



**TEST REPORT CONCERNING THE COMPLIANCE OF A
INDUCTIVE PROXIMITY TAG READER
OPERATING AT 134.2 kHz INCLUDING A MOTOR AND
SENSOR CONTROL UNIT
BRAND Nedap, MODEL VC4 TWIN 2 ISO FDX-B
WITH 47 CFR PART 15 (10-1-09) AND THE
REQUIREMENTS OF INDUSTRY CANADA:
RSS-GEN (ISSUE 3, DECEMBER 2010) AND
RSS-210 (ISSUE 8, DECEMBER 2010).**

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MEASUREMENT/TECHNICAL REPORT

N.V. Nederlandsche Apparatenfabriek "Nedap"
Model: VC4 TWIN 2 ISO FDX-B

FCC ID: CGD-TF2
IC: 1444A-TF2

This report concerns:		Original grant/certification	Class 2 change	Verification
Equipment type:		Inductive RFID tag reader		
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-09 edition), RSS-GEN, RSS-210 and the measurement procedures of ANSI C63.4-2009. TÜV Rheinland EPS B.V. at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: June 28, 2012

Signature:



O. Hoekstra
 Senior Engineer Telecom TÜV Rheinland EPS B.V.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Description of test item

Test item : Inductive RFID tag reader, operating on 134.2 kHz including a motor and sensor control unit.
Manufacturer : N.V. Nederlandsche Apparatenfabriek "Nedap"
Brand : Nedap
Model : VC4 Twin 2 ISO FDX-B
Serial number : C125 C 0001
FCC ID : CGD-TF2
IC : 1444A-TF2



Applicant information


Applicant's representative : Mr. J. Hulshof
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Test(s) performed

Location : Leek
Test(s) started : March 9, 2012
Test(s) completed : March 23, 2012
Purpose of test(s) : Equipment Authorization (Original grant/certification)

Test specification(s) : 47 CFR Part 15 (10-1-09 Edition) and
RSS-GEN (ISSUE 3, DECEMBER 2010) AND RSS-210 (ISSUE 8, DECEMBER 2010)

Test engineer(s) : M.C. Edwards van Muyen / R.A. van der Meer  

Report written by : R.A. van der Meer 

Report date : June 28, 2012

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The test results relate only to the item(s) tested.**

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1 General information.

1.1 Product description.

1.1.1 Introduction.

The EUT is a module for animal RF detection at a farm with the possibility to drive two independent external antennas. The EUT is made to read passive tags carried by animals. It has a transmitter and a receiver to read full duplex tags. Full duplex tags transmit the label code with AM modulation at the same frequency as the transmitter, in this case 134.2 kHz.

The EUT has a μ -controller that decodes the received tag code and communicates with other devices. It also has several outputs to drive motors and inputs to read sensors for farm management.

The content of this report and measurement results have not been changed other than the way of presenting the data.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original grant/certification in equipment authorization files under FCC ID: CGD-TF2 and IC: 1444A-TF2.

1.3 Tested system details.

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

EUT1	:	Inductive RFID card reader operating at 134.2 kHz
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek "Nedap"
Brand	:	Nedap
Model	:	VC4 TWIN 2 ISO FDX-B
Serial number	:	C125 C 0001
Voltage input rating	:	22 - 42 Vdc
Voltage output rating	:	--
Current input rating	:	not provided
Remarks	:	--

The EUT is tested with the following antenna configurations:

Antenna 1	:	Single Loop Walk Over antenna
Model	:	--
Serial number	:	--
Antenna 2	:	Single Loop Walk Through antenna
Model	:	--
Serial number	:	--

The EUT is tested with the following auxiliary equipment:

AUX1 : Power supply
 Manufacturer : N.V. Nederlandsche Apparatenfabriek "Nedap"
 Brand : Nedap
 Model : -
 Type number : 9839216
 Voltage input rating : 100 - 240 Vac
 Voltage output rating : 27 Vdc
 Remark : AUX1 and AUX2 are placed in 1 cabinet



AUX2 : Procescontroler
 Manufacturer : N.V. Nederlandsche Apparatenfabriek "Nedap"
 Brand : Nedap
 Model : VC4 X-ACT
 Art. number : 9843809
 Serial number : J110 B 006
 Voltage input rating : 27 Vdc
 Remark : AUX1 and AUX2 are placed in 1 cabinet



