



InterLab®

Final Report on

N-COM B4 (built into helmet NOLAN N4)

Report Reference: MDE_REDox_1101_FCCb
acc. Title 47 CFR chapter I part 15 subpart B
Date: September 29, 2011

Test Laboratory:

7Layers AG
Borsigstr. 11
40880 Ratingen
Germany

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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Chairman of the Supervisory Board:
Markus Becker
Vorstand • Board:
Dr. H.-J. Meckelburg



Registergericht • registered in:
Düsseldorf, HRB 44096
USt-IdNr • VAT No.:
DE 203159652
TAX No. 147/5869/0385

1 Administrative Data

1.1 Project Data

Project Responsible: Carsten Steinröder
Date Of Test Report: 2011/09/28
Date of first test: 2011/09/07
Date of last test: 2011/09/19

1.2 Applicant Data

Company Name: Opticos srl
Street: via Terzi di S.Agata 2
City: 24030 Brembate di sopra
Country: Italy

Contact Person: Mr. Claudio Corollo
Phone: +39 035 602 285
Fax: +39 035 602 261
E-Mail: c.corollo@nolan.it

1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

7 layers DE

Company Name : 7 layers AG
Street : Borsigstrasse 11
City : 40880 Ratingen
Country : Germany
Contact Person : Mr. Michael Albert
Phone : +49 2102 749 201
Fax : +49 2102 749 444
E Mail : michael.albert@7Layers.de

Laboratory Details

Lab ID	Identification	Responsible	Accreditation Info
Lab 1	Conducted Emissions	Mr. Robert Machulec Mr. Andreas Petz	DAkkS-Registration no. D-PL-12140-01-01
Lab 2	Radiated Emissions	Mr. Robert Machulec Mr. Andreas Petz	DAkkS-Registration no. D-PL-12140-01-01

1.4 Signature of the Testing Responsible



Carsten Steinröder
responsible for tests performed in: Lab 1, Lab 2

1.5 Signature of the Accreditation Responsible

A handwritten signature in blue ink that appears to read "Macduff".

Accreditation scope responsible person
responsible for Lab 1, Lab 2

2 Test Object Data

2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

OUT: N-COM B4 (built into helmet NOLAN N4)

Manufacturer:

Company Name: Please see applicant data

Contact Person: -

Parameter List:

Parameter name	Value
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Ancillary Equipment: AC charger

Manufacturer:

Company Name: AK Technology Co.Ltd.

Street: 3F., No.501-13 Chung-Cheng Rd,

Hsin-Tien

231 Taipei

City: TAIWAN

Country: TAIWAN

Contact Person: -



2.2 Detailed Description of OUT Samples

Sample : a01

<i>OUT Identifier</i>	N-COM B4 (built into helmet NOLAN N4)		
<i>Sample Description</i>	radiated test sample		
<i>HW Status</i>	1.1		
<i>SW Status</i>	1.00		
<i>Date of Receipt</i>	2011/07/20		
<i>Nominal Voltage</i>	5 V	<i>Normal Temp.</i>	20 °C

Sample : AC1

<i>OUT Identifier</i>	AC charger
<i>Sample Description</i>	AC Adaptor Model:AK00G-0500040VU
<i>Date of Receipt</i>	2011/07/20
<i>Low Voltage</i>	100 V
<i>High Voltage</i>	240 V
<i>Nominal Voltage</i>	120 V

Parameter List:

Parameter Description	Value
Parameter for Scope FCC_v2	
AC Power Supply	120 (VAC)

2.3 OUT Features

Features for OUT: AC charger

Designation	Description	Allowed Values	Supported Value(s)
Features for scope: FCC_v2			
AC	The OUT is powered by or connected to AC Mains		

Features for OUT: N-COM B4 (built into helmet NOLAN N4)

Designation	Description	Allowed Values	Supported Value(s)
Features for scope: FCC_v2			
BT	EUT supports Bluetooth data rate of 1 Mbps with GFSK modulation in the band 2400 MHz - 2483.5 MHz		
DC	The OUT is powered by or connected to DC Mains		
EDR2	EUT supports Bluetooth using data rate of 2 Mbps with PI/4 DQPSK modulation in the band 2400 MHz - 2483.5 MHz		
EDR3	EUT supports Bluetooth using data rate of 3 Mbps with 8DPSK modulation in the band 2400 MHz - 2483.5 MHz		
Iant	Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment		
TantC	temporary antenna connector, which may be only built-in for testing, designed as an example part of the equipment		

