

<b>Prüfbericht-Nr.:</b> Test Report No.:	<b>20042101.r02</b>	<b>Auftrags-Nr.:</b> Order No.:	<b>89003933</b>	Seite 1 von 25 Page 1 of 25
<b>Kunden-Referenz-Nr.:</b> Client Reference No.:	<b>POC-LM-000544</b>	<b>Auftragsdatum:</b> Order date:	<b>2020-05-12</b>	
<b>Auftraggeber:</b> Client:	<b>Nedap N.V., Parallelweg 2 7141 DC Groenlo, Netherlands</b>			
<b>Prüfgegenstand:</b> Test item:	<b>134.2 kHz Inductive RFID tag Reader</b>			
<b>Bezeichnung / Typ-Nr.:</b> Identification / Type No.:	<b>VP1105B</b>			
<b>Auftrags-Inhalt:</b> Order content:	<b>Compliance with regulatory requirements</b>			
<b>Prüfgrundlage:</b> Test specification:	<b>47 CFR PART 15 (10-1-19 EDITION), Subpart 15C RSS-Gen (Issue 5 April 2018) General Requirements for Compliance of Radio Apparatus and RSS-210 (Issue 10 Dec 2019) Licence-exempt Radio Apparatus. -</b>			

<b>Wareneingangsdatum:</b> Date of receipt:	<b>2020-05-29</b>
<b>Prüfmuster-Nr.:</b> Test sample No.:	<b>20042101-1</b>
<b>Prüfzeitraum:</b> Testing period:	<b>2020-06-10 / 2020-06-18</b>
<b>Ort der Prüfung:</b> Place of testing:	<b>Leek</b>
<b>Prüflaboratorium:</b> Testing laboratory:	<b>TÜV Rheinland Nederland B.V. Leek Laboratory</b>
<b>Prüfergebnis*:</b> Test result*:	<b>Pass</b>



<b>geprüft von / tested by:</b>			<b>genehmigt von / reviewed &amp; authorized by:</b>		
<i>Datum /date:</i> 2020-06-18 Richard van der Meer, Expert			<i>Datum /date:</i> 2020-06-18 Erik van der Wal, Expert		
<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> <i>issue date is equal to authorized date</i>					
<b>Zustand des Prüfgegenstandes bei Anlieferung:2</b> <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
<div>* 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</div> <div><i>Legend:        1 = very good                      2 = good                      3 = satisfactory                      4 = sufficient                      5 = poor</i> <i>P(ass) = passed a.m.    Test specification(s)    F(ail) a.m. test specification(s)    N/A = not applicable    N/T = not tested</i></div>					
<div><b>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.</b> <i>This test report only relates to the above mentioned 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</i></div>					

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## TEST SUMMARY

Test Specification Clause	Test Case	Pass	Fail	Not applicable	Not performed
§15.209 / RSS-Gen Table 5	Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.207 / RSS-Gen Table 4	AC Power Line Conducted Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Revisions Revisions

Revision Revision	Datum Date	Anmerkung Remark	Verfasser Author
-	2020.06.18	First release	R. van der Meer

Note: Latest revision report will replace all previous reports

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## **1. General Remarks**

### **1.1.1 Complementary Materials**

There is no attachment to this test report.

### **1.1.2 Special Accessories**

None.

### **1.1.3 Equipment modifications**

None

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## **2. Test Sites**

### **2.1 Test Facilities**

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meters. The site is listed with the FCC and ISED and accredited by RvA (Cert #L484). The 3 meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meter. H-field measurements have been done in the Semi-Anechoic chamber to identify emissions from the EUT and final testing been performed on the outside facilities at 3m, 5m and 10m distance.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located in Leek, 9351VT Eiberkamp 10, 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 Designation Number NL0005 (test site 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 CABID number NL0002 (test site 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.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 25 Vdc.

*(\*)When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.*

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## 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
<b>For Radiated Emissions</b>					
Measurement Receiver	Rohde & Schwarz	ERC7	2790499	08/2019	08/2020
RF Cable S-AR	Gigalink	APG0500	2789217	03/2020	03/2021
Test facility	Comtest	FCC listed: 786213 IC: 2932G-2	2789009	03/2020	03/2022
Spectrum Analyzer	Rohde & Schwarz	FSV	2790106	07/2018	07/2020
Antenna mast+control	Innco	CO3000	9002463	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	2789214	07/2019	07/2020
Biconilog Testantenna	Teseq	CBL 6111D	2789237	11/2019	11/2020
Magnetic Loop Antenna, Active	Chase	HLA-6120	2790033	12/2017	12/2020
Magnetic Loop Antenna, Passive	EMCO	6509	2788774	12/2017	12/2020
25Vdc power supply	Delta Elektronika	E 030-3	2788897	02/2020	02/2021
120Vac source	EMtest	DPA500N	2789197	11/2019	11/2021

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
<b>For AC Powerline Conducted Emissions</b>					
Pulse limiter	R&S	ESH3-Z2	2788823	09/2019	09/2020
120Vac source	EMtest	DPA500N	2789197	11/2019	11/2021
LISN	Rohde & Schwarz	ESH2-Z5	2788791	06-27/2018	06-27/2020
Measurement Receiver	Rohde & Schwarz	ESCS30	2790497	07/2019	07/2020
Shielded room for Conducted emissions	--	--	2789207	NA	NA
Temperature-Humiditymeter	Extech	SD500	2789211	07/2019	07/2020
25Vdc power supply	Delta Elektronika	E 030-3	2788897	02/2020	02/2021

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing. NA= Not Applicable

### Accreditation

The reported tests were performed under ISO17025 accreditation, unless otherwise specified as 'not under Accreditation'. An overview of all TÜV Rheinland Nederland B.V. accreditations, notifications and designations, please visit our website [www.tuv.com/nl](http://www.tuv.com/nl). You can find the relevant declarations under the download link.