AUX3 : Motor
 Manufacturer : N.V. Nederlandsche Apparatenfabriek "Nedap"
 Brand : Nedap
 Model : -
 Art. number : 8009589
 Serial number : P610A0363
 Remark : -



AUX4 : Antennatransformator
 Manufacturer : GEA
 Brand : GEA
 Model : EWA 2 High Power
 Art. number : 9965823
 Serial number : C222 A 0010
 Remark : MOD. AS408723



1.4 Test Summary

The EUT was tested in accordance with the specifications given in the table below.

Test Standard		Description	Page	Pass / Fail
47 CFR Part 15 (10-1-09 Edition)	RSS-210 Issue 8, December 2010			
15.207(a)	RSS-Gen(7.2.4)	Conducted emissions	16	Pass
15.209	RSS-Gen(4.9 and 7.2.5) and RSS-210(2.5)	Radiated emissions	11 - 15	Pass

Table : testspecifications

Testmethods: ANSI C63:2009 and RSS-Gen Issue 3, December 2010

1.4.1 Description of input and output ports.

Number	Terminal	From	To	Remarks
1	Mains	Mains	AUX1	--
2	DC Power and control	AUX1+AUX2	EUT	--
3	Motor control	EUT	Motor	--
4	Output	EUT	AUX4	--
5	Antenna tuner	AUX4	Antenna	(either antenna 1 or antenna2)

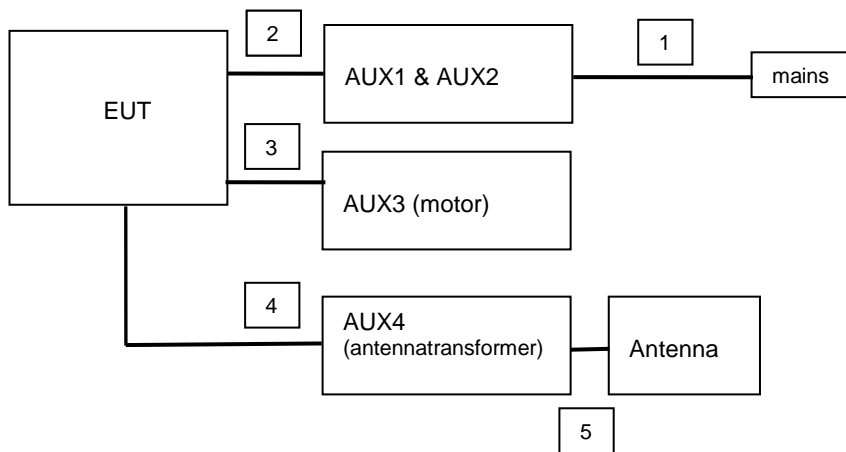


Figure 1. Basic set-up

1.5 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-09 Edition), sections 15.31, 15.207 and 15.209, RSS-GEN (ISSUE 3, DECEMBER 2010) RSS-210 (ISSUE 8, DECEMBER 2010).

The test methods, which have been used, are based on ANSI C63.4: 2009.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters.

Radiated emission tests below 30 MHz were performed at a measurement distance of 3 meters and 10 meters. To calculate the field strength level from these results to the appropriate distance at which the limit is specified, the calculation on Appendix 1 is used.

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.

1.6 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland EPS B.V., located in Leek, 9351 VT 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 (10-1-06 edition).

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. 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.

1.7 Test conditions.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 120VAC/60Hz to the AC/DC Power Supply – the DC output was varied across the voltage range specified by the manufacturer
Air pressure	: 950 – 1050 hPa

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.

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 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 C63.4: 2009.

2.2 EUT mode of operation.

The EUT has been tested in both passive, i.e. the EUT is ready to detect a tag and active mode i.e. the EUT is reading a tag. To assess the behavior of the EUT while reading the tag, the EUT is tested with a tag presented such that it continuously reads the tag. The intentional radiator tests have been performed with a complete functioning EUT and interconnections.

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 in order to achieve compliance.

2.5 Product Labelling

The product labeling information is available in the technical documentation package.

