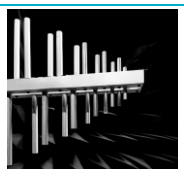
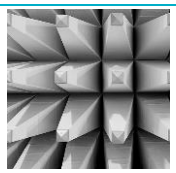




CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test Report No.: 1-0097/20-01-04-A

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing Laboratory

CTC advanced GmbH
Untertürkheimer Straße 6 – 10
66117 Saarbrücken/Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://ctcadvanced.com
e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-05

Applicant

X2E GmbH
Jahnstrasse 2b
76870 Kandel/Germany
Fax: +49 7275 9143-109
Contact: Gerhard Spengler
e-mail: gerhard.spengler@x2e.de

Manufacturer

same as applicant

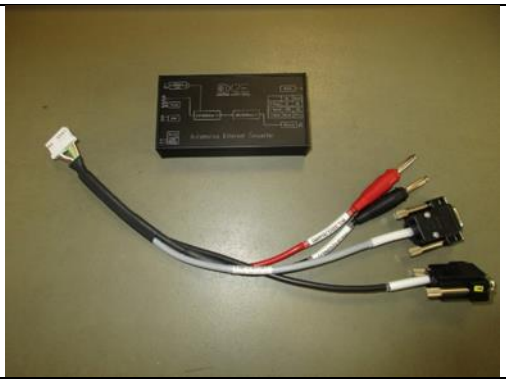
Test Standard/s

FCC - Title 47 CFR Part 15: 2020	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
ICES-003, Issue 6: 2017	Interference-Causing Equipment Standard Digital Apparatus

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**Automotive Ethernet Converter**
Model name:	**AEC**
S/N serial number:	0000B9
HW hardware status:	Rev0103
SW software status:	04.01.00
FCC-ID	2AU4HAEC
Power Supply:	DC 12 V or 115V / 60Hz with power adapter



This test report is electronically signed and valid without handwritten signature. The public keys can be requested at the test laboratory to verify the electronic signatures.

Test Report authorised:

Uli Kraus
cn=Uli Kraus, o=CTC advanced GmbH, ou=KRA-161129, email=uli.kraus@ctcadvanced.com, c=DE
2020.07.06 07:46:32 +02'00'

Uli Kraus
Electromagnetic Compatibility & Acoustics

Test performed:

cn=Hans-Joachim Wolsdorfer, o=ctcadvanced GmbH, ou=WLD-191118, email=joachim.wolsdorfer@ctcadvanced.de, c=DE
2020.07.06 12:02:03 +02'00'

Joachim Wolsdorfer
Electromagnetic Compatibility & Acoustics

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.
The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".
CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.
Under no circumstances does the CTC advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.
Under no circumstances does the CTC advanced GmbH test report include or imply any product or service warranties from CTC advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CTC advanced GmbH.
All rights and remedies regarding vendor’s products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH.
In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronical signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2020-03-05
Date of receipt of test item:	2020-05-15
Start of test:	2020-05-15
End of test:	2020-05-19
Person(s) present during the test:	Mr Spengler

3 Test standard/s:

Test Standard	Test Standard Description
FCC - Title 47 CFR Part 15: 2020	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
ICES-003, Issue 6: 2017	Interference-Causing Equipment Standard Digital Apparatus
ANSI C63.4-2014	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

4 Test Environment

Temperature:	20°C – 25°C
Relative humidity content:	30 % - 50 %
Air pressure:	1020 hPa
Power supply:	230 V / 50 Hz

5 Test Laboratories sub-contracted

---

6 Information about Test Conditions

6.1 Test Item

Kind of test item :	**Automotive Ethernet Converter**	
Type identification :	**AEC OABR2Eth**	
Equipment classification:	Equipment for fixed use	
Environment classification:	Industrial environment	
Supply voltage :	DC 12 V or 115V / 60Hz with power adapter	
Ports :	**Description**	**Direction**
	Ethernet 1000T-Base	In / output
	Multi I/O port*1	In / output
	USB*2	In / output
Mounting position:	Table top	
Additional information:		
*1: Multi IO port contains: CAN, VCC and OABR (unshielded cable) *2: only for service and maintenance - this is a class B digital device: the instructions furnished the user shall include a statement according to §15.105 of the used FCC rules Equipment class JAB (Part 15 Class B Digital Device)		

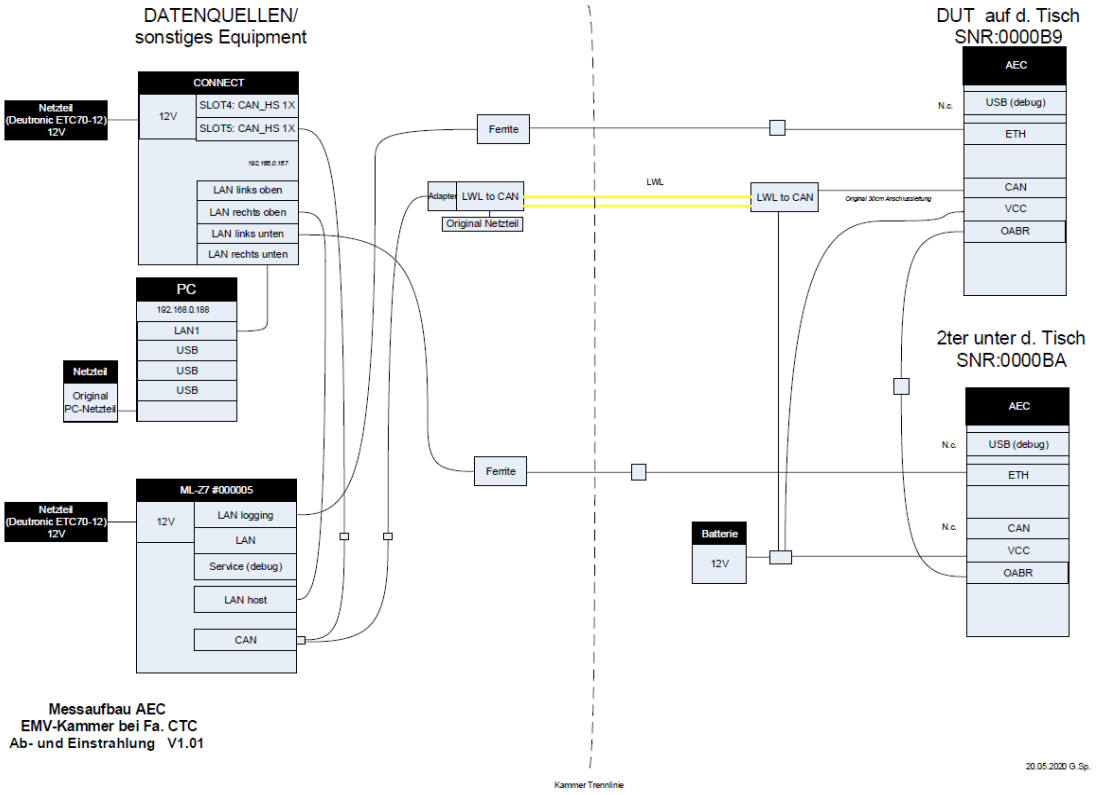
6.2 EUT: Type, S/N etc. and Short Descriptions Used in this Test Report

short descrip-tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Automotive Ethernet converter	OABR2Eth	0000B9	Rev 0103	04.01.00

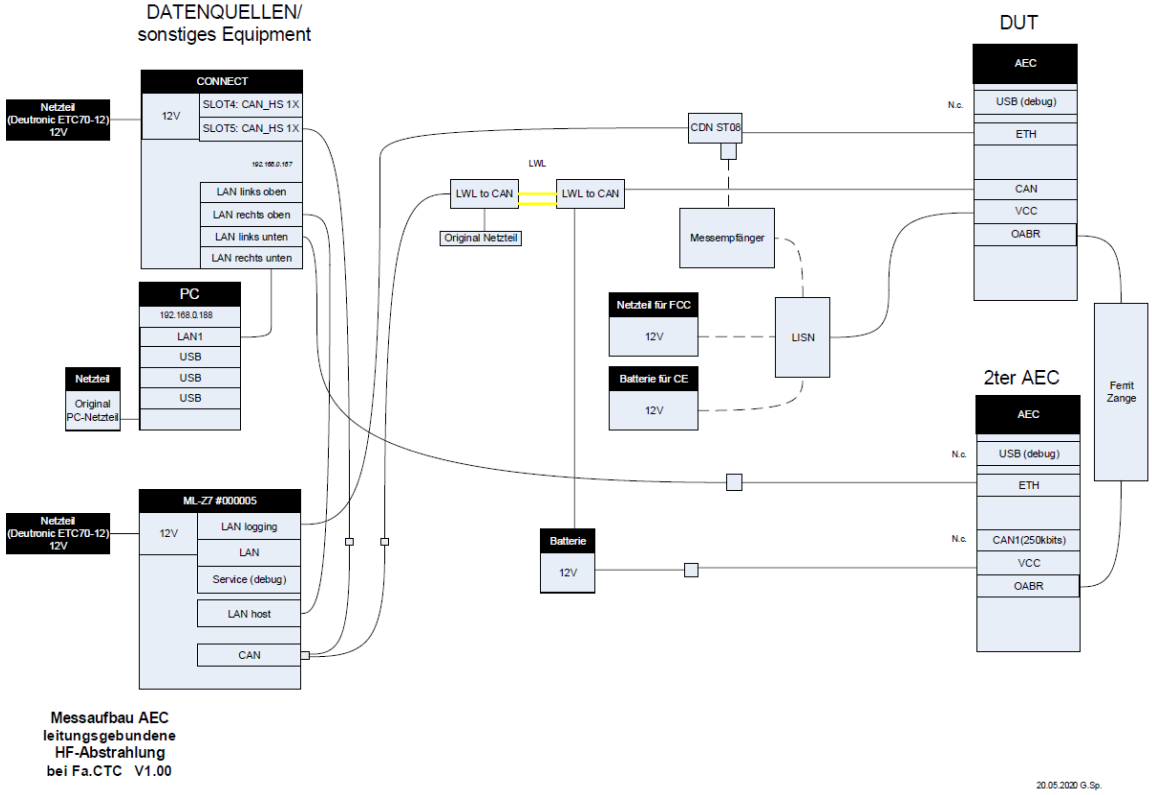
*) EUT short description is used to simplify the identification of the EUT in this test report.

