EUT: RFID Reader HH 500
FCC ID: VLUHH500

Date of issue: 2007-12-11

Deutscher Akkreditierungs Rat
DAR
DAT-P-225/96-02

Test Report
acc. to the relevant standard
47 CFR Part 15 C – Intentional Radiators
Measurement Procedure:
ANSI C63.4 - 1992
relating to
Advanced ID Asia Engineering Co. Ltd.
RFID Reader HH 500

Measurement of Radio- Noise Emissions
from Low- Voltage Electrical and Electronic Equipment
Technical characteristics and test methods for radio equipment
in the frequency range 9 kHz to 40 GHz

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EUT: RFID Reader HH 500
FCC ID: VLUHH500

Date of issue: 2007-12-11

Manufacturer's details	
Manufacturer	Advanced ID Asia Engineering Co. Ltd.
Manufacturer's grantee code	VLU
Manufacturer's address	65/12 Moo 10 T. Sankumpang
	A. Sankumpang
	Chiang Mai 501030
	Thailand
	+66 53 39 09 09
	+66 53 39 09 10
	gottfried@aee.co.th
Relevant standard used	47 CFR Part 15C - Intentional Radiators
	ANSI C63.4-1992

Test Report prepared by	
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Equipment Under Test (EUT)	
Equipment category	RFID reader
Trade name	Advanced ID Corporation
Type designation	RFID Reader HH 500
Serial no.	376680
Variants	RFID Reader PR 500

EUT: RFID Reader HH 500
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1. Test results

CFR Section	Report Chapter	Requirements Headline	Test result		
15.203	11.1	Antenna requirement	**pass**	~~**fail**~~	~~**n.t.**~~
15.205(a)	11.2	Operation in the restricted bands	**pass**	~~**fail**~~	~~**n.t.**~~
15.207	11.3	Conducted emissions	**pass**	~~**fail**~~	~~**n.t.**~~
15.209(a)	11.4	Radiated emissions	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(a)(1)(i)	11.5	Channel occupancy / bandwidth	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(b)(2)	11.6	Peak output power	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(b)(4)	11.7	Radio frequency hazard	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(d)	11.8	Out of band emissions	**pass**	~~**fail**~~	~~**n.t.**~~

Test requirements kept	**yes**	~~**no**~~

Signature (Technical engineer) Ralf Trepper

Signature (Manager) Manfried Dudde

EUT: RFID Reader HH 500
FCC ID: VLUHH500

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2. Test laboratory

Company name	: m.dudde hochfrequenz-technik
Street	: Rottland 5a
City	: 51429 Bergisch Gladbach
Country	: Germany
Laboratory	: FCC Registration Number: 699717 This site has been fully described in a report submitted to the FCC, and renewed with letter dated July 12, 2005, Registration Number 699717.
Phone	: +49-2207-9689-0
Fax	: +49-2207-9689-20
E-Mail	: manfred.dudde@t-online.de
Web	: http://www.dudde.com

3. Introduction

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of m. dudde hochfrequenz - technik.

This report contains the result of tests performed by m. dudde hochfrequenz - technik for the purpose of a type approval. The order for carrying out these tests has been placed by:

Manufacturer

Company name	: Advanced ID Asia Engineering Co. Ltd.
Address	: 65/12 Moo 10 T. Sankumpang A. Sankumpang
Postcode	: 501030
City/town	: Chiang Mai
Country	: Thailand
Telephone	: +66 53 39 09 09
Fax	: +66 53 39 09 10
E-mail	: gottfried@aee.co.th
Date of order	: 2007-06-12
References	: Mr. Gottfried Auer

4. Product

Samples of the following apparatus were submitted for testing:

Type of equipment	:	RFID reader
Trademark	:	Advanced ID Corporation
Type designation	:	**RFID Reader HH 500**
Hardware version	:	RFID Reader HH 500
Serial number	:	376680
Software release	:	---
Power used	:	110 V AC \ 50…60Hz (AC / DC Adaptor)
		9.6 V DC (internal Accu)
Frequency used	:	902.300 MHz – 927.700 MHz
Generated or used frequencies	:	902.300 MHz – 927.700 MHz
		7.3728 MHz Crystal, 12.000 MHz Crystal, 13.000 TCXO
FCC ID	:	**VLUHH500**

