

# TEST RESULT SUMMARY

## FCC PART 15 SUBPART C

Section 15.225

## FCC PART 15 SUBPART C

Section 15.207 Conducted Emission Requirements

MANUFACTURER'S NAME	DataCard
NAME OF EQUIPMENT	SP35
TYPE OF EQUIPMENT	13.56 MHz RF ID
MODEL NUMBER	<b>SP35</b>
MANUFACTURER'S ADDRESS	11111 Bren Road West Minnetonka MN 55343
TEST REPORT NUMBER	NC301419
TEST DATE	03 & 07 April, 15 May 2003

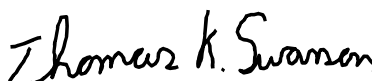
According to testing performed at TÜV Product Service Inc, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in FCC Part 15 Subpart C, Sections 15.207 and 15.225.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

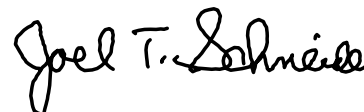
TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 15 Subpart C, Sections 15.207 and 15.225.

Date: 28 May 2003

Location: Taylors Falls MN  
USA



T. K. Swanson  
Tested By



J. T. Schneider  
Reviewed By

# EMC EMISSION - TEST REPORT

Test Report File No. : **NC301419** Date of issue: 28 May 2003Model / Serial No. : **SP35 / D000044**Product Name : **SP35**Product Type : **13.56 MHz RF ID**Applicant : **DataCard**Manufacturer : **DataCard**License holder : **DataCard**Address : **11111 Bren Road West**: **Minnetonka MN 55343**Test Result :  **Positive**  **Negative**Test Project Number :  
Reference(s) : **NC301419**Total pages including  
Appendices : **33**

*TÜV Product Service Inc is a subcontractor to TÜV Product Service, GmbH according to the principles outlined in ISO/IEC Guide 25 and EN 45001.*

*TÜV Product Service Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV Product Service Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV Product Service Inc issued reports.*

*This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.*

*TÜV Product Service Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NVLAP, and VCCI*

## D I R E C T O R Y - E M I S S I O N S

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	FCC 15.207 - Conducted emissions      10/150 kHz - 30 MHz	<u>5, 9</u>
	FCC 15.225 - Radiated emissions      10 kHz - 30 MHz	<u>5, 9</u>
	FCC 15.225 - Radiated emissions      30 MHz - 1000 MHz	<u>6, 9</u>
	Interference power      30 MHz - 300 MHz	<u>N/A</u>
	Equivalent Radiated emissions      1 GHz - 18 GHz	<u>N/A</u>
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	Constructional Data Form	<u>B2 – B7</u>
	Product Information Form(s)	<u>N/A</u>
<b>E)</b>	<b>Appendix C</b>	
	Measurement Protocol	<u>C1 - C2</u>

## EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

- |  |   |                                    |
|--|---|------------------------------------|
| <input type="checkbox"/> - EN 50081-1 / 1991   | <input type="checkbox"/> - Group 1                          | <input type="checkbox"/> - Group 2 |
| <input type="checkbox"/> - EN 55011 / 1991   | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - EN 55013 / 1990   | <input type="checkbox"/> - Household appliances and similar |                                    |
| <input type="checkbox"/> - EN 55014 / 1987   | <input type="checkbox"/> - Portable tools                   |                                    |
|  | <input type="checkbox"/> - Semiconductor devices            |                                    |
| <input type="checkbox"/> - EN 55014 / A2:1990  | <input type="checkbox"/> - Household appliances and similar |                                    |
| <input type="checkbox"/> - EN 55014 / 1993   | <input type="checkbox"/> - Portable tools                   |                                    |
|  | <input type="checkbox"/> - Semiconductor devices            |                                    |
| <input type="checkbox"/> - EN 55015 / 1987   |   |                                    |
| <input type="checkbox"/> - EN 55015 / A1:1990  |   |                                    |
| <input type="checkbox"/> - EN 55015 / 1993   |   |                                    |
| <input type="checkbox"/> - EN 55022 / 1987   | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - EN 55022 / 1994   | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - BS  |   |                                    |
| <input type="checkbox"/> - VCCI  | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |
| <input checked="" type="checkbox"/> - FCC Part 15 Subpart C Section 15.225                                 |   |                                    |
| <input checked="" type="checkbox"/> - FCC Part 15 Subpart C Section 15.207 Conducted Emission Requirements |   |                                    |
| <input type="checkbox"/> - FCC Part 15 Subpart B   | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - CISPR 11 (1990)   | <input type="checkbox"/> - Group 1                          | <input type="checkbox"/> - Group 2 |
|  | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - CISPR 22 (1993)   | <input type="checkbox"/> - Class A                          | <input type="checkbox"/> - Class B |

**Environmental conditions in the lab:**

	<u>Actual</u>
Temperature	: 21 - 24 °C
Relative Humidity	: 55 - 75 %
Atmospheric pressure	: 99.0 – 99.3 kPa
Power supply system	: 50/60 Hz – 230/115 VAC – 1 Phase

**Sign Explanations:**

- not applicable
- applicable



### Emissions Test Conditions: CONDUCTED EMISSIONS [FCC 15.207]

The **CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE)** measurements were performed at the following test location:

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room
- New Brighton Lab Shielded Room

#### Test equipment used:

	TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ -	2417	3825/2	Electro-Mechanics (EMCO)	50 Ω LISN	8812-1439	1-15-04
■ -	2534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	12-03-03

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

### Emissions Test Conditions: RADIATED EMISSIONS [FCC 15.225 (a),(b) 10 kHz - 30 MHz]

The **RADIATED EMISSIONS (MAGNETIC FIELD)** measurements were performed at the following test location:

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)

#### at a test distance of :

- 0.3 meters
- 1 meter
- 3 meter
- 10 meters
- 30 meters

#### Test equipment used:

	TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ -	2534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	12-03-03
■ -	2517	HFH2-Z2	Polarad	Loop Antenna	879285/036	3-26-04

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

**Emissions Test Conditions: RADIATED EMISSIONS [FCC 15.225 (b) Electric Field 30 - 1000 MHz]**

The *RADIATED EMISSIONS (ELECTRIC FIELD)* measurements, in the frequency range of 30 MHz-1000 MHz, were tested in a horizontal and vertical polarization at the following test location:

- Test not applicable

- - Wild River Lab Large Test Site (Open Area Test Site) – NSA measurements made 1-03, due 1-04.
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)

