

Company: Clear Systems GmbH
Schweinthal 25
D- 91349 Egloffstein

Device under Test: μ -controller board
Type: Andino X1
Serial number: EMC sample
S-Team internal number: 20160428-1

Attending the test:

Clear Systems GmbH : Mr. Leufgen
S-TEAM Elektronik GmbH : Mr. Melkuhn

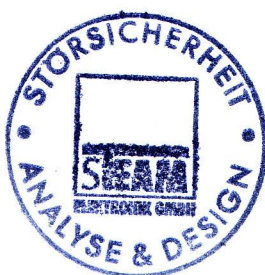
Test date: 28/04/2016

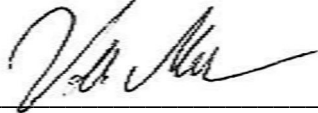
The examinations were made according to the Generic Standard

DIN EN 61000-6-2: 2005 (according to **VDE 0839 part 6-2** / March 2006), and

DIN EN 61000-6-3: 2007+ A1: 2011 (according to **VDE 0839 part 6-3** / September 2011)

Results: See results of individual measurements on pages 42 to 58
standard are informativ only.




Responsible Official **V. Melkuhn**


Lab Supervisor **M. Hartmann**

Untereisesheim, 2016-05-10

THE TEST RESULTS IN THIS REPORT RELATE EXCLUSIVELY TO THE PRODUCT PRESENTED FOR THE TEST.
THERE CANNOT BE TAKEN ANY RESPONSIBILITY FOR CONCLUSIONS AND GENERALIZATIONS BASED ON THE TEST RESULTS FOR
OTHER SPECIMEN OR SAMPLES REPRESENTING THE SAME TYPE AS THE TESTED PRODUCT. THIS TEST REPORT MUST NOT BE
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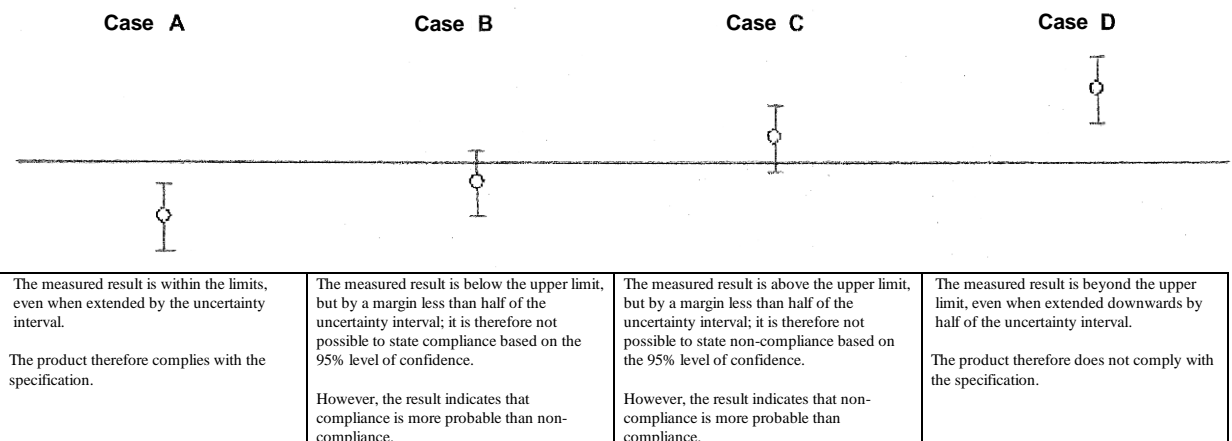
1. Environment

Vicinity temperature	:	$(23 \pm 5)^{\circ} \text{C}$
Atmospheric humidity	:	30 - 60 %
Atmospheric pressure	:	860 - 1060 mbar

The exact values are recorded continuously and can be delivered if requested.

2. Measurement uncertainty

All measurement results are subordinated to uncertainty components. All measurement uncertainties are defined as the range which is assumed to contain the real value with a quoted probability. This probability lies at 95% in usually quoted measurement uncertainty (so called measurement uncertainty with $k=2$)



○ = Measured results
┌ = Uncertainty interval

Test location	Measurement uncertainty
Electrostatic discharge (ESD)	$\pm 10 \%$ of test level
Radiated electromagnetic field	$\pm 13 \%$ of test level
Fast transient disturbances (BURST)	$\pm 10 \%$ of test level
SURGE	$\pm 10 \%$ of test level
High frequent uncoupled emissions	$\pm 25 \%$ of test level
Magnetic field	$\pm 10 \%$ of test level
Voltage variations	$\pm 5 \%$ of test level
Voltage dips, short interruptions	$\pm 5 \%$ of test level
Conducted emissions 9 kHz to 150 kHz	4,3 dB
150kHz to 30 MHz	3,9 dB
Radiated emissions field strength 9 kHz to 1000 MHz at 3m distance	6 dB

3. Description and name of examinee

Indication of device under test : **μ-controller board**
Type : **Andino X1**
Serial number : EMC sample
S-Team internal number : 20160428-1
Status of device under test : serial sample
Supply voltage : 24 VDC
Power : <75 W / 0.2 A
Highest internal switching frequency : <9 kHz
Reaction time of device under test : <1 sec.
Dimensions : Length 200 mm width 200 mm depth 30 mm
Modifications : none

Picture of device under test:



4. Indication of test specification

Emission measurements according to DIN EN 61000-6-3 part 6-3: 2007+ A1: 2011
Emission standard for residential, commercial and light-industrial environments
according to VDE 0839 part 6-3 / September 2011

Used partly-standards

Radiated field strength / conducted emissions
DIN EN 55022: 2011 according to **VDE 0875 part 22** of 12.2011

Immunity measurements according to EN 61000-6-2: 2005 part 6-2:2005
Generic standards emission standard for industrial environments (IEC 61000-6-2: 2005)
according to VDE 0839 part 6-2 / June 2011

Used partly-standards

Immunity ESD
DIN EN 61000-4-2: 2009 according to **VDE 0847 part 4-2** of 12.2009

Immunity radiated electromagnetic fields
DIN EN 61000-4-3: 2006+A1:2008+ A2: 2010 according to **VDE 0847 part 4-3** of 04.2011

Immunity Burst
DIN EN 61000-4-4: 2012 according to **VDE 0847 part 4-4** of 04.2013

Immunity Surge
DIN EN 61000-4-5: 1995 +A1: 2014 according to **VDE 0847 part 4-5** of 03.2015

Immunity high frequent uncoupled emission
DIN EN 61000-4-6: 2014 according to **VDE 0847 part 4-6** of 08.2014

Immunity magnetic fields
DIN EN 61000-4-8: 2010 according to **VDE 0847 part 4-8** of 11.2010

5. Changes, additions and confinements other than the test specification

none

6. Order of measurements

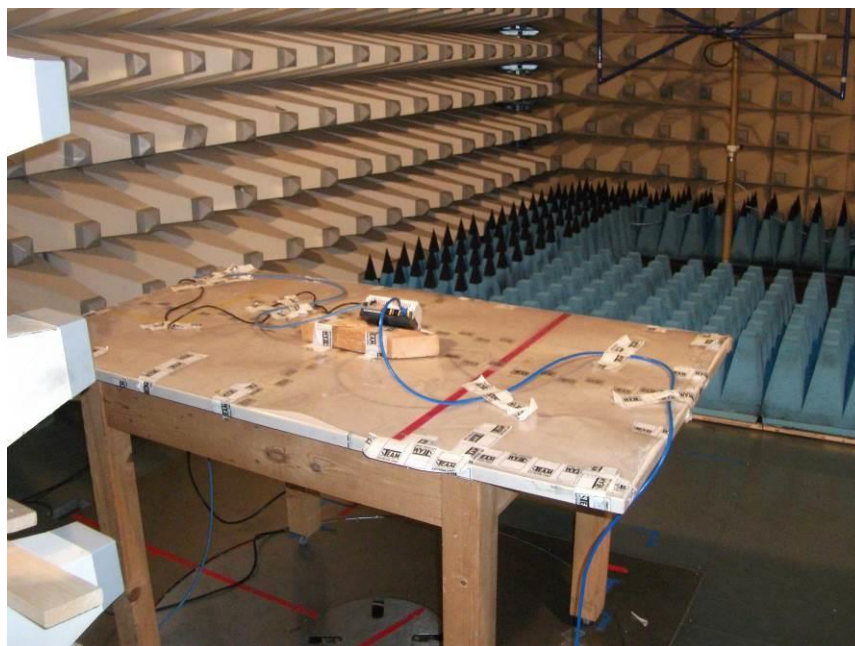
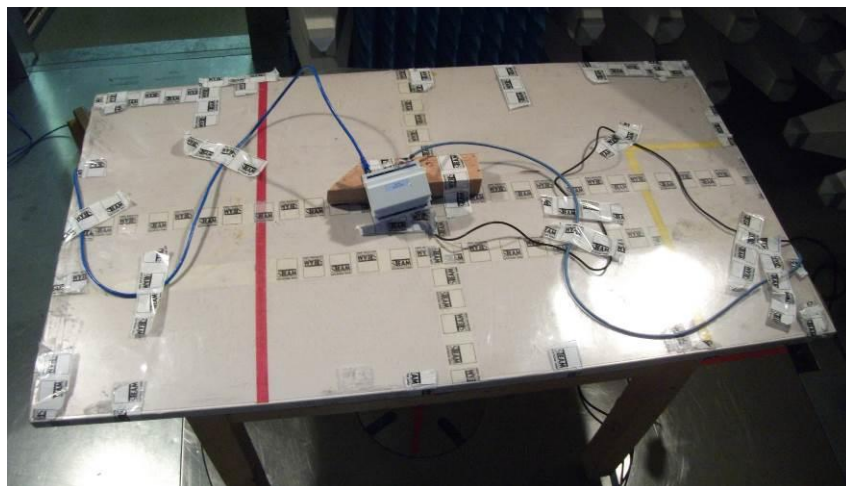
1. Immunity to radiated electromagnetic fields
2. Immunity to high frequent uncoupled emissions
3. Immunity to fast transient disturbances (Burst)
4. Immunity to magnetic fields with energy technical frequencies
5. Radiated emissions field strength
6. Conducted emissions
7. Immunity to electrostatic discharge (ESD)
8. Immunity to surge

