



Test Report EMC

FCC listed test laboratory; Registration No. 91098

A description of the test site pursuant to 47 CFR 2.948 has
been filed with the Federal Communications Commission.

Test Laboratory:

VDE Prüf- und Zertifizierungsinstitut GmbH
VDE Testing and Certification Institute
Laboratory for EMC measurements

Merianstraße 28
D-63069 Offenbach

Tel.: +49 (0) 69 8306-747
Fax: +49 (0) 69 8306-620
E-mail: Stephan.Kloska@vde.com

Equipment under test

Applicant:	Cross Match Technologies GmbH; Unstrutweg 4, 07743 Jena
Manufacturer:	Cross Match Technologies GmbH; Unstrutweg 4, 07743 Jena
File number:	2295300-3250-0011/124999
EUT:	Information Technology Equipment and Intentional Radiator
Brand/model:	D SCAN AUTHENTICATOR CF V2 (RJ 0479)
EUT received:	2009-10-12

Applied standards

Main Standard	Basic Standards
Standards that have been applied to the 13,56 MHz tag reader:	
47 CFR 15, Subpart C: Intentional Radiators § 15.225 (Operation within the band 13.110-14.010 MHz) as an alternative to the general radiated emission as provided in § 15.209	ANSI C63.4:2003
Standards that are applicable to the non-radio equipment:	
47 CFR 15, Subpart B: Unintentional Radiators Limits for class B equipment	ANSI C63.4:2003

Remarks: ---

Result: Pass

Information about modifications to the EUT at the test laboratory:

In order to achieve compliance with the regulations, no modifications were made to the EUT in the course of the tests.

Date of issue:	2010-04-19 (This document supersedes Test Report FG43-3-124999.)	
Tested by:	Mr. Wolfgang Klos EMC Test Engineer	
Reviewed:	Mr. Stephan Kloska, Dr.-Ing. Head of the Laboratory	



Contents Directory

1	Description of the sample (EUT).....	3
2	Summary of test results	6
2.1	Test results for intentional radiators	6
2.2	Test results for unintentional radiators.....	6
3	Test and measuring results for intentional radiators	7
3.1	AC Power Line Conducted Emissions (150 kHz - 30 MHz)	7
3.1.1	Summary	7
3.1.2	Detailed test protocol	8
3.2	Radiated emissions within the band 13.110-14.010 MHz.....	9
3.3	Radiated emissions outside the band 13.110-14.010 MHz	14
3.3.1	Frequency range 9 kHz ... 30 MHz	14
3.3.2	Frequency range 30 MHz ... 1000 MHz	16
3.3.3	Frequency range 1 GHz ... 5 GHz.....	20
3.4	Frequency stability under extreme conditions.....	24
3.5	Variation of the radiated signal level of the fundamental frequency component caused by variation of the input power	27
4	Test and measuring results for unintentional radiators.....	28
4.1	AC Power Line Conducted Emissions (150 kHz - 30 MHz)	28
4.1.1	Summary	28
4.1.2	Detailed test protocol	29
4.2	Measurement of the electric field strength (30 MHz – 1000 MHz)	30
4.2.1	Summary	30
4.2.2	Detailed Test Protocol.....	31
4.3	Measurement of the electric field strength (1 GHz - 5 GHz)	32
4.3.1	Summary	32
4.3.2	Detailed Test Protocol.....	33
5	Drawings.....	34
5.1	Test configuration (Block diagram).....	34
5.2	Conducted Emissions Test Setup	35
6	Measurement data	36
6.1	AC power line conducted emissions.....	36
6.1.1	Scan No. 1 (reader active)	36
6.1.2	Scan No. 2 (stand-by)	38
6.2	Electric field strength, 30 MHz - 1000 MHz.....	40
6.3	Radiated emissions, $f > 1$ GHz	42
6.3.1	Preliminary measurements	42
6.3.2	Final measurements.....	44
7	Photographs.....	46
7.1	Photos	46

This test report contains only the results of a single investigation carried out on the product submitted. It is not a generally valid judgement by the VDE Testing and Certification Institute regarding the properties of similar products taken from current production. It does not apply to all VDE specifications applicable to the tested products. It does not entitle the applicant to use the VDE certification mark and the mark "GS = geprüfte Sicherheit (approved safety)".

This Test report may only be passed to a third party in its complete wording including this preamble and the date of issue. Any publication or reproduction require the prior written approval of the VDE Testing and Certification Institute.

1 Description of the sample (EUT)

Type of EUT:	Live scanner for documents with USB 2.0 interface and built-in tag reader
Intended use:	To read the information contained in passports and similar documents from the transponder chip built in the document Typical users of this device will be officials from the police or customs and similar user groups. It is not a mass-product. It is not designed for use by the general public.
Brand name:	Cross Match Technologies
Model, Type designation:	D SCAN AUTHENTICATOR CF V2 (RJ 0479)

Units constituting the test setup:

a) Equipment under test

Device No.	Description	Manufacturer	Type/Model	Serial No.	Rated Supply Voltage	Remarks (e.g. FCC ID)
1	Document scanner	Cross Match Technologies	D SCAN AUTHENTICATOR CF V2 Model RJ 0479	000900614.D 2009	21 ± 3 V DC 1 A Protection class III	FCC ID: WO8RJ0479V2 IC: 7944A-RJ0479V2

Ports of the EUT:

No.	Description	specified length	Shield type
1	DC Power Input	1,5 m	shielded
2	USB 2.0 port	< 1,9 m	shielded

The EUT must be supplied from an external DC source (e.g. AC/DC power converter) which is not marketed together with it.

b) Supporting Equipment

Device No.	Description	Manufacturer	Type/Model	Serial No.	Rated Supply Voltage	Remarks (e.g. FCC ID)
2	External Power supply (supplying the EUT)	SINPRO	SPU63-107	S0053164	100 - 240 VAC; 47-63 Hz; 1.6 A	
3	Notebook PC	Fujitsu Siemens	Amilo M1425	3948760419		acting as host computer
3a	External Power supply (supplying the Notebook PC)	Li Shin	0335C2065	A304351435 95		
4	USB Mouse	Microsoft	Wheel Mouse Optical USB and PS/2 compatible	None	5 V DC, supplied from USB	FCC DoC
5	Notebook PC	ASUS	M6000NE36M	4ANP007199		acting as a second device connected via a cross link Ethernet cable to the host PC for achieving a minimum configuration
5a	External Power supply (supplying the Notebook PC)	Delta Electronics	ADP-65DB		100 - 240 VAC; 50-60 Hz; 1.5 A	

c) Information about the cables used in the test set-up

Cable No.	Numbers of the devices connected	Description; Type	Length	Shield Type	Remarks
1	1 - 2	DC power cable for the EUT	1,5 m	shielded	Not removable from power supply unit
2	2 - Mains	AC power cable	1,8 m	unshielded	
3	2 - 3	USB cable from EUT to computer	1,9 m	shielded	
4	3 - 3a	DC power cable for Notebook PC	1,8 m	shielded	Not removable from power supply unit
5	3a - Mains	AC power cable	1,8 m	unshielded	
6	3 - 4	USB Mouse cable	1,9 m	shielded	Not removable from Mouse
7	3 - 5	Crosslink Ethernet cable	10 m	shielded	
8	5 - 5a	DC power cable for Notebook PC	1,8 m	shielded	Not removable from power supply unit
9	5a - Mains	AC power cable	1,8 m	unshielded	

Possible operating modes of the sample

No.	Description
1	Optical scanning of the documents for recognition of the security characteristics and gathering of the information content of the document by reading out the RFID tag in the document
2	Ready (Device powered on, but no live communication because no application software has been started)

Operating modes selected for testing

No.	Operating mode	Rationale
1	Continuously scanning of the document	This is the normal mode of operation with all the system components exercised. For test purposes, the application software was modified for continuous repetition of the reading process.
2	Ready	Only investigated during the preliminary measurements

Disturbance sources

No.	Description	Manufacturer	Type designation	Generated frequencies
1	Power supply PCB	Cross Match	RJ0479:312.25 Rev. D	150 kHz, 12 MHz
2	Base Cam PCB	Cross Match	RJ0479:302.25 Rev. B	15 MHz (USB), 24 MHz, 36 MHz, 48 MHz, 480 MHz (USB)
3	Illumination2 PCB	Cross Match	RJ0479:324.25 Rev. E	500 kHz
4	RFID Controller HID	Cross Match	RJ 0479:388.25 Rev. A	8 MHz, 13.56 MHz, 15 MHz (USB)
5	Antenna PCB (RFID-reader)	Cross Match	RJ 0479:389.25 Rev. A	---

EMC-measures

No.	Location	Description	Specification	Manufacturer	Type designation
1	DC input	Suppressor diode		Fairchild	SMCJ 33 CA
2	Internal USB connections	Common Mode Choke		Würth Elektronik	744 231 371

Description of shield- and contacting measures for EMC

No.	Description of the measure
1	Metal screening plate on the camera board
2	Shield cap on the Base Cam over FPGA, RAM and USB controller
3	Copper band from the shield cap of the Base Cam to the metal plate on the Power Supply board

Further measures

Description
- none -



Information about modifications to the EUT at the test laboratory:

In order to comply with the class B limits for unintentional radiators, no modifications were made.
Also no modifications were necessary to comply with the rules for intentional radiators.

2 Summary of test results

2.1 Test results for intentional radiators

Test		Frequency range	Page	Remarks	Result
1.1	Conducted emissions AC Power input terminals § 15.207 (a)	150 kHz - 30 MHz	7	---	Pass
1.2	Radiated emissions (Magnetic field strength) § 15.225 (a) to (d)	9 kHz - 30 MHz	9	Wanted signal and spurious emissions	Pass
1.3	Radiated emissions (Electric field strength) § 15.209 (a)	30 MHz – 1 GHz	16	Harmonics of 13,56 MHz	Pass
1.4	Radiated emissions Electric fieldstrength § 15.209 (a)	> 1 GHz	20	The highest frequency to be investigated for this type of equipment is 5 GHz. ^{*)}	Pass
1.5	Frequency tolerance of the carrier signal under extreme conditions	+/-0.01% of the operating frequency	24	Extreme values: Supply voltage: 17.85 V and 24.15 V Temperature: -20 °C, +50° C	Pass

^{*)} The upper value of the investigated frequency band was determined according to § 15.31 (a)(4).

2.2 Test results for unintentional radiators

Test		Frequency range	Page	Remarks	Result
2.1	Conducted emissions AC Power input terminals § 15.107 (a)	150 kHz - 30 MHz	28	Class B limits Measured in a representative configuration at the AC power port of a typical AC adapter	Pass
2.2	Radiated emissions (Electric field strength) § 15.109 (g)	30 MHz – 1 GHz	30	Class B limits	Pass
2.3	Radiated emissions Electric fieldstrength § 15.109 (a)	1 GHz - 5 GHz ^{*)}	32	Class B limits	Pass
2.4	Conducted emissions Power at the antenna terminals	see § 15.33	---	This test is not applicable	Not applicable

^{*)} The upper value of the investigated frequency band was determined according to § 15.33 (b)(1).

3 Test and measuring results for intentional radiators

3.1 AC Power Line Conducted Emissions (150 kHz - 30 MHz)

3.1.1 Summary

Summarizing table of the six highest measurement values relative to the limit

Device connected to the LISN: External power supply for the EUT								
Fre- quency [MHz]	Meter Reading [dB(μV)]	Detector Function	Correction [dB]	Measured Value [dB(μV)]	Limits QP / AV [dB(μV)]	Margin [dB]	Result	Comments / Remarks
0.798	41.2	AV	incl.	41.2	46.0	4.8	Pass	N
13.5645	44.9	AV	incl.	44.9	50.0	5.1	Pass	N
1.266	39.8	AV	incl.	39.8	46.0	6.2	Pass	N
1.1985	38.7	AV	incl.	38.7	46.0	7.3	Pass	N
1.3335	37.5	AV	incl.	37.5	46.0	8.5	Pass	L1
0.8655	37.2	AV	incl.	37.2	46.0	8.8	Pass	N

All readings were automatically taken with an observation time of at least 2 seconds after running an automated prescan. Before the frequency scan was started, the test set-up was optimized for maximum emission level by employing the spectrum analyzer functionality of the measuring instrument.

All readings above were taken while the EUT was reading a tagged document.
Further information about the tests carried out can be found on the following pages.

Result: Pass

**The measured conducted emissions of the EUT were found to be equal or below the specified limits.
The minimum margin of a measurement value to the limit was 4.8 dB.**

3.1.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-14
Environmental conditions:	22° C, 36 % r.h

Instruments:		Test Location: Building M, Shielded Room No. 1			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1820054	Artificial mains network	R&S	ESH2-Z5	2009-06-15	2010-06
1820028	Artificial mains network	R&S	ESH3-Z5	2009-06-10	2010-06
1800137	EMI Test Receiver	R&S	ESCI-3	2009-06-10	2010-06
1060557	Digital Multimeter	GMC	22S	2009-01-26	2010-01
1300822	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test set-up:	The system under test was installed on a non-conductive table of 80 cm height in the shielded room. The arrangement of components on the table was according to drawing # 1 on page 34. The table was positioned in parallel to one conductive wall of the shielded room, maintaining a horizontal distance of 40 cm between the rear of equipment under test and the wall of the shielded room. The power cable of the EUT was routed to one artificial mains network (LISN). Excess length of the power cable was bundled. All other devices were powered from a separate LISN. Excess length of the interconnecting cables was draped over the back edge of the table. If necessary, the cables were bundled in the center in order to maintain a minimum distance of 40 cm to the floor. For details refer to drawing # 2 and the photographs.
Operating modes:	See below. The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 7.2 and 13.1.3 and Annexures H.1 and H.2

Result: Pass

Protocol:

The following measurements were made:

Scan No.	Operating Mode	Line under test	Result	Comments
1	Continuously reading a tagged document, with USB communications	L and N	Pass	-
2	Stand-by (scanner ready, but not initialized)	L and N	Pass	-

Measurement data can be found in Section 6.1 of this report.



3.2 Radiated emissions within the band 13.110-14.010 MHz

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-12
Environmental conditions:	22° C, 38% r.h.

Instruments:		Test Location: Building M, 10 m Semi-anechoic chamber			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810009	Shielded loop antenna	R&S	HFH2-Z2	2008-11-08	2009-11
1800118	EMI Test Receiver	R&S	ESI26	2009-06-09	2011-06 (2 years)
1300823	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test setup:	The EUT with a passive RFID tagged document on top was placed on a non-conductive table of 0.8 m height and horizontal dimensions of 1.5 m x 1.0 m. The AC adapter and a host computer were also located on this table. The arrangement of components on the table was according to drawing # 1 on page 34. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed. Excess length of the interconnecting cables was draped over the back edge of the table. A minimum distance of 40 cm to the floor was maintained for all cables. For details refer to the photographs.
Operating modes investigated:	Active communication between the transceiver and the RFID tag (continuously reading the tag). The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result:	Pass
----------------	-------------

The level of the wanted signal of the EUT was found below the limits specified in 47 CFR 15.225 under normal and extreme conditions.

The margin of the measured value to the limit was 50.14 dB in the band from 13.553 MHz to 13.567 MHz.

Protocol:

All measurements were made at a test distance of 3 m.

The maximum value of the magnetic field strength in the frequency range 13.010 MHz to 14.010 MHz (wanted signal of the transmitter) was measured under normal operating conditions with the Quasi Peak detector employed. It was obtained by optimizing the azimuths of turntable and antenna.

The magnetic field strength at 13.56 MHz, measured at 3 m was 73.82 dB(μ V/m) expressed in terms of the electric field strength under far field conditions.

Later (relative) measurements, refer to Section 3.5 of this report, showed that this reading was 0.04 dB below the maximum value which was found when the transmitter was operated under extreme test conditions.

To calculate the value for the specified test distance of 30 m, a correction of -40 dB (40 dB/decade) was applied to the field strength level measured at 3 m.

