

Test Report

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RF test report

110090-AU01+W02 Ed. 2



 Industry Canada Industrie Canada
Elatec Vertriebs GmbH

Transponder

TWN3 Mifare NFC



The test result refers exclusively
to the model tested.

This report must not be copied without
the written authorization by the lab.
Revision: 1.0



DGA-PL-224/95-03 / BNetzA-CAB-02/21-02/2

EMV **TESTHAUS** GmbH

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Accreditation:



Registration number: DGA-PL-224/95-03
CAB (EMC) registration number: BNetzA-CAB-02/21-02/3
FCC facility registration number: 221458
MRA US-EU, FCC designation number: DE0010

Location of Testing:

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94315 Straubing
Germany

The technical accuracy is guaranteed through the quality management of the
EMV **TESTHAUS** GmbH



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110090-AU01+W02
Ed. 2

Page 2 of 29

Table of contents

1	Test regulations	5
2	Equipment under Test (EUT)	6
3	AC power line conducted emissions	8
5	Radiated emission measurement (<1 GHz)	18
6	Occupied Bandwidth (99%)	24
8	Equipment calibration status	27
9	Measurement uncertainty	28
10	Summary	29



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110090-AU01+W02
Ed. 2

Page 3 of 29

List of pictures

Picture 1: Outline of conducted emission test setup	9
Picture 2: Conducted emission on mains, phase 1 (Chart)	10
Picture 3: Conducted emission on mains, phase 1 (Table).....	11
Picture 4: Conducted emission on mains, phase 1 (Chart), with 50 Ohm load.....	12
Picture 5: Conducted emission on mains, phase 1 (Table), with 50 Ohm load.....	13
Picture 6: Conducted emission on mains, neutral (Chart).....	14
Picture 7: Conducted emission on mains, neutral (Table).....	15
Picture 8: Conducted emission on mains, neutral (Chart), with 50 Ohm load.....	16
Picture 9: Conducted emission on mains, neutral (Table), with 50 Ohm load	17
Picture 12: Test setup for radiated emission measurement (< 30 MHz).....	19
Picture 13: Test setup for radiated emission measurement (< 1 GHz).....	20
Picture 14: Radiated emission 9 kHz – 30 MHz (pre-scan, 3 m).....	21
Picture 15: Radiated emission 30 MHz – 1000MHz.....	22
Picture 16: Radiated emission 30 MHz – 1000MHz (Table).....	23
Picture 17: Test setup for radiated emission measurement (< 30 MHz).....	25
Picture 18: Occupied bandwidth 99%	26

List of tables

Table 1: Equipment Calibration status	27
Table 2: Measurement uncertainty	28



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Page 4 of 29

1 Test regulations

CFR 47 Part 2: October 1, 2010	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
CFR 47 Part 15: October 1, 2010	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
ANSI C63.4: December 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
RSS-Gen Issue 3, December 2010	General Requirements and Information for the Certification of Radiocommunication Equipment, published by Industry Canada
RSS-102 Issue 4, March 2010, updated December 2010	Radio Frequency Exposure Compliance of Radiocommunications Apparatus
RSS-210 Issue 8, December 2010	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada

1.1 Summary of test results

Standard	Test result
FCC CFR 47 Part 15	Passed
RSS-210 Issue 3 and RSS-Gen Issue 3	Passed



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Page 5 of 29

2 Equipment under Test (EUT)

Product type: Transponder
Model Name: TWN3 Mifare NFC
Manufacturer: Elatec Vertriebs GmbH
Serial number: Sample 2
FCC ID: WP5TWN3F1
IC: 7948A-TWN3F1
Application freq. band: N/A
Frequency range: 13.56 MHz
Operating frequency: 13.56 MHz
Number of RF-channels: 1
Modulation: ASK
Antenna type: Integrated PCB antenna
 detachable not detachable
Power supply: Host powered (USB)
nominal: 5.0 VDC
Alternative: If equipped with serial port, external 5 VDC power supply
Temperature range: -20°C to +55°C



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Ed. 2

Page 6 of 29

2.2 Photo documentation

For photos taken during testing, see annex A.
For photos of the EUT, see annex B.
For internal photos of the EUT, see annex C.

2.3 Short description of the EUT

The EUT is a RFID reader for the MiFare RFID tags. It is operating at a frequency of 13.56 MHz.

2.4 Operation mode

The EUT was tested in the following operation modes:

- Reading tags continuously. The EUT was preconfigured for this operation mode.
- The EUT employs a combined receiver and transmitter that cannot be operated separately.

Physical type of connection to the host computer: USB or RS232, DSUB25, DSUB9 or PS/2. Based on preliminary tests the device with USB connector was identified as worst case. All following test were carried out with this type of connection.

2.5 Configuration

The following peripheral devices and interface cables were connected during the tests:

Device	Model:	S/N
Transponder	TWN3 Mifare NFC	Sample 2
19" LCD monitor	Belinea 1019	N/A
Test Notebook	Pro 600 IW	N/A
AC power supply	SADP-65KB AD	N/A
Test PC-System 1	Fujitsu Siemens Esprimo P9900	YL6K001108
USB Mouse	Microsoft	N/A
PS/2 Keyboard	Maxdata	N/A

Used cables

Numbers:	Description: (type / lengths / remarks)	Serial No
1	EUT: non-detachable USB cable (shielded / 2 m)	N/A
2	AC cable, unshielded, 1.5m	N/A
1	DVI cable, shielded, 1.5 m	N/A



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Page 7 of 29

3 AC power line conducted emissions

according to CFR 47 Part 15, section 15.207

3.1 Test location

Description	Manufacturer	Inventory No.
Shielded chamber	Siemens - Matsushita	E00107

3.2 Test instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESCS 30	Rohde & Schwarz	E00003
<input type="checkbox"/>	ESCI	Rohde & Schwarz	E00001
<input checked="" type="checkbox"/>	ESH 2-Z5	Rohde & Schwarz	E00004
<input checked="" type="checkbox"/>	ESH 2-Z5	Rohde & Schwarz	E00005