7. Emissions

7.1 Radiated emissions field strength

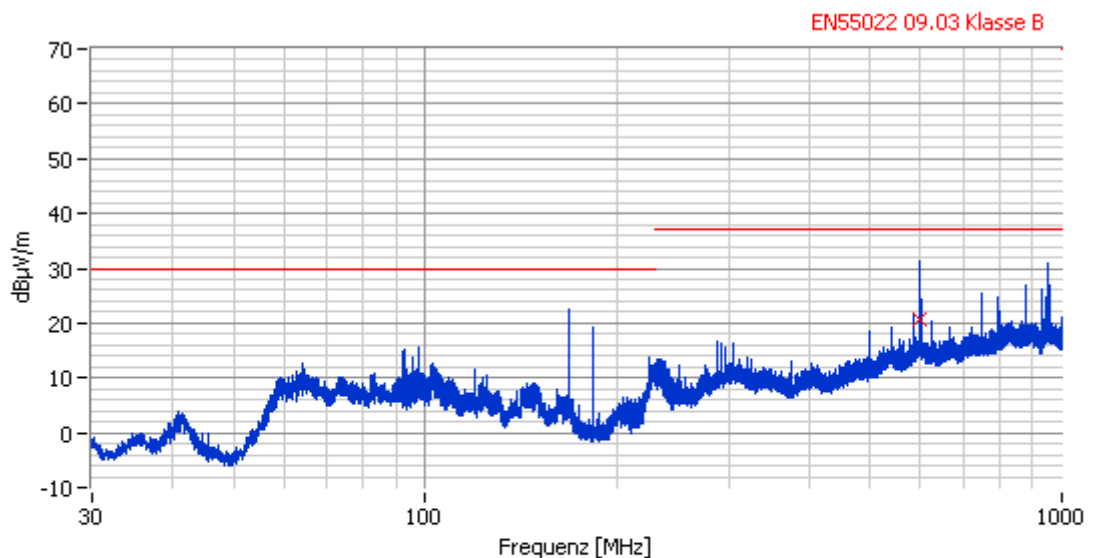
Test specification	:	DIN EN 55022: 2011 according to VDE 0875 part 22 of 12.2011
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Frequency range	:	30 MHz ó 1000 MHz
Bandwidth	:	ZF: 120 kHz
Work status	:	<ul style="list-style-type: none">- standard mode- power supply: 24 VDC- Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1- Testscript: Receive Data from Atmel Print Data to ssh Console- Atmel Controller:- Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Measurement setup	:	desktop device, panel directed towards the antennae
Modification	:	see page 4

Measurement setup:



Radiated emissions ó horizontal

Company : **Clear Systems GmbH**
Device under test : **Andino X1**
Work status : see page 7
Test pattern : radiated field strength in dB μ V/m
Frequency range : 30 ó 1000 MHz
Detector : peak
Polarization : horizontal



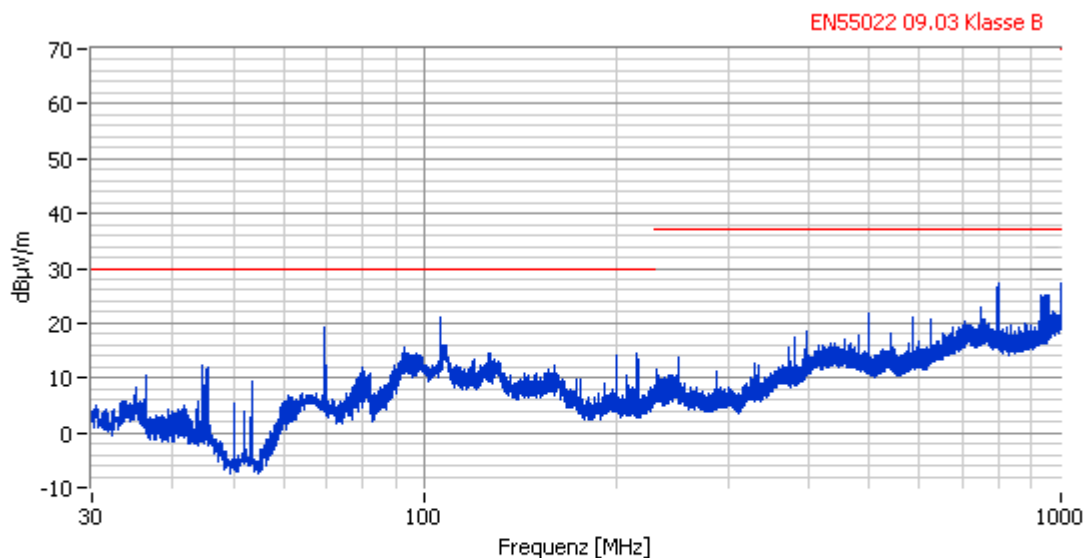
Frequenzband:	30.00MHz - 1000.00MHz	Prüfmittel:	Logper horizontal
Schrittweite:	50,0E+3 Hz	Datum:	28.04.2016
Verweildauer:	5 ms	Uhrzeit:	08:44
Detektor:	Peak	Prüfer:	V. Melkuhn
Messdatei:	E:\EMVTEST\CLEAR SYSTEMS\160428\FSSstrahlung001\30,00MHz-1000,		

Test result:

Limit value of basic standard according to EN 55022 B, is passed with peak ó detector in this frequency range.

Radiated emissions ó vertical

Company : **Clear Systems GmbH**
Device under test : **Andino X1**
Work status : see page 7
Test pattern : radiated field strength in dBµV/m
Frequency : 30 ó 1000 MHz
Detector : peak
Polarization : vertical



Frequenzband:	30.00MHz - 1000.00MHz	Prüfmittel:	Logper vertikal
Schrittweite:	50,0E+3 Hz	Datum:	28.04.2016
Verweildauer:	5 ms	Uhrzeit:	08:41
Detektor:	Peak	Prüfer:	V. Melkuhn
Messdatei:	E:\EMVTEST\CLEAR SYSTEMS\160428\F55strahlung001\30,00MHz-1000,		

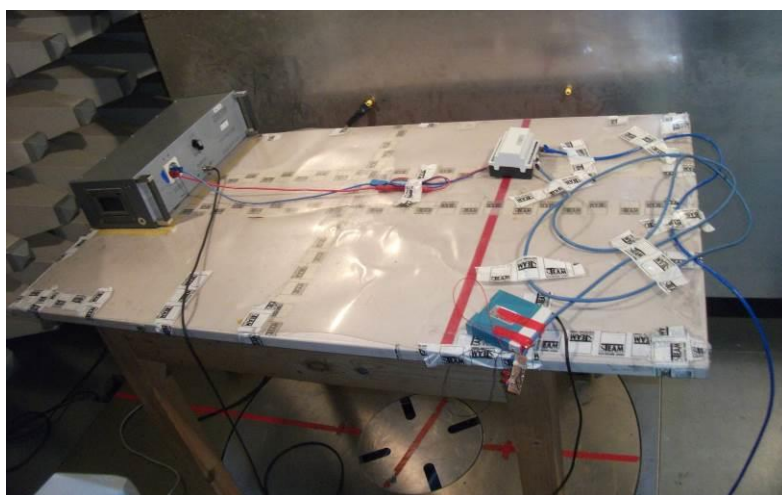
Test result:

Limit value of basic standard according to EN 55022 B, is passed with peak ó detector in this frequency range.