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## 2.3 Measurement Uncertainty

**Table 2: Emission Measurement Uncertainty**

Measurement Type	Frequency	Uncertainty
Radiated Emission	9kHz - 30MHz	±5.0dB
	30MHz - 1GHz	±5.0dB
AC Power Line Conducted Emissions	150kHz - 30MHz	±3.5dB

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### 3. General Product Information

The EUT is used for electronic animal identification through RFID. The EUT has the capability of operating on 134.2 kHz. For details refer to the User Guide, data sheet and circuit diagram.

#### Technical Specifications

Technical Specifications	Value
Operating Frequency	134.2 kHz
Channel number	1
Operation Voltage	25 Vdc
Modulation	None
Antenna Type tested	Internal magnetic wire loop
Antenna Gain	-(loop antenna)

#### 3.1 Countermeasures to achieve compliance

No additional measures were employed to achieve compliance.

#### 3.2 Operation Modes

Testing was performed at 134.2 kHz, the only operating frequency at MaximumHfPowerLevel of 100%. Extra power option=1 for maximum boost was enabled.



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### 3.3 Physical Configuration for Testing

The EUT was tested on a stand-alone basis as per Figure 1.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2013.

Test setup as in Fig.1. After starting VPU (on AUX4), connection with the tags is made automatically.

List of tested cables					
Number	Function	From	To	Length	Remarks
1	mains	mains	AUX4&5	> 3m	Both in one screened cable
2	DC power Main	AUX5	AUX3	> 3m	
3	DC power &CAN EUT	AUX3	EUT	> 3m	-
4	com	AUX3	AUX4	<3m	-

See Figure 1 on the next page.

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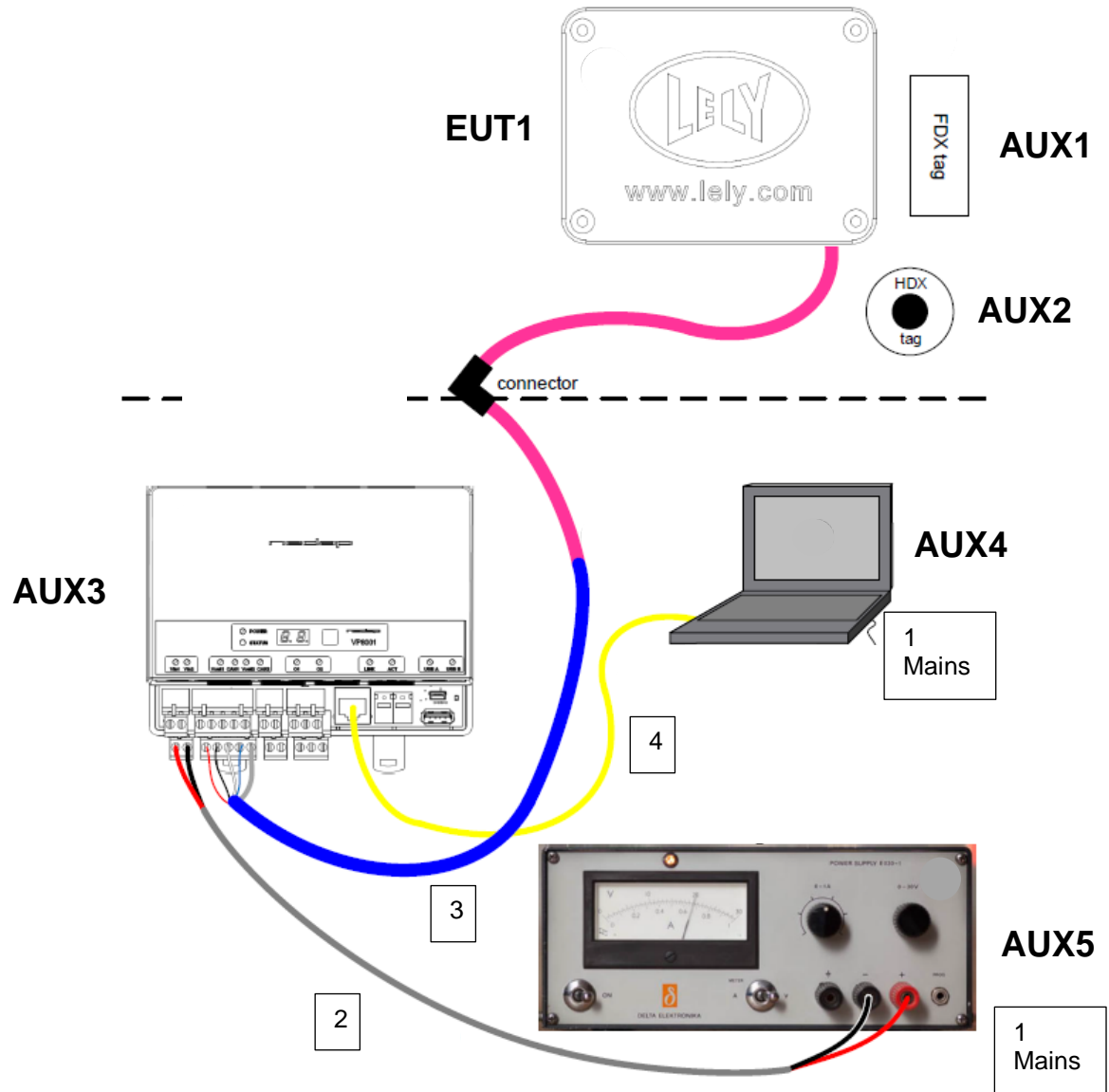