6.3 EUT set-up(s)

Radiated emission (set1)



Conducted emission (set 2)



EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	Data transfer	---

7 Summary of Test Results

☒ No deviations from the technical specifications were ascertained
☐ There were deviations from the technical specifications ascertained

7.1 Emission

7.1.1 Enclosure

EMI Phenomenon	Frequency range	Basic standard	Result
Radiated Interference Field Strength	30 - 1000 MHz	FCC Part 15 Class B	passed
Radiated Interference Field Strength	> 1 GHz	FCC Part 15 Class B	passed

7.1.2 AC Mains Power Input/Output Ports

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15– 30 MHz	FCC Part 15 Class B	passed

Remarks:

NA1	Not tested because not required by used standard
NA2	Test not applicable because port does not exists
NA3	Test not applicable because port only for services
NA4	Test not applicable because port lengths not longer than 3m
NA5	Not tested because not required by customer
NA6	Not tested because used frequency < 108 MHz
NA7	Not tested because the device is for vehicular use

7.2 Measurement and Test Set-up

Note: The test configuration is in accordance with the requirements given in the standards in point 3

7.3 Measurement uncertainty

The uncertainty of the measurement equipment fulfils CISPR 16 and the related European and national standards.

The semi anechoic chamber fulfils the requirements of CISPR 16-1 (ANSI C63.4) for a test volume of 4m ∅.

The table below shows the measurement uncertainties for each measurement method. The expended uncertainty (k=2 or 95%) was calculated with worst case values.

Measurement Method	Frequency area Impulse duration time	Description	Expanded uncertainty (k=2 or 95%)
Radiated Emission FCC part 15 B, ANSI C63.4	30 MHz – 18 GHz	- / -	± 4.28 dB
Conducted Emission FCC part 15 B, ANSI C63.4	9 kHz – 30 MHz	- / -	± 3.49 dB

8 Detailed test results - Emission

8.1 Conducted Emission

8.1.1 Instrumentation for Test (see equipment list)

G 1	G 2	F 21									

8.1.2 Test Plan

EUT set-up	Set 2		
Operating mode	**Port / Line**	**Limit**	**Result**
Op 1	AC power line	FCC part 15 B Class B	passed

Remark :	Powered by external power supply (115V / 60Hz) Power supply : Deutronic ETC 70G-12 Tischnetzteil

8.1.3 Conducted Limits (Power-Line)

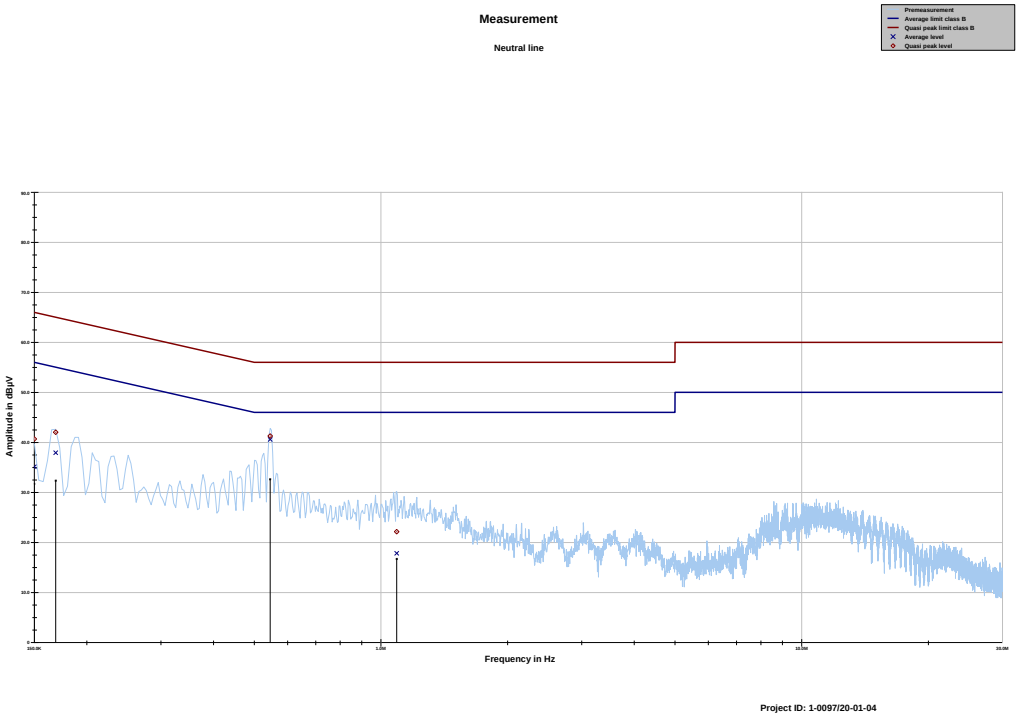
	FCC part 15 B Class B		FCC part 15 B Class A	
Frequency- range	**Quasi-Peak (dBµV)**	**Average (dBµV)**	**Quasi-Peak (dBµV)**	**Average (dBµV)**
0,15 MHz – 0,5 MHz	66-56	56-46	79	66
0,5 MHz -5 MHz	56	46	73	60
5 MHz -30 MHz	60	50	73	60

8.1.4 Calibration Information

Device	Serial number	Internal Number	Calibration valid until	Calibration interval
ESCI	100083	3000003312	12 / 2020	12 month
VISN ESH 3-Z5	893045/004	300000584	12 / 2020	24 month

Remarks: All emission components and the shielded room were checked weekly
Cable loss: 0.6 to 2.4 dB (150kHz to 30 MHz)

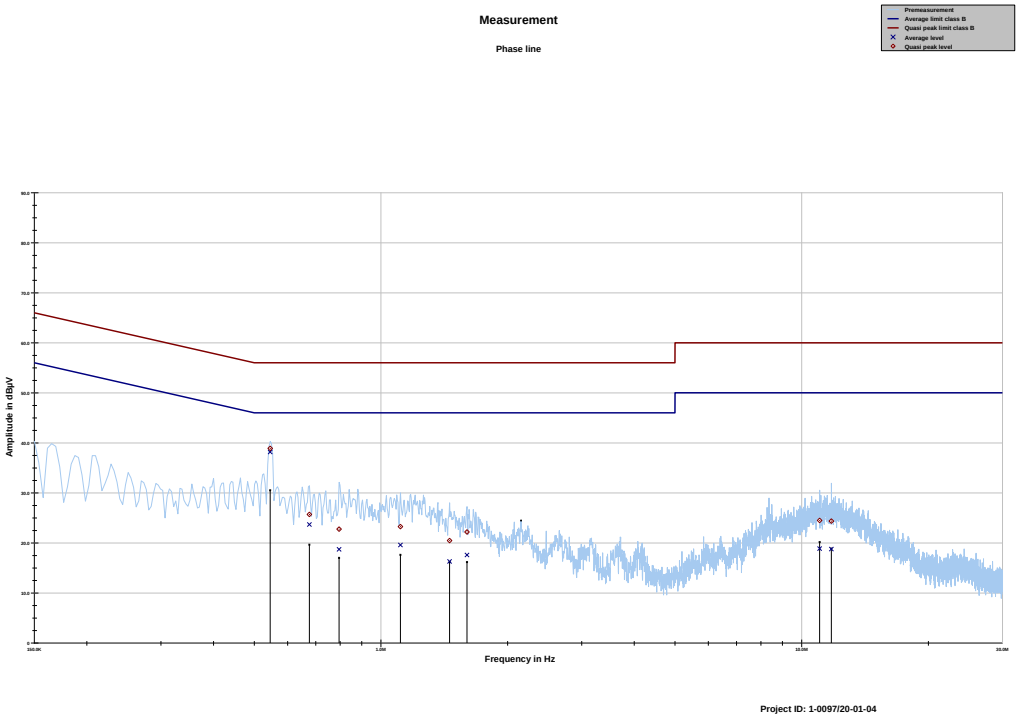
8.1.5 Test Results of Main



Neutral line tbl
Project ID: 1-0097/20-01-04

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	40.67	25.33	66.000	35.11	20.89	56.000
0.168656	42.02	23.00	65.026	37.93	17.54	55.467
0.545512	41.27	14.73	56.000	40.59	5.41	46.000
1.090275	22.14	33.86	56.000	17.82	28.18	46.000

Project ID - 1-0097/20-01-04
EUT - AEC (Automotiv Ethernet Converter)
Serial Number - 0000B9
Operating mode - Data transfer



Phase line tbl

Project ID: 1-0097/20-01-04

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.545512	38.89	17.11	56.000	38.17	7.83	46.000
0.676106	25.68	30.32	56.000	23.68	22.32	46.000
0.795506	22.76	33.24	56.000	18.72	27.28	46.000
1.112663	23.24	32.76	56.000	19.57	26.43	46.000
1.455938	20.46	35.54	56.000	16.29	29.71	46.000
1.601456	22.18	33.82	56.000	17.58	28.42	46.000
11.034056	24.48	35.52	60.000	18.86	31.14	50.000
11.765381	24.35	35.65	60.000	18.76	31.24	50.000

