

EUT: PPD Reader
FCC ID: B7OPPDREADER

Date of issue: 2012-05-31



**Test Report acc. to FCC Title 47 CFR Part 15
relating to
Scemtec Automation GmbH
PDD Reader**

**Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
Measurement Procedure:
ANSI C63.4-2009**

EUT: PPD Reader
 FCC ID: B7OPPDREADER

Date of issue: 2012-05-31

Manufacturer's details

Manufacturer	Scemtec Automation GmbH
Manufacturer's grantee code	B7O
Manufacturer's address	Scemtec Automation GmbH Auf'm Angst 3 42553 Velbert Germany Phone: +49 (0) 2053 493655 Fax: + 49 (0) 2053 493649 Email: benedict.juretko@scemtecautomation.de
Relevant standard used	47 CFR Part 15C - Intentional Radiators ANSI C63.4-2009

Test Report prepared by

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Equipment Under Test (EUT)

Equipment category	Transmitter
Trade name	LOC locatesolution
Type designation	PPD Reader
Serial no.	---
Variants	---

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1. Test results

Clause	Requirements headline	Test result			Report page number
8.1	Antenna Requirement	Pass	Fail	N.t.*	9
8.2	Restricted bands of operation	Pass	Fail	N.t.*	10 to 12
8.3	Conducted limits	Pass	Fail	N.t.*	13 to 16
8.4	Radiated emission limits	Pass	Fail	N.t.*	17 to 22

* Not tested

The equipment meets the requirements	Yes	No
--------------------------------------	-----	----

Signature:

 (Technician)

Signature:

 (Manager)

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2. Introduction

This test report consists of:

- Test result summary
- List of contents
- Introduction and further information
- Performance assessment
- Detailed test information

All pages have been numbered consecutively and bear the m. dudde hochfrequenz-technik logo, the test report number, the date, the test specification in its current version as well as the type designation of the EUT. The total number of pages in this report is **26**.

The tests were carried out at:

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

in a representative assembly and in accordance with the test methods and/or requirements stated in:

FCC Title 47 CFR Part 15 Subpart C & ANSI C63.4-2009

The sample of the product was received on:

- 2012-01-24

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

- 2012-01-24 – 2012-01-31

3. Testing laboratory

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

4. Applicant

Company name : Scemtec Automation GmbH
Address : Auf'm Angst 3
: 42553 Velbert
Country : Germany
Telephone : +49 (0) 2053 493655
Fax : + 49 (0) 2053 493649
Email : benedict.juretko@scemtecautomation.de
Date of order : 2012-01-24
References : Mr. Benedict Juretko

5. Product and product documentation

Samples of the following apparatus were submitted for testing:

Manufacturer : Scemtec Automation GmbH
Trademark : LOC locatesolution
Type designation : **PPD Reader**
Hardware version : PPD Reader
Serial number : ---
Software release : ---
Type of equipment : Non specific SRD
Power used : 12 V DC
Frequency used : 125 kHz
Generated frequencies : 125 kHz (Carrier), 16 MHz (Crystal), 2*32 MHz (Crystal)
: 2*32 kHz (Crystal), 32.768 kHz (Crystal)
ITU emission class : 6K86 A1D

For issuing this report the following product documentation was used:

Description	Date	Identifications
External photographs of the Equipment Under Test (EUT)	2012-05-31	Annex no. 1
Internal photographs of the Equipment Under Test (EUT)	2012-05-31	Annex no. 2
Channel occupancy / bandwidth	2012-05-31	Annex no. 3
Label sample	2012-05-31	Annex no. 4
Functional description / User manual	2012-05-31	Annex no. 5
Test setup photos	2012-05-31	Annex no. 6
Block diagram	2012-05-31	Annex no. 7
Operational description	2012-05-31	Annex no. 8
Schematics	2012-05-31	Annex no. 9
Parts list	2012-05-31	Annex no. 10

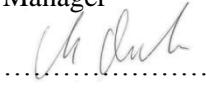
6. Conclusions, observations and comments

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

The results of the tests as stated in this report are exclusively applicable to the EUT as identified in this report. m. dudde hochfrequenz-technik cannot be held liable for properties of the EUT that have not been observed during these tests.

m. dudde hochfrequenz-technik assumes the sample to comply with the requirements of FCC Title 47 CFR Part 15 for the respective test sector, if the test results turn out positive.