Figure 1: Test Setup Diagram

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### **3.4 Special Accessories and Auxiliary Equipment**

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

Test item (EUT1)	: Inductive RFID tag Reader
Manufacturer	: Nedap Livestock Management
Brand mark	: Nedap
Model	: VP1105B
Serial number	: 9228004
Applied software	: Nedap VPU

Test item (AUX1)	: RFID transponder
Model	: FDX

Test item (AUX2)	: RFID Transponder
Model	: HDX

Test item (AUX3)	: Processing control unit
Manufacturer	: Nedap Livestock Management
Brand mark	: Nedap
Model	: VP8001
Serial number	: 9911057

Test item (AUX4)	: Laptop
Manufacturer	: Hewlett Packard
Brand mark	: Hewlett Packard
Model	: EliteBook 840 G6
Serial number	: 5CG93278NN

Test item (AUX5)	: Power Supply
Manufacturer	: Delta Elektronika
Brand mark	: Delta
Model	: E030-3
Serial number	: 08855 (Inventory nr. 2788897)

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## **4. Test Results**

### **4.1.1 20dB and 99% Bandwidth**

#### **RESULT: Pass**

Tested by:

R. van der Meer

Date of testing:

2020-06-18

Requirements:

For 99% Bandwidth: RSS-Gen Section 4.6.1: No requirement is given.

Test procedure 20dB bandwidth:

ANSI C63.10-2013 section 11.8.1

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 200 Hz, video bandwidth to 1kHz and the span wide enough to capture the modulated carrier.

For 99% Bandwidth:

Test procedure: RSS-Gen.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the selected span, Video bandwidth was set to 3 times the resolution bandwidth. The span was set to capture the whole modulation process. The Spectrum analyzers automated function for 99% BW was used.

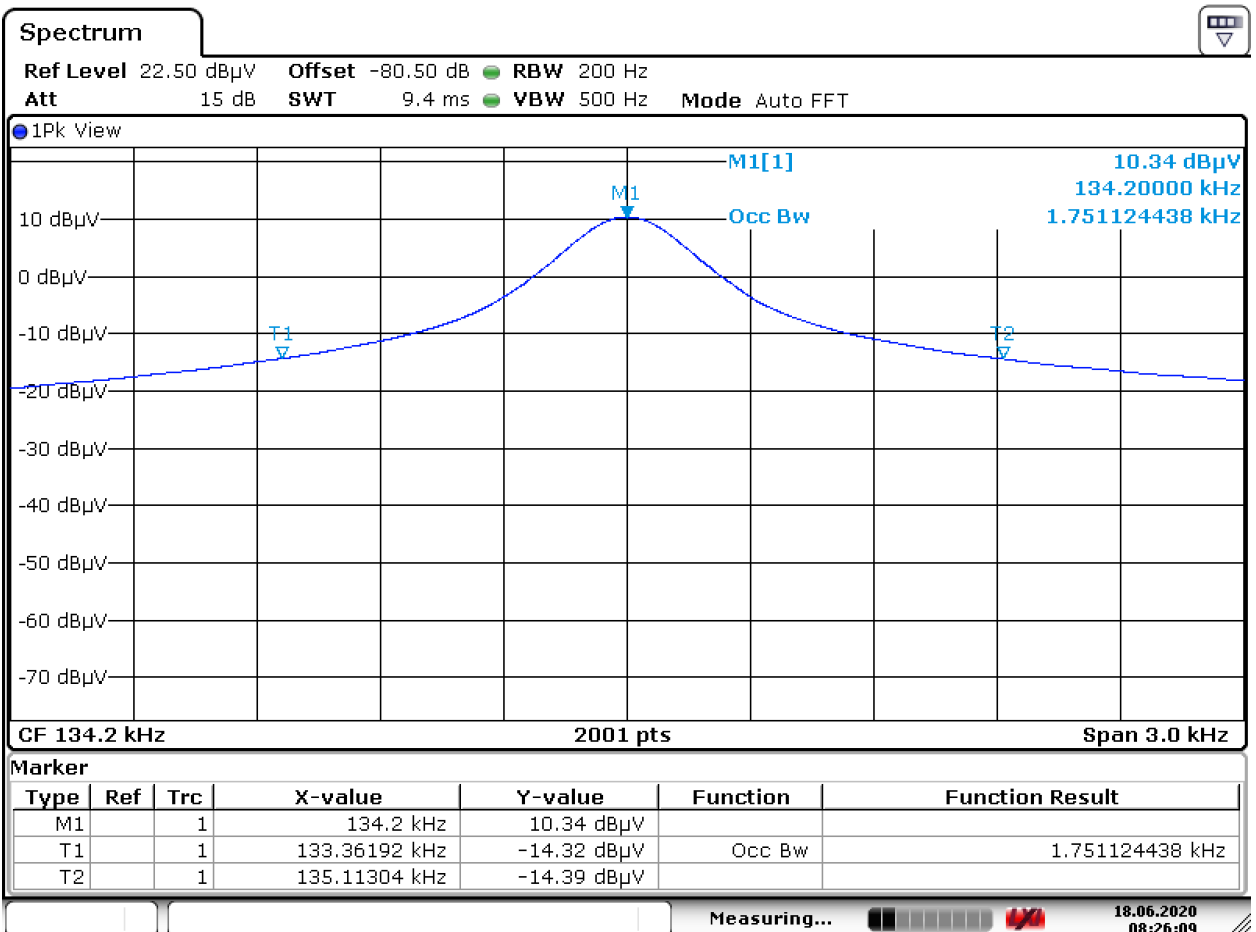
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## 20dB and 99% Bandwidth

Operating Frequency [MHz]	99% Bandwidth [kHz]	20dB Bandwidth [kHz]	Plot number
0.1342	1.75	1.02	A1/A2



