TEST REPORT CONCERNING THE COMPLIANCE OF AN INDUCTIVE PROXIMITY CARD READER, BRAND INTEGRATED ENGINEERING, MODEL DESFIRE, WITH 47 CFR PART 15 (2003-12-08).

FCC listed	: 90828
Industry Canada	: IC3501
VCCI registered	: R-1518, C-1598

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MEASUREMENT/TECHNICAL REPORT

Integrated Engineering B.V.

Model : DESfire

FCC ID: P4E-SMARTPROX11

March 24, 2004

This report concerns:	Original grant/certification	~~Class 2 change~~	~~Verification~~
Equipment type:	Inductive proximity card reader operating on 13.56 MHz		
Deferred grant requested per 47 CFR 0.457(d)(1)(ii) ?	~~Yes~~	~~No~~	n.a.

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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 and the measurement procedures of ANSI C63.4-1992. TNO Electronic Products & Services (EPS) B.V. at Niekerk, 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: March 24, 2004 Signature:

P.A.J.M. Robben, B.Sc.E.E.
TNO Electronic Products & Services (EPS) B.V.

Description of test item

Test item	:	Inductive proximity card reader operating on 13.56 MHz
Manufacturer	:	Integrated Engineering B.V.
Brand	:	Integrated Engineering
Model	:	DESfire
Serial number	:	0408510
Revision	:	1.1
Receipt number	:	1
Receipt date	:	February 6, 2004

Applicant information

Applicant's representative	:	Mr. R.J. Holslag
Company	:	Integrated Engineering B.V.
Address	:	Paasheuvelsweg 20
Postal code	:	1105 BJ
City	:	Amsterdam
PO-box	:	n.a.
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Test(s) performed

Location	:	Niekerk
Test(s) started	:	February 11, 2004
Test(s) completed	:	March 24, 2004
Purpose of test(s)	:	Type approval / certification
Test specification(s)	:	47 CFR Part 15 (2003-12-08)

Test engineer	:	H.J. Pieters/J. Schuurmans
Report written by	:	J. Schuurmans
Project leader:	:	H.J. Pieters

This report is in conformity with NEN-EN-ISO/IEC 17025: 2000.
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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 inductive proximity reader, brand Integrated Engineering, model DESfire, is designed to function as a security measure in order to prevent unauthorized access to buildings (or parts of buildings). A person who wants to enter a secure building, or a secure area in the building, must have a key card in which a valid access code is stored. When the key card is in close proximity of the card reader the code will be transmitted and validated by a computer system which is connected to the reader itself. Access will be granted to the secure area if it is determined that a valid code has been transmitted.

1.1.2 Choice of operating frequency.

The operating frequency of the inductive proximity card reader brand Integrated Engineering, model SmartID/ISO14443/DESfire, is 13.56 MHz (continuous carrier).

1.1.3 Operating principles.

The inductive proximity card reader is a DC powered system with an integral antenna. The inductive proximity card reader generates a RF-field at a frequency of 13.56 MHz. (continuous carrier) which activates the electronics in the key card. The activated key card then sends an identification code to the inductive proximity card reader by modulating the RF-field. The modulation of the 13.56 MHz RF-field can be detected and then the code is demodulated by the inductive proximity card reader. The code is then transmitted by a wired connection to the computer system for validation.

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

Not applicable.

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 in table 1 below. FCC ID's are stated in this overview where applicable. The EUT is listed in the first row of table 1.

Description	Manufacturer	Model number	Serial number	FCC ID	Cable descriptions
Inductive cardreader	Integrated Engineering B.V.	DESfire	0408510	P4E-SMARTPROX11	data/DC power cable
AC/DC power adapter Input: 120 VAC/60 Hz 15W/ Output: 9 VDC, 1A	Sceptre	PD9010APL5	n.a.	n.a. (DoC)	DC power cable to EUT.

Table 1 - Tested system details overview.