5. Test schedule

The tests were carried out in accordance with the specifications detailed in chapter 7 “Summary“ of this report at:

- m. dudde hochfrequenz - technik, D-51429 Bergisch Gladbach

The test sample was received on:

- 2007-07-04

The tests were carried out in the following period of time:

- 2007-09-27 - 2007-10-12

6. Product and measurement documentation

For issuing this report the following product documentation was used and the following annexes were created:

Description	Date	Identifications
External photographs of the **E**quipment **U**nder **T**est (EUT)	2007-10-12	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2007-10-12	Annex no. 2
Channel occupancy / bandwidth	2007-10-12	Annex no. 3
FCC ID label sample	2007-10-12	Annex no. 4
Functional description	2007-10-12	Annex no. 5
Test setup photos	2007-10-12	Annex no. 6
Block diagram	2007-10-12	Annex no. 7
Schematics	2007-10-12	Annex no. 8
Technical description	2007-10-12	Annex no. 9
Antenna description	2007-12-11	Annex no. 10

The above mentioned documentation will be filed at m. dudde hochfrequenz - technik for a period of 10 years following the issue of this report.

7. Observations and comments

8. Summary

The product is intended for the use in the following areas of application:

Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the frequency range of 9 kHz to 40 GHz

The samples were tested according to the following specification:

47 CFR Part 15 – Intentional Radiators, ANSI C63.4 - 1992

9. Conclusions

Samples of the apparatus were found to **CONFORM WITH** the specifications stated in chapter 7 "Summary" of this report.

In the opinion of m. dudde hochfrequenz - technik, the samples satisfied all applicable requirements relating to the network interface types specified in chapter 7 "Summary".

The results of the type tests as stated in this report are exclusively applicable to the product item as identified in this report. m. dudde hochfrequenz - technik does not accept any responsibility for the results stated in this report, with respect to the properties of product items not involved in these tests.

This report consists of a main module, modules with test results and annexes listed in chapter 5:
“Product documentation”. All pages have been numbered consecutively and bear the m. dudde hochfrequenz - technik logo, the report number and sub numbers.
The total number of pages in this report is **40**.

Tester:

Date : 2007-12-11
Name : Ralf Trepper

Signature : 

Technical responsibility for area of testing:

Date : 2007-12-11
Name : Manfried Dudde

Signature : 

10. Operation description

10.1 EUT details

10.2 EUT configuration

Testing was carried out using software control which allowed the following changes to be made:

- Output power: maximum, +27 dBm
- Frequency hopping in the band: 902 – 928 MHz
- Frequency hopping using a pseudo random sequence.
- Changes in modulation: None,
- Single frequency operation
- Channel spacing: 200 kHz

The RFID Reader HH 500 was tested with a fully loaded integrated accumulator and with an external power supply (Type: Sunny COMPUTER TECHNOLOGY EUROPE s.r.o., model: SYS1308-2418-W2E).

10.3 EUT measurement description

Radiated emission test

The **SkyeModule M9** is inserted in the **RFID Reader HH 500 and RFID Reader PR 500**. Both variants contain the same antenna. One configuration will be tested as stand alone device (**RFID Reader HH 500)**. In order to establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test sample. Secondly the test sample have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical has been varied. All generated frequencies, the lowest and the highest frequency of the **RFID Reader HH 500,** have been viewed.

Conducted emission test

The device was connected to the artificial mains network via an external AC / DC adaptor. It has been tested in two runs: with activated **RFID Reader HH 500** in read write mode to read user data and write user data into different tags, and in stand by mode. L1 and N have been viewed too.

11.1 Antenna requirement

11.1.1 Regulation

15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

11.1.2 Result

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

The antenna is integrated in the EUT and can only be replaced by original construction equality antennas.

11.2 Operation in the restricted bands

11.2.1 Regulation

Section 15.205 Restricted bands of operation

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this Section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to Section 15.213.

(4) Any equipment operated under the provisions of § 15.253, § 15.255 or § 15.257 of this part.