2.4 Auxiliary Equipment

AE No.	Type Designation	Serial No.	HW Status	SW Status	Description
AE AE2	Flatron L1740BQ	509WANF1W607	-	-	TFT monitor
AE AE5	M-BB48	LZC90505478	-	-	Mouse
AE AE4	PA3378E-3AC3	G71C0006R310	-	-	Laptop AC Adapter
AE AE6	RS 6000	G 0000273 2P28	-	-	Keyboard
AE AE3	TECRA M9	87060248H	-	Windows XP	Laptop

2.5 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

Setup No.	List of OUT samples		List of auxiliary equipment	
	Sample No.	Sample Description	AE No.	AE Description
A01_FCC_AC (AC Mains - AC/DC Charger Setup)				
	Sample: AC1	AC Adaptor Model:AK00G-0500040VU		
	Sample: a01	radiated test sample		
A01_FCC_PC (FCC 15b - Computer Peripheral Setup)				
	Sample: a01	radiated test sample	AE AE2	TFT monitor
			AE AE5	Mouse
			AE AE4	Laptop AC Adapter
			AE AE6	Keyboard
			AE AE3	Laptop

3 Results

3.1 General

Documentation of tested devices:

Available at the test laboratory.

Interpretation of the test results:

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

Note:

Special software used for testing:

The OUT was connected to a PC (via USB) to set the specific test modes. On the PC the Software "BlueTest3" by CSR was used to set the OUT into Bluetooth Test Mode.



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3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

<i>Designation</i>	<i>Description</i>
FCC47CFRChIPART15bRADIO FREQUENCY DEVICES	Part 15, Subpart B - Unintentional Radiators

3.3 List of Test Specification

Test Specification: **FCC part 2 and 15**
Version 10-1-10 Edition
Title: PART 2 - GENERAL RULES AND REGULATIONS
PART 15 - RADIO FREQUENCY DEVICES



Reference: MDE_REDox_1101_FCCb

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3.4 Summary

<i>Test Case Identifier / Name</i>	<i>Result</i>	<i>Date of Test</i>	<i>Lab Ref.</i>	<i>Setup</i>
15b.1 Conducted Emissions (AC Power Line) §15.107				
15b.1; Mode = transmit	Passed	2011/09/19	Lab 1	A01_FCC_AC
	Passed	2011/09/09	Lab 1	A01_FCC_PC
15b.2 Spurious Radiated Emissions §15.109				
15b.2; Mode = transmit	Passed	2011/09/15	Lab 2	A01_FCC_AC
	Passed	2011/09/07	Lab 2	A01_FCC_PC



Reference: MDE_REDox_1101_FCCb

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3.5 Detailed Results

3.5.1 15b.1 Conducted Emissions (AC Power Line) §15.107

Test1: 15b.1; Mode = transmit

Result: Passed

Setup No.: A01_FCC_PC

Date of Test: 2011/09/09 5:26

Body: FCC47CFRChIPART15bRADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

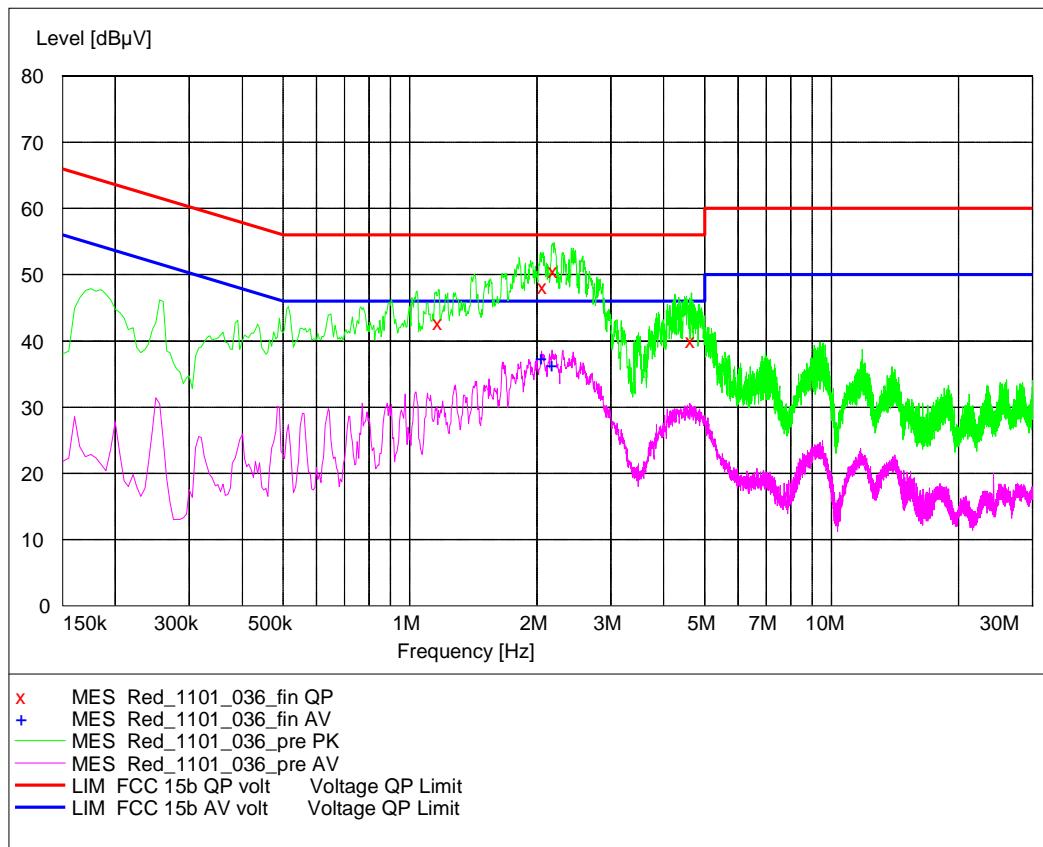
Detailed Results:

