Deutsche Akkreditierungsstelle D-PL-12053-01-01

Test Report
acc. to the relevant standard
47 CFR Part 15 B – Unintentional Radiators
Measurement Procedure:
ANSI C63.4 - 2003
relating to
HARTING Electric GmbH & Co. KG
Ha-VIS RF-R500

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

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach
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Manufacturer's details	
Manufacturer	HARTING Electric GmbH & Co. KG
Manufacturer's grantee code	**Z4N**
Manufacturer's address	HARTING Electric GmbH & Co. KG
	Wilhelm –Harting-Straße 1
	D-32339 Espelkamp
	Tel.: +49 (0) 5772 47-97100
	Fax : +49 (0) 5772 47-495
	Contact person: Jan Regtmeier
	Email: jan.regtmeier@HARTING.com
Relevant standard used	47 CFR Part 15B - Unintentional Radiators
	ANSI C63.4-2003

Test Report prepared by	
Technical engineer	Ralf Trepper
	m.dudde hochfrequenz-technik (laboratory)
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	Germany
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Equipment **U**nder **T**est **(EUT)**	
Equipment category	Digital device
Trade name	HARTING
Type designation	Ha-VIS RF-R500
Serial no.	01:23:45:67:89:0A:32911
Variants	Ha-VIS RF-R500-c-US Ha-VIS RF-R500-p-US

1. Test results

CFR Section	Report Chapter	Requirements Headline	Test result		
15.107	11.1	Conducted emissions	**Pass**	~~Fail~~	~~N.t.~~
15.109(a)	11.2	Radiated emissions	**Pass**	~~Fail~~	~~N.t.~~

The equipment meets the requirements	**Yes**	~~No~~

Signature
Technican: .....
(Ralf Trepper)

Signature
Manager : .....
(Manfried Dudde)

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List of contents Page

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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 May 29, 2008, Registration Number 699717.
Phone	: +49 (0) 2207 9689-0
Fax	: +49 (0) 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:

4. Applicant

Company name	: HARTING Electric GmbH & Co. KG
Address	: Wilhelm –Harting-Straße 1 D-32339 Espelkamp
Country	: Germany
Telephone	: +49 (0) 5772 47-97100
Fax	: +49 (0) 5772 47-495
Email	: jan.regtmeier@HARTING.com
Date of order	: 2011-08-09
References	: Mr. Jan Regtmeier

4. Product

Samples of the following apparatus were submitted for testing:

Manufacturer	: HARTING Electric GmbH & Co. KG
Trademark	: HARTING
Type designation	: Ha VIS RF-R500
Hardware versions	: **Ha VIS RF-R500**
Variants	: ---
Serial number	: 01:23:45:67:89:0A:32911
Software release	: LINUX (Kernel 3.X.X)
Type of equipment	: FHSS Transceiver (UHF RFID Reader)
Power used	: 24.0 V DC
Frequency used	: 902.750 MHz – 927.250 MHz (50 channels with 500 kHz channel spacing)

Generated or used frequencies : 902.750 MHz – 927.250 MHz (Carrier)
18.432 MHz, 20.0 MHz, 25.0 MHz, 81.92 MHz (Crystals, UHF Long Range Reader Ha-VIS RF-R500-p-US)
18.432 MHz, 20.0 MHz, 25.0 MHz, 81.92 MHz (Crystals, UHF Long Range Reader Ha-VIS RF-R500-c-US)

5. Testing laboratory

The tests were carried out in accordance with the specifications detailed in chapter 8 of this report at:

m. dudde hochfrequenz-technik
Rottland 5a, 51429 Bergisch Gladbach, Germany

Phone: +49 - (0) 22 07 / 96 89-0
Fax: +49 - (0) 22 07 / 96 89-20

- FCC Registration Number: **699717**

Accredited by:

DAkkS Deutsche Akkreditierungsstelle GmbH
DAkkS accreditation number: D-PL-12053-01

The test sample was received on:

- 2011-08-09

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

- 2012-03-14 - 2012-03-27

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)	2012-03-06	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2012-03-06	Annex no. 2
Channel occupancy / bandwidth	2012-03-06	Annex no. 3
Label sample	2012-03-06	Annex no. 4
Functional description / User manual	2012-03-06	Annex no. 5
Test setup photos	2012-03-06	Annex no. 6
Block diagram	2012-03-06	Annex no. 7
Operational description	2012-03-06	Annex no. 8
Schematics	2012-03-06	Annex no. 9
Parts list	2012-03-06	Annex no. 10
Antenna description	2012-03-06	Annex no. 11

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

Comments: There are two versions. Ha-VIS RF-R500-p is with PoE connectivity. On Ha-VIS RF-R500-c there is no PoE connectivity.