**at a test distance of :**

- 3 meters
- - 10 meters
- 30 meters

**Test equipment used :**

	TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ -	2665	ZHL-1042J	Mini-Circuits	Preamplifier	32296	10-15-03
■ -	3202	EM-6917B	Electro-Metrics	Biconicalog Periodic	102	10-04-03
■ -	2690	8566B	Hewlett-Packard	Spectrum Analyzer (Unit F)	2430A00930	12-02-03
■ -	2678	85662A	Hewlett-Packard	Analyzer Display (Unit F)	2403A08134	12-02-03
■ -	2684	85650A	Hewlett-Packard	Quasi-Peak Adapter (Unit F)	2521A01006	11-26-03

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

**Emissions Test Conditions: INTERFERENCE POWER**

The *INTERFERENCE POWER* measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location:

■ - Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room
- New Brighton Lab Shielded Room

### Emissions Test Conditions: RADIATED EMISSIONS Electric Field 1 to 100 GHz

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range 1 GHz - 100 GHz were performed in a horizontal and vertical polarization at the following test location:

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room

**at a test distance of:**

- 1 meters
- 3 meters
- 10 meters

### Emissions Test Conditions: FREQUENCY TOLERANCE OF THE CARRIER SIGNAL [FCC 15.225 (c)]

The *FREQUENCY TOLERANCE* measurements were performed at the following test location:

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room
- DataCard

**Test equipment used:**

	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ -	8591E	Hewlett-Packard	Spectrum Analyzer	3501A03603	10-25-03
■ -	901	Emco	Near Field Probe	7405-901	N/A
■ -	F-12-CNV-5-5	Thermotron	Temperature Chamber		N/A
■ -	HH23	Omega	Microprocessor Thermometer	SPL-900-194	5-07-03

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.



**Equipment Under Test (EUT) Test Operation Mode - Emission tests :**

The device under test was operated under the following conditions during emissions testing:

- Standby
- Test program (H - Pattern)
- Test program (color bar)
- Test program (customer specific)
- Practice operation
- Normal Operating Mode
- - 1. FCC/ RTTE testing was done using a diagnostic program that ensure constant RF communications under the worst case circumstances, Highest power level, highest data duty cycle, high data transmission rate.
  - 2. SP35 testing all options except contacted smartcard option, this includes SP35 printing full color images, encoding data on the magnetic stripe and reading a contactless smartcard
  - 3. SP35 testing contacted smartcard option. The printer repeatedly issued smartcard transaction using the contacted smartcard option.

**Configuration of the device under test:**

- - See Constructional Data Form in Appendix B - Page B2
- See Product Information Form in Appendix B - beginning on Page B3

**The following peripheral devices and interface cables were connected during the measurement:**

- \_\_\_\_\_ Type : \_\_\_\_\_
- \_\_\_\_\_ Type : \_\_\_\_\_
- \_\_\_\_\_ Type : \_\_\_\_\_
- \_\_\_\_\_ Type : \_\_\_\_\_
- \_\_\_\_\_ Type : \_\_\_\_\_
- - unshielded power cable
- unshielded cables
- - shielded cables                      MPS.No.: \_\_\_\_\_
- customer specific cables
- \_\_\_\_\_
- \_\_\_\_\_

### Emission Test Results:

#### FCC 15.207 - Conducted emissions 150 kHz - 30 MHz

The requirements are  - MET  - NOT MET

Minimum margin of compliance \_\_\_\_\_ 2 dB at \_\_\_\_\_ 543.0 kHz

Maximum margin of non-compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

#### FCC 15.225 (a)(b) - Radiated emissions (magnetic field) 10 kHz - 30 MHz

The requirements are  - MET  - NOT MET

Minimum limit margin for fundamental \_\_\_\_\_ 47 dB at \_\_\_\_\_ 13.56 MHz

Minimum limit margin for spurious/harmonics \_\_\_\_\_ >10 dB at \_\_\_\_\_ kHz

Remarks: The fundamental was measured to be 33 dBuV/m (44.67 microvolts/meter) in Quasi-Peak mode at 30 meters. The limit is 80 dBuV/m (10000 microvolts/meter) at 30 meters. No spurious emissions or other harmonics were detected within 10 dB of the 30 uV/m limit. For band edge compliance the carrier meets the spurious limits at 13.56065 MHz and 13.56180 MHz.

#### FCC 15.225 (b) - Radiated emissions (electric field) 30 MHz - 1000 MHz

The requirements are  - MET  - NOT MET

Minimum margin of compliance \_\_\_\_\_ >10 dB at \_\_\_\_\_ MHz

Minimum limit margin for spurious \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: No emissions detected within 10 dB of the limit. Testing done up to 1000 MHz due to oscillator frequency of card printer (non-RF device) RF ID is contained in. This report only addresses emissions from RF ID.

#### Interference Power at the mains and interface cables 30 MHz - 300 MHz

The requirements are  - MET  - NOT MET  - N/A

Remarks: \_\_\_\_\_

#### Equivalent Radiated emissions 1 GHz - 100 GHz

The requirements are  - MET  - NOT MET  - N/A

Remarks: \_\_\_\_\_

#### FCC 15.225 (c) - Frequency Tolerance of the Carrier Signal

The requirements are  - MET  - NOT MET

Remarks: Limit is  $\pm 0.01\%$  of 13.56 MHz, or  $\pm 1.356$  kHz, so allowed band is 13.558644 MHz to 13.561356 MHz. Frequency deviates from 13.560 MHz to 13.5613 MHz from  $-20$  to  $50$  degrees C and 102 to 138 VAC.

**DEVIATIONS FROM STANDARD:**

None.

**GENERAL REMARKS:**

The radiated measurements from 10 kHz to 30 MHz are made in quasi-peak detection, except for the levels noted between 110-490 kHz, which are made in average detection.

This testing was performed to ensure compliance while using the Abracon crystal, model ABL5-13.56MHZ-20-4-T and the Vanlong, model HC49SD-13.56-20-C-3-5-F-TR.

**SUMMARY:**

The requirements according to the technical regulations are

- met

- **not** met.

The device under test does

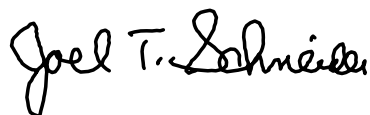
- fulfill the general approval requirements mentioned on page 3.

- **not** fulfill the general approval requirements mentioned on page 3.