Maximum H-field at a distance of 30 m:

Calculated value (max. field strength level under normal or extreme test conditions): + 33.86 dB μ V/m

Specified limit for 13.56 MHz: 15 848 μ V/m + 84.00 dB μ V/m

Results of the final measurements at the semi-anechoic chamber:

Frequency MHz	Test Distance m	Field Strength dB(μ V/m)	Detector Type	Remarks
13.56	3	73.82	Quasi Peak	Measured value at 3 m
13.56	3	73.86	Quasi Peak	Measured value at 3 m, corrected by +0.04 dB to consider variations of the radiated signal level due to variations of the supply voltage.
13.56	30	33.86	Quasi Peak	Calculated value for 30 m test distance, calculated from the corrected field strength value for 3 m using an extrapolation factor of 40 dB/decade

47 CFR 15.225 Transmitter Spectrum Mask

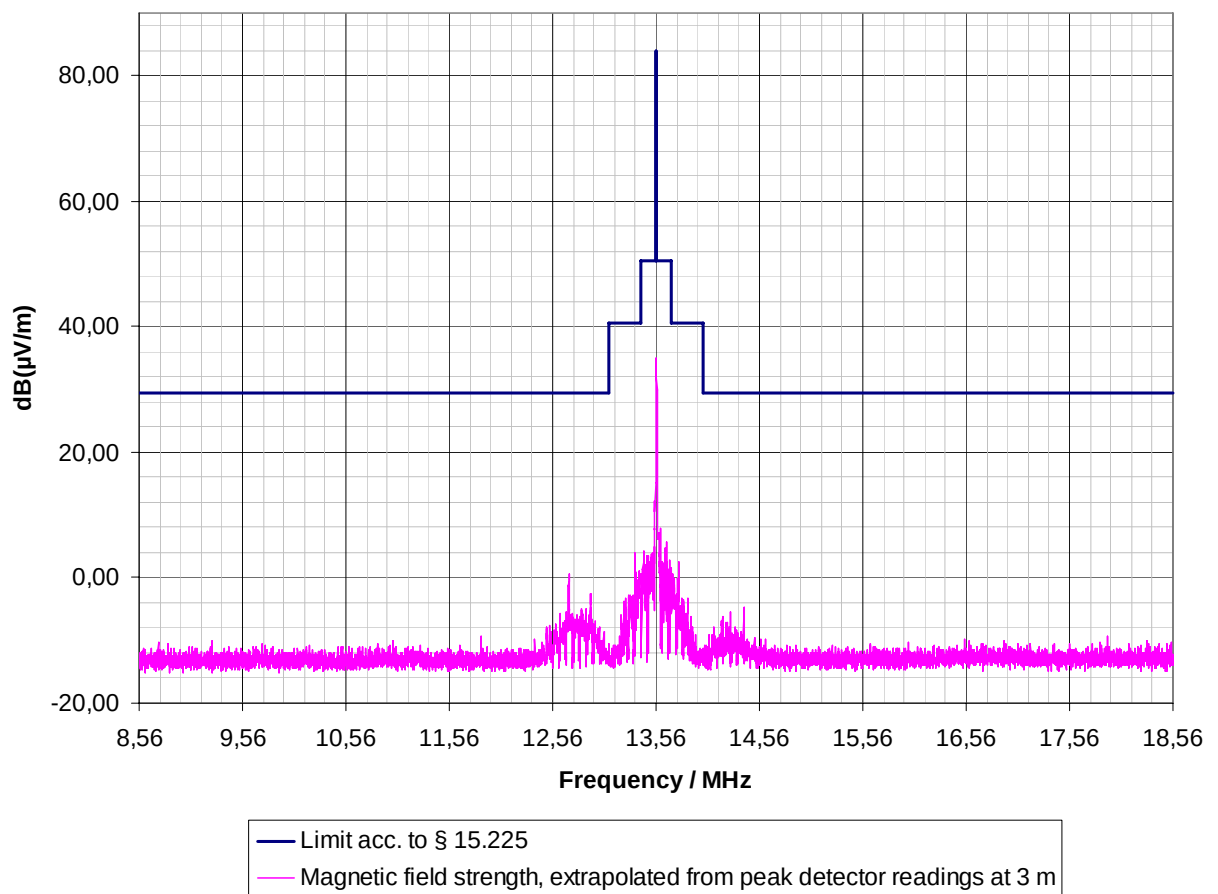


Figure 1 Transmitter spectrum mask

47 CFR 15.225 Transmitter Spectrum Mask

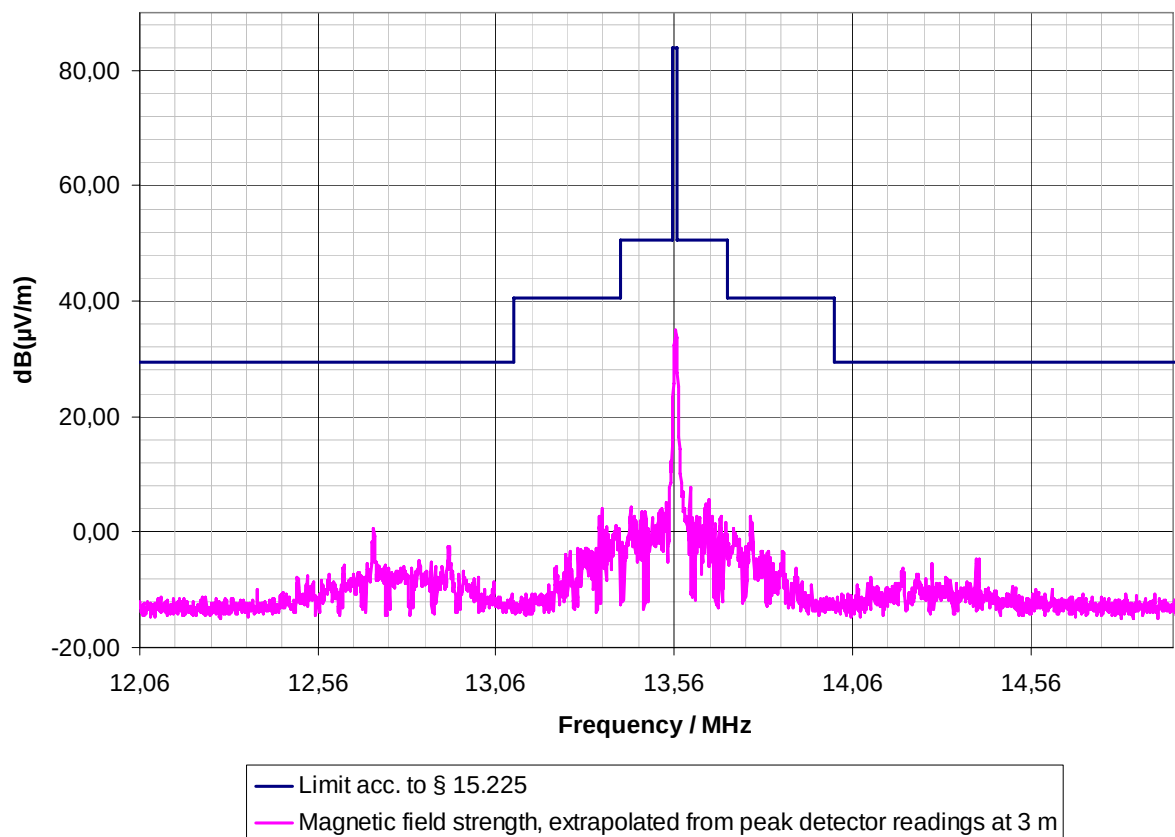


Figure 2 Transmitter spectrum mask (zoomed)

47 CFR 15.225 Transmitter Spectrum Mask

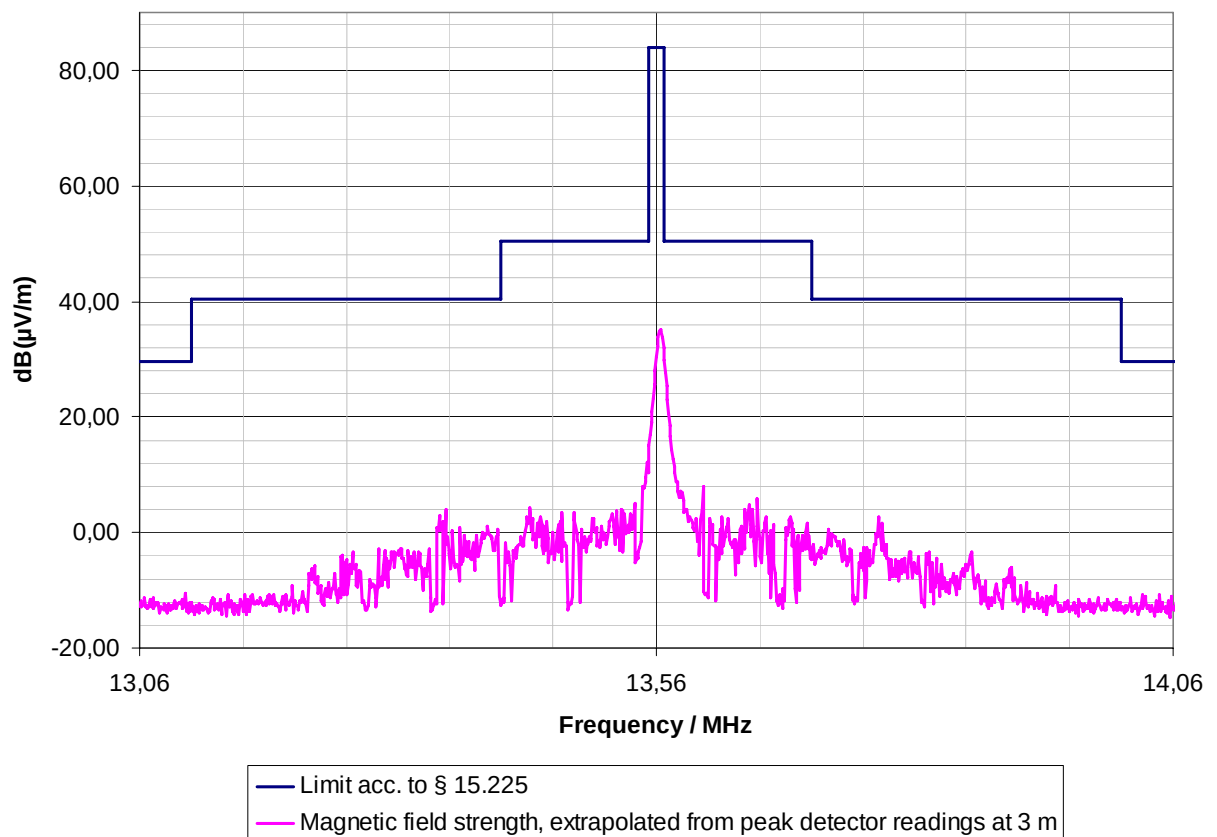


Figure 3 Transmitter spectrum mask (zoomed)



3.3 Radiated emissions outside the band 13.110-14.010 MHz

3.3.1 Frequency range 9 kHz ... 30 MHz

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-12
Environmental conditions:	22° C, 38% r.h.

Instruments:		Test Location: Building M, 10 m Semi-anechoic chamber			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810009	Shielded loop antenna	R&S	HFH2-Z2	2008-11-08	2009-11
1800118	EMI Test Receiver	R&S	ESI26	2009-06-09	2011-06 (2 years)
1300823	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test setup:	The EUT with a RFID tagged document was placed on a non-conductive table of 0.8 m height and horizontal dimensions of 1.5 m x 1.0 m. The AC adapter and the host computer were also located on this table. The arrangement of components on the table was according to drawing # 1 on page 34. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed. Excess length of the interconnecting cables was draped over the back edge of the table. A minimum distance of 40 cm to the floor was maintained for all cables. For details refer to the photographs in the appendix.
Operating modes investigated:	1. Standby / ready 2. Active communication between the transceiver and the transponder (tagged document lying on the scanning surface) The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result: Pass

The measured emissions (spurious) of the transmitter in the frequency range 9 kHz ... 30 MHz were found below the limit.

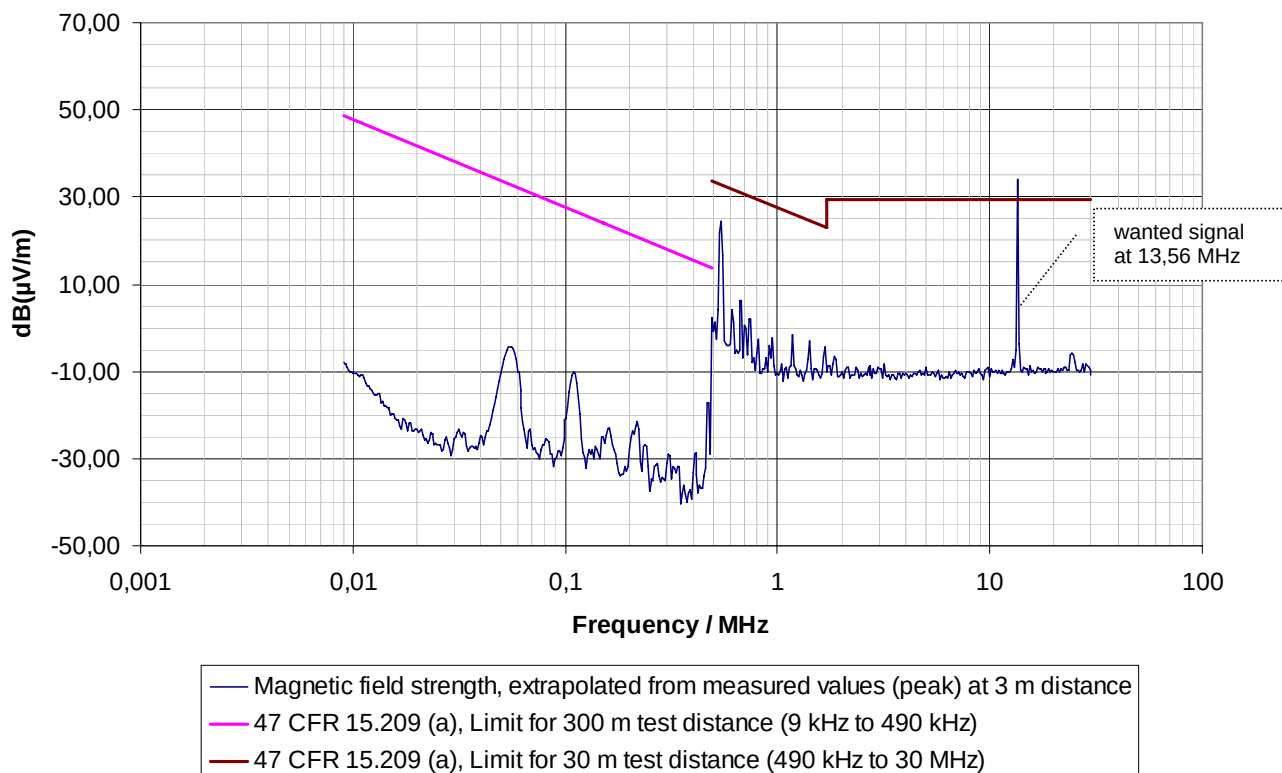
The minimum margin of a measurement value to the limit was 7.75 dB.

Protocol:

The diagram on the following page shows the result of repetitive sweeps (max hold) with the peak detector employed while the transmitter was transmitting. In a preliminary investigation it was found that the transmitting mode was causing equal or higher emissions than the operation in stand-by mode. During the measurement at a distance of 3 m the turntable was rotated, and also the orientation of the loop antenna was varied to obtain the maximum readings.

The limit line shown in the table was derived from the specified limits by applying a correction of 40 dB per decade.

Radiated emissions of the transmitter in the frequency range 9 kHz to 30 MHz (Fast Prescan)



The following table shows the field strength levels of spurious emissions obtained with the Quasi Peak detector (final readings). The IF bandwidth of the receiver was 200 Hz for the frequency range 9 kHz to 150 kHz and 9 kHz for the frequency range 150 kHz to 30 MHz. The test distance was 3 m.

For comparison with the limits, the measured values from 3 m test distance had been converted to values valid for the specified test distance using a correction factor of 40 dB per decade.

Frequency kHz	Measured field strength @ 3 m dB(μV/m)	Specified test distance m	Calculated field strength for the specified test distance dB(μV/m)	Limit for transmitters at the specified test distance dB(μV/m)	Margin dB	Remarks
0,0543	69,9	300	-10,1	32,91	43,01	PASS
0,1075	53,5	300	-26,5	26,98	53,48	PASS
0,2144	59,0	300	-21,0	20,98	41,98	PASS
0,3064	51,5	300	-28,5	17,88	46,38	PASS
0,4054	52,4	300	-27,6	15,45	43,05	PASS
0,4723	64,5	300	-15,5	14,12	29,62	PASS
0,5410	65,2	30	25,2	32,95	7,75	PASS
0,6753	47,0	30	7,0	31,01	24,01	PASS
0,9409	37,7	30	-2,3	28,13	30,43	PASS
1,1762	36,7	30	-3,3	26,19	29,49	PASS
1,4122	35,7	30	-4,3	24,61	28,91	PASS
1,6610	33,0	30	-7,0	23,20	30,20	PASS
24,680	28,0	30	-12,0	29,54	41,54	PASS
27,120	27,9	30	-12,1	29,54	41,64	PASS

3.3.2 Frequency range 30 MHz ... 1000 MHz

3.3.2.1 Summary

Summarizing table of the six highest measurement values relative to the limit

Fre- quency MHz	Dis- tance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	QP Reading dB(μV)	An- tenna- factor dB/m	Con- version factor dB	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
533,46	10	2	Hor.	0	10	20,84	10,46	41,3	46,02	4,72	PASS	
828,07	10	1,8	Ver.	50	5,6	24,63	10,46	40,69	46,02	5,33	PASS	
67,8	10	3,3	Ver.	80	13,3	10,45	10,46	34,21	40	5,79	PASS	1)
40,68	10	1,3	Ver.	0	10,1	13,52	10,46	34,08	40	5,92	PASS	1)
684,05	10	2,3	Ver.	0	6,1	22,5	10,46	39,06	46,02	6,96	PASS	
54,25	10	1,3	Ver.	230	9,5	12,8	10,46	32,76	40	7,24	PASS	

Remark 1): Harmonics of 13.56 MHz

If not indicated otherwise, all numbers are Quasi-Peak readings (IF Bandwidth 120 kHz). All readings were taken with the test receiver manually tuned to the frequency listed in the tables. The azimuth of the EUT and the antenna height were optimized for maximum reading at each individual frequency.

The measurements were conducted while the EUT was set up as table-top equipment in a typical configuration as described in the detailed protocol. The EUT was operated in reading mode with active transmitter.

Further information about the tests carried out can be found on the following pages.

Result: Pass

The measured radiated emissions of the EUT in the frequency range of 30 MHz to 1 GHz were found to be equal or below the specified limits.

The minimum margin of a measurement value to the limit was 4.72 dB.



3.3.2.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-12
Environmental conditions:	22° C, 38% r.h.

Instruments:		Test Location: 10 m Semi-anechoic chamber			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810061	Trilog Antenna	Schwarzbeck	VULB 9163	2009-05-26	2011-05 (2 years)
1800118	EMI Test Receiver	R&S	ESI 26	2009-06-09	2011-06 (2 years)
1150007	EMI Test Receiver	R&S	ESVS 30	2009-06-17	2010-06
1300823	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test setup:	The EUT with a RFID tagged document was placed on a non-conductive table of 0.8 m height and horizontal dimensions of 1.5 m x 1.0 m. The AC adapter and a host computer were also located on this table. The arrangement of components on the table was according to drawing # 1 on page 34. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed. Excess length of the interconnecting cables was draped over the back edge of the table. A minimum distance of 40 cm to the floor was maintained for all cables. For details refer to the photographs in the appendix.
Operating modes investigated:	1. Standby / ready 2. Active communication between the transceiver and the transponder (tagged document lying on the scanning surface) The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result: Pass

The measured emissions (spurious) of the transmitter in the frequency range 30 MHz ... 1000 MHz were found below the specified limits given in 47 CFR 15.209 (a).

The minimum margin of a measurement value to the limit was 4.72 dB.

