre-scan plot with peak detector. Radiated emissions from 1 GHz – 6 GHz.



Prüfbericht-Nr: 19111401.f01  
Test report No: 19111401.f01

Seite 17 von 24  
Page 17 of 24

### 3.2.2 Spectrum plot 6 – 12 GHz



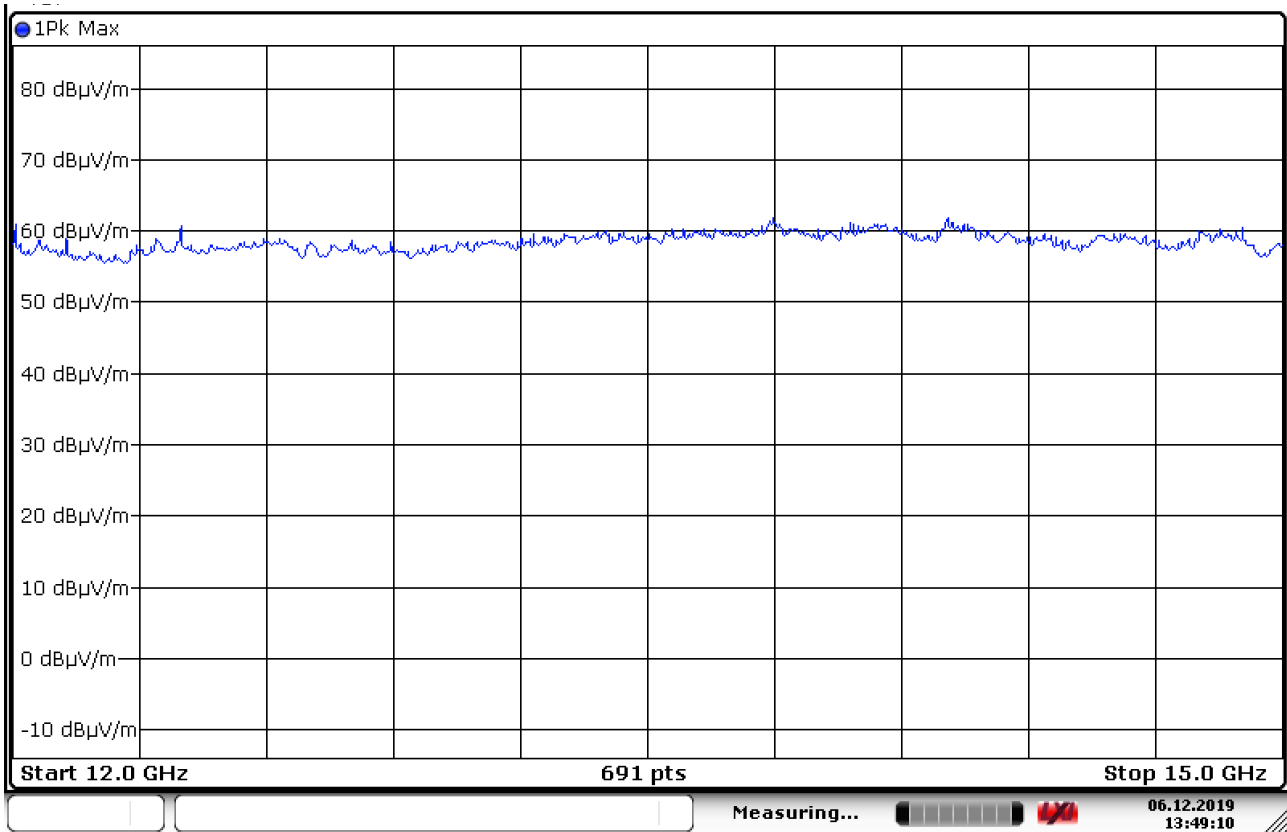
Date: 6.DEC.2019 12:57:57

Plot 3: Pre-scan plot with peak detector. Radiated emissions from 6 GHz – 12 GHz.