1.4 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (2003-12-08), sections 15.207, 15.205, 15.209 and 15.225

The test methods, which have been used, are based on ANSI C63.4: 1992.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters. Below 30 MHz the radiated emission tests were carried out at measurement distances of 3 and 10 meters. The test results regarding the radiated emission tests on frequencies below 30 MHz have been extrapolated in order to determine the field strength of the measured values at measurement distances of 30 and 300 meters (as required by 47 CFR Part 15).

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.

1.5 Test facility.

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at TNO Electronic Products & Services (EPS) B.V., located in Niekerk, 9822 TL Smidshornerweg 18, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 2, section 2.948, per October 23, 2000.

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 list of all public test facilities is available on the Internet at http://www.fcc.gov.

1.6 Product labeling.

In accordance with 47 CFR Part 15.19 (a)(3) the following text shall be placed on a label, which is attached to the EUT:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

In accordance with 47 CFR Part 2.925 (a)(1), the FCC ID shall be placed on a label, which is attached to the EUT.

For further details about the labeling requirements (size, legibility, etc.) as set by the Federal Communications Commission see 47 CFR Part 15.19 (a)(3), 47 CFR Part 15.19 (b)(2), 47 CFR Part 15.19 (b)(4), 47 CFR Part 2.925 and 47 CFR Part 2.926.

2 System test configuration.

2.1 Justification.

The system was configured for testing in a typical fashion (as a customer would normally use it). During all tests the EUT was set up to function in accordance with the manufacturer's instructions.

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: 1992.

2.2 EUT mode of operation.

Radiated and conducted emission measurements were carried out when the system was active and was generating a continuous transmitting signal.

2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance with the appropriate sections of 47 CFR Part 15.

2.4 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance with the appropriate sections of 47 CFR Part 15.

2.5 Configuration of the tested system.

Unit title	:	Inductive proximity card reader
Model number	:	smartID/ISO14443/DESfire
Part number	:	500-8060
FCC ID	:	P4E-SMARTPROX11
Frequency range	:	13.56 MHz (continuous carrier)
Description/details	:	see section 1.1 of this test report
Power supply	:	+4.75 – 12.3 VDC
Clock Oscillator(s)	:	13.56, 22.1184
Cabinet & Screening	:	Plastic
Interface Cable(s)	:	data cable and DC power cable
Method of screening	:	n.a.
Method of grounding	:	n.a.
Operating configuration	:	See section 1.3 of this test report

2.6 Block diagram of the EUT.

The block diagram is available in the technical documentation package as an addendum to this test report.

2.7 Schematics of the EUT.

The schematics are available in the technical documentation package as an addendum to this test report.

2.8 Partlist of the EUT.

The partlist is available in the technical documentation package as an addendum to this test report.

3 Radiated emission data.

3.1 Radiated field strength measurements (frequency range of 30-1000 MHz, E-field).

Frequency (MHz)	Measurement results dB(µV)/m @ 3 metres Quasi-peak		Limits dB(µV)/m @ 3 metres Quasi-peak	Margin (dB) Quasi-peak		Result
	Vertical	Horizontal		Vertical	Horizontal	
108.50	19.1	9.8	43.5	-24,40	-33,70	PASS
135.62	31.6	20.1	43.5	-11,90	-23,40	PASS
162.75	27.8	16.2	43.5	-15,70	-27,30	PASS
189.87	19.8	24.4	43.5	-23,70	-19,10	PASS
217.00	20.7	21.4	46.0	-25,30	-24,60	PASS
244.12	25.7	26.6	46.0	-20,30	-19,40	PASS
271.24	24.6	20.5	46.0	-21,40	-25,50	PASS
298.37	15.2	22.2	46.0	-30,80	-23,80	PASS
325.49	27.3	23.1	46.0	-18,70	-22,90	PASS
352.62	17.1	32.0	46.0	-28,90	-14,00	PASS
379.74	25.0	23.7	46.0	-21,00	-22,30	PASS
406.86	31.0	33.2	46.0	-15,00	-12,80	PASS

Table 2

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15, sections 15.205 and 15.209, with the EUT operating in continuous transmit mode on 13.56 MHz, are depicted in table 2.

