TEST REPORT CONCERNING THE COMPLIANCE OF AN INDUCTUVE PROXIMITY CARD READER OPERATING ON 13.562 MHZ, BRAND INTEGRATED ENGINEERING, MODEL SMARTREADER WITH 47 CFR PART 15 (2006-02-01).

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

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MEASUREMENT/TECHNICAL REPORT

Integrated Engineering B.V.

Model : Smarttrans

FCC ID: P4E-SMARTPIN-1

September 6, 2006

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

Report prepared by:		
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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: September 6, 2006 Signature:

P. de Beer
TNO Electronic Products & Services (EPS) B.V.

Description of test item

Test item	:	13.56 MHz Inductive Proximity Card Reader
Manufacturer	:	Integrated Engineering B.V.
Brand	:	Integrated Engineering
Model	:	Smartreader
Serial number(s)	:	n.a.
Revision	:	n.a.
Receipt date	:	June 1, 2006

Applicant information

Applicant's representative	:	Ir. R. Holslag
Company	:	Integrated Engineering B.V.
Address	:	Paasheuvelweg 20
Postal code	:	1105 BJ
City	:	Amsterdam
PO-box	:	-
Postal code	:	-
City	:	-
Country	:	The Netherlands
Telephone number	:	+31 (0) 20 46 20 755
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Test(s) performed

Location	:	Niekerk
Test(s) started	:	May 16, 2006
Test(s) completed	:	July 12, 2006
Purpose of test(s)	:	Equipment Authorisation (Certification, permissive class II change)
Test specification(s)	:	47 CFR Part 15 (2006-02-01)
Test engineers	:	J. Schuurmans, B.Sc.E.E.
Report written by	:	J. Schuurmans, B.Sc.E.E.
Report date	:	September 6, 2006

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1 General information.

1.1 Product description.

1.1.1 Introduction.

The EUT is an inductive proximity card reader intended to be used in access control systems, parking systems and other applications using RF ID readers. It is capable of reading 13.56 MHz inductive tags.

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

The product(s) with FCC ID P4E-SMARTPIN-1. This test report supports the permissive class II change in equipment authorization files under FCC ID P4E-SMARTPIN-1.

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.

EUT	:	13.56 MHz Inductive Card Reader
Manufacturer	:	Integrated Engineering
Brand	:	Integrated Engineering
Model	:	Smarttrans
Serial number	:	n.a.
Voltage input rating	:	+5 - +12 VDC
Current input rating	:	700 mAmps
Remarks	:	-

Auxiliary equipment 1	:	AC/DC power adapter
Manufacturer	:	Integrated Engineering.
Brand	:	Integrated Engineering
Model	:	FW7238/05
Serial number	:	n.a.
Voltage input rating	:	100-240 VAC, 50-60 Hz
Current input rating	:	160 mAmps max.
Voltage output rating	:	+5 VDC
Current output rating	:	1.3 Amps
Remarks	:	-

Auxiliary equipment 3	:	Laptop
Manufacturer	:	Dell Computer Corporation
Brand	:	Dell
Model	:	C600
Serial number	:	TW-0791UH-12800-155-4387
Voltage input rating	:	100-240 VAC, 50-60 Hz
Current input rating	:	3.5 Amps max.
Remarks	:	used on IO port.

1.3.1 Description of input and output ports.

Number	Ports	From	To	Shielding	Remarks
1	AC mains	AC mains	AE1	~~yes~~ / no	**None**
2	DC power input port	AE1	EUT	~~yes~~ / no	**None**
3	Serial port	EUT	AE3	yes / ~~no~~	**None**

AE = Auxiliary equipment

1.4 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (2006-02-01), sections 15.207 and 15.209.

The test methods, which have been used, are based on ANSI C63.4: 2003.

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 in appendix 1 has been applied.

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 15, 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.

A label, in accordance with 47 CFR Part 15.19 (b)(1)(i), shall be 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)(1), 47 CFR Part 15.19 (b)(2) and 47 CFR Part 15.19 (b)(4).

2 System test configuration.

2.1 Justification.

The system was configured for testing in a typical fashion (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: 2003.

2.2 EUT mode of operation.

The EUT has been tested in active mode, i.e. the EUT is ready to detect a card. To assess the behaviour of the EUT while reading the card, the EUT is tested with a card presented such that it continuously reads the card, and continuously sends data to the serial port of the EUT, connected to AE3.

The intentional radiator tests (15.207, 15.209) have been performed with the EUT which contains a keypad and interconnect (see internal pictures exhibit).

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 Block diagram of the EUT.

The block diagram is available in the technical documentation package which will be submitted to the Commission.

2.6 Schematics of the EUT.

The schematics are available in the technical documentation package which will be submitted to the Commission.

2.7 Part list of the EUT.

The part list is available in the technical documentation package which will be submitted to the Commission.