7.2 Conducted emissions to power supply ports

Test specification	:	DIN EN 55022: 2011 according to VDE 0875 part 22 of 12.2011
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Frequency range	:	150 kHz ó 30 MHz
Bandwidth	:	ZF: 9 kHz / Video: 30 kHz
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to ssh Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Measurement setup	:	desktop device
Modification	:	see page 4 C14 instead of 100nF now 1µF Common mode choke Würth: L4 instead of Würth 744206 now 744272121

Measurement setup:



Conducted emissions

Date : 28/04/2016

Company : **Clear Systems GmbH**

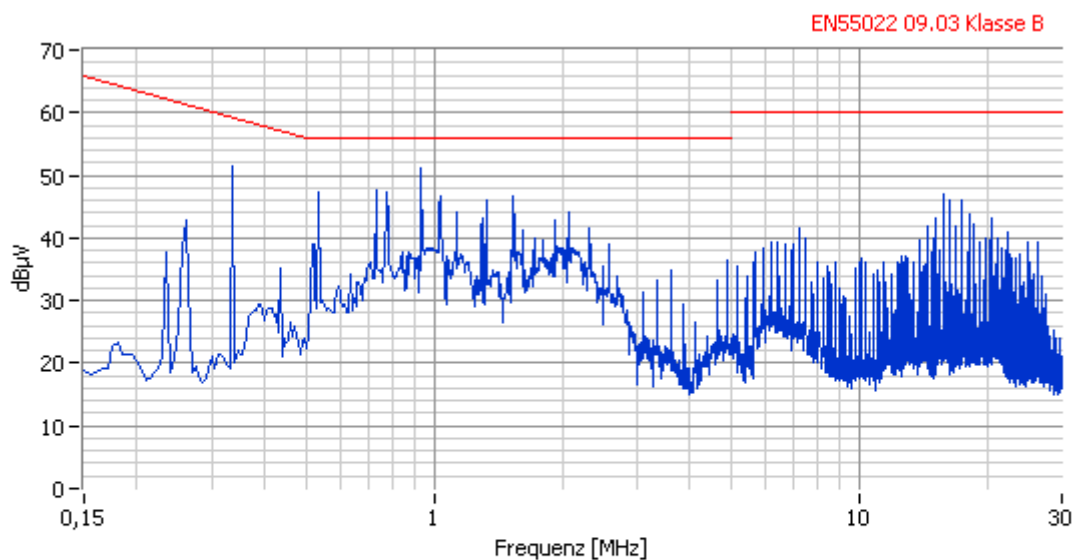
Device under test : **Andino X1**

Work status : see page 11

Test pattern : conducted emissions (+Ub) in dB μ V

Frequency range : 150 kHz ó 30 MHz

Detector : peak



Frequenzband:	0.15MHz - 30.00MHz	Prüfmittel:	BNN_Ind
Schrittweite:	5,0E+3 Hz	Datum:	28.04.2016
Verweildauer:	50 ms	Uhrzeit:	11:10
Detektor:	Peak	Prüfer:	V. Melkuhn
Messdatei:	E:\EMVTEST\CLEAR SYSTEMS\160428\F55pannung001\0,15MHz-30,00MHz__001.PEAK		

Test result:

Limit value of basic standard according to EN 55022 B, is passed with peak ó detector in this frequency range.

Conducted emissions

Date : 28/04/2016

Company : **Clear Systems GmbH**

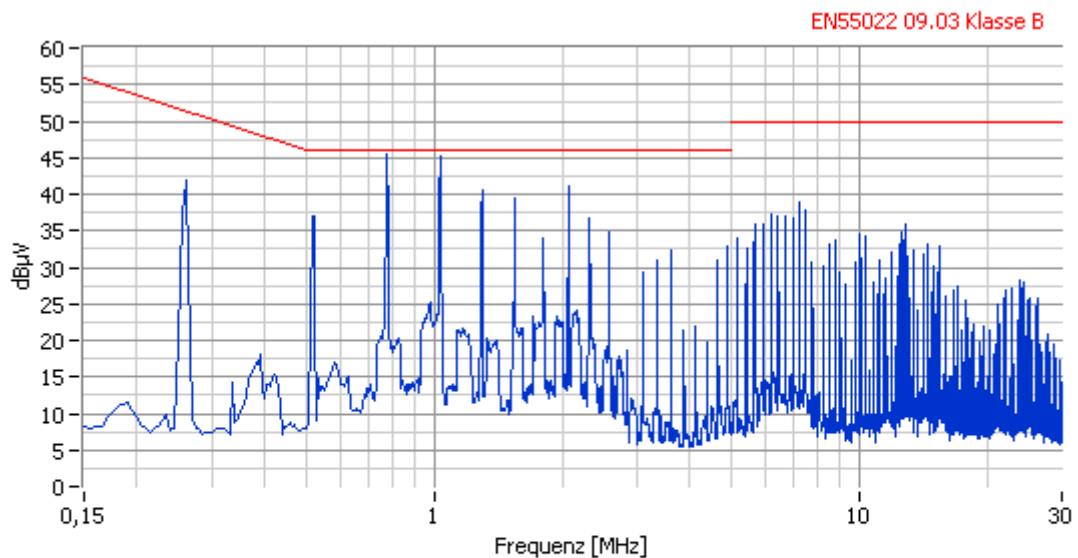
Device under test : **Andino X1**

Work status : see page 11

Test pattern : conducted emissions (+Ub) in dB μ V

Frequency range : 150 kHz ó 30 MHz

Detector : average



Frequenzband:	0.15MHz - 30.00MHz	Prüfmittel:	BNN_Ind
Schrittweite:	5,0E+3 Hz	Datum:	28.04.2016
Verweildauer:	50 ms	Uhrzeit:	11:10
Detektor:	Average	Prüfer:	V. Melkuhn
Messdatei:	E:\EMVTEST\CLEAR SYSTEMS\160428\F55spannung001\0,15MHz-30,00MHz__001.AVG		

Test result:

Limit value of basic standard according to EN 55022 B, is passed with average ó detector in this frequency range.

Conducted emissions

Date : 28/04/2016

Company : **Clear Systems GmbH**

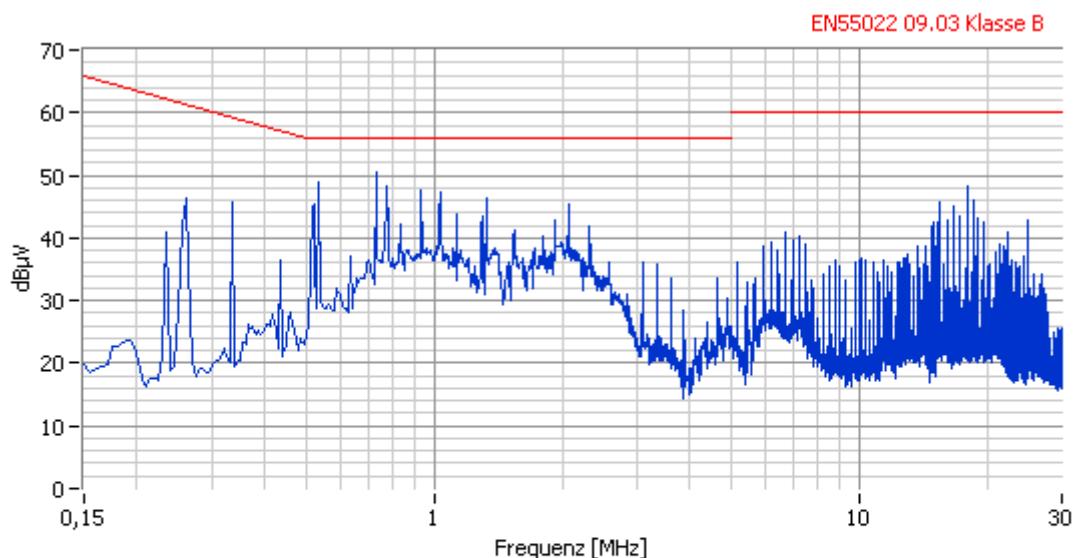
Device under test : **Andino X1**

Work status : see page 11

Test pattern : Conducted emissions (GND) in dB μ V

Frequency range : 150 kHz ó 30 MHz

Detector : peak



Frequenzband:	0.15MHz - 30.00MHz	Prüfmittel:	BNN_Ind
Schrittweite:	5,0E+3 Hz	Datum:	28.04.2016
Verweildauer:	50 ms	Uhrzeit:	11:16
Detektor:	Peak	Prüfer:	V. Melkuhn
Messdatei:	E:\EMVTEST\CLEAR SYSTEMS\160428\F55pannung001\0,15MHz-30,00MHz__002.PEAK		

Test result:

Limit value of basic standard according to EN 55022 B, is passed with peak ó detector in this frequency range.