Project ID - 1-0097/20-01-04
EUT - AEC (Automotiv Ethernet Converter)
Serial Number - 0000B9
Operating mode - Data transfer

8.1.6 Signal strength calculation

Calculation formula:
SS = UR + CF + VC

List of abbreviations:

SS	►	signal strength
UR	►	voltage at the receiver
CF	►	loss of the cable and filter (passband filter 130 kHz – 30 MHz)
VC	►	correction factor of the ISN (ESH3-Z5)

List with correction factors:

Frequency [MHz]	CF [dB]	VC [dB]
0,150	9,80	1,42
1,000	9,80	0,41
5,000	9,90	0,32
10,000	9,90	0,23
15,000	10,00	0,39
20,000	10,00	1,19
25,000	10,20	1,55
30,000	10,30	1,31

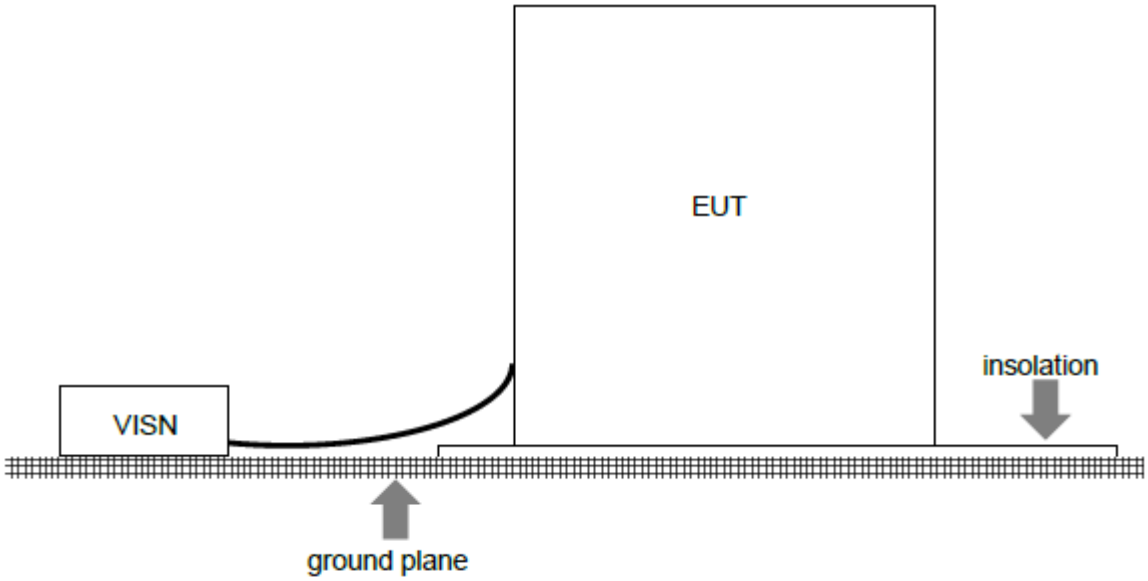
Example calculation:
For example at 10,000 000 MHz the measured Voltage (UR) is 37,62 dBµV, the loss of the cable and filter (CF) is 9,90 dB and the correction factor of the ISN (VC) is 0,23 dB the final result will be calculated:
SS [dBµV] = 37,62 [dBµV] + 9,90 [dB] + 0,23 [dB] = 47,75 [dBµV] (244, 06 µV)

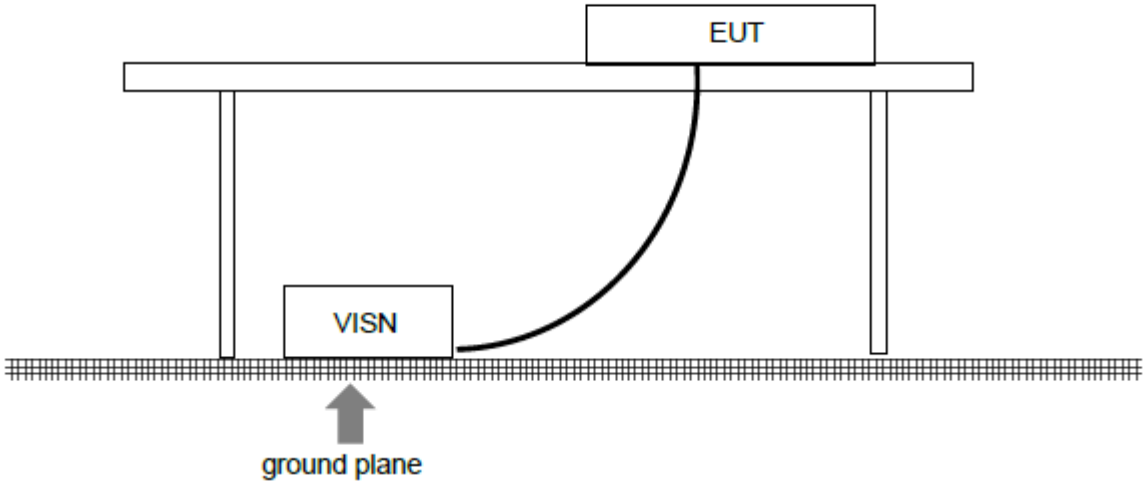
8.1.7 Version of test software

Software Version: TILE 7.3.0.15

8.1.8 Test Set-up

According to EMC basic standard **ANSI C 63.4**





8.2 Electromagnetic Radiated Emissions (Distance 10 m)

8.2.1 Instrumentation for Test (see equipment list)

F 1	F 2	F 4b	F 5	F 6	F 7	F 8	F 21				

8.2.2 Test Plan

EUT set-up	set 1		
Operating mode	**Application**	**Limit**	**Result**
op 1	Enclosure	FCC part 15 B Class B	passed

Remarks:	Powered by batterie

8.2.3 Radiated Limits

Frequency- range	**FCC part 15 B Class B**	**FCC part 15 B Class A**
30 MHz – 88 MHz	30 dBµV/m	39,1 dBµV/m
88 MHz – 216 MHz	33,5 dBµV/m	43,5 dBµV/m
216 MHz – 960 MHz	36 dBµV/m	46,4 dBµV/m
above 960 MHz	44 dBµV/m	49,5 dBµV/m
	* This values are recalculated from the class B limits at 3 m antenna distance in §15.109 (g 2) of the FCC rules	.

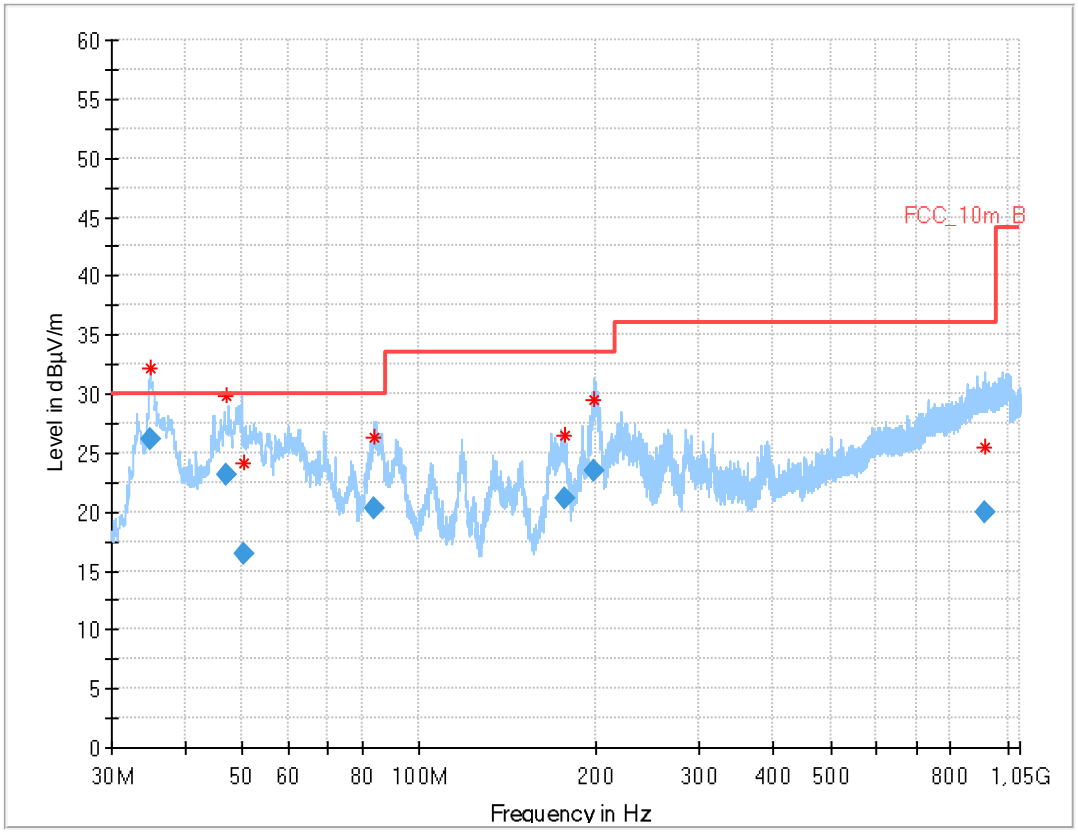
8.2.4 Calibration Information

Device	**Serial number**	**Internal Number**	**Calibration valid until**	**Calibration interval**
ESR 3	1316.3003K03-102587-ct	300005771	12 / 2020	12 month
Trilog Antenna	9163-295	300003787	02 / 2021	24 month
Remarks: System check of all relevant devices and the chamber (weekly)				