Note: - Field strength values of radiated emissions at frequencies not listed in table 2 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : H.J. Pieters

Date March5, 2004

3.2 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field).

Frequency (MHz)	Measurement results dBµV Quasi-peak		Antenna factor	Cable loss	Measurement results dB(µV)/m Quasi-peak (calculated)	Limits Part 15.209 & 225 dB(µV)/m
	3 meters	10 meters	dB	dB	30 meters	
0.009 - 0.490	<10.0	n.a.	20.5	1	-	28.5 – 13.8 (300 m)
0.490 - 1.705	<10.0	n.a.	19.5	1	-	33.8 - 22.9 (30 m)
1.705 – 13.56	< 10.0	n.a.	19.5	1	-	29.5 (30 m)
13.110-13.410	<10	n.a.	19.5	1	-	40.5 (30 m)
13.410-13.553	11.9	n.a.	19.5	1	-	50.5 (30 m)
13.553-13.567	46.9	25.6	19.5	1	26.7	84.0 (30m)
13.567-13.710	<10	n.a.	19.5	1	-	50.5 (30m)
13.710—14.010	<10	n.a.	19.5	1	-	40.5 (30m)
27.124	<10	n.a.	19.7	1	-	29.5 (30m)

Table 3

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15, sections 15.205 and 15.209, with the EUT operating in continuous transmit mode on 13.56 kHz, are depicted in table 3.

Notes:

- A total work out of the calculated measurement result can be found in the Appendix 1.
- Frequency range: 9-90 kHz Average detector used during measurements
  110-490 kHz Average detector used during measurements
- The radiated field strengths were measured at a distance of 3 and 10 meters. Measured field strengths at a distance of 10 meters were already below the limit of 30/300 meters
- n.a. indicates that no field strength values could be measured on the listed frequencies or in the listed frequency range
- Field strength values of radiated emissions at frequencies not listed in table 3 are more than 20 dB below the applicable limit

  The EUT was varied in three positions, the loop antenna was varied in two orientations. The reported value is the worst case found at the reported frequency.

  The EUT was tested in both normal mode (i.e. without a label in its proximity) and in activated mode (i.e. with a label in its proximity.

Test engineer

Signature

Name : J. Schuurmans

Date : March 23 , 2004

4 Conducted emission data.

Frequency (MHz)	Measurement results dB(µV) Neutral		Measurement results dB(µV) Line 1		Limits dB(µV)		Margin (dB) Neutral		Margin (dB) Line 1		Result
	QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	
15.00	30.5	8.6	30.3	8.5	60.0	50.0	-29.5	-41.4	-29.7	-41.5	PASS
0.50	19.4	7.2	19.1	7.1	56.0	46.0	-36.6	-38.8	-36.9	-38.9	PASS
1.00	12.3	6.6	12.3	6.7	56.0	46.0	-43.7	-39.4	-43.7	-39.3	PASS
5.06	14.7	7.8	13.6	7.3	60.0	50.0	-45.3	-42.2	-46.4	-42.7	PASS
6.00	12.2	6.6	12.2	6.8	60.0	50.0	-47.8	-43.4	-47.8	-43.2	PASS
13.56	46.3	45.2	43.5	41.5	60.0	50.0	-13.7	-4.8	-16.5	-8.5	PASS
27.12	37.5	35.8	35.0	33.0	60.0	50.0	-22.5	-14.2	-25.0	-17.0	PASS
29.90	13.7	8.3	13.8	8.3	60.0	50.0	-46.3	-41.7	-46.2	-41.7	PASS

Table 4.