Conducted emissions

Date : 28/04/2016

Company : **Clear Systems GmbH**

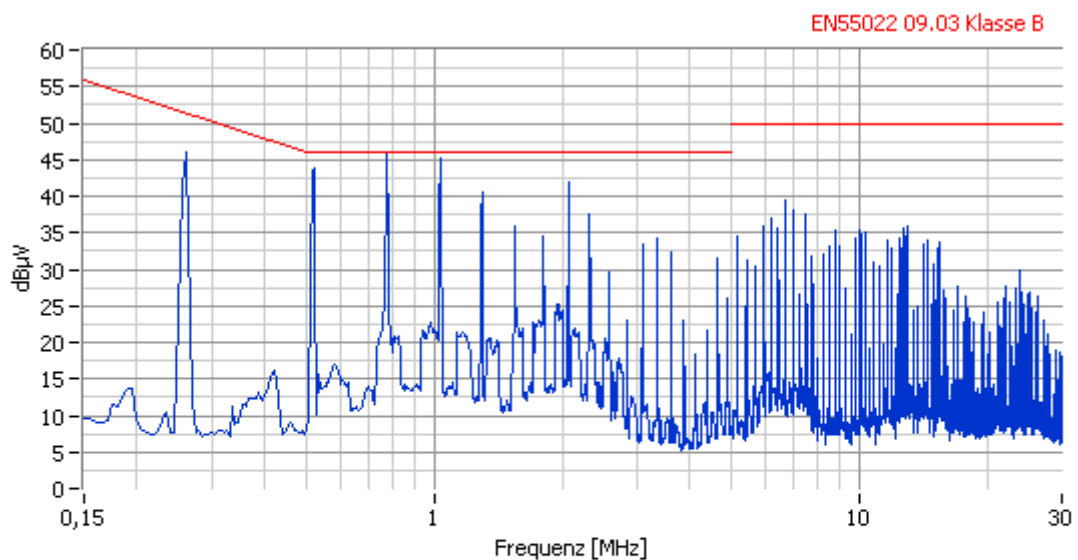
Device under test : **Andino X1**

Work status : see page 11

Test pattern : Conducted emissions (GND) in dB μ V

Frequency range : 150 kHz ó 30 MHz

Detector : average



Frequenzband:	0.15MHz - 30.00MHz	Prüfmittel:	BNN_Ind
Schrittweite:	5,0E+3 Hz	Datum:	28.04.2016
Verweildauer:	50 ms	Uhrzeit:	11:16
Detektor:	Average	Prüfer:	V. Melkuhn
Messdatei:	E:\EMVTEST\CLEAR SYSTEMS\160428\F55spannung001\0,15MHz-30,00MHz__002.AVG		

Test result:

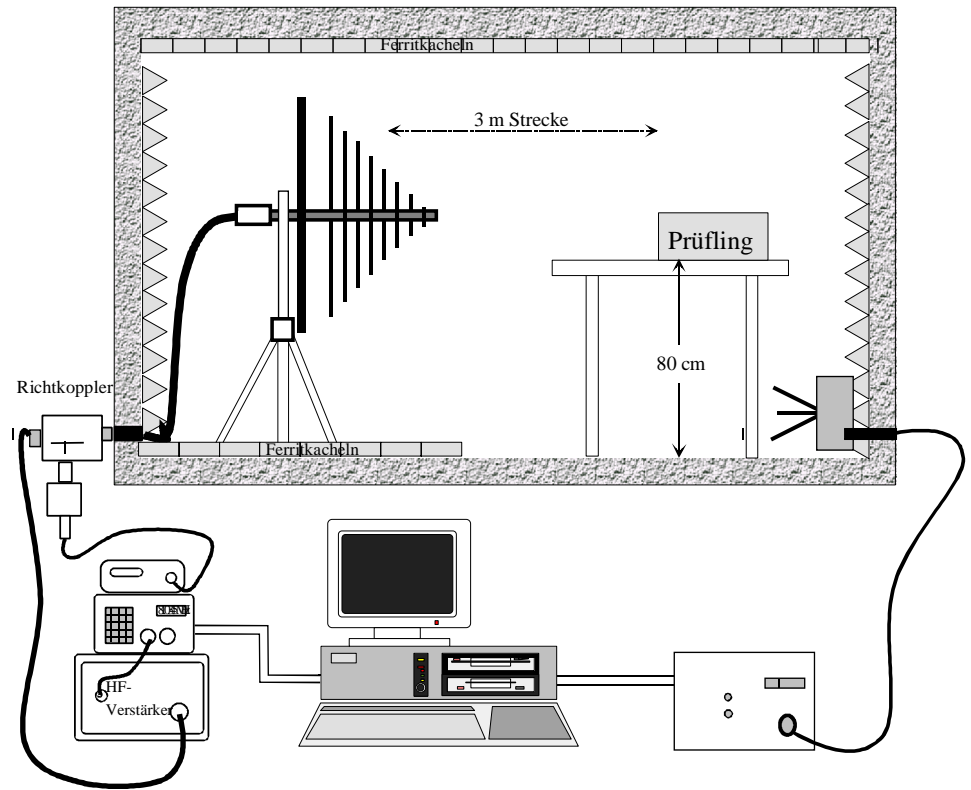
Limit value of basic standard according to EN 55022 B, is passed with average ó detector in this frequency range.

8. Immunity

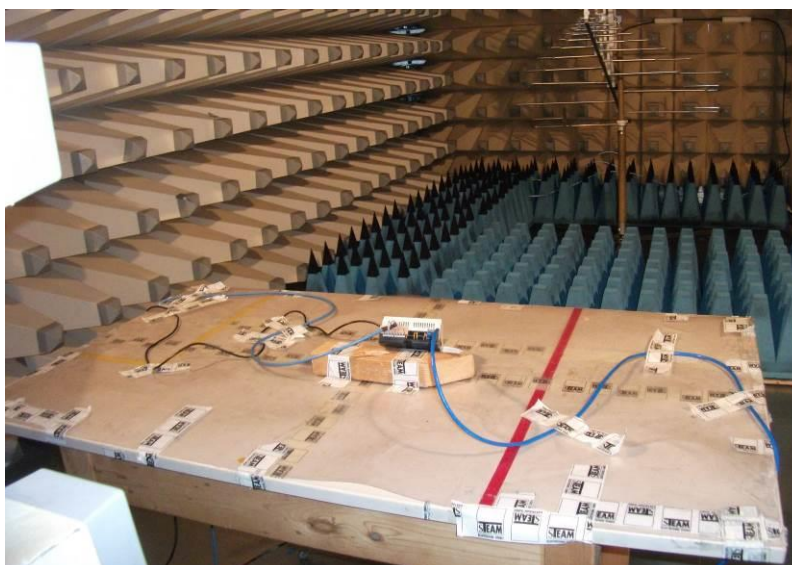
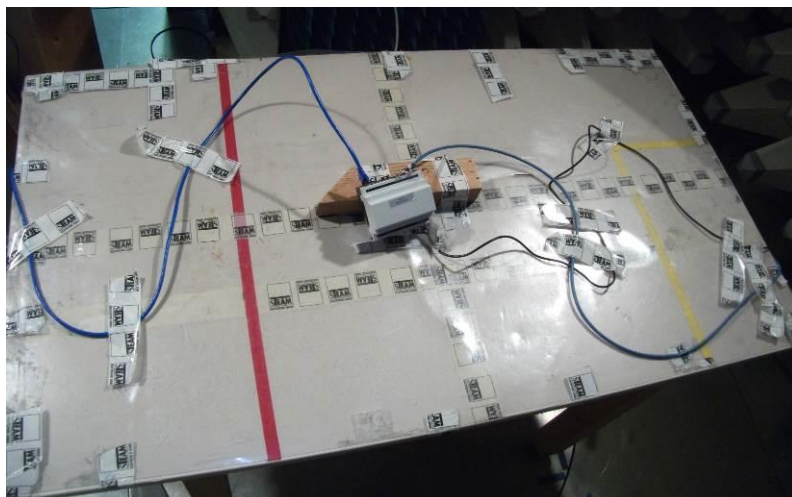
8.1 Immunity to radiated electromagnetic fields

Test specification	:	DIN EN 61000-4-3: 2006+A1:2008+ A2: 2010 according to VDE 0847 part 4-3 of 04.2011
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Frequency range	:	80 MHz ó 1000 MHz
Measurement site	:	anechoic chamber
Frequency step	:	<1 % of actual value
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Raspberry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to SSH Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Test criteria	:	<ul style="list-style-type: none"> - None of the Messages received from the Atmel Controller are lost - Atmel up and Working - Raspberry up and Working - Ethernet up and Working
Tolerance	:	none
Measurement setup	:	desktop device, see pictures on pages 18 and 19
Modifications	:	see page 4

Measurement setup:



Measurement setup:



Immunity to radiated emissions

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Work status : see page 17

Holding time : 2 sec

Radiated emissions directed to : **Front**
Most of the couplings are expected to be on the wires, because of the small dimensions of the device under test. Therefore the device was stressed by the interference in only one position (0°).

Test range:

Frequency : 80 MHz ó 1000 MHz

Modulation : Modulation type: AM
Modulation frequency: 1 kHz
Modulation grade: 80 %

Field strength : **10 V/m** (continuous wave, effective value)

Polarization : **Horizontal / Vertical**

Test result:

The DUT does not show any deviations outside the specified limits during the test.

The standards for **Test criteria A** are passed.

Immunity to radiated emissions

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Work status : see page 17

Holding time : 2 sec

Radiated emissions directed to : **Front**
Most of the couplings are expected to be on the wires, because of the small dimensions of the device under test. Therefore the device was stressed by the interference in only one position (0°).