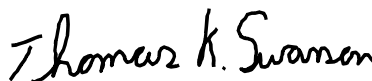
Testing Start Date: 03 April 2003

Testing End Date: 15 May 2003

- TÜV PRODUCT SERVICE INC -

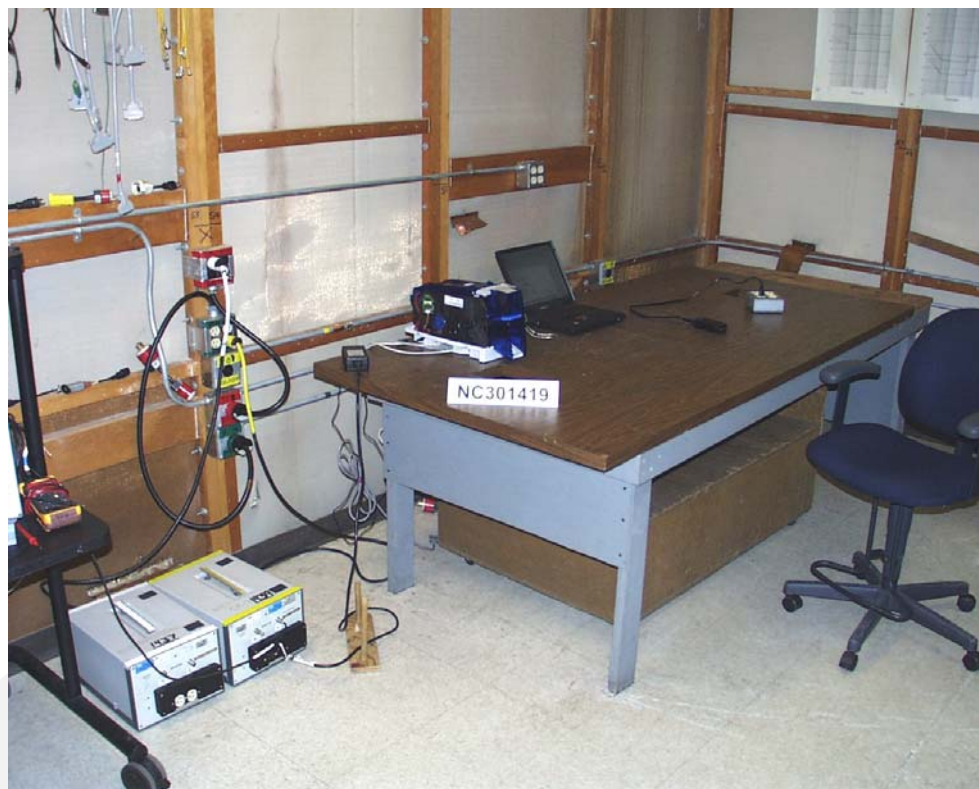


J. T. Schneider  
Reviewed By



Tested By:  
T. K. Swanson

Test-setup photo(s): Conducted emission 150 kHz - 30 MHz



Test-setup photo(s): Radiated emission 10 kHz - 30 MHz





Test-setup photo(s):  
Radiated emission 30 MHz - 1000 MHz



## Appendix A

Test Data Sheets  
and  
Test Setup Drawing(s)

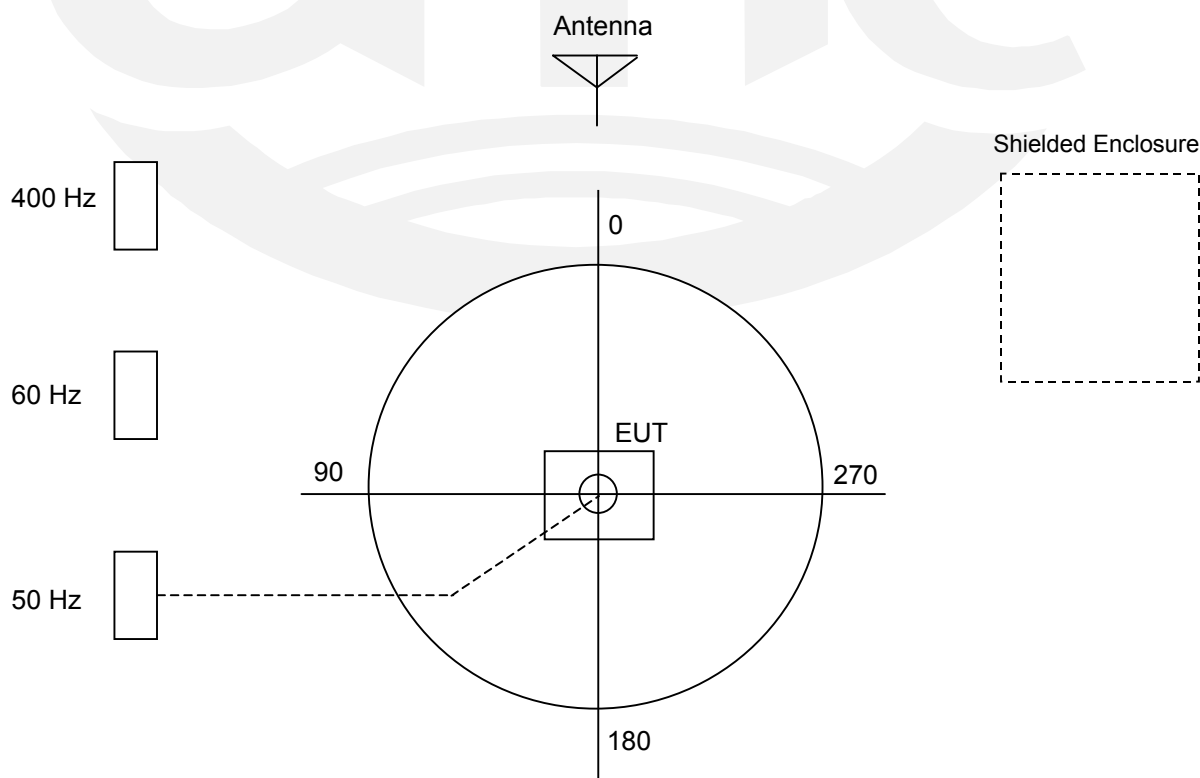


## TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB  
Large Test Site

Notes:

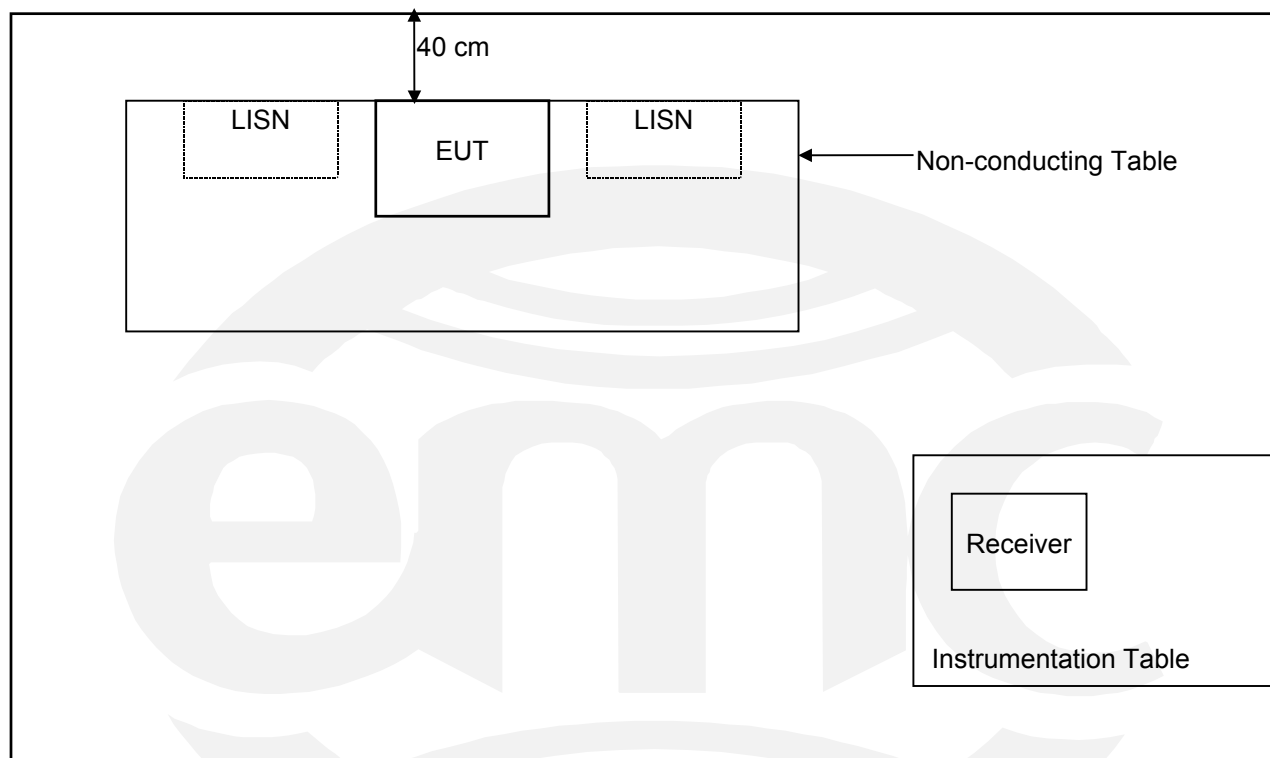
1. Items shown in dotted lines are located on the floor below the test area. It is 5 meters vertically from the ground floor to the test area.
2. 50 Hz, 60 Hz, and 400 Hz are power panels for alternating current.
3. The antenna may be positioned horizontally 3, 10 or 30 meters from the center of the turntable.
4. The circle is a 6.7 meter diameter turntable.
5. A ground plane is in the plane of this sheet.
6. The test sample is shown in the azimuthal position representing zero degrees.



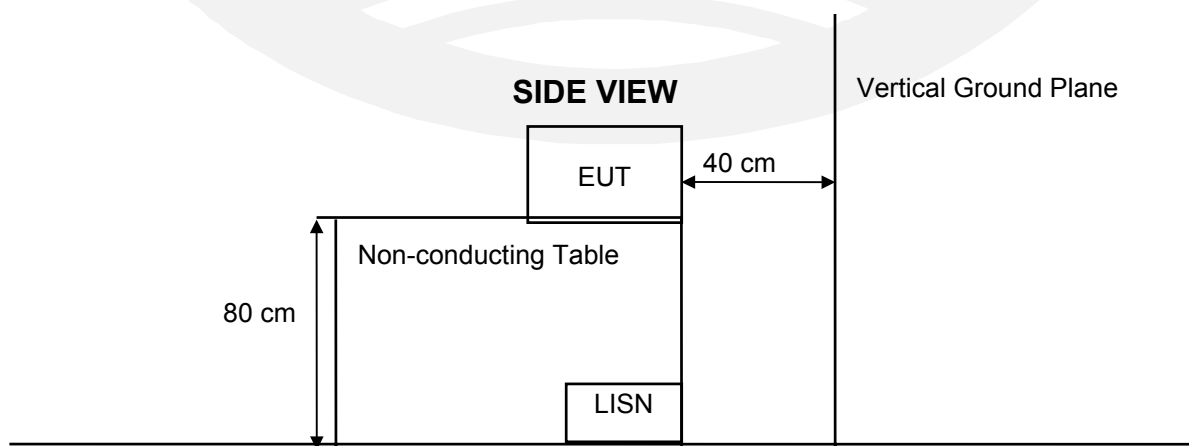
**TEST SETUP FOR EMISSIONS TESTING**

WILD RIVER LAB  
Screen Room

**TOP VIEW**



**SIDE VIEW**



Other Measurements:  
2 meters from top of EUT to ceiling  
80 cm from closest part of EUT to the LISN



FCC Part 15.225 Magnetic Field Radiated Emissions 10 kHz to 30 MHz							
Customer Name: DataCard							
EUT: SP35 with Abracon Crystal							
Test Report # NC301419							
Test Date: 07 April 2003							
	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	margin
MHz	0.3 m	1 m	3 m	10 m	30 m	30 m Limit	dB
0.009						80	
0.49						80	
0.49						80	
1.705						80	
1.705						80	
<b>13.56</b>		<b>89</b>	<b>67</b>	<b>48</b>	<b>33</b>	<b>80</b>	<b>47</b>
30						80	
Quasi-Peak							
All Levels are measured - No extrapolations							
No further harmonics or spurious emisison detected 10 kHz to 30 MHz							
Customer Name: DataCard							
EUT: SP35 with Vanlong Crystal							
Test Report # NC301419							
Test Date: 07 April 2003							
	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	margin
MHz	0.3 m	1 m	3 m	10 m	30 m	30 m Limit	dB
0.009						80	
0.49						80	
0.49						80	
1.705						80	
1.705						80	
<b>13.56</b>		<b>89</b>	<b>67</b>	<b>46</b>	<b>33</b>	<b>80</b>	<b>47</b>
30						80	
Quasi-Peak							
All Levels are measured - No extrapolations							
No further harmonics or spurious emisison detected 10 kHz to 30 MHz							
Noise Floor level at 13.56 MHz is 28 dBuV/m							

Datacard SP35 Transmitter with Abracon Crystal  
April 2003

FCC frequency stability

Test Equipment List:

Thermotron F-12-CNV-5-5, s/n 4947.