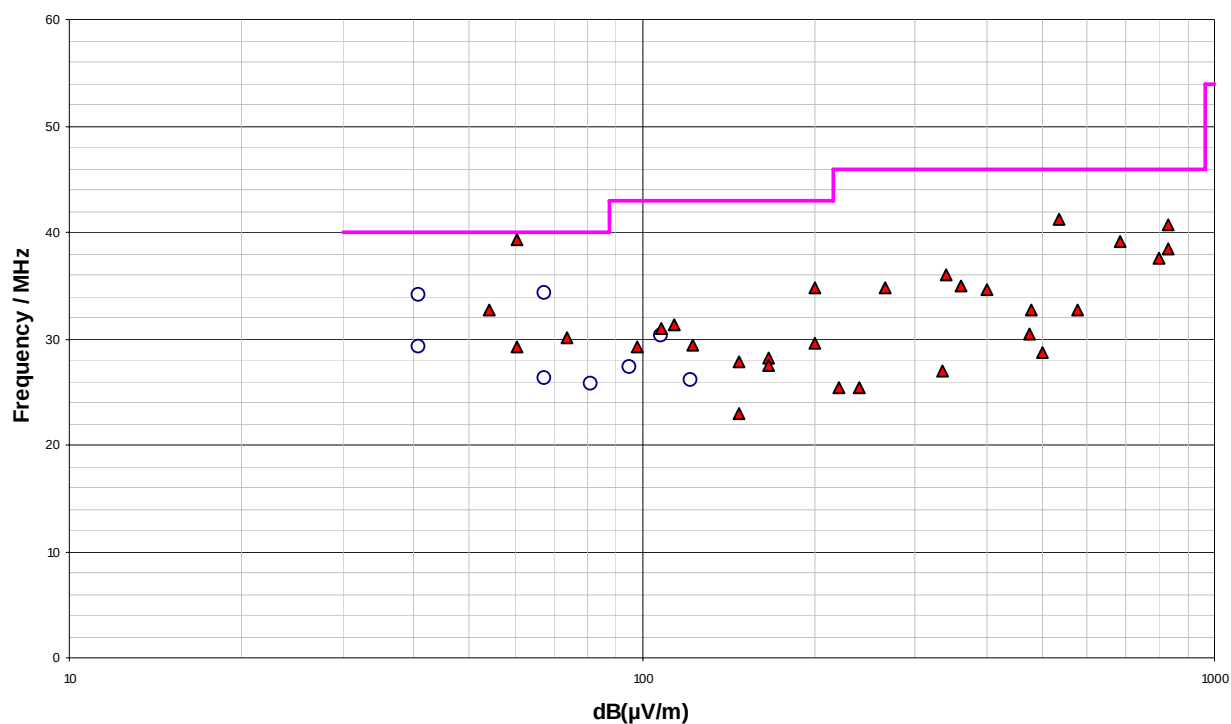
Protocol:

Measurements of the electric fieldstrength were carried out in the frequency range 30 MHz to 1000 MHz with a test distance of 10 m with the Quasi Peak detector employed.

Preliminary investigations with a spectrum analyzer had shown that the level of emissions in ready mode was equal or less than the level of emissions in reading mode with active transmitter.

The table on the following page shows the conversion of the final measurement values in reading mode (with active transmitter) taken at 10 m distance to a test distance of 3 m and their comparison with the field strength limits given in § 15.209. A conversion factor of 20 dB/decade was employed.

Radiated emissions of the transmitter in the frequency range 30 MHz to 1000 MHz



Electrical Fieldstrength: Table of measured data

Fre- quency MHz	Dis- tance m	Height of Antenna m	Polari- zation	EUT Angle 1°	QP Reading dB(μV)	An- tenna- factor dB/m	Con- version factor dB	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
40,68	10	1,3	Ver.	0	10,1	13,52	10,46	34,08	40	5,92	PASS	1)
40,68	10	4	Hor.	90	5,3	13,52	10,46	29,28	40	10,72	PASS	1)
54,25	10	1,3	Ver.	230	9,5	12,8	10,46	32,76	40	7,24	PASS	
60,32	10	4	Hor.	60	5,5	13,22	10,46	29,18	40	10,82	PASS	not related to the operation of the EUT, see note 2)
60,32	10	3,3	Ver.	80	15,6	13,22	10,46	39,28	40	0,72	PASS	not related to the operation of the EUT, see note 2)
67,8	10	3,3	Ver.	80	13,3	10,45	10,46	34,21	40	5,79	PASS	1)
67,82	10	4	Hor.	30	5,3	10,44	10,46	26,2	40	13,8	PASS	1)
73,73	10	1,7	Ver.	180	11,2	8,43	10,46	30,09	40	9,91	PASS	
81,38	10	4	Ver.	90	6,4	8,94	10,46	25,8	40	14,2	PASS	1)



Fre- quency MHz	Dis- tance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	QP Reading dB(μV)	An- tenna- factor dB/m	Con- version factor dB	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
94,95	10	1,5	Ver.	180	3,8	13	10,46	27,26	43,52	16,26	PASS	1)
98,3	10	4	Hor.	0	5,3	13,41	10,46	29,17	43,52	14,35	PASS	
108,5	10	1	Ver.	200	6,7	13,12	10,46	30,28	43,52	13,24	PASS	1)
108,51	10	1	Ver.	200	7,3	13,12	10,46	30,88	43,52	12,64	PASS	
114,3	10	1,2	Ver.	180	8,6	12,23	10,46	31,29	43,52	12,23	PASS	
122,07	10	4	Hor.	0	4,7	10,89	10,46	26,05	43,52	17,47	PASS	1)
122,87	10	1	Ver.	0	8,2	10,78	10,46	29,44	43,52	14,08	PASS	
147,44	10	4	Hor.	180	3,2	9,26	10,46	22,92	43,52	20,6	PASS	
147,44	10	1	Ver.	0	8,1	9,26	10,46	27,82	43,52	15,7	PASS	
166,62	10	1	Ver.	240	7,6	10,12	10,46	28,18	43,52	15,34	PASS	
166,8	10	4	Hor.	240	6,9	10,13	10,46	27,49	43,52	16,03	PASS	
200,5	10	4	Hor.	240	12,3	12,09	10,46	34,85	43,52	8,67	PASS	
200,5	10	1	Ver.	170	7,1	12,09	10,46	29,65	43,52	13,87	PASS	
221,17	10	4	Hor.	240	2	12,93	10,46	25,39	46,02	20,63	PASS	
240	10	4	Hor.	30	0,9	13,95	10,46	25,31	46,02	20,71	PASS	
266,73	10	4	Hor.	0	10	14,35	10,46	34,81	46,02	11,21	PASS	
336,05	10	3,5	Hor.	0	0	16,45	10,46	26,91	46,02	19,11	PASS	
339,1	10	1	Ver.	0	9	16,59	10,46	36,05	46,02	9,97	PASS	
361,92	10	3,4	Hor.	30	7,2	17,31	10,46	34,97	46,02	11,05	PASS	
400	10	3,5	Hor.	0	6,2	17,95	10,46	34,61	46,02	11,41	PASS	
474,74	10	2,4	Hor.	0	0,9	19,15	10,46	30,51	46,02	15,51	PASS	
478,2	10	4	Ver.	180	3	19,28	10,46	32,74	46,02	13,28	PASS	
501,86	10	3	Ver.	180	-1,8	20,05	10,46	28,71	46,02	17,31	PASS	
533,46	10	2	Hor.	0	10	20,84	10,46	41,3	46,02	4,72	PASS	
576,19	10	3	Ver.	160	0,7	21,58	10,46	32,74	46,02	13,28	PASS	
684,05	10	2,3	Ver.	0	6,1	22,5	10,46	39,06	46,02	6,96	PASS	
800	10	1,4	Hor.	60	2,9	24,18	10,46	37,54	46,02	8,48	PASS	
828,07	10	1,4	Hor.	0	3,4	24,63	10,46	38,49	46,02	7,53	PASS	
828,07	10	1,8	Ver.	50	5,6	24,63	10,46	40,69	46,02	5,33	PASS	

Remarks:

- 1) Harmonics of 13,56 MHz
- 2) This disturbance was not caused by the operation of the EUT, but from the host PC. Even after removal of the EUT from the turntable this disturbance frequency was present with unchanged level.

3.3.3 Frequency range 1 GHz ... 5 GHz

3.3.3.1 Summary

Summarizing table of the six highest measurement values relative to the limit

Frequency	Test Distance	Antenna Height	Pol.	EUT Azimuth	Detector function	Instrument Reading	Antenna Factor	Cable loss and amp. gain	Measured Field strength	Limit	Margin	Result
MHz	m	m		°		dBμV/m	dB	dB	dBμV/m	dBμV/m	dB	
1764.0	3	1.00	V	170	AV	46.56	26.41	-29.97	43.00	54.00	11.00	pass
1764.0	3	2.30	H	230	AV	42.36	26.41	-29.97	38.80	54.00	15.20	pass
1404.0	3	2.15	H	50	AV	42.12	24.83	-30.39	36.56	54.00	17.44	pass
1476.0	3	1.60	H	180	AV	40.62	25.28	-30.25	35.65	54.00	18.35	pass
1692.0	3	1.00	V	225	AV	39.49	26.24	-30.13	35.60	54.00	18.40	pass
1620.0	3	1.80	V	310	AV	39.42	26.05	-30.24	35.23	54.00	18.77	pass

All readings taken with the peak detector had a margin of more than 20 dB to the limit.

The measurements were made inside a 10 m semi-anechoic chamber with a test distance of 3 m.
The IF bandwidth/RBW was always 1 MHz.

All final readings were taken with the test receiver manually tuned to the frequency of interest.
The azimuth of the EUT was optimized for maximum reading at each individual frequency.
The measurements were conducted while the EUT was set up as table-top equipment in a typical configuration as described in the detailed protocol. The EUT was operated in reading mode with active transmitter.

Further information about the tests carried out can be found on the following pages.

Result: Pass

The measured radiated emissions of the EUT in the frequency range of 1 GHz to 5 GHz were found to be equal or below the specified limits.

The minimum margin of a measurement value to the limit (for average readings) was 11.0 dB.

3.3.3.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-12
Environmental conditions:	22° C, 38% r.h.

Instruments:	Test Location: Semi-anechoic chamber, 3 m test distance				
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810073	Log. per. antenna	R&S	HL050	2009-03-19	2010-03
1800129	Amplifier	AML	AML0123L3702	2009-05-25	2011-05 (2 years)
1800118	EMI Test Receiver	R&S	ESI 26	2009-06-09	2011-06 (2 years)
1300823	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test setup:	The EUT with a RFID tagged document was placed on a non-conductive table of 0.8 m height and horizontal dimensions of 1.5 m x 1.0 m. The AC adapter and the host computer were also located on this table. The arrangement of components on the table was according to drawing # 1 on page 34. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed. Excess length of the interconnecting cables was draped over the back edge of the table. A minimum distance of 40 cm to the floor was maintained for all cables. For details refer to the photographs in the appendix.
Operating modes investigated:	- Standby / ready - Active communication between the transceiver and the transponder (tagged document lying on the scanning surface) The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result: Pass

The measured emissions (spurious) of the transmitter in the frequency range 1 GHz ... 5 GHz were found below the specified limits.

The minimum margin of a measurement value to the limit was 11.0 dB.

Protocol:

Measurements of the electric fieldstrength were carried out in the frequency range 1 GHz to 5 GHz with a test distance of 3 m and in accordance with the provisions of §15.209.

Preliminary investigations had shown that the level of emissions in ready mode was equal or less than the level of emissions in reading mode with active transmitter.

A graphical representation of the results of automated pre-scans in transmitting mode is given in Section 6.3 of this report.

The graph and table on the following page show a comparison of the measured values in reading mode (with active transmitter) with the field strength limits given in § 15.209.

Radiated emissions in the frequency range 1- 5 GHz, Final Readings at 3 m

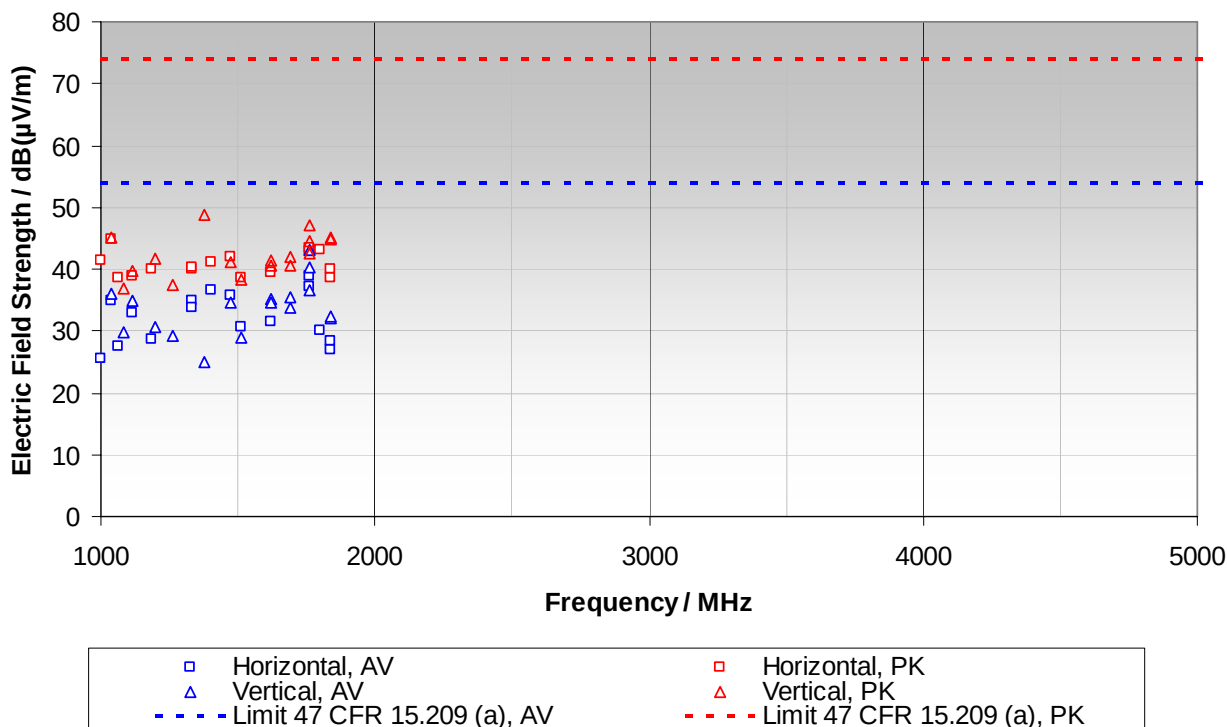


Table of measured values (final readings)

Frequency MHz	Test distance m	Antenna height RX m	Polarisation -	Turntable azimuth °	Instrument reading dBμV	Detector type -	Antenna factor dB(1/m)	Correction for cables and amplifier dB	Electrical field strength dB(μV/m)	Limit 47 CFR 15.209 (a), 3 m dB(μV/m)	Margin dB	Result -	Comments -
1000,000	3	1,00	H	180	51,30	PK	22,20	-32,20	41,30	74	32,70	PASS	
1000,000	3	1,00	H	180	35,50	AV	22,20	-32,20	25,50	54	28,50	PASS	
1037,600	3	1,00	H	180	54,55	PK	22,40	-32,05	44,90	74	29,10	PASS	ambient disturbance
1037,600	3	1,00	H	180	44,65	AV	22,40	-32,05	35,00	54	19,00	PASS	ambient disturbance
1066,800	3	1,00	H	300	47,77	PK	22,55	-31,83	38,50	74	35,50	PASS	
1066,800	3	1,00	H	300	36,77	AV	22,55	-31,83	27,50	54	26,50	PASS	
1116,000	3	1,35	H	350	47,40	PK	22,80	-31,37	38,83	74	35,17	PASS	
1116,000	3	1,35	H	350	41,45	AV	22,80	-31,37	32,88	54	21,12	PASS	
1188,000	3	1,90	H	160	47,96	PK	23,14	-31,10	40,00	74	34,00	PASS	
1188,000	3	1,90	H	160	36,51	AV	23,14	-31,10	28,55	54	25,45	PASS	
1332,000	3	2,80	H	230	46,32	PK	24,28	-30,61	40,00	74	34,00	PASS	
1332,000	3	2,80	H	230	41,32	AV	24,28	-30,61	35,00	54	19,00	PASS	
1404,000	3	2,15	H	50	46,67	PK	24,83	-30,39	41,10	74	32,90	PASS	
1404,000	3	2,15	H	50	42,12	AV	24,83	-30,39	36,55	54	17,45	PASS	
1476,000	3	1,60	H	180	46,97	PK	25,28	-30,25	42,00	74	32,00	PASS	
1476,000	3	1,60	H	180	40,62	AV	25,28	-30,25	35,65	54	18,35	PASS	
1512,000	3	1,40	H	180	43,23	PK	25,49	-30,22	38,50	74	35,50	PASS	
1512,000	3	1,40	H	180	35,23	AV	25,49	-30,22	30,50	54	23,50	PASS	
1620,000	3	1,40	H	230	43,69	PK	26,05	-30,24	39,50	74	34,50	PASS	
1620,000	3	1,40	H	230	35,68	AV	26,05	-30,24	31,49	54	22,51	PASS	
1764,000	3	1,10	H	230	46,49	PK	26,41	-29,97	42,93	74	31,07	PASS	
1764,000	3	1,10	H	230	40,81	AV	26,41	-29,97	37,25	54	16,75	PASS	
1836,000	3	3,50	H	230	41,77	PK	26,63	-29,90	38,50	74	35,50	PASS	
1836,000	3	3,50	H	230	30,17	AV	26,63	-29,90	26,90	54	27,10	PASS	