8.2.5 Test Results

Common Information

EUT:	AEC (Automotiv Ethernet Converter)
Serial number:	0000B9
Test description:	FCC part 15 B class B @ 10m
Operating condition:	1000MBit/s mode
Operator name:	Kraus
Comment:	DC 12V ; ETH: shielded



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
34.821	26.11	30.0	3.9	1000	120.0	100.0	V	181	12
46.852	23.21	30.0	6.8	1000	120.0	106.0	V	158	14
50.459	16.46	30.0	13.5	1000	120.0	200.0	V	199	14
83.837	20.33	30.0	9.7	1000	120.0	200.0	V	46	8
176.392	21.08	33.5	12.4	1000	120.0	313.0	V	210	10
198.099	23.53	33.5	10.0	1000	120.0	179.0	V	120	12
914.078	19.96	36.0	17.0	1000	120.0	252.0	H	151	24

8.2.6 Hardware Set-up

Subrange 1	
Frequency Range:	30 MHz - 2 GHz
Receiver:	ESR 3 [ESR 3] @ GPIB0 (ADR 20), SN 1316.3003K03/102587, FW 3.46 SP1
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 Correction Table (vertical): VULP_9163_SN318_10m Correction Table (horizontal): VULP_9163_SN318_10m Correction Table (vertical): Cable_EN_1GHz (AIRCOM) Correction Table (horizontal): Cable_EN_1GHz (AIRCOM)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12
Software version:	EMC32 V10.59.0

8.2.7 Sequence of testing

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a nonconducting table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.2.8 Signal strength calculation

Calculation formula:
$SS = U_R + CL + AF$

List of abbreviations:

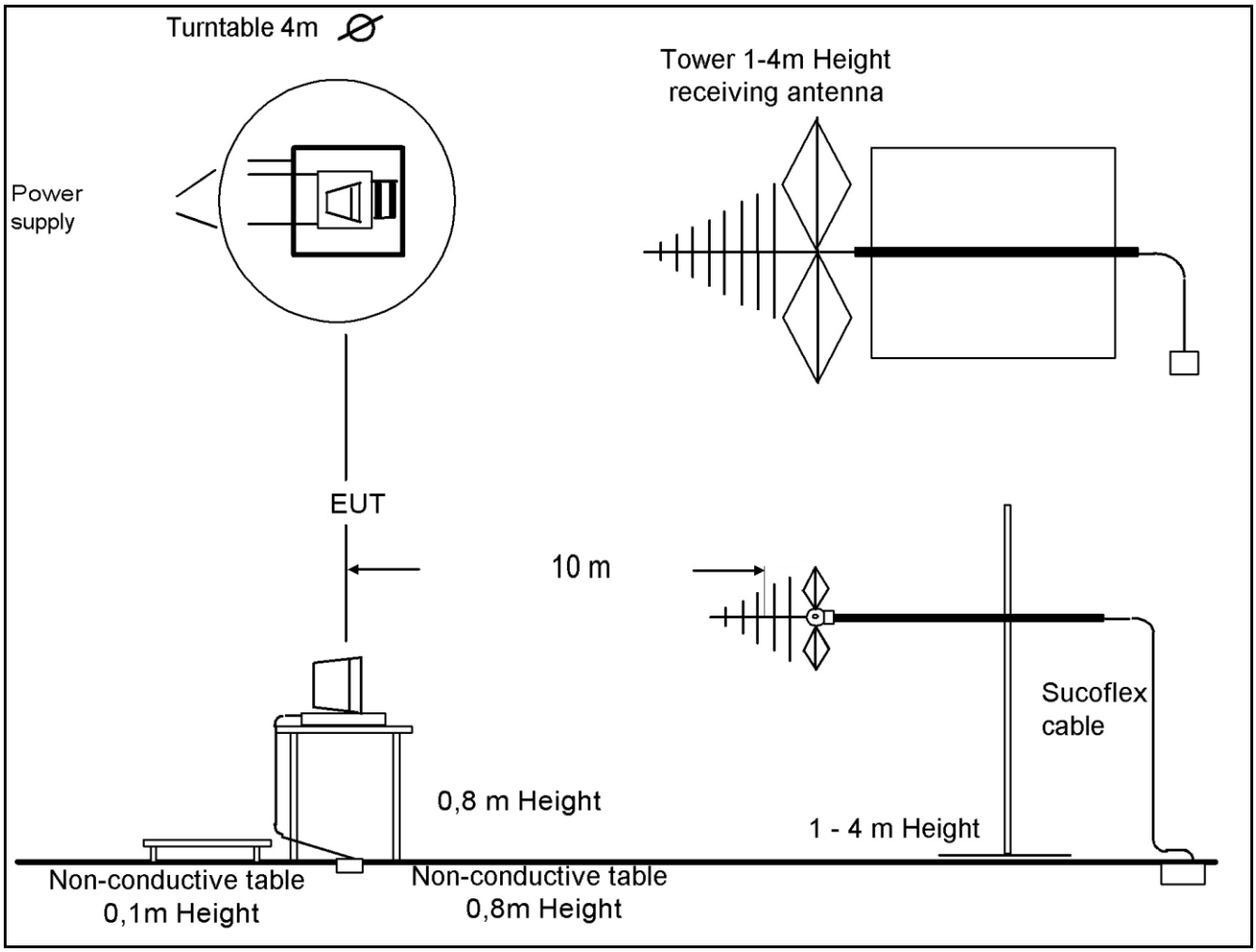
SS	►	signal strength
U_R	►	voltage at the receiver
CL	►	loss of the cable
AF	►	antenna factor

List with correction factors:

Frequency [MHz]	CL [dB]	AF [1/m]
30,000	0,20	12,30
100,000	0,60	11,30
200,000	1,10	10,60
300,000	1,30	13,20
400,000	1,60	15,30
500,000	1,90	16,80
600,000	2,00	18,80
700,000	2,20	20,30
800,000	2,30	21,50
900,000	2,40	22,80
1000,000	2,50	23,30

Example calculation:
For example at 500,000 000 MHz the measured Voltage (U_R) is 12,35 dBµV, the loss of the cable (CL) is 1,90 dB and the antenna factor (AF) is 16,80 dB (m^{-1}) the final result will be calculated:
SS [dBµV/m] = 12,35 [dBµV] + 1,90 [dB] + 16,80 [dB (m^{-1})] = 31,05 [dBµV/m] (35,69 µV/m)

8.2.9 Test Set-up



8.3 Electromagnetic Radiated Emissions (Distance 5 m)

8.3.1 Instrumentation for Test (see equipment list)

F 1	F 6	F 21	F 29	F 30	F 33						

8.3.2 Test Plan

EUT set-up	set 1		
Operating mode	**Application**	**Limit**	**Result**
op 1	Enclosure	FCC part 15 B Class B	passed

Remarks:	The measured values are recalculated from 5m to 3m distance Powered by batterie

8.3.3 Radiated Limits

Frequency- range	**47CFR15: (FCC part 15 B) Class B**	**47CFR15: (FCC part 15 B) Class A ***
above 1GHz	54 dBµV/m	59,5 dBµV/m
		* This values are recalculated from the class A limits at 10 m antenna distance in §15.109 (g 2) of the FCC rules.

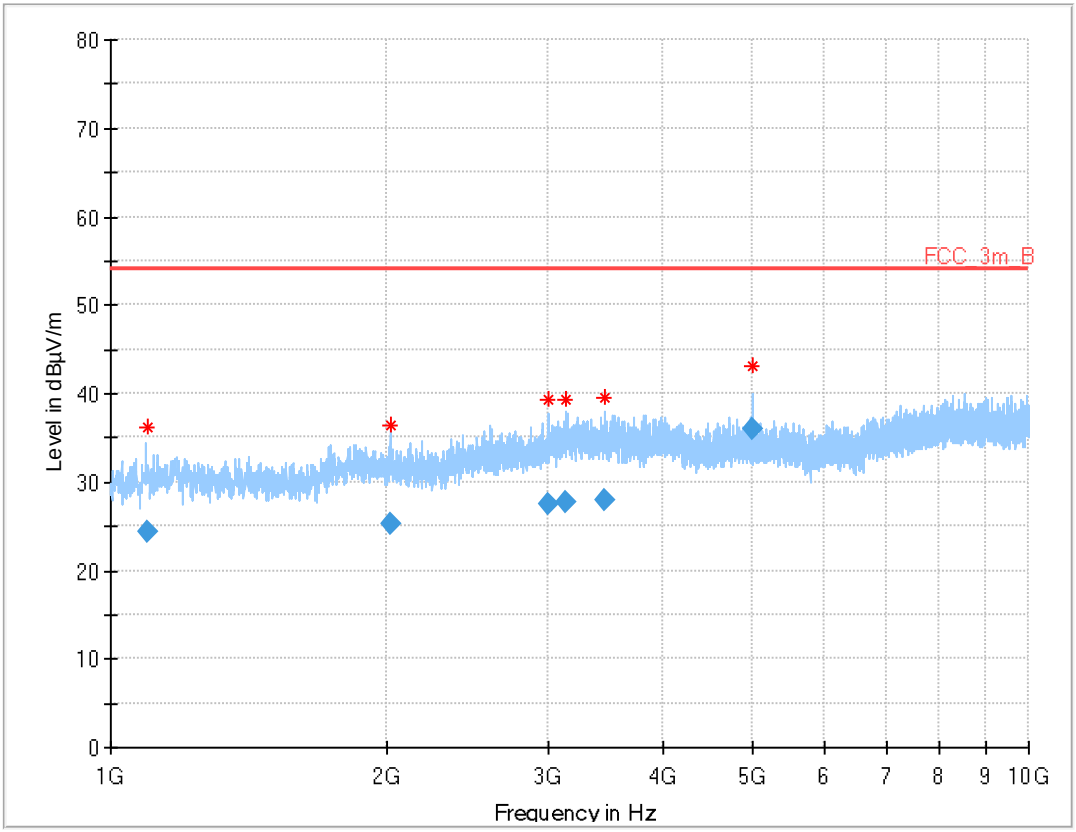
8.3.4 Calibration Information

Device	**Serial number**	**Internal Number**	**Calibration valid until**	**Calibration interval**
FSU 26	200809	300003874	12/2020	12 month
Horn Antenna	8812-3088	300001032	07/2021	24 month
Remarks: System check of all relevant devices and the chamber (weekly)				