Omega HH23 Microprocessor Thermometer, SPL-900-194, cal due 5/7/03

Fluke 73 III Multimeter, s/n 82010308, cal due 9/9/03

HP8591E spectrum analyzer, TUV #2777, cal due 10/25/03.

EMCO 7405-901 loop probe.

Limit is  $\pm 0.01\%$  of 13.56 MHz, or  $\pm 1.356$  kHz, so allowed band is 13.558644 MHz to 13.561356 MHz.

-20 degrees C	13.5613 MHz
-10 degrees C	13.5605 MHz
0 degrees C	13.5613 MHz
10 degrees C	13.5613 MHz
20 degrees C	13.5613 MHz
30 degrees C	13.5613 MHz
40 degrees C	13.5613 MHz
50 degrees C	13.5603 MHz
102 VAC	13.5610 MHz
138 VAC	13.5603 MHz

Datacard SP35 Transmitter with Vanlong Crystal  
April 2003

FCC frequency stability

Test Equipment List:

Thermotron F-12-CNV-5-5, s/n 4947.

Omega HH23 Microprocessor Thermometer, SPL-900-194, cal due 5/7/03

Fluke 73 III Multimeter, s/n 82010308, cal due 9/9/03

HP8591E spectrum analyzer, TUV #2777, cal due 10/25/03.

EMCO 7405-901 loop probe.

Limit is  $\pm 0.01\%$  of 13.56 MHz, or  $\pm 1.356$  kHz, so allowed band is 13.558644 MHz to 13.561356 MHz.

-20 degrees C	13.5605 MHz
-10 degrees C	13.5603 MHz
0 degrees C	13.5608 MHz
10 degrees C	13.5610 MHz
20 degrees C	13.5603 MHz
30 degrees C	13.5603 MHz
40 degrees C	13.5610 MHz
50 degrees C	13.560 MHz
102 VAC	13.5598 MHz
138 VAC	13.560 MHz

# Conducted Electromagnetic Emissions



Test Report #: 1419 Run 01 Test Area: SCREEN ROOM  
 Test Method: EN55022 Test Date: 07-Apr-2003  
 EUT Model #: SP35 EUT Power: \_\_\_\_\_  
 EUT Serial #: \_\_\_\_\_ Temperature: \_\_\_\_\_ °C  
 Manufacturer: DataCard Relative Humidity: \_\_\_\_\_ %  
 EUT Description: \_\_\_\_\_ Air Pressure: \_\_\_\_\_ kPa  
 Notes: CLASS B SCAN FOR INTENTIONAL RADIATOR Page: 1 of 4

FREQ (MHz)	LEVEL (dBuV)	CABLE / LISN / ATTEN (dB)	FINAL (dBuV)	TEST POINT	DELTA1 EN55022 B QP	DELTA2 EN55022 B Avg
60 Hz 110 VAC						
0.162	59.2 Qp	0.0 / 2.8 / 0.0	62.0	Neutral	-3.4	N/A
0.162	46.2 Av	0.0 / 2.8 / 0.0	49.0	Neutral	N/A	-6.4
0.217	52.2 Qp	0.0 / 1.9 / 0.0	54.1	Neutral	-8.8	N/A
0.217	36.8 Av	0.0 / 1.9 / 0.0	38.7	Neutral	N/A	-14.2
0.271	47.6 Qp	0.0 / 1.6 / 0.0	49.2	Neutral	-11.9	N/A
0.271	36.9 Av	0.0 / 1.6 / 0.0	38.5	Neutral	N/A	-12.6
0.543	39.2 Qp	0.0 / 0.3 / 0.0	39.5	Neutral	-16.5	N/A
0.543	43.7 Av	0.0 / 0.3 / 0.0	44.0	Neutral	N/A	-2.0
20.36	55.3 Qp	0.3 / 0.1 / 0.0	55.7	Neutral	-4.3	N/A
20.36	46.0 Av	0.3 / 0.1 / 0.0	46.4	Neutral	N/A	-3.6
8.86	47.3 Qp	0.2 / 0.1 / 0.0	47.5	Neutral	-12.5	N/A
8.86	40.3 Av	0.2 / 0.1 / 0.0	40.5	Neutral	N/A	-9.5
21.58	50.8 Qp	0.3 / 0.1 / 0.0	51.2	Neutral	-8.8	N/A
21.58	42.0 Av	0.3 / 0.1 / 0.0	42.4	Neutral	N/A	-7.6
0.162	55.5 Qp	0.0 / 2.8 / 0.0	58.3	Line 1	-7.1	N/A
0.162	44.5 Av	0.0 / 2.8 / 0.0	47.3	Line 1	N/A	-8.1
0.217	51.6 Qp	0.0 / 1.9 / 0.0	53.5	Line 1	-9.4	N/A
0.217	37.6 Av	0.0 / 1.9 / 0.0	39.5	Line 1	N/A	-13.4
0.271	40.9 Qp	0.0 / 1.6 / 0.0	42.5	Line 1	-18.6	N/A
0.271	34.2 Av	0.0 / 1.6 / 0.0	35.8	Line 1	N/A	-15.3
0.543	38.1 Qp	0.0 / 0.3 / 0.0	38.4	Line 1	-17.6	N/A
0.543	35.8 Av	0.0 / 0.3 / 0.0	36.1	Line 1	N/A	-9.9
8.86	48.2 Qp	0.2 / 0.1 / 0.0	48.4	Line 1	-11.6	N/A

Tested by: TKS

\_\_\_\_\_  
Printed

*Thomas K. Swanson*

\_\_\_\_\_  
Signature

Reviewed by: JTS

\_\_\_\_\_  
Printed

*Joel T. Schmeiser*

\_\_\_\_\_  
Signature

# Conducted Electromagnetic Emissions



Test Report #: 1419 Run 01 Test Area: SCREEN ROOM  
 Test Method: EN55022 Test Date: 07-Apr-2003  
 EUT Model #: SP35 EUT Power: \_\_\_\_\_  
 EUT Serial #: \_\_\_\_\_ Temperature: \_\_\_\_\_ °C  
 Manufacturer: DataCard Relative Humidity: \_\_\_\_\_ %  
 EUT Description: \_\_\_\_\_ Air Pressure: \_\_\_\_\_ kPa  
 Notes: CLASS B SCAN FOR INTENTIONAL RADIATOR Page: 2 of 4