Additional equipment for the tests to carry on the Ha-VIS RF-R500-p:

HP Laptop,
Type: compaq nx6325
SN: CNU64907YN

PoE Switching adapter,
Model: SL POWER ELECTRONICS
PW183RD48000F07 (UL: 2L85 / E136791)
Input: 110-250 V AC / 50-60 Hz / 1.0 A max.
Output: +48 V DC / 0.625 A / 30 W max.

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 15B – Unintentional Radiators, ANSI C63.4 - 2003

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9. Conclusions

Samples of the apparatus were found to **CONFORM WITH** the specifications stated in chapter 8 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 8.

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 6. 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 **21.**

Technical inspector:

Date : 2012-05-31

Name : Ralf Trepper

Signature : .....

Technical responsibility for area of testing:

Date : 2012-05-31

Name : Manfried Dudde

Signature : .....

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10. Operation description

7.1 EUT details

The Ha VIS RF-R500 Reader are along range reader (up to 6), operating at UHF (902-928 MHz), in a Frequency Hopping Mode. The readers have a RF output level of 1 W.
The readers can be supplied with 24 VDC.
The Ha VIS RF-R500 Reader contains a LINUX operating system. The system is capable of using channels which are separated by a frequency spacing of 500kHz, starting at a centre frequency of 902.7 MHz (channel 1). The transmitter and receiver parts each have a hop time (time for switching from one hopping channel to the next), determined by the settling time of the on-chip frequency synthesizer. Of all available channels are used for TX hopping. During each transmission all hopping channels (1-50) are used. Thereby it is inherently ensured that the hopping channels are used equally often for TX. The sequence of hopping channels during a transmission and exact timing for TX on each hopping channel is determined by a pseudo-random algorithm.

7.2 EUT configuration

Testing was carried out using software control implemented in the EUT with the following settings:
- Output power: off
- Frequency hopping in the band 902 – 928 MHz: off

7.3 EUT measurement description

Radiated emission test

One configuration will be tested as standalone device. 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, middle and the highest frequency of the UHF Long Range Reader Ha VIS RF-R500 Reader, have been viewed.

Conducted measurements

1.) the UHF Long Range Reader Ha VIS RF-R500 Reader was connected via external power supply to the artificial mains network. It has been tested only in continuous transmit mode. L1 and N have been viewed.
2.) the UHF Long Range Reader Ha VIS RF-R500 Reader was connected via external POE power supply **(model: PW183RD48000F07 (UL: 2L85 / E136791)** to the artificial mains network. It has been tested only in continuous transmit mode. L1 and N have been viewed.
3.) the UHF Long Range Reader Ha VIS RF-R500 Reader was connected via USB to an Laptop **(Type: HP compaq nx6325 / SN CNU64907YN)**. It has been tested in standby and continuous transmit mode. L1 and N have been viewed.
4.) the UHF Long Range Reader Ha VIS RF-R500 Reader was connected via RS232 to an Laptop **(Type: HP compaq nx6325 / SN CNU64907YN)**. It has been tested in standby and continuous transmit mode. L1 and N have been viewed.

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11.1 Conducted limits

11.1.1 Regulation

(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 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions 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 band edges.

Frequency of Emission (MHz)	**Conducted limit (dB µV)**	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

(b) For a Class A digital device 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 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms LISN. Compliance with the provisions 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 (dB µV)**	
	Quasi-peak	Average
0.15-0.5	79	66
5-30	73	60

(c) The limits shown in paragraphs (a) and (b) of this Section shall not apply to carrier current systems operating as unintentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in Section 15.109(e).