Comments: ---

Date	: 2012-05-31	Date	: 2012-05-31
Name	: Ralf Trepper	Name	: Manfried Dudde
Function	: Technician	Function	: Manager
Signature	: 	Signature	: 

7. Operational description

7.1 EUT details

Inductive Transmitter PPD Reader

The person Proximity Detection (PPM) system locates people and objects using active RFID technology

7.2 EUT configuration

With the aid of test software the PPD reader can be set to in all the required test modes

7.3 EUT measurement description

Radiated measurements

The **Inductive Transmitter PPD Reader** was tested in a typical fashion. During preliminary emission tests the **Inductive Transmitter PPD Reader** was operated in continuous transmitting mode for worst case emission mode investigation. Therefore, the final qualification testing was completed with **Inductive Transmitter PPD Reader** operated in continuous modes.

All tests were performed with the applicant's typical voltage: 12.0 V DC

In order to establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test samples, secondly the test ample have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical had been varied.

Conducted measurements

The device was connected to the artificial mains network via two external power supplies **PS18A** and this to the artificial mains network. It has been tested in two runs: first, with inactive **Inductive Transmitter PPD Reader**, second with activated **Inductive Transmitter PPD Reader** in read write mode to read user data and write user data into different tags.

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8.1 Antenna requirement

8.1.1 Regulation

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 this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, 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.

8.1.2 Result

The equipment meets the requirements	Yes	No	N.t.
Further test results are attached	Yes	No	Page no.

Integrated ferrite loop antenna.

N.t.* See page no. 23

8.2 Restricted bands of operation

8.2.1 Regulation

(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
¹0.495 - 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 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).

8.2.2 Result

The equipment meets the requirements	Yes	No	N.t.
Further test results are attached	Yes	No	Page no.

N.t.* See page no. 23

8.3 Conducted limits

8.3.1 Regulation

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator 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 μ H/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 boundary between the frequency ranges.

Frequency of emission(MHz)	Conducted limit (dB μ V)	
	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) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current system 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 μ V within the frequency band 535–1705 kHz, as measured using a 50 μ H/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(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 provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtainig 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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8.3.2 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	---
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	07/2011	07/2014	Dudde
RF- cable	Aircell 1.5m [BNC/N]	K30	09/2011	09/2012	Dudde

8.3.3 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 C63.4-2009 Section 7.

Additional equipment must also be connected to a second LISN with the same specifications described in the above sentence (if required).

8.3.4 Result

Tested with external AC/DC power supply (power supply PS18A)

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dB μ V]	Spec. limit (average) [dB μ V]	Margin [dB]	Remarks
L1	0.181	9	-2	55.8	57.8	* ¹
N	0.181	9	-2	55.8	57.8	* ¹
L1	0.301	9	-2	51.7	53.7	* ¹
N	0.301	9	-2	51.7	53.7	* ¹
L1	0.4307	9	46.0	47	1.0	* ²
N	0.4307	9	46.0	47	1.0	* ²
L1	0.6237	9	40.0	46	6.0	* ²
N	0.6237	9	40.0	46	6.0	* ²
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	1.443	9	26.0	46	20.0	* ²
N	1.443	9	26.0	46	20.0	* ²
L1	1.7527	9	31.5	46	14.5	* ²
N	1.7527	9	31.5	46	14.5	* ²
L1	2.4977	9	42.0	46	4.0	* ²
N	2.4977	9	42.0	46	4.0	* ²
L1	2.7447	9	36.0	46	10.0	* ²
N	2.7447	9	36.0	46	10.0	* ²
L1	3.2527	9	32.0	46	14.0	* ²
N	3.2527	9	32.0	46	14.0	* ²
L1	4.000	9	-2	46	48.0	* ¹
N	4.000	9	-2	46	48.0	* ¹
L1	6.7644	9	-2	50	52.0	* ¹
N	6.7644	9	-2	50	52.0	* ¹
L1	14.7497	9	30.0	50	20.0	* ²
N	14.7497	9	30.0	50	20.0	* ²
L1	21.7467	9	27.0	50	23.0	* ²
N	21.7467	9	27.0	50	23.0	* ²
L1	27.0575	9	-2	50	52.0	* ¹
N	27.0575	9	-2	50	52.0	* ¹

Remark: *¹ Noise level of the measuring instrument $\leq -2\text{dB}\mu\text{V}$ (0.009 – 30MHz)Remark: *² Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	Yes	No	N.t.
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Further test results are attached	Yes	No	Page no.
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N.t.* See page no. 25

Date: 2012-02-14

Vers. no. 1.12

8.4 Radiated emission limits, general requirements

8.4.1 Regulation

(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., §§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 §§ 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.