Frequency (MHz)	Measurement results dB(µV) Neutral		Measurement results dB(µV) Line 1		Limits dB(µV)		Margin (dB) Neutral		Margin (dB) Line 1		Result
	QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	
15.00	31.5	8.1	31.2	8.2	60.0	50.0	-28.5	-41.9	-28.8	-41.8	PASS
0.50	20.3	6.9	31.2	8.1	56.0	46.0	-35.7	-39.1	-24.8	-37.9	PASS
1.00	12.3	6.7	12.0	6.5	56.0	46.0	-43.7	-39.3	-44.0	-39.5	PASS
5.06	14.2	7.5	13.1	7.2	60.0	50.0	-45.8	-42.5	-46.9	-42.8	PASS
6.00	12.2	6.6	12.2	6.8	60.0	50.0	-47.8	-43.4	-47.8	-43.2	PASS
13.56	47.4	47.0	36.6	36.1	60.0	50.0	-12.6	-3.0	-23.4	-13.9	PASS
27.12	24.5	23.2	23.4	21.8	60.0	50.0	-35.5	-26.8	-36.6	-28.2	PASS
29.90	13.7	8.2	13.7	8.2	60.0	50.0	-46.3	-41.8	-46.3	-41.8	PASS

Table 5.

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15, section 15.207, at the 110 Volts AC mains connection terminals of the AC/DC power supply connected to the EUT and with the EUT operating in continuous transmit mode on 13.56 MHz, are depicted in table 4. Table 5 depicts the same, but now with a card in proximity of the EUT.

Test engineer

Signature :

Name : J. Schuurmans

Date : March 23, 2004

5 Carrier signal frequency stability.

5.1 Stability with respect to temperature

In the plots below plot are shown of the carrier signal, measured using a magnetic loop probe. The plot show the carrier frequency at –20 degrees C, 20 degrees C and +50 degrees C. The stability is better than +/-0.01% as required for compliance with 47 CFR 15.225 (e).

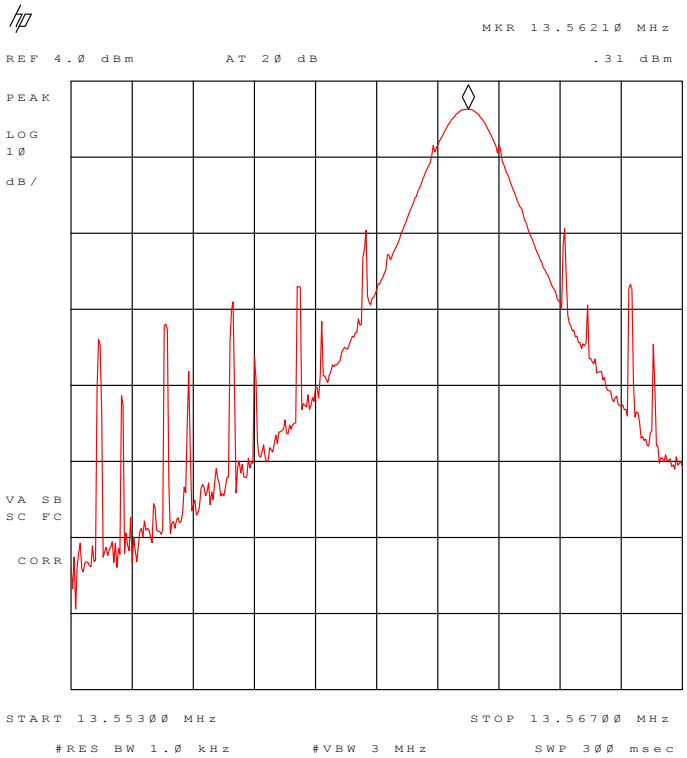

Figure 1: Spectrum of carrier at +20 degrees. 1 unit horizontally correpsonds to 1.4 kHz, or 0.01%