8.3.5 Test Results

Common Information

EUT:	AEC (Automotiv Ethernet Converter)
Serial number:	0000B9
Test description:	FCC part 15 B class B
Operating condition:	1000MBit/s mode
Operator name:	Kraus
Comment:	DC 12V ; ETH: shielded



Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg	Corr. (dB/m)
1096.382	24.39	54.0	29.6	1000	1000.0	H	51	-6
2015.790	25.22	54.0	28.8	1000	1000.0	V	320	-4
2995.306	27.50	54.0	26.5	1000	1000.0	V	32	-1
3127.746	27.80	54.0	26.2	1000	1000.0	H	111	-1
3456.689	28.02	54.0	26.0	1000	1000.0	H	151	0
5000.081	36.00	54.0	18.0	1000	1000.0	V	104	2

8.3.6 Hardware Set-up

Subrange 1

Frequency Range:	1 GHz - 10 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 17), SN 200809/026, FW 4.71
Signal Path:	1_6_EN FW 1.0 Correction Table: 3_5m Correction Table: LNA_EN (matix)
Antenna:	BBHA 9120 B Correction Table (vertical): BBHA9120 Correction Table (horizontal): BBHA9120 Correction Table (vertical): Cable_Horn_EN (1103) Correction Table (horizontal): Cable_Horn_EN (1103)
Antenna Tower:	Manual [---]
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12
Software version:	EMC32 V10.59.0

8.3.7 Sequence of testing

Setup

- The Equipment was setup to simulate a typical usage like described in the user manual / or described by manufacturer.
- If the EUT is a tabletop system, a nonconducting table with 0,8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is: (see ANSI C 63.4)
  < 18 GHz = 3 m
  18-26 GHz = 1,5 m
  26-40 GHz = 0,75 m
- The EUT was set into operation.

Premeasurement

- The turntable rotates continuous from 0° to 360°
- The antenna is polarized vertical and horizontal.
- In accordance to the antenna beam and the size of the EUT the antenna height changes in 30 cm steps, start at 1 meter. If it is not possible to tilt the emissions will be checked with a manually tilted antenna from top side.
- The analyzer scans quickly to find the maximum emissions of the EUT

Final measurement

- The final measurement will be performed with minimum the six highest peaks (depends on emissions and number of measured points below 1 GHz)
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.
- The final measurement will be done with AV (Average / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit, and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

8.3.8 Signal strength calculation

Calculation formula:
$SS = U_R + CL + AF + PA + DC$

List of abbreviations:

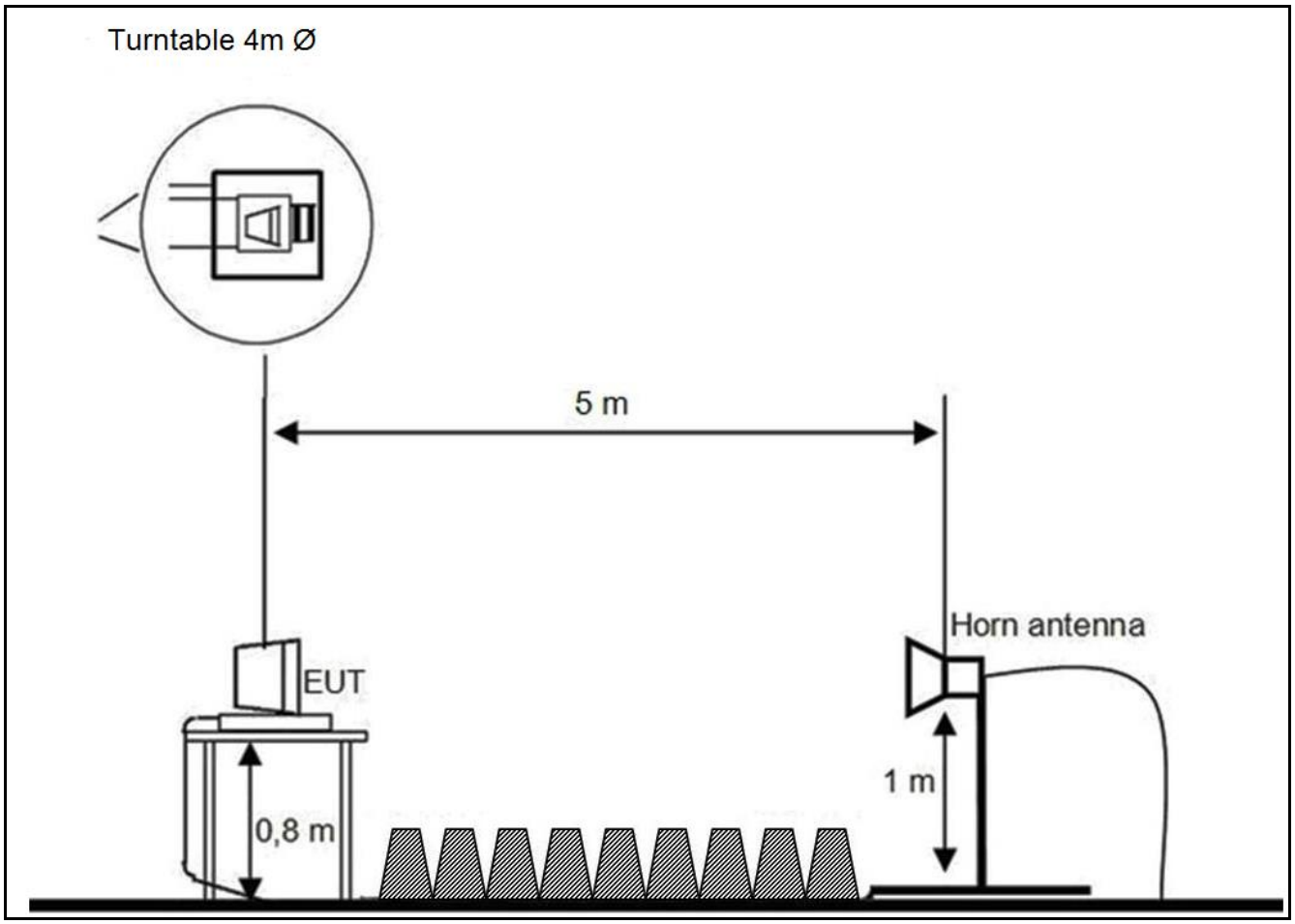
SS	►	signal strength
U_R	►	voltage at the receiver
CL	►	loss of the cable and gain of the preamp
AF	►	antenna factor
DC	►	distance correction (results measured on 5 m calculated to 3 m)

List with correction factors: column CL in table contains cable factor and preamplifier correction

Frequency [GHz]	CL [dB]	AF [dB1/m]	DC [dB]
1,000	-35,50	26,20	4,40
1,500	-35,20	26,10	4,40
2,000	-35,10	26,70	4,40
2,500	-35,00	26,50	4,40
3,000	-34,70	27,60	4,40
3,500	-34,80	28,40	4,40
4,000	-35,00	28,60	4,40
4,500	-34,90	28,90	4,40
5,000	-34,80	29,30	4,40
5,500	-34,35	29,80	4,40
6,000	-34,00	30,30	4,40
6,500	-33,50	31,20	4,40
7,000	-33,10	31,20	4,40
7,500	-33,40	31,70	4,40
8,000	-33,80	32,10	4,40
8,500	-33,75	32,30	4,40
9,000	-33,70	31,70	4,40
9,500	-33,50	29,40	4,40
10,000	-33,40	33,00	4,40

Example calculation:
For example at 4,000 000 000 GHz the measured Voltage (U_R) is 46,13 dBµV, the loss of the cable (CL) is -35,00 dB, the antenna factor (AF) is 28,60 dB(m^{-1}) and the distance correction (DC) is 4,40 dB the final result will be calculated:
SS [dBµV/m] = 46,13 [dBµV] + (-35,00) [dB] + 28,60 [dB(m^{-1})] + 4,4 [dB] = 44,13 [dBµV/m] (160,88 µV/m)

