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<i>Client:</i>		Nedap N.V., Parallelweg 2 7141 DC Groenlo Netherlands, A. Haytema			
<i>Test Item:</i>		134.2 kHz Inductive RFID Card Reader / Motor controller			
<i>Identification:</i>		VP1801B		<i>Serial Number:</i> KO25 A 0028	
<i>Project No.:</i>		19022705		<i>Date of Receipt:</i> April 23, 2019	
<i>Testing Location:</i>		TÜV Rheinland Nederland B.V. Eiberkamp 10 9351VT Leek			
<i>Test Specification:</i>		FCC 47 CFR Part 15, Subpart C, (10-1-18 Edition) RSS-Gen (Issue 5, April 2018); RSS-210 (Issue 9, August 2016) ANSI C63.10-2013			
<i>Test Result:</i>		The test item passed the test specification(s).			
<i>Testing Laboratory:</i>		TÜV Rheinland Nederland B.V. Eiberkamp 10 9351 VT Leek			
<i>Tested by:</i>		<i>Reviewed by:</i>			
					
2019-07-04 R. van der Meer / Inspector		2019-07-04 E. van der Wal / Reviewer			
<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>	<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>
<i>Other Aspects:</i> -.					
Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested					
<p>This report shall not be reproduced, except in full, without the written permission of TÜV Rheinland Nederland B.V.</p> <p>The test results relate only to the item(s) tested.</p> <p>The content of this report and measurement results have not been changed other than the way of presenting the data.</p>					

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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
-	04.07.2019	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

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 ISSED 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 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.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 120 Vac.

()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)
For Radiated Emissions (H-field) on outside facility					
Measurement Receiver	Rohde & Schwarz	ESCS30	A01980	07/2018	07/2019
Magnetic Loop Antenna, Active	Chase	HLA-6120	A01491	12/2017	12/2020
Magnetic Loop Antenna, Passive	EMCO	6509	A00006	12/2017	12/2020
For Radiated Emissions					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2018	03/2019
RF Cable S-AR	Gigalink	APG0500	A00447	01/2019	01/2020
Controller	Maturo	SCU/088/8090811	A00450	N/A	N/A
Controller	EMCS	DOC202	A00257	N/A	N/A
Test facility	Comtest	FCC listed: 786213 IC: 2932G-2	A00235	10/2017	10/2020
Spectrum Analyzer	Rohde & Schwarz	FSV	A00377	07/2018	07/2019
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	06/2018	06/2020
Biconilog Testantenna	Teseq	CBL 6111D	A00466	10/2018	10/2019
Magnetic Loop Antenna, Active	Chase	HLA-6120	A01491	12/2017	12/2020
Magnetic Loop Antenna, Passive	EMCO	6509	A00006	12/2017	12/2020

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Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
For AC Powerline Conducted Emissions					
Pulse limiter	R&S	ESH3-Z2	2788823 (A00051)	11/2018	11/2019
Variac	RFT	LSS020	A00171	NA	NA
LISN	R&S	ESH2-Z5	2788791 (A00019)	06/2018	06/2020
Measurement Receiver	Rohde & Schwarz	ESCS30	A00726	10/2018	10/2019
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humidity meter	Extech	SD500	A00444	06/2019	06/2020

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. You can find the relevant declarations under the download link.

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

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. There are nine types of antennas, of which two are tested (the smallest and the largest). 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 (emission designator 1K03 P0N)
Antenna Type tested	VP6012 and Single Loop Walk Through
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.

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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.

List of used cables					
No.	Function	From	To	Length	Remarks
1	AC Power	Mains	AUX3	> 1 m	-
2	DC power	AUX3	AUX2	< 3 m	-
3	DC power	AUX2	EUT	> 3 m	-
4	RF Output	EUT	AUX1a/1b	> 3 m	-

See Figure 1 & 2 on the next page.

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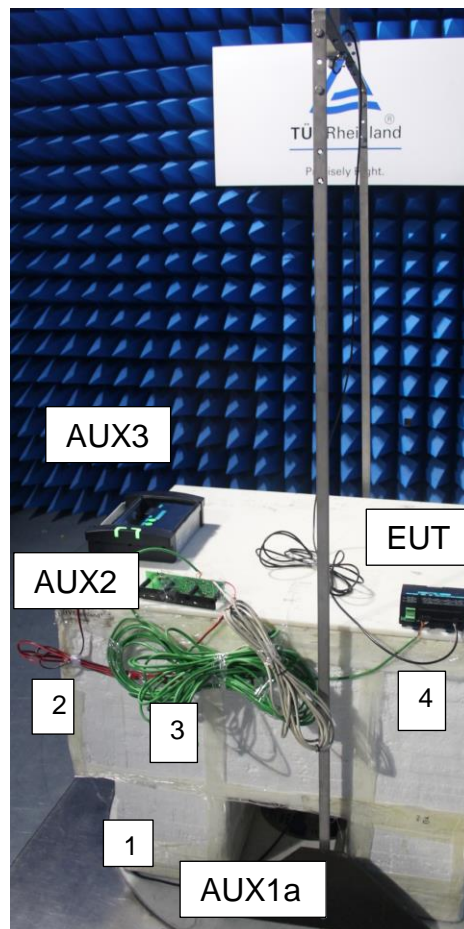


Figure 1: Test Setup Photos – EUT in combination with Single Walk Through Antenna