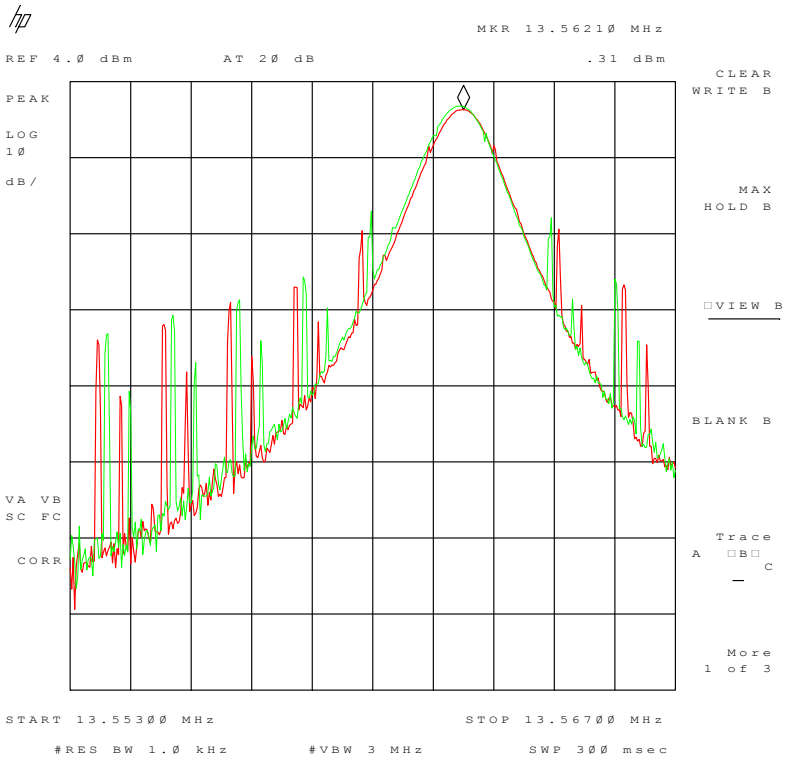

Figure 2 Spectrum of carrier at -20 degrees. 1 unit horizontally correpsonds to 1.4 kHz, or 0.01%

The red trace is +20 degrees C, the green trace is –20 degrees C

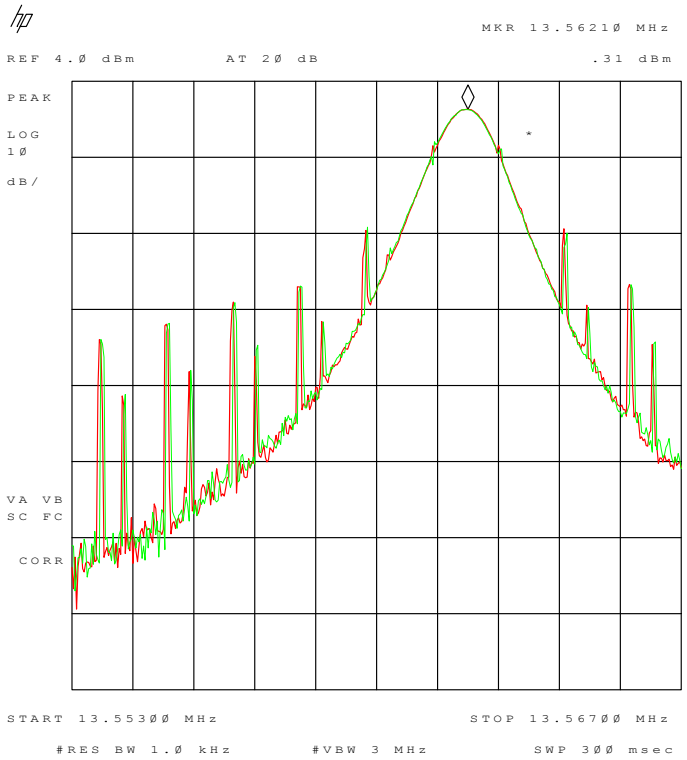

Figure 3Spectrum of carrier at +50 degrees. 1 unit horizontally correpsonds to 1.4 kHz, or 0.01%
The red trace corresponds to +20 degrees C, the green trace corresponds to +50 degrees C

