

TEST REPORT # EMCC-990004EB, 2002-07-15

EQUIPMENT UNDER TEST:

Trade Name:	KILN Data Collector
Model:	KILN Data Collector
Serial No:	None
Equipment Category:	Receiver
Manufacturer:	SMARTCO GmbH
Address:	Konrad-Hornschuch-Str. 57 73660 Urbach Germany
Phone:	+49-7181-87063
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RELEVANT STANDARD: 47 CFR Part 15B - Unintentional Radiators

MEASUREMENT PROCEDURE USED:

ANSI C63.4-1992 FCC/OET MP-4 (1987) Other

TEST REPORT PREPARED BY:

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TEST PERSONNEL:



Klaus Pfister

HEAD OF LABORATORY:



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TEST OF SMARTCO GMBH MODEL KILN DATA COLLECTOR TO 47 CFR PART 15B - UNINTENTIONAL RADIATORS

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1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance to the FCC regulations for unintentional radiators operating under section 15.101 ff. of the Code of Federal Regulations title 47.

1.2 Limits and Reservations

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in this report.

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1.3 Test Location

Company Name:	EMCC DR. RAŠEK
Street:	Moggast 72-74
City:	91320 Ebermannstadt
Country:	Germany
Laboratory:	Test Laboratory of EMCC DR. RAŠEK FCC Registration Number: 90566 This site has been fully described in a report submitted to the FCC, and accepted in the letter dated February 09, 2000 Registration Number 90566.
Phone:	+49-9194-9016
Fax:	+49-9194-8125
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Web:	www.emcc.de

1.4 Manufacturer

Company Name:	SMARTCO GmbH
Street:	Konrad-Hornschuch-Str. 57
City:	73660 Urbach
Country:	Germany
Name for contact purposes:	Mr Martin Gläser
Phone:	+49-7181-87063
Fax:	+49-7181-89542
E-mail:	smartco@compuserve.com

1.5 Dates

Date of receipt of EUT:	CW 26/2002
Test date:	CW 26/2002

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

Device:	Remote control (RF) receiver
Model:	KILN Data Collector
Serial Number:	None
Application:	Wireless data acquisition system for kiln control systems
Power:	24 V DC, supply via RS485 interface
Receive Frequency:	916.5 MHz, one RF channel
Antenna:	internal, integral
Interface ports:	RS485
Variants:	Variant 1: first Pt100 sensor replaced by resistor of 100Ω, Variant 2: second Pt100 sensor replaced by resistor of 100Ω, Variant 3: both Pt100 sensors replaced by resistors of 100Ω. Most complex version tested.

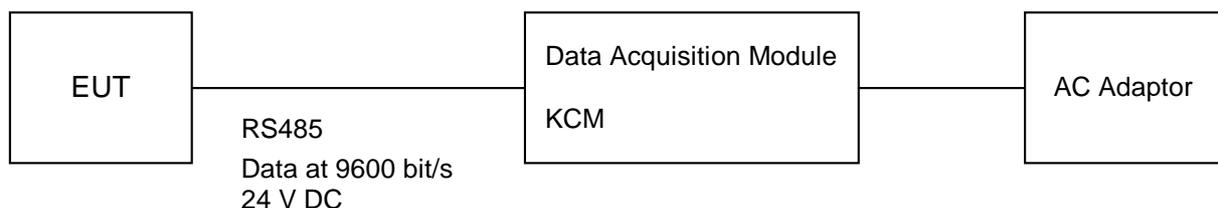
FCC-ID: NP6RXKILN-I

The EUT determines the electrical resistance of two Pt100 sensors and converts the results into temperature readings. In addition, the EUT receives moisture and/or temperature readings sent by the corresponding transmitter "KILN Data Transmitter". The readings are sent serially to the microcontroller (permanently active, clock frequency 3.6864 MHz) at 2400Bd.

2.2 EUT Peripherals

EUT peripherals used during the tests: - data acquisition module,
- AC adaptor.

Test setup



2.3 Mode of Operation During Testing

The receiver was tested in a typical fashion. During testing the receiver covered with its appropriate receive signal supplied by an associated transmitter in sufficient proximity.