.

(5) Biomedical telemetry devices operating under the provisions of Section 15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of Subpart D or F of this part.

(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under § 15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in § 15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under § 15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in § 15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of Section 15.245 shall not exceed the limits specified in Section 15.245(b).

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator. (d) The following devices are exempt from the requirements of this Section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle. (2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to Section 15.213.

(4) Any equipment operated under the provisions of § 15.253, § 15.255 or § 15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of Section 15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of Subpart D or F of this part.

(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under § 15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in § 15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under § 15.249 are exempt from 83 complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in § 15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbancesensors operating under the provisions of Section 15.245 shall not exceed the limits specified in Section 15.245(b).

11.2.2 Result

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	**yes**	~~**no**~~	page no: **22-27**

11.3 Conducted emissions

11.3.1 Regulation

Section 15.207(a) For an intentional radiator which 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 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50µH/50ohms line impedance stabilization network (LISN). Compliance with this provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission(MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15-0.50	66 to 56*	56 to 46*
0.50-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency

Section 15.207(c) 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 connected 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.

11.3.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Remarks
Receiver (9 kHz - 30MHz)	Rhode & Schwarz ESH2 (22)	882902/007	05 / 06	05 / 08	---
Protector limiter 9 kHz - 30MHz, 10 dB	Rhode & Schwarz ESH 3Z2 (272)	357,881052	03 / 06	03 / 08	---
V-LISN 50 ohms//(50 uH+5 ohms)	RFT NNB 11 (72)	13835240	03 / 07	03 / 10	---
V-LISN 50 ohms//(50 uH+5 ohms)	emco 3810/2 LISN (49b)	---	03 / 07	03 / 10	---

11.3.3 Test procedures

The EUT and the additional equipment (if required) are connected to the main power through a line impedance stabilization network (LISN). The LISN must be appropriate to ANSI C63.4: 1992 Section 7. Additional equipment must also be connected to a second LISN with the same specifications described in the above sentence (if required).

11.3.4 Test results

TRANSMITTER CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result Quasi-peak [dBµV]	Spec Limit (Average) [dBµV]	Margin [dB]	Remarks
L1	**0.1586**	**10**	**39.0**	**55.8**	**16.8**	***2**
N	**0.1586**	**10**	**39.0**	**55.8**	**16.8**	***2**
L1	**0.3581**	**10**	**46.0**	**51.7**	**5.7**	***2**
N	**0.3581**	**10**	**46.0**	**51.7**	**5.7**	***2**
L1	0.475	10	≤-2	47	49	*1
N	0.475	10	≤-2	47	49	*1
L1	0.600	10	≤-2	46	48	*1
N	0.600	10	≤-2	46	48	*1
L1	0.725	10	≤-2	46	48	*1
N	0.725	10	≤-2	46	48	*1
L1	0.850	10	≤-2	46	48	*1
N	0.850	10	≤-2	46	48	*1
L1	1.000	10	≤-2	46	48	*1
N	1.000	10	≤-2	46	48	*1
L1	1.125	10	≤-2	46	48	*1
N	1.125	10	≤-2	46	48	*1
L1	2.000	10	≤-2	46	48	*1
N	2.000	10	≤-2	46	48	*1
L1	4.000	10	≤-2	46	48	*1
N	4.000	10	≤-2	46	48	*1
L1	6.7644	10	≤-2	50	52	*1
N	6.7644	10	≤-2	50	52	*1
L1	13.5288	10	≤-2	50	52	*1
N	13.5288	10	≤-2	50	52	*1
L1	**24.0037**	**10**	**48.0**	**50**	**2.0**	***2**
N	**24.0037**	**10**	**47.0**	**50**	**3.0**	***2**
L1	27.0575	10	≤-2	50	52	*1
N	27.0575	10	≤-2	50	52	*1
Measurement uncertainty			< ± 2 dB			

Remark: *[1] Noise level of the measuring instrument ≤ -2 dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

11.4 Radiated emissions

11.4.1 Regulation

15.209(a)

Section 15.209 Radiated emission limits, general requirements. (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