2.6 Block diagram of the EUT.

The block diagram is available in the technical documentation package.

2.7 Schematics of the EUT.

The schematics are available in the technical documentation package.

2.8 Part list of the EUT.

The part list is available in the technical documentation package.

3 Radiated emission data.

3.1 Radiated field strength measurements (30 MHz – 1 GHz, E-field)

3.1.1 EUT tested with Single Loop Walk Over antenna

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass/Fail
48.005	11	3.3	9.2	20.2	12.5	40.0	Pass
56.290	16.0	13.6	6.0	22.0	19.6	40.0	Pass
68.000	15.3	16.6	5.5	20.8	22.1	40.0	Pass
88.000	14.3	15.1	8.9	23.2	24.0	40.0	Pass
171.992	13.6	14.7	10.2	23.8	24.9	43.5	Pass
188.960	16.5	17.2	9.4	25.9	26.6	43.5	Pass

Table 1a Radiated emissions of the EUT

3.1.2 EUT tested with Single Loop Walk Through antenna

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass/Fail
48.005	18.4	7.2	9.2	27.6	16.4	40.0	Pass
63.994	9.7	6.0	5.3	15.0	11.3	40.0	Pass
75.003	14.5	9.1	6.6	21.1	15.7	40.0	Pass
88.000	15.5	14.5	8.9	24.4	23.4	40.0	Pass
206.130	12.7	12.3	10.6	23.3	22.9	43.5	Pass
484.001	8.7	8.0	20.4	29.1	28.4	46.0	Pass

Table 1b Radiated emissions of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT operating on 134.2 kHz are depicted in Tables 1a and 1b. 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. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is ± 5.0 dB
3. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz.
5. The EUT was tested in both passive mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity). Maximum values have been noted.
6. Measurements were performed up to 1350 MHz.

Used test equipment and ancillaries:

99858	99847	99855	99107	99608	99609	15667	15453	99651

Test engineer

Signature :

Name : M.C Edwards van Muyen
Date : March 23, 2012

3.2 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), Peak- and Quasi Peak values, EUT with Single Loop Walk Over antenna.

Frequency (MHz)	Measurement results	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits
	dBµV @3m						
0.2684	56.0	Pk	20.1	1	80	-2.9 @300m	39.0 @300m
0.4026	48.6	Pk	20.0	1	80	-10.4 @300m	35.5 @300m
0.5368	20.0	Qp	20.0	1	40	1.0	33.0
0.6711	25.1	Qp	19.7	1	40	5.8	31.1
0.8053	20.0	Qp	19.7	1	40	0.7	29.5
0.9395	24.1	Qp	19.7	1	40	4.8	28.1

Table 2a Radiated emissions of the EUT, Peak- and Quasi peak values

Fundamental Frequency (MHz)	(a) Measurement results (dBµV)		Detector	(b) Antenna factor	(c) Cable loss	(d) Extrapolation factor	Measurement results (calculated =a+b+c-d)	Measurement results (calculated =a+b+c-d)	Measurement results (calculated according to Appendix-1)	Limits Part 15.209
	3 m	10 m								
0.1342	58.6	28.4	Pk	71	1	n.a.	130.6	100.4	15.1	45.05

Table 2b Emissions of the fundamental of the EUT

3.3 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), Average values, EUT with Single Loop Walk Over antenna.

Frequency (MHz)	Measurement results Peak	Correction Factor	Average value	Limits Average
0.1342	15.1	0.0	15.1	25.05
0.2684	-2.9	0.0	-2.9	19.0
0.4026	-10.4	0.0	-10.4	15.5

Table 2c Radiated emission of the EUT

3.4 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), Peak- and Quasi Peak values, EUT with Single Loop Walk Through antenna.