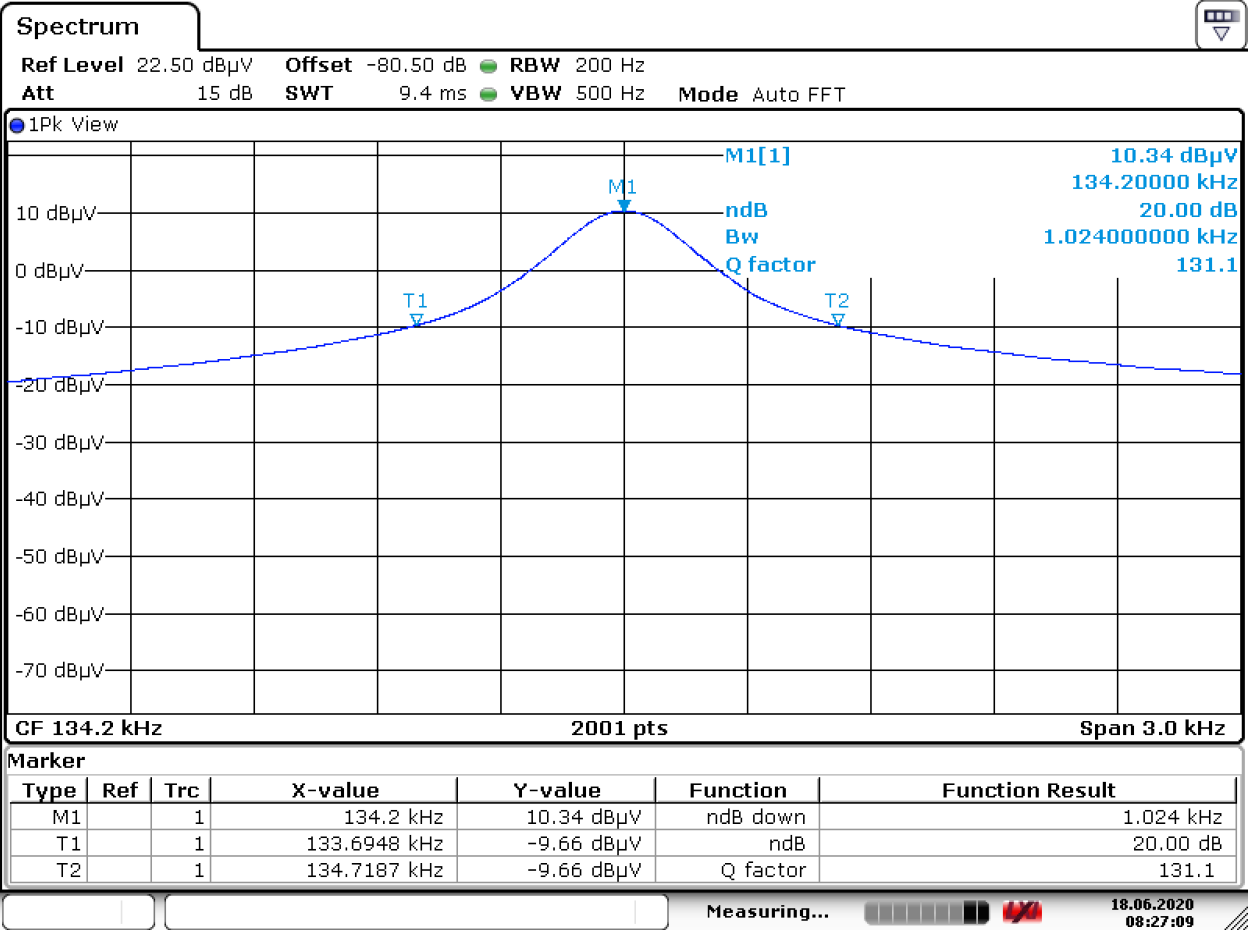
Date: 18.JUN.2020 08:26:09

Plot A1, 99% dB BW,  
with tags (is worst case)

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Date: 18.JUN.2020 08:27:08

Plot A2 20 dB BW, with tags (is worst case)

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## 4.1.2 Radiated Emissions of Transmitter

### RESULT: Pass

Tested by:

R. van der Meer

Date of testing:

2020-06-15 / 2020-06-17

Frequency range:

9kHz - 1GHz

Requirements:

FCC 15.209 and RSS-Gen

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following tables:

Frequency (MHz)	Field strength (microvolts/meter)	Field strength (dB $\mu$ V/m)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	43.5-13.8	300
0.490-1.705	24000/F(kHz)	33.8-22.9	30
1.705-30.0	30	29.5	30

Table 2a. Field strength limits

Frequency (MHz)	Field strength ( $\mu$ V/meter)	Field strength (dB $\mu$ V/m)	Measurement distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0 (Av), 74 (Pk)	3

Table 2b applicable limits

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen Table 7, must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen Table 5&6.

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Test procedure:

ANSI C63.10-2013.

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 were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9 kHz to 1 GHz. Radiated emission testing was performed at a distance of 3 meters in a 5 meter semi-anechoic chamber. I

Final radiated emission measurements below 30MHz were made at 3m, 5m and 10m distance on the outside open field facility. The measured values were corrected to the 30m distance using the extrapolation factor of 40dB/decade as per FCC Part 15.31(f)(2) or by determining the proper extrapolation factor by using the measurement results at 3m and 10m 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.



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#### 4.1.3 Radiated field strength measurements H-field, 0.009-30 MHz.