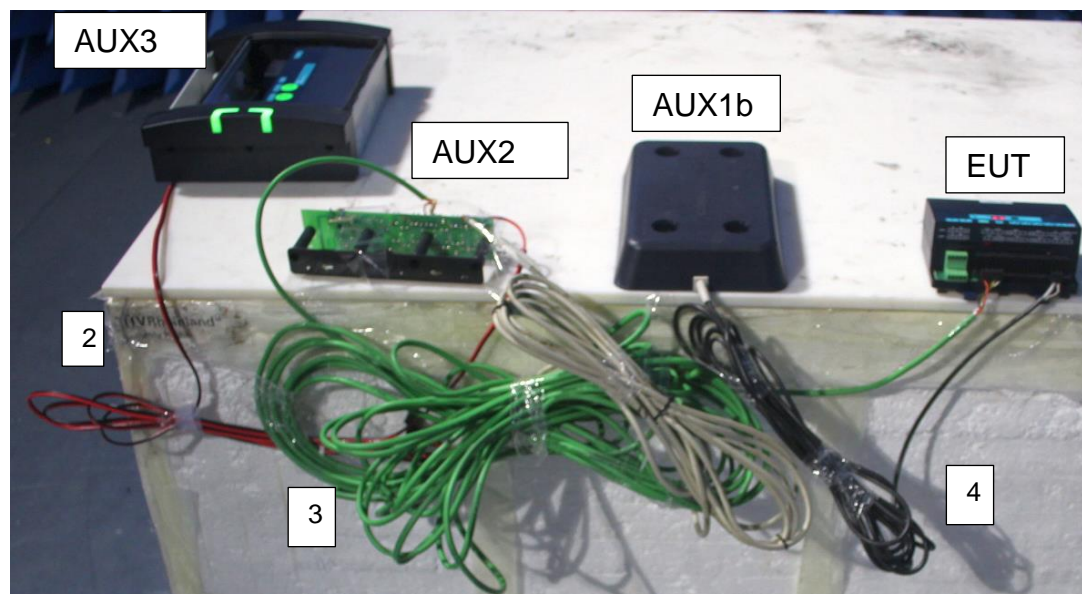


Figure 2: Test Setup Photos – EUT in combination with VP6012 antenna

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3.4 Special Accessories and Auxiliary Equipment

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

AUX1 Antenna	
Auxiliary 1a & 1b	: Antenna Single Loop Walk Through and V-Sence
Manufacturer	: Nedap N.V.
Brand	: Nedap
Model	: ---
Serial number	: ---
Part number	: 9835733 and VP6012
Remark	: -
AUX2 VCS3 Interface	
Auxiliary 2	: Interface bridge milking
Manufacturer	: Nedap N.V.
Brand	: Nedap
Model	: VC3
Part number	: 9650610
Voltage input rating	: 25Vdc
AUX3 Power supply	
Auxiliary 3	: Power supply (AC/DC switched power supply)
Manufacturer	: Nedap N.V.
Brand	: Nedap
Model	: VP2001B
Voltage input rating	: 100..240V/ 50/60 Hz
Voltage output rating	: 25Vdc 4 Amp

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4. Test Results

4.1.1 20dB and 99% Bandwidth

RESULT: Pass

Date of testing: 2019-07-03

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.

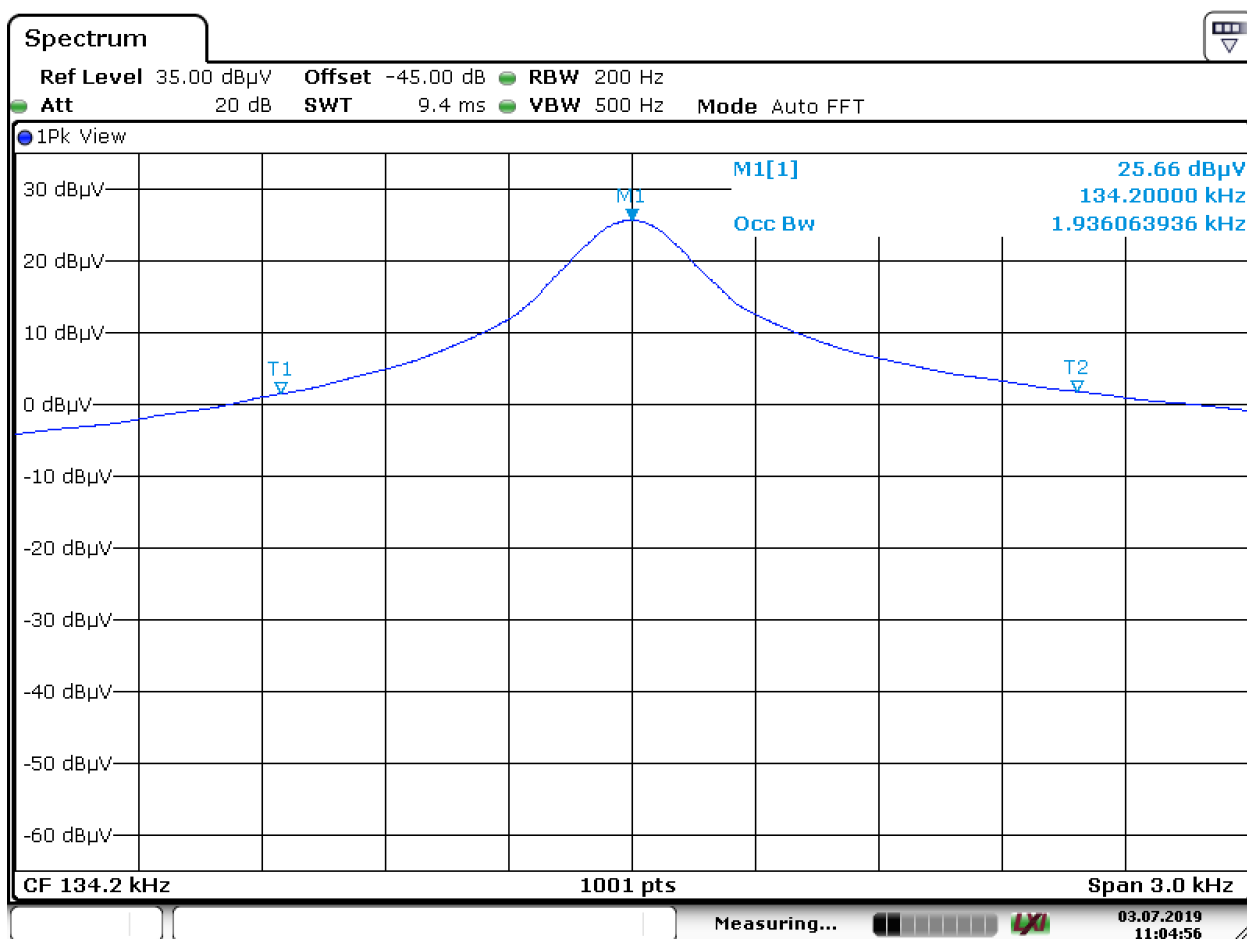
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20dB and 99% Bandwidth