Frequency (MHz)	Measurement results	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits
	dBµV @3m					dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	65.6	Pk	20.1	1	80	6.7 @300m	39.0 @300m
0.4026	68.7	Pk	20.0	1	80	9.7 @300m	35.5 @300m
0.5368	46.4	Qp	20.0	1	40	27.4	33.0
0.6711	35.0	Qp	19.7	1	40	15.7	31.1
0.8053	34.0	Qp	19.7	1	40	14.7	29.5
0.9395	39.2	Qp	19.7	1	40	19.9	28.1

Table 2d Radiated emissions of the EUT, Peak- and Quasi peak values

Fundamental Frequency (MHz)	(a) Measurement results (dBµV)		Detector	(b) Antenna factor	(c) Cable loss	(d) Extrapolation factor	Measurement results (calculated =a+b+c-d)	Measurement results (calculated =a+b+c-d)	Measurement results (calculated according to Appendix-1)	Limits Part 15.209
	3 m	10 m					dBµV/m @3m	dBµV/m @10m	dBµV/m	dBµV/m @300m
0.1342	65.6	35.9	Pk	71	1	n.a.	137.6	107.9	24.0	45.05

Table 2e Emissions of the fundamental of the EUT

3.5 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), Average values, EUT with Single Loop Walk Through antenna.

Frequency (MHz)	Measurement results Peak	Correction Factor	Average value	Limits Average
	dBµV/m @300m		dBµV/m @300m	dBµV/m @300m
0.1342	24.0	0.0	24.0	25.05
0.2684	6.7	0.0	6.7	19.0
0.4026	9.7	0.0	9.7	15.5

Table 2f Radiated emission of the EUT

Correction factor (Cf) for Pulse operation:

$$Cf = 20 \text{ Log} (\text{TON} / \text{TPeriod})$$

Where TON is the On time of the pulse, TON = 100 msec.

Where TPeriod is the total time of one pulse period, TPeriod = 104 msec

Period time exceeds 100msec, the Correction factor in that case:

$$Cf = 20 \text{ log} (100/100) = 0.0 \text{ dB}$$

Note: TON time varies between 70msec and 100 msec, depending on the quality of reception and the distance between the EUT and the tag. In a worst case situation the TON time will be 100msec, while the total time remains 104 msec.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT operating in continuous transmit mode on 134.2 kHz, are depicted in Tables 2a through 2f.

Notes:

1. Calculated measurement results for the fundamental at 134.2 kHz are obtained by using the calculation as mentioned in Appendix 1.
2. A resolution bandwidth of 9 kHz was used during testing
3. Field strength values of radiated emissions at frequencies not listed in Table 2a and 2d are more than 20 dB below the applicable limit
4. The EUT was varied in three positions, the loop antenna was varied in horizontal and vertical orientations and also around it's axis. The reported value is the worst case found at the reported frequency.
5. The EUT was tested in both normal mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity).
6. Measurement uncertainty is ±5.0dB

Used test equipment and ancillaries:

99070	99107	99120	15453	12479	15667	99855	99651	

Test engineer

Signature :



Name : M.C. Edwards van Muyen

Date : March 20, 2011

4 Conducted emission data.

4.1 Conducted emission data of the EUT

Frequency (MHz)	Measurement results dB(µV) Neutral/L2		Measurement results dB(µV) Line 1		Limits dB(µV)		Result
	QP	AV	QP	AV	QP	AV	
0.15000	30.1	14.8	31.0	16.2	66.0	56.0	PASS
0.15732	30.6	21.8	31.7	23.0	65.5	55.5	PASS
0.17862	29.0	26.7	28.7	26.9	64.5	54.5	PASS
0.33172	25.4	24.1	25.4	24.0	59.5	49.5	PASS
0.41427	20.0	11.2	21.8	13.1	57.6	47.6	PASS
11.79943	22.0	19.2	22.9	19.7	60.0	50.0	PASS
13.61145	24.1	22.1	25.3	23.4	60.0	50.0	PASS
30.00000	34.6	30.9	29.9	29.0	60.0	50.0	PASS

Table 3 Conducted emission measurements of the EUT

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207 and RSS-Gen section 7.2.4, at the 120 Volts AC mains connection terminals of the AC/DC power supply which was connected to the EUT, are depicted in Table 3. The EUT was tested in both passive and active mode (while detecting a card). Maximum values 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 ± 3.5 dB
2. The resolution bandwidth used was 9 kHz.
3. Tested with a impedance matching load instead of an antenna as per KDB, maximum values noted.

