



Test Report EMC

FCC listed*) test laboratory

Test Laboratory:

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Equipment under test

Applicant:	Cross Match Technologies GmbH; Unstrutweg 4, 07743 Jena
Manufacturer:	Cross Match Technologies GmbH; Unstrutweg 4, 07743 Jena
File number:	2295300-3250-0012/106192
EUT:	Information Technology Equipment and Intentional Radiator
Brand/model:	D SCAN AUTHENTICATOR CF V1 (RJ 0479)
EUT received:	2008-07-10

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:	2009-05-11 (This document supersedes Test Report FG43-4-106192.)	
Tested by:	Mr. Wolfgang Klos EMC Test Engineer	
Reviewed:	Mr. Stephan Kloska, Dr.-Ing. Head of the Laboratory	

*) FCC Information:

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



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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 V1 (RJ 0479)
Serial number:	000900153.K2007

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 V1 Model RJ 0479	000900169.C 2007	21 ± 3 V DC 1 A Protection class III	FCC ID: WO8RJ0479 IC: 7944A-RJ0479

b) Support 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		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	Notebook PC	ASUS	M6000NE36M	4ANP007199		acting as a second device connected to the host pC for achieving a minimum configuration
4a	External Power supply (supplying the Notebook PC)	Delta Electronics	ADP-65DB			

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

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 is running)

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	

Generated frequencies

ISM-Frequency:	13,56 MHz
Operational frequencies:	150 kHz; 500 kHz; 12 MHz; 24 MHz; 36 MHz; 48 MHz; 480 MHz

Disturbance sources

No.	Description	Manufacturer	Type designation	Remarks
1	Power supply PCB	Cross Match	RJ0479:312.25 AEZ03	150 kHz, 12 MHz
2	Base Cam PCB	Cross Match	RJ0479:302.25 AEZ01	24 MHz, 36 MHz, 48 MHz, 480 MHz
3	Illumination PCB	Cross Match	RJ0479:324.25 Rev. C	500 kHz
4	RFID Adapter ACG	Cross Match	RJ0479:385.25 Rev. F	8 MHz, 13.56 MHz, 27.12 MHz
5	Antenna PCB (RFID-reader)	Cross Match	RJ0479:386.25 Rev. B	---

EMC-measures

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

Description of shield- and contacting measures for EMC

No.	Description of the measure
1	Metal screening plate on the camera 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 had to be 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	6	At 13,56 MHz, the limits were met after replacement of the transmit antenna with a dummy load.	Pass See rule interpretation released by the FCC from 4/12/05 to the TCB council.
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	14	Harmonics of 13,56 MHz	Pass
1.4	Radiated emissions Electric fieldstrength § 15.209 (a)	> 1 GHz	18	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	21	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	24	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	27	Class B limits	Pass
2.3	Radiated emissions Electric fieldstrength § 15.109 (a)	1 GHz - 5 GHz ^{*)}	29	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
3.074	42.9	AV	incl.	42.9	46	3.1	PASS	
2.942	42.7	AV	incl.	42.7	46	3.3	PASS	
3.006	42.7	AV	incl.	42.7	46	3.3	PASS	
0.534	42.4	AV	incl.	42.4	46	3.6	PASS	
3.610	42.2	AV	incl.	42.2	46	3.8	PASS	
3.742	41.8	AV	incl.	41.8	46	4.2	PASS	
13.558	53.0	AV	incl.	53.0	50	-3.0		Not considered for the evaluation. with reference to the rule interpretation released by the FCC from 4/12/05 to the TCB council.

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 3.1 dB.



3.1.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-11
Environmental conditions:	21° C, 49 % r.h

Instruments:					
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1820054	Artificial mains network	R&S	ESH2-Z5	2008-06-27	2009-06
1820028	Artificial mains network	R&S	ESH3-Z5	2008-06-11	2009-06
1800142	EMI Test Receiver	R&S	ESCI-3	2008-06-11	2009-06
1060417	Digital Multimeter	GMC	18S	2008-04-10	2009-04

Information concerning the test:

Test set-up:	<p>The system under test was installed on a non-conductive table of 80 cm height in the shielded room.</p> <p>The arrangement of components on the table was according to drawing # 1 on page 31. 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.</p> <p>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.</p> <p>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.</p> <p>For details refer to drawing # 2 and the photographs.</p>
Operating modes:	<p>Reading of a tagged document.</p> <p>The supply voltage was 120 V, 60 Hz.</p>
Test procedure:	ANSI C63.4:2003, Clauses 7.2 and 13.1.3 and Annexures H.1 and H.2

Result: Pass

Protocol:

On the following page



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	Limit-exceeding reading at 13.56 MHz not considered for the evaluation, with reference to the results of scan No. 3 and the rule interpretation released by the FCC from 4/12/05 to the TCB council.
2	Stand-by (scanner ready, but not initialized)	L and N	Pass	-
3	Reading mode with USB communications, but reader antenna replaced by dummy load	L and N	Pass	Disturbance level of the 13.56 MHz below the disturbance level of the unintentional radiators contained in the EUT.

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

While the RFID tag reader was on, the limits §15.207 were not met.

Nevertheless the final result is "pass", with reference to the rule interpretation released by the FCC from 4/12/05 to the TCB council.

Attempts to maximize the emissions by changing the cable arrangement did not show any significant changes except for the measurements made at 13.56 MHz without dummy load.



3.2 Radiated emissions within the band 13.110-14.010 MHz

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-10
Environmental conditions:	20° C, 51% r.h.

Instruments:		Test Location: 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	2007-09-20	2008-09
1800118	EMI Test Receiver	R&S	ESi26	2007-06-12	2009-06 (2 years)
1300369	Hygrometer	AHLBORN	2296-1K	2008-01-29	2009-01

Information concerning the test:

Test setup:	<p>The EUT with a passive 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 31. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed.</p> <p>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.</p> <p>For details refer to the photographs.</p>
Operating modes investigated:	Active communication between the transceiver and the RFID tag (continuously reading the tag)
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Prior to the final measurement, preliminary investigations were carried out with test distances of 1 m and 3 m. The final measurement was conducted with a test distance 10 m.

Measurement values from the various distances can be found on the following page.

The final measurement of the magnetic field strength (wanted signal of the transmitter) was made under normal operating conditions at a distance of 10 m, employing a Quasi Peak detector.

The measured value was 55 dB(μV/m).

To calculate the value for the specified test distance of 30 m, a correction of -19.1 dB (40 dB/decade) was applied to the field strength level measured at 10 m.

Maximum H-field at a distance of 30 m:

Calculated value (max. field strength level under normal or extreme test conditions):	+ 35.9 dBμV/m
Specified limit for 13.56 MHz:	15 848 μV/m + 84.0 dBμV/m

Result:	Pass
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The level of the wanted signal of the EUT was found below the limits specified in 47 CFR 15.225. The margin of the measured value to the limit was 48.1 dB in the band from 13.553 MHz to 13.567 MHz.

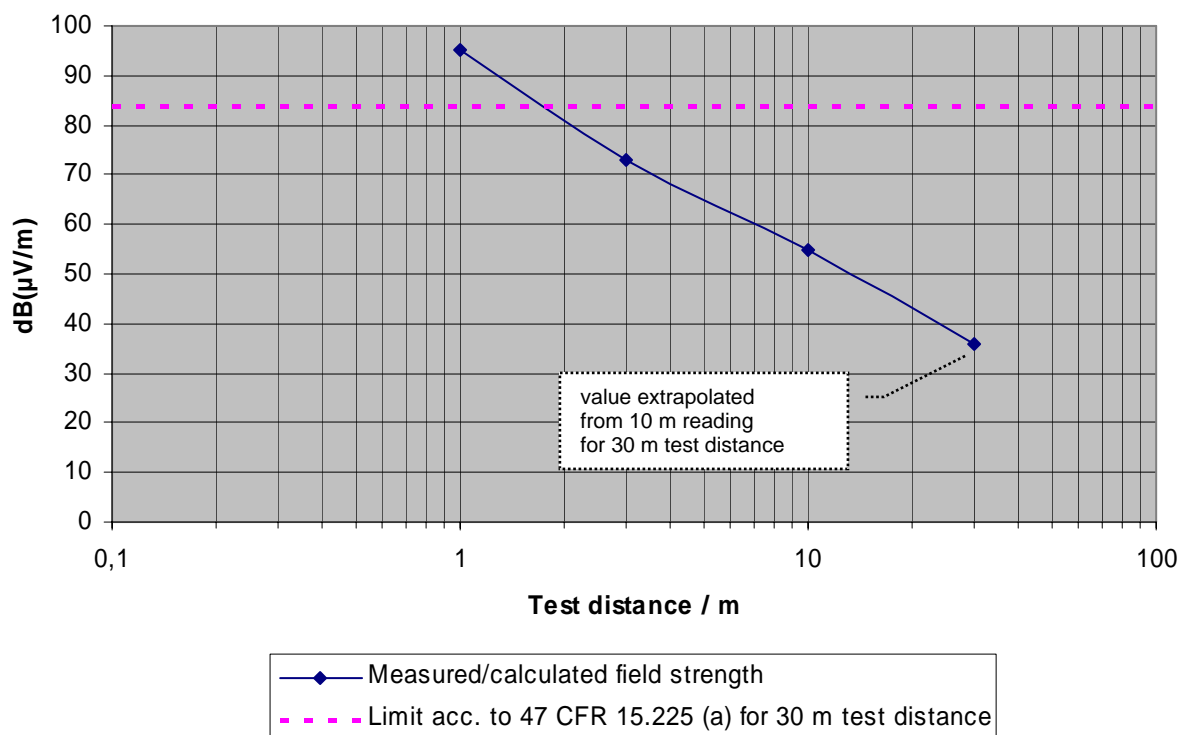
Protocol:

- The highest reading of the fundamental frequency was found when the turntable azimuth was in the range 270° to 315°.
- Removing the passport with the RFID tag did not have any significant influence on the signal level.

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

Frequency MHz	Test Distance m	Field Strength dB(μV/m)	Detector Type	Remarks
13.56	1	95.0	Quasi Peak	Measured value
13.56	3	73.0	Quasi Peak	Measured value
13.56	10	55.0	Quasi Peak	Measured value
13.56	30	35.9	Quasi Peak	Calculated value from the field strength reading at 10 m using an extrapolation factor of 40 dB/decade