11.4.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –26.5 GHz)	Hewlett Packard Spectrum Analyzer 8593E (171)	3528U00990	2006/05	2008/05
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2006/03	2008/03
Loop antenna (0.009 - 30 MHz)	Schwarzbeck			
Bilog antenna (30 - 1000 MHz)	CHASE CBL611A (167)	1517	2003/09	2009/09
Horn antenna (0,86-8,5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	1998/01	2008/01
Horn antenna (2-14 GHz)	Schwarzbeck BBHA 9120 A (284)	169	1998/01	2008/01

11.4.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 1992 Section 8 “Radiated Emissions Testing”

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 10,000 MHz
Test distance	3 m*(for frequencies above 30 MHz)
Test instrumentation resolution bandwidth	9 kHz (0.009 – 30MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 10,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 10,000 MHz)
Receive antenna polarization / orientation	0 – 360°
	Vertical / horizontal (30 MHz - 1,000 MHz)

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

11.4.4 Calculation of field strength Section 15.209 below 30 MHz

The receiver reading gives not directly the field strength result in (dBµV/m). The antenna factors of the loop antenna and cable losses must be added to find the correct result.

For frequencies below 30 MHz and for a test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40 dB/decade (inverse linear distance for field strength measurements).

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Loop antenna factor + cable loss

FS = 40.7 - 40 = 0.7 [dBµV/m]

Level in µV/m Common Antilogarithm (0.7/20) = 1.1

11.4.5 Calculation of field strength Section 15.209 above 30 MHz

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

11.4.6 Calculation of average correction factor

The average correction factor is computed by analyzing the "worst case" on time in any 100msec time period and using the formula: Corrections Factor + 20*log (worst case on time/100msec) Analysis of the remote transmitter worst case on time in any 100msec time period is an on time of 50msec, therefore the correction factor is 20*log (50/100) = - 6 dB. The maximum correction factor to be applied is 20 dB per section 15.35 of the FCC rules.

11.4.7 Calculation of the field strength Section 15.247

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For example:

The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB (1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 39.8

For a test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1), the field strength is calculated by adding additionally an extrapolation factor of 20dB/decade (inverse linear distance for field strength measurements).

11.4.8 Result

(lowest frequency)(902.3 MHz)

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)									
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
No emissions detected									
Measurement uncertainty		± 4 dB							

EUT: RFID Reader HH 500
FCC ID: VLUHH500

Date of issue: 2007-12-11

(lowest frequency)(902.3 MHz)

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dBµV	Test distance m	Correction factor dB	Distance extrapol. factor dB	AV Correction factor dB	Level corrected dBµV/m	Limit dBµV/m	Margin dBµV/m	Polaris. EUT / antenna	Antenna height cm
30.0000	100, AV	≤ 3.5	3	-2.6*[5]	0	0	0.9	40.0	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.8*[5]	0	0	-7.3	40.0	47.3	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.3*[5]	0	0	-6.8	43.5	50.3	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.5*[5]	0	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.8*[6]	0	0	8.3	54.0	45.7	H,V/H,V	100-400
2706.900	**1000, AV**	**16.3**	**3**	**8.1*[6]**	**0**	**0**	**24.9**	**54.0**	**29.1**	**V, 0°/V**	**147**
3609.200	**1000, AV**	**9.3**	**3**	**8.3*[6]**	**0**	**0**	**16.8**	**54.0**	**37.2**	**V, 0°/V**	**215**
4511.500	**1000, AV**	**≤ 10**	**3**	**8.9*[6]**	**0**	**0**	**18.9**	**54.0**	**35.1**	**H,V/H,V**	**100-400**
5413.800	**1000, AV**	**≤ 10**	**3**	**9.2*[6]**	**0**	**0**	**19.2**	**54.0**	**34.8**	**H,V/H,V**	**100-400**
7500.0000	1000, AV	≤ 14	3	12.9*[6]	0	0	26.9	54.0	27.1	H,V/H,V	100-400
8120.700	**1000, AV**	**≤ 14**	**3**	**14.8*[6]**	**0**	**0**	**28.8**	**54.0**	**25.2**	**H,V/H,V**	**100-400**
9023.000	**1000, AV**	**≤ 14**	**3**	**15.9*[6]**	**0**	**0**	**29.9**	**54.0**	**24.1**	**H,V/H,V**	**100-400**
11000.0000	1000, AV	≤ 14	3	18.3*[6]	0	0	32.3	54.0	21.7	H,V/H,V	100-400
Measurement uncertainty		± 4 dB									

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

Remark: *[1] Noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)
Remark: * Peak Limit according to Section 15.35 (b).