8.3.9 Test Set-up



9 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
	Radiated emission in chamber F				
F-1	Control Computer	F+W		2934939v001	300005258
F-2	Trilog-Antenna	Schwarzbeck	VULB 9163	9163-295	300003787
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	Netgear	GS108P	26V12A3H50336	300000368
F-5	EMI Test receiver	R&S	ESR	1316.3003K03-102587-ct	300005771
F-6	Turntable Interface-Box	EMCO / ETS-LINDGREN	Model 105637	44583	300003747
F-7	Tower/Turntable Controller	EMCO / ETS-LINDGREN	Model 2090	64672	300003746
F-8	Tower	EMCO / ETS-LINDGREN	Model 2175	64762	300003745
F-9	Ultra Notch-Filter Rejected band Ch. 62	WRCD		9	
	Radiated immunity in chamber F				
F-10	Control Computer	F+W		FW0502032	300003303
F-11	Signal Generator	R&S	SMB 100A	1406.6000k02-113856	300005266
F-13	RF-Amplifier	Bonn	BLWA 0860-250/100D	035491	300003210
F-14	Stacked Logper Antenna	Schwarzbeck	STLP9128 E	9128 E 013	300003408
F-14a	Bicon-Antenna	EMCO	3109	8906-2309	300000575
F-14b	Bicon-Antenna	Schwarzbeck	Balun VHBD 9134 elements BBFA 9146	3011 0057	300005385
F-15	RF-Amplifier	ar	1000LM20	20562	-/-
F-16	Directional Coupler	ar	DC7144A	312786	300003411
F-16a	Directional coupler	emv	DC 2000	9401-1677	300000592
F-18	Power Meter	R&S	NRP2	104973	300005114
F-19	Power sensor	R&S	NRP-Z91	103332	300005114-1
F-20	Power sensor	R&S	NRP-Z91	103333	300005114-2
F-35	RF- Amplifier	Bonn	BLMA 2060-5	097392A	300003908
F-36	Stacked Microwave Log.-Per. Antenna	Schwarzbeck	STLP9149	9149-044	300003919
	Harmonics and flicker in front of chamber F				
F-21	Flicker and Harmonics Test System	Spitzenberger & Spies	PHE4500/B I PHE4500/B II	B5983 B5984	300003314
F-28	Power Supply	Hewlett Packard	6032 A	2920 A 04466	300000580
	Radiated emission in chamber F > 1GHz				
F-29	Horn antenna	Schwarzbeck	BBHA 9120 B	188	300003896
F-30	Amplifier	ProNova	0518C-138	005	F 024
F-31	Amplifier	Miteq	42-00502650-28-5A	1103782	300003379
F-32	Horn antenna	Emco	3115	8812-3088	300001032
F-33	Spectrum Analyzer	R&S	FSU26	200809	300003874
F-34	Loop antenna	EMCO	6502	8905-2342	300000256

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
	Conducted emission in chamber G				
G-1	EMI Receiver	R&S	ESCI	100083	300003312
G-2	V-ISN	Rohde & Schwarz	ESH 3-Z5	892475/017	300002209
G-2a	V-ISN	Rohde & Schwarz	ESH 2-Z5	892602/024	300000587
G-3	2-Wire ISN	Schaffner	ISN T200	19075	300003422
G-4	4-Wire ISN	Schaffner	ISN T400	22325	300003423
G-5	Shielded wire ISN	Schaffner	ISN ST08	22583	300003433
G-6	Unshielded 8 wire ISN	Teseq	ISN T800	26113	300003833
G-7	Unshielded 8 wire ISN	Teseq	ISN T8-Cat. 6	26374	300003851
G-8	RF Current probe	Solar	9134-1	100254	300004163
G-9	V-ISN	Schaffner	ISN PLC-150	21579	300003318
G-10	V-ISN	Schaffner	ISN PLC-25-30	21584	300003319
G 10a	PLC Filter	TESEQ	Filter PLC	23436	300003598
G 10b	Coupling unit 75 Ohm	Fiedler	AC	----	300003272.04
	Conducted immunity in chamber G				
G-11	Signal generator	R&S	SMG	8610647025	300000204.01
G-12	RF-Amplifier	BONN	BSA 0125-75	066502-01	300003545
G-13	Power Meter	R&S	URV 5	837723/025	300002844.01
G-14	Power Sensor	R&S	URV 5-Z2	832874/021	300002239
G-15	Directional coupler	emv	DC 2000	9401-1677	300000592
G-16	Attenuator 6dB	Alan	50HP6-100 N	121048 0348	300003148
G-17	EM-Injection Clamp	FCC	203i	232	300000626
G-18	CDN	FCC	FCC-801-M3-16	237	300000627
G-19	CDN	FCC	FCC-801-T2	78	300000629
G-20	CDN	FCC	FCC-801-AF 2	62	300000630
G-21	CDN	FCC	FCC-801-AF 4	61	300000631
G-22	CDN	FCC	FCC-801-M1	2027	300002761
G-23	CDN	TESEQ	CDN M016S	38741	300004847
G-23a	CDN	TESEQ	CDN M516A	35049	300004848
G-24	transformer for 50Hz Loop Antenna	EM-Test	MC2630	0200-10	300002659.01
G-25	50Hz Loop Antenna	EM-Test	MS 100	none	300002659
	Surge, Burst, Dips and Interruptions in chamber G				
G-26	Hybrid-Generator	EM-Test	UCS 500N7	P1506148835	300005070
G-27	Motor Variac	EM-Test	MV 2616	0600-01	300002658
G-28	Capacitive Coupling Clamp	MWB	KKS 100	---	300000589
G-29a	Coupling Decoupling Network	EMC-Partner	CDN-2000-06-32	158	300004108
G-29	Coupling Decoupling Network	EMC-Partner	CDN-UTP8 ED3	1503	300004752
	ESD in chamber G				
G-30	ESD generator	Schlöder	SESD 30000	511333	300005097
	Emission on bench in chamber G				
G-31	Absorbing Clamp	R&S	MDS-21	832 231/006	300000527
	generic in chamber G				
G-32	power supply	Hewlett Packard	6038A	2848A06673	300001512
	Conducted interference in chamber G				
G 33	Signal generator	R&S	AFGU	862490/032	300001201
G 34	Audio amplifier	Crown 5002VZ	MACRO-TECH 5002VZ	8001641218	300004094
G 35	Shunt	Schwarzbeck	Shunt 9570	9570118	300004107
G 36	Coupling network	EM-Test	CN 200N1	P1322118851	300004742

10 Observations

No observations, exceeding those reported with the single test cases, have been made.