3.3 Limits

Frequency [MHz]	Quasi-peak [dB μ V]	Average [dB μ V]
0.15 – 0.5	66 - 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

3.4 Test procedure

1. The tests of conducted emission were carried out in a shielded room using a line impedance stabilization network (LISN) 50 μ H/50 Ohms and an EMI test receiver.
2. The EMI test receiver was connected to the LISN and set to a measurement bandwidth of 9 kHz in the frequency range from 0.15 MHz to 30 MHz.
3. The EUT was placed on a wooden table and connected to the LISN.
4. To accelerate the measurement the detector of the EMI test receiver was set to peak and the whole frequency range from 0.15 MHz to 30 MHz were scanned.
5. After that all peaks values with fewer margins than 10 dB to quasi-peak limit or exceeding the limit were marked and re-measured with quasi-peak detector.
6. If after that all values are under the average limit no addition measurement is necessary. In case there are still values between quasi-peak and average limit than these values were re-measured again with an average detector.
7. These measurements were done on all current carrying conductors.
8. Additionally for a device with a permanent antenna the measurements are done with a suitable dummy load, in lieu of the permanent antenna (see KB174176).



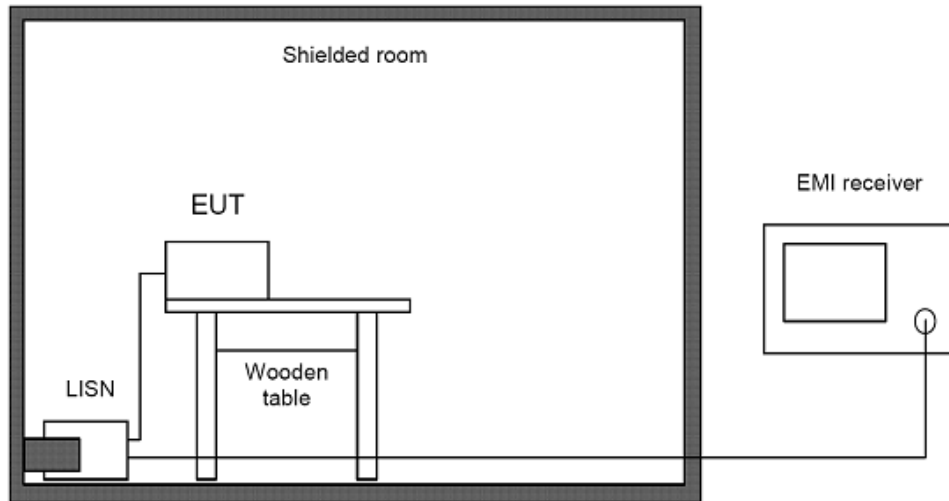
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Page 8 of 29

3.5 Test setup



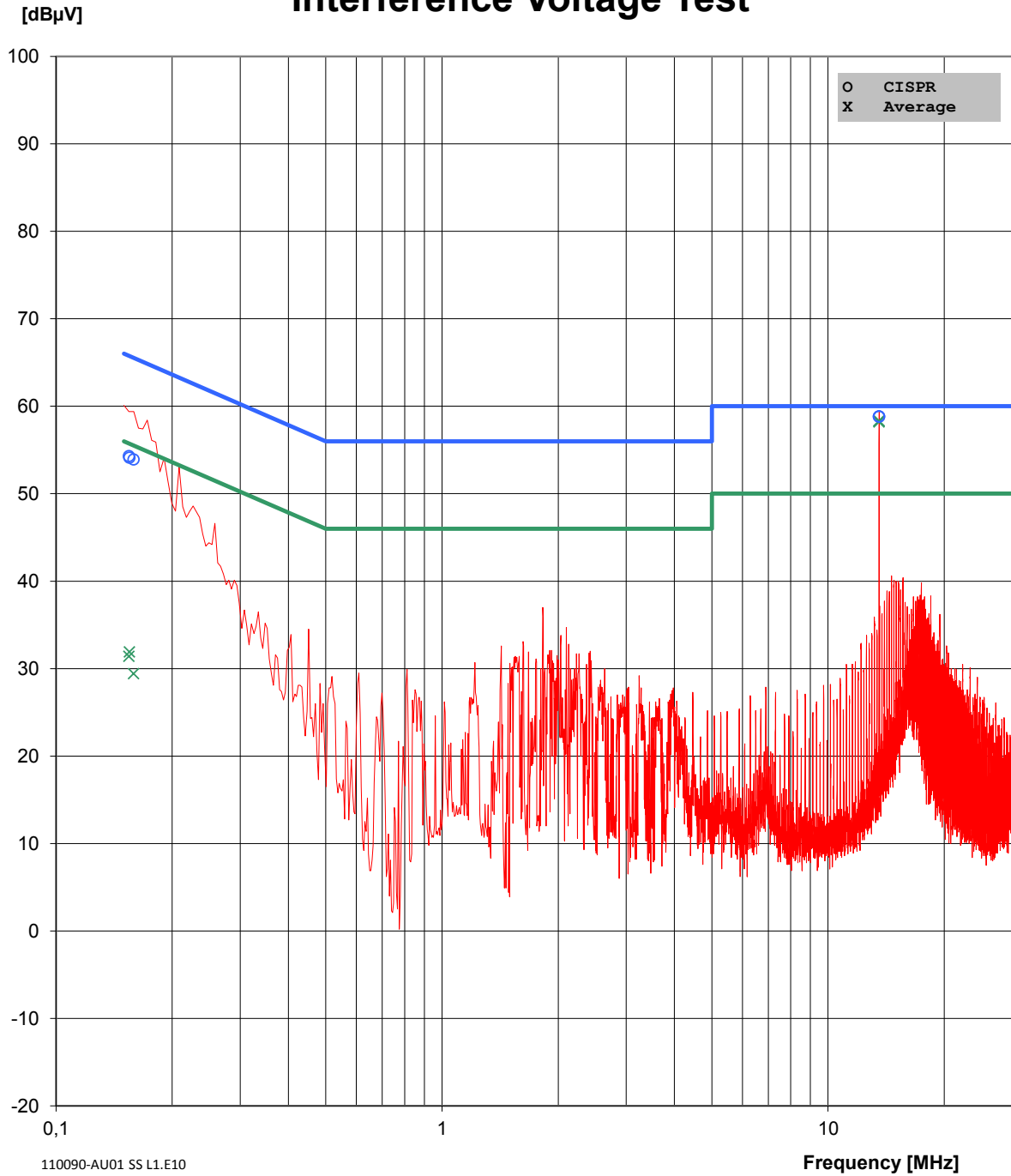
Picture 1: Outline of conducted emission test setup

Comments: All peripheral devices were additionally decoupled by means of a line stabilization network.