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

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(middle frequency)(915.0 MHz)

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°

No emissions detected

Measurement uncertainty	± 4 dB

EUT: RFID Reader HH 500
FCC ID: VLUHH500

Date of issue: 2007-12-11

(middle frequency)(915.0 MHz)

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polaris. EUT / antenna	Antenna height **cm**
30.0000	100, AV	≤ 3.5	3	-2.60	0	0	0.9	40.0	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.80	0	0	-7.3	40.0	47.3	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.30	0	0	-6.8	43.5	50.3	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.50	0	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.80*[6]	0	0	8.3	54.0	45.7	H,V/H,V	100-400
2745.000	**1000, AV**	**16.2**	**3**	**8.1*[6]**	**0**	**0**	**24.3**	**54.0**	**29.7**	**V, 0°/V**	**157**
3660.000	**1000, AV**	**8.1**	**3**	**8.3*[6]**	**0**	**0**	**16.4**	**54.0**	**37.6**	**V, 0°/V**	**217**
4575.000	**1000, AV**	**≤ 10**	**3**	**8.9*[6]**	**0**	**0**	**18.9**	**54.0**	**35.1**	**H,V/H,V**	**100-400**
5000.0000	1000, AV	≤ 10	3	9.2*[6]	0	0	19.2	54.0	34.8	H,V/H,V	100-400
7320.000	**1000, AV**	**≤ 14**	**3**	**12.9*[6]**	**0**	**0**	**26.9**	**54.0**	**27.1**	**H,V/H,V**	**100-400**
8235.000	**1000, AV**	**≤ 14**	**3**	**14.8*[6]**	**0**	**0**	**28.8**	**54.0**	**25.2**	**H,V/H,V**	**100-400**
9150.000	**1000, AV**	**≤ 14**	**3**	**15.9*[6]**	**0**	**0**	**29.9**	**54.0**	**24.1**	**H,V/H,V**	**100-400**
11000.0000	1000, AV	≤ 14	3	18.3*[6]	0	0	32.3	54.0	21.7	H,V/H,V	100-400
Measurement uncertainty	± 4 dB										

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

Remark: *[1] Noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)
Remark: * Peak Limit according to Section 15.35 (b).

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

EUT: RFID Reader HH 500
FCC ID: VLUHH500

Date of issue: 2007-12-11

(highest frequency)(927.7 MHz)

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dBµV	Test distance m	Correction factor dB	Distance extrapol. factor dB	Level corrected dBµV/m	Limit dBµV/m	Margin dBµV/m	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
No emissions detected									
Measurement uncertainty		± 4 dB							

(highest frequency)(927.7 MHz)

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polaris. EUT / antenna	Antenna height **cm**
30.0000	100, AV	≤ 3.5	3	-2.60	0	0	0.9	40.0	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.80	0	0	-7.3	40.0	47.3	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.30	0	0	-6.8	43.5	50.3	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.50	0	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.80*[6]	0	0	8.3	54.0	45.7	H,V/H,V	100-400
2783.100	**1000, AV**	**17.8**	**3**	**8.1*[6]**	**0**	**0**	**25.9**	**54.0**	**28.1**	**V, 0°/V**	**158**
3710.800	**1000, AV**	**8.0**	**3**	**8.3*[6]**	**0**	**0**	**16.3**	**54.0**	**37.7**	**V, 0°/V**	**210**
4638.500	**1000, AV**	**≤ 10**	**3**	**8.9*[6]**	**0**	**0**	**18.9**	**54.0**	**35.1**	**H,V/H,V**	**100-400**
5000.0000	1000, AV	≤ 10	3	9.2*[6]	0	0	19.2	54.0	34.8	H,V/H,V	100-400
7500.0000	1000, AV	≤ 14	3	12.9*[6]	0	0	26.9	54.0	27.1	H,V/H,V	100-400
7421.600	**1000, AV**	**≤ 14**	**3**	**14.8*[6]**	**0**	**0**	**28.8**	**54.0**	**25.2**	**H,V/H,V**	**100-400**
8349.300	**1000, AV**	**≤ 14**	**3**	**15.9*[6]**	**0**	**0**	**29.9**	**54.0**	**24.1**	**H,V/H,V**	**100-400**
11000.0000	1000, AV	≤ 14	3	18.3*[6]	0	0	32.3	54.0	21.7	H,V/H,V	100-400
Measurement uncertainty	± 4 dB										