**Magnetic field strength @ 13.56 MHz
expressed in terms of the equivalent electrical field strength**



47 CFR 15.225 Transmitter Spectrum Mask

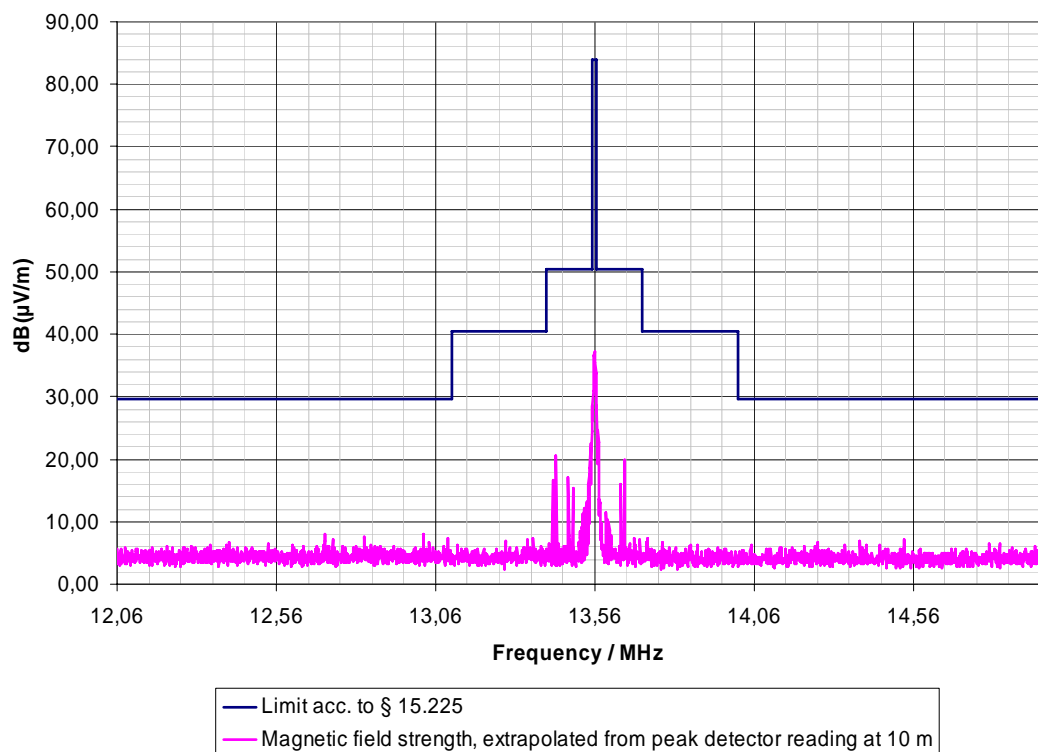


Figure 1 Transmitter spectrum mask

47 CFR 15.225 Transmitter Spectrum Mask

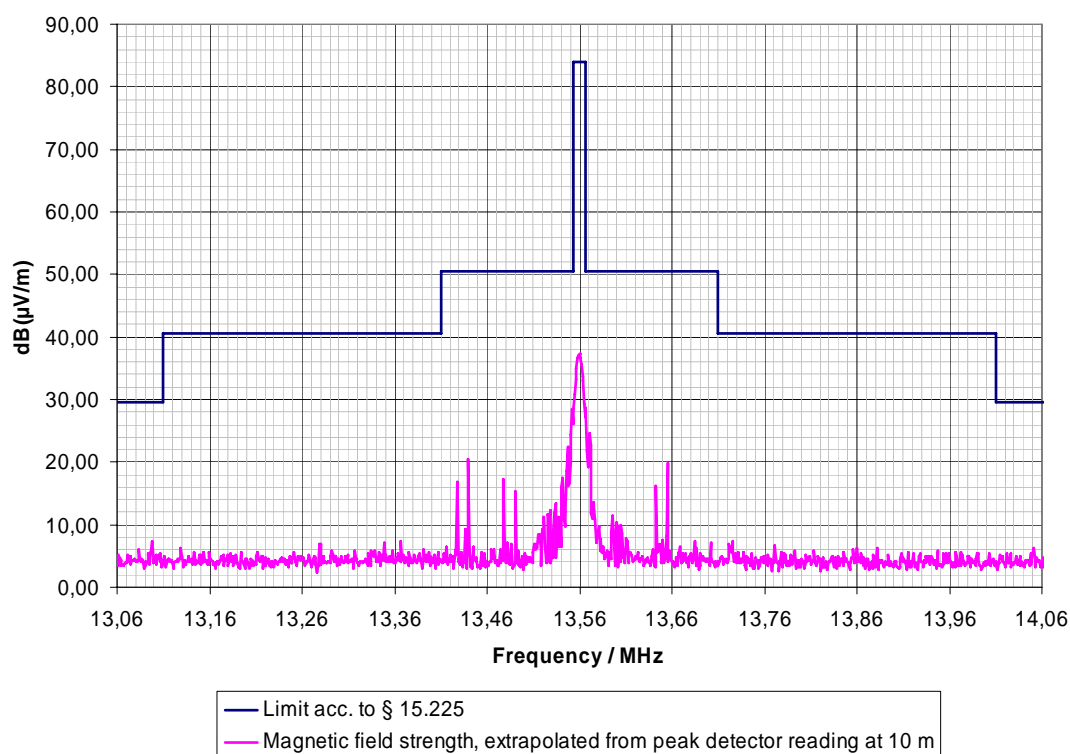


Figure 2 Transmitter spectrum mask (zoomed)



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:	2007-07-10
Environmental conditions:	20° C, 51 % r.h.

Instruments:		Test Location: 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	2007-09-20	2008-09
1800118	EMI Test Receiver	R&S	ESI26	2007-06-12	2009-06 (2 years)
1300369	Hygrometer	AHLBORN	2296-1K	2008-01-29	2009-01

Information concerning the test:

Test setup:	<p>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.</p> <p>The AC adapter and a host computer were also located on this table.</p> <p>The arrangement of components on the table was according to drawing # 1 on page 31. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed.</p> <p>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.</p> <p>For details refer to the photographs in the appendix.</p>
Operating modes investigated:	<ol style="list-style-type: none">1. Standby / ready2. Active communication between the transceiver and the transponder (tagged document lying on the scanning surface)
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.

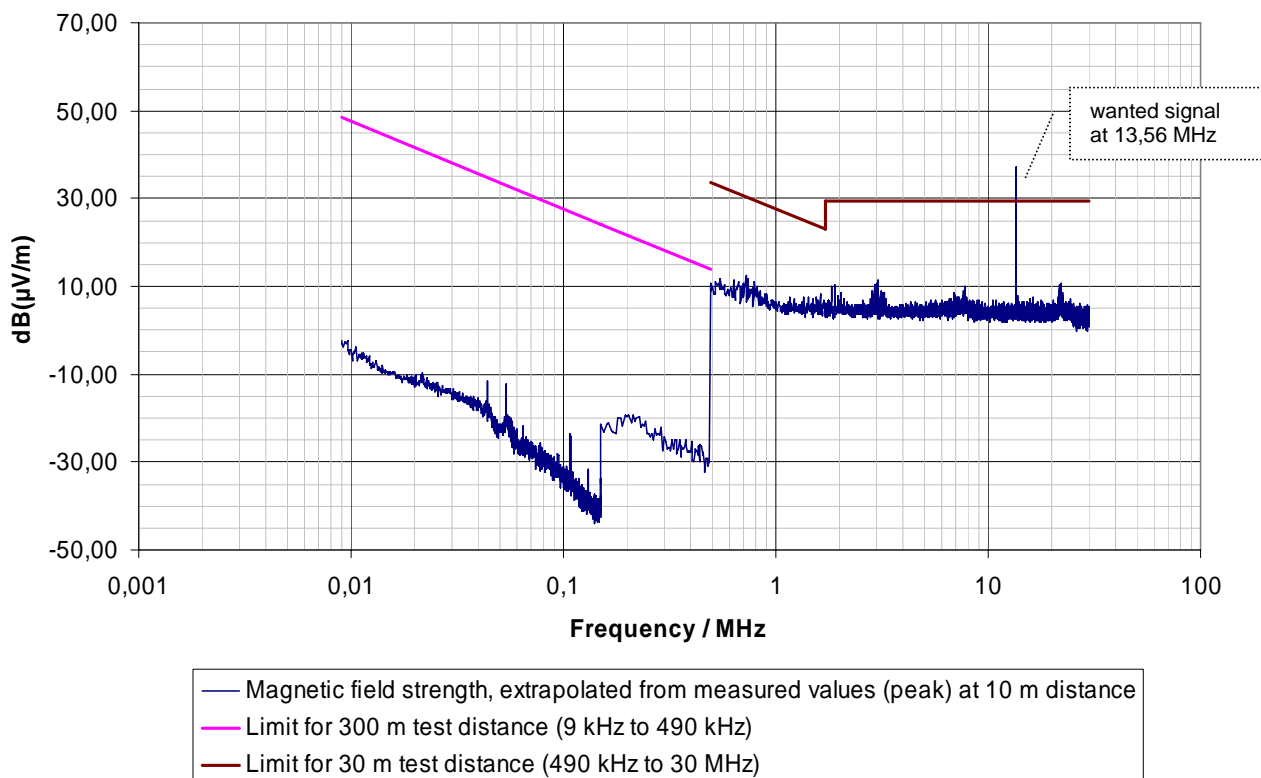
The minimum margin of a measurement value to the limit was 28.2 dB.

Protocol:

The diagram on the following page shows the result of repetitive scans (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 10 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.

Spurious emissions of the transmitter in the frequency range 9 kHz to 30 MHz



The following table shows the field strength levels of spurious emissions obtained with the Quasi Peak detector (final readings). The test distance was 10 m.

For comparison with the limits, the measured values from 10 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 @ 10 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
43.7	36	300	-23.08	37.12	60.20	PASS
53.9	40.7	300	-18.38	32.97	51.35	PASS
195.0	32.8	300	-26.28	21.8	48.08	PASS
213.45	20.1	300	-38.98	21.02	60.00	PASS
7615.5	20.6	30	1.52	29.54	28.2	PASS
16183.5	20.1	30	1.02	29.54	28.52	PASS
21736.5	23.1	30	4.02	29.54	25.52	PASS
22240.5	24.4	30	5.32	29.54	24.22	PASS
27120.0	< 20 (noise level)	30	< 0.92	29.54	> 28.62	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
400	10	2.9	Hor.	0	12.5	17.9	10.46	40.86	46.02	5.16	PASS	
36.76	10	1	Ver.	180	10.76	13.56	10.46	34.78	40.00	5.22	PASS	
384.1	10	1	Ver.	10	12.2	17.41	10.46	40.07	46.02	5.95	PASS	
533.46	10	2.5	Hor.	0	9	20.28	10.46	39.74	46.02	6.28	PASS	
800.19	10	1	Hor.	30	4	24.23	10.46	38.69	46.02	7.33	PASS	
48.5	10	1	Ver.	200	8.5	13.63	10.46	32.59	40.00	7.41	PASS	

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 5.16 dB.



3.3.2.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-11
Environmental conditions:	21° C, 49 % 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	2007-01-15	2009-01 (2 years)
1800118	EMI Test Receiver	R&S	ESI 26	2007-06-12	2009-06 (2 years)
1150007	EMI Test Receiver	R&S	ESVS 30	2008-06-11	2009-06
1300369	Hygrometer	AHLBORN	2296-1K	2008-01-29	2009-01

Information concerning the test:

Test setup:	<p>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.</p> <p>The AC adapter and a host computer were also located on this table.</p> <p>The arrangement of components on the table was according to drawing # 1 on page 31. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed.</p> <p>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.</p> <p>For details refer to the photographs in the appendix.</p>
Operating modes investigated:	<ol style="list-style-type: none">1. Standby / ready2. Active communication between the transceiver and the transponder (tagged document lying on the scanning surface)
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 5.16 dB.

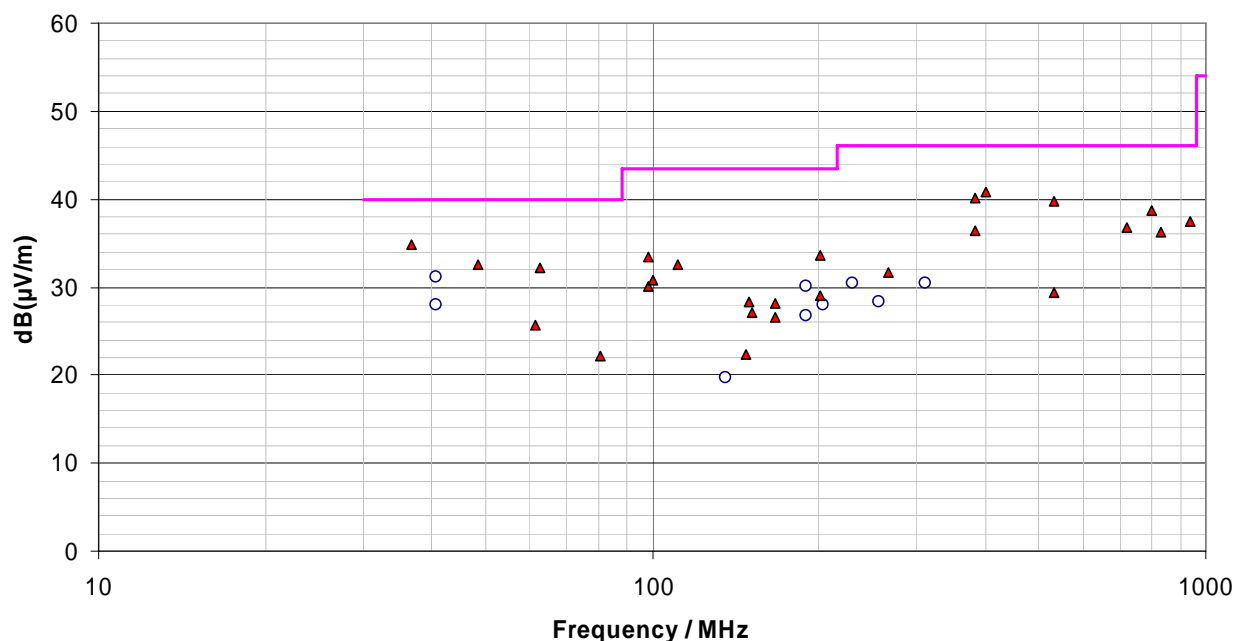
Protocol:

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 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.

