

TEST REPORT

Test Report No.: 1-8402/19-01-08



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

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Applicant

X2E GmbH

Jahnstrasse 2b
76870 Kandel/Germany
Phone: +49 7275 9143-0
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: 2019

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:	Data Logger
Model name:	ML-N4000
S/N serial number:	0000A0
HW hardware status:	See 6.2
SW software status:	See 6.2
FCC ID	2AU4HML-N4000
Power Supply:	12V



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Test Report authorised:

Test performed:

Uli Kraus
Radio Communications & EMC

Joachim Wolsdorfer
Radio Communications & EMC

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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.

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2.2 Application details

Date of receipt of order:	2019-04-11
Date of receipt of test item:	2019-11-08
Start of test:	2019-11-08
End of test:	2019-11-08
Person(s) present during the test:	Mr Spengler

3 Test standard/s:

Test Standard	Test Standard Description
FCC - Title 47 CFR Part 15: 2019	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 :	Data Logger		
Type identification :	XORAYA ML-N4000		
Equipment classification:	Equipment for fixed use		
Environment classification:	Industrial environment		
Supply voltage :	DC 12 v or AC 115 V/ 60 Hz with external powered supply		
Ports : (maximum cable lengths declared by manufacturer)	Description	Direction	
	AC power port using power supply	Input	---
	Signal/control port: USB3* ² , 2x4xCAN* ³ , 8x RS232* ⁸ , Service* ⁴ , ext. Storage* ⁵ , Ethernet 10Gbit* ⁶	In / output	> 3m
	Telecommunication port: 4x Ethernet (Host)* ⁷ , 4x Ethernet (loggin)* ⁷	In / output	> 3m
Is mounting position / usual operating position defined?			Table top
Additional information:			
- 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 * ² : shorter than 3m * ³ : 4 x CAN (shielded cable used) and 4 x CAN unshielded cable used * ⁴ : only for service and maintenance (not connected during normal use) * ⁵ : shorter than 3m (see 6.3) * ⁶ : Fibre optic port * ⁷ : shielded cable used * ⁸ : screened cables are used; length < 30m FCC ID : 2AU4HML-N4000			

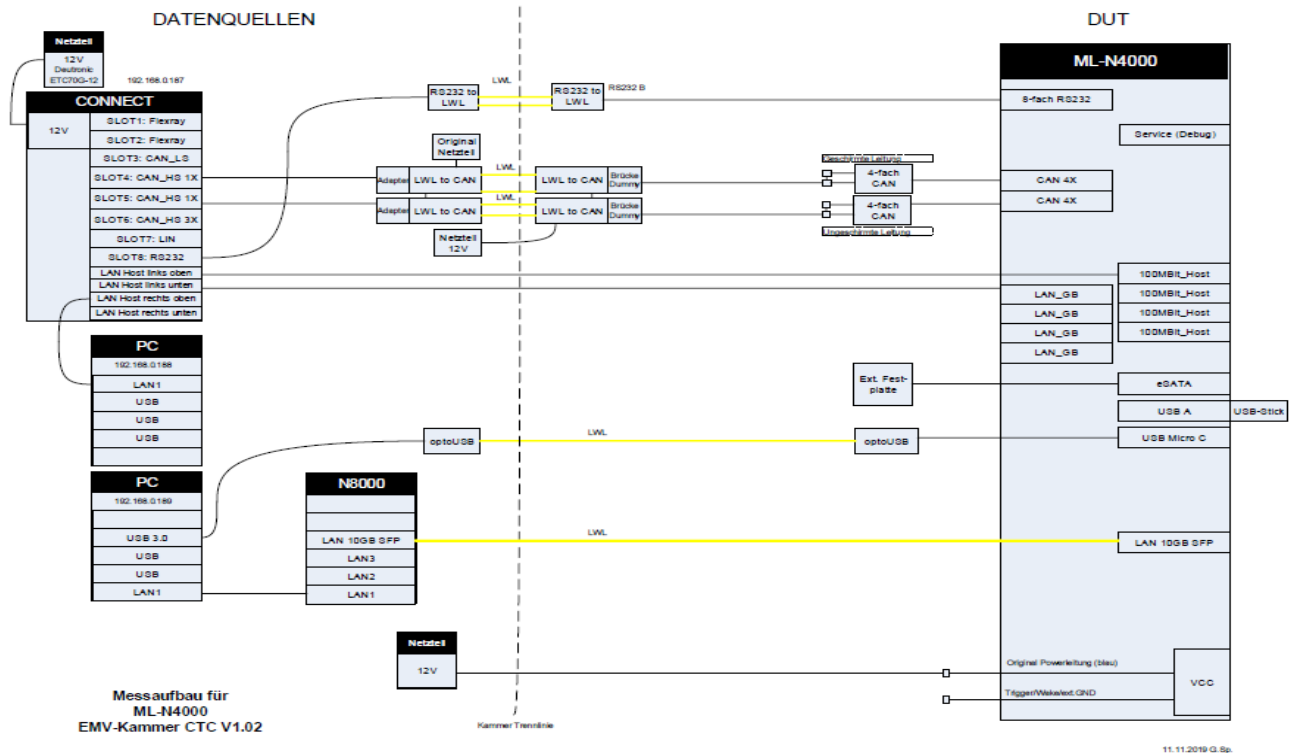
6.2 EUT: Type, S/N etc. and Short Descriptions Used in this Test Report

short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Data logger	XORAYA ML N4000	0000A0	0101	Firmware:4.0a.002d Protocoll: 0.01.0000 FPGA: 5002.0a05 Steuerung Powercontroller: 2.02.0500
EUT B	Power supply	ETC70G-12	Date code 1121	---	---

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

6.3 Auxiliary equipment (AE): Type, S/N etc. and short descriptions

Set 1:



2 RS-232/485/422 Fiber Modem	Criterion	Konverter von Draht-RS232 auf LWL und zurück		modifiziert im Alu-EMV-Gehäuse
1 PCAN-LWL	Peak Systems	Konverter von Draht-CAN auf LWL und zurück	004999#1	
1 PCAN-LWL	Peak Systems	Konverter von Draht-CAN auf LWL und zurück	004997#2	
1 optoUSB-3.0	mkMesstechnik	Konverter von Draht-USB 3.0 auf LWL und zurück	19-016978, 19-016979	
1 MI 1005	Baaske Medical	Medical Isolator Ethernet 5kV	MRC80271	
1 MI 1005	Baaske Medical	Medical Isolator Ethernet 5kV	MRC044618	
1 DT micro3.1 16GB	Kingston	USB-Stick		direkt am Prüfling eingesteckt (USB Typ A)
1 AD00223	IDS	USB-Leitung USB3.0 Typ A St. Auf Typ A St. 1,0m		Verbindung zum optoUSB3.0
1 Xoraya Ext. Storage	X2E GmbH	Optionale externe Festplatte 1TB	0200_0600_0101_0000a0	Konfig: 0284_0001_0200
1 ETC70G-12	Deutronic	12V / 5,5A Netzteil zur Prüflingsversorgung		
2 LipoStar Turbo 11,1V/1300mAh	Jamara	LiPo Akkus zur Versorgung der PCAN-LWL		modifiziert im Alu-EMV-Gehäuse
1 Xoraya Connect	X2E GmbH	Datenquelle für RS232, CAN, ETH	000054	Konfiguration 0950_0001_0206
1 ftlx8573d3btl	Finisar	Industrial Temperature 10GB/s 850nm Multimode SFP+Datacom Transceiver		beim Prüfling eingesteckt
1 ThinkPad E530	Lenovo	Notebook für USB3.0 Datenverkehr	MP-13A7C12-08	
1 ThinkPad T510	Lenovo	Notebook zur Beobachtung des Datenverkehrs ETH, CAN, RS232	R9-BGEHR 11/02	