Frequency	Test distance	Antenna height RX	Polarisation	Turntable azimuth	Instrument reading	Detector type	Antenna factor	Correction for cables and amplifier	Electrical field strength	Limit 47 CFR 15.209 (a), 3 m	Margin	Result	Comments
MHz	m	m	-	°	dBµV	-	dB(1/m)	dB	dB(µV/m)	dB(µV/m)	dB	-	-
1036,800	3	1,00	V	180	54,65	PK	22,40	-32,05	45,00	74	29,00	PASS	ambient disturbance
1036,800	3	1,00	V	180	45,63	AV	22,40	-32,05	35,98	54	18,02	PASS	ambient disturbance
1080,000	3	1,00	V	240	46,08	PK	22,62	-31,70	37,00	74	37,00	PASS	
1080,000	3	1,00	V	240	38,98	AV	22,62	-31,70	29,90	54	24,10	PASS	
1116,000	3	2,10	V	240	48,27	PK	22,80	-31,37	39,70	74	34,30	PASS	
1116,000	3	2,10	V	240	43,57	AV	22,80	-31,37	35,00	54	19,00	PASS	
1200,400	3	1,10	V	280	49,60	PK	23,20	-31,10	41,70	74	32,30	PASS	
1200,400	3	1,10	V	280	38,40	AV	23,20	-31,10	30,50	54	23,50	PASS	
1260,000	3	1,40	V	170	44,81	PK	23,71	-31,12	37,40	74	36,60	PASS	
1260,000	3	1,40	V	170	36,61	AV	23,71	-31,12	29,20	54	24,80	PASS	
1377,200	3	1,00	V	180	54,62	PK	24,63	-30,45	48,80	74	25,20	PASS	
1377,200	3	1,00	V	180	30,82	AV	24,63	-30,45	25,00	54	29,00	PASS	
1476,000	3	2,10	V	170	45,97	PK	25,28	-30,25	41,00	74	33,00	PASS	
1476,000	3	2,10	V	170	39,59	AV	25,28	-30,25	34,62	54	19,38	PASS	
1512,000	3	2,10	V	170	42,93	PK	25,49	-30,22	38,20	74	35,80	PASS	
1512,000	3	2,10	V	170	33,73	AV	25,49	-30,22	29,00	54	25,00	PASS	
1620,000	3	1,80	V	310	45,69	PK	26,05	-30,24	41,50	74	32,50	PASS	
1620,000	3	1,80	V	310	39,42	AV	26,05	-30,24	35,23	54	18,77	PASS	
1692,000	3	1,30	V	280	44,59	PK	26,24	-30,13	40,70	74	33,30	PASS	
1692,000	3	1,30	V	280	37,79	AV	26,24	-30,13	33,90	54	20,10	PASS	
1764,000	3	1,00	V	10	46,16	PK	26,41	-29,97	42,60	74	31,40	PASS	
1764,000	3	1,00	V	10	40,16	AV	26,41	-29,97	36,60	54	17,40	PASS	
1836,000	3	1,00	V	10	48,27	PK	26,63	-29,90	45,00	74	29,00	PASS	
1836,000	3	1,00	V	10	35,27	AV	26,63	-29,90	32,00	54	22,00	PASS	
1836,000	3	1,00	V	160	47,97	PK	26,63	-29,90	44,70	74	29,30	PASS	without passport
1836,000	3	1,00	V	160	35,47	AV	26,63	-29,90	32,20	54	21,80	PASS	without passport
1764,000	3	1,00	V	170	48,16	PK	26,41	-29,97	44,60	74	29,40	PASS	without passport
1764,000	3	1,00	V	170	43,86	AV	26,41	-29,97	40,30	54	13,70	PASS	without passport
1692,000	3	1,00	V	225	45,79	PK	26,24	-30,13	41,90	74	32,10	PASS	without passport
1692,000	3	1,00	V	225	39,49	AV	26,24	-30,13	35,60	54	18,40	PASS	without passport
1620,000	3	1,00	V	225	44,89	PK	26,05	-30,24	40,70	74	33,30	PASS	without passport
1620,000	3	1,00	V	225	38,79	AV	26,05	-30,24	34,60	54	19,40	PASS	without passport
1332,000	3	1,00	H	205	46,72	PK	24,28	-30,61	40,40	74	33,60	PASS	without passport
1332,000	3	1,00	H	205	40,22	AV	24,28	-30,61	33,90	54	20,10	PASS	without passport
1764,000	3	2,30	H	230	46,86	PK	26,41	-29,97	43,30	74	30,70	PASS	without passport
1764,000	3	2,30	H	230	42,36	AV	26,41	-29,97	38,80	54	15,20	PASS	without passport
1800,000	3	2,20	H	230	46,40	PK	26,50	-29,90	43,00	74	31,00	PASS	without passport
1800,000	3	2,20	H	230	33,50	AV	26,50	-29,90	30,10	54	23,90	PASS	without passport
1836,000	3	2,20	H	230	43,27	PK	26,63	-29,90	40,00	74	34,00	PASS	without passport
1836,000	3	2,20	H	230	31,77	AV	26,63	-29,90	28,50	54	25,50	PASS	without passport
1764,000	3	1,00	V	170	50,56	PK	26,41	-29,97	47,00	74	27,00	PASS	Scanner not initialized
1764,000	3	1,00	V	170	46,56	AV	26,41	-29,97	43,00	54	11,00	PASS	Scanner not initialized



3.4 Frequency stability under extreme conditions

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-13

Instruments:		Test Location: Building M, Large shielded room No. 1			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1800104	Spectrum analyzer	R&S	FSEK 30	2008-06-09	2010-06 (2 years)
1810023	Shielded loop 3 cm	EMCO	7405-902	---	No cal. required
1060557	Digital Multimeter	GMC	22S	2009-01-26	2010-01
S002797	Environmental chamber	Vötsch	VM 04/200	---	---
1200241	Temperature recorder	Yokogawa	DX1012-1-4-2	2009-07-31	2010-07
S002616	Adjustable power supply	Schiller	VCD 35.01	---	No cal. required

Test setup:

The EUT was connected via a coupling device (H-Field probe temporarily fixed on top of the document scanner) to a spectrum analyzer. It was powered from an adjustable DC power source which was located outside the environmental chamber.

Operating modes:

Transmitter on

The EUT was operated under normal and extreme test voltages at various ambient temperatures.

Operating modes:

Transmitter on

The EUT was operated at three different temperatures while it was supplied with input voltages in the range from 85% to 115% of the rated voltage.

Test method:

ANSI C63.4:2003, Sections 13.1.6 and Annex H.5

The frequency of the signal at the output of the coupling device was measured with a spectrum analyzer (marker counter mode employed) for further evaluations.

Result:

Pass

The frequency stability of the transmitter was found to be in compliance with the requirements of 47 CFR 15.225 (e).

Records/Evaluation:

Measurement data can be found on the following page.

Evaluation concerning the maximum drift:

Lowest carrier frequency measured under extreme conditions: 13.56394MHz

Highest carrier frequency measured under extreme conditions: 13.56416 MHz

Permitted range of values (13.5641 MHz +/- 0.01%)

Lower limit:

13.562744 MHz

Upper limit:

13.565456 MHz

Protocol:

a) Under normal conditions:

Using a spectrum analyzer, a reference point at some level (here: the peak of the spectrum envelope) was selected on the slope of the wanted signal, and the frequency at this point was measured and recorded.

b) Under extreme conditions:

For each combination of interest concerning voltage and temperature, the frequency at the same reference point on the slope was measured and recorded at startup, two, five and ten minutes after startup.

Spectrum analyzer settings:

RBW:	100 Hz	VBW:	5 kHz
ATT:	10 dB	REF:	87 dB(μV)
Span:	1 kHz	SWT:	10 s
Y-Scaling:	10 dB/division	Counter res.:	10 Hz

Frequency stability vs. temperature

The following measurements were made with 21 V supply voltage

Frequency / MHz	Minutes after startup			
Ambient temperature / °C	0	2	5	10
-20	13.56415	13.56416	13.56415	13.56416
20	13.56410	13.56407	13.56406	13.56406
50	13.56396	13.56394	13.56395	13.56395

$f_{\min}$	13.56394
$f_{\max}$	13.56416

For a graphical representation of the measured values refer to: On the following page

Frequency stability vs. input voltage

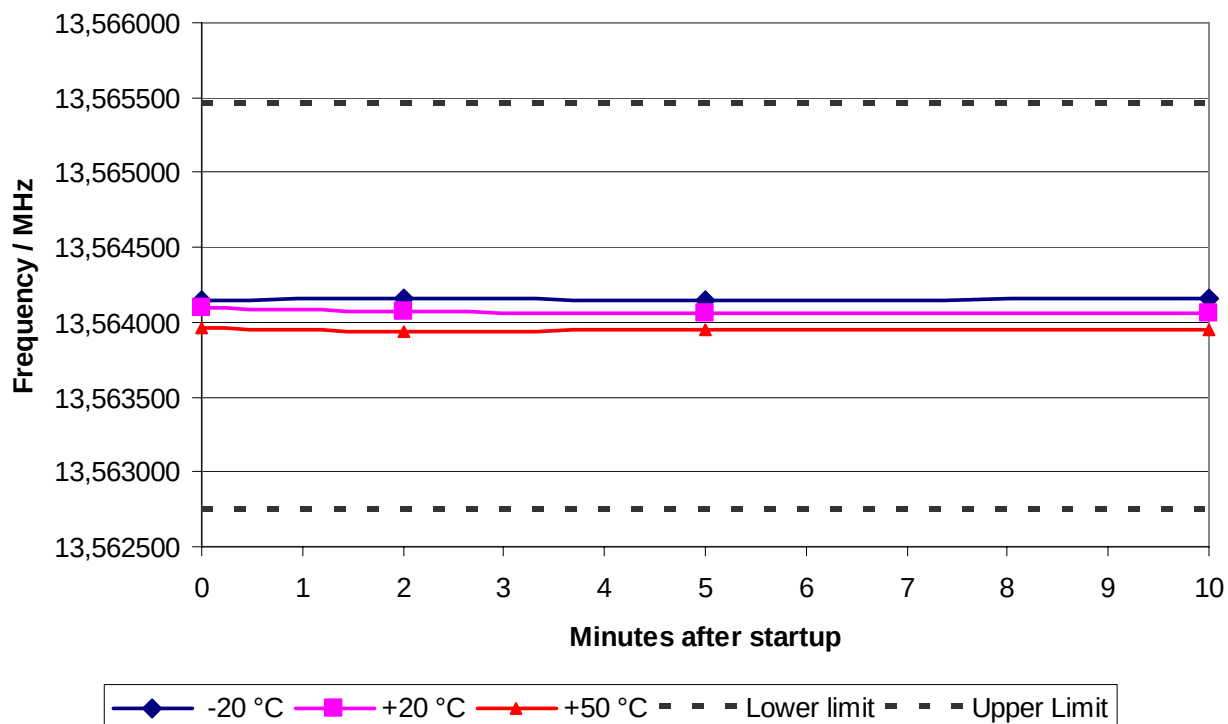
The following measurements were made with +20 °C ambient temperature.

Frequency / MHz	Minutes after startup			
Supply voltage / V	0	2	5	10
17.85	13.56410	13.56407	13.56407	13.56407
21.00	13.56410	13.56407	13.56406	13.56406
24.15	13.56410	13.56407	13.56406	13.56406

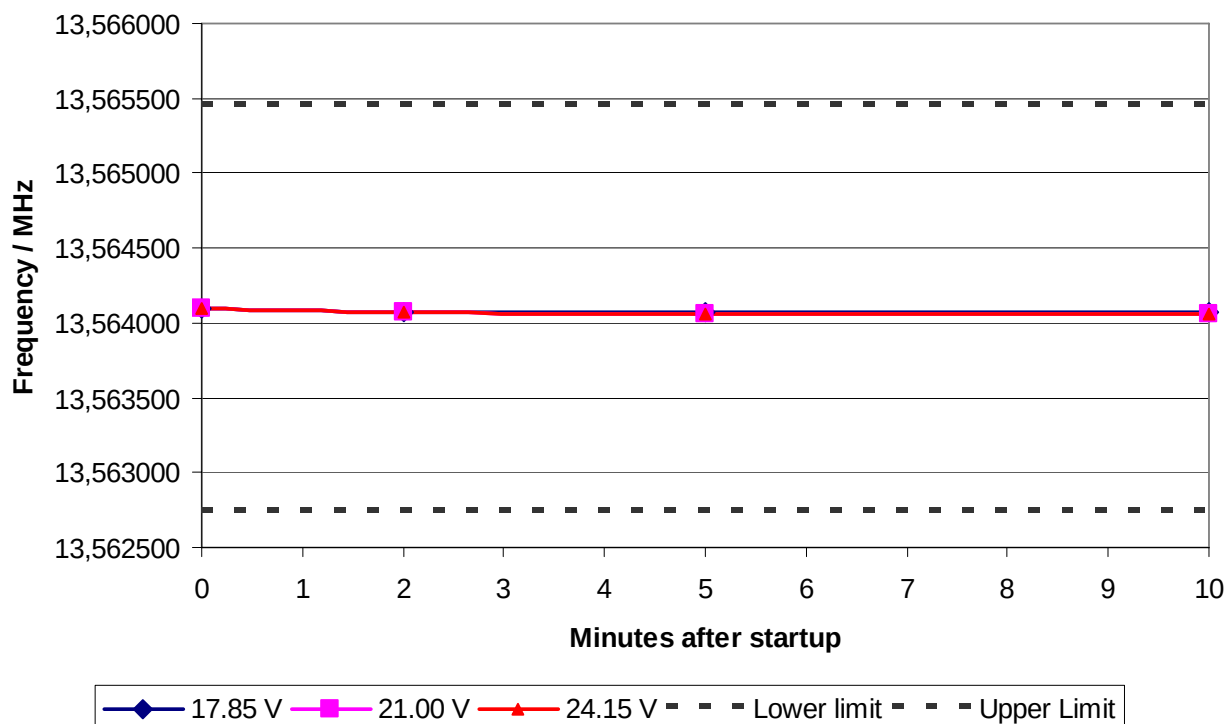
$f_{\min}$	13.56406
$f_{\max}$	13.56410

For a graphical representation of the measured values refer to: On the following page

Carrier frequency vs. ambient temperature



Carrier frequency vs. supply voltage



3.5 Variation of the radiated signal level of the fundamental frequency component caused by variation of the input power

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-13

Instruments:	Test Location: Building M, Large shielded room No. 1				
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1800104	Spectrum analyzer	R&S	FSEK 30	2008-06-09	2010-06 (2 years)
1810023	Shielded loop 3 cm	EMCO	7405-902	---	No cal. required
1060557	Digital Multimeter	GMC	22S	2009-01-26	2010-01
S002797	Environmental chamber	Vötsch	VM 04/200	---	---
1200241	Temperature recorder	Yokogawa	DX1012-1-4-2	2009-07-31	2010-07
S002616	Adjustable power supply	Schiller	VCD 35.01	---	No cal. required

Test setup:

The EUT was connected via a coupling device (H-Field probe temporarily fixed on top of the document scanner) to a spectrum analyzer. It was powered from an adjustable DC power source which was located outside the environmental chamber.

Operating modes:

Transmitter on.

The EUT was operated at three different temperatures while it was supplied with input voltages in the range from 85% to 115% of the rated voltage.

Test method:

47 CFR 15.31 (e)

At each combination of supply voltage and ambient temperature, the level of the signal at the output of the coupling device was measured with a spectrum analyzer for further evaluations.

For each combination of interest concerning voltage and temperature, the signal level at 13.56 MHz was measured approx. fifteen minutes after startup.

Result: refer to: On page 9

Records/Evaluation:

Variation of the level of wanted emissions at 13,56 MHz under extreme conditions

Ambient temperature		-20 ° C (Extreme low temperature)	+20 ° C (Normal temperature)	+50 ° C (Extreme high temperature)
Supply Voltage				
17,85 V (Extreme low voltage)	Spectrum analyzer reading / dBμV (rel. deviation to normal temperature and nominal voltage)	76,14 -2,32	78,50 0,04	75,95 -2,51
21 V (Nominal voltage)	Spectrum analyzer reading / dBμV (rel. deviation to normal temperature and nominal voltage)	76,15 -2,31	78,46 0	75,87 -2,59
24,15 V (Extreme high voltage)	Spectrum analyzer reading / dBμV (rel. deviation to normal temperature and nominal voltage)	76,16 -2,3	78,46 0	75,82 -2,64

Spectrum Analyzer Settings: CF=13,56 MHz, RBW=100 kHz, VBW=1 MHz, SPAN=0, SWT=AUTO, Y=1 dB/div.

4 Test and measuring results for unintentional radiators

4.1 AC Power Line Conducted Emissions (150 kHz - 30 MHz)

4.1.1 Summary

Summarizing table of the six highest measurement values relative to the limit

Device connected to the LISN: External power supply for the EUT								
Fre- quency [MHz]	Meter Reading [dB(μV)]	Detector Function	Correction [dB]	Measured Value [dB(μV)]	Limits QP / AV [dB(μV)]	Margin [dB]	Result	Comments / Remarks
0.798	41.2	AV	incl.	41.2	46.0	4.8	Pass	N
13.5645	44.9	AV	incl.	44.9	50.0	5.1	Pass	N
1.266	39.8	AV	incl.	39.8	46.0	6.2	Pass	N
1.1985	38.7	AV	incl.	38.7	46.0	7.3	Pass	N
1.3335	37.5	AV	incl.	37.5	46.0	8.5	Pass	L1
0.8655	37.2	AV	incl.	37.2	46.0	8.8	Pass	N

Applied limits: 47 CFR 15.107 (a)

All readings were automatically taken with an observation time of at least 2 seconds after running an automated prescan. Before the frequency scan was started, the test set-up was optimized for maximum emission level by employing the spectrum analyzer functionality of the measuring instrument.

All readings above were taken while the EUT was reading a tagged document.
Further information about the tests carried out can be found on the following pages.

Result: Pass

The measured conducted emissions of the EUT were found to be equal or below the specified limits.
The minimum margin of a measurement value to the limit was 4.8 dB.



4.1.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-14
Environmental conditions:	22° C, 36 % r.h

Instruments:		Test Location: Building M, Shielded Room No. 1			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1820054	Artificial mains network	R&S	ESH2-Z5	2009-06-15	2010-06
1820028	Artificial mains network	R&S	ESH3-Z5	2009-06-10	2010-06
1800137	EMI Test Receiver	R&S	ESCI-3	2009-06-10	2010-06
1060557	Digital Multimeter	GMC	22S	2009-01-26	2010-01
1300822	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test set-up:	The system under test was installed on a non-conductive table of 80 cm height in the shielded room. The arrangement of components on the table was according to drawing # 1 on page 34. The table was positioned in parallel to one conductive wall of the shielded room, maintaining a horizontal distance of 40 cm between the rear of equipment under test and the wall of the shielded room. The power cable of the EUT was routed to one artificial mains network (LISN). Excess length of the power cable was bundled. All other devices were powered from a separate LISN. Excess length of the interconnecting cables was draped over the back edge of the table. If necessary, the cables were bundled in the center in order to maintain a minimum distance of 40 cm to the floor. For details refer to drawing # 2 and the photographs.
Operating modes:	See below. The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 7.2 and 11.5 and Annexures D.1 and D.2

Result: Pass

Protocol:

The following measurements were made:

Scan No.	Operating Mode	Line under test	Result	Comments
1	Continuously reading a tagged document, with USB communications	L and N	Pass	-
2	Stand-by (scanner ready, but not initialized)	L and N	Pass	-

Measurement data can be found in Section 6.1 of this report.