Spurious emissions of the transmitter in the frequency range 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
- 47 CFR 15.209 (a), Limit for 3 m test distance (30 MHz to 1000 MHz)

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
36.76	10	1	Ver.	180	10.76	13.56	10.46	34.78	40.00	5.22	PASS	
40.68	10	4	Hor.	0	3.5	14.1	10.46	28.06	40.00	11.94	PASS	1)
40.68	10	1	Ver.	170	6.5	14.1	10.46	31.06	40.00	8.94	PASS	1)
48.5	10	1	Ver.	200	8.5	13.63	10.46	32.59	40.00	7.41	PASS	
61.6	10	4	Hor.	135	1.9	13.35	10.46	25.71	40.00	14.29	PASS	
62.5	10	1	Ver.	20	8.6	13.07	10.46	32.13	40.00	7.87	PASS	
80.7	10	4	Hor.	180	2.8	8.94	10.46	22.20	40.00	17.80	PASS	
98.3	10	1	Ver.	90	9.9	13.12	10.46	33.48	43.52	10.04	PASS	
98.3	10	4	Hor.	30	6.5	13.12	10.46	30.08	43.52	13.44	PASS	
100.2	10	1	Ver.	90	7.1	13.24	10.46	30.80	43.52	12.72	PASS	
111.1	10	1.1	Ver.	180	9.6	12.52	10.46	32.58	43.52	10.94	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
135.6	10	4	Hor.	30	0	9.28	10.46	19.74	43.52	23.78	PASS	1)
147.44	10	4	Hor.	180	2.6	9.2	10.46	22.26	43.52	21.26	PASS	
150	10	1.1	Ver.	180	8.6	9.23	10.46	28.29	43.52	15.23	PASS	
151.4	10	4	Hor.	0	7.4	9.3	10.46	27.16	43.52	16.36	PASS	
166.7	10	1.1	Ver.	60	7.6	10.06	10.46	28.12	43.52	15.40	PASS	fluctuating level
167.1	10	4	Hor.	135	6	10.08	10.46	26.54	43.52	16.98	PASS	
189.83	10	4	Hor.	320	4.1	12.13	10.46	26.69	43.52	16.83	PASS	1)
189.84	10	1.1	Ver.	180	7.5	12.13	10.46	30.09	43.52	13.43	PASS	1) fluctuating level
200.6	10	4	Hor.	45	11	12.15	10.46	33.61	43.52	9.91	PASS	
200.6	10	1	Ver.	90	6.4	12.15	10.46	29.01	43.52	14.51	PASS	
203.4	10	1	Ver.	0	5.4	12.17	10.46	28.03	43.52	15.49	PASS	1)
230.51	10	1	Ver.	0	6.4	13.62	10.46	30.48	46.02	15.54	PASS	1)
257.63	10	1	Ver.	10	3.7	14.22	10.46	28.38	46.02	17.64	PASS	1)
266.73	10	3	Hor.	60	7	14.2	10.46	31.66	46.02	14.36	PASS	
311.87	10	1	Ver.	10	4.5	15.52	10.46	30.48	46.02	15.54	PASS	1)
384.1	10	3	Hor.	300	8.5	17.41	10.46	36.37	46.02	9.65	PASS	
384.1	10	1	Ver.	10	12.2	17.41	10.46	40.07	46.02	5.95	PASS	
400	10	2.9	Hor.	0	12.5	17.9	10.46	40.86	46.02	5.16	PASS	
533.45	10	3	Ver.	20	-1.3	20.28	10.46	29.44	46.02	16.58	PASS	
533.46	10	2.5	Hor.	0	9	20.28	10.46	39.74	46.02	6.28	PASS	
720	10	2.6	Ver.	330	3	23.35	10.46	36.81	46.02	9.21	PASS	
800.19	10	1	Hor.	30	4	24.23	10.46	38.69	46.02	7.33	PASS	
828.08	10	2	Ver.	0	1.2	24.6	10.46	36.26	46.02	9.76	PASS	
936.08	10	1.6	Ver.	20	1.1	25.88	10.46	37.44	46.02	8.58	PASS	

Note 1) Spurious emissions of the 13,56 MHz tag reader (Harmonics)



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	
1764.2	3	1.4	V	0	Average	45.1	26.06	-30.63	40.16	54	13.84	pass
1080.0	3	1	V	170	Average	45.24	22.26	-32.19	36.50	54	17.50	pass
1044.1	3	2.2	V	40	Average	45.27	22	-32.50	36.27	54	17.73	pass
1000.0	3	1.5	V	0	Average	37.5	21.7	-32.58	28.20	54	25.80	pass
1174.5	3	1	H	90	Peak	56.32	22.92	-31.64	47.60	74	26.40	pass
1764.2	3	1.4	V	0	Peak	49.5	26.06	-30.63	44.93	74	29.07	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 13.8 dB.



3.3.3.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-11
Environmental conditions:	21° C, 49 % r.h.

Instruments:		Test Location: Semi-anechoic chamber, 3 m test distance			
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810066	Log. per. antenna	R&S	HL025	2006-09-15	2009-09 (3 years)
1800107	Amplifier	AML	AML0123L3702	2008-07-07	2009-07
1800118	EMI Test Receiver	R&S	ESI 26	2007-06-12	2009-06 (2 years)

Information concerning the test:

Test setup:	<p>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.</p> <p>The AC adapter and a host computer were also located on this table.</p> <p>The arrangement of components on the table was according to drawing # 1 on page 31. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed.</p> <p>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.</p> <p>For details refer to the photographs in the appendix.</p>
Operating modes investigated:	<ol style="list-style-type: none">1. Standby / ready2. Active communication between the transceiver and the transponder (tagged document lying on the scanning surface)
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 13.8 dB.

Protocol:

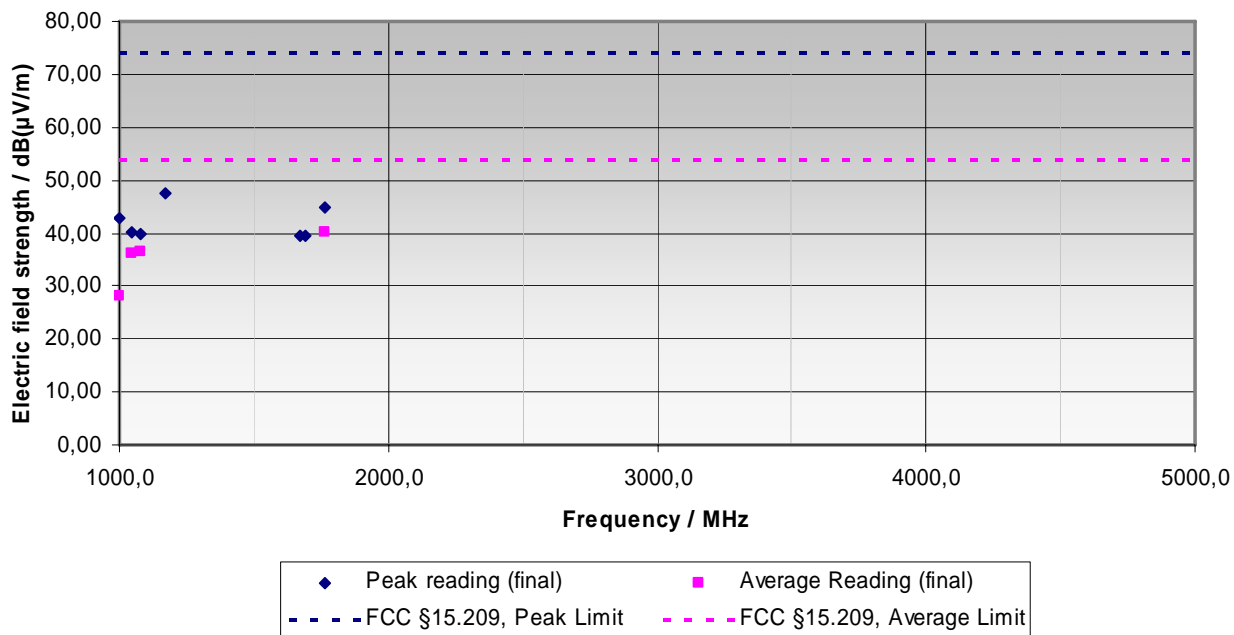
Measurements of the electric fieldstrength were carried out in the frequency range 1 GHz to 5 GHz with a test distance of 3 m and in accordance with the provisions of §15.209.

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 1 ... 5 GHz



Frequency MHz	Test Distance m	Antenna Height m	Pol.	EUT Azimuth °	Detector function	Instrument Reading dBµV/m	Antenna Factor dB	Cable loss and amp. gain dB	Measured Field strength dBµV/m	Limit dBµV/m	Margin dB	Result
1000	3	1.5	V	0	Peak	53.8	21.7	-32.58	42.92	74	31.08	pass
1044.1	3	2.2	H	40	Peak	50.77	22	-32.50	40.27	74	33.73	pass
1080	3	1	H	170	Peak	49.61	22.26	-32.19	39.68	74	34.32	pass
1174.5	3	1	H	90	Peak	56.32	22.92	-31.64	47.60	74	26.40	pass
1670	3	1.4	V	0	Peak	44.36	25.97	-30.85	39.48	74	34.52	pass
1692.3	3	1.4	V	0	Peak	44.36	25.99	-30.81	39.54	74	34.46	pass
1764.2	3	1.4	V	0	Peak	49.5	26.06	-30.63	44.93	74	29.07	pass
1000	3	1.5	V	0	Average	37.5	21.7	-32.58	28.20	54	25.80	pass
1044.1	3	2.2	V	40	Average	45.27	22	-32.50	36.27	54	17.73	pass
1080	3	1	V	170	Average	45.24	22.26	-32.19	36.50	54	17.50	pass
1764.2	3	1.4	V	0	Average	45.1	26.06	-30.63	40.16	54	13.84	pass



3.4 Frequency stability under extreme conditions

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2009-05-04

Instruments:		Test Location: Climatic Chamber F4			
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 6 cm	EMCO	7405-901	---	No cal. required
1060555	Digital Multimeter	GMC	22S	2009-02-02	2010-02
5160340	Environmental chamber	Vötsch	VLM 07/300	2009-04-16	2010-04
1430354	Adjustable power supply	ELVI	PS7330	---	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.