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(f) In accordance with §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 §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 §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 §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.

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8.4.2 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
Receiver (9 kHz – 30.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSV 30 (502)	100932	02/2010	02/2013	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
Pre-amplifier (12GHz - 30GHz)	Schwarzbeck BBV9719 (443)	9719-004	03/2011	03/2013	Dudde
Magnetic loop antenna (9 kHz - 30 MHz)	Schwarzbeck FMZB 1516 (23)	---	05/2010	05/2013	Dudde
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)	---	04/2011	04/2014	Schwarzbeck
Bilog antenna (1- 18 GHz)	Schwarzbeck STLP 9148 (445)	---	09/2009	09/2012	Schwarzbeck
Horn antenna (15.0-40.0 GHz)	Schwarzbeck BBHA 9170 (280)	---	03/2011	03/2013	Dudde
RF- cable	Kabelmetal 18m [N]	K1	09/2011	09/2012	Dudde
RF- cable	Sucoflex 100 Suhner 1.5 m [SMA]	K17a	09/2011	09/2012	Dudde
RF- cable	Sucoflex 100 Suhner 1.5 m [SMA]	K18a	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

8.4.3 Test procedure

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 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4: 2009 Section 8 “Radiated Emissions Testing”

Measurement procedures for electric field radiated emissions above 1 GHz are covered in Clause 8 of ANSI C63.4-2009. The C63.4-2009 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Subclause 8.3.1.2 of C63.4-2009 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beamwidth of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in C63.4-2009, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beamwidth of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTS, measuring system sensitivity, etc.

C63.4-2009 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

Radiated emissions test characteristics	
Frequency range	30 MHz - 4,000 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz) 1 MHz (1000 MHz - 4,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/horizontal

* 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).

8.4.4 Calculation of the field strength

The field strength is calculated by the following calculation:

$$\text{Corrected Level} = \text{Receiver Level} + \text{Correction Factor} \text{ (without the use of a pre-amplifier)}$$

$$\text{Corrected Level} = \text{Receiver Level} + \text{Correction Factor} - \text{Pre-amplifier} \text{ (with the use of a pre-amplifier)}$$

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

For example:

The receiver reading is 32.7 dB μ V. 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 35.91dB μ V/m.

The 35.91dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} (35.91/20) = 39.8$$

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).

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8.4.5 Test result

Antenna 1

RADIATION EMISSIONS BELOW 30 MHz (Section 15.205, 15.209)									
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dB μ V	Test distance m	Correction factor dB	Distance extrapol. factor dB	Level corrected dB μ V/m	Limit dB μ V/m	Margin dB μ V/m	Polarisation EUT / antenna orientation
0.1250	AV/10kHz	56.0	10	20.2	-59.1	17.2	AV25.6 @ 300	8.4	V, 90°/90°
0.2500	AV/10kHz	< 4.0	10	20.2	-59.1	-34.9	AV19.6 @ 300	54.5	V, H/0-360°
0.3750	AV/10kHz	< 4.0	10	20.2	-59.1	-34.9	AV16.1 @ 300	51.0	V, H/0-360°
0.5000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV33.6 @ 30	28.5	V, H/0-360°
0.6250	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV31.7 @ 30	26.6	V, H/0-360°
0.7500	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV30.1 @ 30	25.0	V, H/0-360°
0.8750	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV28.6 @ 30	23.5	V, H/0-360°
1.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV27.6 @ 30	22.5	V, H/0-360°
1.1250	QPK/9.0kHz	18.6	10	20.2	-19.1	19.7	AV26.6 @ 30	6.9	V, 0°/0°
1.2500	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV25.6 @ 30	28.5	V, H/0-360°
1.5000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV24.1 @ 30	19.00	V, H/0-360°
3.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
5.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
8.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
10.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
20.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
30.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
Measurement uncertainty			4 dB						