6.4 EUT operating modes

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

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 Ø.

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									
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8.1.2 Test Plan

EUT set-up	Set 1 + EUT B (power supply)		
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)
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8.1.3 Conducted Limits (Power-Line)

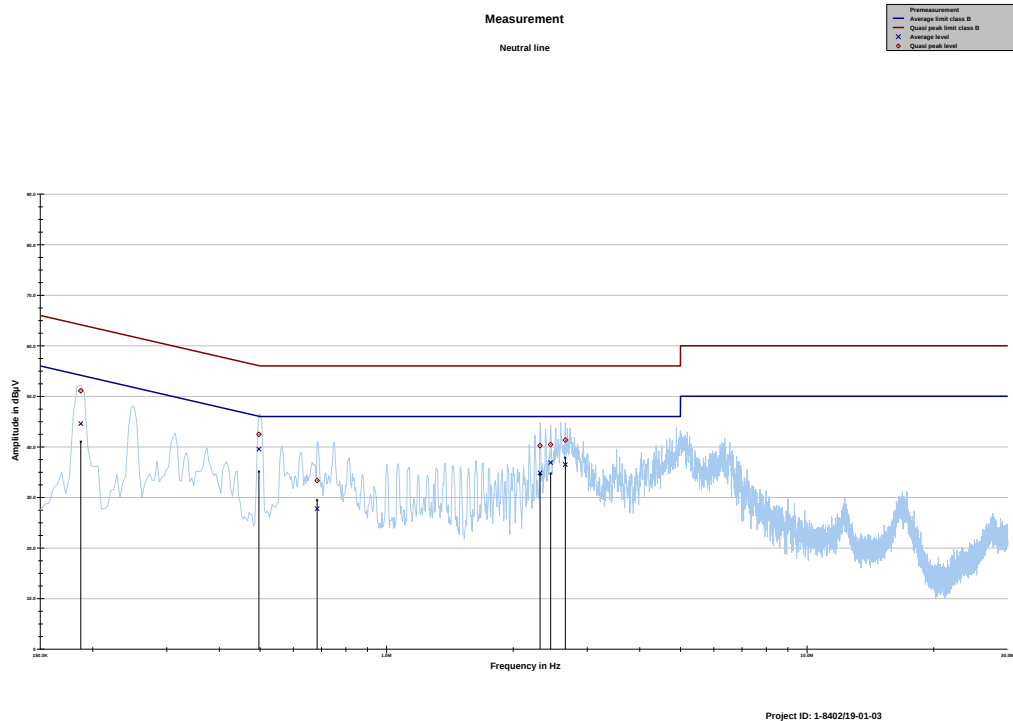
Frequency- range	FCC part 15 B Class B		FCC part 15 B Class A	
	Quasi-Peak (dBµV)	Average (dBµV)	Quasi-Peak (dBµV)	Average (dBµV)
0,15 MHz – 0,5 MHz	66-56	56-46	79	66
0,5 MHz -5 MHz	56	46	73	60
5 MHz -30 MHz	60	50	73	60

8.1.4 Calibration Information

Device	Serial number	Internal Number	Calibration valid until	Calibration interval
Agilent MXE EMI Receiver with RF Filter Unit	3617A00170	3000004405	12 / 2019	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

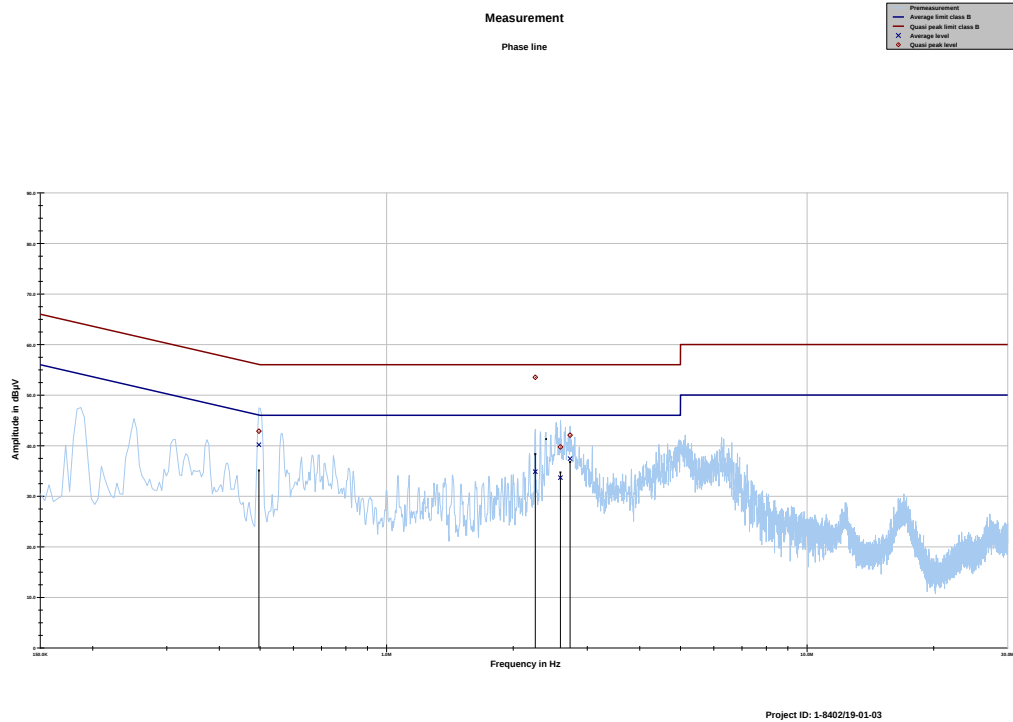
Project ID: 1-8402/19-01-03

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.187312	51.09	13.06	64.155	44.59	10.34	54.934
0.497006	42.48	13.57	56.050	39.55	6.53	46.086
0.683569	33.34	22.66	56.000	27.78	18.22	46.000
2.317856	40.23	15.77	56.000	34.85	11.15	46.000
2.455913	40.45	15.55	56.000	36.89	9.11	46.000
2.661131	41.35	14.65	56.000	36.48	9.52	46.000