3.6 Test results

Temperature:	22°C	Humidity:	32%
Tested by:	M. Janker	Test date:	2011-04-18

Interference Voltage Test



Picture 2: Conducted emission on mains, phase 1 (Chart)



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Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,16	54,1	66,0	11,9	31,9	56,0	24,1	0,0	110090-AU01 SS L1,F10
0,15	54,3	65,8	11,5	31,4	55,8	24,4	0,0	
0,16	53,9	65,5	11,6	29,4	55,5	26,1	0,0	
13,56	58,8	60,0	1,2	58,3	50,0	-8,3	0,0	
13,56	58,8	60,0	1,2	58,3	50,0	-8,3	0,0	
13,56	58,8	60,0	1,2	58,2	50,0	-8,2	0,0	
13,56	58,8	60,0	1,2	58,2	50,0	-8,2	0,0	

Picture 3: Conducted emission on mains, phase 1 (Table)



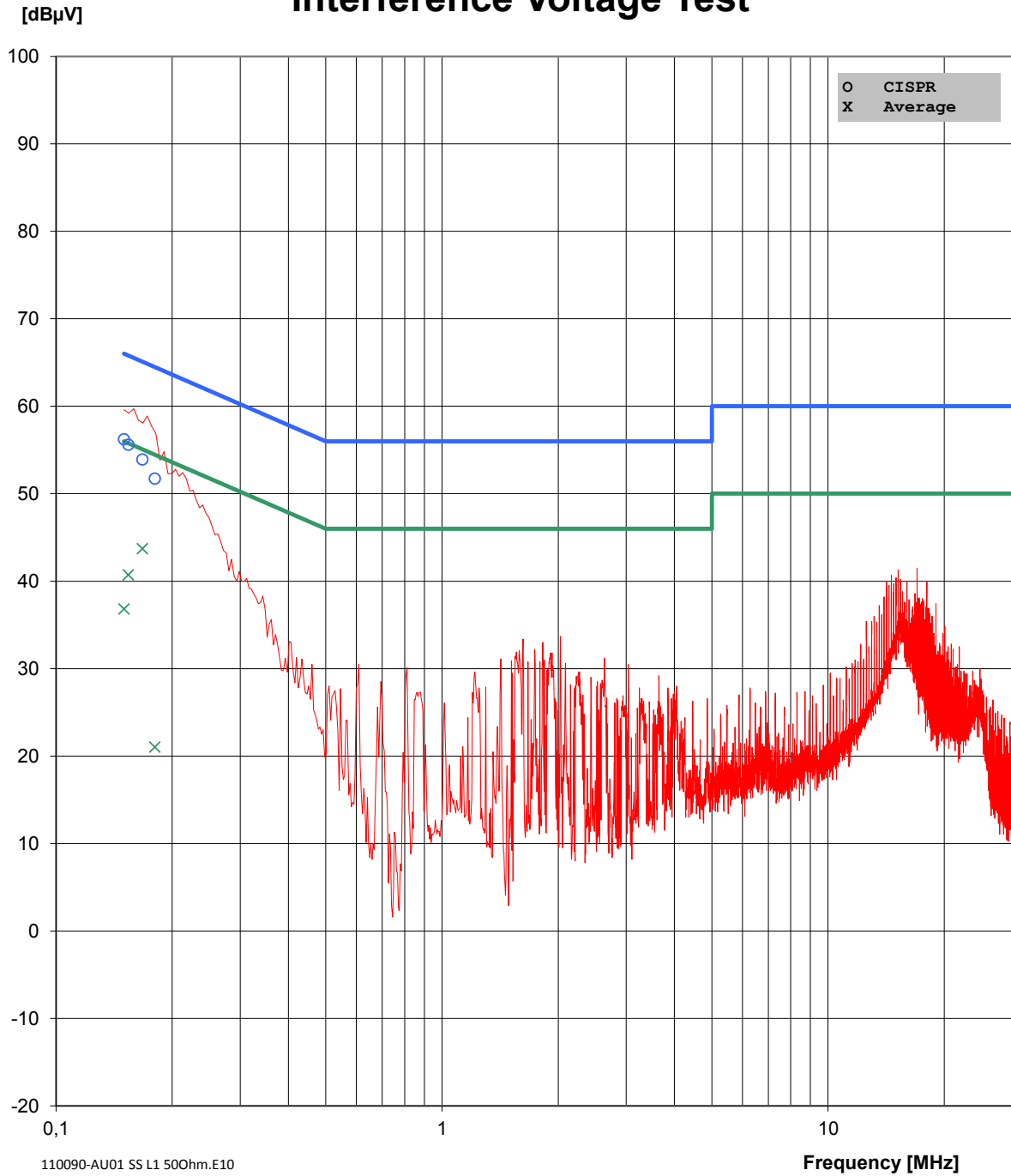
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 Ed. 2

Page 11 of 29

Interference Voltage Test



Picture 4: Conducted emission on mains, phase 1 (Chart), with 50 Ohm load

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,15	56,2	66,0	9,8	36,8	56,0	19,2	0,0	110090-AU01 SS L1 50Ohm.F10
0,15	55,6	65,8	10,2	40,7	55,8	15,1	0,0	
0,17	53,9	65,1	11,2	43,7	55,1	11,4	0,0	
0,18	51,7	64,5	12,8	21,0	54,5	33,5	0,0	