Test range:

Frequency : 1400 MHz ó 2700 MHz

Modulation : Modulation type: AM
Modulation frequency: 1 kHz
Modulation grade: 80 %

Field strength : **3 V/m** (continuous wave, effective value)

Polarization : **Horizontal / Vertical**

Test result:

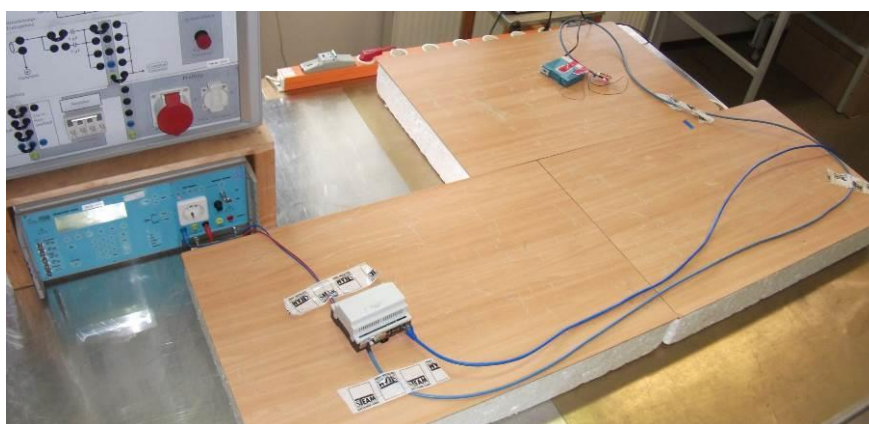
The DUT does not show any deviations outside the specified limits during the test.

The standards for **Test criteria A** are passed.

8.2 Immunity to fast transient disturbances (Burst)

Test specification	:	DIN EN 61000-4-4: 2012 according to VDE 0847 part 4-4 of 04.2013
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to SSH Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Test criteria	:	<ul style="list-style-type: none"> - None of the Messages received from the Atmel Controller are lost - Atmel up and Working - Rasperry up and Working - Ethernet up and Working
Placement of Device under test	:	placed upon styrofoam (thickness: 10 cm) see pictures pages 23 and 25
Measurement setup	:	desktop device
Modifications	:	see page 4

Measurement setup:



Immunity to fast transient disturbances on DC power supply ports

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Work status : see page 22

Test criteria : see page 22

Holding time : >1 minute / uncoupling

Uncoupling between (+Ub) and reference line				
Polarity	0.5 kV	1 kV	2 kV	
positive	OK	OK	OK	
negative	OK	OK	OK	

Uncoupling between (GND) and reference line				
Polarity	0.5 kV	1 kV	2 kV	
positive	OK	OK	OK	
negative	OK	OK	OK	

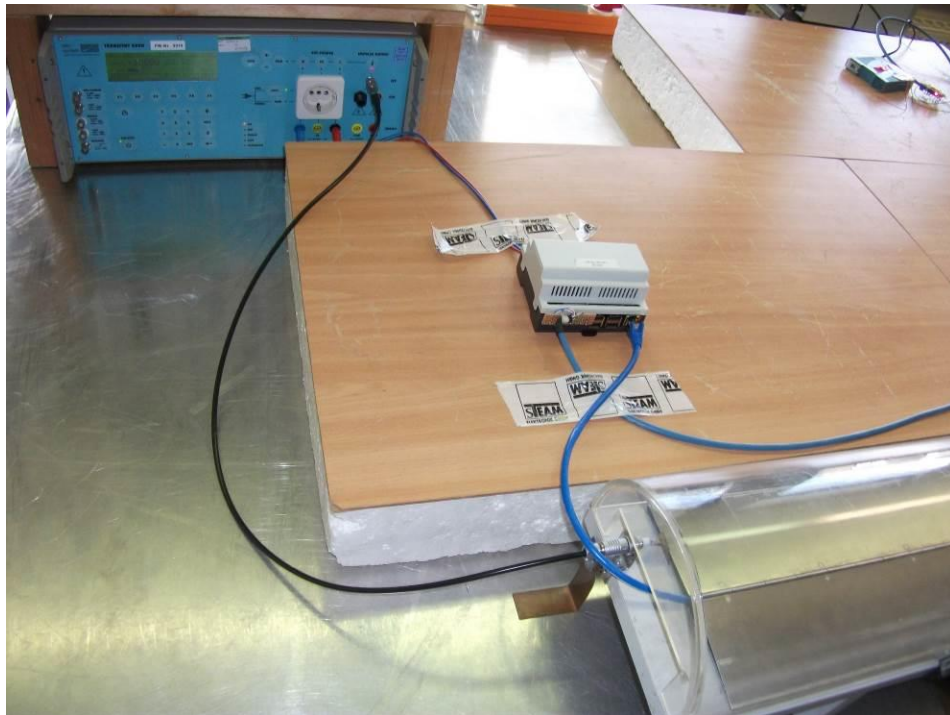
Uncoupling between (+Ub), (GND) and reference line				
Polarity	0.5 kV	1 kV	2 kV	
positive	OK	OK	OK	
negative	OK	OK	OK	

Test result:

After ending of test series electronic functioning accordingly.

The standards for **Test criteria B** are passed.

Measurement setup:



Immunity to fast transient disturbances on Ethernet cable

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Work status : see page 22

Test criteria : see page 22

Holding time : >1 minute / uncoupling

Uncoupling with capacitive clamp on (Ethernet cable)			
Polarity	0.5 kV	1 kV	2 kV
positive	OK	OK	OK
negative	OK	OK	OK

Test result:

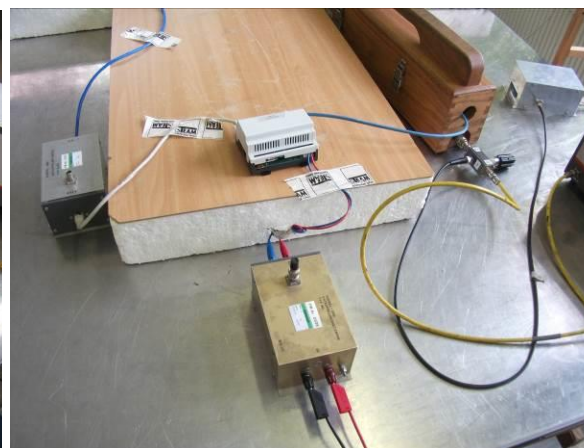
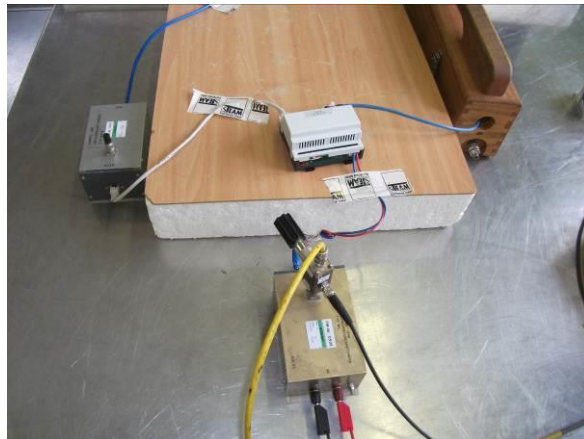
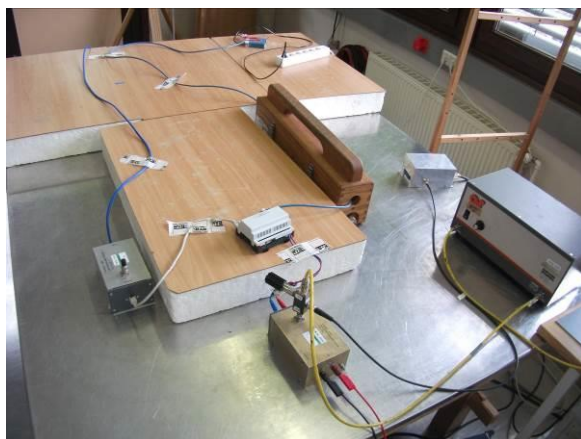
After ending of test series electronic functioning accordingly.

The standards for **Test criteria B** are passed.

8.3 Immunity to high frequent conducted disturbances

Test specification	:	DIN EN 61000-4-6: 2014 according to VDE 0847 part 4-6 of 08.2014
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Frequency range	:	150 kHz ó 80 MHz
Frequency step	:	<1 % of actual value
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to SSH Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Test criteria	:	<ul style="list-style-type: none"> - None of the Messages received from the Atmel Controller are lost - Atmel up and Working - Rasperry up and Working - Ethernet up and Working
Tolerance	:	none
Measurement setup	:	<ul style="list-style-type: none"> - placed upon styrofoam (thickness: 10 cm) - desktop device, see pictures page 28
Modifications	:	see page 4

Measurement setup:



Conducted immunity

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Holding time per
Frequency step : 2 s

Work status : see page 27

Test criteria : see page 27

Tested cable : **power supply line CDN: M3**

Remarks : Ethernet cable decoupled over CDN: RJ45
Signal lines decoupled over CDN: injection clamp

Test range:

Frequency : 150 kHz ó 80 MHz

Modulation : Modulation type: AM
Modulation frequency: 1 kHz
Modulation grade: 80 %

Testing voltage : **10 V (EMK)**

Test result:

The DUT does not show any deviations outside the specified limits during the test.