Project ID - 1-8402/19-01-03

EUT - Xoraya ML N4000

Operating mode - data transfer



Phase line tbl

Project ID: 1-8402/19-01-03

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.497006	42.87	13.18	56.050	40.19	5.90	46.086
2.258156	53.52	2.48	56.000	34.84	11.16	46.000
2.590238	39.73	16.27	56.000	33.67	12.33	46.000
2.732025	42.07	13.93	56.000	37.44	8.56	46.000

Project ID - 1-8402/19-01-03

EUT - Xoraya ML N4000

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

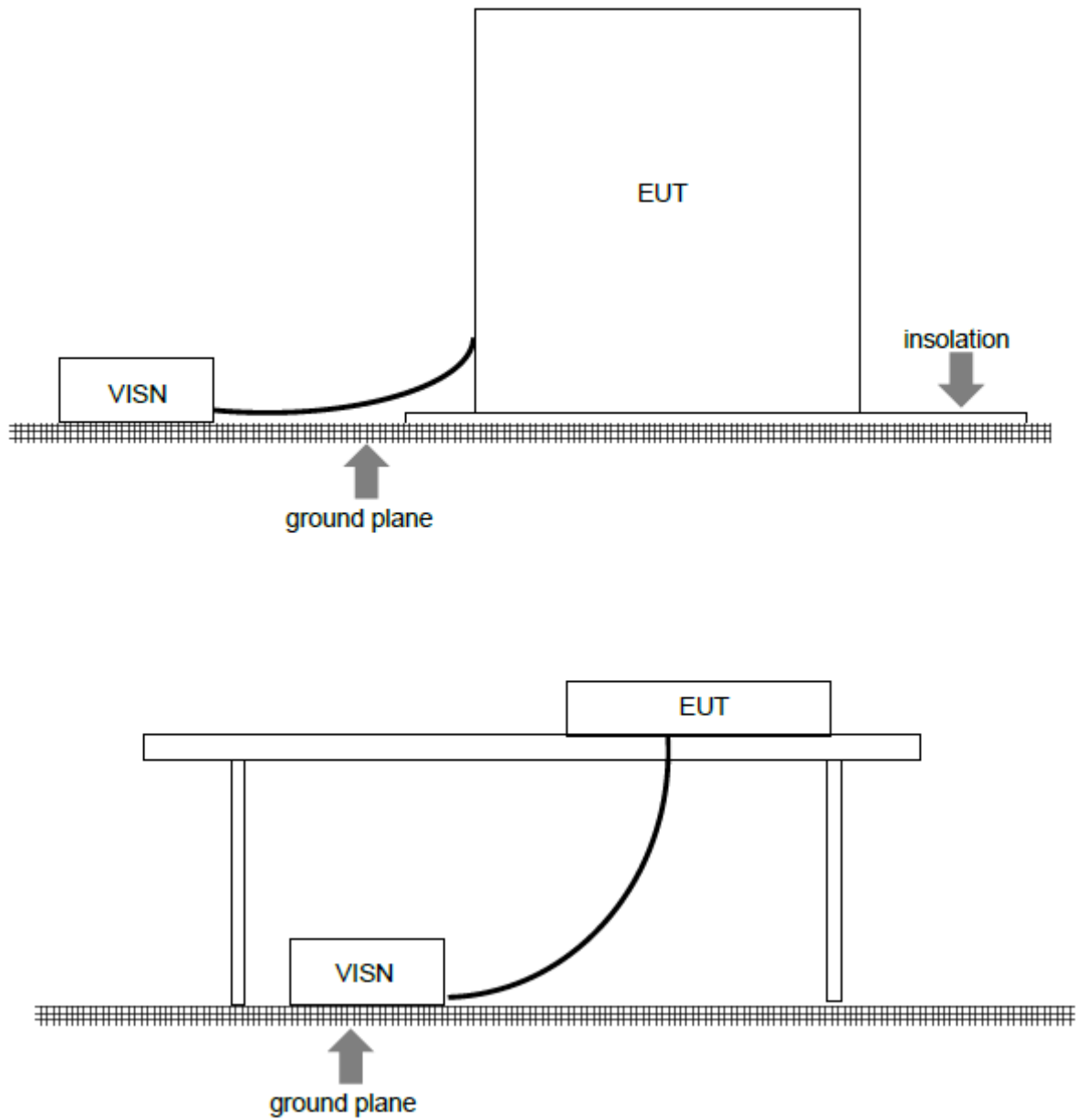
Example calculation:

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:

$$SS \text{ [dB}\mu\text{V]} = 37,62 \text{ [dB}\mu\text{V]} + 9,90 \text{ [dB]} + 0,23 \text{ [dB]} = \underline{47,75 \text{ [dB}\mu\text{V]}} \text{ (244, 06 } \mu\text{V)}$$

8.1.7 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	F 28			
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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 external power supply (12V DC)

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

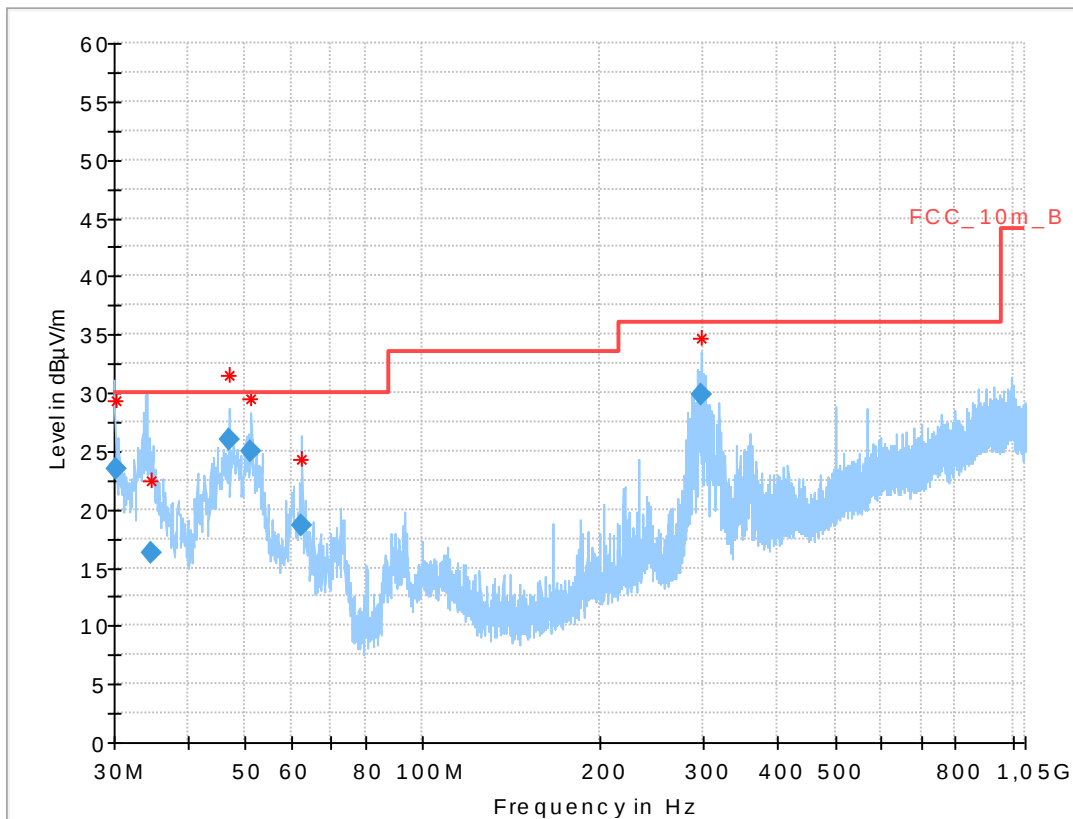
Device	Serial number	Internal Number	Calibration valid until	Calibration interval
ESR 3 Receiver	1316.3003K03/102 587	300003312	05/2020	12 month
Trilog Antenna	9163-371	300003854	11/2019	24 month