4.2 Measurement of the electric field strength (30 MHz – 1000 MHz)

4.2.1 Summary

Fre- quency MHz	Dis- tance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	QP Reading dB(μV)	An- tenna- factor dB/m	Con- version factor dB	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
533,46	10	2	Hor.	0	10	20,84	10,46	41,3	46,02	4,72	PASS	
828,07	10	1,8	Ver.	50	5,6	24,63	10,46	40,69	46,02	5,33	PASS	
67,8	10	3,3	Ver.	80	13,3	10,45	10,46	34,21	40	5,79	PASS	1)
40,68	10	1,3	Ver.	0	10,1	13,52	10,46	34,08	40	5,92	PASS	1)
684,05	10	2,3	Ver.	0	6,1	22,5	10,46	39,06	46,02	6,96	PASS	
54,25	10	1,3	Ver.	230	9,5	12,8	10,46	32,76	40	7,24	PASS	1)

Remark 1): spurious emissions of the tag reader

Applied limits: 47 CFR 15.109 (a)

If not indicated otherwise, all numbers are Quasi-Peak readings (IF Bandwidth 120 kHz).

The measurement distance was 10 m.

All readings were taken with the test receiver manually tuned to the frequency listed in the tables. The azimuth of the EUT and the antenna height were optimized for maximum reading at each individual frequency.

The measurements were conducted while the EUT was set up as table-top equipment in a typical configuration as described in the detailed protocol. The EUT was operated in reading mode with active transmitter.

Further information about the tests carried out can be found on the following pages.

Result: Pass

The measured radiated emissions of the EUT in the frequency range of 30 MHz to 1 GHz were found to be equal or below the specified limit.

The minimum margin of a measurement value to the limit was 4.72 dB.



4.2.2 Detailed Test Protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-12
Environmental conditions:	22° C, 38% r.h.

Instruments:		Test Location: 10 m Semi-anechoic chamber			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810061	Trilog Antenna	Schwarzbeck	VULB 9163	2009-05-26	2011-05 (2 years)
1800118	EMI Test Receiver	R&S	ESI 26	2009-06-09	2011-06 (2 years)
1150007	EMI Test Receiver	R&S	ESVS 30	2009-06-17	2010-06
1300823	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test setup:	The EUT with a RFID tagged document was placed on a non-conductive table of 0.8 m height and horizontal dimensions of 1.5 m x 1.0 m. The AC adapter and a host computer were also located on this table. The arrangement of components on the table was according to drawing # 1 on page 34. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed. Excess length of the interconnecting cables was draped over the back edge of the table. A minimum distance of 40 cm to the floor was maintained for all cables. For details refer to the photographs in the appendix.
Operating modes investigated:	Scanning mode The voltage of the supplying mains was 120 V, 60 Hz.
Test procedure:	ANSI C63.4:2003, Clauses 7.2 and 11.6 and Annexures D.3 and D.4

Result: Pass

The measured emissions (spurious) of the transmitter in the frequency range 30 MHz ... 1000 MHz were found below the specified limits given in 47 CFR 15.109 (a).

The minimum margin of a measurement value to the limit was 4.72 dB.

Protocol:

Measurements of the electric fieldstrength were carried out in the frequency range 30 MHz to 1000 MHz with a test distance of 10 m. To compare the readings with the limits which are specified for 3 m test distance, a correction of 10,46 dB (20 dB/decade) was applied.

Exploratory measurements:

Preliminary measurements with a spectrum analyzer had shown that the operating mode causing the highest level of emissions is continuously scanning.

Attempts to maximize the emissions by changing the cable arrangement did not show any significant changes.

Final testing

Measurement data sheets from the final measurements can be found in Section 6.2.

4.3 Measurement of the electric field strength (1 GHz - 5 GHz)

4.3.1 Summary

Summarizing table of the six highest measurement values relative to the limit

Frequency	Test Distance	Antenna Height	Pol.	EUT Azimuth	Detector function	Instrument Reading	Antenna Factor	Cable loss and amp. gain	Measured Field strength	Limit	Margin	Result
MHz	m	m		°		dBμV/m	dB	dB	dBμV/m	dBμV/m	dB	
1764.0	3	1.00	V	170	AV	46.56	26.41	-29.97	43.00	54.00	11.00	pass
1764.0	3	2.30	H	230	AV	42.36	26.41	-29.97	38.80	54.00	15.20	pass
1404.0	3	2.15	H	50	AV	42.12	24.83	-30.39	36.56	54.00	17.44	pass
1476.0	3	1.60	H	180	AV	40.62	25.28	-30.25	35.65	54.00	18.35	pass
1692.0	3	1.00	V	225	AV	39.49	26.24	-30.13	35.60	54.00	18.40	pass
1620.0	3	1.80	V	310	AV	39.42	26.05	-30.24	35.23	54.00	18.77	pass

All readings taken with the peak detector had a margin of more than 20 dB to the limit.

Applied limits: 47 CFR 15.109 (a)

The measurements were made inside a 10 m semi-anechoic chamber with a test distance of 3 m. The IF bandwidth/RBW was always 1 MHz.

All final readings were taken with the test receiver manually tuned to the frequency of interest. The azimuth of the EUT was optimized for maximum reading at each individual frequency. The measurements were conducted while the EUT was set up as table-top equipment in a typical configuration as described in the detailed protocol. The EUT was operated in reading mode with active transmitter. Further information about the tests carried out can be found on the following pages.

Result: Pass

The measured radiated emissions of the EUT in the frequency range of 1 GHz to 5 GHz were found to be equal or below the specified limits.

The minimum margin of a measurement value to the limit was 11.0 dB.

4.3.2 Detailed Test Protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-10-12
Environmental conditions:	22° C, 38% r.h.

Instruments:	Test Location: Semi-anechoic chamber, 3 m test distance				
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810073	Log. per. antenna	R&S	HL050	2009-03-19	2010-03
1800129	Amplifier	AML	AML0123L3702	2009-05-25	2011-05 (2 years)
1800118	EMI Test Receiver	R&S	ESI 26	2009-06-09	2011-06 (2 years)
1300823	Hygrometer	rotronic	hygrolog NT	2009-01-05	2010-03

Information concerning the test:

Test set-up:	The device under test was installed on a non-conductive table of 80 cm height and horizontal dimensions of 1.5 m x 1.0 m. The arrangement of components on the table was according to drawing # 1 on page 34. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed. Excess length of the interconnecting cables was draped over the back edge of the table. A minimum distance of 40 cm to the floor was maintained for all cables. For details refer to the photographs.
Operating modes:	Scanning mode
Test procedure:	ANSI C63.4:2003, Clauses 7.2 and 11.6 and Annexures D.3 and D.4

Result: Pass

Protocol:

All measurements were carried out with a measuring distance of 3 m.

Preliminary testing:

The pretests had shown that the operating mode causing the highest level of emissions is continuously scanning.

The device under test was put into operation in the semi-anechoic chamber. Automated prescans were run with the antenna at four different height positions. During the prescans the turntable with the EUT was rotated.

Attempts to maximize the emissions by changing the cable arrangement did not show any significant changes.

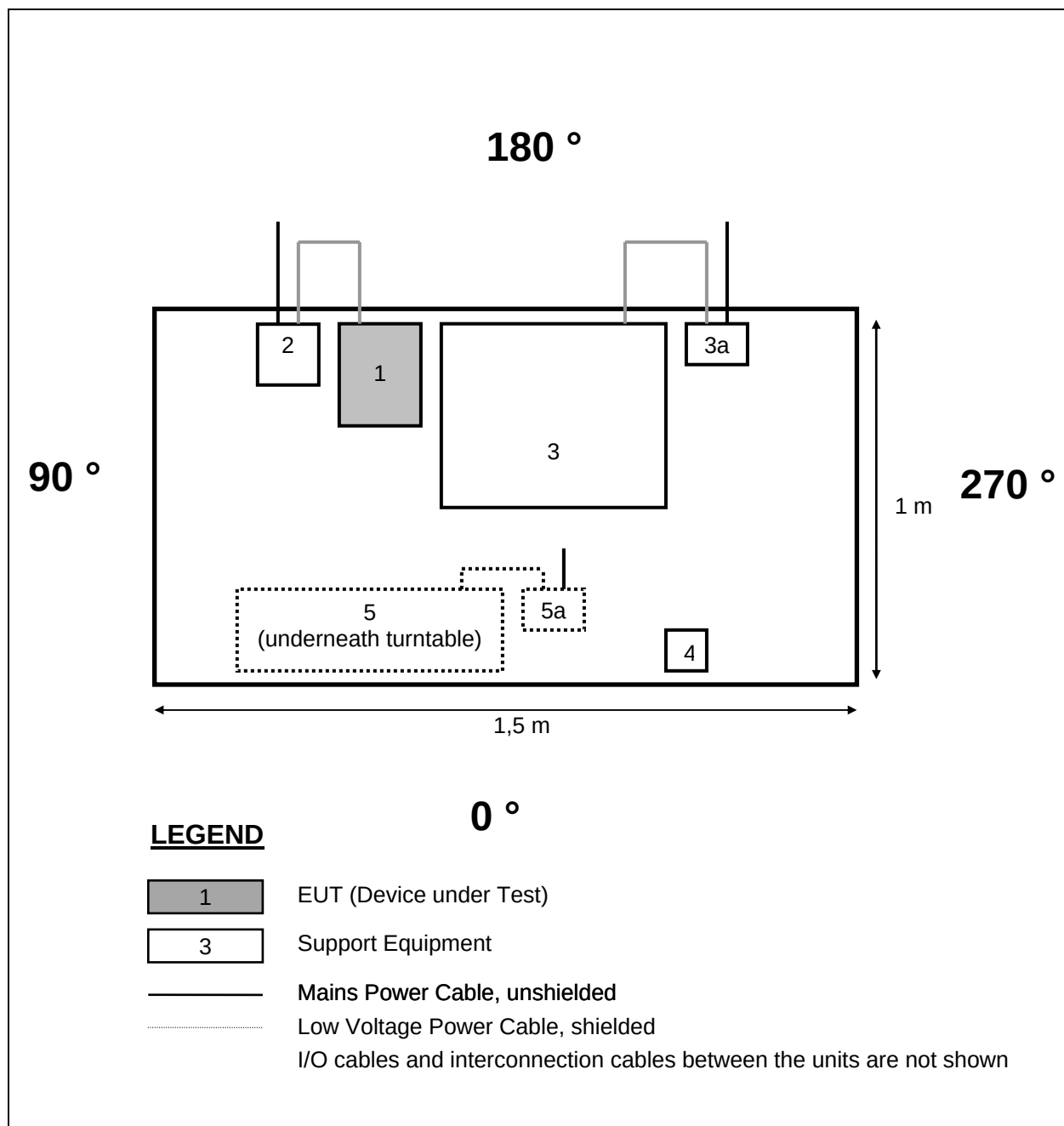
Final testing

Measurement data sheets from the final measurements can be found in section 6.3.

To obtain the final measurement values, the receiver was manually tuned to the frequencies found in the pretest with the highest level relative to the limit. At these frequencies, azimuth and antenna height were manually optimized to obtain the maximum readings.

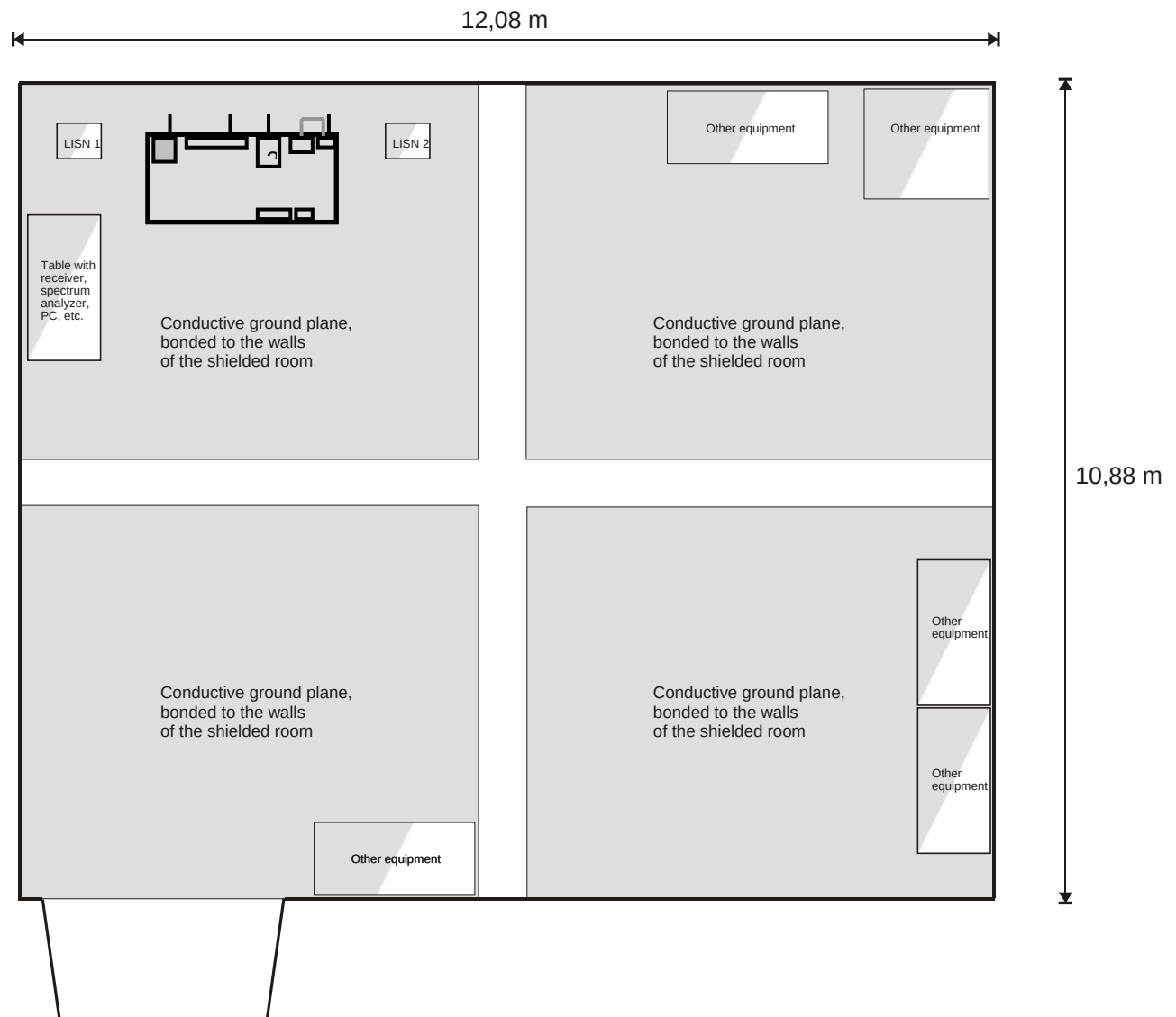
5 Drawings

5.1 Test configuration (Block diagram)



Drawing # 1: Test configuration for measurements of radiated and conducted emissions

5.2 Conducted Emissions Test Setup



Drawing #2: Conducted emissions test setup

6 Measurement data

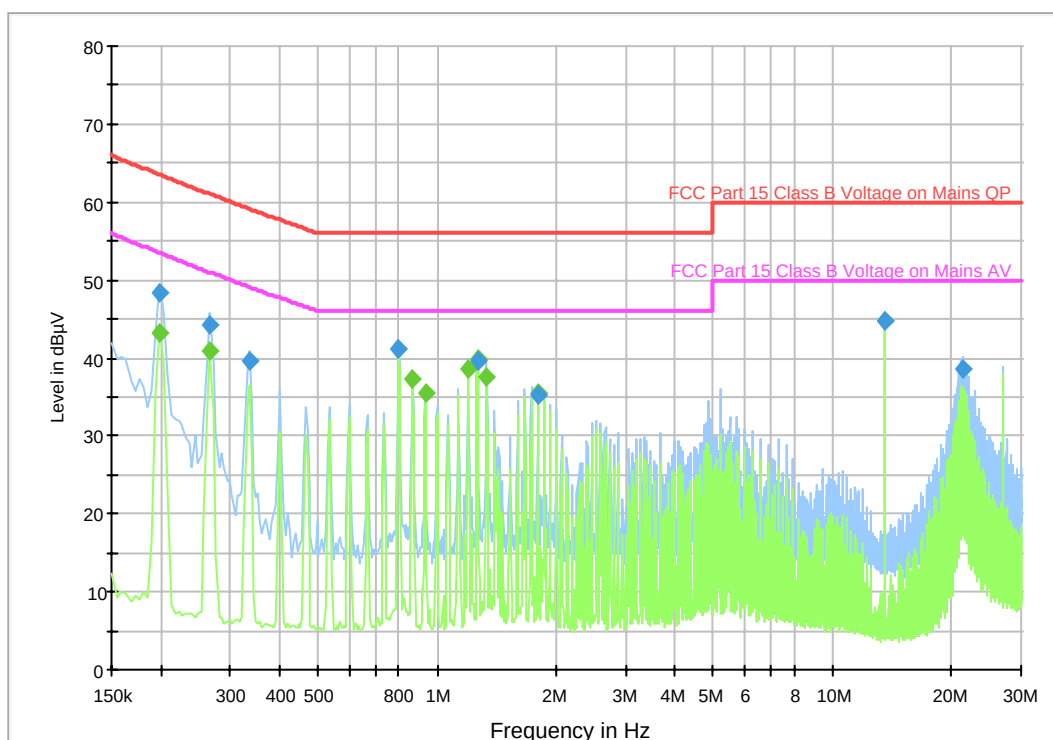
6.1 AC power line conducted emissions

6.1.1 Scan No. 1 (reader active)

Test Information

Test description:	Disturbance voltage
Device under test:	RFID reader
Line under test:	AC power input of the external AC/DC converter, Terminal L1
Location of test:	Building M, Shielded room No. 1
Test engineer:	W. Klos
Operating conditions:	Reading tagged passport
Comments:	with AC/DC converter SINPRO

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average (final)	9kHz	2s	ESCI
150kHz - 30MHz	Peak; Average (Prescan)	9kHz	20 ms	ESCI



Notes:

The curves in the diagram show the maxima of the values measured on Line and Neutral.
The preliminary scans with Peak and Average detector were made with a dwell time of 50 ms.

Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.199500	48.3	2000.000	9.000	GND	N	10.0	15.2	63.5	
0.267000	44.4	2000.000	9.000	GND	N	10.0	16.6	61.0	
0.334500	39.5	2000.000	9.000	GND	N	10.0	19.7	59.2	
0.798000	41.0	2000.000	9.000	GND	N	10.0	15.0	56.0	
1.266000	39.6	2000.000	9.000	GND	N	10.0	16.4	56.0	
1.797000	35.4	2000.000	9.000	GND	L1	10.0	20.6	56.0	
...	...	...	...	...	...	...	...	...	...

Final Measurement Detector 2

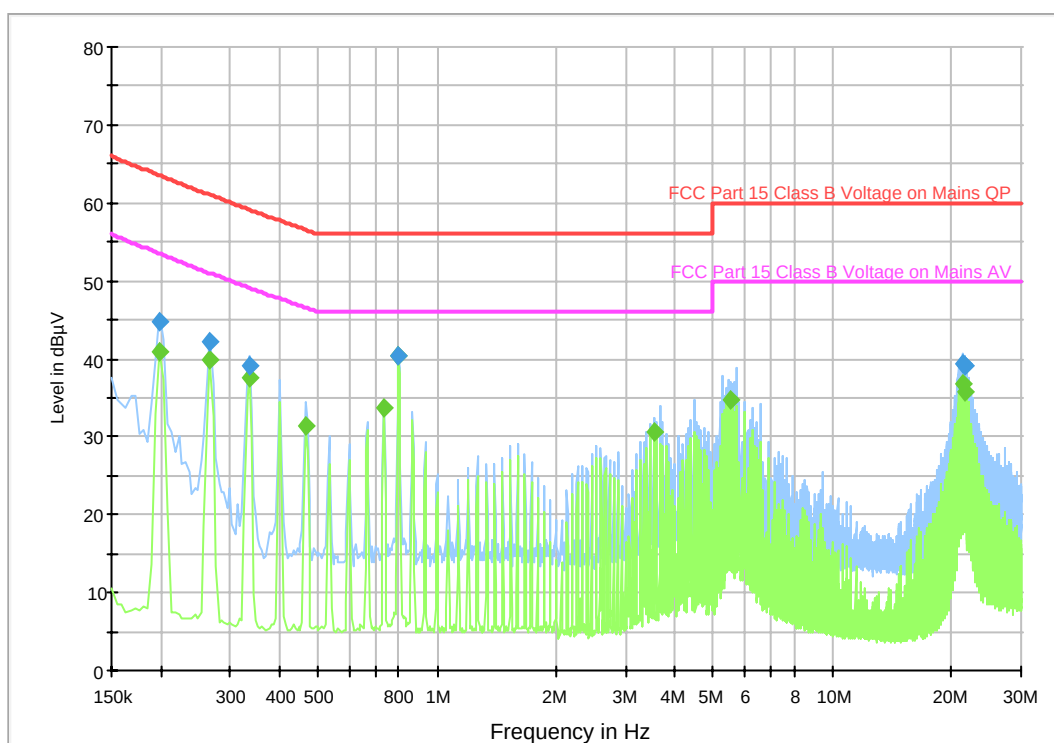
Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.199500	43.3	2000.000	9.000	GND	N	10.0	10.2	53.5	
0.267000	40.8	2000.000	9.000	GND	N	10.0	10.2	51.0	
0.798000	41.2	2000.000	9.000	GND	N	10.0	4.8	46.0	
0.865500	37.2	2000.000	9.000	GND	N	10.0	8.8	46.0	
0.933000	35.4	2000.000	9.000	GND	N	10.0	10.6	46.0	
1.198500	38.7	2000.000	9.000	GND	N	10.0	7.3	46.0	
1.266000	39.8	2000.000	9.000	GND	N	10.0	6.2	46.0	
1.333500	37.5	2000.000	9.000	GND	L1	10.0	8.5	46.0	
1.797000	35.5	2000.000	9.000	GND	L1	10.0	10.5	46.0	
13.564500	44.9	2000.000	9.000	GND	N	10.0	5.1	50.0	

6.1.2 Scan No. 2 (stand-by)

Test Information

Test description:	Disturbance voltage
Device under test:	RFID reader
Line under test:	AC power input of the external AC/DC converter, Terminal N
Location of test:	Building M, Shielded room No. 1
Test engineer:	W. Klos
Operating conditions:	Ready, scanner not initialized
Comments:	with AC/DC converter SINPRO

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average (final)	9kHz	2s	ESCI
150kHz - 30MHz	Peak; Average (Prescan)	9kHz	20 ms	ESCI



Notes:

The curves in the diagram show the maxima of the values measured on Line and Neutral.
The preliminary scans with Peak and Average detector were made with a dwell time of 50 ms.



Final Measurement Detector 1

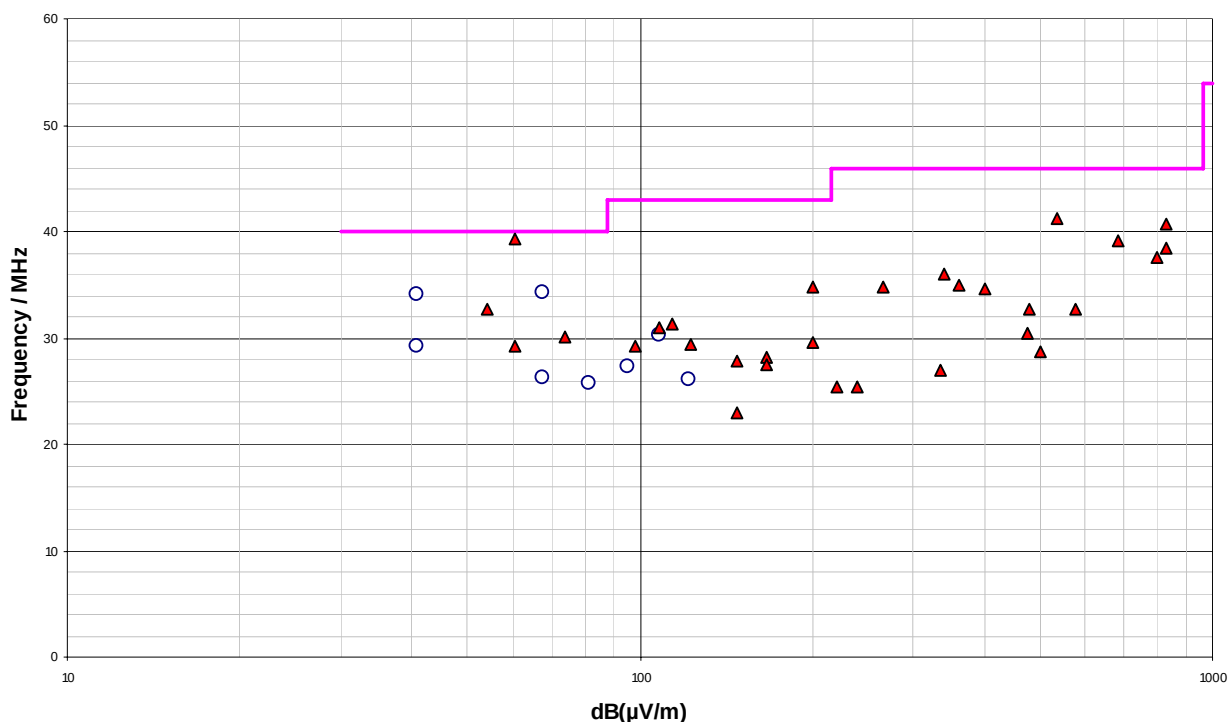
Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.199500	44.9	2000.000	9.000	GND	N	10.0	18.6	63.5	
0.267000	42.1	2000.000	9.000	GND	N	10.0	18.9	61.0	
0.334500	39.1	2000.000	9.000	GND	N	10.0	20.1	59.2	
0.798000	40.4	2000.000	9.000	GND	N	10.0	15.6	56.0	
21.507000	39.3	2000.000	9.000	GND	N	10.0	20.7	60.0	
21.574500	39.1	2000.000	9.000	GND	N	10.0	20.9	60.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.199500	40.9	2000.000	9.000	GND	N	10.0	12.6	53.5	
0.267000	39.8	2000.000	9.000	GND	N	10.0	11.2	51.0	
0.334500	37.6	2000.000	9.000	GND	N	10.0	11.5	49.1	
0.465000	31.5	2000.000	9.000	GND	N	10.0	15.0	46.5	
0.730500	33.7	2000.000	9.000	GND	N	10.0	12.3	46.0	
0.798000	40.5	2000.000	9.000	GND	N	10.0	5.5	46.0	
3.529500	30.7	2000.000	9.000	GND	N	10.0	15.3	46.0	
5.527500	34.8	2000.000	9.000	GND	N	10.0	15.2	50.0	
21.507000	36.9	2000.000	9.000	GND	N	10.0	13.1	50.0	
21.642000	35.6	2000.000	9.000	GND	N	10.0	14.4	50.0	

6.2 Electric field strength, 30 MHz - 1000 MHz

Radiated emissions of the transmitter in the frequency range 30 MHz to 1000 MHz



- 47 CFR 15.209 (a), Limit for 3 m test distance (30 MHz to 1000 MHz)
- Electric field strength - Harmonics from 13.56 MHz -, extrapolated from measured values (QP) at 10 m distance
- ▲ Electric field strength - Other disturbance frequencies -, extrapolated from measured values (QP) at 10 m distance

Electrical Fieldstrength: Table of measured data

Fre- quency MHz	Dis- tance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	QP Reading dB(μV)	An- tenna- factor dB/m	Con- version factor dB	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
40,68	10	1,3	Ver.	0	10,1	13,52	10,46	34,08	40	5,92	PASS	1)
40,68	10	4	Hor.	90	5,3	13,52	10,46	29,28	40	10,72	PASS	1)
54,25	10	1,3	Ver.	230	9,5	12,8	10,46	32,76	40	7,24	PASS	
60,32	10	4	Hor.	60	5,5	13,22	10,46	29,18	40	10,82	PASS	not related to the operation of the EUT, see note 2)
60,32	10	3,3	Ver.	80	15,6	13,22	10,46	39,28	40	0,72	PASS	not related to the operation of the EUT, see note 2)
67,8	10	3,3	Ver.	80	13,3	10,45	10,46	34,21	40	5,79	PASS	1)
67,82	10	4	Hor.	30	5,3	10,44	10,46	26,2	40	13,8	PASS	1)
73,73	10	1,7	Ver.	180	11,2	8,43	10,46	30,09	40	9,91	PASS	



Fre- quency MHz	Dis- tance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	QP Reading dB(μV)	An- tenna- factor dB/m	Con- version factor dB	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
81,38	10	4	Ver.	90	6,4	8,94	10,46	25,8	40	14,2	PASS	1)
94,95	10	1,5	Ver.	180	3,8	13	10,46	27,26	43,52	16,26	PASS	1)
98,3	10	4	Hor.	0	5,3	13,41	10,46	29,17	43,52	14,35	PASS	
108,5	10	1	Ver.	200	6,7	13,12	10,46	30,28	43,52	13,24	PASS	1)
108,51	10	1	Ver.	200	7,3	13,12	10,46	30,88	43,52	12,64	PASS	
114,3	10	1,2	Ver.	180	8,6	12,23	10,46	31,29	43,52	12,23	PASS	
122,07	10	4	Hor.	0	4,7	10,89	10,46	26,05	43,52	17,47	PASS	1)
122,87	10	1	Ver.	0	8,2	10,78	10,46	29,44	43,52	14,08	PASS	
147,44	10	4	Hor.	180	3,2	9,26	10,46	22,92	43,52	20,6	PASS	
147,44	10	1	Ver.	0	8,1	9,26	10,46	27,82	43,52	15,7	PASS	
166,62	10	1	Ver.	240	7,6	10,12	10,46	28,18	43,52	15,34	PASS	
166,8	10	4	Hor.	240	6,9	10,13	10,46	27,49	43,52	16,03	PASS	
200,5	10	4	Hor.	240	12,3	12,09	10,46	34,85	43,52	8,67	PASS	
200,5	10	1	Ver.	170	7,1	12,09	10,46	29,65	43,52	13,87	PASS	
221,17	10	4	Hor.	240	2	12,93	10,46	25,39	46,02	20,63	PASS	
240	10	4	Hor.	30	0,9	13,95	10,46	25,31	46,02	20,71	PASS	
266,73	10	4	Hor.	0	10	14,35	10,46	34,81	46,02	11,21	PASS	
336,05	10	3,5	Hor.	0	0	16,45	10,46	26,91	46,02	19,11	PASS	
339,1	10	1	Ver.	0	9	16,59	10,46	36,05	46,02	9,97	PASS	
361,92	10	3,4	Hor.	30	7,2	17,31	10,46	34,97	46,02	11,05	PASS	
400	10	3,5	Hor.	0	6,2	17,95	10,46	34,61	46,02	11,41	PASS	
474,74	10	2,4	Hor.	0	0,9	19,15	10,46	30,51	46,02	15,51	PASS	
478,2	10	4	Ver.	180	3	19,28	10,46	32,74	46,02	13,28	PASS	
501,86	10	3	Ver.	180	-1,8	20,05	10,46	28,71	46,02	17,31	PASS	
533,46	10	2	Hor.	0	10	20,84	10,46	41,3	46,02	4,72	PASS	
576,19	10	3	Ver.	160	0,7	21,58	10,46	32,74	46,02	13,28	PASS	
684,05	10	2,3	Ver.	0	6,1	22,5	10,46	39,06	46,02	6,96	PASS	
800	10	1,4	Hor.	60	2,9	24,18	10,46	37,54	46,02	8,48	PASS	
828,07	10	1,4	Hor.	0	3,4	24,63	10,46	38,49	46,02	7,53	PASS	
828,07	10	1,8	Ver.	50	5,6	24,63	10,46	40,69	46,02	5,33	PASS	

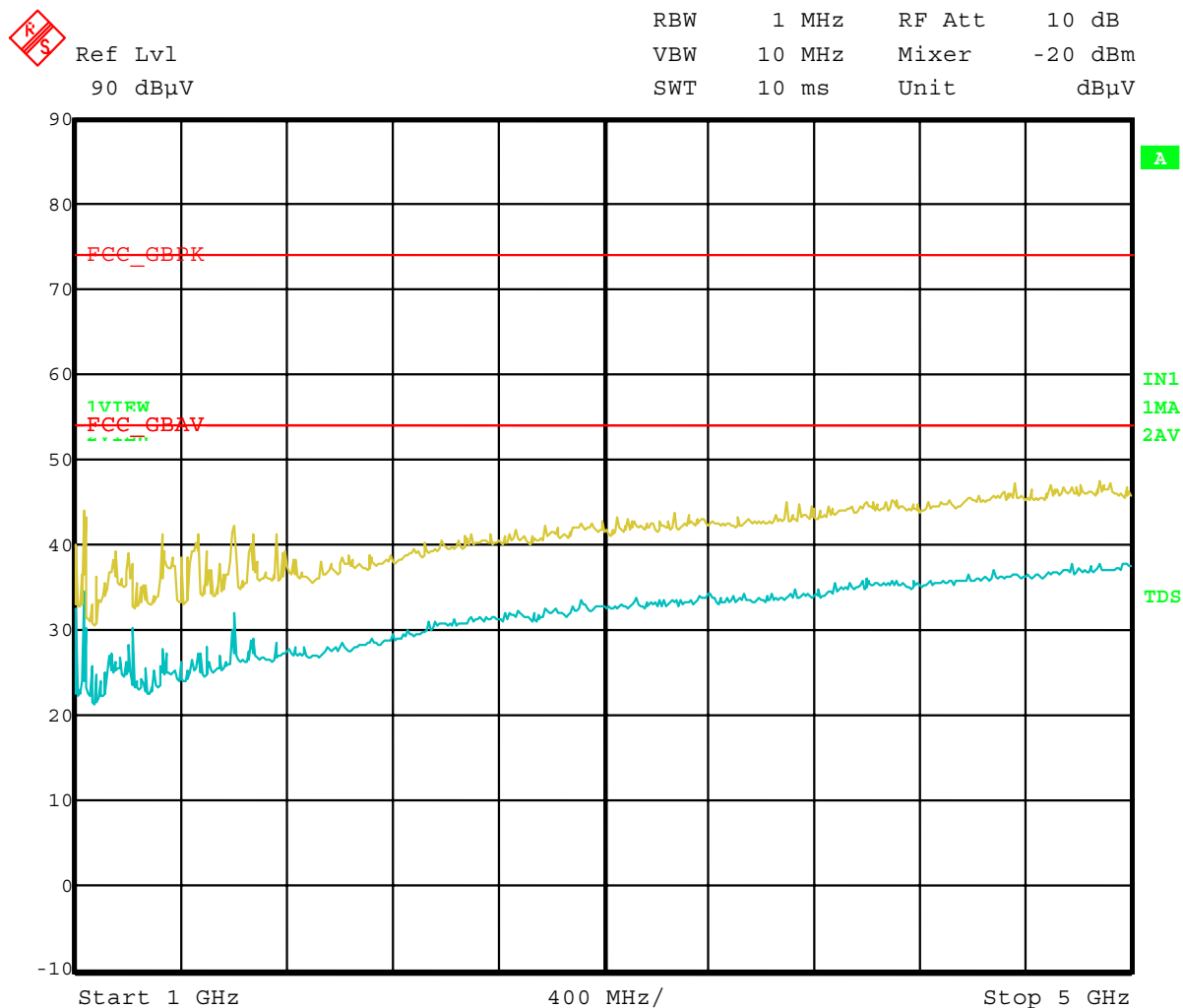
Remarks:

1) Harmonics of 13,56 MHz

2) This disturbance was not caused by the operation of the EUT, but from the host PC. Even after removal of the EUT from the turntable this disturbance frequency was present with unchanged level.