FREQ (MHz)	LEVEL (dBuV)	CABLE / LISN / ATTEN (dB)	FINAL (dBuV)	TEST POINT	DELTA1 EN55022 B QP	DELTA2 EN55022 B Avg
8.86	39.2 Av	0.2 / 0.1 / 0.0	39.4	Line 1	N/A	-10.6
20.36	53.8 Qp	0.3 / 0.1 / 0.0	54.2	Line 1	-5.8	N/A
20.36	46.5 Av	0.3 / 0.1 / 0.0	46.9	Line 1	N/A	-3.1
21.58	50.8 Qp	0.3 / 0.1 / 0.0	51.2	Neutral	-8.8	N/A
21.58	42.0 Av	0.3 / 0.1 / 0.0	42.4	Neutral	N/A	-7.6
21.58	51.9 Qp	0.3 / 0.1 / 0.0	52.3	Line 1	-7.7	N/A
21.58	40.2 Av	0.3 / 0.1 / 0.0	40.6	Line 1	N/A	-9.4
50 Hz 230 VAC						
0.150	55.7 Qp	0.0 / 3.0 / 0.0	58.7	Line 1	-7.3	N/A
0.150	25.0 Av	0.0 / 3.0 / 0.0	28.0	Line 1	N/A	-28.0
0.190	51.4 Qp	0.0 / 2.2 / 0.0	53.6	Line 1	-10.4	N/A
0.190	19.6 Av	0.0 / 2.2 / 0.0	21.8	Line 1	N/A	-32.2
0.320	47.6 Qp	0.0 / 1.4 / 0.0	49.0	Line 1	-10.7	N/A
0.320	30.5 Av	0.0 / 1.4 / 0.0	31.9	Line 1	N/A	-17.8
0.245	48.2 Qp	0.0 / 1.8 / 0.0	50.0	Line 1	-11.9	N/A
0.245	17.5 Av	0.0 / 1.8 / 0.0	19.3	Line 1	N/A	-32.6
0.649	42.3 Qp	0.0 / 0.1 / 0.0	42.4	Line 1	-13.6	N/A
0.649	38.4 Av	0.0 / 0.1 / 0.0	38.5	Line 1	N/A	-7.5
17.80	59.7 Qp	0.3 / 0.1 / 0.0	60.1	Line 1	0.1 *	N/A
17.80	48.4 Av	0.3 / 0.1 / 0.0	48.8	Line 1	N/A	-1.2
17.8 MHz Deleted from summary - not due to transmitter						

Tested by: TKS

\_\_\_\_\_  
Printed

*Thomas K. Swanson*

\_\_\_\_\_  
Signature

Reviewed by: JTS

\_\_\_\_\_  
Printed

*Joel T. Schneider*

\_\_\_\_\_  
Signature

# Conducted Electromagnetic Emissions



Test Report #: 1419 Run 01 Test Area: SCREEN ROOM  
 Test Method: EN55022 Test Date: 07-Apr-2003  
 EUT Model #: SP35 EUT Power: \_\_\_\_\_  
 EUT Serial #: \_\_\_\_\_ Temperature: \_\_\_\_\_ °C  
 Manufacturer: DataCard Relative Humidity: \_\_\_\_\_ %  
 EUT Description: \_\_\_\_\_ Air Pressure: \_\_\_\_\_ kPa  
 Notes: CLASS B SCAN FOR INTENTIONAL RADIATOR Page: 3 of 4

FREQ (MHz)	LEVEL (dBuV)	CABLE / LISN / ATTEN (dB)	FINAL (dBuV)	TEST POINT	DELTA1 EN55022 B QP	DELTA2 EN55022 B Avg
0.150	55.5 Qp	0.0 / 3.0 / 0.0	58.5	Neutral	-7.5	N/A
0.150	17.7 Av	0.0 / 3.0 / 0.0	20.7	Neutral	N/A	-35.3
0.150	26.0 Pk	0.0 / 3.0 / 0.0	29.0	Neutral	-37.0	-27.0
0.162	57.7 Qp	0.0 / 2.8 / 0.0	60.5	Neutral	-4.9	N/A
0.162	43.8 Av	0.0 / 2.8 / 0.0	46.6	Neutral	N/A	-8.8
0.190	43.1 Qp	0.0 / 2.2 / 0.0	45.3	Neutral	-18.7	N/A
0.190	19.9 Av	0.0 / 2.2 / 0.0	22.1	Neutral	N/A	-31.9
0.320	47.8 Qp	0.0 / 1.4 / 0.0	49.2	Neutral	-10.5	N/A
0.320	38.2 Av	0.0 / 1.4 / 0.0	39.6	Neutral	N/A	-10.1
0.245	49.6 Qp	0.0 / 1.8 / 0.0	51.4	Neutral	-10.5	N/A
0.245	17.1 Av	0.0 / 1.8 / 0.0	18.9	Neutral	N/A	-33.0
0.649	41.9 Qp	0.0 / 0.1 / 0.0	42.0	Neutral	-14.0	N/A
0.649	38.1 Av	0.0 / 0.1 / 0.0	38.2	Neutral	N/A	-7.8
17.80	59.0 Qp	0.3 / 0.1 / 0.0	59.4	Neutral	-0.6	N/A
17.80	50.5 Av	0.3 / 0.1 / 0.0	50.9	Neutral	N/A	0.9 *
17.8 MHz deleted from summary - not due to transmitter						
End of scan						

Tested by: TKS

\_\_\_\_\_  
Printed

*Thomas K. Swanson*

\_\_\_\_\_  
Signature

Reviewed by: JTS

\_\_\_\_\_  
Printed

*Joel T. Schneider*

\_\_\_\_\_  
Signature

# Conducted Electromagnetic Emissions



Test Report #: 1419 Run 01 Test Area: SCREEN ROOM  
 Test Method: EN55022 Test Date: 07-Apr-2003  
 EUT Model #: SP35 EUT Power: \_\_\_\_\_  
 EUT Serial #: \_\_\_\_\_ Temperature: \_\_\_\_\_ °C  
 Manufacturer: DataCard Relative Humidity: \_\_\_\_\_ %  
 EUT Description: \_\_\_\_\_ Air Pressure: \_\_\_\_\_ kPa  
 Notes: CLASS B SCAN FOR INTENTIONAL RADIATOR Page: 4 of 4