Remarks:
System check of all relevant devices and the chamber (weekly)

8.2.5 Test Results

Common Information

EUT: Xoraya ML N4000
 Serial number: 0000A0
 Test description: FCC part 15 class B @ 10 m
 Operating condition: data transfer, 2x ETH, 8x CAN, 8x RS 232; USB 3.0, SFP+
 Operator name: Kraus
 Comment: DC 12V / ETH: FTP



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)
30.143	23.44	30.0	6.56	1000	120	225.0	V	40.0	12
34.554	16.33	30.0	13.67	1000	120	288.0	V	51.0	12
46.952	26.06	30.0	3.94	1000	120	104.0	V	227.0	14
51.165	24.91	30.0	5.09	1000	120	100.0	V	264.0	14
62.496	18.63	30.0	11.37	1000	120	200.0	V	255.0	12
296.250	29.79	36.0	6.21	1000	120	124.0	V	99.0	14

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 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table (vertical): Cable_EN_1GHz (1005) Correction Table (horizontal): Cable_EN_1GHz (1005)
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 $\pm 45^\circ$ 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:

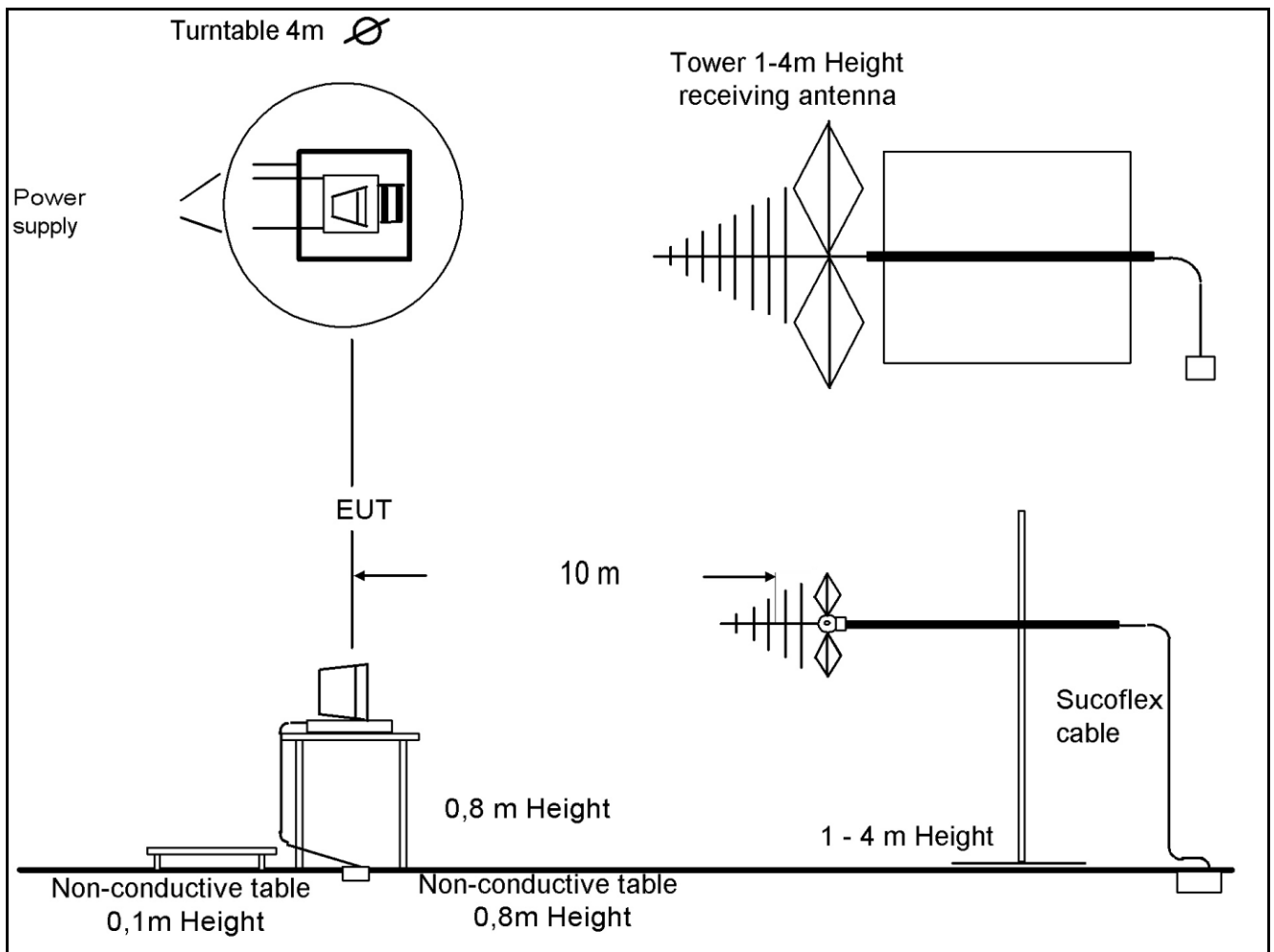
Frequency [MHz]	CL [dB]	AF [1/m]
30,000	0,20	12,30
100,000	0,60	11,30
200,000	1,10	10,60
300,000	1,30	13,20
400,000	1,60	15,30
500,000	1,90	16,80
600,000	2,00	18,80
700,000	2,20	20,30
800,000	2,30	21,50
900,000	2,40	22,80
1000,000	2,50	23,30