with Antenna	Operating Frequency [MHz]	99% Bandwidth [kHz]	20dB Bandwidth [kHz]	Plot number
AUX1a Single Walk Through	0.1342	1.936	1.244	A1/A2
AUX1b VP6012	0.1342	1.777	1.028	B1/B2



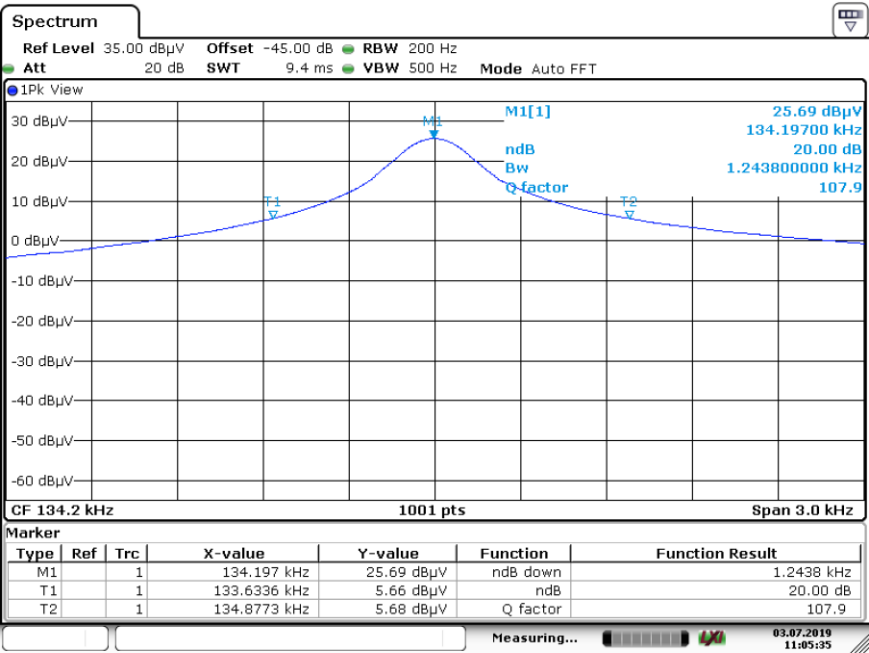
Date: 3.JUL 2019 11:04:56

Plot A1, 99% dB BW, EUT with Single Walk Through antenna,
without tag (is worst case)

Test Report No.:

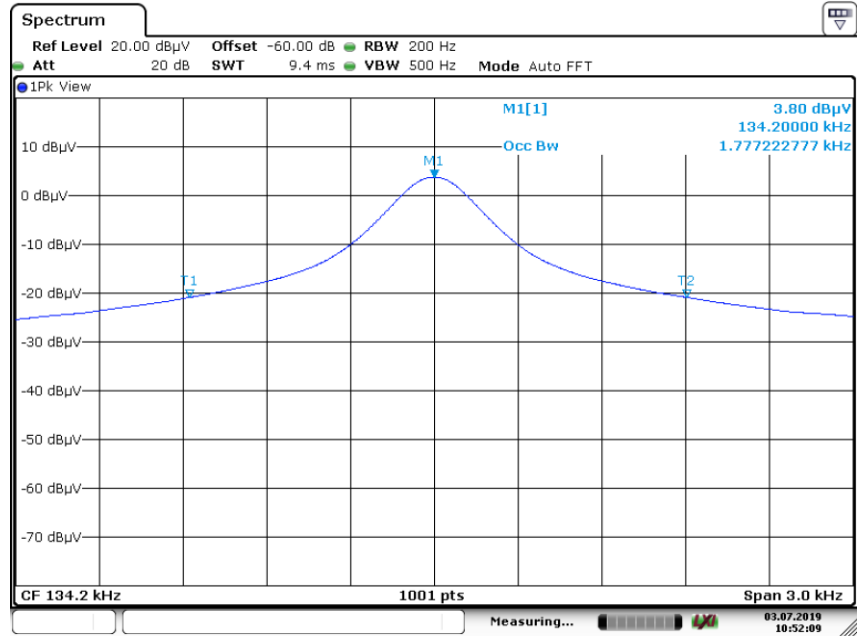
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Date: 3.JUL.2019 11:05:36

Plot A2 20 dB BW, EUT with Single Walk Through antenna, without tag (is worst case)