Annex A Photographs of the test set-up

Photo 1: radiated emission

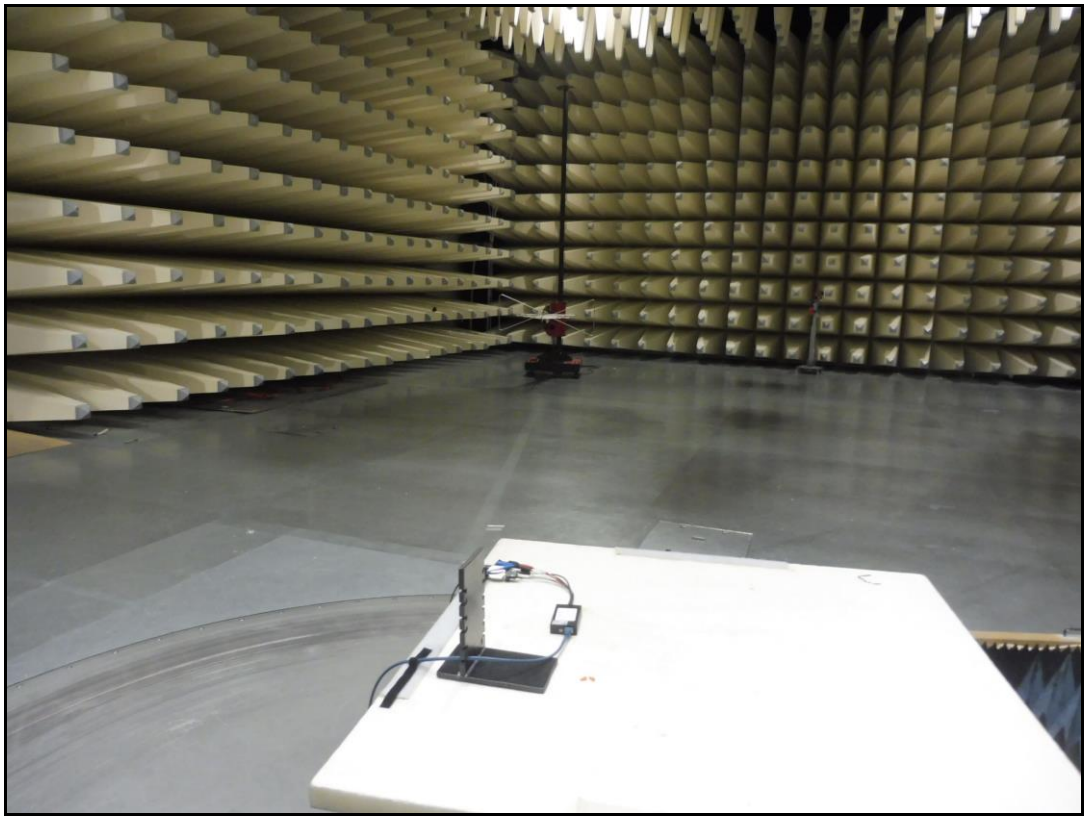


Photo 2: radiated emission

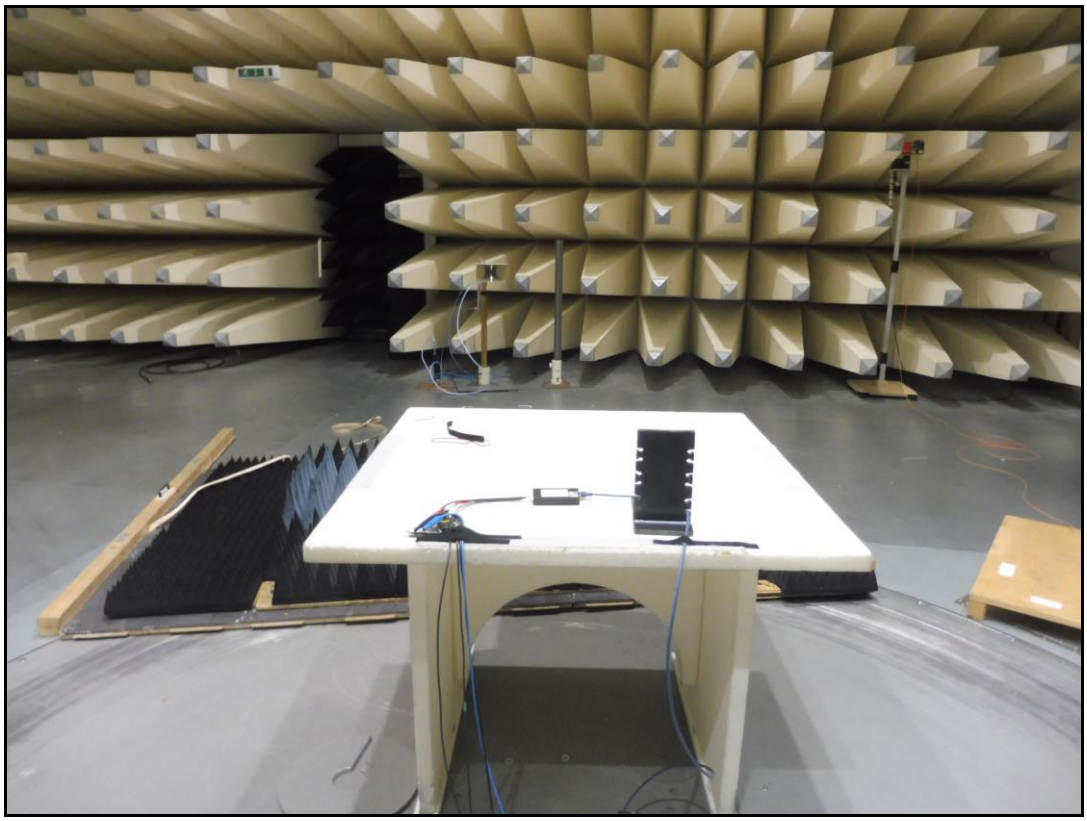
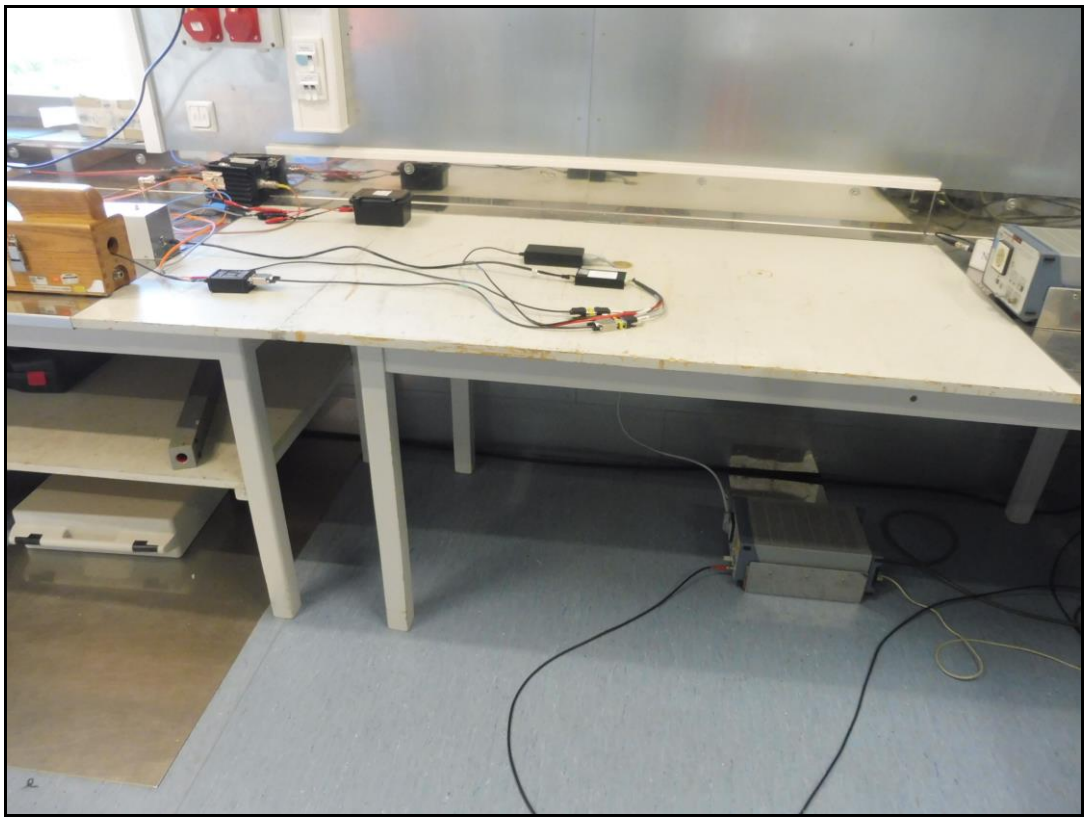