Example calculation:

For example at 500,000 000 MHz the measured Voltage (U_R) is 12,35 dB μ V, 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:

$$SS [dB\mu V/m] = 12,35 [dB\mu V] + 1,90 [dB] + 16,80 [dB (m^{-1})] = \underline{31,05 [dB\mu V/m] (35,69 \mu V/m)}$$

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	F 28					
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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 external power supply (12V DC)
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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

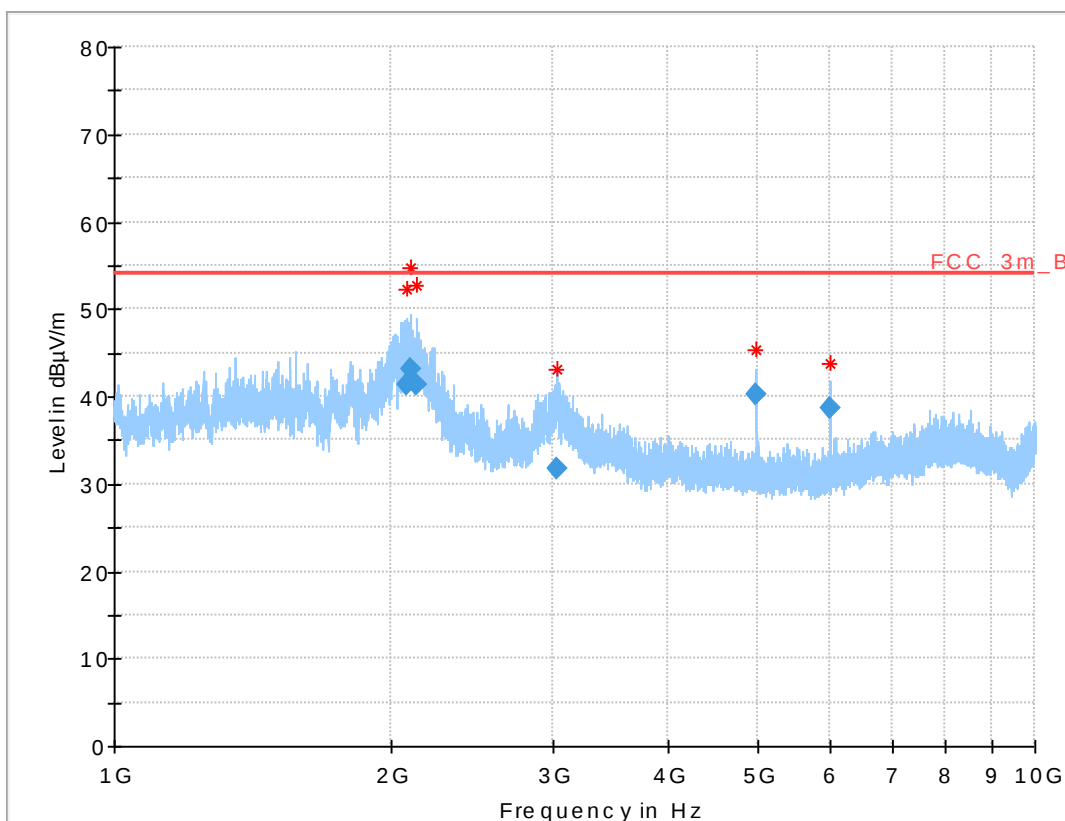
Device	Serial number	Internal Number	Calibration valid until	Calibration interval
FSU 26	200809	300003874	12/2019	12 month
Horn Antenna	9120B188	300003896	04/2020	24 month

Remarks:
System check of all relevant devices and the chamber (weekly)

8.3.5 Test Results

Common Information

EUT: Xoraya ML N4000
 Serial number: 0000A0
 Test description: FCC part 15 B class B @ 10 m
 Operating condition: data transfer, 2x ETH, 8x CAN, 8x RS 232; USB 3.0, SFP+
 Operator name: Kraus
 Comment: DC 12V / ETH: FTP



Final Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2081.770	41.33	54.0	12.67	1000	1000	100.0	H	158.0	-4
2102.469	43.07	54.0	10.93	1000	1000	100.0	H	142.0	-4
2132.063	41.45	54.0	12.55	1000	1000	100.0	H	137.0	-4
3024.750	31.81	54.0	22.19	1000	1000	100.0	V	238.0	-3
4987.858	40.19	54.0	13.81	1000	1000	100.0	V	159.0	-1
5999.874	38.58	54.0	15.42	1000	1000	100.0	H	124.0	0

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 ($\pm 45^\circ$) 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

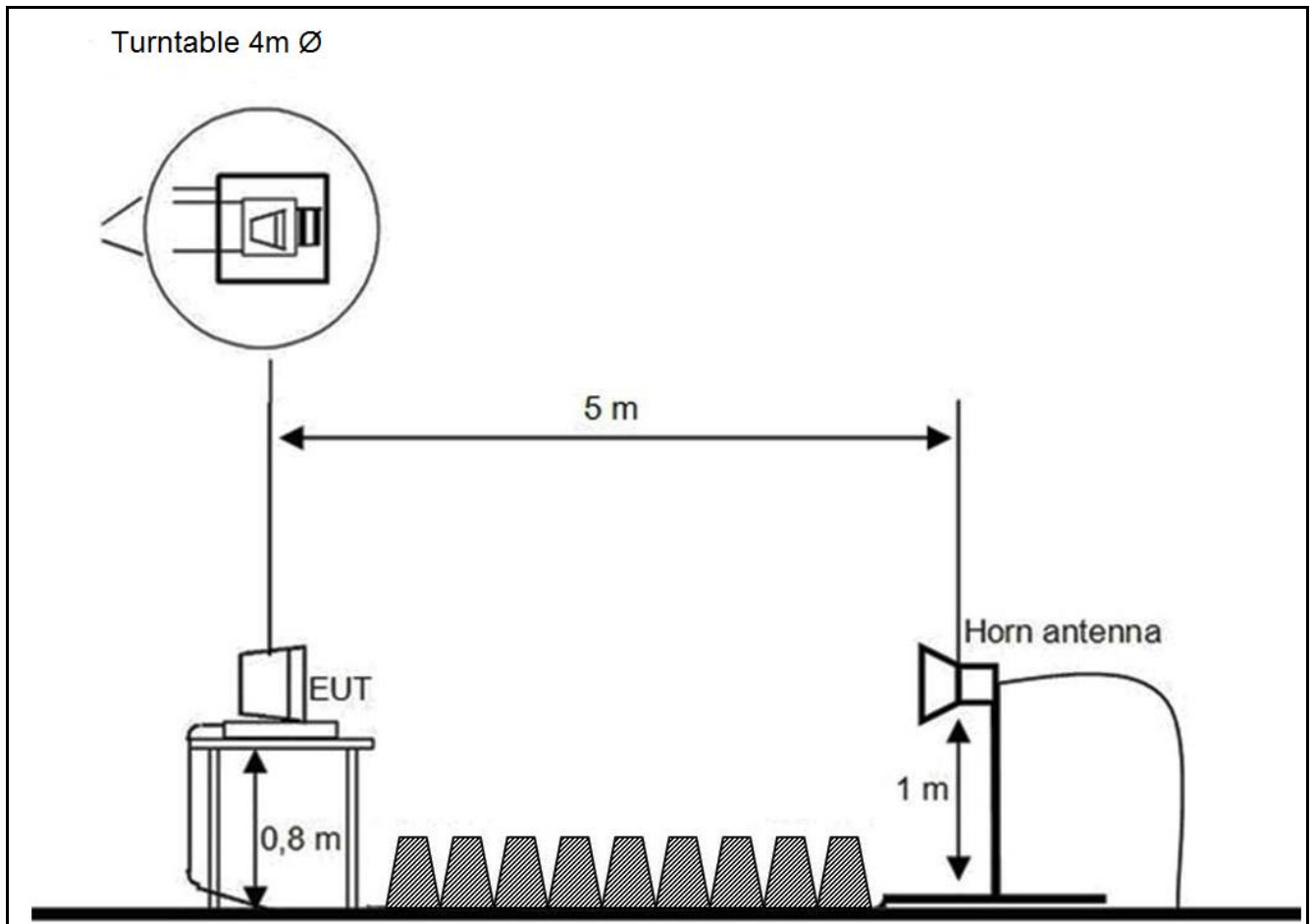
Frequency [GHz]	CL [dB]	AF [dB1/m]	DC [dB]
1,000	-35,50	26,20	4,40
1,500	-35,20	26,10	4,40
2,000	-35,10	26,70	4,40
2,500	-35,00	26,50	4,40
3,000	-34,70	27,60	4,40
3,500	-34,80	28,40	4,40
4,000	-35,00	28,60	4,40
4,500	-34,90	28,90	4,40
5,000	-34,80	29,30	4,40
5,500	-34,35	29,80	4,40
6,000	-34,00	30,30	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 dB μ V, 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:

$$SS \text{ [dB}\mu\text{V/m]} = 46,13 \text{ [dB}\mu\text{V]} + (-35,00) \text{ [dB]} + 28,60 \text{ [dB(m}^{-1}\text{)]} + 4,4 \text{ [dB]} = \underline{\underline{44,13 \text{ [dB}\mu\text{V/m]}}} \text{ (160,88 } \mu\text{V/m)}$$

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	9163-371	300003854
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	Netgear	GS108P	26V12A3H50336	300000368
F-5	EMI Test receiver	R&S	ESR3	1316.3003K03/102587	300003312
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	9709-5289	300000213
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	Agilent	MXE (N9038A)	MY51210197	300004405
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
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

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
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

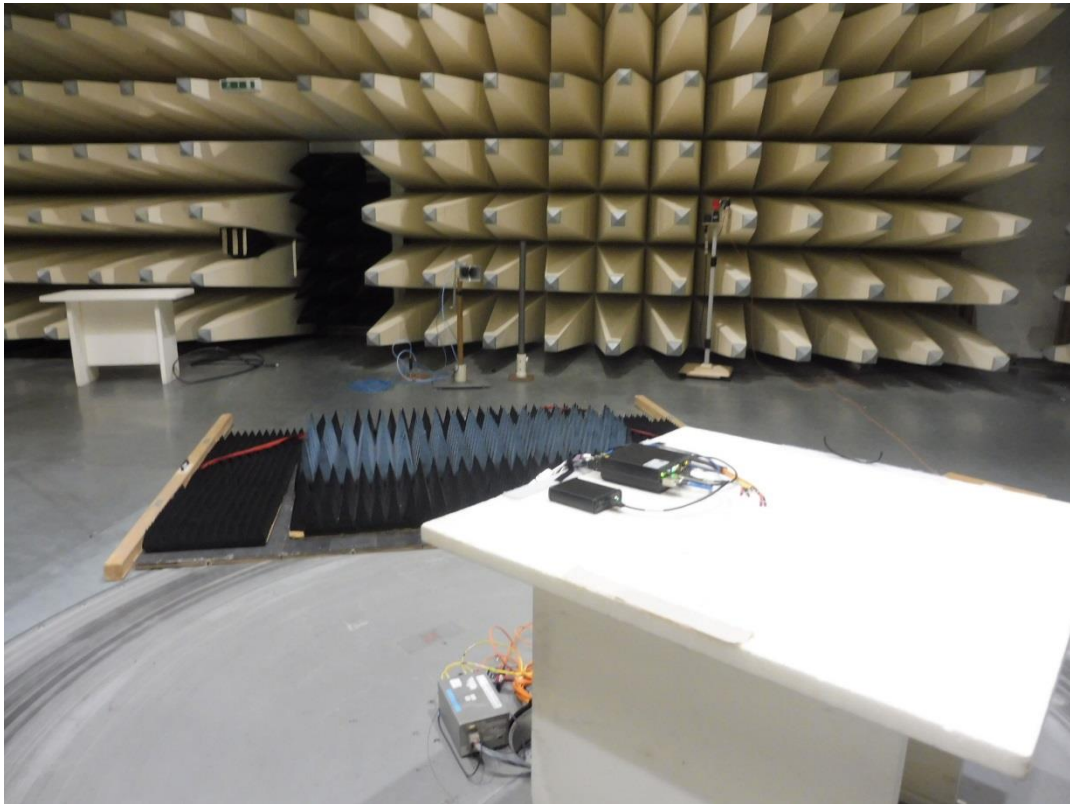


Photo 2: radiated emission

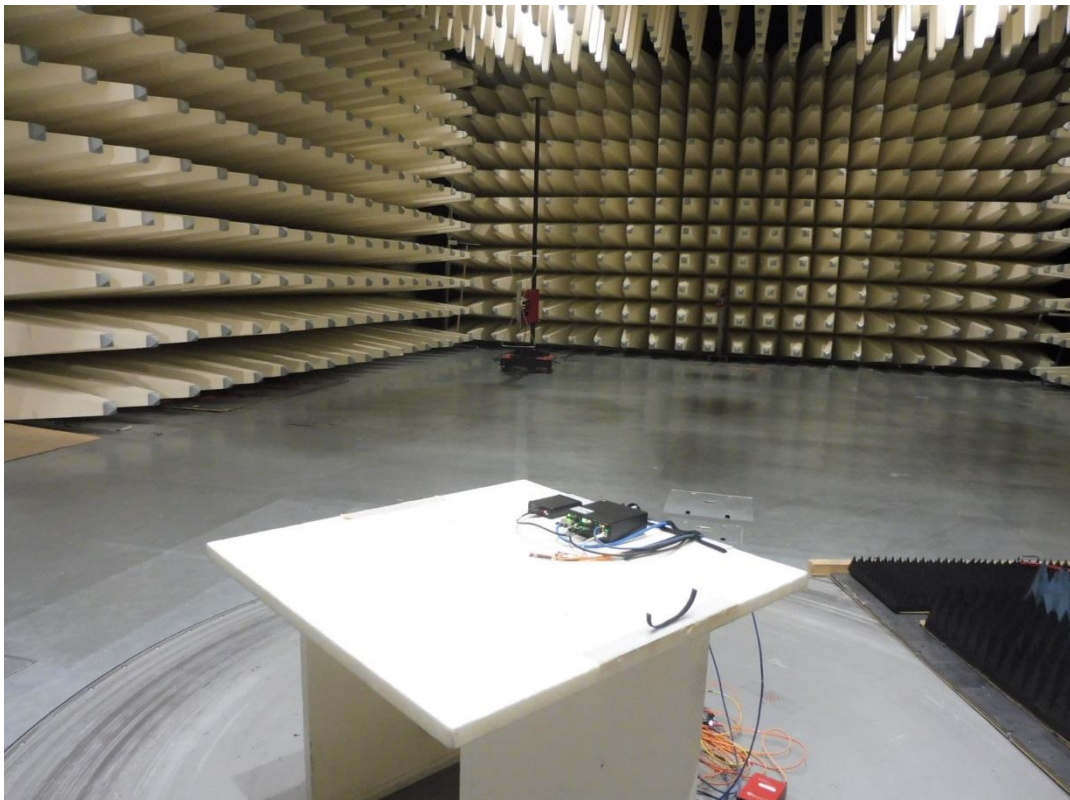


Photo 3: radiated emission

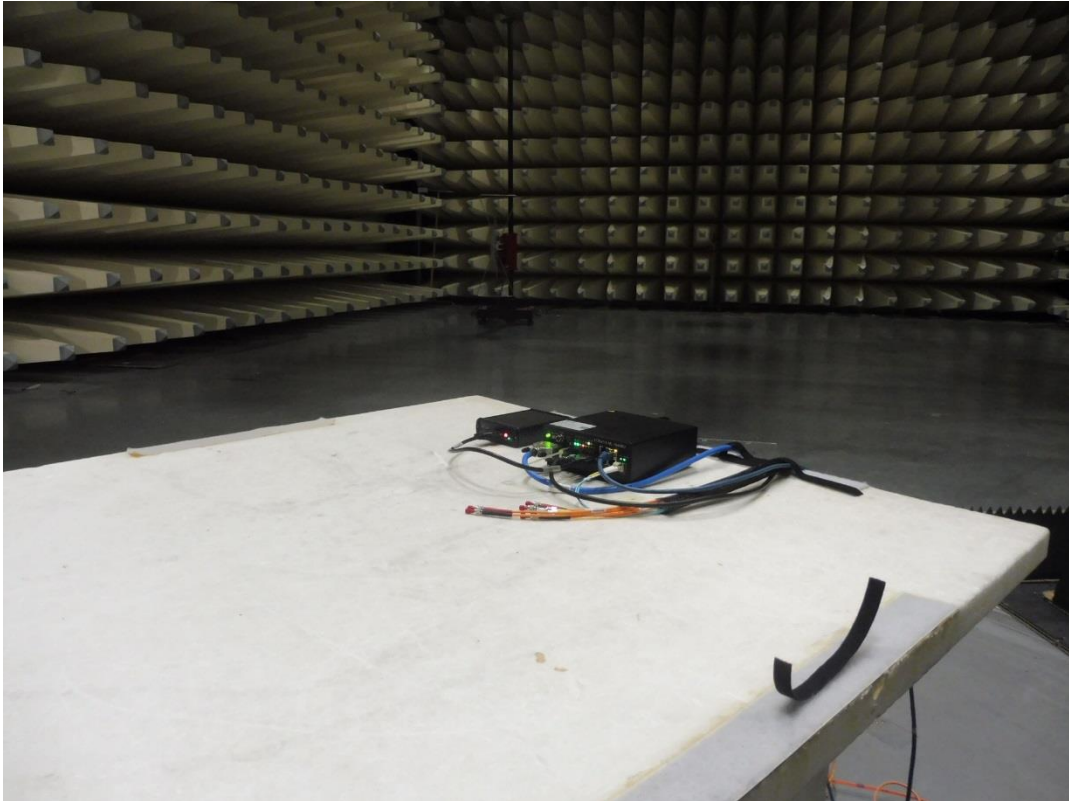


Photo 4: conducted emission



Annex B Photographs of the EUT

Photo 5: EUT