AC MAINS CONDUCTED

EUT: Nolan N4 (UH010b03) / 09.09.2011
 Manufacturer: Redox
 Operating Condition: BT TX on 2441 MHz, loopback mode, Packettype: 1-DH1
 Test Site: 7 layers Ratingen
 Operator: Doe
 Test Specification: ANSI C63.4; FCC 15.107 / 15.207
 Comment: computer peripheral setup
 Start of Test: 09.09.2011 / 09:24:41

SCAN TABLE: "FCC Voltage"

Short Description:		FCC Voltage				
Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak	20.0 ms	9 kHz	ESH3-Z5
Average						



MEASUREMENT RESULT: "Red_1101_036_fin QP"

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Line	PE
1.170000	42.80	10.1	56	13.2	N	GND
2.070000	48.20	10.1	56	7.8	L1	GND
2.200000	50.70	10.1	56	5.3	N	GND
4.650000	40.10	10.3	56	15.9	N	FLO

MEASUREMENT RESULT: "Red_1101_036_fin AV"

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Line	PE
2.055000	37.60	10.1	46	8.4	N	GND
2.175000	36.50	10.1	46	9.5	L1	GND



Reference: MDE_REDox_1101_FCCb

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Test1: 15b.1; Mode = transmit

Result: Passed

Setup No.: A01_FCC_AC

Date of Test: 2011/09/19 5:24

Body: FCC47CFRChIPART15bRADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

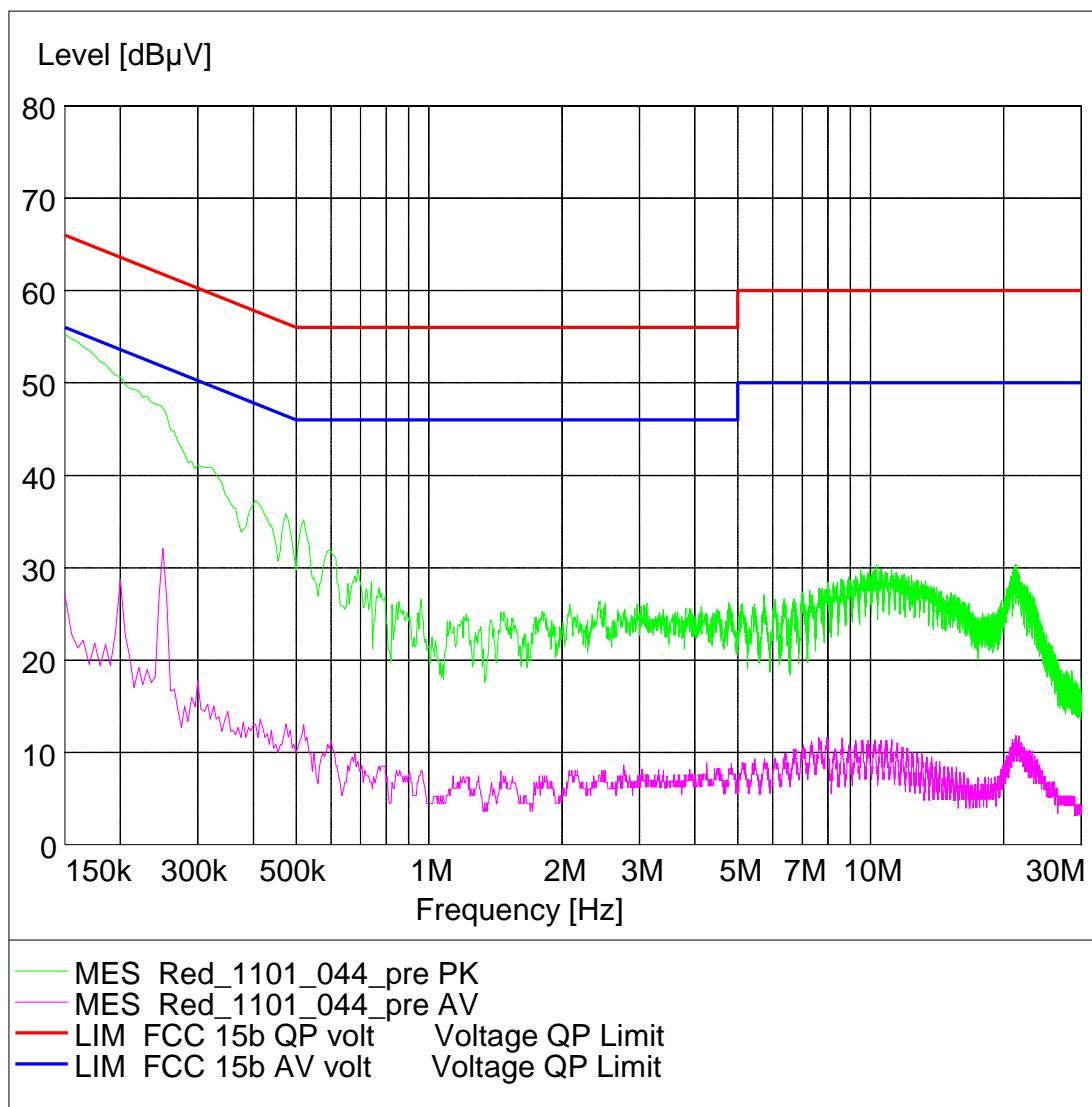
Detailed Results:

AC MAINS CONDUCTED

EUT: Nolan N4 (UH010b03) / 19.09.2011
 Manufacturer: Redox
 Operating Condition: BT normal connection to mobile phone
 Test Site: 7 layers Ratingen
 Operator: Doe
 Test Specification: ANSI C63.4; FCC 15.107 / 15.207
 Comment:
 Start of Test: 19.09.2011 / 12:32:12

SCAN TABLE: "FCC Voltage"

Short Description:			FCC Voltage			
Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak	20.0 ms	9 kHz	ESH3-Z5
Average						





Reference: MDE_REDox_1101_FCCb

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3.5.2 15b.2 Spurious Radiated Emissions §15.109