3 Radiated emission data.

3.1 Radiated field strength measurements (30 MHz – 1 GHz, 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	
50.00	33.7	23.3	40.0	-6.3	-16.7	PASS
54.25	32.3	15.4	40.0	-7.7	-24.6	PASS
67.81	29.3	22.6	40.0	-10.7	-17.4	PASS
81.37	27.1	14.6	40.0	-12.9	-25.4	PASS
94.93	16.6	11.6	43.5	-26.9	-31.9	PASS
108.50	18.1	39.7	43.5	-25.4	-3.8	PASS
122.06	33.0	29.4	43.5	-10.5	-14.1	PASS
135.62	34.1	31.5	43.5	-9.4	-12.0	PASS
162.74	18.2	26.4	43.5	-25.3	-17.1	PASS
168.50	31.8	38.9	43.5	-11.7	-4.6	PASS
170.00	12.1	20.8	43.5	-31.4	-22.7	PASS
176.30	18.2	23.7	43.5	-25.3	-19.8	PASS
189.87	24.9	24.3	43.5	-18.6	-19.2	PASS
190.00	22.1	13.8	43.5	-21.4	-29.7	PASS
203.43	32.3	29.3	43.5	-11.2	-14.2	PASS
216.99	30.1	28.1	46.0	-15.9	-17.9	PASS
220.00	26.7	22.5	46.0	-19.3	-23.5	PASS
284.80	34.6	30.3	46.0	-11.4	-15.7	PASS
290.00	31.0	31.8	46.0	-15.0	-14.2	PASS
311.92	32.0	31.1	46.0	-14.0	-14.9	PASS
420.42	29.2	22.0	46.0	-16.8	-24.0	PASS

Table 1: Radiated emissions of the EUT.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15, section 15.209, with the EUT tested in active mode and while detecting a card are depicted in table 1.

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.

Test engineer

signature : 

Name : J. Schuurmans

Date August 2, 2006

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

Frequency (MHz)	Measurement results dBµV		Antenna factor	Cable loss	Measurement results dB(µV)/m (calculated)	Limits Part 15.209 dB(µV)/m
	3 meters	10 meters	dB	dB		
0.009 - 0.490	<10.0	n.a.	20.5	1	-	48.5 – 13.8 (300 m)
0.490 - 1.705	<10.0	n.a.	19.5	1	-	33.8 - 22.9 (30 m)
1.705 – 30.0	< 10.0	n.a.	19.5	1	-	29.5 (30 m)
13.562	48.3	27.9	19.6	1	29.9	84.0 (30m)
27.12	7.9	n.a.	19.4	1	-	29.5 (30m)

Table 2 Radiated emissions of the EUT.

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 125 kHz and 13.562 MHz, are depicted in table 2.

Notes:

- A example of a calculated measurement result can be found in Appendix 1.
- Frequency range: 9-90 kHz Average detector used during measurements
  110-490 kHz Average detector used during measurements
- 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