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

Remark: *[1] Noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)
Remark: * Peak Limit according to Section 15.35 (b).

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

11.5 Channel occupancy / bandwidth

11.5.1 Regulation

15.247(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

11.5.2 Test equipment

Type	**Manufacturer/ Model no.**	**Serial no.**	**Last calibration**	**Next calibration**
Receiver (9 kHz –26.5 GHz)	Hewlett Packard Spectrum Analyzer 8593E (171)	3528U00990	2006/05	2008/05
Probe for relative measurement (800 – 950MHz)	R&S 204.1010.02 (357)	UG 89B/J	2006/03	2009/03

11.5.3 Test procedures

Testing was carried out in accordance with the less than 250 kHz requirements.
Measurements were carried out on 3 single frequencies across the operating range.
Measurements were carried out with different tags, the worst case measurement were documented.

There are 128 hopping frequencies in use, the maximum 20 dB bandwidth is 105 kHz and the maximum average time of occupancy is 360 msec.

In addition the average time of occupancy on any frequency shall not exceed 400 milliseconds in any 20 second period.
Using a spectrum analyser with a Zero span, the “on frequency time” was determined to be maximal 90 msec.
With the spectrum analyser still operating with a Zero span the transmitter was observed to be “on frequency”, on average, 4 times in any 20 second period.
Therefore 90.0 msec * 4 times = 360.0 msec.

11.5.4 Result

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	**yes**	~~**no**~~	Annex no. 3

11.6 Peak output power

11.6.1 Regulation

15.247(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

11.6.2 Test equipment

Type	**Manufacturer/ Model no.**	**Serial no.**	**Last calibration**	**Next calibration**
Receiver (9 kHz –26.5 GHz)	Hewlett Packard Spectrum Analyzer 8593E (171)	3528U00990	2006/05	2008/05
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2006/03	2008/03
Pre-amplifier (1 GHz - 18GHz)	Narda (345a)	---	2006/03	2008/03
Bilog antenna (30 - 1000 MHz)	CHASE CBL611A (167)	1517	2003/09	2009/09
Horn antenna (0,86-8,5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	1998/01	2008/01
Horn antenna (2-14 GHz)	Schwarzbeck BBHA 9120 A (284)	169	1998/01	2008/01

11.6.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 1992 Section 8 “Radiated Emissions Testing”

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 14,000 MHz
Test distance	3 m*(for frequencies above 30 MHz)
Test instrumentation resolution bandwidth	9 kHz (0.009 – 30MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 10,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 14,000 MHz)
Receive antenna polarization / orientation	0 – 360°
	Vertical / horizontal (30 MHz - 14,000 MHz)

11.6.4 Calculation of the radiated power

The radiated power is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Substituted over the whole frequency band and listed in an correction table

For example:

The receiver reading is -32.7 dBm. The Correction Factor with the use of a pre-amplifier for the measured frequency of 434 MHz is +12.5 dB and the cable factor for the measured frequency is 0.71 dB, giving a power level of -19.49 dBm.
-19.49 dBm = 11.25 µW

11.6.5 Result

Radiated measurement was carried out, because the antenna is an integrated type!