Test1: 15b.2; Mode = transmit

Result: Passed

Setup No.: A01_FCC_PC

Date of Test: 2011/09/07 5:31

Body: FCC47CFRChIPART15bRADIO FREQUENCY DEVICES

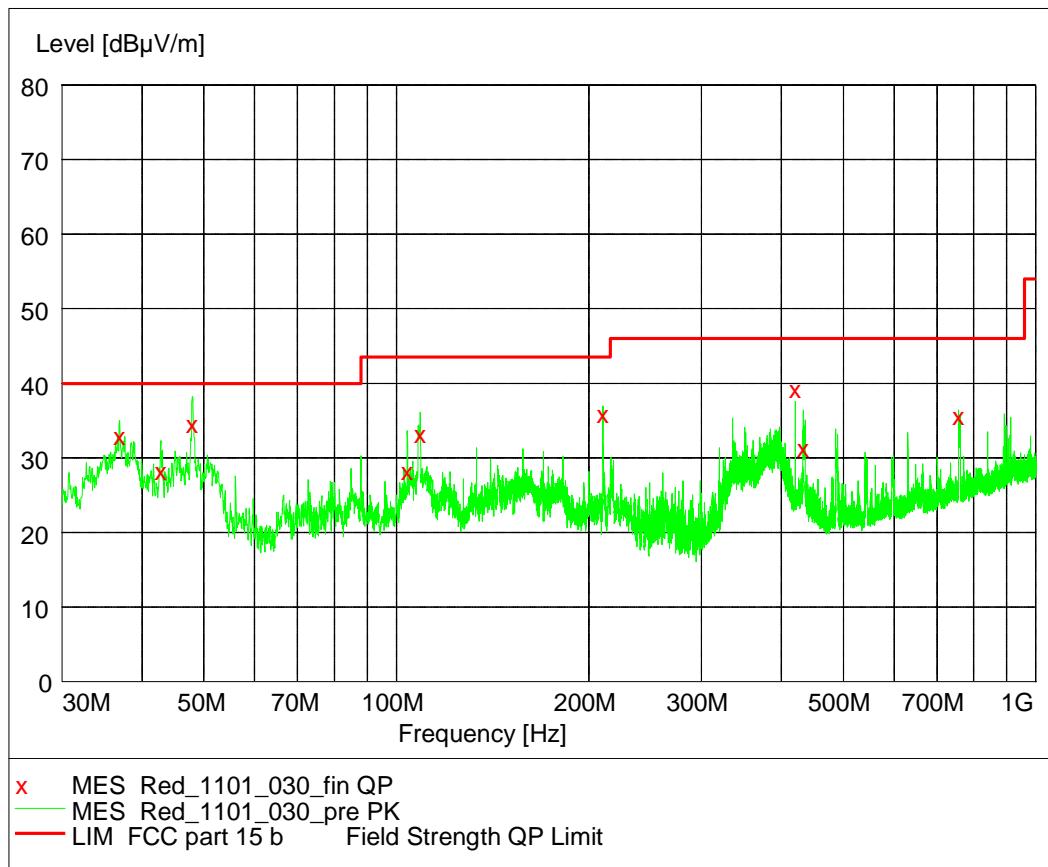
Test Specification: FCC part 2 and 15

Detailed Results:
EMI RADIATED TEST

EUT: Nolan N4 (UH010b03)
 Manufacturer: Redox
 Operating Condition: BT TX on 2441 MHz, loopback mode, 1-DH1
 Test Site: 7 layers, Ratingen
 Operator: Gal
 Test Specification: FCC part 15 b
 Comment: Horizontal EUT position
 Start of Test: 07.09.2011 / 09:09:25

SCAN TABLE: "FCC part 15 b"

Short Description:		FCC part 15 b				
Start Frequency	Stop Frequency	Step Width	Detector	Meas.	IF Time	Transducer
30.0 MHz	1.0 GHz	60.0 kHz	MaxPeak	1.0 ms	120 kHz	HL562


MEASUREMENT RESULT: "Red_1101_030_fin QP"

Frequency MHz	Level dB μ V/m	Transd dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
36.900000	33.20	16.6	40.0	6.8	100.0	284.00	VERTICAL
42.780000	28.40	13.4	40.0	11.6	102.0	247.00	VERTICAL
47.940000	34.80	10.1	40.0	5.2	100.0	157.00	VERTICAL
103.980000	28.40	10.7	43.5	15.1	100.0	202.00	VERTICAL
108.900000	33.40	10.5	43.5	10.1	104.0	0.00	VERTICAL
210.360000	36.20	9.3	43.5	7.3	157.0	93.00	HORIZONTAL
420.780000	39.50	16.1	46.0	6.5	143.0	0.00	VERTICAL
432.540000	31.60	16.4	46.0	14.4	142.0	157.00	VERTICAL
756.960000	35.90	22.1	46.0	10.1	100.0	203.00	VERTICAL



Reference: MDE_REDox_1101_FCCb

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Test1: 15b.2; Mode = transmit