Frequency (MHz)	Measurement results	Measurement results (for info only)	Measurement results	Detector	Extrapolation factor	Measurement results (calculated)	Limits	Pass/Fail
	dBμV @3m	dBμV @5m	dBμV @10m		dB	dBμV/m @300m	dBμV/m @300m	
0.1342 (fundamental)	116,2 (x) 92.4 (y) 93.7 (z)	99.9 (x) 86.2 (y) 89.8 (z)	88.5 (x) 83.5 (y) 86.2 (z)	Pk	105.9 *1	10.3 (x)	45.1	Pass
0.1342 (fundamental)	112.9 (x) 87.8 (y) 89.4 (z)	95.4(x) 78.4 (y) 83.9 (z)	85.7 (x) 75.1 (y) 77.4 (z)	Av	104.0 *1	8.9 (x)	25.1	Pass
0.2684 *H	76,2 (x)	-	-	Pk	80	-3,8 (x)	39.0	Pass
0.2684 *H	43,7 (x)	-	-	Av	80	-36,3 (x)	19.0	Pass
0.4026 *H	55,3 (x)	-	-	Pk	80	-24,7 (x)	35.5	Pass
0.4026 *H	41,6 (x)	-	-	Av	80	-38,4 (x)	15.5	Pass
7,17	45,1 (x)	-	-	Pk <sup>6</sup>	40	5,1 (x)	29.5@30m	Pass

Table 3 Radiated emissions of the EUT

#### Test equipment used (for reference see test equipment listing).

2789083	2790033	2788774	2789217	2788897				

#### Notes:

1. Calculated measurement results are obtained by using the 40 dB/decade extrapolation factor and the antenna factor and cable loss is included. For instance the corrected value for 0.2684 MHz fundamental frequency is calculated as: Measurement result– Extrapolation Factor => 76.2 dBμV– 80 dB = -3.8 dBμV/m. For the fundamental the extrapolation factor is calculated from the measured value obtained at 3m and 10m by using the equation:  $(d1/d2)^n = (H_{d2}/H_{d1})$ .
2. In the frequency range 9 kHz – 10 MHz Peak detector used during measurements with a resolution bandwidth of 9kHz was used. Most Peak values were already within Av limits. For the frequency range 10 MHz – 30 MHz a Quasi peak detector used during measurements with a resolution bandwidth of 9kHz was used.
3. Field strength values of radiated emissions at frequencies in the frequency range 0.009 – 30 MHz not listed in Table 3 are more than 20 dB below the applicable limit. The reported value is the worst case found at the reported frequency. Measurement antenna in axial position was the worst case.
4. Restricted bands were investigated and were found to be below the levels as reported in Table 3.
5. Measurement uncertainty is ±5.0dB.
6. Pk value within Qp limit.

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#### 4.1.4 Radiated Spurious Emissions, 30MHz - 1GHz

Frequency [MHz]	EUT Orientation	Antenna Orientation	Level QP [dB $\mu$ V/m]	Limit QP [dB $\mu$ V/m]	Verdict [Pass/Fail]
30,7	Vertical	Vertical	29.1	40.0	Pass
36,5	Vertical	Vertical	30.1	40.0	Pass
98,6	Vertical	Vertical	24.7	43.5	Pass
236.2	Vertical	Horizontal	34.3	46.0	Pass
300.3	Z	Horizontal	30.1	46.0	Pass
397.3	Z	Vertical	26.5	46.0	Pass

Table 4 Radiated emissions of the EUT

Note:

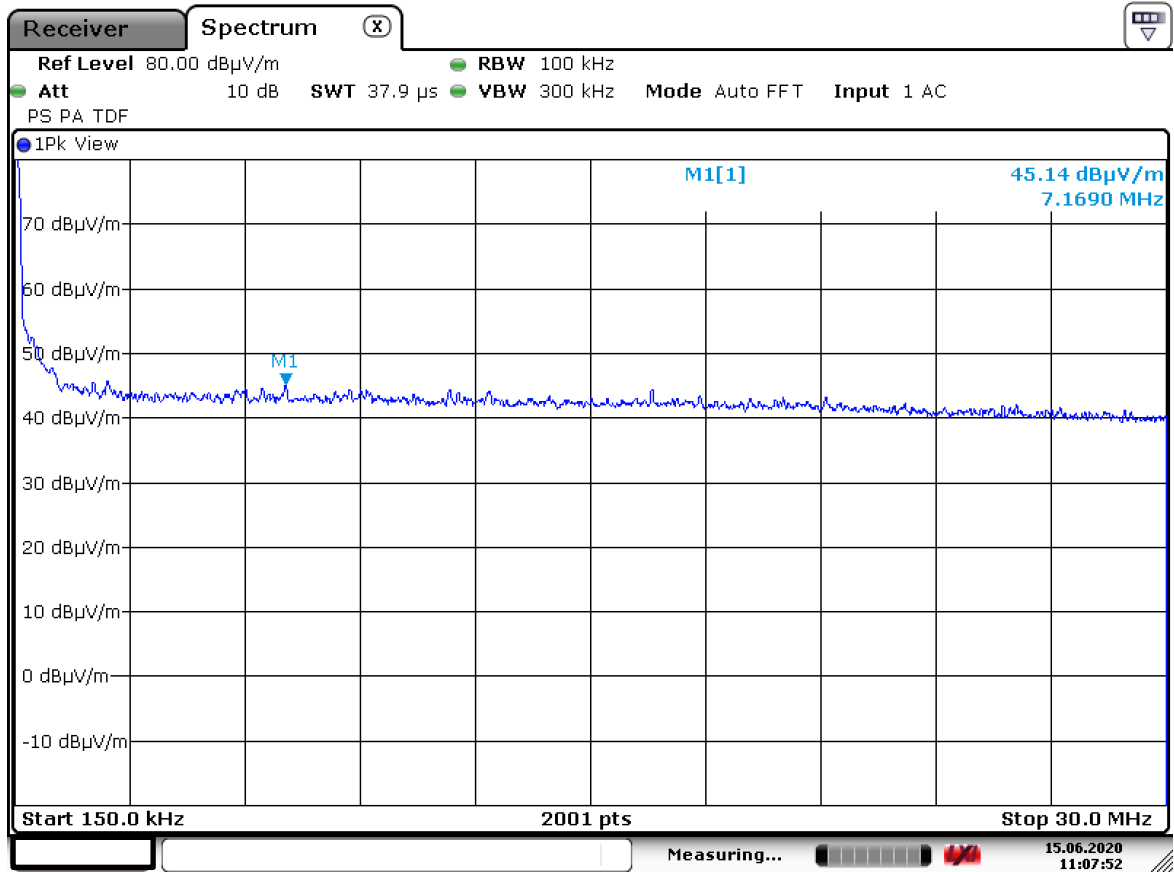
- Level QP = Reading QP + Factor
- Tested in modes as described in section 3.2, the 6 highest values noted.
- \*<sup>R</sup> refers to a frequency in a restricted band, \*<sup>H</sup> refers to a harmonic of the fundamental
- Quasi Peak detector used with a bandwidth of 120 kHz.
- Measurement uncertainty is +/- 5.0 dB.
- a selection of plots are provided on the next pages