Picture 5: Conducted emission on mains, phase 1 (Table), with 50 Ohm load



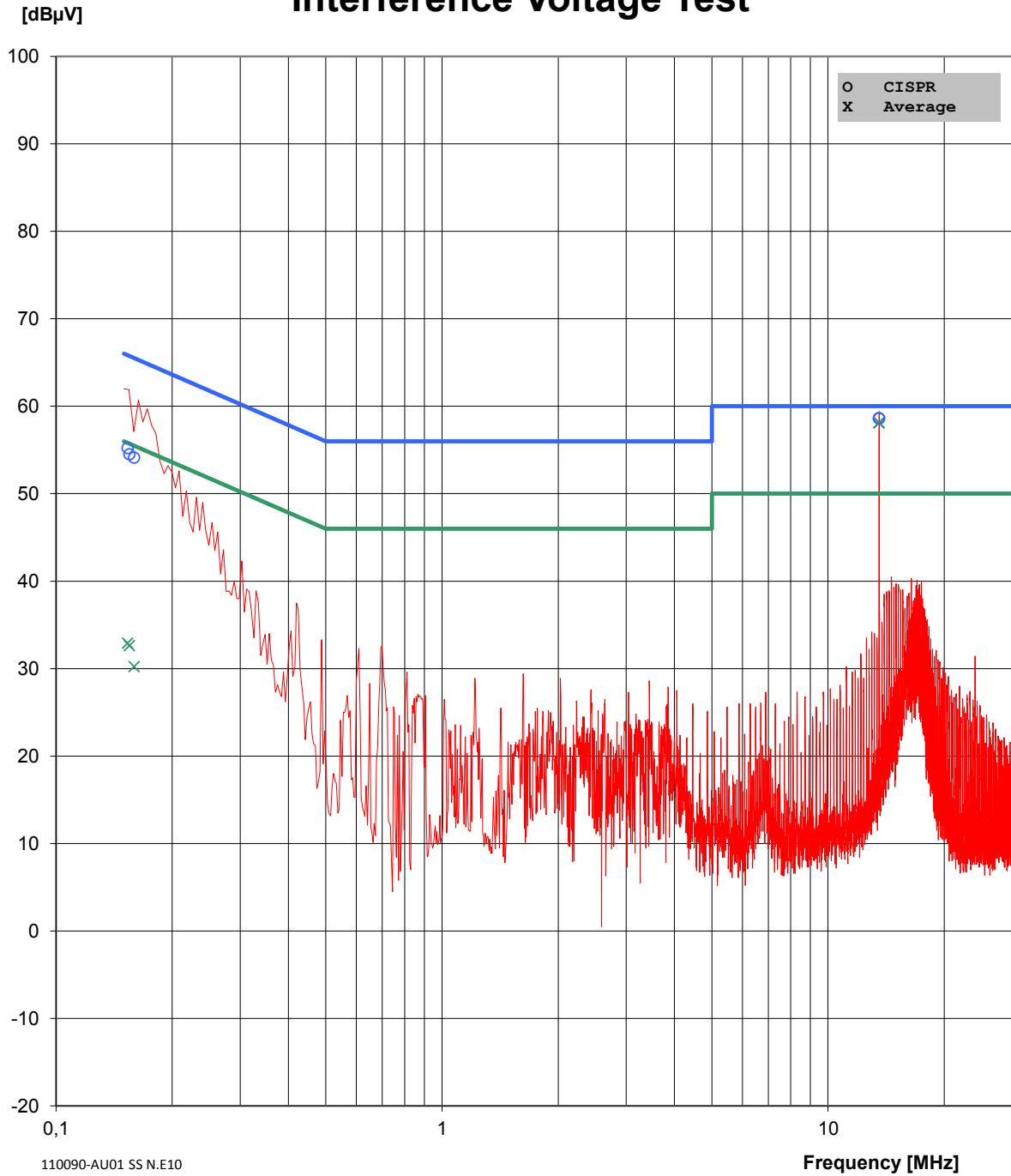
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Page 13 of 29

Interference Voltage Test



Picture 6: Conducted emission on mains, neutral (Chart)

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,16	54,5	66,0	11,5	32,6	56,0	23,4	0,0	110090-AU01 SS N.E10
0,16	54,1	65,8	11,7	30,2	55,8	25,6	0,0	
0,15	55,2	65,3	10,1	32,9	55,3	22,4	0,0	
13,56	58,6	60,0	1,4	58,1	50,0	-8,1	0,0	
13,56	58,6	60,0	1,4	58,1	50,0	-8,1	0,0	
13,56	58,6	60,0	1,4	58,1	50,0	-8,1	0,0	
13,56	58,6	60,0	1,4	58,1	50,0	-8,1	0,0	

Picture 7: Conducted emission on mains, neutral (Table)