The standards for **Test criteria A** are passed.

Conducted immunity

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Holding time per
Frequency step : 2 s

Work status : see page 27

Test criteria : see page 27

Tested cable : **signal lines cable CDN: EM Injection Clamp**

Remarks : Ethernet cable decoupled over CDN: RJ45
Power supply lines decoupled over CDN: M2

Test range:

Frequency : 150 kHz ó 80 MHz

Modulation : Modulation type: AM
Modulation frequency: 1 kHz
Modulation grade: 80 %

Testing voltage : **10 V (EMK)**

Test result:

The DUT does not show any deviations outside the specified limits during the test.

The standards for **Test criteria A** are passed.

Conducted immunity

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Holding time per
Frequency step : 2 s

Work status : see page 27

Test criteria : see page 27

Tested cable : **Ethernet cable** CDN: RJ45

Remarks : Power supply lines decoupled over CDN: M2
Signal lines decoupled over CDN: injection clamp

Test range:

Frequency : 150 kHz ó 80 MHz

Modulation : Modulation type: AM
Modulation frequency: 1 kHz
Modulation grade: 80 %

Testing voltage : **10 V (EMK)**

Test result:

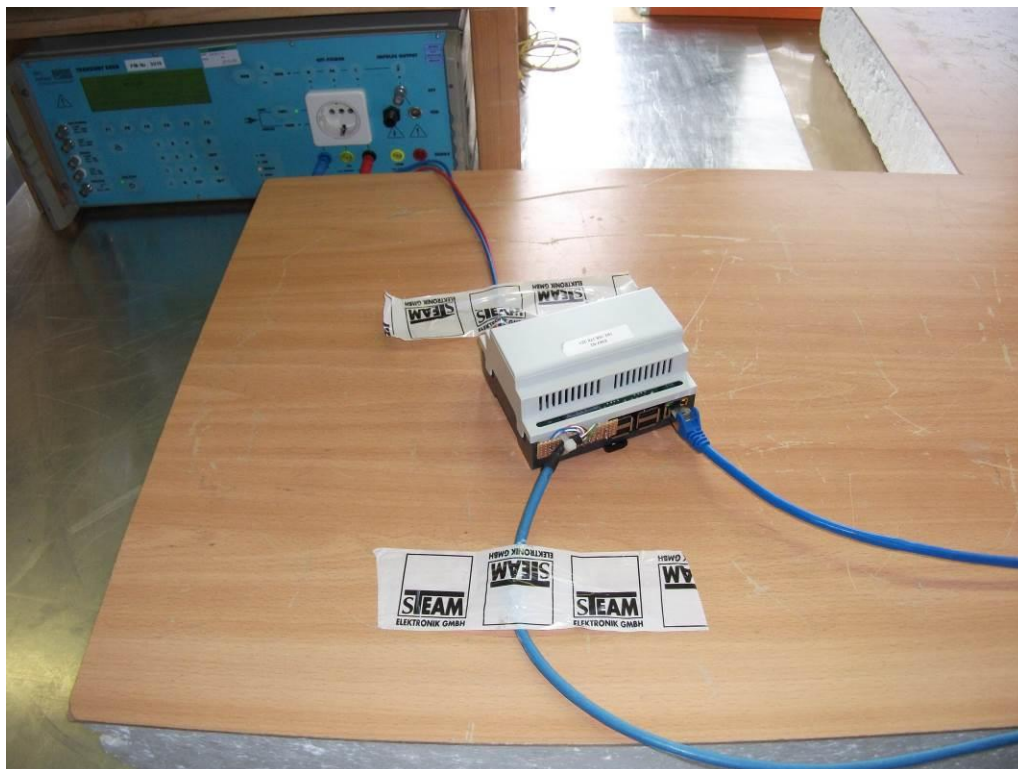
The DUT does not show any deviations outside the specified limits during the test.

The standards for **Test criteria A** are passed.

8.4 Immunity to surge

Test specification	:	DIN EN 61000-4-5: 2014 according to VDE 0847 part 4-5 of 03.2015
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Test voltages	:	+Ub - GND: 500V, generator- source-impedance 2 Ohm +Ub ó PE; GND - PE: 500V
Triggering	:	none (DC power line)
Pulse repeat frequency	:	1 impulse per 30 seconds
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to SSH Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Rasperry
Test criteria	:	<ul style="list-style-type: none"> - None of the Messages received from the Atmel Controller are lost - Atmel up and Working - Rasperry up and Working - Ethernet up and Working
Measurement setup	:	desktop device, see page 33
Test setup	:	power supply cable: 30 cm
Modifications	:	see page 4

Measurement setup



Immunity to surge to power supply lines

Date : 11.02.2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Work status : see page 32

uncouplings between the power supply lines (+Ub) and (GND)
 $R_i = 2 \Omega / C_k = 18 \mu F$

Polarity	Triggering	0.5 kV
positive	0°	OK
negative	0°	OK

Test result:

After ending of test series electronic functioning accordingly.

Therefore the standards for **Test criteria B** are passed.

8.5 Immunity to electrostatic discharge (ESD)

Test specification	:	DIN EN 61000-4-2: 2009 according to VDE 0847 part 4-2 of 12.2009
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to SSH Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Test criteria	:	<ul style="list-style-type: none"> - None of the Messages received from the Atmel Controller are lost - Atmel up and Working - Rasperry up and Working - Ethernet up and Working
Measurement setup	:	placed upon foil, 1 mm thick
Modifications	:	see page 4

Immunity to ESD
Direct discharge

Date : 28/04/2016



Company : **Clear Systems GmbH**

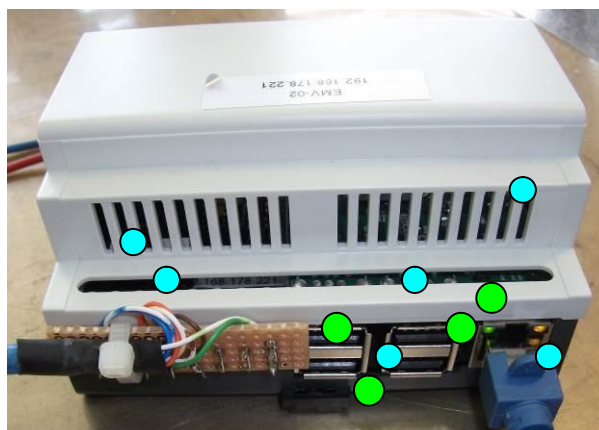
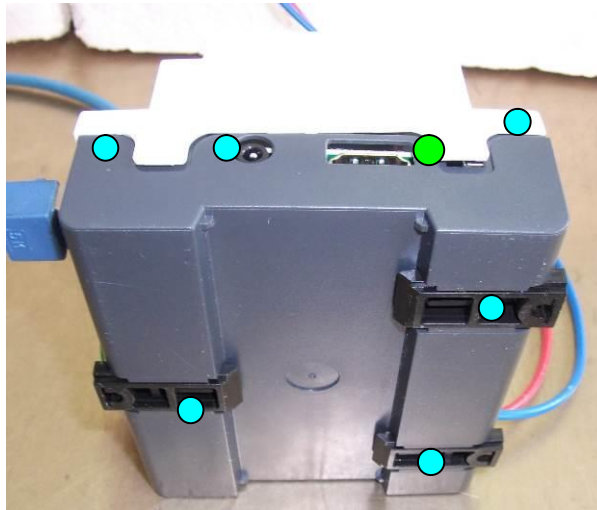
Device under test : **Andino X1**

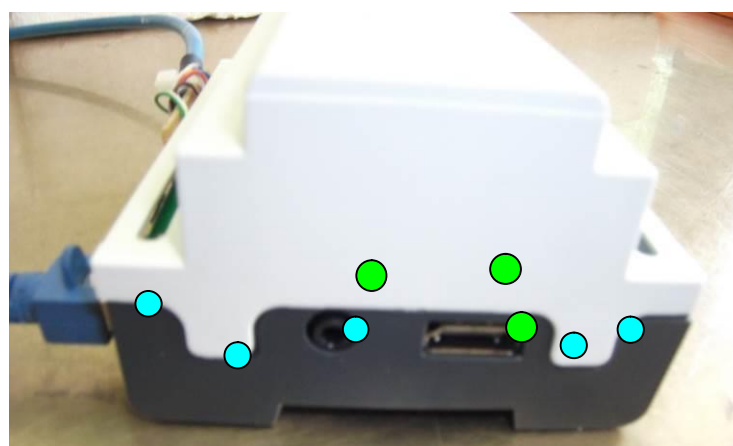
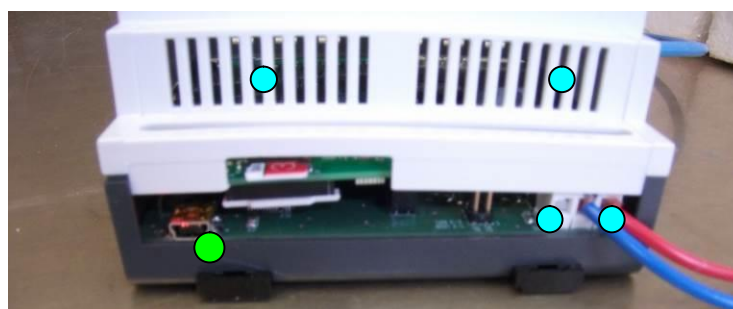
Work status : see page 35

Test criteria : see page 35

Measurement points:

-  Measurement point contact discharge
-  Measurement point air discharge





Immunity to ESD

Direct discharge

Contact discharge to touchable metal parts / connector:

+2 kV	-2 kV	+4 kV	-4 kV
OK	OK	OK	OK

Therefore the standards for **test criteria B** are passed.

air discharge to touchable insulated parts of the case:

+2 kV	-2 kV	+4 kV	-4 kV	+8 kV	-8 kV
OK	OK	OK	OK	OK	OK

Therefore the standards for **test criteria B** are passed.