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#### 4.1.5 Plots of the emissions



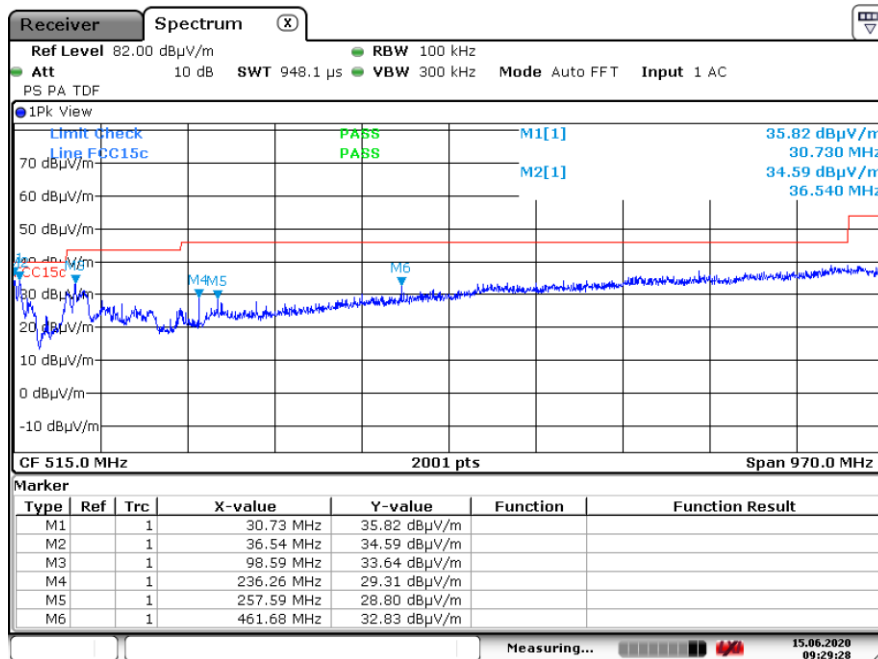
Date: 15.JUN.2020 11:07:52

Plot of the emissions in the range 1 – 30 MHz (Peak detector values shown), EUT vertical

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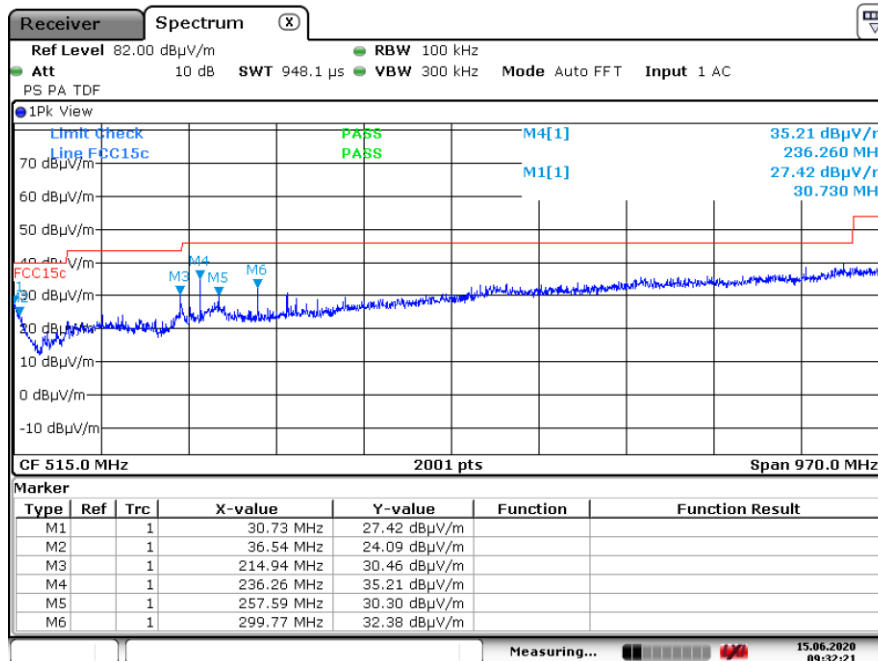
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Date: 15.JUN.2020 09:29:29

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), Test Antenna Vertical EUT vertical (X)