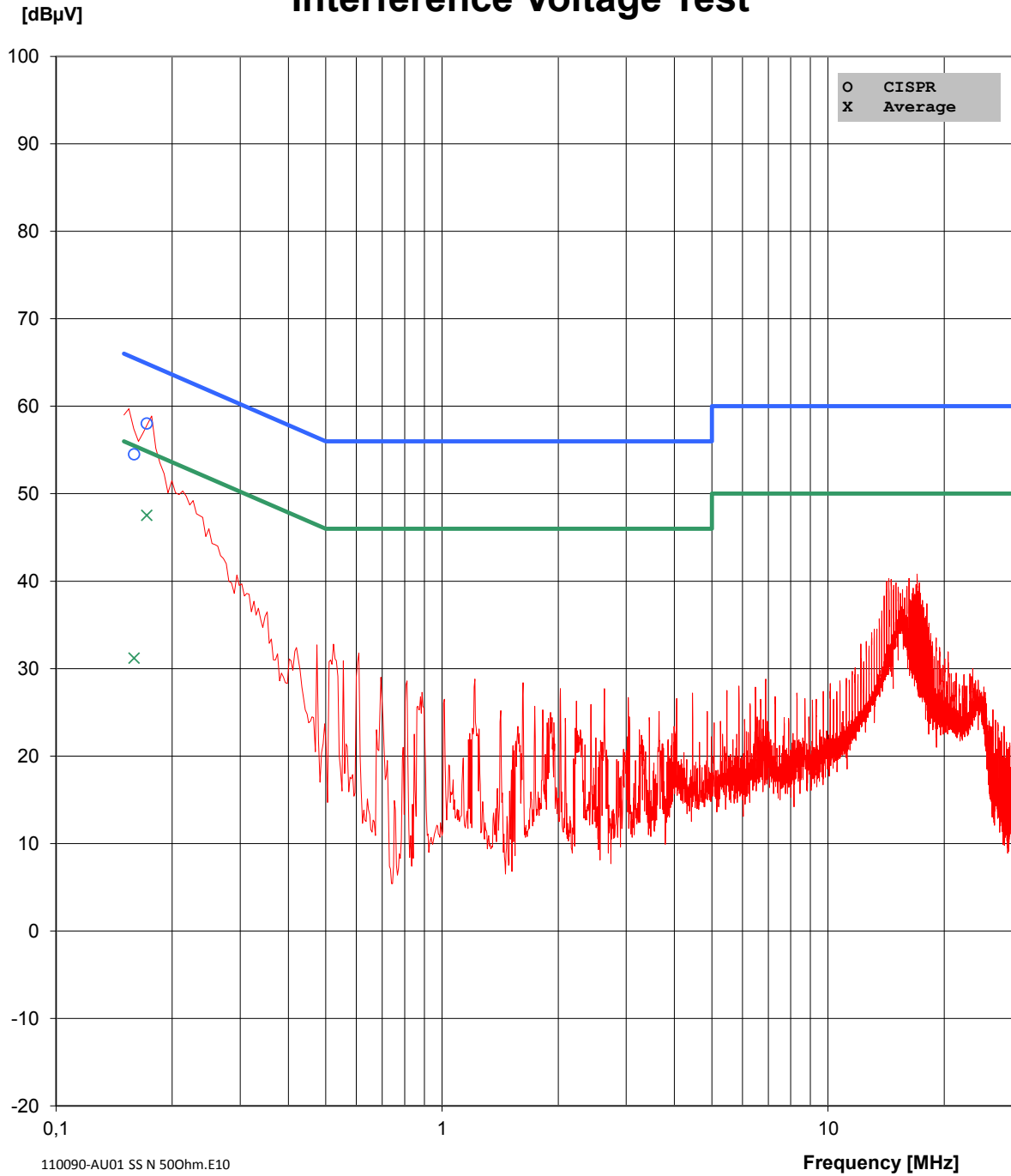


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Interference Voltage Test



Picture 8: Conducted emission on mains, neutral (Chart), with 50 Ohm load

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,16	54,5	65,8	11,3	31,2	55,8	24,6	0,0	110090-AU01 SS N 50Ohm.E10
0,17	58,0	64,6	6,6	47,5	54,6	7,1	0,0	

Picture 9: Conducted emission on mains, neutral (Table), with 50 Ohm load



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Page 17 of 29

5 Radiated emission measurement (<1 GHz)

according to CFR 47 Part 15, section 15.205(a), 15.209(a), 15.247(d)

5.1 Test Location

- Scan with peak detector in 3 m CDC.
- Final CISPR measurement with quasi peak detector on 3 m open area test site.

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open site area	EMV TESTHAUS GmbH	E00354

5.2 Test instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input checked="" type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00012
<input checked="" type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input checked="" type="checkbox"/>	Feedline OATS	Huber & Suhner	200024

5.3 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency [MHz]	Field strength F_s [$\mu\text{V}/\text{m}$]	Field strength [dB $\mu\text{V}/\text{m}$]	Measurement distance d [m]
0.009 – 0.490	266.6 – 4.9	48.5 – 13.8	300
0.490 – 1.705	48.98 – 14.08	33.8 – 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40	3



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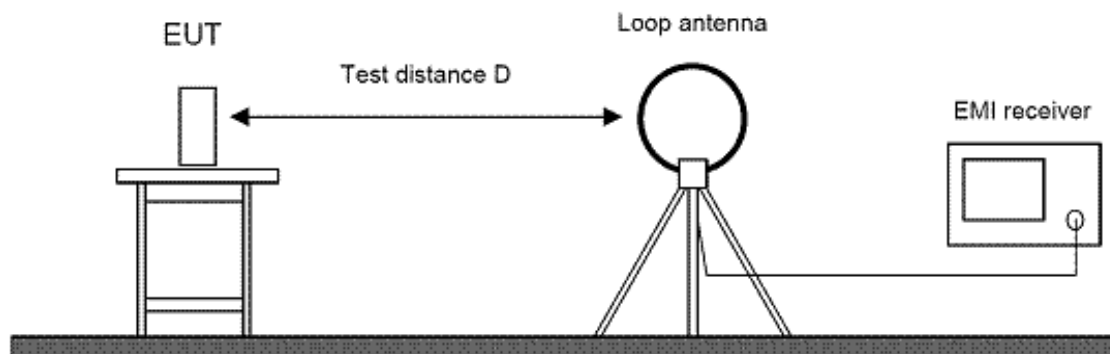
Page 18 of 29