Photo 6: EUT



Photo 7: EUT



Photo 8: EUT



Photo 9: EUT



Photo 10: EUT B



Photo 11: EUT A

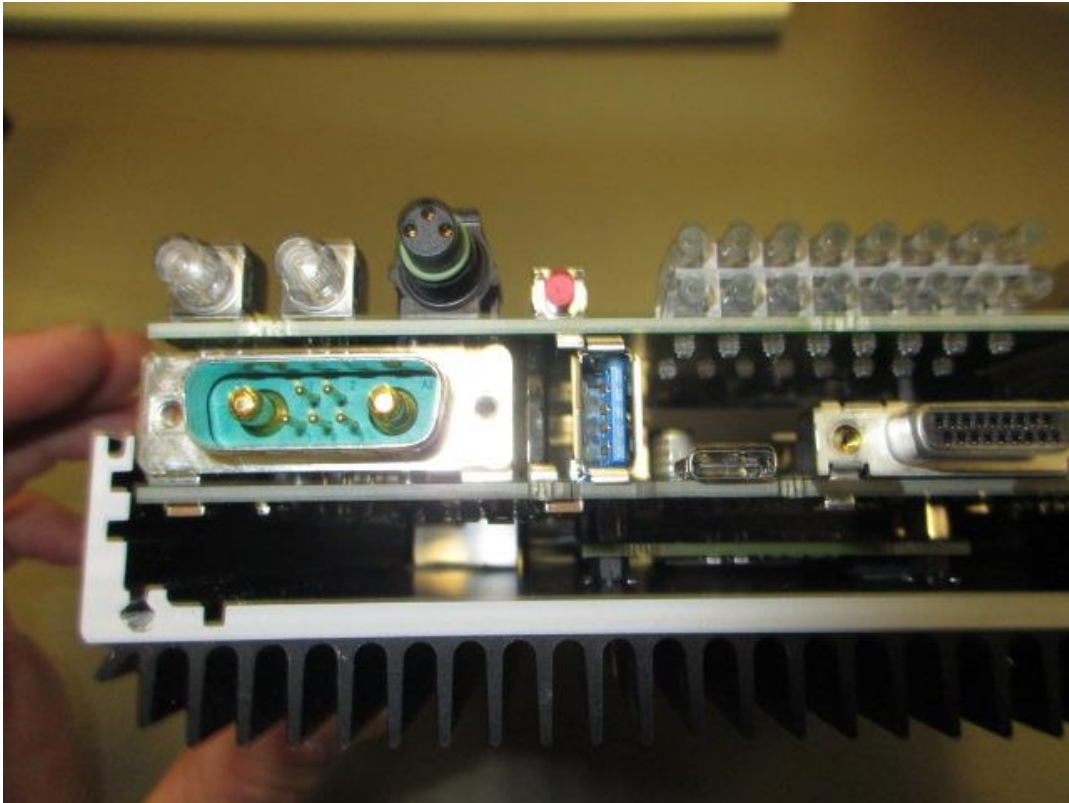


Photo 12: EUT A

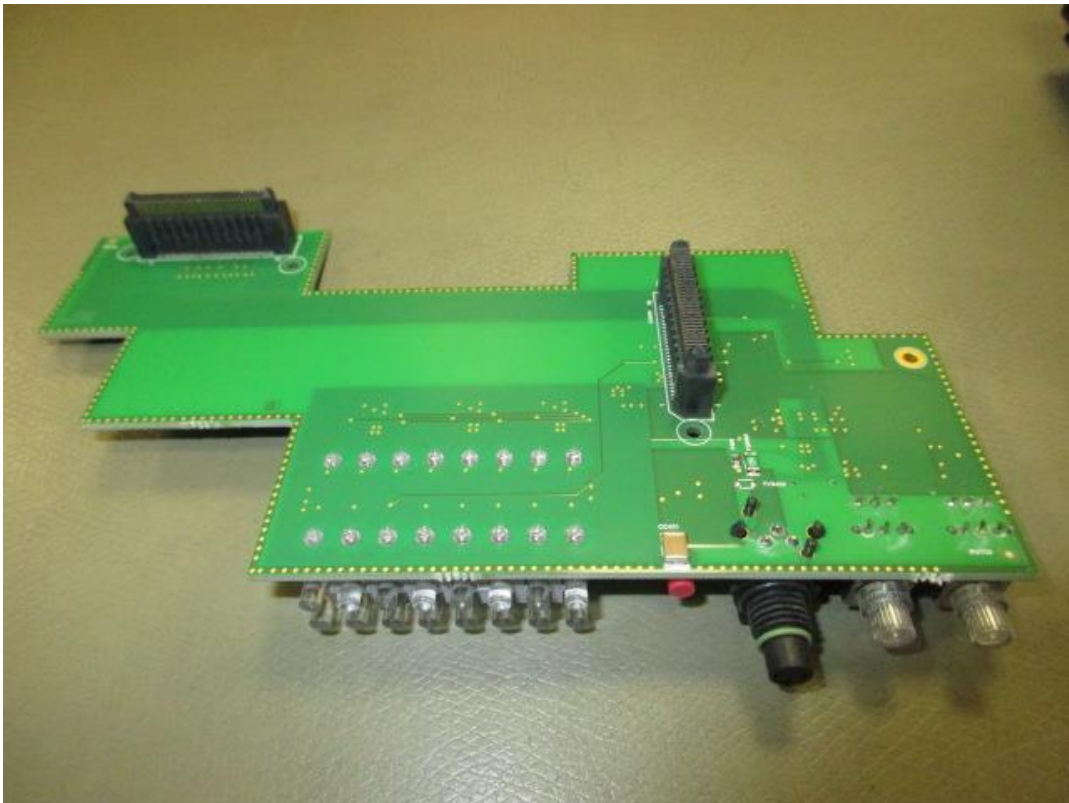


Photo 13: EUT A



Photo 14: EUT A



Photo 15: EUT A



Photo 16: EUT A



Photo 17: EUT A



Photo 18: EUT A



Photo 19: EUT A

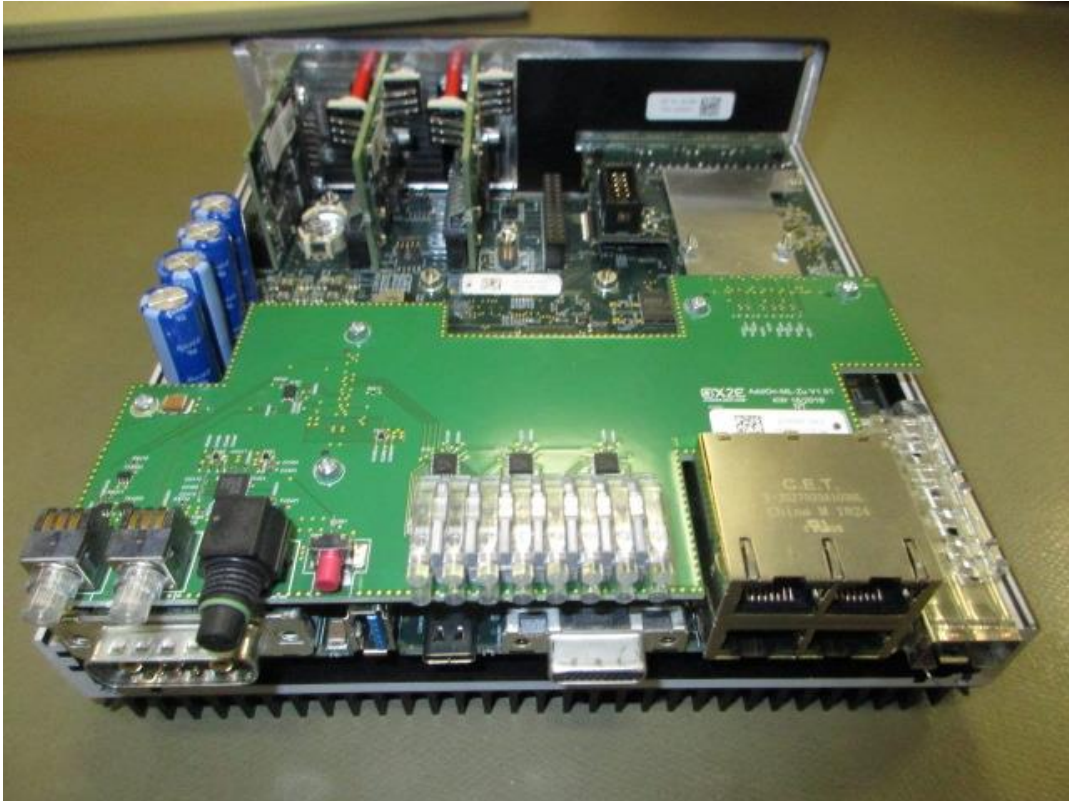


Photo 20: EUT A



Annex C Document history

Version	Applied changes	Date of release
---	Initial release	2019-11-12

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