(lowest frequency)(902.3 MHz)

PEAK OUTPUT POWER (Section 15.247 (b)(2))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm (E.I.R.P)**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
902.300	**100, PK**	**-18.6**	**3**	**45.0**	**0**	**0**	**26.4**	**30**	**3.6**	**V, 0° / V**	**100**
	100, PK	**-18.3**	**3**	**44.8**	**0**	**0**	**26.5**	**30**	**3.5**	**V, 0° / H**	**122**
Measurement uncertainty	± 3 dB										

* Bandwidth = the measuring receiver bandwidth

(middle frequency)(915.0 MHz)

PEAK OUTPUT POWER (Section 15.247 (b)(2))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm (E.I.R.P)**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
915.000	**100, PK**	**-18.6**	**3**	**45.0**	**0**	**0**	**26.4**	**30**	**3.6**	**V, 0° / V**	**100**
	100, PK	**-18.1**	**3**	**44.8**	**0**	**0**	**26.7**	**30**	**3.3**	**V, 0° / H**	**122**
Measurement uncertainty	± 3 dB										

* Bandwidth = the measuring receiver bandwidth

(highest frequency)(927.7 MHz)

PEAK OUTPUT POWER (Section 15.247 (b)(2))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm (E.I.R.P)**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
927.700	**100, PK**	**-18.4**	**3**	**45.0**	**0**	**0**	**26.6**	**30**	**3.4**	**V, 0° / V**	**100**
	100, PK	**-17.9**	**3**	**44.8**	**0**	**0**	**26.9**	**30**	**3.1**	**V, 0° / H**	**122**
Measurement uncertainty	± 3 dB										

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

11.7 Radio frequency hazard

11.7.1 Regulation

15.247(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

11.7.2 Result

The EUT will only be used with a separation of 20 centimetres or greater between the antenna and the body of the user. The MPE calculation for this exposure is shown below.

The peak radiated output power (EIRP) is calculated as follows:

EIRP = P + G EIRP = 26.9 dBm	Where, P = Power input to the antenna (mW) G = Power gain of the antenna (dBi)

The numeric gain (G) of the antenna with a gain specified in dB is determined by:

$G = Log^{-1}$ (dB antenna gain / 10)

$G = Log^{-1}$ (0.1 / 10)

G = 1.02

Power density at the specific separation:

$S = PG/(4R^2\pi)$ $S = (489.78) / (4 * 20^2 * \pi)$ **$S = 0.0974$ mW/cm^2**	Where, S = Maximum power density (mW/cm^2) P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

The maximum permissible exposure (MPE) for the general population is 1 mW/cm^2.
The power density at 20cm does not exceed the 1 mW/cm^2 limit.

Estimated safe separation:

$R = \sqrt{(PG/4л)}$ $R = \sqrt{(489.78/4л)}$ **R = 6.24 cm** **R = 1.97 cm**	Where, P = Power input to the antenna (mW) G = Numeric power gain of the antenna) R = Distance to the **center** of the radiation of the antenna (20cm = limit for MPE) R = Distance to the **backside** of the radiation of the antenna (EIRP 10 dB below the center of radiation) (20cm = limit for MPE)

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	**yes**	~~**no**~~	Annex no. 10

11.8 Out of band emissions

11.8.1 Regulation

15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

11.8.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –26.5 GHz)	Hewlett Packard Spectrum Analyzer 8593E (171)	3528U00990	2006/05	2008/05
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2006/03	2008/03
Pre-amplifier (1 GHz - 18GHz)	Narda (345a)	---	2006/03	2008/03
Bilog antenna (30 - 1000 MHz)	CHASE CBL611A (167)	1517	2003/09	2009/09
Horn antenna (0,86-8,5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	1998/01	2008/01
Horn antenna (2-14 GHz)	Schwarzbeck BBHA 9120 A (284)	169	1998/01	2008/01

11.8.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 1992 Section 8 “Radiated Emissions Testing”

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 14,000 MHz
Test distance	3 m*(for frequencies above 30 MHz)
Test instrumentation resolution bandwidth	9 kHz (0.009 – 30MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 10,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 14,000 MHz)
Receive antenna polarization / orientation	0 – 360°
	Vertical / horizontal (30 MHz - 14,000 MHz)