(d) 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.

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11.1.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Calibration executed by
Receiver (9 kHz - 30MHz)	Schwarzbeck FMLK 1518 (428)	1518294 9360	08/2010	08/2013	Schrarzbeck
Panorama- Monitor FMLK / VUMA	PAZ1550 (429)	---	---	---	---
Protector limiter 9 kHz - 30MHz 10 dB	Rhode & Schwarz ESH 3Z2 (272)	357,881052	09/2011	09/2013	Dudde
V-LISN 50 ohms//(50 uH+5 ohms)	RFT NNB 11 (72)	13835240	07/2010	07/2013	Dudde
V-LISN 50 ohms//(50 uH+5 ohms)	EMCO (49b)	9512-1227	07/2010	07/2014	Dudde
RF- cable	Aircell 1.5m [BNC/N]	K30	09/2011	09/2012	Dudde

11.1.3 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).

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11.1.4 Test results

1.) Tested with external DC power supply

CONDUCTED EMISSIONS (Section 15.107)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	**0.1989**	**9**	**48.0**	**54.6**	**6.6**	***2**
N	**0.1989**	**9**	**48.0**	**54.6**	**6.6**	***2**
L1	**0.3089**	**9**	**40.0**	**54.5**	**14.5**	***2**
N	**0.3089**	**9**	**40.0**	**54.5**	**14.5**	***2**
L1	0.400	9	-2	47.7	49.7	*1
N	0.400	9	-2	47.7	49.7	*1
L1	0.600	9	-2	46	48.0	*1
N	0.600	9	-2	46	48.0	*1
L1	0.775	9	-2	46	48.0	*1
N	0.775	9	-2	46	48.0	*1
L1	0.850	9	-2	46	48.0	*1
N	0.850	9	-2	46	48.0	*1
L1	1.000	9	-2	46	48.0	*1
N	1.000	9	-2	46	48.0	*1
L1	1.575	9	-2	46	48.0	*1
N	1.575	9	-2	46	48.0	*1
L1	2.450	9	-2	46	48.0	*1
N	2.450	9	-2	46	48.0	*1
L1	**2.889**	**9**	**31.0**	**46**	**15.0**	***2**
N	**2.889**	**9**	**31.0**	**46**	**15.0**	***2**
L1	**4.502**	**9**	**29.5**	**46**	**16.5**	***2**
N	**4.502**	**9**	**29.5**	**46**	**16.5**	***2**
L1	5.750	9	-2	46	48.0	*1
N	5.750	9	-2	46	48.0	*1
L1	6.750	9	-2	50	52.0	*1
N	6.750	9	-2	50	52.0	*1
L1	11.100	9	-2	50	52.0	*1
N	11.100	9	-2	50	52.0	*1
L1	20.293	9	-2	50	52.0	*1
N	20.293	9	-2	50	52.0	*1
L1	27.058	9	-2	50	52.0	*1
N	27.058	9	-2	50	52.0	*1

Remark: *1 Noise level of the measuring instrument ≤ -2dBµV (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.

N.t. see page no. 20

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2.) Tested with external PoE power supply (model: PW183RD48000F07 (UL: 2L85 / E136791)