5.2 Stability with power supply variation

While the mains voltage was varied from 85% (93.5 Vac) to 115% (126.5%) the carrier freqeuncy varied less than 100 Hz. This is whithin the limits in 47 CFR 15.225 (e).

Test engineer

Signature :

Name : J. Schuurmans

Date : March 21, 2004

6 List of utilized test equipment.

Inventory number	Description	Brand	Type
12471	Biconical antenna 20MHz-200MHz	EATON	94455-1
12473	Log-per antenna 200-1000MHz	EATON	96005
12476	Antenna mast	EMCO	TR3
12477	Antenna mast 1-4 mtr	Poelstra	--
12482	Loop antenna	EMCO	6507
12483	Guidehorn	EMCO	3115
12484	Guidehorn	EMCO	3115
12488	Guidehorn 18 - 26.5 GHz	EMCO	RA42-K-F-4B-C
12533	Signalgenerator	MARCONI	2032
12559	Digital storage oscilloscope	Le Croy	9310M
12561	DC Power Supply 20A/70V	DELTA	SM7020D
12567	Plotter	HP	7440A
12605	calibrated dipole 28MHz-1GHz	Emco	3121c
12608	HF milliwattmeter	Hewlett Packard	HP435a
12609	Power sensor 10MHz-18GHz	Hewlett Packard	HP8481A
12636	Polyester chamber	Polyforce	--
12640	Temperature chamber	Heraeus	VEM03/500
13664	Spectrum analyzer	HP	HP8593E
13078	Preamplifier 0.1 GHz - 12 GHz	Miteq	AMF-3D-001120-35-14p
13452	Digital multi meter	HP	34401A
13526	Signalgenerator 20 GHz	Hewlett & Packard	83620A
13594	Preamplifier 10 GHz - 25 GHz	Miteq	AMF-6D-100250-10p
13886	Open Area testsite	Comtest	--
14051	Anechoic room	Comtest	--
14450	2.4 GHz bandrejectfilter	BSC	XN-1783
15633	Biconilog Testantenna	Chase	CBL 6111B
15667	Measuring receiver	R&S	ESCS 30
99045	DC Power Supply 3A/30V	DELTA	E030/3
99055	Non-conducting support	NMi	--
99061	Non-conducting support 150cm	NMi	--
99068	Detector N-F/BNC-F	Radiall	R451576000
99069	Cable 5m RG214	NMi	--
99071	Cable 10m RG214	NMi	--
99076	Bandpassfilter 4 - 10 GHz	Reactel	7AS-7G-6G-511
99077	Regulating trafo	RFT	LTS006
99112	Tripod	Chase	--
99136	Bandpassfilter 10 - 26.5 GHz	Reactel	9HS-10G/26.5G-S11

Appendix 1

Calculated measurements results radiated field strength, H-Field

General Formula:

d_1 = short distance

d_2 = long distance

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

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

Measured field strength at 13.56 MHz:

H_{3m} = 67.4 dBµV/m = 2344.2 µV/m

H_{10m} = 46.1 dBµV/m = 201.84 µV/m

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

$n = \log(201.84/2344.23) / \log(3/10)$

$n = 2.04$

Calculated field strength at 13.56 MHz (10m --> 30m):

$H_{30m} = H_{d2}$

$n \log(d_1/d_2) = \log(H_{d2}/H_{d1})$ => $2.04 \log(10/30) = \log(H_{d2} / 201.84)$

$H_{30} = 21.54$ µV/m = 26.66 dBµV/m