88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

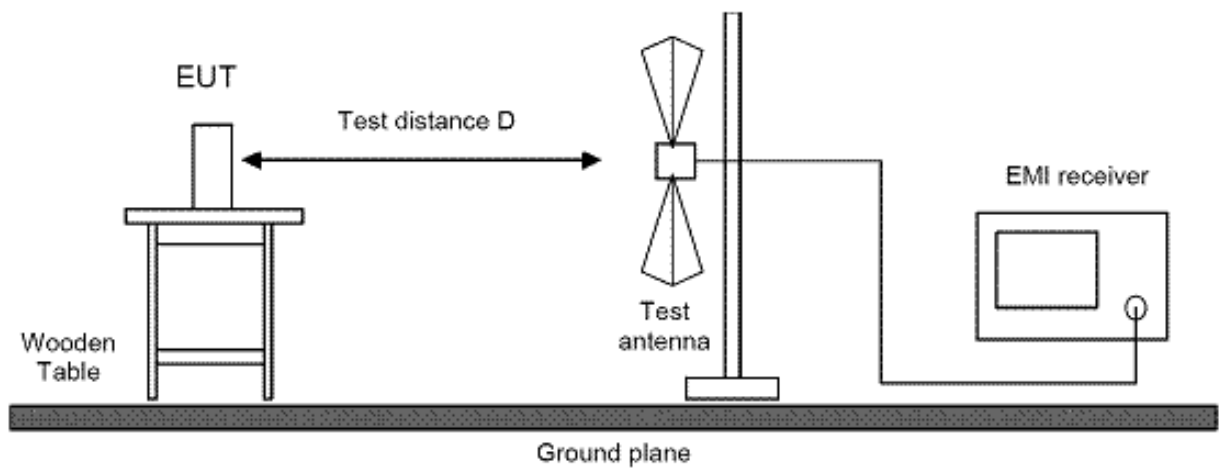
5.4 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a compact diagnostic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna was set to vertical polarization.
4. The EMI receiver performed a scan from 30MHz to 1000MHz with the detector set to peak and the measurement bandwidth to 120 kHz.
5. The turn table was rotated to 6 different positions ($360^\circ / 6$) and the antenna polarization was changed to horizontal.
6. Repeat the test procedure at step 4 and 5.
7. The test setup was then placed in an OATS at 3 m distance and all peak values over or with less distance to limit then 6dB were marked and re-measured with a quasi-peak detector.
8. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
9. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization. The highest value was recorded.
10. For emissions below 30MHz, measurements were done with a loop antenna. The recorded data were measured in QP mode of the receiver. Antenna height was not changed during this test.

5.5 Test setup



Picture 12: Test setup for radiated emission measurement (< 30 MHz)



Picture 13: Test setup for radiated emission measurement (< 1 GHz)

5.6 Test deviation

There is no deviation with the original standard.

5.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

5.8 Test results

Transmit mode

Temperature:	30°C	Humidity:	27%
Tested by:	M. Janker	Test date:	2011-04-21

Radiated Emission Measurement 9 kHz – 30 MHz

Amplitudes of spurious emissions that are attenuated more than 20 dB below the permissible limit are not reported.

Frequency (MHz)	Reading (dB μ V/m)	Detector	Recalculation factor (dB/decade)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin	Result
13,56	52,9	QP	40	12,9	29.54	16,64	PASS

Note:

Measured value = 52,9 dB μ V/m @ 3 m

Recalculation factor = 40 dB / decade

Recalculated value = 52,9 dB μ V/m @ 3 m - 40 dB = **12,9 dB μ V/m @ 30 m**



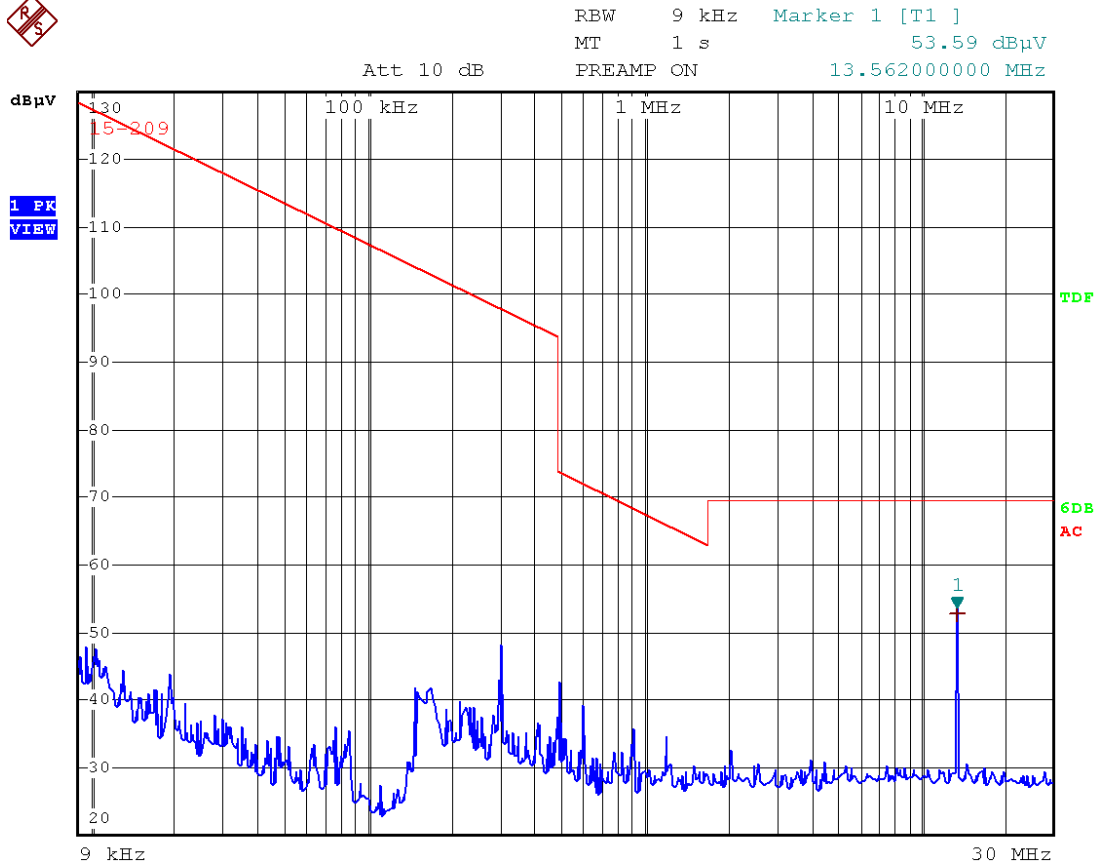
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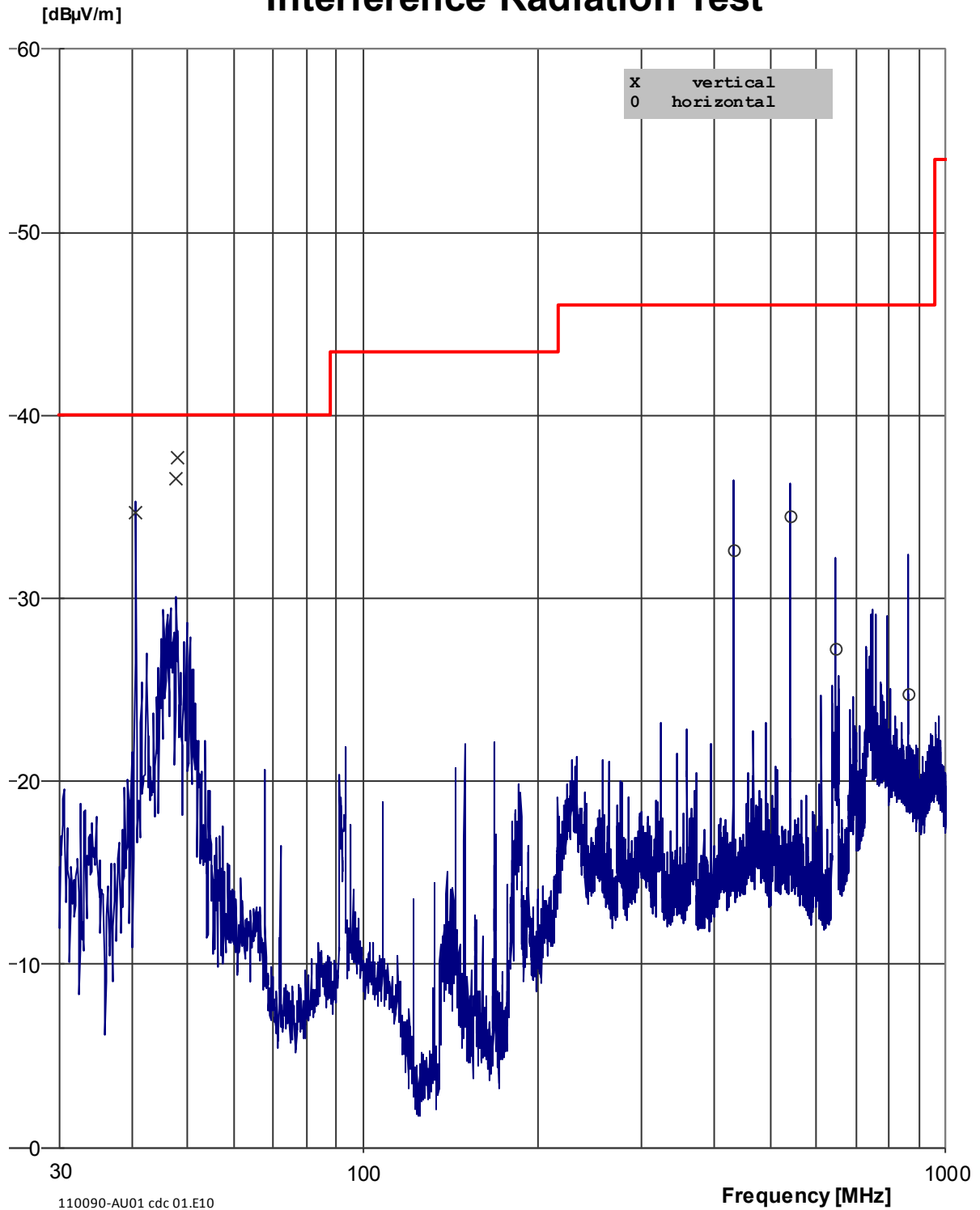
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Page 20 of 29