The EUT was operated in normal operation mode.

2.4 Modifications Required for Compliance

None.

3 TEST RESULTS SUMMARY

Summary of Test Results Receiver, model KILN Data Collector

Requirement	CFR Section	Report Section	Test Result
Conducted Emissions	15.107	4	Pass
Radiated Spurious Emissions	15.109, 15.205(b)	5	Pass

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the procedure ANSI C63.4 - 1992 and all applicable Public Notices received prior to the date of testing. All emissions from the device were found to be within the limits outlined in this report.

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in this report.

Test Personnel: Klaus Pfister
Issuance Date: 2002-07-15

4 CONDUCTED EMISSIONS TESTS

Test Requirement: FCC CFR47, Part 15B

Test Procedure: ANSI C63.4:1992

4.1 Regulation

Section 15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

Section 15.107 (f) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

4.2 Test Equipment

Type	Manufacturer/ Model No.	Serial No.	Last Calibration	Next Calibration
Receiver (45 kHz - 30 MHz)	Rohde & Schwarz ESS	837010/001	May 2001	November 2002
Protector Limiter (45 kHz...30MHz, 10 dB)	Rohde & Schwarz ESH3-Z2 357.8810.52	844.165/032	January 2002	January 2003
V-LISN 50 ohms / (50 μ H + 5 ohms)	Schwarzbeck NSLK8126	8126228	March 2002	March 2004
AC Power Source (115 VAC, 60 Hz)	ELGAR/BOR 501A	1903	n.a.	n.a.
AC/DC Power Supply	Eltronix EA-3050	001	n.a.	n.a.

4.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that is placed above the groundplane. Ceiling or wall-mounted devices also are positioned on a tabletop for testing purposes. Floor standing equipment is placed either directly on the groundplane or on insulating material if normally placed on a nonconducting floor. The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter. The EUT is connected to a dedicated LISN and all peripherals are connected to a second separate LISN circuit. The LISNs are bonded to the groundplane.

Conducted measurements are made on each current carrying conductor with respect to ground.

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4.4 Test Results

PRODUCT EMISSIONS QUASI PEAK DATA							
No	Tested Line	Emission Frequency [MHz]	Receiver Bandwidth [kHz]	Result [dB(μV)]	Spec Limit [dB(μV)]	Margin [dB]	Remarks
1	L1	0.450	10	26.5	48.0	21.5	
2	N	0.455	10	30.2	48.0	17.8	
3	L1	0.535	10	24.4	48.0	23.6	
4	N	0.535	10	27.2	48.0	20.8	
5	L1	0.630	10	22.5	48.0	25.5	
6	N	0.650	10	24.9	48.0	23.1	
7	L1	0.745	10	20.4	48.0	27.6	
8	N	0.745	10	22.8	48.0	25.2	
9	L1	0.885	10	18.0	48.0	30.0	
10	N	0.930	10	20.4	48.0	27.6	
11	N	1.115	10	19.6	48.0	28.4	
12	N	1.245	10	17.4	48.0	30.6	
13	N	1.470	10	15.5	48.0	32.5	

Device: Remote Control (RF) Receiver

Receiver Model: KILN Data Collector

The EUT meets the requirements of this section.

Test Personnel: Klaus Pfister

Test Date: 2002-06-25

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5 RADIATED EMISSIONS

Test Requirement: FCC CFR47, Part 15B

Test Procedure: ANSI C63.4:1992

5.1 Regulation

Section 15.109 Radiated emission limits. (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (microvolts/meter)
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

(c) In the emission tables above, the tighter limits apply at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which the radiated emissions are to be measured and the detector functions and other measurement standards apply.

(f) For a receiver which employs terminals for the connection of an external receiving antenna, the receiver shall be tested to demonstrate compliance with the provisions of this Section with an antenna connected to the antenna terminals unless the antenna conducted power is measured as specified in Section 15.111(a). If a permanently attached receiving antenna is used, the receiver shall be tested to demonstrate compliance with the provisions of this Section.