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	**0.1989**	**9**	**49.0**	**54.6**	**5.6**	***2**
N	**0.1989**	**9**	**49.0**	**54.6**	**5.6**	***2**
L1	**0.3089**	**9**	**41.5**	**54.5**	**13.0**	***2**
N	**0.3089**	**9**	**41.0**	**54.5**	**13.5**	***2**
L1	0.400	9	-2	47.7	49.7	*1
N	0.400	9	-2	47.7	49.7	*1
L1	0.600	9	-2	46	48.0	*1
N	0.600	9	-2	46	48.0	*1
L1	0.775	9	-2	46	48.0	*1
N	0.775	9	-2	46	48.0	*1
L1	0.850	9	-2	46	48.0	*1
N	0.850	9	-2	46	48.0	*1
L1	1.000	9	-2	46	48.0	*1
N	1.000	9	-2	46	48.0	*1
L1	1.575	9	-2	46	48.0	*1
N	1.575	9	-2	46	48.0	*1
L1	2.450	9	-2	46	48.0	*1
N	2.450	9	-2	46	48.0	*1
L1	**2.889**	**9**	**30.0**	**46**	**16.0**	***2**
N	**2.889**	**9**	**30.0**	**46**	**16.0**	***2**
L1	**4.502**	**9**	**31.5**	**46**	**14.5**	***2**
N	**4.502**	**9**	**31.5**	**46**	**14.5**	***2**
L1	5.750	9	-2	46	48.0	*1
N	5.750	9	-2	46	48.0	*1
L1	**6.749**	**9**	**29.0**	**50**	**21.0**	***2**
N	**6.749**	**9**	**29.0**	**50**	**21.0**	***2**
L1	11.100	9	-2	50	52.0	*1
N	11.100	9	-2	50	52.0	*1
L1	20.293	9	-2	50	52.0	*1
N	20.293	9	-2	50	52.0	*1
L1	27.058	9	-2	50	52.0	*1
N	27.058	9	-2	50	52.0	*1

Remark: *1 Noise level of the measuring instrument ≤ -2dBµV (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.

N.t. see page no. 20

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3.) Tested with USB connection to an HP Laptop (Type: compaq nx6325 / SN CNU64907YN)

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	**0.1829**	**9**	**47.0**	**54.6**	**7.6**	***2**
N	**0.1829**	**9**	**47.0**	**54.6**	**7.6**	***2**
L1	**0.2059**	**9**	**40.0**	**54.5**	**14.5**	***2**
N	**0.2059**	**9**	**40.0**	**54.5**	**14.5**	***2**
L1	0.400	9	-2	47.7	49.7	*1
N	0.400	9	-2	47.7	49.7	*1
L1	0.600	9	-2	46	48.0	*1
N	0.600	9	-2	46	48.0	*1
L1	0.775	9	-2	46	48.0	*1
N	0.775	9	-2	46	48.0	*1
L1	0.850	9	-2	46	48.0	*1
N	0.850	9	-2	46	48.0	*1
L1	1.000	9	-2	46	48.0	*1
N	1.000	9	-2	46	48.0	*1
L1	1.575	9	-2	46	48.0	*1
N	1.575	9	-2	46	48.0	*1
L1	2.450	9	-2	46	48.0	*1
N	2.450	9	-2	46	48.0	*1
L1	**3.443**	**9**	**27.0**	**46**	**19.0**	***2**
N	**3.443**	**9**	**27.0**	**46**	**19.0**	***2**
L1	**4.302**	**9**	**28.5**	**46**	**17.5**	***2**
N	**4.302**	**9**	**28.5**	**46**	**17.5**	***2**
L1	5.750	9	-2	46	48.0	*1
N	5.750	9	-2	46	48.0	*1
L1	6.300	9	-2	50	52.0	*1
N	6.300	9	-2	50	52.0	*1
L1	11.100	9	-2	50	52.0	*1
N	11.100	9	-2	50	52.0	*1
L1	20.293	9	-2	50	52.0	*1
N	20.293	9	-2	50	52.0	*1
L1	27.058	9	-2	50	52.0	*1
N	27.058	9	-2	50	52.0	*1

Remark: *1 Noise level of the measuring instrument ≤ -2dBµV (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.

N.t. see page no. 20

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4.) Tested with RS232 connection to an HP Laptop (Type: compaq nx6325 / SN CNU64907YN)