Used test equipment and ancillaries:

13313	99161	12512	15667	99852		

Test engineer

Signature :



Name : M.C Edwards van Muyen

Date : March 22, 2012

5 List of utilized test equipment.

Inventory number	Description	Brand	Model	Last cal.	Next cal.
12476	Antenna mast	EMCO	TR3	NA	NA
12477	Antenna mast 1-4 mtr	Poelstra	NA	NA	NA
12479	Passive loop antenna	EMCO	6509	NA	NA
12512	LISN	EMCO	3625/2	01/2012	01/2014
13313	Pulse Limiter	R&S	ESH3-Z2	02/2012	02/2013
15453	Active loopant. 60 cm	Chase	HLA6120	05/2011	05/2012
15633	Biconilog Testantenna	Chase	CBL 6111B	02/2012	02/2013
15667	Measuring receiver	R&S	ESCS30	06/2011	06/2012
99070	Coax 15m RG213	NMi Certin B.V.	Cable 15M	10/2011	10/2012
99107	Controller	Heinrich Deisel	4630-100	NA	NA
99120	DC supply 0-30V/1,2A	Voltcraft	TNG30	NA	NA
99161	Variac 250V 6A	RFT	LTS006	NA	NA
99608	Controller	EMCS	DOC202	NA	NA
99609	Antenna mast	EMCS	AP-4702C	NA	NA
99651	Variac	NA	--	NA	NA
99847	S-AR	Siepel	FCC listed: 90828	02/2012	02/2015
99852/ 99855	Humidity/Temperature Datalogger	Extech	SD500	02/2012	02/2013
99858	Cable S-AR	Gigalink	APG0500	01/2012	01/2013
99861	Controller S-AR	Maturo	SCU/088/8090811	NA	NA

NA= Not Applicable

Appendix 1

Calculated measurements results radiated field strength, H-Field

The rules of Part 15 section 15.31 allow scaling of the measured values or limits when measurements are made at distances other than those specified. The extrapolation factor for frequencies below 30 MHz are 40 dB/decade which means that for a distance change of 10 to 1 (a decade), the limit, or measured value, may be recalculated by adding (moving closer) or subtracting (moving away) 40 dB, respectively.

It is also possible to make radiated-emission measurements at two different distances and extrapolate to a third distance. The calculation method described below, should then be followed.

General Formula:

d_1 = short distance

d_2 = long distance

So:

$$(d_1/d_2)^n = H_{d2}/H_{d1}$$

$$n \log(d_1/d_2) = \log(H_{d2}/H_{d1})$$

Calculation of n:

$$n = \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$$

Calculation of field strength at 300m:

$$H_{d2} = H_{d1} (d_1/d_2)^n$$

Example

For the fundamental frequency of 134.2 kHz the level at a distance of 300m would be calculated as follows:
EUT in combination with Single Loop Walk Trough antenna

$$d_1 = 3\text{m} \quad H_{d1} = 137.6 \text{ dB}\mu\text{V/m} = 7585776 \mu\text{V/m}$$

$$d_2 = 10\text{m} \quad H_{d2} = 107.9 \text{ dB}\mu\text{V/m} = 248313.3 \mu\text{V/m}$$

$$\text{Calculation for n: } n = \log(H_{d2}/H_{d1}) / \log(d_1/d_2) > n = \log(7585776 / 248313.3) / \log(3\text{m}/10\text{m}) > n = 2.840$$

$$H_{d2} = H_{d1} (d_1/d_2)^n > H_{d2} = 7585776 (3/300)^{2.840} = 24.0 \text{ dB}\mu\text{V/m}.$$

EUT in combination with Single Loop Walk Over antenna

$$d_1 = 3\text{m} \quad H_{d1} = 130.6 \text{ dB}\mu\text{V/m} = 3388442 \mu\text{V/m}$$

$$d_2 = 10\text{m} \quad H_{d2} = 100.4 \text{ dB}\mu\text{V/m} = 104712.9 \mu\text{V/m}$$

$$\text{Calculation for n: } n = \log(H_{d2}/H_{d1}) / \log(d_1/d_2) > n = \log(3388442 / 104712.9) / \log(3\text{m}/10\text{m}) > n = 2.888$$

$$H_{d2} = H_{d1} (d_1/d_2)^n > H_{d2} = 3388442 (3/300)^{2.888} = 15.1 \text{ dB}\mu\text{V/m}$$