Picture 14: Radiated emission 9 kHz – 30 MHz (pre-scan, 3 m)

Interference Radiation Test



Picture 15: Radiated emission 30 MHz – 1000MHz



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Page 22 of 29

Interference Radiation Test

Freq. [MHz]	U_Rec [dBµV/m]	Limit [dBµV/m]	Corr. [dB]	U_Ant. [dBµV]	delta_U [dB]	Turn- table	Antenna	Pol.	Remark
40,70	34,7	40,0	14,4	20,3	5,3	222°	100 cm	V	110090-AU01 cdc.01.F10
47,80	36,6	40,0	14,1	22,5	3,4	339°	100 cm	V	
48,00	37,7	40,0	14,1	23,6	2,3	326°	100 cm	V	
432,00	32,7	46,0	17,5	15,1	13,3	148°	250 cm	H	
540,00	34,5	46,0	19,8	14,7	11,5	117°	250 cm	H	
648,00	27,3	46,0	21,4	5,9	18,7	339°	250 cm	H	
864,00	24,8	46,0	24,0	0,8	21,2	239°	250 cm	H	

Picture 16: Radiated emission 30 MHz – 1000MHz (Table)



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 Ed. 2

Page 23 of 29

6 Occupied Bandwidth (99%)

according to RSS Gen Issue 2, section 4.6.1

6.1 Test location

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open site area	EMV TESTHAUS GmbH	E00354

6.2 Test Instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00012
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011
<input checked="" type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input checked="" type="checkbox"/>	Feedline OATS	Huber & Suhner	200024

6.3 Test method to demonstrate compliance

The EUT has no detachable antenna therefore the radiated method was used

If not specified in the applicable RSS the occupied bandwidth is measured as the 99% emission bandwidth.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.