Remark: *¹ Noise level of the measuring instrument $\leq 4.0 \text{ dB}\mu\text{V}$ @ 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.
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Further test results are attached	Yes	No	Page no.
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*Antenna1***RADIATION EMISSIONS ABOVE 30 MHz (Section 15.205, 15.209)**

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dB μ V	Test distance m	Correction factor dB	Distance extrapol. factor dB	AV Correction factor dB	Level correcte d dB μ V/ m	Limit dB μ V/m	Margin dB μ V/ m	Polaris. EUT / antenna	Antenna height cm
30.0000	<i>QPK/120kHz</i>	≤ 3.5	3	-2.60	0	0	0.90	40.00	39.10	H,V/H,V	100-400
40.8000	<i>QPK/120kHz</i>	30.1	3	-8.2	0	0	21.9	40.0	18.1	H,100°/H	208
88.0000	<i>QPK/120kHz</i>	≤ 3.5	3	-10.80	0	0	-7.30	40.00	47.30	H,V/H,V	100-400
216.0000	<i>QPK/120kHz</i>	≤ 3.5	3	-10.30	0	0	-6.80	43.50	50.30	H,V/H,V	100-400
960.0000	<i>QPK/120kHz</i>	≤ 3.5	3	8.50	0	0	12.00	43.50	31.50	H,V/H,V	100-400
1700.0000	<i>AV/1000kHz</i>	≤ 4.5	3	3.80	0	0	8.30	54.00	45.70	H,V/H,V	100-400
2250.0000	<i>AV/1000kHz</i>	≤ 10	3	8.00	0	0	18.00	54.00	36.00	H,V/H,V	100-400
4000.0000	<i>AV/1000kHz</i>	≤ 10	3	8.40^{*6}	0	0	18.40	54.00	35.60	H,V/H,V	100-400
5000.0000	<i>AV/1000kHz</i>	≤ 10	3	9.10^{*6}	0	0	19.40	54.00	34.60	H,V/H,V	100-400
7500.0000	<i>AV/1000kHz</i>	≤ 14	3	$12.9^{*6}0$	0	0	26.90	54.00	27.10	H,V/H,V	100-400
8300.0000	<i>AV/1000kHz</i>	≤ 14	3	14.80^{*6}	0	0	28.80	54.00	25.20	H,V/H,V	100-400
9400.0000	<i>AV/1000kHz</i>	≤ 14	3	16.00^{*6}	0	0	30.00	54.00	24.00	H,V/H,V	100-400
11000.0000	<i>AV/1000kHz</i>	≤ 14	3	18.25^{*6}	0	0	32.25	54.00	21.75	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 ≤ 3.5 dB μ V @ 3m distance (30 – 1,000 MHz)Remark: ^{*2} noise floor noise level of the measuring instrument ≤ 4.5 dB μ V @ 3m distance (1,000 – 2,000 MHz)Remark: ^{*3} noise floor noise level of the measuring instrument ≤ 10 dB μ V @ 3m distance (2,000 – 5,500 MHz)Remark: ^{*4} noise floor noise level of the measuring instrument ≤ 14 dB μ V @ 3m distance (5,500 – 14,500 MHz)Remark: ^{*5} for using a pre-amplifier in the range between 100 kHz and 1,000 MHzRemark: ^{*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.
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Further test results are attached	Yes	No	Page no.
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Antenna 2