FREQ (MHz)	LEVEL (dBuV)	CABLE / LISN / ATTEN (dB)	FINAL (dBuV)	TEST POINT	DELTA1 EN55022 B QP	DELTA2 EN55022 B Avg
---------------	-----------------	------------------------------	-----------------	------------	------------------------	-------------------------

***** MEASUREMENT SUMMARY *****						
0.543	43.7 Av	0.0 / 0.3 / 0.0	44.0	Neutral	N/A	-2.0
20.36	46.5 Av	0.3 / 0.1 / 0.0	46.9	Line 1	N/A	-3.1
0.162	59.2 Qp	0.0 / 2.8 / 0.0	62.0	Neutral	-3.4	N/A
0.150	55.7 Qp	0.0 / 3.0 / 0.0	58.7	Line 1	-7.3	N/A
0.649	38.4 Av	0.0 / 0.1 / 0.0	38.5	Line 1	N/A	-7.5
21.58	42.0 Av	0.3 / 0.1 / 0.0	42.4	Neutral	N/A	-7.6
0.217	52.2 Qp	0.0 / 1.9 / 0.0	54.1	Neutral	-8.8	N/A
8.86	40.3 Av	0.2 / 0.1 / 0.0	40.5	Neutral	N/A	-9.5
0.320	38.2 Av	0.0 / 1.4 / 0.0	39.6	Neutral	N/A	-10.1
0.190	51.4 Qp	0.0 / 2.2 / 0.0	53.6	Line 1	-10.4	N/A
0.245	49.6 Qp	0.0 / 1.8 / 0.0	51.4	Neutral	-10.5	N/A
0.271	47.6 Qp	0.0 / 1.6 / 0.0	49.2	Neutral	-11.9	N/A

Tested by: TKS

\_\_\_\_\_  
Printed

*Thomas K. Swanson*

\_\_\_\_\_  
Signature

Reviewed by: JTS

\_\_\_\_\_  
Printed

*Joel T. Schmeiss*

\_\_\_\_\_  
Signature

# Radiated Electromagnetic Emissions



Test Report #:	<u>1419 Run 1</u>	Test Area:	<u>LTS 10m</u>		
Test Method:	<u>EN55022</u>	Test Date:	<u>03-Apr-2003</u>		
EUT Model #:	<u>SP35 (VANLONG CRYSTAL)</u>	EUT Power:	<u>60HZ/115VAC</u>		
EUT Serial #:	<u></u>			Temperature:	<u>21</u> °C
Manufacturer:	<u>DATACARD</u>			Relative Humidity:	<u>75</u> %
EUT Description:	<u></u>			Air Pressure:	<u>99</u> kPa
Notes:	<u></u>			Page:	<u>1 of 1</u>

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 EN55022 A	DELTA2 N/A
---------------	-----------------	------------------------------	-------------------	-----------------------------	---------------------	---------------

No emissions detected 30 to 1000 MHz.

Tested by: RMJ

\_\_\_\_\_  
Printed

\_\_\_\_\_  
Signature

Reviewed by: TKS

\_\_\_\_\_  
Printed

\_\_\_\_\_  
Signature



# Radiated Electromagnetic Emissions



Test Report #: 1419 Run 1      Test Area: LTS 10m  
 Test Method: EN55022      Test Date: 03-Apr-2003  
 EUT Model #: SP35 (ABRACON CRYSTAL)      EUT Power: 60HZ/115VAC  
 EUT Serial #: \_\_\_\_\_      Temperature: 21 °C  
 Manufacturer: DATACARD      Relative Humidity: 75 %  
 EUT Description: \_\_\_\_\_      Air Pressure: 99 kPa  
 Notes: \_\_\_\_\_      Page: 1 of 1

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 EN55022 A	DELTA2 N/A
---------------	-----------------	------------------------------	-------------------	-----------------------------	---------------------	---------------

No emissions detected 30 to 1000 MHz.

Tested by: RMJ

\_\_\_\_\_  
Printed

\_\_\_\_\_  
Signature

Reviewed by: TKS

\_\_\_\_\_  
Printed

\_\_\_\_\_  
Signature

## Appendix B

Constructional Data Form

and/or

Product Information Form(s)



## EMC Test Plan and Constructional Data Form

PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE.

**Applicant** -- NOTE: This information will be input into your test report as shown below.  
Press the F1 key at any time to get HELP for the current field selected.

Company: Datacard Group

Address: 11111 Bren Road West  
Minnetonka, MN 55343

Contact: Bill Myntti Position: Electrical Engineer

Phone: 952 988 2937 Fax: 2658

E-mail Address: bill\_myntti@datacard.com

**General Equipment Description** -- NOTE: This information will be input into your test report as shown below.

EUT Description Card Printer

EUT Name SP35

Model No.: SP35 Serial No.: D000044

Product Options: Magstripe, Smartcard, Supplies RFID, Graphics

Configurations to be tested: Printing full color card, encoding magentic stripe, operating Gemplus 680 contactless copier.

**Test Objective**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> EMC Directive 89/336/EEC (EMC)                           | <input checked="" type="checkbox"/> FCC: Class <input checked="" type="checkbox"/> A <input type="checkbox"/> B Part <u>b, c</u> |
| Std: <u>EN55022:1998</u>   | <input type="checkbox"/> VCCI: Class <input type="checkbox"/> A <input type="checkbox"/> B                                       |
| <input type="checkbox"/> Machinery Directive 89/392/EEC (EMC)                                | <input checked="" type="checkbox"/> BCIQ: Class <input type="checkbox"/> A <input type="checkbox"/> B                            |
| Std: _____   | <input checked="" type="checkbox"/> Canada: Class <input type="checkbox"/> A <input type="checkbox"/> B                          |
| <input type="checkbox"/> Medical Device Directive 93/42/EEC (EMC)                            | <input checked="" type="checkbox"/> Australia: Class <input type="checkbox"/> A <input type="checkbox"/> B                       |
| Std: _____   | <input checked="" type="checkbox"/> Other: <u>RTTE Directive, EN 300 330 and EN301 489-3: 2000</u>                               |
| <input type="checkbox"/> Vehicle Directive 72/245/EEC (EMC)                                  |  |
| Std: _____   |  |
| <input type="checkbox"/> FDA Reviewers Guidance for Premarket Notification Submissions (EMC) |  |

## EMC Test Plan and Constructional Data Form

### TÜV Product Service Certification Requested

- |  |  |
|--|--|
| <input type="checkbox"/> Attestation of Conformity (AoC) | <input type="checkbox"/> International EMC Mark (IEM)  |
| <input type="checkbox"/> Certificate of Conformity (CoC) | <input checked="" type="checkbox"/> Compliance Document  |
| Protection Class (N/A for vehicles)                      | <input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III |
- (Press **F1** when field is selected to show additional information on Protection Class.)