Prufbericht-Nr: 19111401.f01  
Test report No: 19111401.f01

Seite 18 von 24  
Page 18 of 24

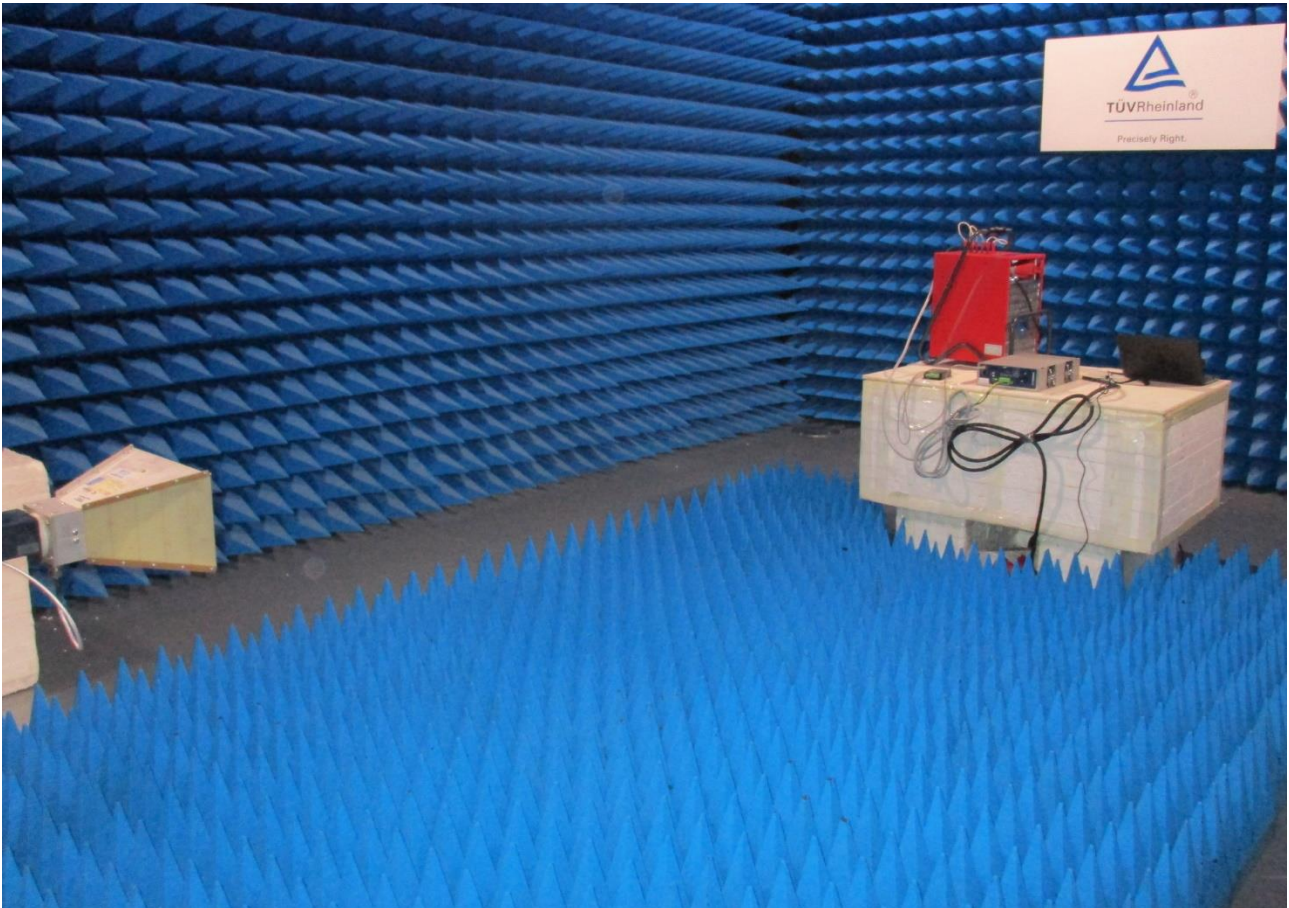
### 3.2.3 Spectrum plot 12 – 15 GHz



Date: 6.DEC.2019 13:49:10

Plot 4: Pre-scan plot with peak detector. Radiated emissions from 12 GHz – 15 GHz.