Photo 3: conducted emission



Annex B Photographs of the EUT

Photo 4: EUT

Photo 5: EUT

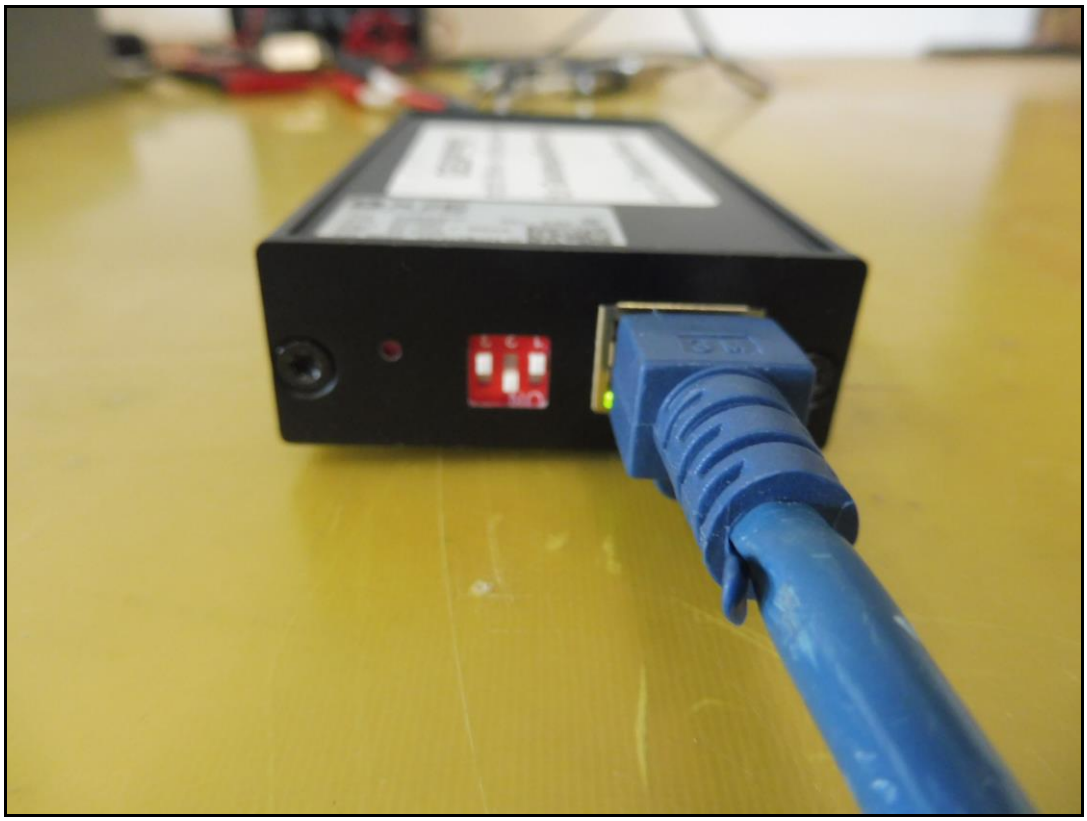


Photo 6: EUT

Photo 7: EUT

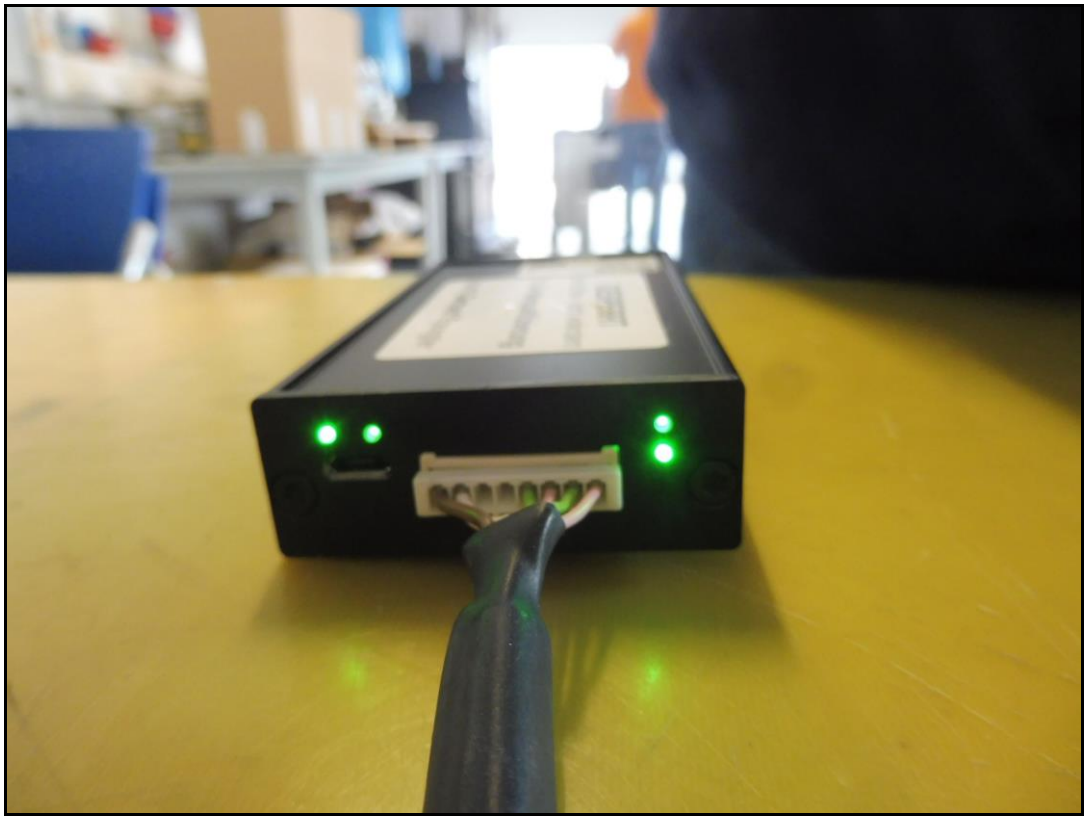


Photo 8: EUT

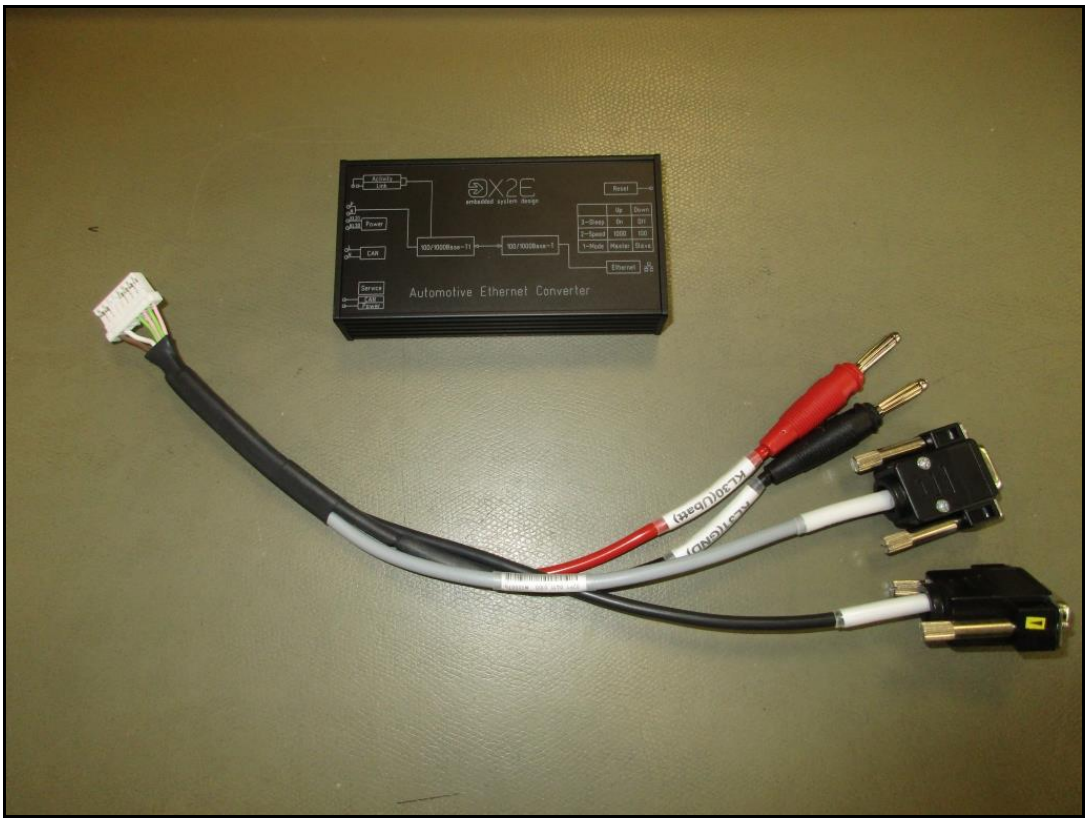


Photo 9: EUT

Photo 10: EUT

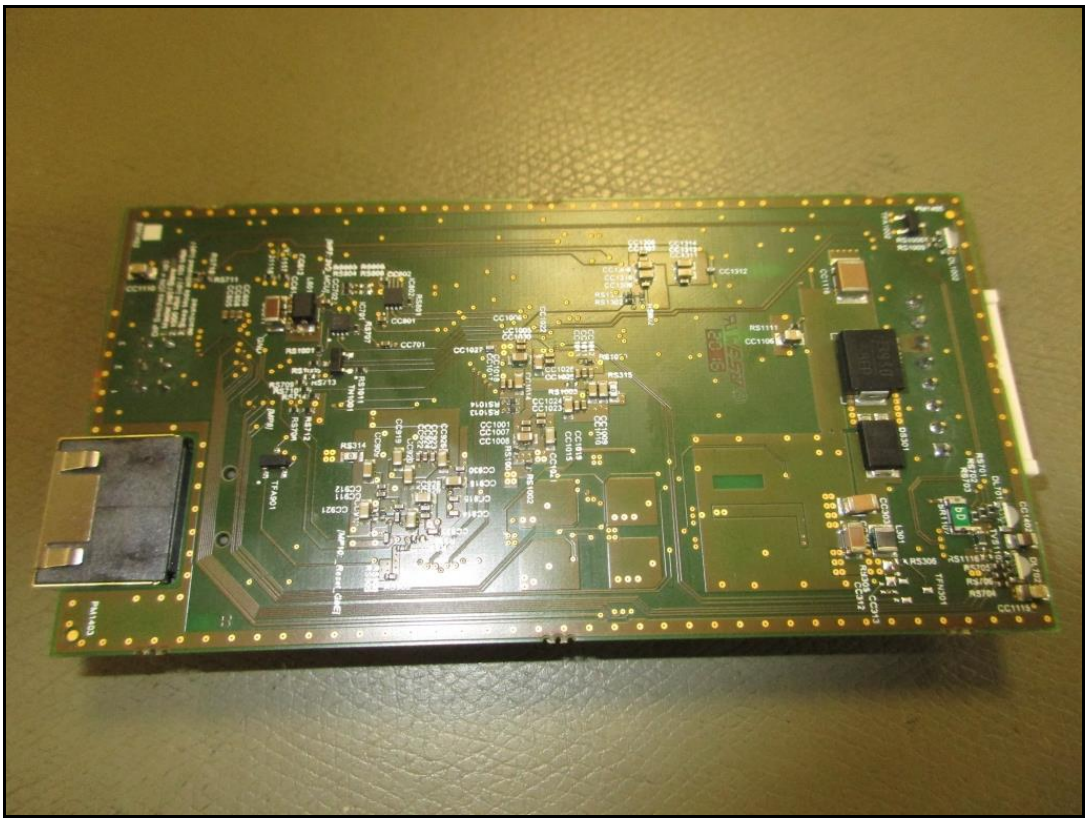
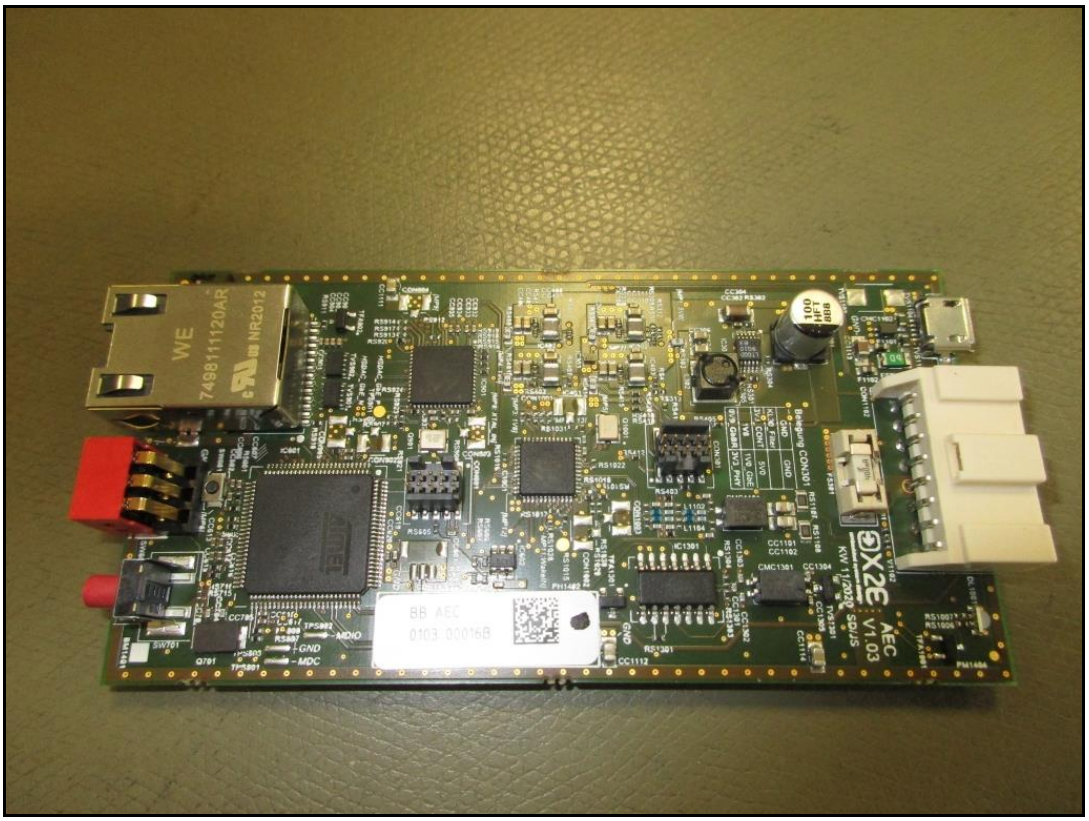


Photo 11: EUT



Annex C Document history

Version	Applied changes	Date of release
- / -	Initial release	2020-06-03
-A	Added FCC-ID	2020-07-06

Annex D Further information

Glossary

DUT	-	Device under Test
EMC	-	Electromagnetic Compatibility
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software