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: 13.559379 MHz

Highest carrier frequency measured under extreme conditions: 13.559795 MHz

Permitted range of values (13.56 MHz +/- 0.01%)

Lower limit:

13.558644 MHz

Upper limit:

13.561356 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:	50 dB	REF:	117 dB(μV)
Span:	1 kHz	SWT:	10 s
Y-Scaling:	10 dB/division	Counter res.:	1 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	13.559634	13.559491	13.559426	13.559405
20	13.559525	13.559448	13.559394	13.559379
50	13.559795	13.559700	13.559425	13.559398

fmin	13.559379
fmax	13.559795

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

Frequency stability vs. input voltage

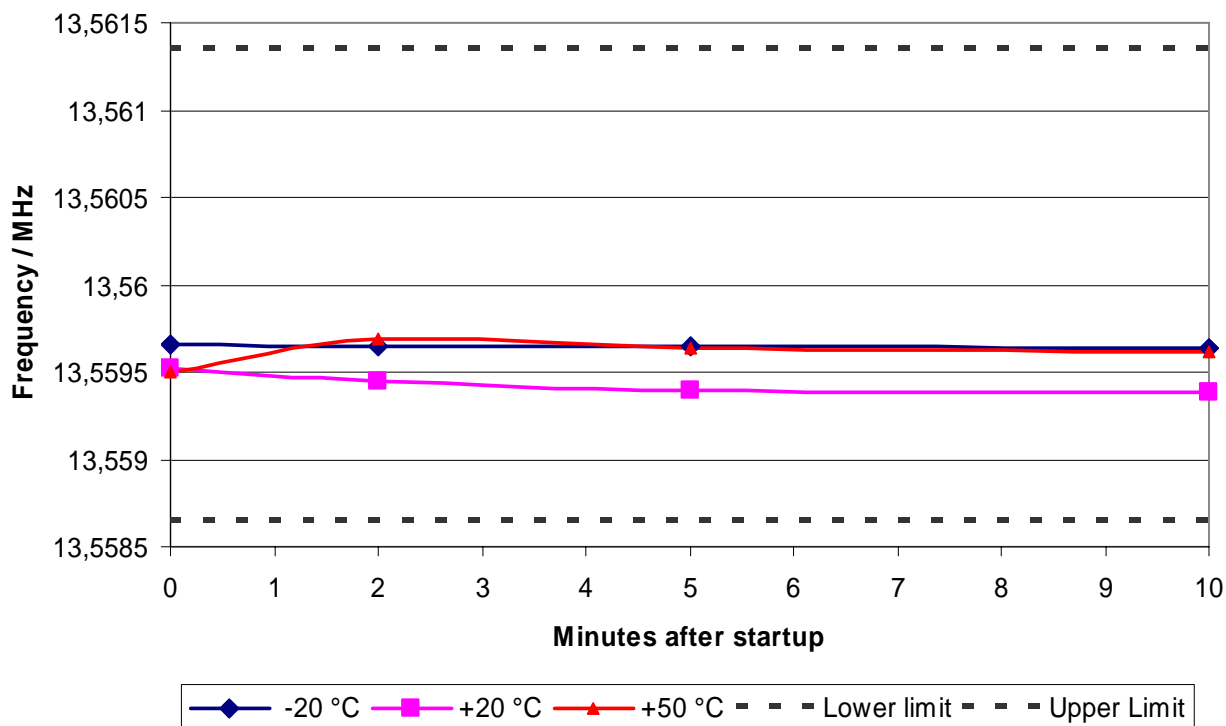
The following measurements were made with +20 °C ambient temperature.

Frequency / MHz	Minutes after startup			
Supply voltage / V	0	2	5	10
17.85	13.559661	13.559651	13.559645	13.559642
21.00	13.559525	13.559448	13.559394	13.559379
24.15	13.559499	13.559693	13.559636	13.559611

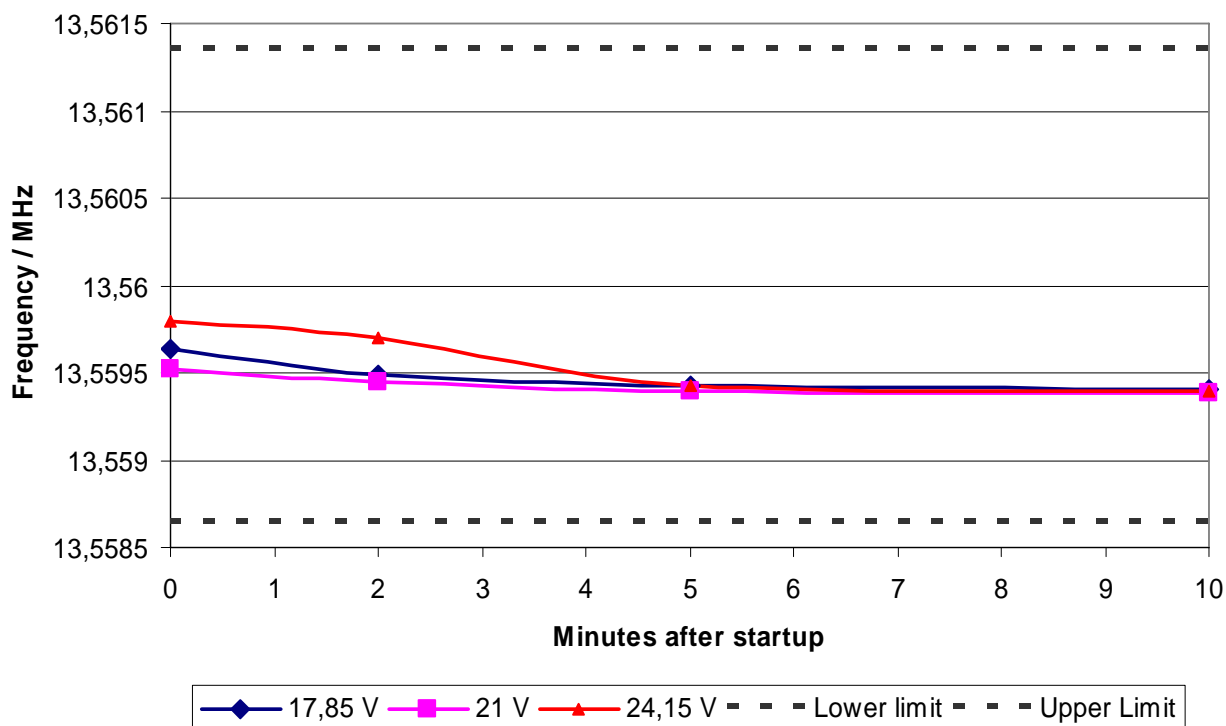
fmin	13.559379
fmax	13.559693

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

Carrier frequency vs. ambient temperature



Carrier frequency vs. supply voltage



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
3.074	42.9	AV	incl.	42.9	46	3.1	PASS	
2.942	42.7	AV	incl.	42.7	46	3.3	PASS	
3.006	42.7	AV	incl.	42.7	46	3.3	PASS	
0.534	42.4	AV	incl.	42.4	46	3.6	PASS	
3.610	42.2	AV	incl.	42.2	46	3.8	PASS	
3.742	41.8	AV	incl.	41.8	46	4.2	PASS	
13.558	53.0	AV	incl.	53.0	50	-3.0		Not considered for the evaluation. with reference to the rule interpretation released by the FCC from 4/12/05 to the TCB council.

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 3.1 dB.**



4.1.2 Detailed test protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-11

Instruments:					
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1820054	Artificial mains network	R&S	ESH2-Z5	2008-06-27	2009-06
1820028	Artificial mains network	R&S	ESH3-Z5	2008-06-11	2009-06
1800142	EMI Test Receiver	R&S	ESCI-3	2008-06-11	2009-06
1060417	Digital Multimeter	GMC	18S	2008-04-10	2009-04

Information concerning the test:

Test set-up:	<p>The system under test was installed on a non-conductive table of 80 cm height in the shielded room.</p> <p>The arrangement of components on the table was according to drawing # 1 on page 31. 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.</p> <p>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.</p> <p>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.</p> <p>For details refer to drawing # 2 and the photographs.</p>
Operating modes:	<p>Reading of a tagged document.</p> <p>The supply voltage was 120 V, 60 Hz.</p>
Test procedure:	ANSI C63.4:2003, Clauses 7.2 and 11.5 and Annexures D.1 and D.2

Result:	Pass
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Protocol:

On the following page



The following measurements were made:

Scan No.	Operating Mode	Line under test	Result	Comments
1	Continuously reading RFID tag	L and N	Pass	Limit-exceeding reading at 13,56 MHz not considered for the evaluation, with reference to the results of scan No. 3 and the rule interpretation released by the FCC from 4/12/05 to the TCB council.
2	Stand-by (scanner ready, but not initialized)	L and N	Pass	-
3	Reading mode, but reader antenna replaced by dummy load	L and N	Pass	Disturbance level of the 13,56 MHz below the disturbance level of the unintentional radiators contained in the EUT.

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

While the RFID tag reader was on, the class B limits of §15.107 and §15.207 were not met. Nevertheless the final result is "pass", with reference to the rule interpretation released by the FCC from 4/12/05 to the TCB council.

Attempts to maximize the emissions by changing the cable arrangement did not show any significant changes except for the measurements made at 13.56 MHz without dummy load.

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

4.2.1 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
400	10	2.9	Hor.	0	12.5	17.9	10.46	40.86	46.02	5.16	PASS	
36.76	10	1	Ver.	180	10.76	13.56	10.46	34.78	40.00	5.22	PASS	
384.1	10	1	Ver.	10	12.2	17.41	10.46	40.07	46.02	5.95	PASS	
533.46	10	2.5	Hor.	0	9	20.28	10.46	39.74	46.02	6.28	PASS	
800.19	10	1	Hor.	30	4	24.23	10.46	38.69	46.02	7.33	PASS	
48.5	10	1	Ver.	200	8.5	13.63	10.46	32.59	40.00	7.41	PASS	

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 limits specified in § 15.109 (a).

The minimum margin of a measurement value to the limit was 5.16 dB.



4.2.2 Detailed Test Protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-11

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	2007-01-15	2009-01 (2 years)
1800118	EMI Test Receiver	R&S	ESI 26	2007-06-12	2009-06 (2 years)
1150007	EMI Test Receiver	R&S	ESVS 30	2008-06-11	2009-06

Information concerning the test:

Test set-up:	<p>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 31. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed.</p> <p>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.</p>
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:

Exploratory measurements:

The pretests 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	
1764.2	3	1.4	V	0	Average	45.1	26.06	-30.63	40.16	54	13.84	pass
1080.0	3	1	V	170	Average	45.24	22.26	-32.19	36.50	54	17.50	pass
1044.1	3	2.2	V	40	Average	45.27	22	-32.50	36.27	54	17.73	pass
1000.0	3	1.5	V	0	Average	37.5	21.7	-32.58	28.20	54	25.80	pass
1174.5	3	1	H	90	Peak	56.32	22.92	-31.64	47.60	74	26.40	pass
1764.2	3	1.4	V	0	Peak	49.5	26.06	-30.63	44.93	74	29.07	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 operating mode # 1 as described in section 1.
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 limits specified in § 15.109 (a).

The minimum margin of a measurement value to the limit (for average readings) was 13.8 dB.

4.3.2 Detailed Test Protocol

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2008-07-11

Instruments:	Test Location: Semi-anechoic chamber, 3 m test distance				
Inventory number	Description	Manufacturer	Type	Date of last calibration	Next calibration due
1810066	Log. per. antenna	R&S	HL025	2006-09-15	2009-09 (3 years)
1800107	Amplifier	AML	AML0123L3702	2008-07-07	2009-07
1800118	EMI Test Receiver	R&S	ESI 26	2007-06-12	2009-06 (2 years)

Information concerning the test:

Test set-up:	<p>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 31. All power cords of the system under test were connected directly to the power outlet on the turntable, no LISNs were installed.</p> <p>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.</p> <p>For details refer to the photographs.</p>
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.