### 3.2.4 Photograph test setup



*Photo 2: Photograph radiated emissions 1 – 15000 GHz*

### 3.3 AC Mains Conducted Emission 0.15-30 MHz

#### 3.3.1 Definition

Result of the measurements concerning the disturbance voltage level at the power input port emitted by the total set-up of the EUT.

#### 3.3.2 Basic standard

The test is performed according to FCC CRF 47 Part 15B § 15.107 and FCC CFR 47 Part 18 § 18.307

#### 3.3.3 Limits

FCC CRF 47 Part 15B:

Frequency (MHz)	Limit Quasi-peak(dB $\mu$ V)	Limit Average(dB $\mu$ V)
0.15 - 0.50	66.0 – 56.0	56.0 – 46.0
0.50 - 5.0	56.0	46.0
5.0 – 30.0	60.0	50.0

FCC CFR 47 Part 18:

Frequency (MHz)	Limit Quasi-peak(dB $\mu$ V)	Limit Average(dB $\mu$ V)
0.45 – 1.6	60.0	50.0
1.6 – 30.0	69.5	59.5

#### 3.3.4 Test procedures

Requirements: 15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the table above, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Test procedure according to ANSI C63.4-2014: Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50  $\mu$ H / 50  $\Omega$  LISN. The frequency range from 150kHz to 30MHz was examined. The six highest EUT emissions relative to the limit were noted. The EUT was positioned at least 40cm from a vertical ground reference plane and at least 80cm from the LISN.

#### 3.3.5 Test deviation

There is no deviation with the original standard

**Prufbericht-Nr: 19111401.f01**  
Test report No: 19111401.f01

Seite 21 von 24  
Page 21 of 24

### 3.3.6 Test results

Test conditions			
		Test location	Leek
Applied Standard(s)	to FCC CRF 47 Part 15B § 15.107 And: FCC CRF 47 Part 18 § 18.307		
Test engineer	W. Brouwer	Test result	Pass
Test date	09-12-2019		

Results and limits L1 (Lowest limit of Part 15 or 18 was used)						
Frequency (MHz)	Quasi peak detector			Average detector		
	Result	Limit	Margin	Result	Limit	Margin
0.16	61.3	65.5	4.1	40.0	55.5	15.5
0.17	62.2	65.0	2.7	45.5	55.0	9.5
0.19	58.0	64.0	6.1	39.9	54.0	14.1
0.20	58.3	63.6	5.3	38.4	53.6	15.3
0.25	47.9	61.8	13.8	30.0	51.8	21.7
3.13	48.4	56.0	7.6	36.4	46.0	9.6
9.96	39.6	60.0	20.4	32.2	50.0	17.8

Results and limits L2( Lowest limit of Part 15 or 18 was used)						
Frequency (MHz)	Quasi peak detector			Average detector		
	Result	Limit	Margin	Result	Limit	Margin
0.16	61.8	65.5	3.7	40.3	55.5	15.1
0.17	62.7	65.0	2.2	45.8	55.0	9.2
0.19	58.6	64.0	5.5	40.4	54.0	13.7
0.20	59.0	63.6	4.6	38.9	53.6	14.7
0.25	48.9	61.8	12.8	30.8	51.8	20.9
3.13	48.6	56.0	7.4	36.3	46.0	9.7
9.96	44.8	60.0	15.2	36.4	50.0	13.6

Table 3 Results Conducted Emission 0.15 - 30 MHz

The results of the AC power line conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.107, 18.307 and ICES-003 Section 6.1, at the 400 Volts AC mains connection terminals of the system, are depicted in Table 3. Maximum values were recorded. The system is tested as in whole, so with all equipment as shown in Figure 1 in place and functioning. Being the worst case situation.

Notes:

1. Measurement uncertainty is  $\pm 3.5$ dB
2. The resolution bandwidth used was 9 kHz.
3. The six highest values relative to the applicable limits were noted.
4. Photo and Graphical Display is provided on the next page.