RADIATION EMISSIONS BELOW 30 MHz (Section 15.205, 15.209)									
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dB μ V	Test distance m	Correction factor dB	Distance extrapol. factor dB	Level corrected dB μ V/m	Limit dB μ V/m	Margin dB μ V/m	Polarisation EUT / antenna orientation
0.1250	AV/10kHz	50.0	10	20.2	-59.1	11.2	AV25.6 @ 300	14.4	V, 0°/0°
0.2500	AV/10kHz	< 4.0	10	20.2	-59.1	-34.9	AV19.6 @ 300	54.5	V, H/0-360°
0.3750	AV/10kHz	< 4.0	10	20.2	-59.1	-34.9	AV16.1 @ 300	51.0	V, H/0-360°
0.5000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV33.6 @ 30	28.5	V, H/0-360°
0.6250	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV31.7 @ 30	26.6	V, H/0-360°
0.7500	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV30.1 @ 30	25.0	V, H/0-360°
0.8750	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV28.6 @ 30	23.5	V, H/0-360°
1.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV27.6 @ 30	22.5	V, H/0-360°
1.1250	QPK/9.0kHz	17.8	10	20.2	-19.1	18.9	AV26.6 @ 30	7.7	V, 90°/0°
1.2500	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV25.6 @ 30	28.5	V, H/0-360°
1.5000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV24.1 @ 30	19.00	V, H/0-360°
3.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
5.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
8.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
10.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
20.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
30.0000	QPK/9.0kHz	< 4.0	10	20.2	-19.1	5.10	AV29.5 @ 30	24.4	V, H/0-360°
Measurement uncertainty			4 dB						

Remark: *¹ Noise level of the measuring instrument $\leq 4.0 \text{ dB}\mu\text{V}$ @ 10m distance (0.009 MHz –30 MHz)

Remark: * Peak Limit according to Section 15.35 (b).

The equipment meets the requirements	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N.t.
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Further test results are attached	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	Page no.
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Antenna2

RADIATION EMISSIONS ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dB μ V	Test distance m	Correction factor dB	Distance extrapol. factor dB	AV Correction factor dB	Level corrected dB μ V/m	Limit dB μ V/m	Margin dB μ V/m	Polaris. EUT / antenna	Antenna height cm
30.0000	QPK/120kHz	≤ 3.5	3	-2.60	0	0	0.90	40.00	39.10	H,V/H,V	100-400
40.8000	QPK/120kHz	33.1	3	-8.2	0	0	24.9	40.0	18.1	H,110°/V	234
88.0000	QPK/120kHz	≤ 3.5	3	-10.80	0	0	-7.30	40.00	47.30	H,V/H,V	100-400
216.0000	QPK/120kHz	≤ 3.5	3	-10.30	0	0	-6.80	43.50	50.30	H,V/H,V	100-400
960.0000	QPK/120kHz	≤ 3.5	3	8.50	0	0	12.00	43.50	31.50	H,V/H,V	100-400
1700.0000	AV/1000kHz	≤ 4.5	3	3.80	0	0	8.30	54.00	45.70	H,V/H,V	100-400
2250.0000	AV/1000kHz	≤ 10	3	8.00	0	0	18.00	54.00	36.00	H,V/H,V	100-400
4000.0000	AV/1000kHz	≤ 10	3	8.40* ⁶	0	0	18.40	54.00	35.60	H,V/H,V	100-400
5000.0000	AV/1000kHz	≤ 10	3	9.10* ⁶	0	0	19.40	54.00	34.60	H,V/H,V	100-400
7500.0000	AV/1000kHz	≤ 14	3	12.9* ⁶ 0	0	0	26.90	54.00	27.10	H,V/H,V	100-400
8300.0000	AV/1000kHz	≤ 14	3	14.80* ⁶	0	0	28.80	54.00	25.20	H,V/H,V	100-400
9400.0000	AV/1000kHz	≤ 14	3	16.00* ⁶	0	0	30.00	54.00	24.00	H,V/H,V	100-400
11000.0000	AV/1000kHz	≤ 14	3	18.25* ⁶	0	0	32.25	54.00	21.75	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 ≤ 3.5dB μ V @ 3m distance (30 – 1,000 MHz)Remark: *² noise floor noise level of the measuring instrument ≤ 4.5dB μ V @ 3m distance (1,000 – 2,000 MHz)Remark: *³ noise floor noise level of the measuring instrument ≤ 10dB μ V @ 3m distance (2,000 – 5,500 MHz)Remark: *⁴ noise floor noise level of the measuring instrument ≤ 14dB μ V @ 3m distance (5,500 – 14,500 MHz)Remark: *⁵ for using a pre-amplifier in the range between 100 kHz and 1,000 MHzRemark: *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.
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Further test results are attached	Yes	No	Page no.
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N.t.* See page no. 25

9. 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

N.t.³ Not tested, because not applicable to the EUT

N.t.⁴ Not tested, because not ordered

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End of test report