6.3 Radiated emissions, $f > 1$ GHz

6.3.1 Preliminary measurements



Title:

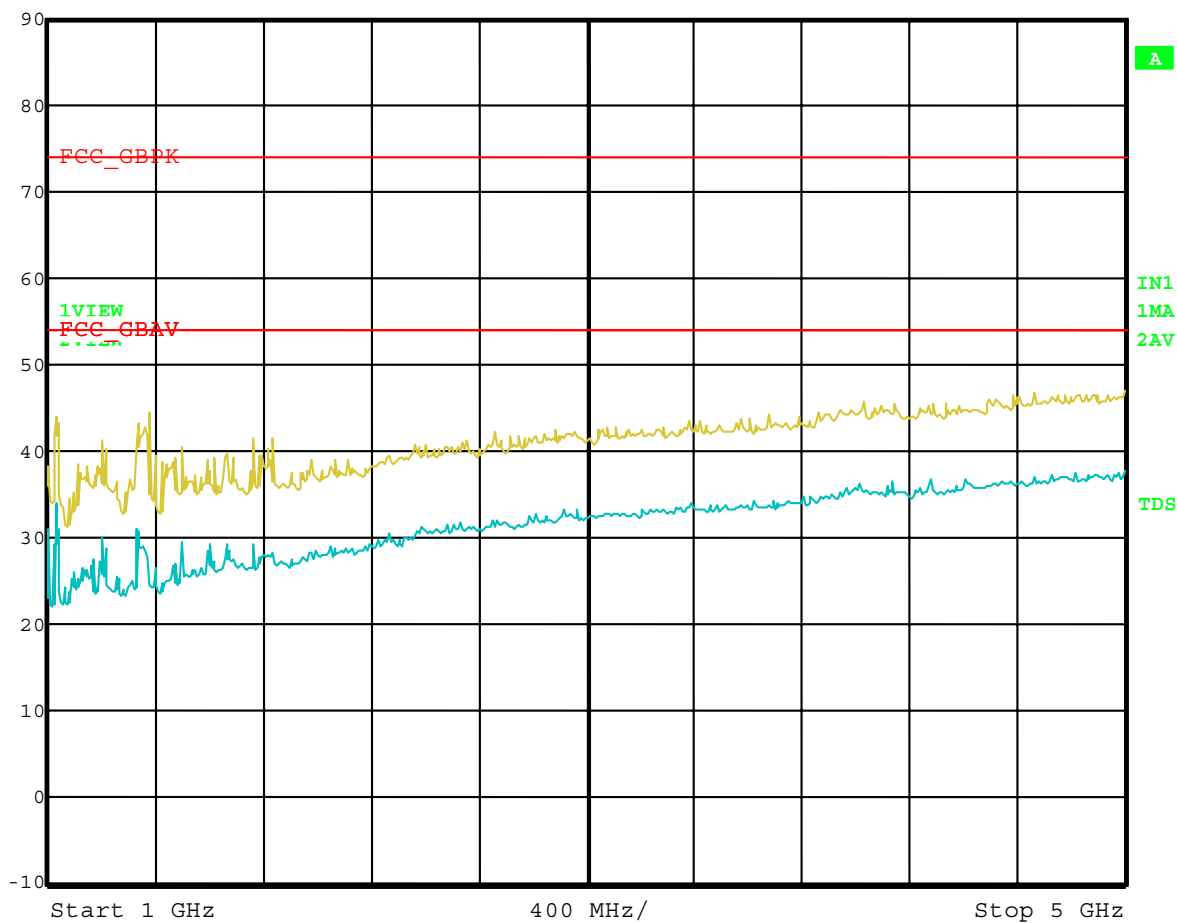
Date: 12.OCT.2009 09:32:20

Repetitive reading of a document, MaxHold, Horizontal



Ref Lvl
90 dBμV

RBW	1 MHz	RF Att	10 dB
VBW	10 MHz	Mixer	-20 dBm
SWT	10 ms	Unit	dBμV



Title:

Date: 12.OCT.2009 09:45:14

Repetitive reading of the document; MaxHold, Vertical

6.3.2 Final measurements

Radiated emissions in the frequency range 1- 5 GHz, Final Readings at 3 m

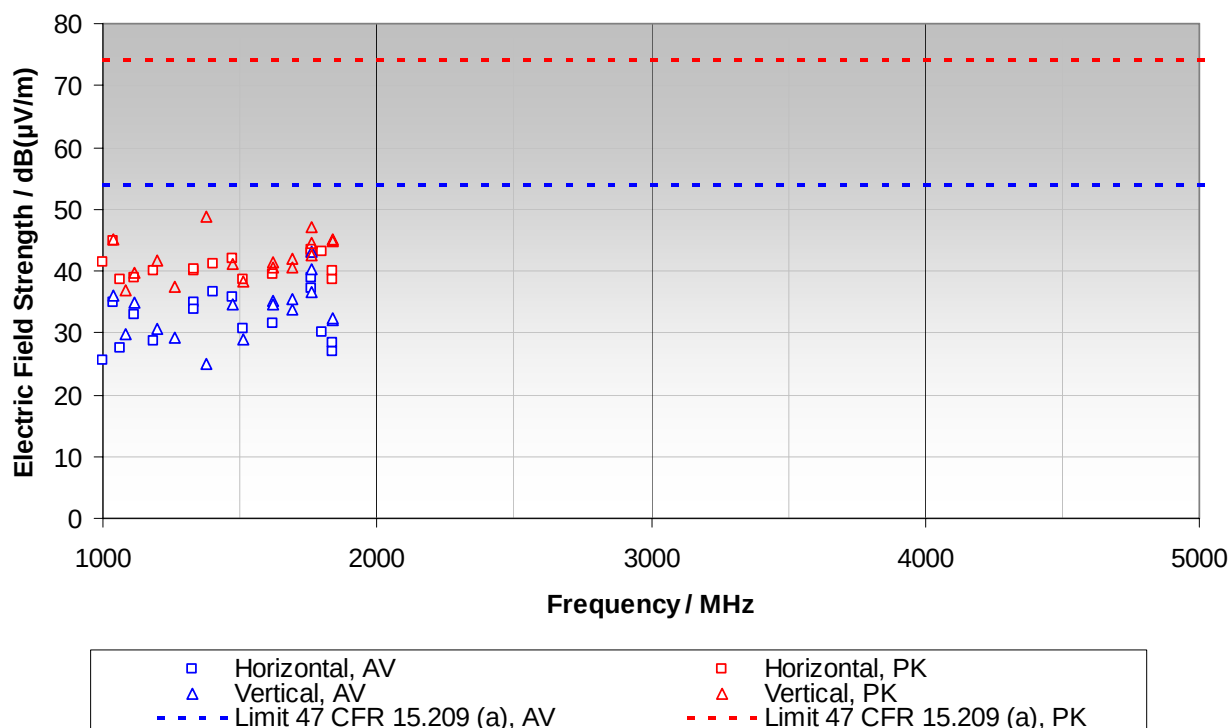


Table of measured values (final readings)

Frequency MHz	Test distance m	Antenna height RX m	Polarisation -	Turntable azimuth °	Instrument reading dBμV	Detector type -	Antenna factor dB(1/m)	Correction for cables and amplifier dB	Electrical field strength dB(μV/m)	Limit 47 CFR 15.209 (a), 3 m dB(μV/m)	Margin dB	Result -	Comments -
1000,000	3	1,00	H	180	51,30	PK	22,20	-32,20	41,30	74	32,70	PASS	
1000,000	3	1,00	H	180	35,50	AV	22,20	-32,20	25,50	54	28,50	PASS	
1037,600	3	1,00	H	180	54,55	PK	22,40	-32,05	44,90	74	29,10	PASS	ambient disturbance
1037,600	3	1,00	H	180	44,65	AV	22,40	-32,05	35,00	54	19,00	PASS	ambient disturbance
1066,800	3	1,00	H	300	47,77	PK	22,55	-31,83	38,50	74	35,50	PASS	
1066,800	3	1,00	H	300	36,77	AV	22,55	-31,83	27,50	54	26,50	PASS	
1116,000	3	1,35	H	350	47,40	PK	22,80	-31,37	38,83	74	35,17	PASS	
1116,000	3	1,35	H	350	41,45	AV	22,80	-31,37	32,88	54	21,12	PASS	
1188,000	3	1,90	H	160	47,96	PK	23,14	-31,10	40,00	74	34,00	PASS	
1188,000	3	1,90	H	160	36,51	AV	23,14	-31,10	28,55	54	25,45	PASS	
1332,000	3	2,80	H	230	46,32	PK	24,28	-30,61	40,00	74	34,00	PASS	
1332,000	3	2,80	H	230	41,32	AV	24,28	-30,61	35,00	54	19,00	PASS	
1404,000	3	2,15	H	50	46,67	PK	24,83	-30,39	41,10	74	32,90	PASS	
1404,000	3	2,15	H	50	42,12	AV	24,83	-30,39	36,55	54	17,45	PASS	
1476,000	3	1,60	H	180	46,97	PK	25,28	-30,25	42,00	74	32,00	PASS	
1476,000	3	1,60	H	180	40,62	AV	25,28	-30,25	35,65	54	18,35	PASS	
1512,000	3	1,40	H	180	43,23	PK	25,49	-30,22	38,50	74	35,50	PASS	
1512,000	3	1,40	H	180	35,23	AV	25,49	-30,22	30,50	54	23,50	PASS	
1620,000	3	1,40	H	230	43,69	PK	26,05	-30,24	39,50	74	34,50	PASS	
1620,000	3	1,40	H	230	35,68	AV	26,05	-30,24	31,49	54	22,51	PASS	
1764,000	3	1,10	H	230	46,49	PK	26,41	-29,97	42,93	74	31,07	PASS	
1764,000	3	1,10	H	230	40,81	AV	26,41	-29,97	37,25	54	16,75	PASS	
1836,000	3	3,50	H	230	41,77	PK	26,63	-29,90	38,50	74	35,50	PASS	
1836,000	3	3,50	H	230	30,17	AV	26,63	-29,90	26,90	54	27,10	PASS	



Frequency MHz	Test distance m	Antenna height RX m	Polarisation -	Turntable azimuth °	Instrument reading dBµV	Detector type -	Antenna factor dB(1/m)	Correction for cables and amplifier dB	Electrical field strength dB(µV/m)	Limit 47 CFR 15.209 (a), 3 m dB(µV/m)	Margin dB	Result -	Comments -
1036,800	3	1,00	V	180	54,65	PK	22,40	-32,05	45,00	74	29,00	PASS	ambient disturbance
1036,800	3	1,00	V	180	45,63	AV	22,40	-32,05	35,98	54	18,02	PASS	ambient disturbance
1080,000	3	1,00	V	240	46,08	PK	22,62	-31,70	37,00	74	37,00	PASS	
1080,000	3	1,00	V	240	38,98	AV	22,62	-31,70	29,90	54	24,10	PASS	
1116,000	3	2,10	V	240	48,27	PK	22,80	-31,37	39,70	74	34,30	PASS	
1116,000	3	2,10	V	240	43,57	AV	22,80	-31,37	35,00	54	19,00	PASS	
1200,400	3	1,10	V	280	49,60	PK	23,20	-31,10	41,70	74	32,30	PASS	
1200,400	3	1,10	V	280	38,40	AV	23,20	-31,10	30,50	54	23,50	PASS	
1260,000	3	1,40	V	170	44,81	PK	23,71	-31,12	37,40	74	36,60	PASS	
1260,000	3	1,40	V	170	36,61	AV	23,71	-31,12	29,20	54	24,80	PASS	
1377,200	3	1,00	V	180	54,62	PK	24,63	-30,45	48,80	74	25,20	PASS	
1377,200	3	1,00	V	180	30,82	AV	24,63	-30,45	25,00	54	29,00	PASS	
1476,000	3	2,10	V	170	45,97	PK	25,28	-30,25	41,00	74	33,00	PASS	
1476,000	3	2,10	V	170	39,59	AV	25,28	-30,25	34,62	54	19,38	PASS	
1512,000	3	2,10	V	170	42,93	PK	25,49	-30,22	38,20	74	35,80	PASS	
1512,000	3	2,10	V	170	33,73	AV	25,49	-30,22	29,00	54	25,00	PASS	
1620,000	3	1,80	V	310	45,69	PK	26,05	-30,24	41,50	74	32,50	PASS	
1620,000	3	1,80	V	310	39,42	AV	26,05	-30,24	35,23	54	18,77	PASS	
1692,000	3	1,30	V	280	44,59	PK	26,24	-30,13	40,70	74	33,30	PASS	
1692,000	3	1,30	V	280	37,79	AV	26,24	-30,13	33,90	54	20,10	PASS	
1764,000	3	1,00	V	10	46,16	PK	26,41	-29,97	42,60	74	31,40	PASS	
1764,000	3	1,00	V	10	40,16	AV	26,41	-29,97	36,60	54	17,40	PASS	
1836,000	3	1,00	V	10	48,27	PK	26,63	-29,90	45,00	74	29,00	PASS	
1836,000	3	1,00	V	10	35,27	AV	26,63	-29,90	32,00	54	22,00	PASS	
1836,000	3	1,00	V	160	47,97	PK	26,63	-29,90	44,70	74	29,30	PASS	without passport
1836,000	3	1,00	V	160	35,47	AV	26,63	-29,90	32,20	54	21,80	PASS	without passport
1764,000	3	1,00	V	170	48,16	PK	26,41	-29,97	44,60	74	29,40	PASS	without passport
1764,000	3	1,00	V	170	43,86	AV	26,41	-29,97	40,30	54	13,70	PASS	without passport
1692,000	3	1,00	V	225	45,79	PK	26,24	-30,13	41,90	74	32,10	PASS	without passport
1692,000	3	1,00	V	225	39,49	AV	26,24	-30,13	35,60	54	18,40	PASS	without passport
1620,000	3	1,00	V	225	44,89	PK	26,05	-30,24	40,70	74	33,30	PASS	without passport
1620,000	3	1,00	V	225	38,79	AV	26,05	-30,24	34,60	54	19,40	PASS	without passport
1332,000	3	1,00	H	205	46,72	PK	24,28	-30,61	40,40	74	33,60	PASS	without passport
1332,000	3	1,00	H	205	40,22	AV	24,28	-30,61	33,90	54	20,10	PASS	without passport
1764,000	3	2,30	H	230	46,86	PK	26,41	-29,97	43,30	74	30,70	PASS	without passport
1764,000	3	2,30	H	230	42,36	AV	26,41	-29,97	38,80	54	15,20	PASS	without passport
1800,000	3	2,20	H	230	46,40	PK	26,50	-29,90	43,00	74	31,00	PASS	without passport
1800,000	3	2,20	H	230	33,50	AV	26,50	-29,90	30,10	54	23,90	PASS	without passport
1836,000	3	2,20	H	230	43,27	PK	26,63	-29,90	40,00	74	34,00	PASS	without passport
1836,000	3	2,20	H	230	31,77	AV	26,63	-29,90	28,50	54	25,50	PASS	without passport
1764,000	3	1,00	V	170	50,56	PK	26,41	-29,97	47,00	74	27,00	PASS	Scanner not initialized
1764,000	3	1,00	V	170	46,56	AV	26,41	-29,97	43,00	54	11,00	PASS	Scanner not initialized