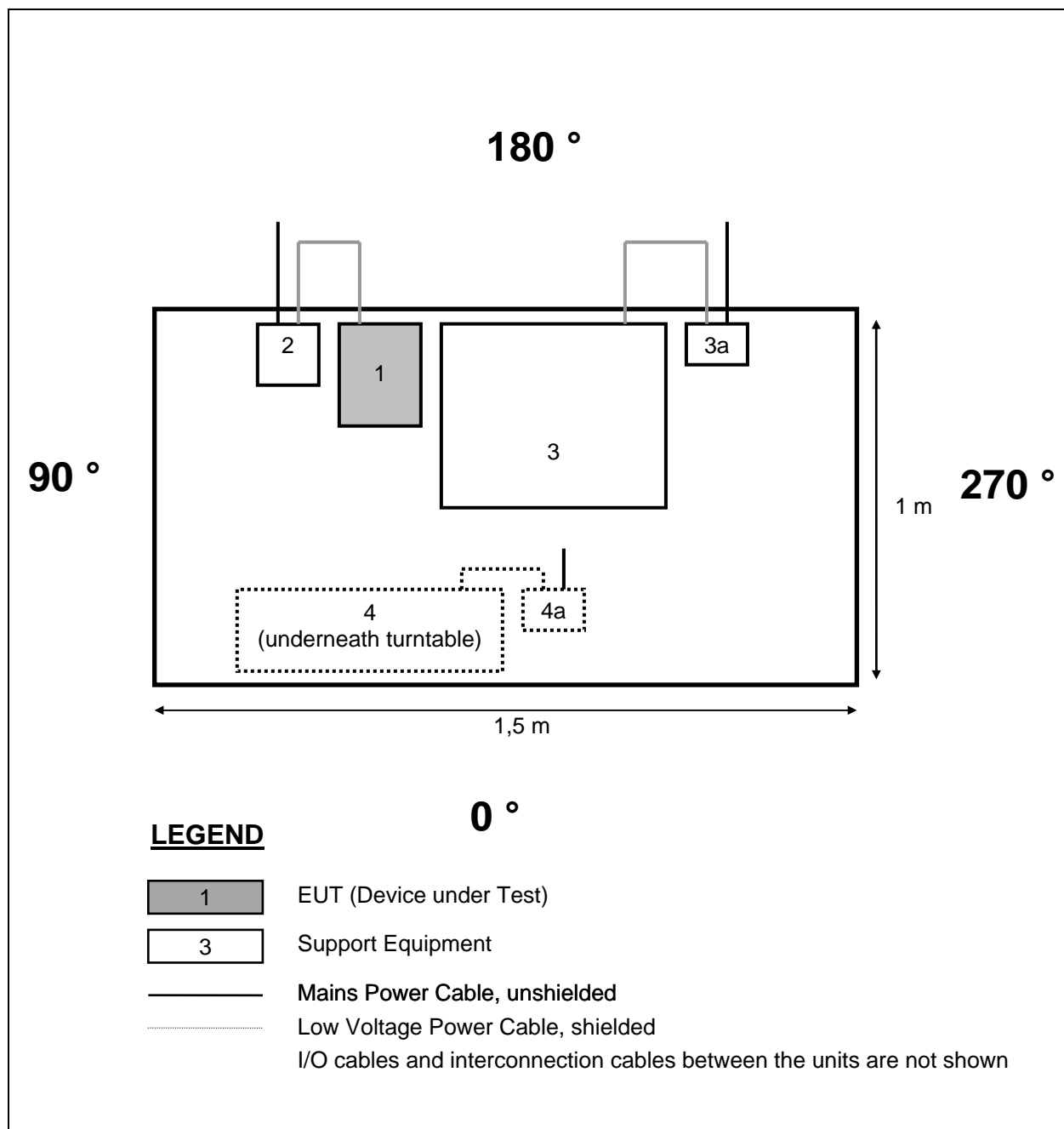
Final testing

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.

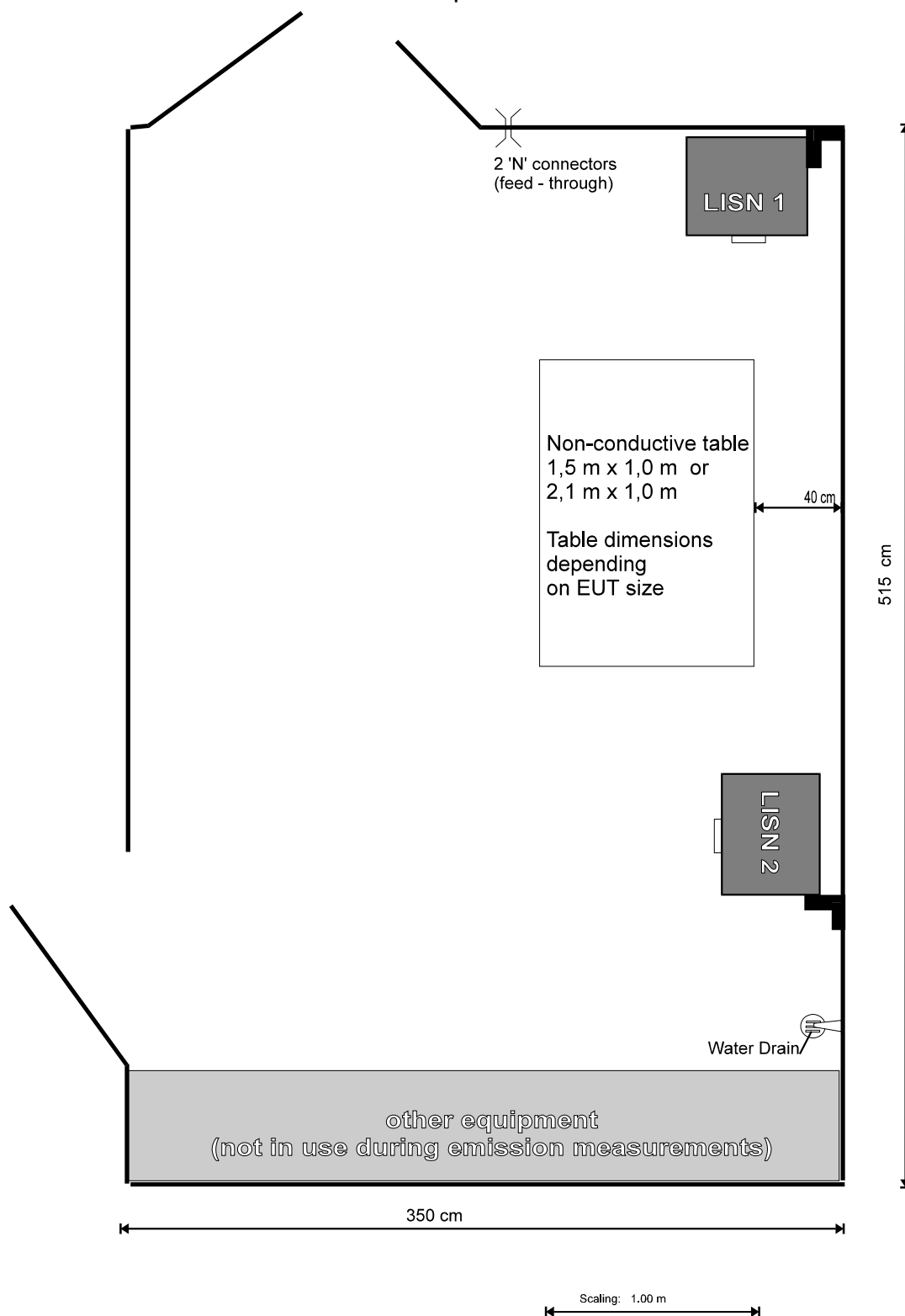
5 Drawings

5.1 Test configuration (Block diagram)



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

5.2 Conducted Emissions Test Setup



Notes:

LISN 2 can be moved so that a minimum distance of 80 cm to the EUT can be maintained even if a larger table is required for complex systems under test.

The 'N' connectors allow operation of the EMI test receiver outside the shielded room.

Drawing #2: Conducted emissions test setup

6 Measurement data

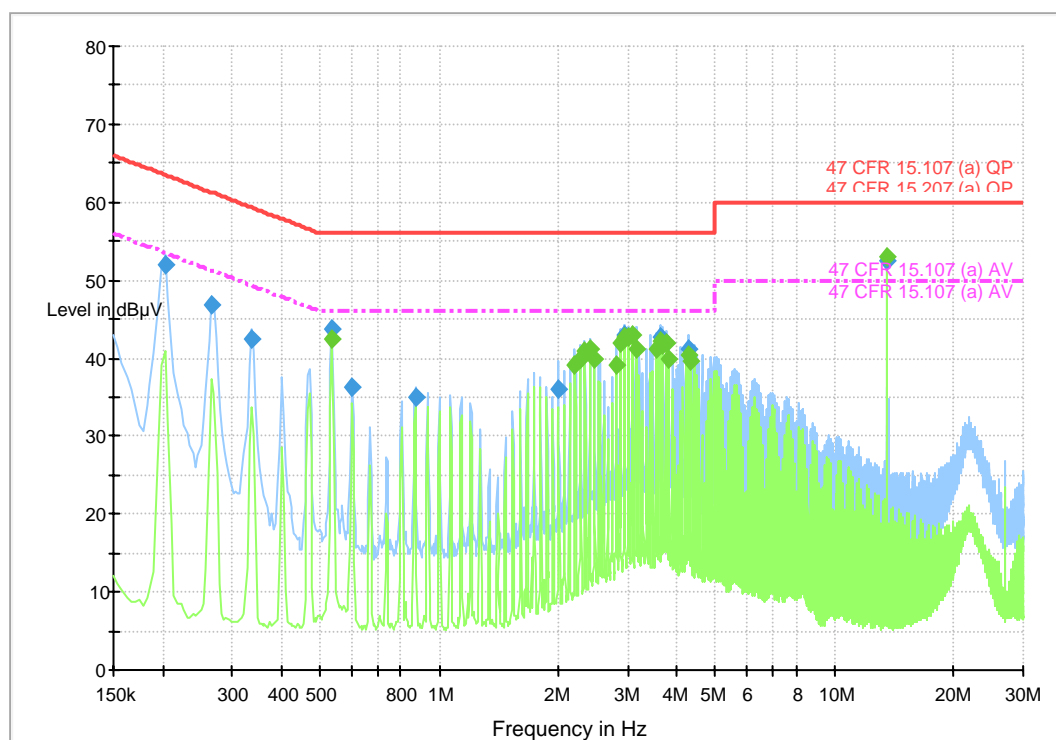
6.1 AC power line conducted emissions

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:	Shielded room #5
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



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.202000	51.9	2000.000	9.000	GND	L1	10.0	11.6	63.5	
0.266000	46.9	2000.000	9.000	GND	L1	10.0	14.3	61.2	
0.334000	42.4	2000.000	9.000	GND	L1	10.0	17.0	59.4	
0.534000	43.6	2000.000	9.000	GND	L1	10.0	12.4	56.0	
0.602000	36.3	2000.000	9.000	GND	L1	10.0	19.7	56.0	
0.870000	35.0	2000.000	9.000	GND	L1	10.0	21.0	56.0	
2.006000	35.9	2000.000	9.000	GND	L1	10.0	20.1	56.0	
2.942000	42.9	2000.000	9.000	GND	N	10.0	13.1	56.0	
3.610000	42.6	2000.000	9.000	GND	N	10.0	13.4	56.0	
...

Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.534000	42.4	2000.000	9.000	GND	L1	10.0	3.6	46.0	
2.206000	39.1	2000.000	9.000	GND	L1	10.0	6.9	46.0	
2.274000	39.8	2000.000	9.000	GND	L1	10.0	6.2	46.0	
2.338000	41.0	2000.000	9.000	GND	L1	10.0	5.0	46.0	
2.406000	41.2	2000.000	9.000	GND	N	10.0	4.8	46.0	
2.474000	39.9	2000.000	9.000	GND	N	10.0	6.1	46.0	
2.806000	39.1	2000.000	9.000	GND	L1	10.0	6.9	46.0	
2.874000	41.9	2000.000	9.000	GND	L1	10.0	4.1	46.0	
2.942000	42.7	2000.000	9.000	GND	L1	10.0	3.3	46.0	
3.006000	42.7	2000.000	9.000	GND	L1	10.0	3.3	46.0	
3.074000	42.9	2000.000	9.000	GND	N	10.0	3.1	46.0	
3.142000	41.2	2000.000	9.000	GND	L1	10.0	4.8	46.0	
3.542000	41.2	2000.000	9.000	GND	N	10.0	4.8	46.0	
3.610000	42.2	2000.000	9.000	GND	N	10.0	3.8	46.0	
3.674000	41.6	2000.000	9.000	GND	N	10.0	4.4	46.0	
3.742000	41.8	2000.000	9.000	GND	N	10.0	4.2	46.0	
3.810000	39.8	2000.000	9.000	GND	L1	10.0	6.2	46.0	
4.278000	40.4	2000.000	9.000	GND	N	10.0	5.6	46.0	
4.346000	39.6	2000.000	9.000	GND	N	10.0	6.4	46.0	
13.558000	53.0	2000.000	9.000	GND	L1	10.0	-3.0	50.0	1)

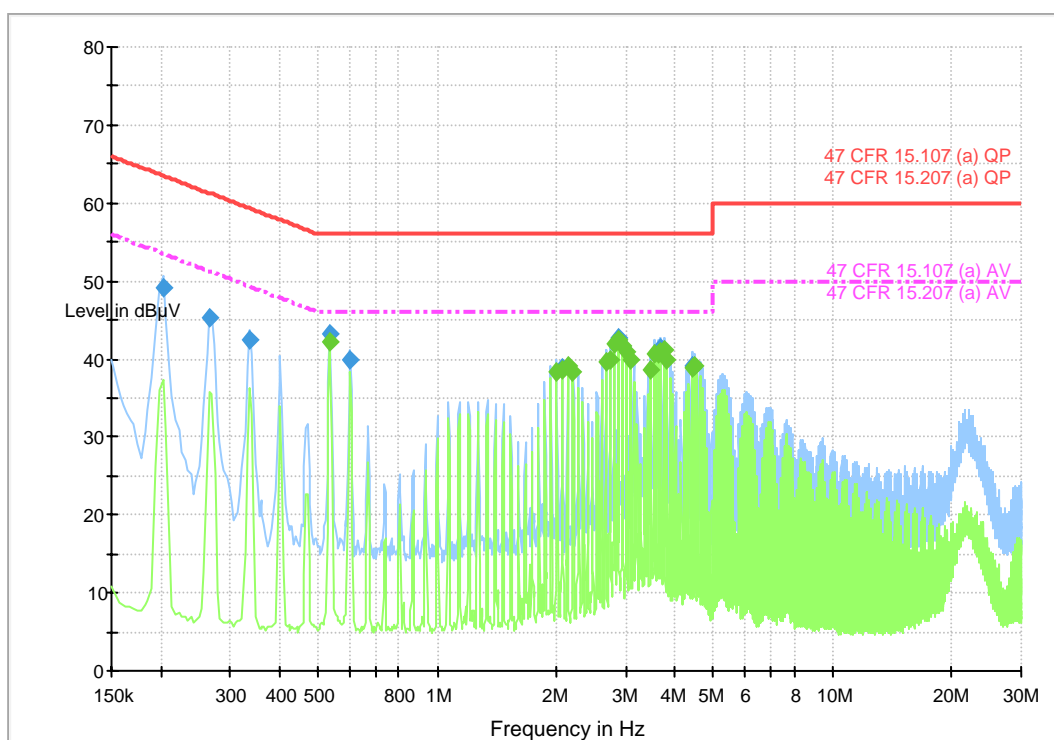
1) Wanted emission of the transmitter, not considered for the evaluation against the limits; see rule interpretation released by the FCC from 4/12/05 to the TCB council.

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:	Shielded room #5
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



Final Measurement Detector 1

Frequency (MHz)	Quasi Peak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.202000	49.2	2000.000	9.000	GND	L1	10.0	14.3	63.5	
0.266000	45.2	2000.000	9.000	GND	L1	10.0	16.0	61.2	
0.334000	42.4	2000.000	9.000	GND	L1	10.0	17.0	59.4	
0.534000	43.3	2000.000	9.000	GND	L1	10.0	12.7	56.0	
0.602000	39.9	2000.000	9.000	GND	L1	10.0	16.1	56.0	
2.070000	38.9	2000.000	9.000	GND	L1	10.0	17.1	56.0	
2.874000	42.7	2000.000	9.000	GND	N	10.0	13.3	56.0	
3.674000	41.4	2000.000	9.000	GND	N	10.0	14.6	56.0	
4.410000	39.1	2000.000	9.000	GND	N	10.0	16.9	56.0	

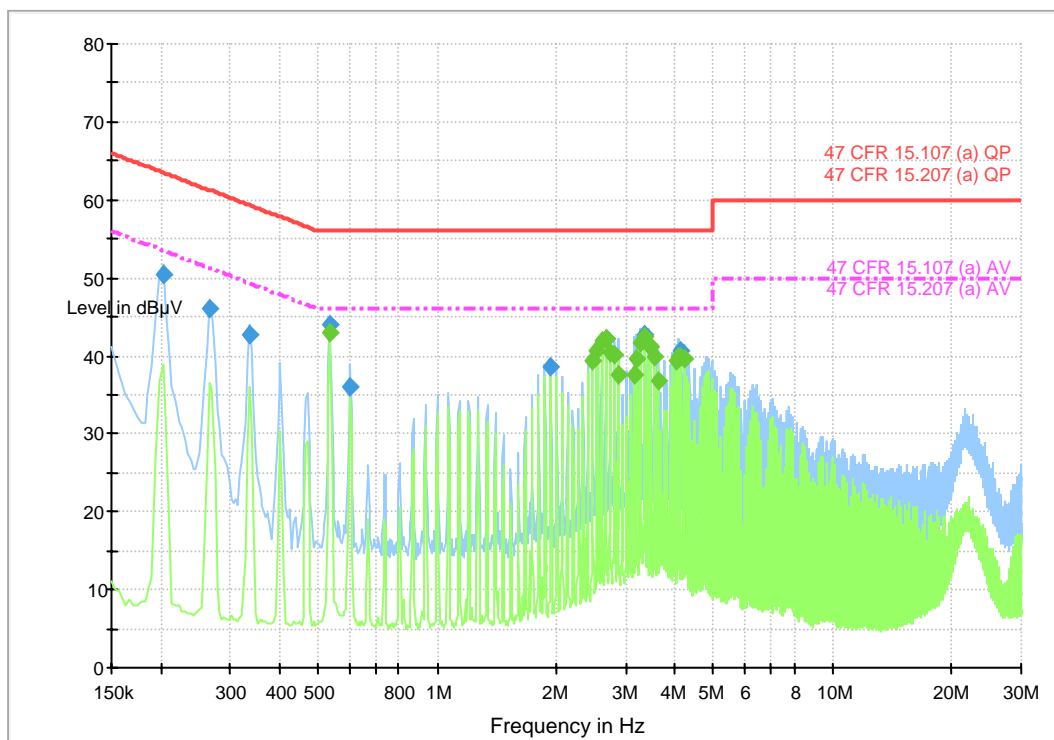
Final Measurement Detector 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.534000	42.2	2000.000	9.000	GND	L1	10.0	3.8	46.0	
2.006000	38.4	2000.000	9.000	GND	L1	10.0	7.6	46.0	
2.070000	38.6	2000.000	9.000	GND	L1	10.0	7.4	46.0	
2.138000	39.1	2000.000	9.000	GND	L1	10.0	6.9	46.0	
2.206000	38.2	2000.000	9.000	GND	L1	10.0	7.8	46.0	
2.674000	39.5	2000.000	9.000	GND	L1	10.0	6.5	46.0	
2.742000	40.0	2000.000	9.000	GND	L1	10.0	6.0	46.0	
2.806000	41.9	2000.000	9.000	GND	N	10.0	4.1	46.0	
2.874000	42.5	2000.000	9.000	GND	L1	10.0	3.5	46.0	
2.942000	41.6	2000.000	9.000	GND	L1	10.0	4.4	46.0	
3.006000	41.0	2000.000	9.000	GND	L1	10.0	5.0	46.0	
3.074000	39.8	2000.000	9.000	GND	L1	10.0	6.2	46.0	
3.474000	38.6	2000.000	9.000	GND	N	10.0	7.4	46.0	
3.542000	40.6	2000.000	9.000	GND	N	10.0	5.4	46.0	
3.610000	40.8	2000.000	9.000	GND	L1	10.0	5.2	46.0	
3.674000	40.8	2000.000	9.000	GND	L1	10.0	5.2	46.0	
3.742000	41.2	2000.000	9.000	GND	N	10.0	4.8	46.0	
3.810000	40.0	2000.000	9.000	GND	N	10.0	6.0	46.0	
4.410000	38.7	2000.000	9.000	GND	N	10.0	7.3	46.0	
4.478000	39.0	2000.000	9.000	GND	N	10.0	7.0	46.0	

6.1.3 Scan No. 3 (reader active, but antennas replaced with dummy load)

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:	Shielded room #5
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



Final Measurement Detector 1

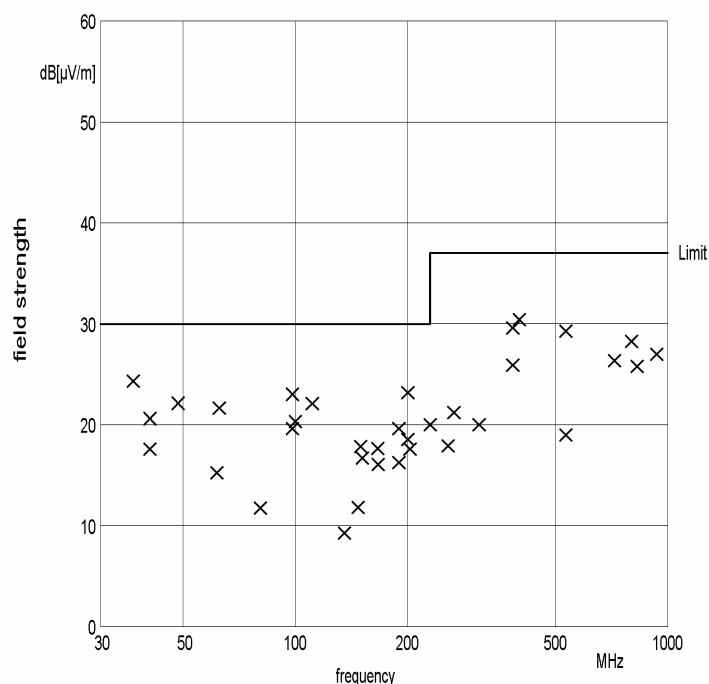
Frequency (MHz)	Quasi Peak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.202000	50.4	2000.000	9.000	GND	L1	10.0	13.1	63.5	
0.266000	46.0	2000.000	9.000	GND	L1	10.0	15.2	61.2	
0.334000	42.6	2000.000	9.000	GND	L1	10.0	16.8	59.4	
0.534000	44.1	2000.000	9.000	GND	L1	10.0	11.9	56.0	
0.602000	36.1	2000.000	9.000	GND	N	10.0	19.9	56.0	
1.938000	38.5	2000.000	9.000	GND	L1	10.0	17.5	56.0	
2.674000	42.2	2000.000	9.000	GND	L1	10.0	13.8	56.0	
3.342000	42.7	2000.000	9.000	GND	N	10.0	13.3	56.0	
4.142000	40.6	2000.000	9.000	GND	N	10.0	15.4	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.534000	43.1	2000.000	9.000	GND	L1	10.0	2.9	46.0	
2.474000	39.3	2000.000	9.000	GND	L1	10.0	6.7	46.0	
2.538000	40.7	2000.000	9.000	GND	L1	10.0	5.3	46.0	
2.606000	42.0	2000.000	9.000	GND	N	10.0	4.0	46.0	
2.674000	42.1	2000.000	9.000	GND	L1	10.0	3.9	46.0	
2.742000	40.4	2000.000	9.000	GND	N	10.0	5.6	46.0	
2.806000	40.0	2000.000	9.000	GND	N	10.0	6.0	46.0	
2.874000	37.6	2000.000	9.000	GND	L1	10.0	8.4	46.0	
3.142000	37.5	2000.000	9.000	GND	L1	10.0	8.5	46.0	
3.206000	39.6	2000.000	9.000	GND	L1	10.0	6.4	46.0	
3.274000	41.8	2000.000	9.000	GND	L1	10.0	4.2	46.0	
3.342000	42.4	2000.000	9.000	GND	N	10.0	3.6	46.0	
3.410000	41.4	2000.000	9.000	GND	N	10.0	4.6	46.0	
3.474000	41.2	2000.000	9.000	GND	N	10.0	4.8	46.0	
3.542000	39.9	2000.000	9.000	GND	N	10.0	6.1	46.0	
3.610000	36.8	2000.000	9.000	GND	L1	10.0	9.2	46.0	
4.010000	39.4	2000.000	9.000	GND	L1	10.0	6.6	46.0	
4.078000	39.7	2000.000	9.000	GND	N	10.0	6.3	46.0	
4.142000	39.9	2000.000	9.000	GND	N	10.0	6.1	46.0	
4.210000	39.6	2000.000	9.000	GND	N	10.0	6.4	46.0	