Section 15.33 Frequency range of radiated measurements:

(b) For unintentional radiators: (1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3), for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the range device operates or tunes (MHz)	Upper frequency of measurement (MHz)
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

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(3) Except for a CB receiver, a receiver employing superheterodyne techniques shall be investigated from 30 MHz up to at least the second harmonic of the highest local oscillator frequency generated in the device. If such receiver is controlled by a digital device, the frequency range shall be investigated up to the higher of the second harmonic of the highest local oscillator frequency generated in the device or the upper frequency of the measurement range specified for the digital device in paragraph (b)(1) of this Section.

Section 15.35 Measurement detector functions and bandwidths.

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. (...)

(b) On any frequency or frequencies above 1000 MHz, the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules, e.g., see Section 15.255. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

5.2 Test Equipment

Type	Manufacturer/ Model No.	Serial No.	Last Calibration	Next Calibration
Receiver (30 MHz - 1 GHz)	Rohde & Schwarz ESS	843513/012	May 2002	November 2003
Antenna (30 MHz - 1 GHz)	EMCO Model 3143	9604-1269	June 2002	December 2003
Receiver (1 GHz - 5 GHz)	Rohde & Schwarz ESAI-D ESMI-RF ESMI-B1	833771/008 833827/002 832504/005	May 2002	November 2003
Antenna (1 GHz - 5 GHz)	Schwarzbeck BBHA 9120 D	137	October 2001	October 2003

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5.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that sits on a flush mounted metal turntable. Floor standing equipment is placed directly on the flush mounted metal turntable [*Remark: Not applicable*]. The EUT is connected to its associated peripherals with any excess I/O cabling bundled to approximately 1 meter.

Preview tests are performed to determine the "worst case" mode of operation. With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz - 5,000 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz), 1 MHz (1,000 MHz - 5,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

5.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where

- FS = Field Strength in dB(μV/m)
- RA = Receiver Amplitude in dB(μV)
- AF = Antenna Factor in dB(1/m)
- CF = Cable Attenuation Factor in dB

Assume a receiver reading of 23.5 dB(μV) is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dB(μV/m). The 32 dB(μV/m) value can be mathematically converted to its corresponding level in μV/m.

$$FS = 23.5 \text{ dB}(\mu\text{V}) + 7.4 \text{ dB}(1/\text{m}) + 1.1 \text{ dB} = 32 \text{ dB}(\mu\text{V}/\text{m})$$

$$FS = 10^{(32/20)} \mu\text{V}/\text{m} = 39.8 \mu\text{V}/\text{m}$$

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5.5 Test Results

PRODUCT EMISSIONS ^{1, 2, 3}									
No	Emission Frequency	Receiver Mode and Bandwidth	Test Distance	Receiver Reading	Correction Factor	Result = Corrected Reading	Spec Limit	Polarization	Margin
	[MHz]	[kHz]	[m]	RA [dB(μV)]	AF+CF [dB(1/m)]	FS [dB(μV/m)]	[dB(μV/m)]	Ant.	[dB]
1	30.40	QP, 120	3	4.0	13.1	17.1	40.0	v	22.9
2	33.18	QP, 120	3	3.0	12.3	15.3	40.0	v	24.7
3	36.87	QP, 120	3	7.1	11.3	18.4	40.0	v	21.6
4	111.20	QP, 120	3	9.0	8.3	17.3	43.5	h	26.2
5	128.87	QP, 120	3	12.3	9.4	21.7	43.5	h	21.8
6	149.55	QP, 120	3	7.1	11.8	18.9	43.5	h	24.6

Device: Remote Control (RF) Receiver

Receiver Model: KILN Data Collector

The EUT meets the requirements of this section.

Test Personnel: Klaus Pfister

Test Date: 2002-06-24, 2002-06-25

¹ 30 MHz - 1,000 MHz: test performed together with corresponding transmitter "KILN Data Transmitter".

² TX carrier disregarded in table.

³ 1,000 MHz - 5,000 MHz: test performed without corresponding transmitter "KILN Data Transmitter"; no emissions found above noise floor.

6 MISCELLANEOUS COMMENTS AND NOTES

None.

7 LIST OF ANNEXES

Following annexes are separated parts to this test report.

Description	Pages
Annex 1: Photographs of test setups	3