Indirect discharge

Contact discharge to horizontal and vertical coupling plate:

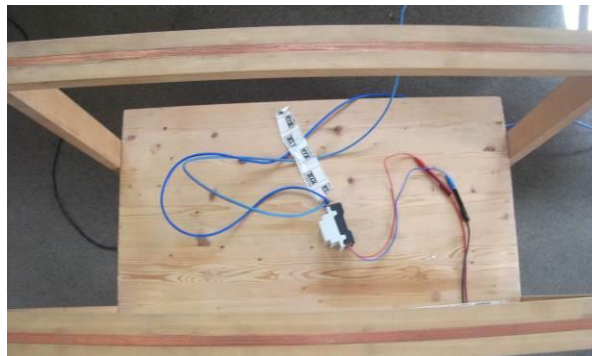
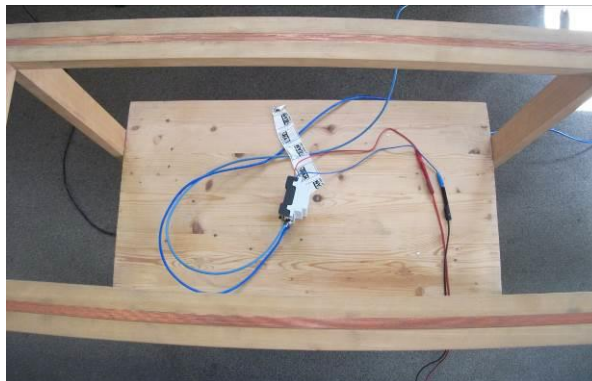
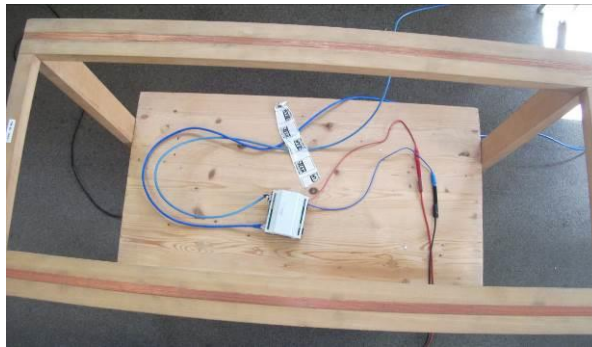
+2 kV	-2 kV	+4 kV	-4 kV
OK	OK	OK	OK

Therefore the standards for **test criteria B** are passed.

8.6 Immunity to magnetic fields with energy technical frequencies

Test specification	:	DIN EN 61000-4-8: 2010 entsprechend VDE 0847 Teil 4-8 vom 11.2010
Company	:	Clear Systems GmbH
Device under test	:	Andino X1
Frequency	:	50 Hz
Holding time	:	> 30 s
Work status	:	<ul style="list-style-type: none"> - standard mode - power supply: 24 VDC - Rasperry Pi3 RASPBIAN JESSIE LITE Version: March 2016 Release date: 2016-03-18 Kernel version: 4.1 - Testscript: Receive Data from Atmel Print Data to SSH Console - Atmel Controller: - Testscript: Turn on/off Relais every 1000 ms Loop back Relais to Input Send Input State to Raspberry
Test criteria	:	<ul style="list-style-type: none"> - None of the Messages received from the Atmel Controller are lost - Atmel up and Working - Raspberry up and Working - Ethernet up and Working
Measurement setup	:	desktop device, see pictures on page 40
Modifications	:	see page 4

Measurement setup:



Immunity to magnetic fields with energy technical frequencies

Date : 28/04/2016

Company : **Clear Systems GmbH**

Device under test : **Andino X1**

Work status : see page 39

Test criteria : see page 39

Test range:

Test field strength : **30 A/m**

Test result:

The device under test shows no interferences during the uncoupling test series outside the defined specifications.

Therefore the standards for **test criteria A** are passed.

9. Summary of test results

This record is a documentation of the measurements, which have been taken to investigate the behavior of the device under test **Andino X1** from **Clear Systems GmbH** in an electromagnetic environment.

Subsequent the results of the individual measurements are listed.

9.1 Immunity / test criteria:

Environmental Phenomena	Test Specification and Units	Reference Documents	Performance Criteria	Test results
radio-frequency electromagnetic field (case)	80 - 1000 MHz 10 V/m (continuous wave, effective value) 80 % AM	EN 61000-4-3: 2006+A1:2008+ A2: 2010	A	passed
radio-frequency electromagnetic field (case)	1400 ó 2700MHz 3 V/m (continuous wave, effective value) 80 % AM	EN 61000-4-3: 2006+A1:2008+ A2: 2010	A	passed
High frequency asymmetric amplitude modulated (power supply lines dC)	0,15 to 80 MHz 10 V (continuous wave, effective value) 80 % AM	EN 61000-4-6 2014	A	passed
High frequency asymmetric amplitude modulated (Ethernet, signal)	0,15 to 80 MHz 10 V (continuous wave, effective value) 80 % AM	EN 61000-4-6 2014	A	passed
Electrostatic discharge (case)	8 kV air discharge 4 kV contact discharge	EN 61000-4-2 2009	B	passed
Electrostatic discharge (indirect discharge)	4 kV horizontal coupling plate 4 kV vertical coupling plate	EN 61000-4-2 2009	B	passed
Fast transient disturbances (to DC power supply lines)	2 kV (peak) 5/50 ns tr/ th 5 kHz repeat frequency	EN 61000-4-4 2012	B	passed
Fast transient disturbances (Ethernet, signal)	2 kV (peak) 5/50 ns tr/ th 5 kHz repeat frequency	EN 61000-4-4 2012	B	passed
Surge to DC power supply lines	1,2/50 (8/20) t _r /t _h µs 0,5 kV symmetric	EN 61000-4-5 2014	B	passed
Magnetic coupling with energy technical frequencies (case)	50 Hz 30 A/m	EN 61000-4-8 2010	A	passed

The remark "ok" on the results of the individual tests signifies that there were no interferences noticeable

Continuing: Immunity / test criteria

Test criteria:

Criteria	Valuation (according to standard specification, short form)
A	All functions of a device/system perform as designed during and after exposure to disturbance.
B	All functions of a device/system perform as designed after exposure, without operating any panels. Variations in mode or loss of data are not permitted.
C	A intermittent functional deficiency is allowed. The function has to return by itself or it must return to normal function by operating the panel.

9.2 Emissions:

Measurement	Frequency range	Limit	Reference document	Demands
Power supply input	150 to 500 kHz 0,5 to 5 MHz 5 to 30 MHz	linear dropping with logarithm. of the frequency from 66 to 56 dB μ V Q* from 56 to 46 dB μ V M* 56 dB μ V Q* 46 dB μ V M* 60 dB μ V Q* 50 dB μ V M*	EN 55022 B 2011	passed
Housing	30 to 230 MHz 230 to 1000 MHz	30 dB μ V/m 37 dB μ V/m	EN 55022 B 2011	passed