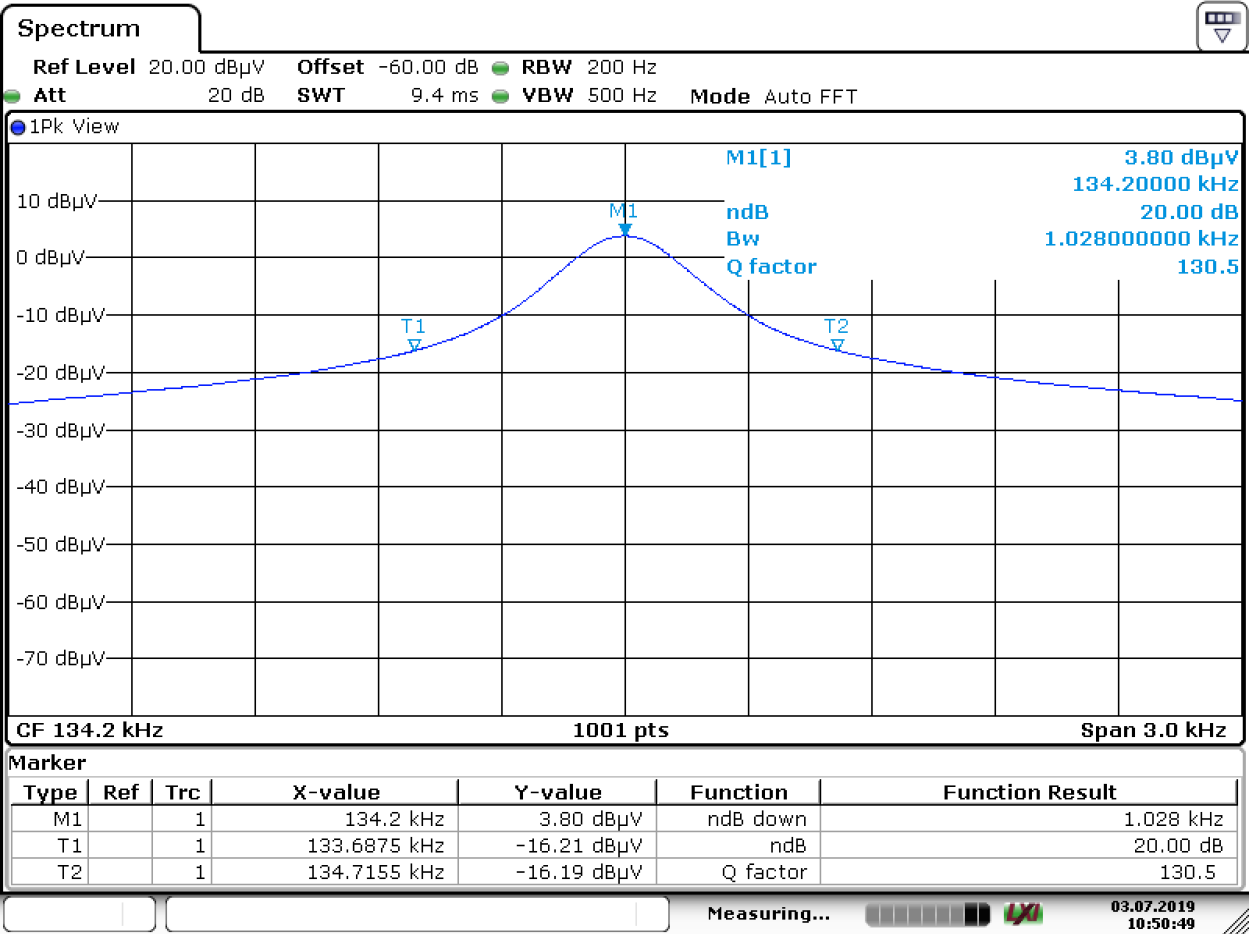
Date: 3.JUL.2019 10:52:09

Plot B1, 99% dB BW, EUT with VP6012, without tag (is worst case)

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Date: 3.JUL.2019 10:50:49

Plot B2, 20 dB BW, EUT with VP6012, without tag (is worst case)

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4.1.2 Radiated Emissions of Transmitter

RESULT: Pass

Date of testing: 2019-05-28 & 2019-06-27

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 table:

Frequency (MHz)	Field strength (microvolts/meter)	Field strength (dBμV/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 2. Field strength 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.

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. The measured values were corrected to the 30m distance using the extrapolation factor of 40dB/decade as per FCC Part 15.31(f)(2). Final radiated emission measurements were made at 3m distance on the outside facility.

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. Where Peak (Pk) values were at least 6 dB under the Average (Av) limits, Av value was not tested. Where Average values were tested, Average values were measured using a reduced Video Bandwidth, with a minimum of 10 kHz.

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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 (for info only)	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits	Pass/Fail
	dBµV @3m	dBµV @5m	dBµV @10m		dB	dB	dB	dBµV/m @300m	dBµV/m @300m	
0.1342 (fundamental)	85.2	77.7	62.5	Pk	19.4	1	80	25.6	45.1	Pass
0.1342 (fundamental)	61.1	53.5	41.7	Av	19.4	1	80	1.5	25.1	Pass
0.2684 *H	45.8	38.5	28.5	Pk	19.3	1	80	-14.2	39.0	Pass
0.2684 *H	15.1	8.5	<<	Av	19.3	1	80	-44.6	19.0	Pass
0.4026 *H	34.2	26.3	14.0	Pk	19.3	1	80	-25.5	35.5	Pass
0.4026 *H	11.6	6.2	<<	Av	19.3	1	80	-48.1	15.5	Pass