6.2 Electric field strength, 30 MHz - 1000 MHz

Test results: Electrical Fieldstrength



106192

Electrical Fieldstrength: Table of measured data (10 m)

Quasi-peak

Fre- quency MHz	Distance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	Reading dB(μV)	An- tenna- factor dB/m	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
36.76	10	1	Ver.	180	10.76	13.56	24.32	30	5.68	PASS	
40.68	10	4	Hor.	0	3.5	14.1	17.6	30	12.4	PASS	1)
40.68	10	1	Ver.	170	6.5	14.1	20.6	30	9.4	PASS	1)
48.5	10	1	Ver.	200	8.5	13.63	22.13	30	7.87	PASS	
61.6	10	4	Hor.	135	1.9	13.35	15.25	30	14.75	PASS	
62.5	10	1	Ver.	20	8.6	13.07	21.66	30	8.34	PASS	
80.7	10	4	Hor.	180	2.8	8.94	11.74	30	18.26	PASS	
98.3	10	1	Ver.	90	9.9	13.12	23.02	30	6.98	PASS	
98.3	10	4	Hor.	30	6.5	13.12	19.62	30	10.38	PASS	
100.2	10	1	Ver.	90	7.1	13.24	20.34	30	9.66	PASS	
111.1	10	1.1	Ver.	180	9.6	12.52	22.12	30	7.88	PASS	
135.6	10	4	Hor.	30	0	9.28	9.28	30	20.72	PASS	1)
147.44	10	4	Hor.	180	2.6	9.2	11.8	30	18.2	PASS	
150	10	1.1	Ver.	180	8.6	9.23	17.83	30	12.17	PASS	
151.4	10	4	Hor.	0	7.4	9.3	16.7	30	13.3	PASS	



Fre- quency MHz	Distance m	Height of An- tenna m	Polari- zation	EUT Angle 1°	Reading dB(μV)	An- tenna- factor dB/m	Σ dB(μV/m)	Limit dB(μV/m)	Margin dB	Result	Remarks
166.7	10	1.1	Ver.	60	7.6	10.06	17.66	30	12.34	PASS	Fluctuating level
167.1	10	4	Hor.	135	6	10.08	16.08	30	13.92	PASS	
189.83	10	4	Hor.	320	4.1	12.13	16.23	30	13.77	PASS	
189.84	10	1.1	Ver.	180	7.5	12.13	19.63	30	10.37	PASS	Fluctuating level 1)
200.6	10	4	Hor.	45	11	12.15	23.15	30	6.85	PASS	
200.6	10	1	Ver.	90	6.4	12.15	18.55	30	11.45	PASS	
203.4	10	1	Ver.	0	5.4	12.17	17.57	30	12.43	PASS	1)
230.51	10	1	Ver.	0	6.4	13.62	20.02	37	16.98	PASS	1)
257.63	10	1	Ver.	10	3.7	14.22	17.92	37	19.08	PASS	1)
266.73	10	3	Hor.	60	7	14.2	21.2	37	15.8	PASS	
311.87	10	1	Ver.	10	4.5	15.52	20.02	37	16.98	PASS	1)
384.1	10	3	Hor.	300	8.5	17.41	25.91	37	11.09	PASS	
384.1	10	1	Ver.	10	12.2	17.41	29.61	37	7.39	PASS	
400	10	2.9	Hor.	0	12.5	17.9	30.4	37	6.6	PASS	
533.45	10	3	Ver.	20	-1.3	20.28	18.98	37	18.02	PASS	
533.46	10	2.5	Hor.	0	9	20.28	29.28	37	7.72	PASS	
720	10	2.6	Ver.	330	3	23.35	26.35	37	10.65	PASS	
800.19	10	1	Hor.	30	4	24.23	28.23	37	8.77	PASS	
828.08	10	2	Ver.	0	1.2	24.6	25.8	37	11.2	PASS	
936.08	10	1.6	Ver.	20	1.1	25.88	26.98	37	10.02	PASS	

Note 1) Spurious emissions of the 13.56 MHz tag reader (Harmonics)

6.3 Radiated emissions, $f > 1$ GHz

Radiated emissions 1-5 GHz, measured at 3 m distance

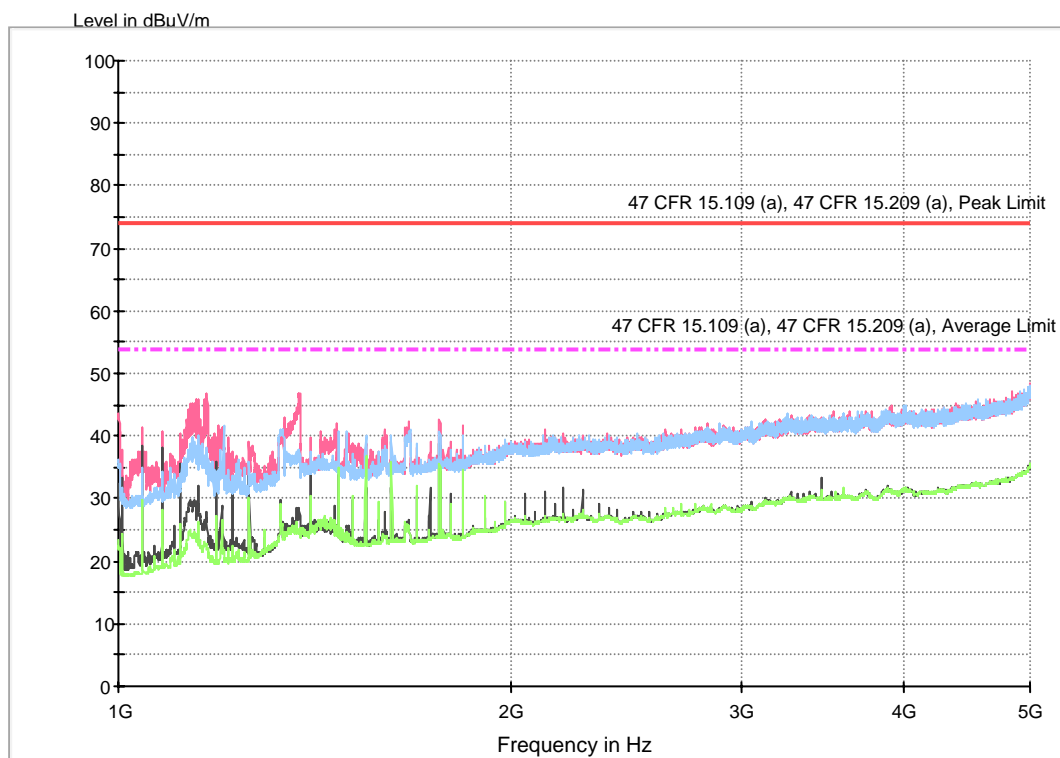


Table of results, final measurement

Frequency MHz	Test Distance m	Antenna Height m	Pol.	EUT Azimuth °	Detector function	Instrument Reading dB μ V/m	Antenna Factor dB	Cable loss and amp. gain dB	Measured Field strength dB μ V/m	Limit dB μ V/m	Margin dB	Result
1000	3	1.5	V	0	Peak	53.8	21.7	-32.58	42.92	74	31.08	pass
1044.1	3	2.2	H	40	Peak	50.77	22	-32.50	40.27	74	33.73	pass
1080	3	1	H	170	Peak	49.61	22.26	-32.19	39.68	74	34.32	pass
1174.5	3	1	H	90	Peak	56.32	22.92	-31.64	47.60	74	26.40	pass
1670	3	1.4	V	0	Peak	44.36	25.97	-30.85	39.48	74	34.52	pass
1692.3	3	1.4	V	0	Peak	44.36	25.99	-30.81	39.54	74	34.46	pass
1764.2	3	1.4	V	0	Peak	49.5	26.06	-30.63	44.93	74	29.07	pass
1000	3	1.5	V	0	Average	37.5	21.7	-32.58	28.20	54	25.80	pass
1044.1	3	2.2	V	40	Average	45.27	22	-32.50	36.27	54	17.73	pass
1080	3	1	V	170	Average	45.24	22.26	-32.19	36.50	54	17.50	pass
1764.2	3	1.4	V	0	Average	45.1	26.06	-30.63	40.16	54	13.84	pass