7 Photographs

7.1 Photos

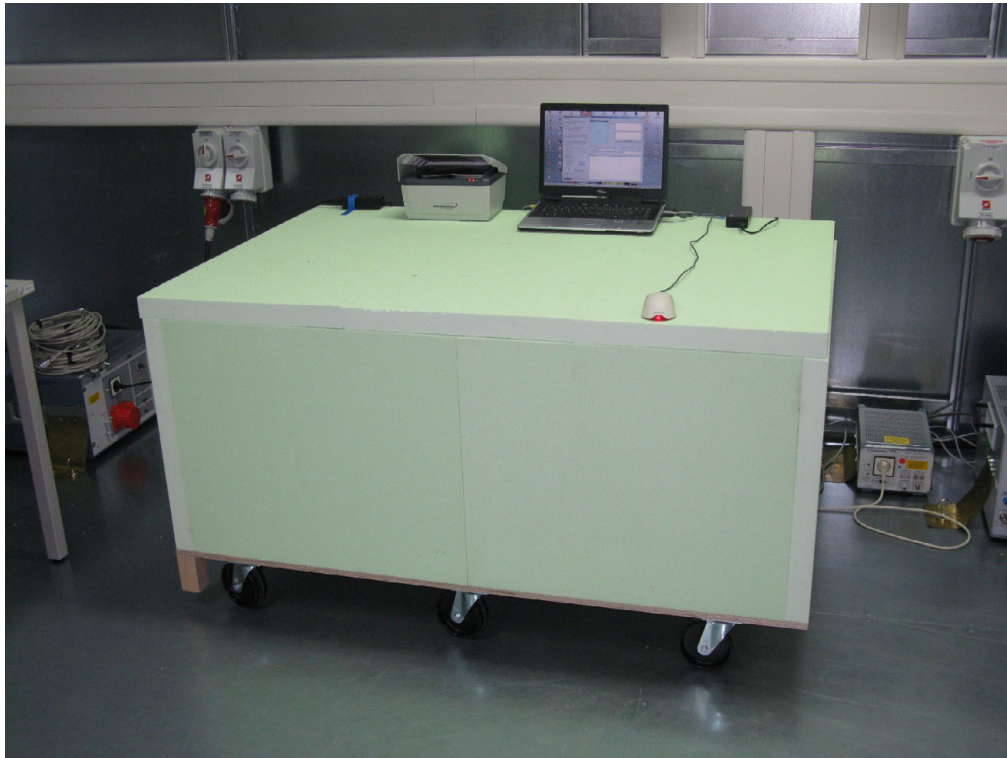


Figure 1 Arrangement for the measurement of conducted emissions



Figure 2 Arrangement for the measurement of conducted emissions

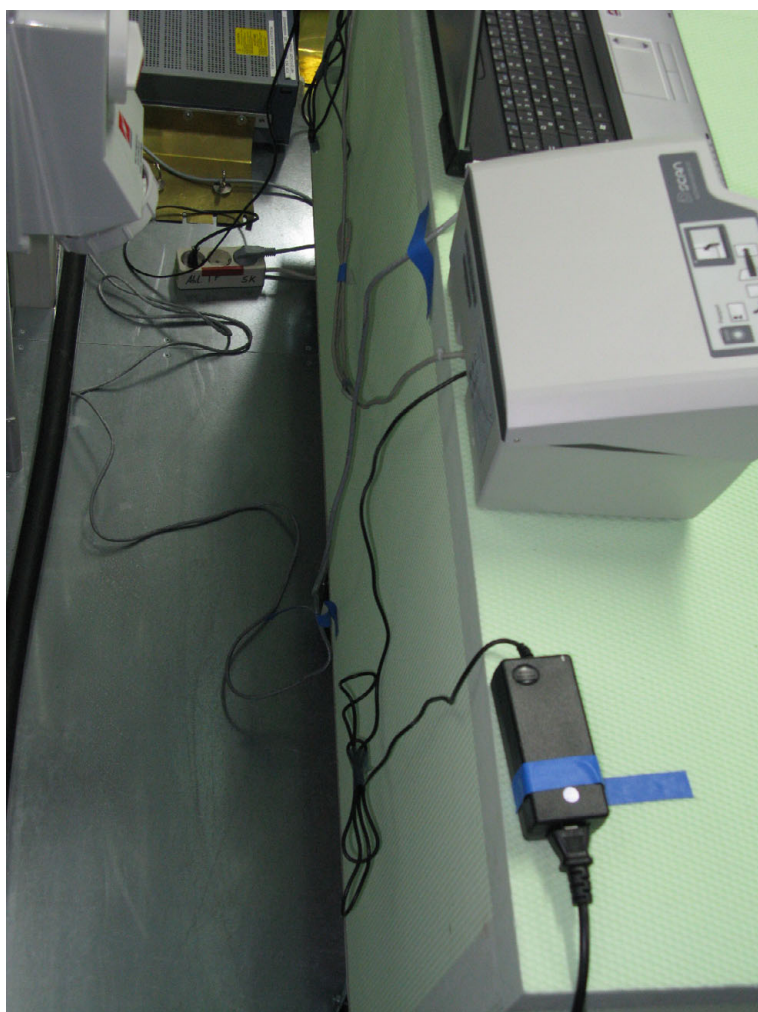


Figure 3 Arrangement for the measurement of conducted emissions



Figure 4 Arrangement for the measurement of conducted emissions



Figure 5 **Arrangement for the measurement of conducted emissions**

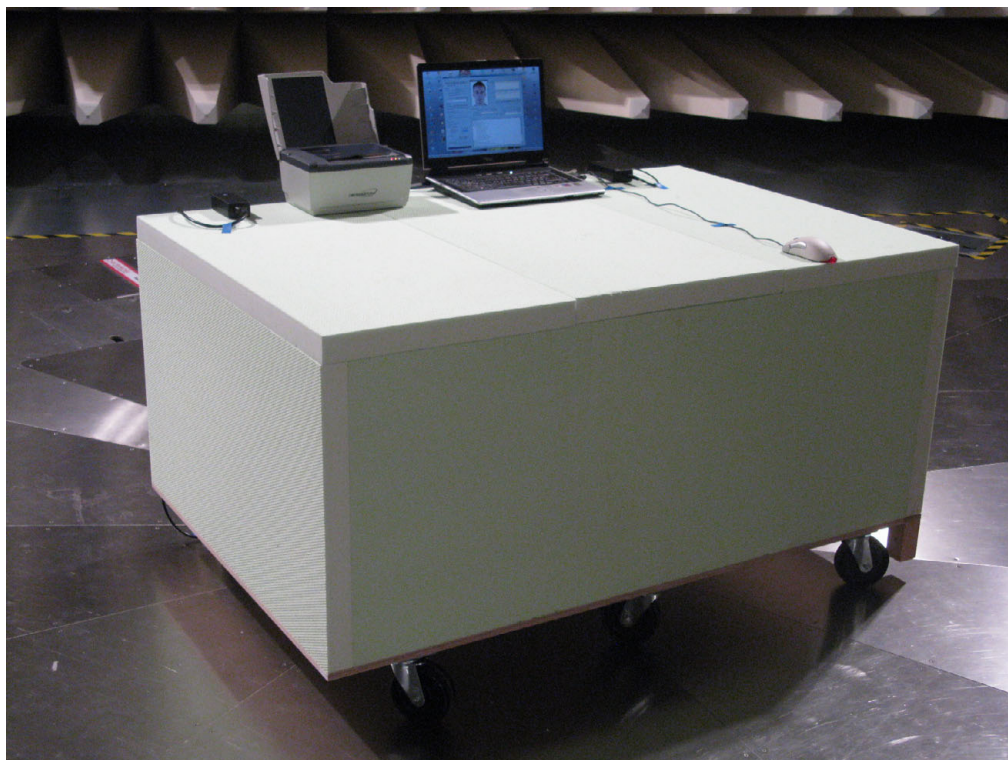


Figure 6 Arrangement for the measurement of radiated emissions

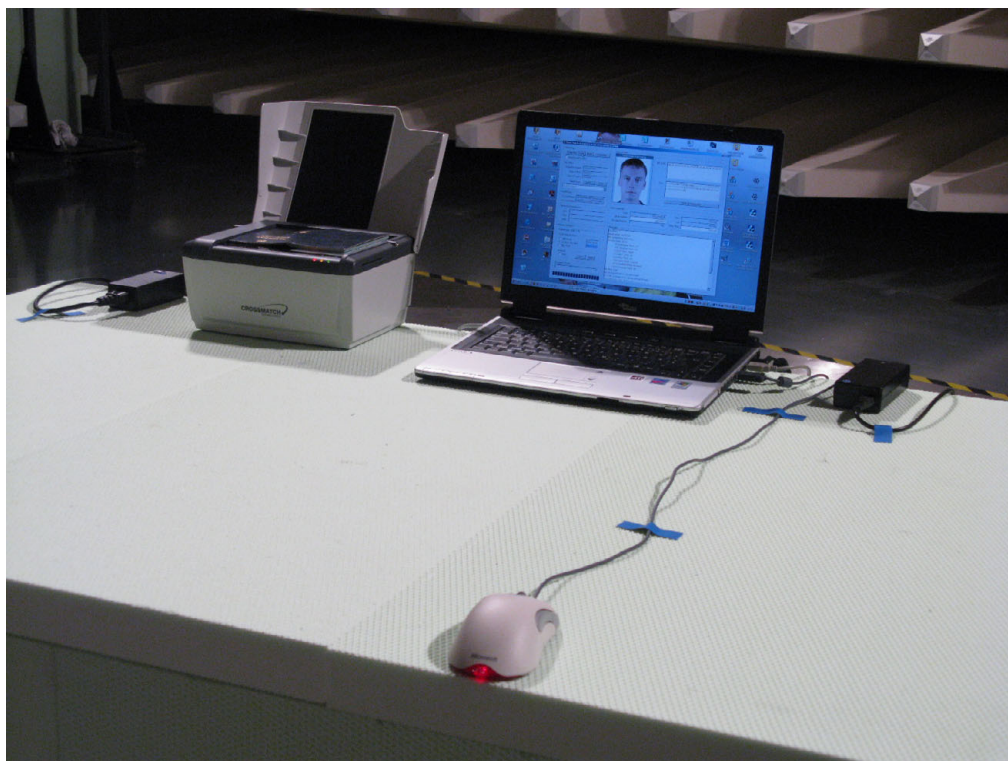


Figure 7 Arrangement for the measurement of radiated emissions

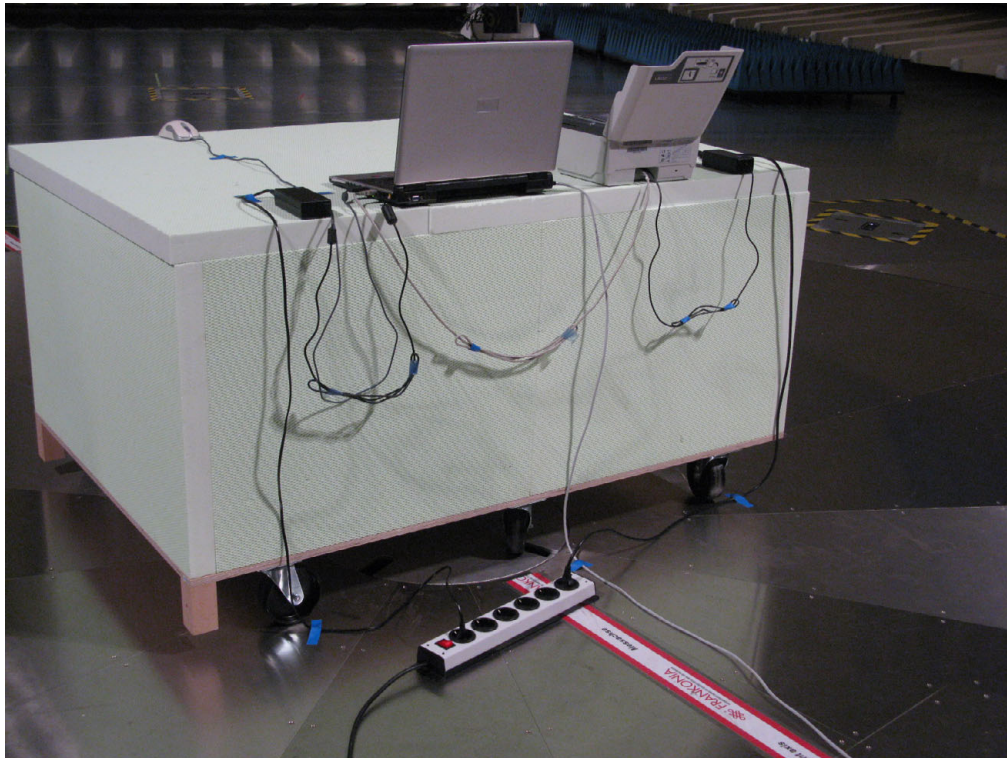


Figure 8 Arrangement for the measurement of radiated emissions

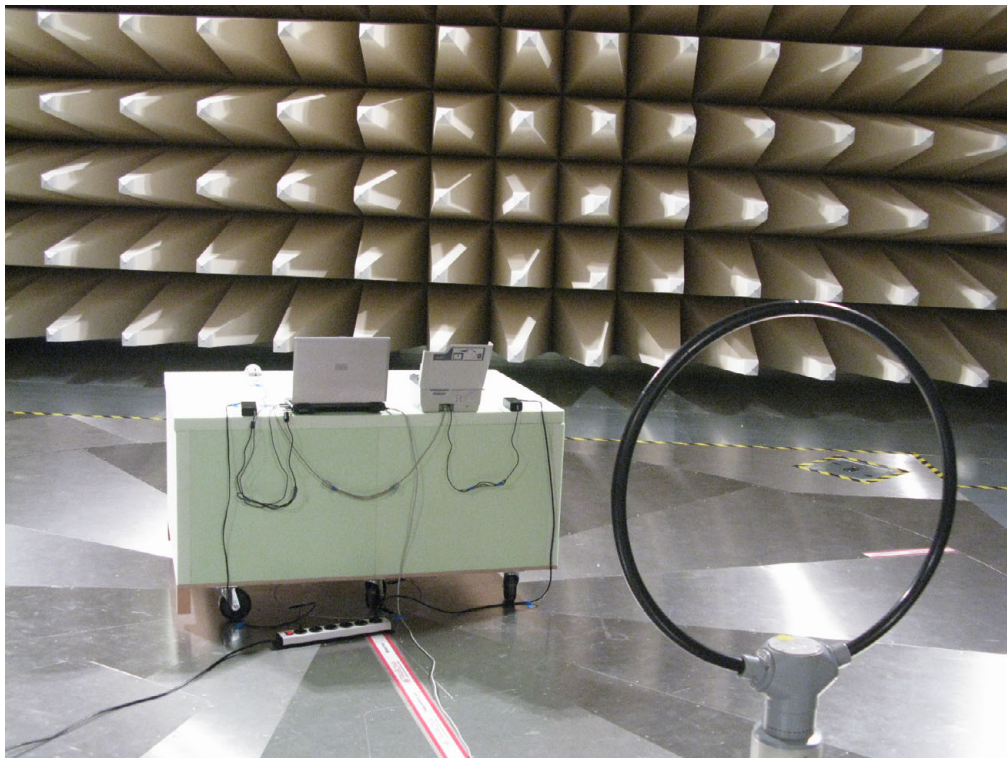


Figure 9 Arrangement for the measurement of radiated emissions (9 kHz to 30 MHz)

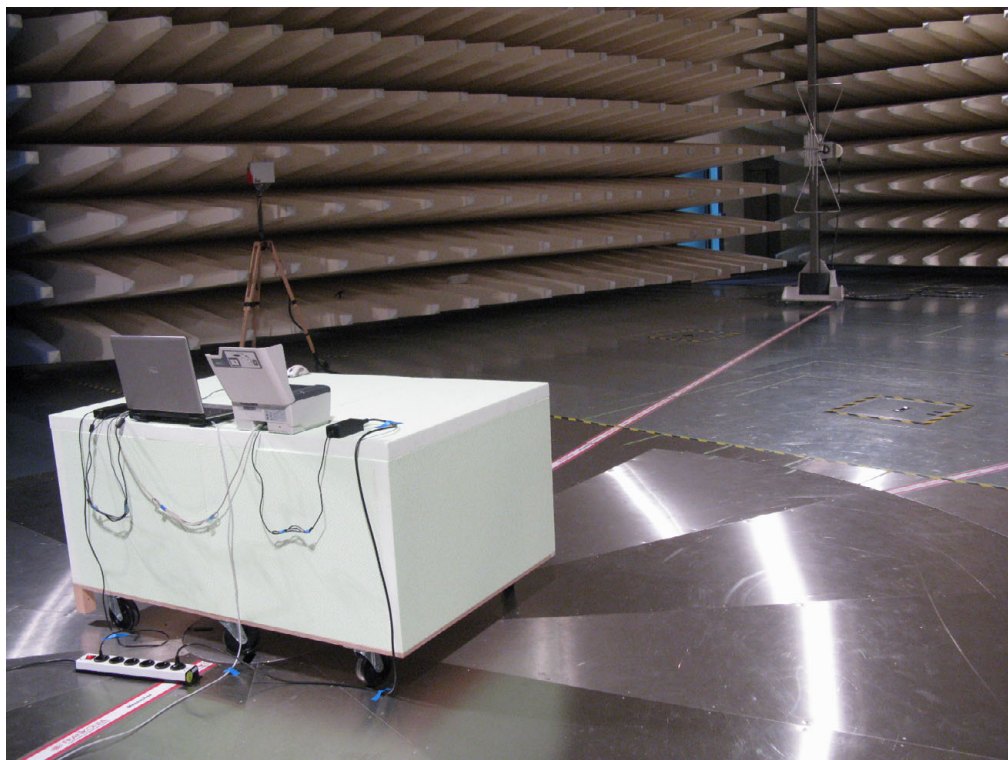


Figure 10 Arrangement for the measurement of radiated emissions (30 MHz to 1 GHz)

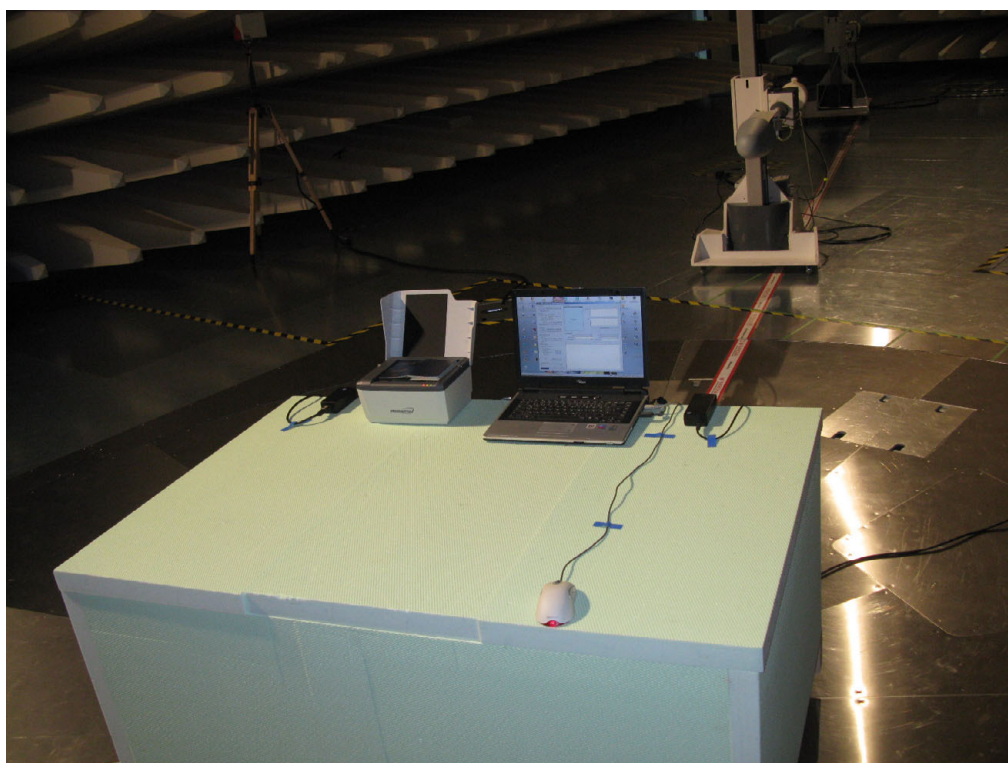


Figure 11 Arrangement for the measurement of radiated emissions (1 GHz to 5 GHz)



Figure 12 View of the EUT from top left



Figure 13 Rear view of the EUT



(intentionally left blank)