Table 3a Radiated emissions of the EUT with Single Loop Walk Through Antenna

Frequency (MHz)	Measurement results	Measurement results (for info only)	Measurement results (for info only)	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits	Pass/Fail
	dBµV @3m	dBµV @5m	dBµV @10m		dB	dB	dB	dBµV/m @300m	dBµV/m @300m	
0.1342 (fundamental)	63.6	50.9	35.2	Pk	19.4	1	80	4.0	45.1	Pass
0.1342 (fundamental)	42.5	33.3	19.0	Av	19.4	1	80	-17.1	25.1	Pass
0.2684 *H	17.2	11.0	3.0	Pk	19.3	1	80	-42.5	39.0	Pass
0.2684 *H	5.8	1.2	<<	Av	19.3	1	80	-53.9	19.0	Pass
0.4026 *H	16.8	10.6	4.2	Pk	19.3	1	80	-42.9	35.5	Pass
0.4026 *H	5.4	0.7	<<	Av	19.3	1	80	-54.3	15.5	Pass

Table 3b Radiated emissions of the EUT with VP6012 antenna

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

A01980	A01491							

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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 0.1342 MHz fundamental frequency is calculated as: Measurement result + Antenna Factor + Cable loss – Extrapolation Factor =>
 $85.2 \text{ dB}\mu\text{V} + 19.4 \text{ dB} + 1 \text{ dB} - 80 \text{ dB} = 25.6 \text{ dB}\mu\text{V/m}.$
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 Tables 3a and 3b are more than 20 dB below the applicable limit. The reported value is the worst case found at the reported frequency.
4. Restricted bands were investigated and were found to be below the levels as reported in Tables 3a and 3b.
5. Measurement uncertainty is $\pm 5.0 \text{ dB}$.

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4.1.4 Radiated Spurious Emissions, 30MHz - 1GHz

Frequency [MHz]	EUT Orientation	Antenna Orientation	Level QP [dB μ V/m]	Limit QP [dB μ V/m]	Verdict [Pass/Fail]
128.9	Horizontal	Horizontal	25.0	43.5	Pass
214.2	Horizontal	Horizontal	20.0	43.5	Pass
249.8	Horizontal	Horizontal	30.2	46.0	Pass
408	Horizontal	Vertical	31.4	46.0	Pass
800	Horizontal	Horizontal	36.3	46.0	Pass
844-960 noise	-	Vertical	32.0	46.0	Pass

Table 4a Radiated emissions of the EUT with Single Loop Walk Through Antenna

Frequency [MHz]	EUT Orientation	Antenna Orientation	Level QP [dB μ V/m]	Limit QP [dB μ V/m]	Verdict [Pass/Fail]
107.5	Horizontal	Horizontal	27.2	43.5	Pass
250	Horizontal	Horizontal	32.1	46.0	Pass
360	Vertical	Vertical	36.9	46.0	Pass
480	Vertical	Vertical	33.5	46.0	Pass
560	Vertical	Vertical	35.9	46.0	Pass
840	-	Vertical	35.9	46.0	Pass

Table 4b Radiated emissions of the EUT with VP6012 antenna

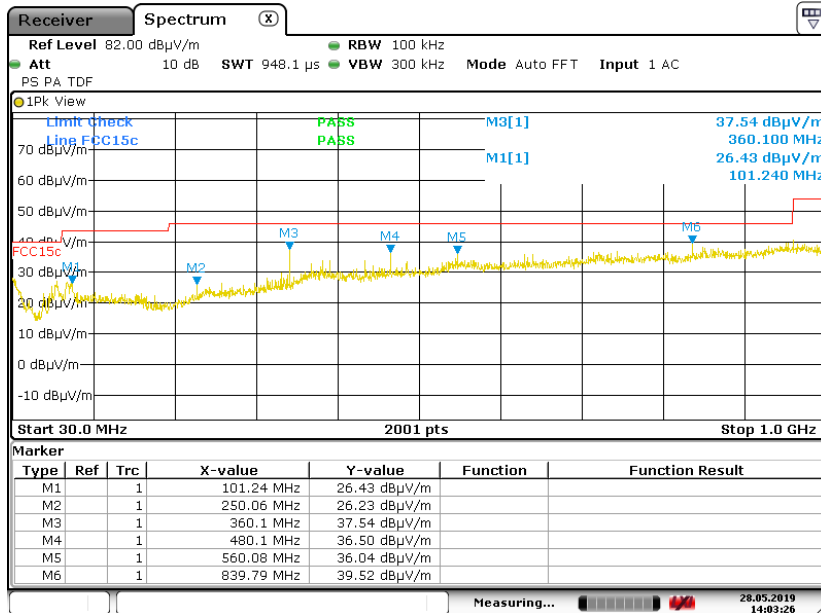
- Note:
- Level QP = Reading QP + Factor
 - Tested in modes as described in section 3.2, the 6 highest values noted.
 - *^R refers to a frequency in a restricted band, *^H refers to a harmonic of the fundamental
 - Quasi Peak detector used with a bandwidth of 120 kHz.
 - Measurement uncertainty is +/-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