Result: Passed

Setup No.: A01_FCC_AC

Date of Test: 2011/09/15 5:33

Body: FCC47CFRChIPART15bRADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

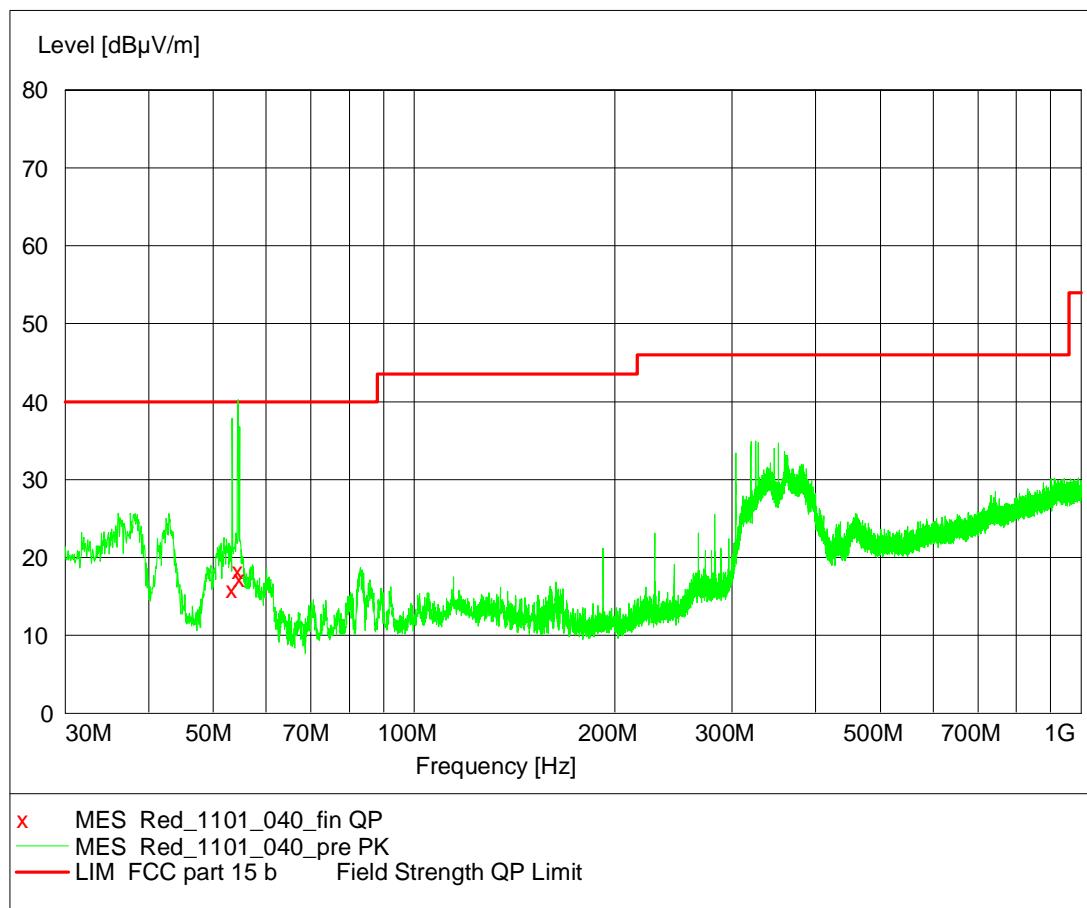
Detailed Results:

EMI RADIATED TEST

EUT: Nolan N4 (UH010b03) / 15.09.2011
 Manufacturer: Redox
 Operating Condition: Charging-mode, connected to mobile-phone
 Test Site: 7 layers, Ratingen
 Operator: Doe
 Test Specification: FCC part 15 b
 Comment: Horizontal EUT position
 Start of Test: 15.09.2011 / 15:27:09

SCAN TABLE: "FCC part 15 b"

FCC part 15 b					
Start Frequency	Stop Frequency	Step Width	Detector	Meas.	IF Transducer
30.0 MHz	1.0 GHz	60.0 kHz	MaxPeak	1.0 ms	120 kHz HL562



MEASUREMENT RESULT: "Red_1101_040_fin QP"

Frequency MHz	Level dB μ V/m	Transd dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
53.400000	15.80	6.6	40.0	24.2	197.0	196.00	VERTICAL
54.480000	18.30	5.9	40.0	21.7	239.0	157.00	VERTICAL
54.780000	17.40	5.7	40.0	22.6	229.0	202.00	VERTICAL

4 Test Equipment Details

4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

Lab ID:	Lab 2
Manufacturer:	Frankonia
Description:	Anechoic Chamber for radiated testing
Type:	10.58x6.38x6 m ³

Single Devices for Anechoic Chamber

Single Device Name	Type	Serial Number	Manufacturer
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m ³ <i>Calibration Details</i>	none	Frankonia <i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18	2011/01/11	2014/01/10
	IC listing 3699A-1 3m	2011/02/07	2014/02/06
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita

Test Equipment Auxiliary Equipment for Conducted emissions

Lab ID:	Lab 1
Manufacturer:	Rohde & Schwarz GmbH & Co.KG
Description:	EMI Conducted Auxiliary Equipment

Single Devices for Auxiliary Equipment for Conducted emissions

Single Device Name	Type	Serial Number	Manufacturer
Cable "LISN to ESI"	RG214 <i>Calibration Details</i>	W18.03+W48.03	Huber&Suhner <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration	2010/11/06	2011/11/05
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG
Two-Line V-Network	ESH 3-Z5 <i>Calibration Details</i>	829996/002	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration	2008/10/13	2011/10/12
	DKD calibration	2011/01/20	2013/01/19