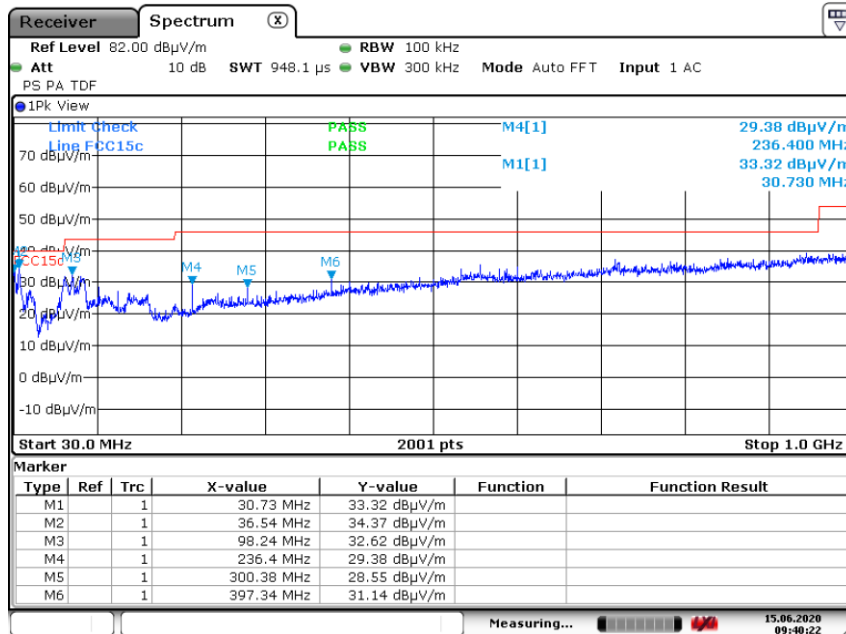
Date: 15.JUN.2020 09:32:21

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), Test Antenna Horizontal, EUT vertical (X)

Test Report No.:

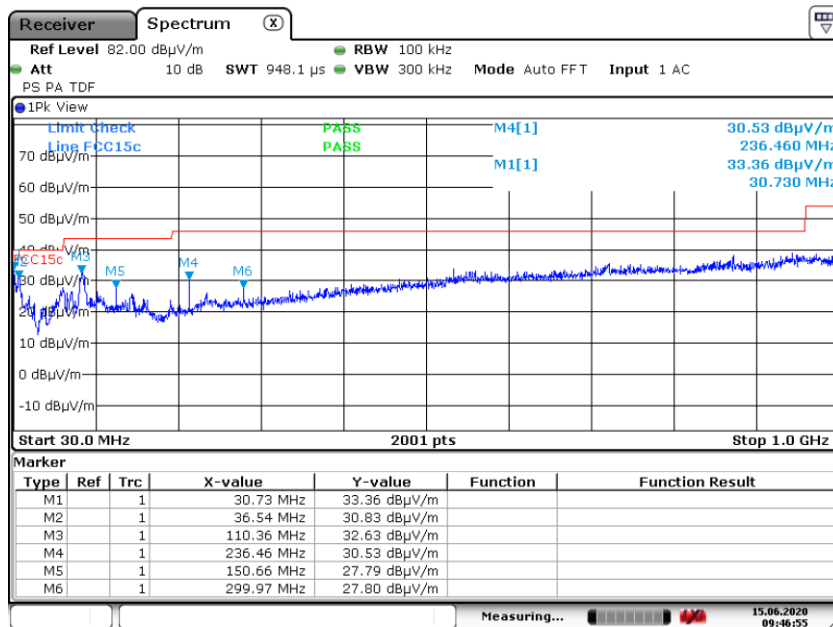
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Date: 15.JUN.2020 09:40:22

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), Test Antenna Vertical EUT horizontal (Y)



Date: 15.JUN.2020 09:46:55

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), Test Antenna Vertical EUT sideways (z)

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## 2 AC Power Line Conducted Measurements

**RESULT: Pass.**

Tested by:

R. van der Meer

Date of testing:

2020-06-10

Requirements: 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 following table, 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.

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

\*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2013.

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 searched. The six highest EUT emissions relative to the limit were noted. The EUT was positioned at least 80cm from the LISN.

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### 2.1.1 AC Power Line Conducted Emission of Transmitter

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.6773	41.7	*	40.1	*	56.0	46.0	Pass
0.7160	41.0	*	41.3	*	56.0	46.0	Pass
0.7242	42.9	*	42.0	*	56.0	46.0	Pass
0.8961	42.3	*	40.1	*	56.0	46.0	Pass
0.9703	35.0	*	36.2	*	56.0	46.0	Pass
1.0055	30.0	*	33.9	*	56.0	46.0	Pass

The results of the AC power line conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a) and RSS-Gen section 8.8, at the 120 Volts/ 60 Hz AC mains connection terminals of AUX5, are depicted in the table above.

#### Notes:

1. The resolution bandwidth used was 9 kHz.
2. From pre-test the worst case configuration proved to be mode wherein the EUT was not scanning a tag. Worst case values noted.
3. Qp values already within Av limits, therefor Av not tested.
4. Measurement uncertainty is +/- 3.5 dB.
5. Plots are provided on the next pages.