7 Photographs

7.1 Photos



Figure 1 Arrangement for the measurement of conducted emissions

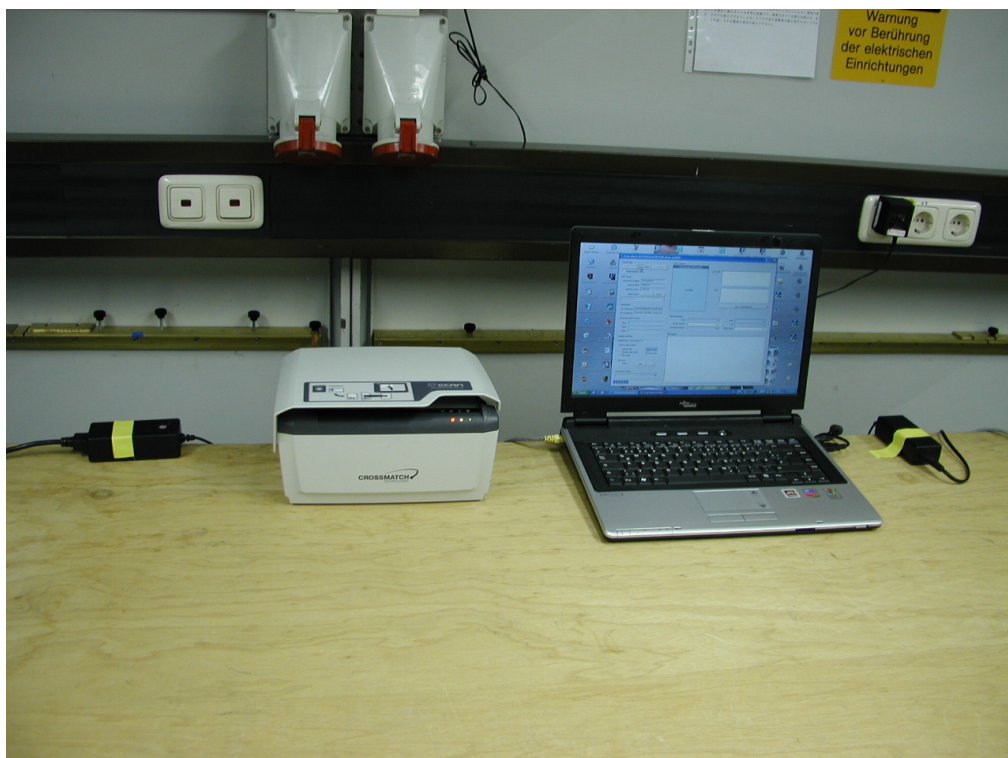


Figure 2 Arrangement for the measurement of conducted emissions



Figure 3 Arrangement for the measurement of conducted emissions

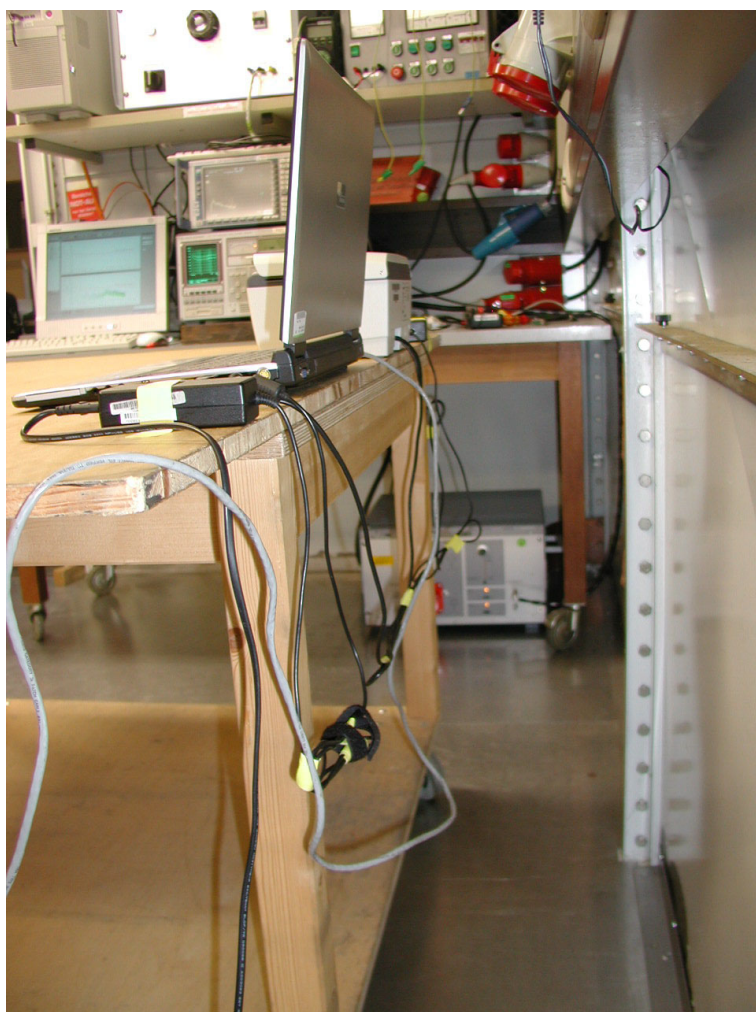


Figure 4 Arrangement for the measurement of conducted emissions



Figure 5 Arrangement for the measurement of radiated emissions

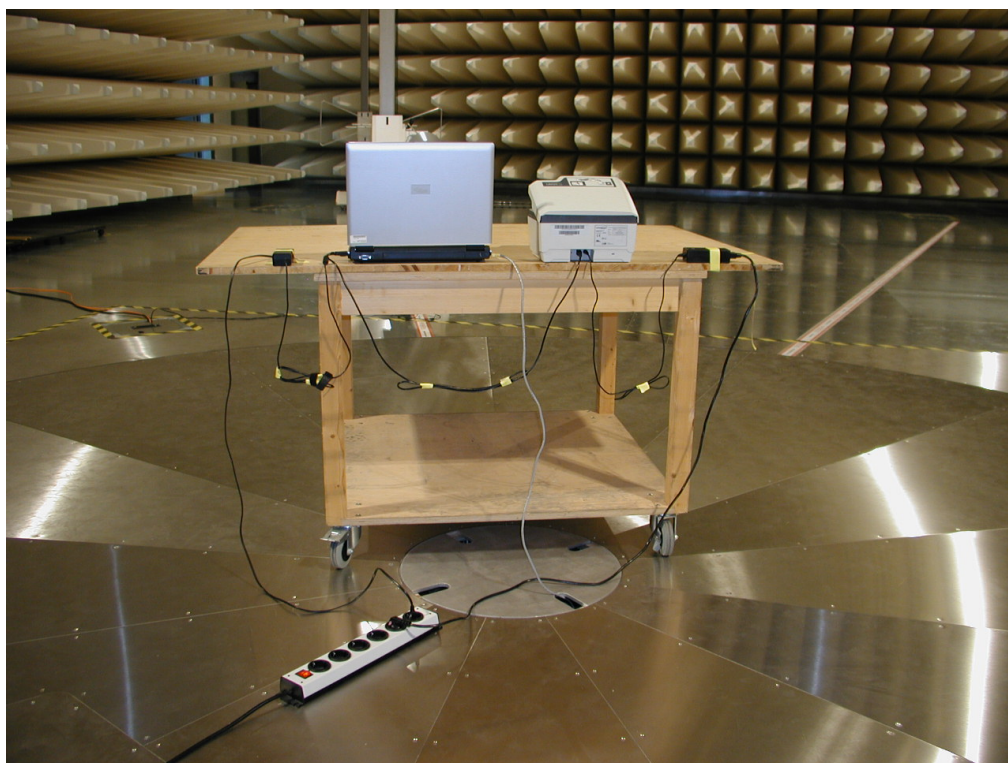


Figure 6 Arrangement for the measurement of radiated emissions



Figure 7 Arrangement for the measurement of radiated emissions

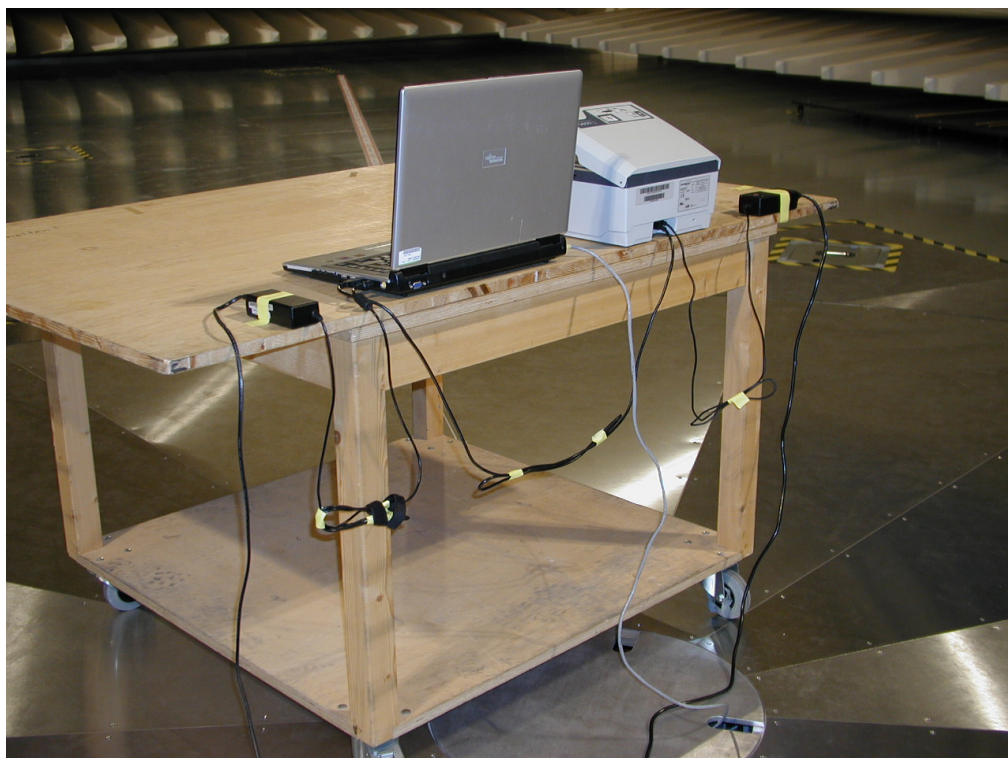


Figure 8 Arrangement for the measurement of radiated emissions



Figure 9: EUT with electrically shielded loop on the scanner surface for relative measurements in the environmental chamber



Figure 10: Rear view of the document scanner

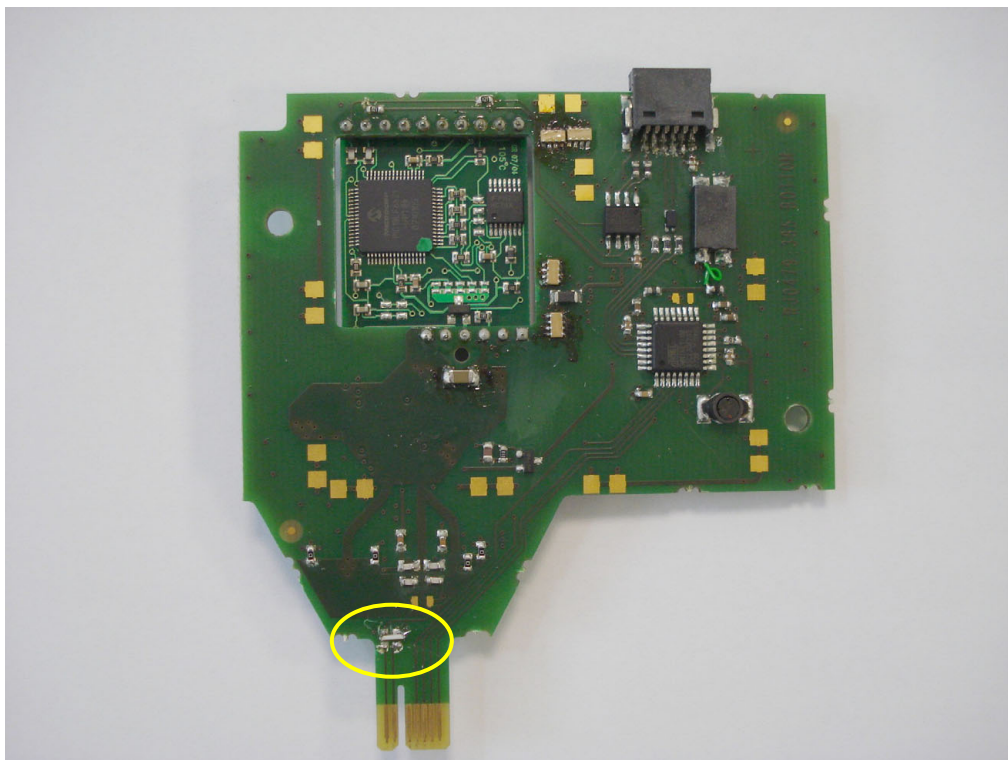


Figure 11: RFID adapter with dummy load (used for the measurement of conducted emissions)

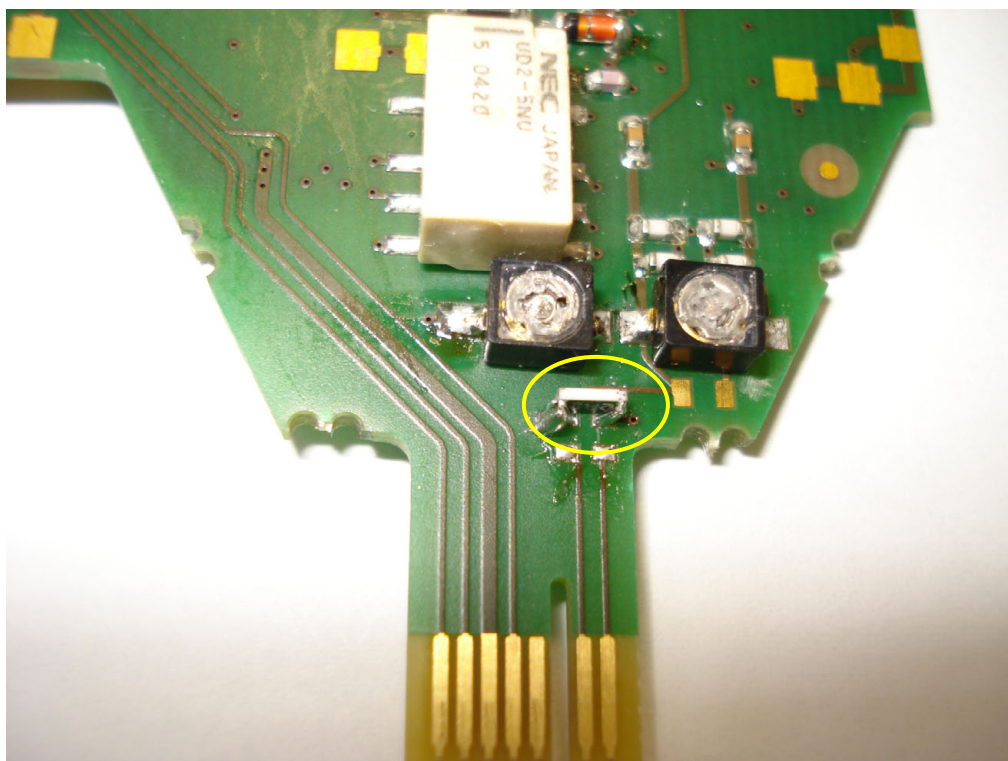


Figure 12: Dummy load (used for the measurement of conducted emissions)



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