Test Equipment Auxiliary Equipment for Radiated emissions
Lab ID:

Description:

Serial Number:

Lab 2

Equipment for emission measurements

see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AS 620 P	620/37	HD GmbH
Biconical dipole	VUBA 9117 <i>Calibration Details</i>	9117-108	Schwarzbeck <i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2008/10/27 2013/10/26
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P <i>Calibration Details</i>	849785	Miteq <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4 <i>Calibration Details</i>	-	Miteq <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P <i>Calibration Details</i>	896037	Miteq <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
Cable "ESI to EMI Antenna"	EcoFlex10 <i>Calibration Details</i>	W18.01- 2+W38.01-2	Kabel Kusch <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
Cable "ESI to Horn Antenna"	UFB311A+UFB293C <i>Calibration Details</i>	W18.02- 2+W38.02-2	Rosenberger Micro-Coax <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
Double-ridged horn	HF 906 <i>Calibration Details</i>	357357/001	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/04/16 2012/04/15
Double-ridged horn	HF 906 <i>Calibration Details</i>	357357/002	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/04/28 2012/04/27
High Pass Filter	4HC1600/12750-1.5-KK <i>Calibration Details</i>	9942011	Trilithic <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
High Pass Filter	5HC2700/12750-1.5-KK <i>Calibration Details</i>	9942012	Trilithic <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
High Pass Filter	5HC3500/12750-1.2-KK <i>Calibration Details</i>	200035008	Trilithic <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10
High Pass Filter	WHKX 7.0/18G-8SS <i>Calibration Details</i>	09	Wainwright <i>Last Execution</i> <i>Next Exec.</i>
	Path Calibration		2011/05/11 2011/11/10



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Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/05/27 2012/05/26
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration		2008/10/07 2011/10/06
Network Analyzer	E5071B	MY42200813	Agilent
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2010/11/09 2011/11/09
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH

Test Equipment Auxiliary Test Equipment

Lab ID:	Lab 2
Manufacturer:	see single devices
Description:	Single Devices for various Test Equipment
Type:	various
Serial Number:	none

Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/10/07 2011/10/06
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co. KG



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Test Equipment Digital Signalling Devices

Lab ID:

Lab 1, Lab 2

Description:

Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer
Bluetooth Signalling Unit CBT	CBT	100589	Rohde & Schwarz GmbH & Co. KG
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
<i>HW/SW Status</i>			
Hardware:		2007/07/16	
B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04			
Software:			
K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22			
Firmware:			
µP1 8v50 02.05.06			
<i>---</i>			
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			
Standard calibration		2008/12/01	2011/11/30
<i>HW/SW Status</i>			
HW options:		2007/01/02	
B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02			
SW options:			
K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10,			
Firmware:			
µP1 8v40 01.12.05			
<i>---</i>			
SW:		2008/11/03	
K62, K69			

Test Equipment Emission measurement devices

Lab ID: **Lab 1, Lab 2**
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer
Personal Computer	Dell	30304832059	Dell
Power Sensor	NRV-Z1	836219/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/10/20 2011/10/19
Powermeter	NRVS	836333/064	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/10/15 2011/10/14
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/12/03 2011/12/02

Test Equipment Shielded Room 02

Lab ID: **Lab 1**
Manufacturer: Frankonia
Description: Shielded Room for conducted testing
Type: 12 qm
Serial Number: none

4.2 Laboratory Environmental Conditions

Laboratory	Date	Temperature	Humidity	Air Pressure
Lab 1	2011/09/09	25 °C	44 %	1005 hPa
	2011/09/19	23 °C	48 %	1004 hPa
Lab 2	2011/09/07	25 °C	40 %	1003 hPa
	2011/09/15	25 °C	40 %	1016 hPa



Reference: MDE_REDOX_1101_FCCb

acc. Title 47 CFR chapter I part 15 subpart B

5 Annex

5.1 Additional Information for Report

Test Description

Conducted emissions (AC power line)

Standard FCC Part 15 Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009. The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50 μ H || 50 Ohm Line Impedance Stabilization Network (LISN) which meets the requirements of ANSI C63.4-2009, Annex B, in the frequency range of the measurements. The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.

Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.107, Class B Limit

Frequency Range (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

FCC Part 15, Subpart B, §15.107, Class A Limit

Frequency Range (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V)
0.15 - 0.5	79	66
0.5 - 30	73	60

Used conversion factor: Limit (dB μ V) = 20 log (Limit (μ V)/1 μ V).

NOTES:

A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

The chosen operating mode is selected as representative mode to generate "worst-case" conditions, i.e. high power consumption.

 Spurious radiated emissions

Standard FCC Part 15, Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description

Measurement below 1 GHz:

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009.

The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The test was performed at the distance of 3 m between the EUT and the receiving antenna. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The radiated emissions measurements were made in a typical installation configuration. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition.

Step 1: Preliminary scan (test to identify the highest amplitudes relative to the limit)

Intention of this step is, to determine the radiated EMI-profile of the EUT.

Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 μ s
- Turntable angle range: -180° to $+180^\circ$
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2:

A further measurement will be performed on the frequencies determined in step 1. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

Settings for step 2:

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -180° to $+180^\circ$
- Turntable step size: 45°
- Height variation range: 1 – 4 m

- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by +/- 22.5° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/- 25 cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range: -22.5° to +22.5° around the determined value
- Height variation range: -0.25 m to +0.25 m around the determined value

Step 4: Final measurement (with QP detector)

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak(< 1GHz)
- Measured frequencies: in step 3 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

Measurement above 1 GHz:

The following modifications apply to the measurement procedure for the frequency range above 1 GHz: The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse-linear-distance-squared for the power density measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz) are used, the steps 2-4 as described before, are omitted. Step 1 was performed at one height of the receiving antenna only.

Detector: Peak, Average (simultaneously)

RBW = VBW = 1 MHz; above 7 GHz 100 kHz

Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.109, Radiated Emission Limits
 Frequency Range (MHz): Class B Limit (dB μ V/m)

Frequency Range (MHz)	Class B Limit (dB μ V/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Frequency Range (MHz)	Class A Limit (dB μ V/m) / @ 3m !
30 - 88	49.5
88 - 216	54.0
216 - 960	56.9
above 960	60.0

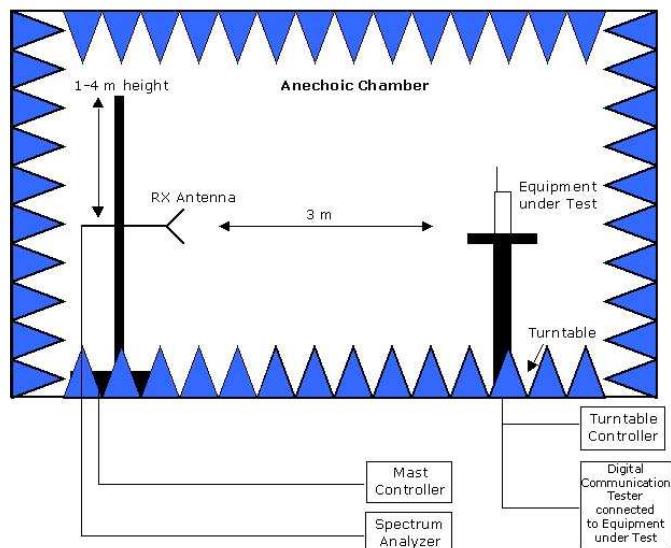
§15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

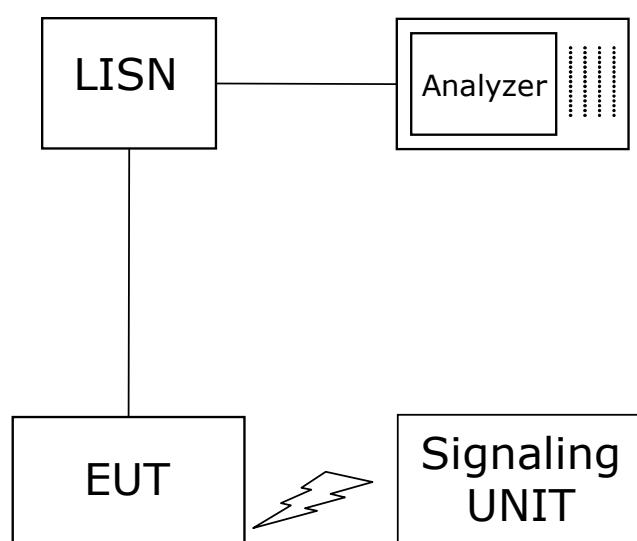
Used conversion factor: Limit (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)

NOTE: A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

Setup Drawings



Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.



Setup in the shielded room for conducted measurements at AC mains port



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