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	**0.1829**	**9**	**47.0**	**54.6**	**7.6**	***2**
N	**0.1829**	**9**	**47.0**	**54.6**	**7.6**	***2**
L1	**0.2059**	**9**	**40.0**	**54.5**	**14.5**	***2**
N	**0.2059**	**9**	**40.0**	**54.5**	**14.5**	***2**
L1	0.400	9	-2	47.7	49.7	*1
N	0.400	9	-2	47.7	49.7	*1
L1	0.600	9	-2	46	48.0	*1
N	0.600	9	-2	46	48.0	*1
L1	0.775	9	-2	46	48.0	*1
N	0.775	9	-2	46	48.0	*1
L1	0.850	9	-2	46	48.0	*1
N	0.850	9	-2	46	48.0	*1
L1	1.000	9	-2	46	48.0	*1
N	1.000	9	-2	46	48.0	*1
L1	1.575	9	-2	46	48.0	*1
N	1.575	9	-2	46	48.0	*1
L1	2.450	9	-2	46	48.0	*1
N	2.450	9	-2	46	48.0	*1
L1	**3.443**	**9**	**27.0**	**46**	**19.0**	***2**
N	**3.443**	**9**	**27.0**	**46**	**19.0**	***2**
L1	**4.302**	**9**	**28.5**	**46**	**17.5**	***2**
N	**4.302**	**9**	**28.5**	**46**	**17.5**	***2**
L1	5.750	9	-2	46	48.0	*1
N	5.750	9	-2	46	48.0	*1
L1	6.300	9	-2	50	52.0	*1
N	6.300	9	-2	50	52.0	*1
L1	11.100	9	-2	50	52.0	*1
N	11.100	9	-2	50	52.0	*1
L1	20.293	9	-2	50	52.0	*1
N	20.293	9	-2	50	52.0	*1
L1	27.058	9	-2	50	52.0	*1
N	27.058	9	-2	50	52.0	*1

Remark: *1 Noise level of the measuring instrument ≤ -2dBµV (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.

N.t. see page no. 20

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11.2 Radiated emissions

11.2.1 Regulation

(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)
33-88	100
88-216	150
216-960	200
Above 960	500

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission (MHz)	Field strength (microvolts/meter)
33-88	90
88-216	150
216-960	210
Above 960	300

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

(d) For CB receivers, the field strength of radiated emissions within the frequency range of 25 - 30 MHz shall not exceed 40 microvolts/meter at a distance of 3 meters. The field strength of radiated emissions above 30 MHz from such devices shall comply with the limits in paragraph (a).

(e) Carrier current systems used as unintentional radiators or other unintentional radiators that are designed to conduct their radio frequency emissions via connecting wires or cables and that operate in the frequency range of 9 kHz to 30 MHz, including devices that deliver the radio frequency energy to transducers, such as ultrasonic devices not covered under Part 18 of this Chapter, shall comply with the radiated emission limits for intentional radiators provided in Section 15.209 for the frequency range of 9 kHz to 30 MHz. As an alternative, carrier current systems used as unintentional radiators and operating in the frequency range of 525 kHz to 1705 kHz may comply with the radiated emission limits provided in Section 15.221(a). At frequencies above 30 MHz, the limits in paragraph (a), (b) or (g) of this Section, as appropriate, continue to 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.

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement" (incorporated by reference, see § 15.38). In addition:

(1) The test procedure and other requirements specified in this Part shall continue to apply to digital devices.

(2) If, in accordance with Section 15.33 of this Part, measurements must be performed above 1000 MHz, compliance above 1000 MHz shall be demonstrated with the emission limit in paragraph (a) or (b) of this Section, as appropriate. Measurements above 1000 MHz may be performed at the distance specified in the CISPR 22 publications for measurements below 1000 MHz provided the limits in paragraphs (a) and (b) of this Section are extrapolated to the new measurement distance using an inverse linear distance extrapolation factor (20 dB/decade), e.g., the radiated limit above 1000 MHz for a Class B digital device is 150 uV/m, as measured at a distance of 10 meters.

(3) The measurement distances shown in CISPR Pub. 22, including measurements made in accordance with this paragraph above 1000 MHz, are considered, for the purpose of Section 15.31(f)(4) of this Part, to be the measurement distances specified in the regulations. (4) If the radiated emissions are measured to demonstrate compliance with the alternative standards in this paragraph, compliance must also be demonstrated with the conducted limits shown in Section 15.107(e) of this Part. [This rule paragraph was retained by accident in the R&O in ET Docket No. 98-80 and is no longer applicable.]

(h) Radar detectors shall comply with the emission limits in paragraph (a) of this section over the frequency range of 11.7-12.2 GHz.