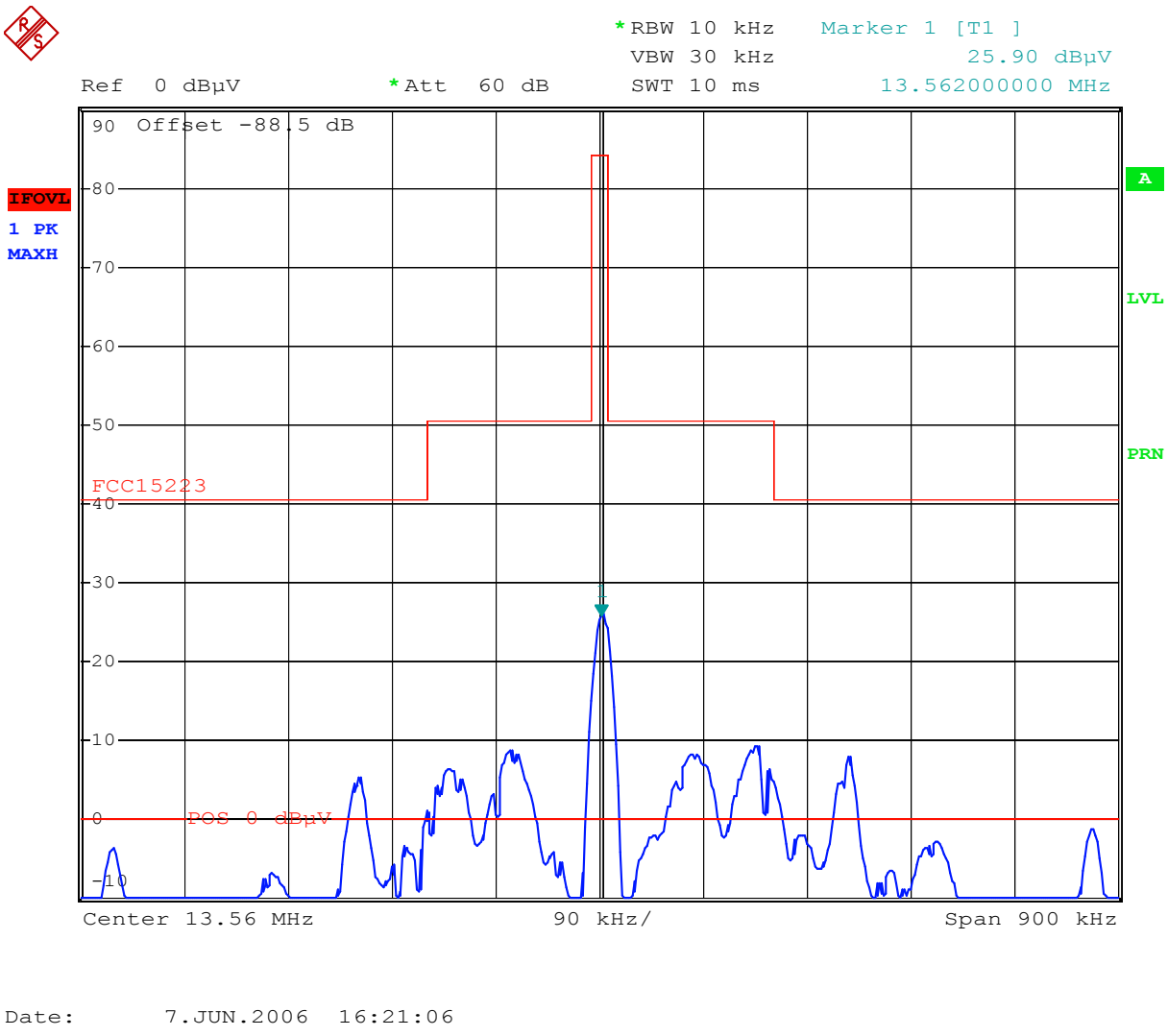
Signature 

Name : J. Schuurmans

Date : June 1, 2006

3.3 Carrier frequency stability on 13.562 MHz

In the figure below, the fieldstrength around 13.562 MHz according to 47 CFR 15.225 is plotted. The plot is achieved using an inductive loop antenna. The axis of the plot have been shifted to correspond to the level emitted and measured at 30 m.



Plot 1: Plot showing the fieldstrength generated by the 13.562 MHz Tx, plotted relative to the field strength limits in 47 CFR 15.225

Note: The frequency stability of the 13.562 carrier is tested to supply voltage variation and temperature variations according to 47 CFR 15.225. The variation is within the specified limits.

4 Conducted emission data.

4.1 Conducted emission data of he EUT.

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	
0.15	34.3	23.1	34.2	23.1	66.0	56.0	-31.7	-32.9	-31.8	-32.9	PASS
0.20	37.1	26.5	36.9	26.4	63.6	53.6	-26.5	-27.1	-26.7	-27.2	PASS
0.37	29.4	18.5	28.0	18.0	58.5	48.5	-29.1	-30.0	-30.5	-30.5	PASS
1.17	45.3	45.1	45.4	45.2	56.0	46.0	-10.7	-0.9	-10.6	-0.8	PASS
13.56	51.5	41.5	51.2	42.3	60.0	50.0	-8.5	-8.5	-8.8	-7.7	PASS
27.12	38.9	38.4	38.5	34.6	60.0	50.0	-21.1	-11.6	-21.5	-15.4	PASS

Table 3: Conducted emission measurements.

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 which was connected to the EUT, are depicted in table 3. The EUT was tested in both active mode, and while detecting a card.

Notes:

1. The conducted emissions on frequencies which are not listed in the table above were found to be below 25 dBµV on both line 1 and line 2.

Test engineer

Signature : 

Name : J. Schuurmans, B.Sc.E.E.

Date : August 2, 2006

5 List of utilized test equipment.

Inventory number	Description	Brand	Model
12476	Antenna mast	EMCO	TR3
12477	Antenna mast 1-4 mtr	Poelstra	--
12491	Measuring receiver	R&S	ESH3
12493	Spectrum monitor ESH3	R&S	EZM
12512	LISN FCC	Emco	3725/2
12605	calibrated dipole 28MHz-1GHz	Emco	3121c
12636	Polyester chamber	Polyforce	--
13313	Pulse limiter	R&S	ESH3-Z2
13886	Open Area testsite	Comtest	--
14051	Anechoic room	Comtest	--
15633	Biconilog Testantenna	Chase	CBL 6111B
15667	Measuring receiver	R&S	ESCS 30
99055	Non-conducting support	NMi	--
99061	Non-conducting support 150cm	NMi	--
99077	Regulating trafo	RFT	LTS006
99112	Tripod	Chase	--

Appendix 1

Calculated measurements results radiated field strength, H-Field

General Formula:

d_1 = short distance

d_2 = long distance

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

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

Measured field strength at 13.562 MHz:

H_{3m} = 68.9 dBµV/m = 2786.12 µV/m

H_{10m} = 48.5 dBµV/m = 266.07 µV/m

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

$n = \log(266.07/2786.12) / \log(3/10)$

$n = 1.95$

Calculated field strength at 13.562 MHz (10m --> 30m):

$H_{30m} = H_{d2}$, $H_{10m} = H_{d1}$

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

$H_{30} = 31.2$ µV/m = 29.9 dBµV/m