### Attendance

Test will be:     Attended by the customer     Unattended by the customer

### Failure - Complete this section if testing will not be attended by the customer.

- If a failure occurs, TÜV Product Service should:
- Call contact listed above, if not available then stop testing. (After hrs phone): \_\_\_\_\_
  - Continue testing to complete test series.
  - Continue testing to define corrective action.
  - Stop testing.

### EUT Specifications and Requirements

Length: 16"                      Width: 8"                      Height: 10"                      Weight: 8 lbs.  
 : \_\_\_\_\_

### Power Requirements

*Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)*

Voltage:            100-230            (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases:      1

Current (Amps/phase(max)): 2A            Current (Amps/phase(nominal)): 1A

Other \_\_\_\_\_

### Other Special Requirements

### Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)  
 Office Environment

### EUT Power Cable

- |   |    |  |                              |
|---|----|--|------------------------------|
| <input type="checkbox"/> Permanent      | OR | <input checked="" type="checkbox"/> Removable  | Length (in meters): <u>3</u> |
| <input type="checkbox"/> Shielded       | OR | <input checked="" type="checkbox"/> Unshielded |                              |
| <input type="checkbox"/> Not Applicable |    |  |                              |

EMC Test Plan and Constructional Data Form



EUT Interface Ports and Cables												
Interface			Shielding									
Type	Analog	Digital	Qty	Yes	No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
<b>EXAMPLE:</b>												
RS232	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil over braid	Coaxial	Metallized 9-pin D-Sub	Characteristic Impedance	6	<input checked="" type="checkbox"/>	<input type="checkbox"/>
USB	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foi;	None	USB A-B	USB spec 1.1	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>
RS232	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil	None	Dsub9	None	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>

# EMC Test Plan and Constructional Data Form



**EUT Software.**

Revision Level:

Description:

**EUT Operating Modes to be Tested** -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing. Consult with your TÜV Product Service Representative if additional assistance is required.

1. FCC/ RTTE testing was done using a diagnostic program that ensure constant RF communications under the worst case circumstances, Highest power level, highest data duty cycle, high data transmission rate.
2. SP35 testing all options except contacted smartcard option, this includes SP35 printing full color images, encoding data on the magnetic stripe and reading a contactless smartcard
3. SP35 testing contacted smartcard option. The printer repeatedly issued smartcard transaction using the contacted smartcard option.

**EUT System Components** -- List and describe all components which are part of the EUT. For FCC testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc.)

Description	Model #	Serial #	FCC ID #

## EMC Test Plan and Constructional Data Form

<b>Support Equipment</b> -- List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc)			
<i>Description</i>	<i>Model #</i>	<i>Serial #</i>	<i>FCC ID #</i>
Computer Gateway2000	Solo2300	BC497510552	
Power Supply Gateway2000	ADP-50FB	AC298046351	

<b>Oscillator Frequencies</b>			
<i>Frequency</i>	<i>Derived Frequency</i>	<i>Component # / Location</i>	<i>Description of Use</i>
4MHz	Fund.	Y4	Oscillator for system clock generation
13.56MHz	Fund.	Y3	RFID communication clock
12MHz	48MHz	U10	TPH logic control
48MHz	4MHz	U6, U7, U10	system clock

<b>Power Supply</b>			
<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Type</i>
Analog Vision	PEC0240	02000125	<input checked="" type="checkbox"/> Switched-mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____
			<input type="checkbox"/> Switched-mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____

<b>Power Line Filters</b>		
<i>Manufacturer</i>	<i>Model #</i>	<i>Location in EUT</i>

## EMC Test Plan and Constructional Data Form

<b>Critical EMI Components (Capacitors, ferrites, etc.)</b>				
<i>Description</i>	<i>Manufacturer</i>	<i>Part # or Value</i>	<i>Qty</i>	<i>Component # / Location</i>
Ferrite bead	Steward	28A2025-0A0	1	TPH data cable
Ferrite bead	Ferrite	0431164951	1	RFID cable
Inducter	Steward	60ohm	1	Smartcard ground
Capacitor, 330uF, 35V	Panasonic		2	TPH power

**EMC Critical Detail --** Describe other EMC Design details used to reduce high frequency noise.

This testing was performed to ensure compliance while using the Abracon crystal, model ABL5-13.56MHZ-20-4-T and the Vanlong, model HC49SD-13.56-20-C-3-5-F-TR.

(PLEASE INSERT "ELECTRONIC SIGNATURE" BELOW IF POSSIBLE)

**Authorization Signatures**

\_\_\_\_\_  
Customer authorization to perform tests according to this test plan.

\_\_\_\_\_  
Date

Bill Myntti

\_\_\_\_\_  
Test Plan/CDF Prepared By (please print)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Reviewed by TÜV Product Service Associate

\_\_\_\_\_  
Date



## Appendix C

### MEASUREMENT PROTOCOL FOR FCC

#### GENERAL INFORMATION

##### Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of  $\pm 4.5$  dB. The equipment comprising the test systems are calibrated on an annual basis.

##### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

#### CONDUCTED EMISSIONS

The final level, expressed in  $\text{dB}\mu\text{V}$ , is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between  $\text{dB}\mu\text{V}$  and  $\mu\text{V}$ , the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

#### RADIATED EMISSIONS

The final level, expressed in  $\text{dB}\mu\text{V}/\text{m}$ , is arrived at by taking the reading from the spectrum analyzer (Level  $\text{dB}\mu\text{V}$ ), adding the antenna correction factor and cable loss factor (Factor dB) to it, then subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment A.

Example:

FREQ (MHz)	LEVEL ( $\text{dB}\mu\text{V}$ )	CABLE/ANT/PREAMP (dB)	FINAL ( $\text{dB}\mu\text{V}/\text{m}$ )	POL/HGT/AZ (m) (deg)	DELTA1 FCC B
60.80	42.5Qp	+ 1.2 + 10.9 - 25.5 =	29.1	V 1.0 0.0 -	-10.9

## DETAILS OF TEST PROCEDURES

### General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

### Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50  $\Omega$ /50  $\mu$ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

### Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.

In the frequency range of 9 kHz to 30 MHz, measurements are made with quasi-peak or average detection with a loop antenna. The antenna is positioned 1 meter above the ground plane and rotated about its vertical axis for maximum response at each azimuth about the EUT. The antenna is also positioned horizontally at the specified distances.