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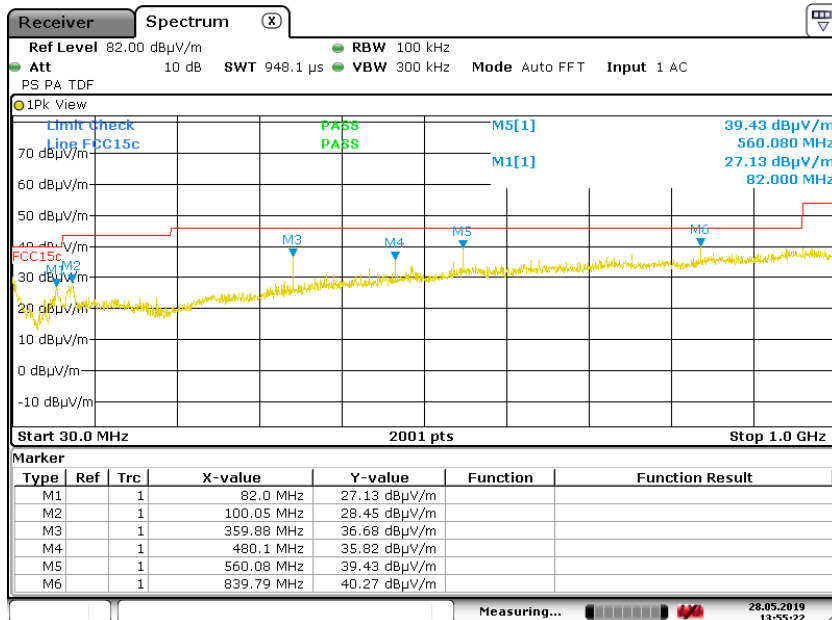
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4.1.5 Plot of the emissions in the range 30 -1000 MHz



Date: 28.MAY.2019 14:03:26

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), EUT with VP6012 Horizontal, Antenna Vertical



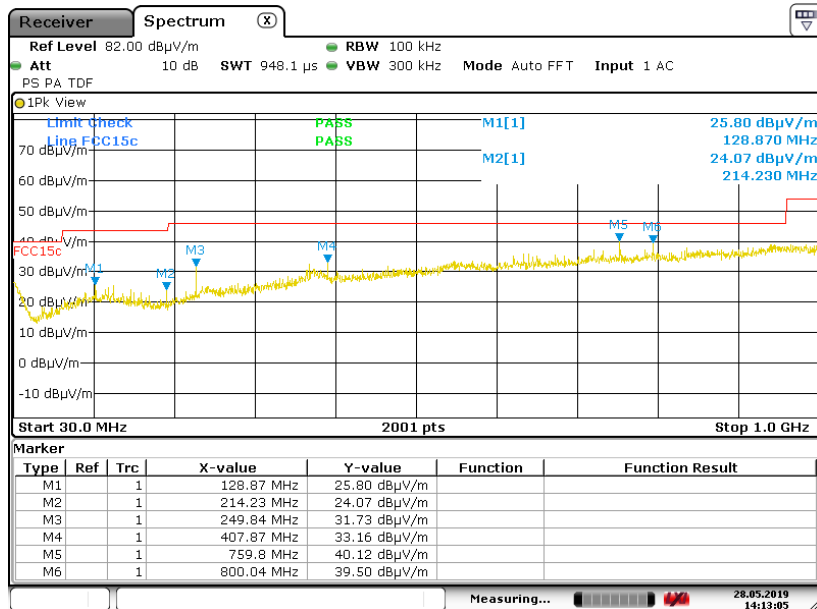
Date: 28.MAY.2019 13:55:22

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), EUT with VP6012 Vertical, Antenna Vertical

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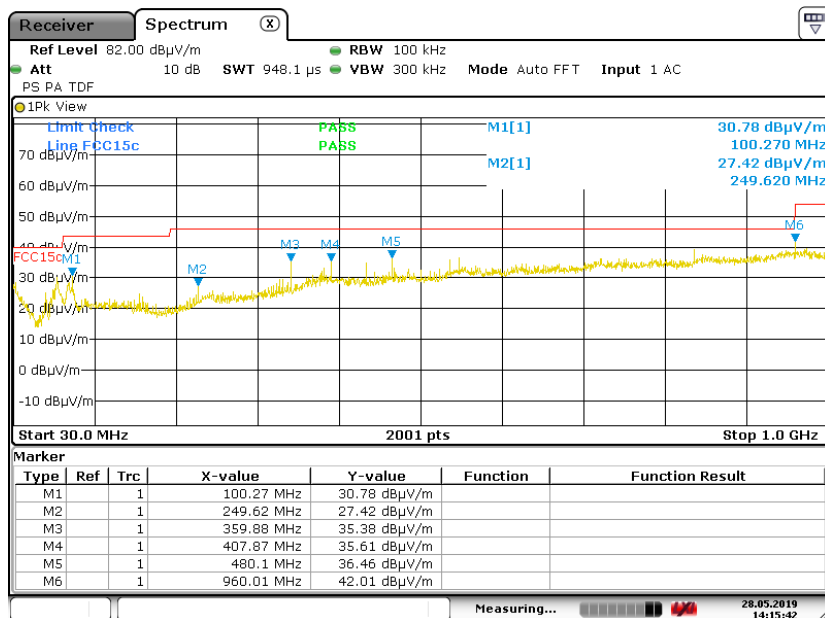
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Date: 28.MAY.2019 14:13:06

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), EUT with Single Walk Through Antenna Horizontal, Test Antenna Horizontal



Date: 28.MAY.2019 14:15:42

Plot of the emissions in the range 30 – 1000 MHz (Peak detector values shown), EUT with Single Walk Through Antenna, Test Antenna Vertical

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5 AC Power Line Conducted Measurements

RESULT: Pass.

Date of testing:

2019-07-02

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 μ 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 μ V) Quasi-Peak	Conducted Limit (dB μ 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 μ H / 50 Ω 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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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	
0.1500	43.0	*	43.4	*	66.0	56.0	Pass
0.1617	33.7	*	32.4	*	65.5	55.5	Pass
0.2984	32.0	*	33.8	*	60.2	50.2	Pass
0.4039	38.5	*	33.0	*	57.9	47.9	Pass
0.4156	30.0	*	38.1	*	57.6	47.6	Pass
2.5641	31.3	*	30.1	*	60.0	50.0	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 the EUT (with VP6012 antenna), are depicted in the table above.