Used Equipment

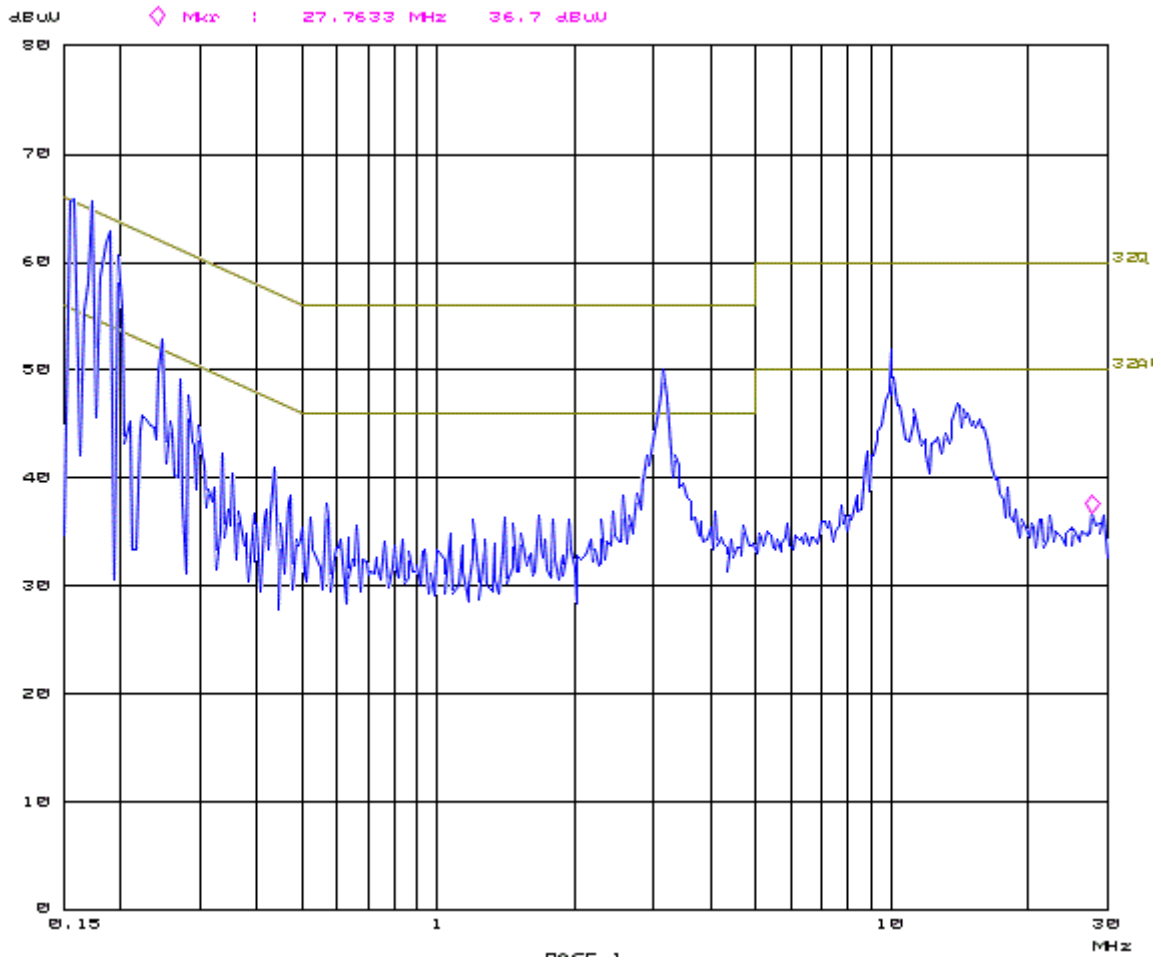
A00726	A01978	A00022	A00354	A00093				
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Photograph test setup



Photo 3: Photograph conducted emissions 0.15-30 MHz

### 3.3.7 Spectrum plot



Plot 5: Pre-scan plot with peak detector. Conducted emissions from 0.15 - 30 MHz.

**Prufbericht-Nr: 19111401.f01**  
*Test report No: 19111401.f01*

Seite 24 von 24  
Page 24 of 24

END OF THIS EMC TESTREPORT