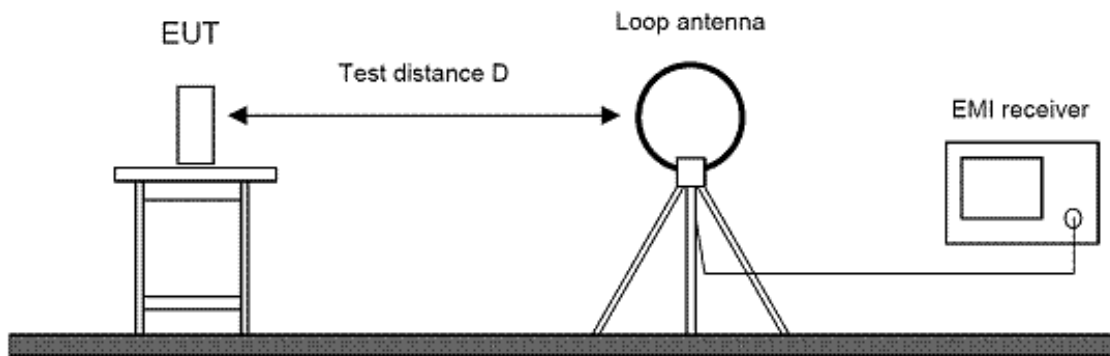
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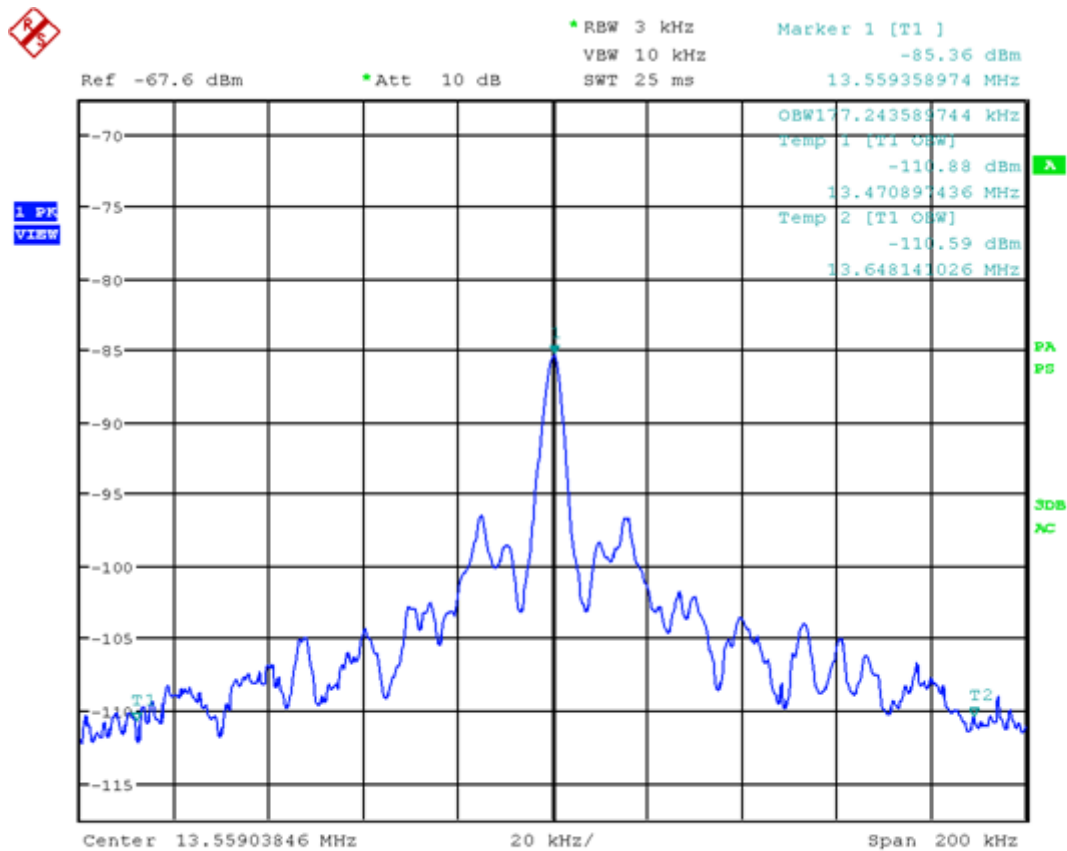
Page 24 of 29

6.4 Test setup



Picture 17: Test setup for radiated emission measurement (< 30 MHz)

6.5 Test results



Picture 18: Occupied bandwidth 99%

Occupied Bandwidth: **177.24kHz**

8 Equipment calibration status

Inventory Number	Model Number	Manufacturer	Last calibration	Next calibration	Cycle of calibration
W00002	ESU26	Rohde & Schwarz	Sep 09	Sep 11	2 Years
E00001	ESCI	Rohde & Schwarz	Sep 09	Mar 11	2 Years
E00003	ESCS 30	Rohde & Schwarz	Oct 10	Oct 12	1 Year
E00004	ESH 2-Z5	Rohde & Schwarz	Jan 11	Jan 13	2 Years
E00005	ESH 2-Z5	Rohde & Schwarz	Sep 09	Sep 11	2 Years
E00060	HFH2-Z2	Rohde & Schwarz	Oct 08	Oct 11	4 Years
E00011	VULB 9160	Schwarzbeck	Sep. 09	Sep. 11	2 Years
E00012	VULB 9163	Schwarzbeck	Mar 11	Mar 12	1 Years
C00015	VC ³ 4034	Vötsch	Aug 10	Aug 14	4 Years

Table 1: Equipment Calibration status



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110090-AU01+W02
 Ed. 2

Page 27 of 29

9 Measurement uncertainty

Description	Max. deviation	k=
Conducted emission AMN (9kHz to 30 MHz)	± 4,0 dB	2
Radiated emission open field (30 MHz to 1 GHz)	± 4,5 dB	2
Radiated emission absorber chamber (> 1000 MHz)	± 5,4 dB	2

Table 2: Measurement uncertainty

Comment: The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. If k=2 the value of the measurements lies within the assigned range of values with a probability of 95 %.



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Elatec Vertriebs GmbH
TWN3 MiFare NFC

110090-AU01+W02
Ed. 2

Page 28 of 29

10 Summary

The EMC Regulations according to the marked specifications are

KEPT

The EUT does fulfill the general approval requirements mentioned.

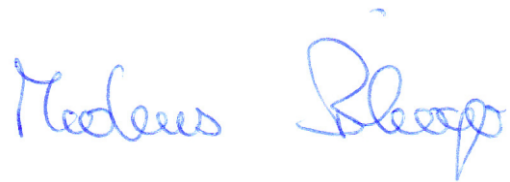
NOT KEPT

The EUT does not fulfill the general approval requirements mentioned.

Place, Date: Straubing, May 04, 2011



Marco Janker
EMI / EMC Test Engineer



Markus Biberger
Technical Executive / EMV **TESTHAUS**
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Page 29 of 29