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.1500	35.0	*	40.3	*	66.0	56.0	Pass
0.1539	37.8	*	35.0	*	66.0	56.0	Pass
0.2906	34.9	*	35.1	*	60.5	50.5	Pass
0.4039	40.2	*	40.4	*	57.9	47.9	Pass
0.4938	29.2	*	30.0	*	56.2	46.2	Pass
2.5074	32.0	*	31.9	*	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 the EUT (with Single WalkThrough antenna), 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.

Test Report No.:

19022705.r01

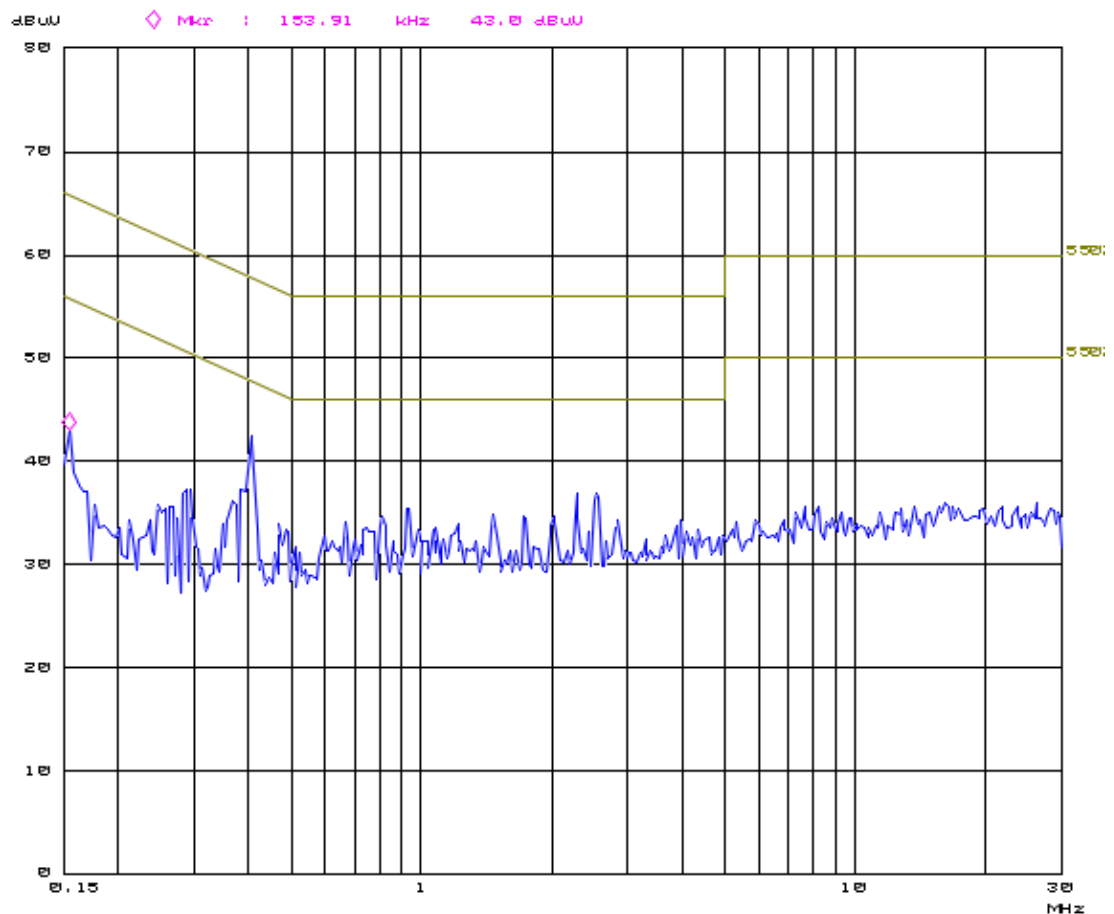
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Plots of the AC Power-line Conducted Emissions

02. Jul 19 13:34

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



PAGE 1

Plot of the AC Power-line Conducted emissions on L1, EUT with VP6012

Test Report No.:

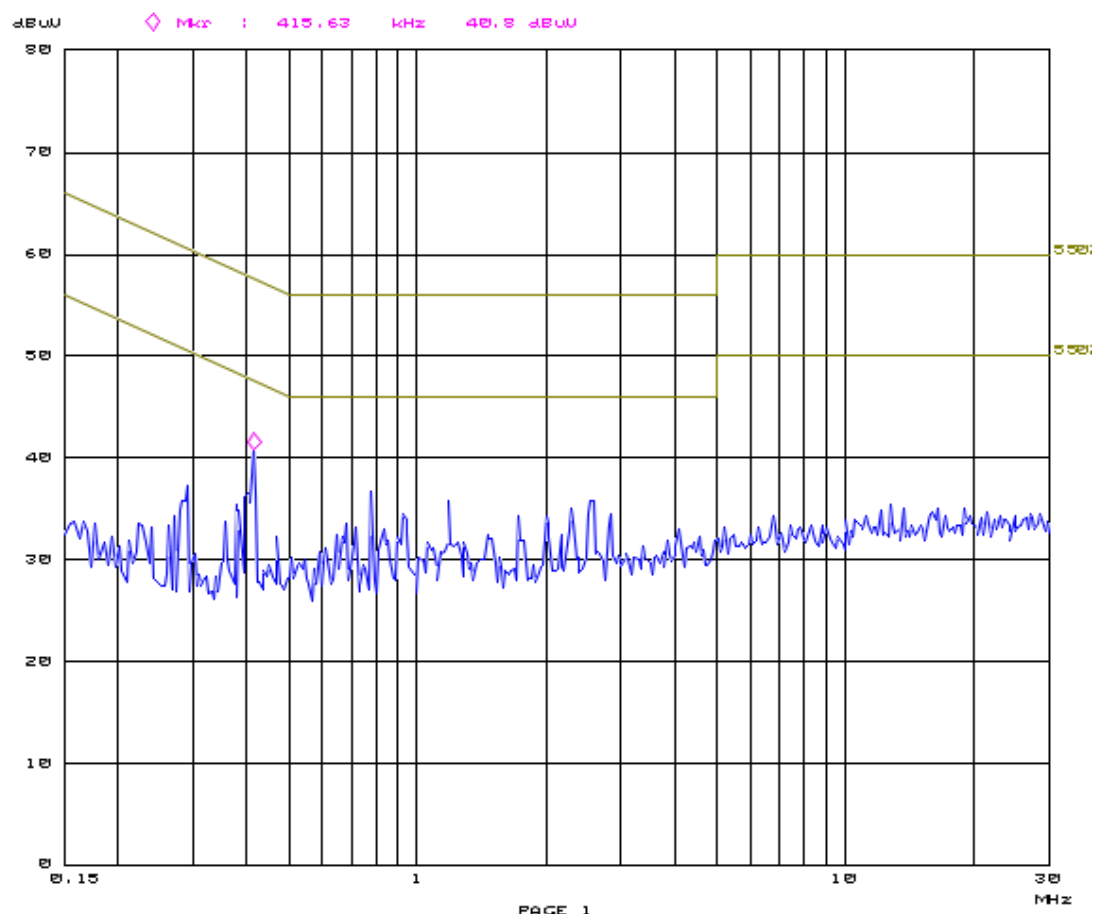
19022705.r01

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02. Jul 19 13:26

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, EUT with VP6012

Test Report No.:

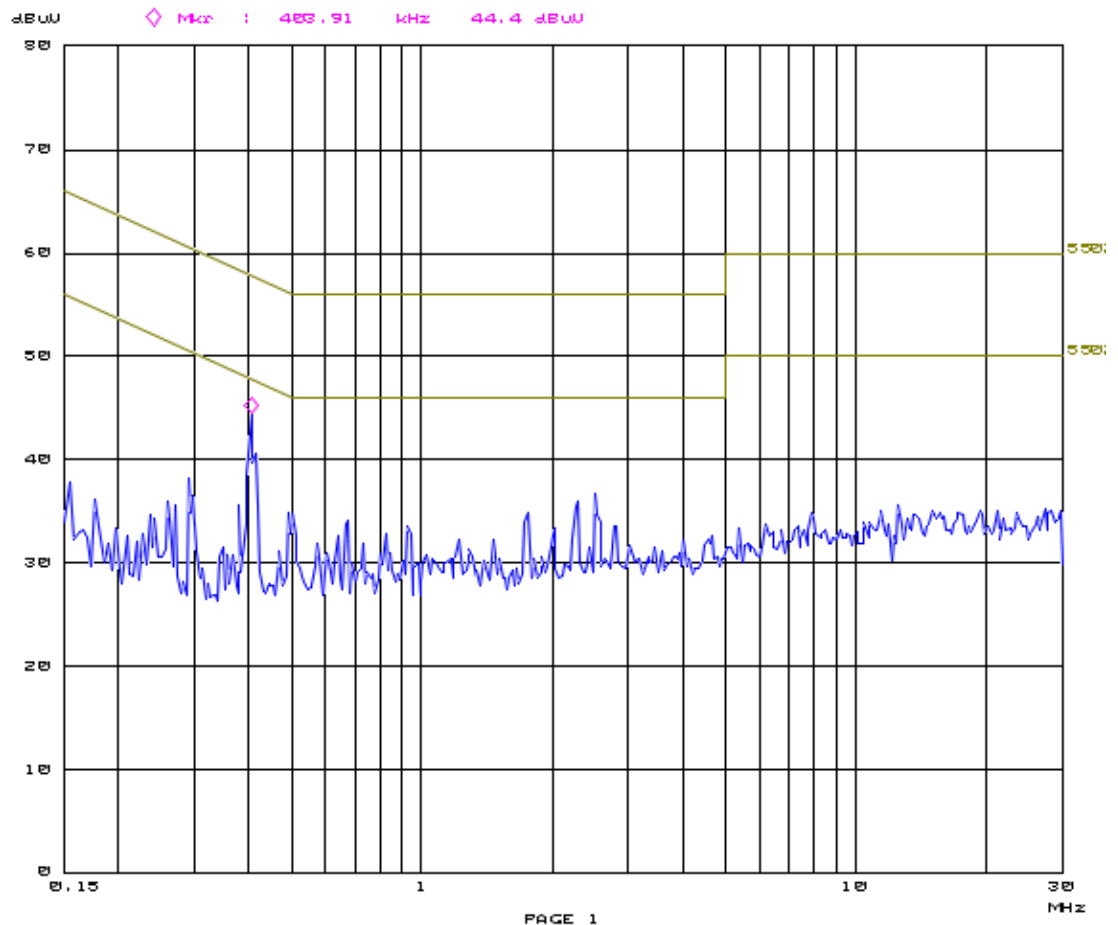
19022705.r01

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22. Jul 19 13:43

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, EUT with Single Walk Through Antenna

Plot of the AC Power-line Conducted emissions on L2/N, EUT with Single Walk Through Antenna

Test Report No.:

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End of report