*) Q = measured with quasi-peak-rectifier
M = measured with average-rectifier

10. List of test equipment

Used device	Test equip. Nr.	Device	Manufacturer	Model	Last calibr.	Next calibr.
EMC - Test equipment						
X	3000	anechoic chamber	Frankonia	7 x 4,5 x 3 m		
X	3001	Bilog. antennae	Chase	CBL 6111		--
	3002	Monopole antennae	Schwarzbeck	VAMP 9243	05/2014	05/2016
	3005	Transient Limiter	HP	11947 A	03/2014	03/2015
	3006	Field strength measurement device	Wandel & Goltermann	EMR-20	01/2008	01/2015
X	3007	HF ópower amplifier	ar	100W 1000M1	--	--
X	3008	HF - power amplifier	ar	75A220	--	--
	3011	Electrical power divider	S-TEAM	SLT 150	03/2017	03/2017
	3012	CDN 3 x 16 A	Schaffner	CDN 300		
	3013	CDN / Surge	S-TEAM	SK 1,2 /50		
	3014	LISN	S-TEAM	STVN / 4 / 16	03/2016	03/2017
	3015	LISN	Schwarzbeck	NNLA 8119	03/2016	03/2017
	3016	LISN 5µH 50 Ω	S-TEAM	NN- KFZ01	03/2016	03/2017
	3017	LISN 5µH 50 Ω	S-TEAM	NN- KFZ02	03/2016	03/2017
	3018	LISN 5µH 50 Ω	S-TEAM	NN- KFZ03	03/2016	03/2017
	3019	Interference generator	EMC Partner	Transient 2000	01/2014	01/2017
	3020	Measurement transformer - clamp	Rohde & Schwarz	MDS 20	07/1997	--
	3021	current clamp	Schaffner	SMZ 11	06/2003	--
	3023	directional coupler	ar	DC 6180	03/2016	03/2017
	3025	100 mm strip line	S-TEAM	SST-100	--	--
	3026	directional coupler	Werlatone	C6145-10	03/2016	03/2017
X	3027	micro wave power meter	Rohde& Schwarz	URV 5	07/2015	07/2016
X	3028	measuring head	Rohde& Schwarz	URY-Z4	07/2015	07/2016
	3029	measuring head	Rohde& Schwarz	URY-Z4	07/2015	07/2016
	3030	micro wave power meter	Rohde& Schwarz	URV 5	07/2015	07/2016
	3031	measuring head	Rohde& Schwarz	URY-Z4	07/2015	07/2016
X	3032	HF ópower amplifier	Milmega	ASO 104-30/17	--	--
X	3033	EMI Receiver	Rohde& Schwarz	ESCI	06/2015	06/2016
X	3034	bilog. antenna	Schwarzbeck	STLP9128 E special	--	--
X	3036	power meter	HP	437B	07/2015	07/2016
X	3037	power sensor	HP	8485A	07/2015	07/2016
X	3038	HF óamplifier	TESEQ	CBA 1G-1000	--	--
X	3039	HF óamplifier	TESEQ	CBA 3G 300	--	--
X	3040	horn antenna	ar	ATH800M5G	--	--
	3041	directional coupler	Bonn	BDC 0810-50/2500	03/2016	03/2017
	3042	directional coupler	Bonn	BDC 1040-40/500	03/2016	03/2017
	3043	amplifier	Spitzenberger+Spies	EM 1500/B	--	--
	3044	horn antenna	EMCO	3115	--	--
	3045	ISN	TESEQ	ISN ST08	03/2015	03/2020
	3047	artificial mains network LISN 5µH 50 Ω	Schwarzbeck	NNBM 8124-200A	03/2016	03/2017
	3048	artificial mains network LISN 5µH 50 Ω	Schwarzbeck	NNBM 8124-200A	03/2016	03/2017
	3049	HF ópower amplifier	ar	100W 1000M1	--	--
	3050	Loop antenna	Rohde & Schwarz	HFH2-Z2	--	--

Used device	Test equip. Nr.	Device	Manufacturer	Model	Last calibr.	Next calibr.
ESD - Test equipment						
X	0109	ESD generator	TESEQ	NSG 438	03/2016	03/2017
X	0110	ESD uncoupling link	TESEQ	330 Ω /150 pF	03/2016	03/2017
	0111	ESD uncoupling link	TESEQ	2 K Ω /150 pF	03/2016	03/2017
	0112	ESD uncoupling link	TESEQ	330 Ω /330 pF	03/2016	03/2017
	0113	ESD uncoupling link	TESEQ	2 K Ω /330 pF	03/2016	03/2017
Bulk current injection (BCI)						
	0401	Einkoppelzange	FCC	HHS1	--	--
	0402	Kalibrierhalter	FCC	PG-HHS1	--	--
	0405	Messzange	FCC	F-65	--	--
Signal generators						
X	8501	HF generator	HP	HP 8648B	7/2015	7/2016
	8502	HF generator	Rohde & Schwarz	SMX	7/2015	7/2016
	8503	HF generator	HP	8116 A		
	8504	Sweep - generator	HC	HC 6 G205		
	8505	HF generator	Wavetek	Model 270		
X	8507	signal generator	Rohde & Schwarz	SMC100A	7/2015	7/2016
HF - uncoupled emission (part 6)						
X	0501	EM Injection Clamp	FCC	F- 2031	03/2016	03/2017
	0502	CDN	MEB	S9	03/2016	03/2017
	0503	CDN	MEB	S25	03/2016	03/2017
	0504	CDN	FCC	AF9	03/2016	03/2017
	0505	CDN	S-TEAM	M1	03/2016	03/2017
X	0506	CDN	S-TEAM	M2	03/2016	03/2017
	0507	CDN	MEB	M3	03/2016	03/2017
	0508	CDN	S-TEAM	M5	03/2016	03/2017
	0509	CDN	S-TEAM	T2	03/2016	03/2017
	0510	CDN	S-TEAM	RJ45	03/2016	03/2017
	0511	CDN	MEB	T4	03/2016	03/2017
	0512	CDN	S-TEAM	USB	03/2016	03/2017
Fast transient disturbances (Burst) / Surge / Short interruptions and voltage variations						
X	0301	Capacitive Clamp	Schaffner	SL 400- 071D	12/2015	12/2016
Harmonic waves						
	0401	Harmonic / Flicker test system	HP	6842A	09/2011	09/2015
Magnetic field immunity						
X	0601	Helmholtz-Inductor	S-TEAM	HHS1	--	--
X	0602	Measurement generator	S-TEAM	PG-HHS1	--	--
	0603	Magnetic field coil	S-TEAM	RL-KFZ	--	--
EMC-Test equipment car-pulse						
	2201	Generator pulse 1,2,3	Schaffner	NSG 500 C	--	--
	2202	Coupling clamp	Schaffner	CDN 500	--	--
	2204	Generator pulse 1,2,3,5,6,7	Schaffner	NSG 5500	--	--
	2205	Generator pulse 2b, 4	Schaffner	NSG 5600	--	--
	2206	Battery simulationl	Schaffner	PA5740	--	--
Oscilloscopes						
	7002	Storage oscilloscope	HP	54201A	--	--
	7003	Oscilloscope / 100 MHz	Hitachi	V 6 1065	--	--
	7004	Oscilloscope	Tektronix	485	--	--
	7005	Storage oscilloscope	Tektronix	TDS 7404B	04/2014	04/2015

Used device	Test equip. Nr.	Device	Manufacturer	Model	Last calibr.	Next calibr.
Multimeter						
	6501	Digital multimeter	Fluke	8840A	09/2015	09/2016
X	6502	Digital multimeter	Fluke	77 II	09/2015	09/2016
	6503	Digital multimeter	Fluke	77 II	09/2015	09/2016
	6504	Multimeter	Gossen Metrawatt	Metra Hit One	09/2015	09/2016
	6505	Multimeter	Gossen Metrawatt	Metra Hit One	09/2015	09/2016
	6510	Multimeter	PREMA	5017	09/2015	09/2016
X	6511	Digital multimeter	Fluke	77 IV	09/2015	09/2016
	6512	Digital multimeter	Fluke	77 IV	09/2015	09/2016
	6513	Digital multimeter	Keithley	2000	09/2015	09/2016
Power supply						
	9001	Power supply	S- TEAM	SNT 24V-8A		
	9002	Power supply	Gossen	24 K 160 R 0,8		
	9003	Power supply	EA	EA 3025		
	9004	Power supply	EA	EA 3045		
	9005	Power supply	CYE	D 1532		
	9006	Power supply	CYE	D 3022		
	9007	Power supply	Zentro Elektrik	L 7,5/5		
	9008	Power supply	Mc Voice	DF 1731 SB		
	9009	Power supply	Voltcraft	PS 602 Pro		
	9010	Power supply	EA	EA 3045		
	9011	Power supply	S-Team	BRSQ		
	9012	Power supply	Zentro	LD7,5/5-2x30		
General measurement device						
	7501	4-channel-chart recorder	Philips	PM 8224	--	--
	7502	Spectrum Analyzer	HP	8561 A	--	--
	7503	Insulating transformer	S-TEAM	STR230	--	--
	7504	Frequency counter	Philips	PM 6666	07/2014	07/2015
	7505	Network Analyzer	Rohde & Schwarz	ZVRE	03/2016	03/2017
	7509	Field probe	Lindgren	HI-6105/HI-6113	09/2012	09/2015
Software						
X	1001	test location A0200	S-Team	Eektrromagn. HF-field	--	--
X	1002	test location A0500	S-Team	HF coupling	--	--
X	1003	test location A0800/A0900	S-Team	Funkstörfeldstärke/ Funkstörspannung	--	--
	1004	test location A2300	S-Team	Stripline	--	--
X	1005	Störimpulsgenerator	EMC Partner	Burst / Surge / Netzvariation	--	--
	1006	test location A2000/A2001	S-Team	Kfz Funkstörfeldstärke/ Funkstörspannung	--	--
	1007	test location A2200	Schaffner	Kfz - Pulse	--	--
	1008	test location z A2400	S-Team	BCI	--	--
	1009	test location A1000	HP	Oberschwingungen/ Flicker	--	--