11.2.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Calibration executed by
OATS	Dudde (104)	---	08/2010	08/2012	Dudde
Digital Multimeter	GW GDM-8045G (144)	0090256	08/2011	08/2014	Dudde
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	11/2010	11/2012	Rohde & Schwarz
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	01/2012	01/2014	Dudde
Pre-amplifier (1GHz - 18GHz)	Narda --- (345)	---	01/2012	01/2014	Dudde
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)	---	04/2011	04/2014	Schwazbeck
Bilog antenna (1- 18 GHz)	Schwarzbeck STLP 9148 (445)	---	09/2009	09/2012	Schwazbeck
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	03/2011	03/2013	Dudde
RF- cable	Kabelmetal 18m [N]	K1	09/2011	09/2012	Dudde
RF- cable	Aircell 0.5m [BNC]	K40	09/2011	09/2012	Dudde
RF- cable	Sucoflex 100 Suhner 1 m [N]	K52	09/2011	09/2012	Dudde
RF- cable	Aircell 1m [BNC/N]	K56	09/2011	09/2012	Dudde
RF- cable	Sucoflex 100 Suhner 1 m [N] (	K61	09/2011	09/2012	Dudde
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	09/2011	09/2012	Dudde
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	09/2011	09/2012	Dudde

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11.2.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m 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: 2003 Section 8 "Radiated Emissions Testing"

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 25,000 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 - 25,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 10,000 MHz)
	1 m - 3 m (10,000 MHz - 25,000 MHz)
Turn table orientation /	0 – 360°
Receive antenna polarization /	Vertical / horizontal (30 MHz - 25,000 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).

11.2.4 Calculation of the field strength

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

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11.2.5 Result

SPURIOUS RADIATION (Section 15.109)										
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dB µV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dB µV/m**	Limit **dB µV/m**	Margin **dB µV/m**	Polarisation EUT/ antenna	Antenna height **cm**
30.0000	100, QPK	≤ 3.5	3	-2.6*[5]	0	0.9	40.0	39.10	H,V/H,V	100-400
56.909	**100, QPK**	**38.9**	**3**	**-9.3***[5]	**0**	**29.6**	**40.0**	**10.4**	**V/V 30°**	**302**
88.0000	100, QPK	≤ 3.5	3	-10.8*[5]	0	-7.3	40.0	47.3	H,V/H,V	100-400
104.8090	**100, QPK**	**22.4**	**3**	**-9.9***[5]	**0**	**12.5**	**43.5**	**31.0**	**V/V 30°**	**166**
160.7000	**100, QPK**	**47.7**	**3**	**-7.5***[5]	**0**	**40.5**	**43.5**	**3.0**	**V/V 30°**	**131**
216.0000	100, QPK	≤ 3.5	3	-10.3*[5]	0	-6.8	43.5	50.3	H,V/H,V	100-400
396.2000	**100, QPK**	**38.9**	**3**	**-4.3***[5]	**0**	**34.6**	**43.5**	**8.9**	**V/H 30°**	**192**
512.0000	**100, QPK**	**38.4**	**3**	**-2.7***[5]	**0**	**35.7**	**43.5**	**7.8**	**V/H 30°**	**123**
960.0000	100, QPK	≤ 3.5	3	8.5*[5]	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.8*[6]	0	8.3	54.0	45.7	H,V/H,V	100-400
2250.0000	1000, AV	≤ 10	3	8.0*[6]	0	18.0	54.00	36.0	H,V/H,V	100-400
4000.0000	1000, AV	≤ 10	3	8.4*[6]	0	18.4	54.00	35.6	H,V/H,V	100-400
5000.0000	1000, AV	≤ 10	3	9.1*[6]	0	19.4	54.00	34.6	H,V/H,V	100-400
7500.0000	1000, AV	≤ 14	3	12.9*[6]	0	26.9	54.00	27.1	H,V/H,V	100-400
8300.0000	1000, AV	≤ 14	3	14.8*[6]	0	28.8	54.00	25.2	H,V/H,V	100-400
9400.0000	1000, AV	≤ 14	3	16.0*[6]	0	30.0	54.00	24.0	H,V/H,V	100-400
11000.0000	1000, AV	≤ 14	3	18.3*[6]	0	32.3	54.00	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

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no:

N.t. see page no. 20

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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

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End of test report

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