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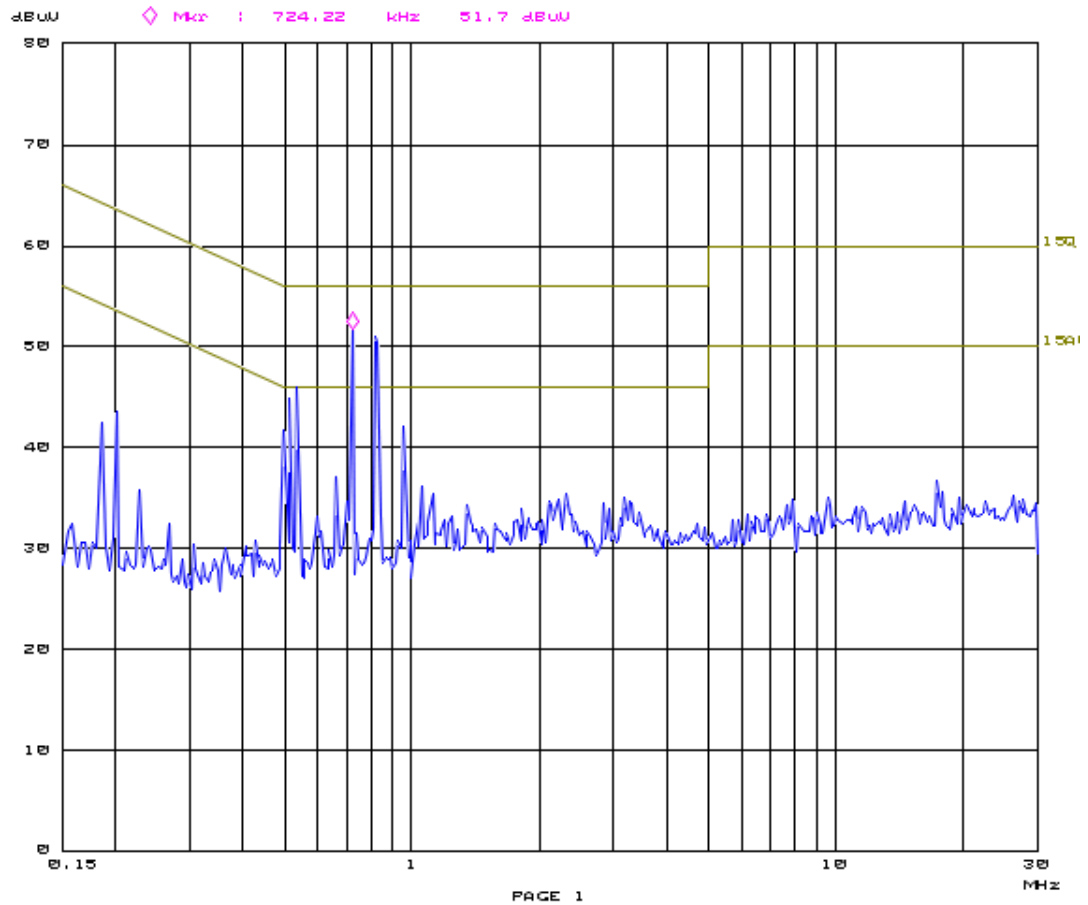
## Plots of the AC Power-line Conducted Emissions

7 GHI

18. Jun 20 14:14

Overview Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	3.9k	9k	PK	0.10ms	20dB LN	OFF



Plot of the AC Power-line Conducted emissions on L1



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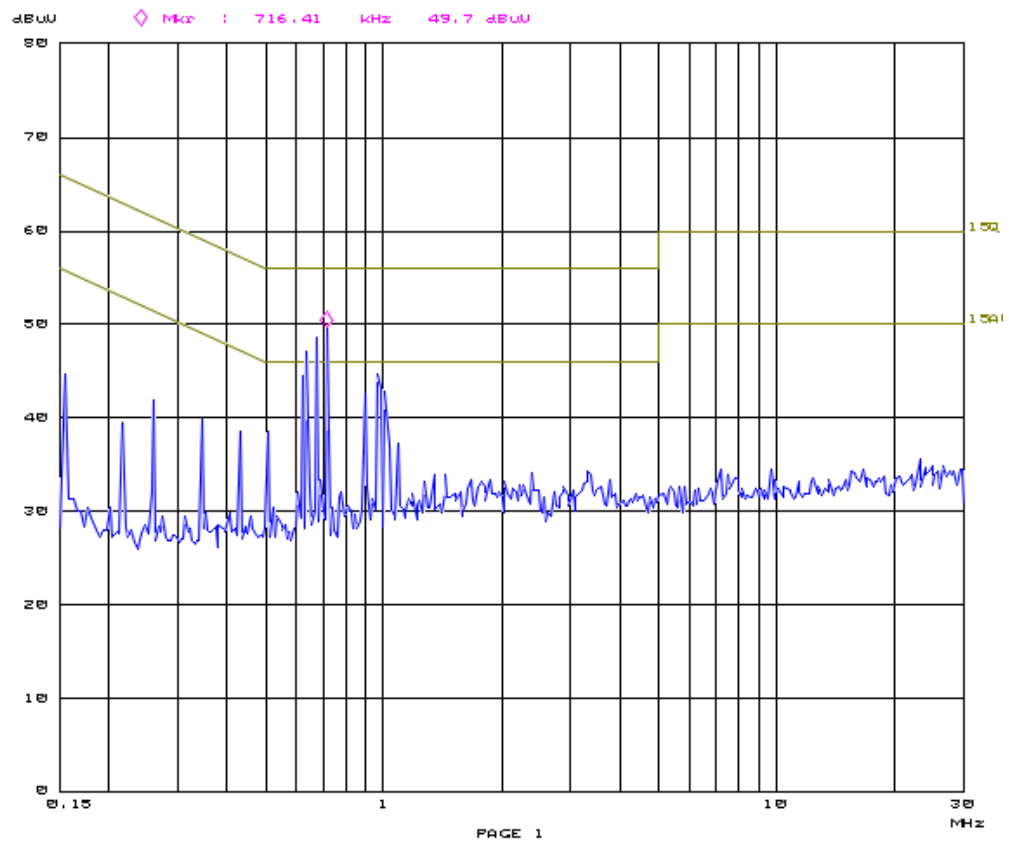
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7GHI

18. Jun 20 14:18

Overview Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	3.9k	9k	PK	0.10ms	20dB	LN OFF



Plot of the AC Power-line Conducted emissions on L2/N

**End of report**