11.8.4 Calculation of the radiated power

The radiated power is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Substituted over the whole frequency band and listed in an correction table

For example:

The receiver reading is -32.7 dBm. The Correction Factor with the use of a pre-amplifier for the measured frequency of 434 MHz is +12.5 dB and the cable factor for the measured frequency is 0.71 dB, giving a power level of -19.49 dBm.
-19.49 dBm = 11.25 µW

11.8.5 Result

(lowest frequency)

OUT OF BAND EMISSION (Section 15.247 (c))											
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
1804.600	**100, PK**	**-60.7**	**3**	**20.1*[6]**	**0**	**0**	**-40.6**	**10**	**50.6**	**V,90°/H**	**112**
2706.900	Measured acc. to Section 15.205(a) and section 15.209(a)										
3609.200	Measured acc. to Section 15.205(a) and section 15.209(a)										
4511.500	Measured acc. to Section 15.205(a) and section 15.209(a)										
5413.800	Measured acc. to Section 15.205(a) and section 15.209(a)										
6316.100	100, PK	≤ -92	3	21.4*[6]	0	0	-70.6	10	80.6	H,V/H,V	100-400
7218.400	100, PK	≤ -92	3	23.1*[6]	0	0	-68.9	10	78.9	H,V/H,V	100-400
8120.700	Measured acc. to Section 15.205(a) and section 15.209(a)										
9023.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
9925.300	100, PK	≤ -92	3	25.3*[6]	0	0	-66.7	10	76.7	H,V/H,V	100-400
Measurement uncertainty	± 4 dB										

* Bandwidth = the measuring receiver bandwidth

EUT: RFID Reader HH 500
FCC ID: VLUHH500

Date of issue: 2007-12-11

(middle frequency)

OUT OF BAND EMISSION (Section 15.247 (c))

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
1830.000	**100, PK**	**-60.4**	**3**	**20.1*[6]**	**0**	**0**	**-40.3**	**10**	**50.3**	**V,90°/H**	**114**
2745.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
3660.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
4575.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
5490.000	100, PK	≤ -92	3	21.4*[6]	0	0	-70.6	10	80.6	H,V/H,V	100-400
6405.000	100, PK	≤ -92	3	23.1*[6]	0	0	-68.9	10	78.9	H,V/H,V	100-400
7320.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
8235.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
9150.000	Measured acc. to Section 15.205(a) and section 15.209(a)										
10065.000	100, PK	≤ -92	3	25.3*[6]	0	0	-66.7	10	76.7	H,V/H,V	100-400
Measurement uncertainty	± 4 dB										

* Bandwidth = the measuring receiver bandwidth

(highest frequency)

OUT OF BAND EMISSION (Section 15.247 (c))

f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
1855.400	**100, PK**	**-60.3**	**3**	**20.1*[6]**	**0**	**0**	**-40.2**	**10**	**50.2**	**V,90°/H**	**114**
2783.100	Measured acc. to Section 15.205(a) and section 15.209(a)										
3710.800	Measured acc. to Section 15.205(a) and section 15.209(a)										
4638.500	Measured acc. to Section 15.205(a) and section 15.209(a)										
5566.200	100, PK	≤ -92	3	21.4*[6]	0	0	-70.6	10	80.6	H,V/H,V	100-400
6493.900	100, PK	≤ -92	3	23.1*[6]	0	0	-68.9	10	78.9	H,V/H,V	100-400
7421.600	Measured acc. to Section 15.205(a) and section 15.209(a)										
8349.300	Measured acc. to Section 15.205(a) and section 15.209(a)										
9277.000	100, PK	≤ -92	3	24.6*[6]	0	0	-67.4	10	77.4	H,V/H,V	100-400
10204.700	100, PK	≤ -92	3	25.3*[6]	0	0	-66.7	10	76.7	H,V/H,V	100-400
Measurement uncertainty	± 4 dB										

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ -103 dBm @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ -102 dBm @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ -96 dBm @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ -92 dBm @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

12. Additional information to the test report

Remarks

n.t.[1] Not tested, because the antenna is part of the PCB

n.t.[2] Not tested, because the EUT is directly battery powered

End of test report