



ACCREDITED TESTING LABORATORY (NR. 312)
for Electromagnetic Compatibility
FCC Recognition as accredited EMC Test Laboratory No: 835627

TEST REPORT No. EMV-E 28a/20

Replacement of EMV-E28/20 issued 05 March 2020

Test procedure: Title 47 - Telecommunication
Chapter I - FEDERAL COMMUNICATIONS COMMISSION
Subchapter A - GENERAL
Part 15 - RADIO FREQUENCY DEVICES

The summary of the results can be found on page 2.

Ordered by: TTControl GmbH

Address: Schoenbrunner Str. 7
1040 Vienna
Austria

On: Vision3Plus 12.1-00-S-U-0-E14214-I-000

This report contains the pages 1 to 19.

Authorized person:

Ing. Thomas Nakovits

Test performed by:

Ing. Markus Winkler, MSc

Date: 2020-03-18
Internal Order Number: EMC/E-2673

Comments:

The testing result refers exclusively to the testing subject.

The production or transmission of extracts of the present report is subject to authorization by the testing laboratory.

Akkreditierung Austria is a full member of the International Laboratory Accreditation Cooperation ILAC and a signatory of the MRA for "Testing, Calibration and Inspection".

1. Summary of all measurements and tests

Measurements according to FCC 47 CFR Part 15 Subpart B - Unintentional Radiators			
Chapter / Norm. Reference	Term	Details see chapter	Result
§15.107 ANSI C63.4-2014	Conducted limits - (AC power line)	---	n.a. ^a
§15.109 ANSI C63.4-2014	Radiated emission limits	4.1	PASS

Table 1: Summary Emission measurements

PASS	The DUT meets the requirements of the standard
FAIL	The DUT does not meet the requirements of the standard
n.a.	The Test is not applicable
n.p.	The Test was not performed

Table 2: General definitions for the report

All indications of Pass/Fail in this report are opinions expressed by Seibersdorf Laboratories based on interpretations and/or observations of test results.

Revision 28a/20 summary:

- Issue date of FCC Standard on title page and chapter 3.3 corrected

^a Device under test has no AC power supply lines

2. Contents

1.	Summary of all measurements and tests	2
2.	Contents	3
3.	General information	4
3.1	Device under test (DUT).....	4
3.2	Test Configuration.....	4
3.3	Standards / Documents.....	7
3.4	Date and location of the measurements and tests.....	8
4.	Measurements and tests – parameters and results	9
4.1	Radiated emissions measurement	9
5.	Annex	12
5.1	Photos of the DUT and the configuration.....	12
5.2	Charts	15

3. General information

3.1 Device under test (DUT)

DUT: Vision3Plus 12.1-00-S-U-0-E14214-I-000
FCC ID: 2AUIVTTCTVISION312
Serial number: V3120020050032
Hardware revision: 00.09-B
Software revision: 029
Year of manufacturing: 2020/01

Manufacturer: TTControl GmbH
Address: Schoenbrunner Str. 7
1040 Vienna
Austria

Highest internal frequency: 996 MHz

Description: Rugged operator interface for off-highway machines

The device under test and all relevant information regarding the device under test were supplied by the customer.

3.2 Test Configuration

The DUT was mounted by György Till, TTControl GmbH and Markus Winkler, Seibersdorf Labor GmbH, in the Semi anechoic chamber (SAC3) of the EMC-Test Laboratory Seibersdorf.

All measurements and tests were performed at rated power.

The power supply voltage of the DUT during the measurements was 27 VDC.

All measurements were performed in the operation mode:

- Power ON mode

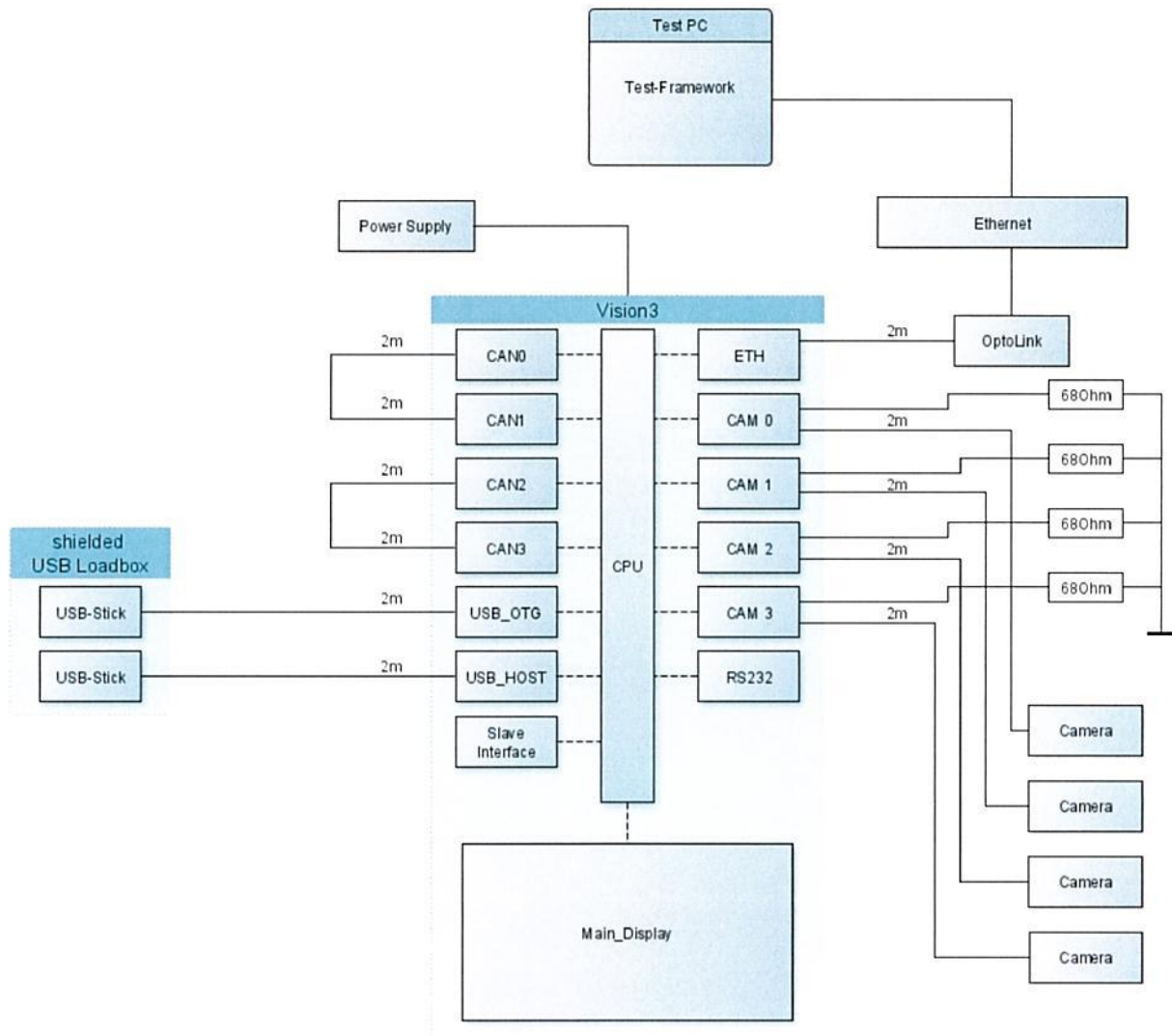
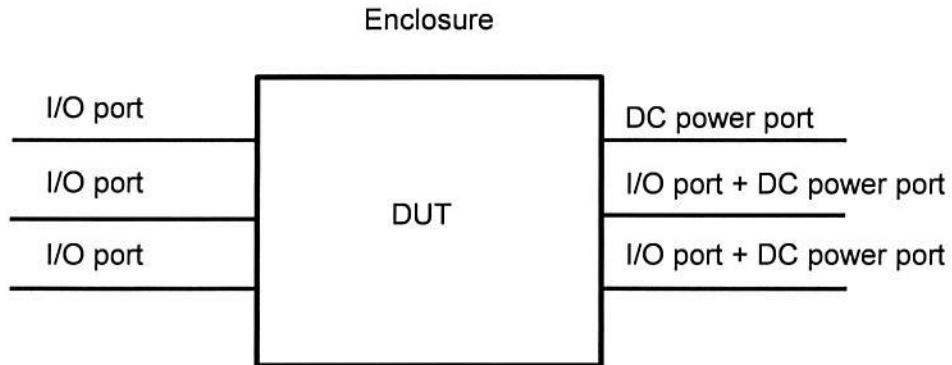


Figure 1: DUT test setup



Type	Name	Cable type / Comments
DC power port	KL30/KL31	2 x 0.75mm ² , unshielded
I/O port	KL15	1 x 0.75mm ² , unshielded
I/O port	WAKEUP	1 x 0.75mm ² , unshielded
I/O port	SERVICE	1 x 0.75mm ² , unshielded
I/O port	CAN0	2 x 0.35mm ² , unshielded, twisted pair
I/O port	CAN1	2 x 0.35mm ² , unshielded, twisted pair
I/O port	CAN2	2 x 0.35mm ² , unshielded, twisted pair
I/O port	CAN3	2 x 0.35mm ² , unshielded, twisted pair
I/O port	RS232	3 x 0.75mm ² , unshielded
I/O port + DC power port	CAM1	2 x 0.75mm ² + RG187 A/U coax, shielded
I/O port + DC power port	CAM2	2 x 0.75mm ² + RG187 A/U coax, shielded
I/O port + DC power port	CAM3	2 x 0.75mm ² + RG187 A/U coax, shielded
I/O port + DC power port	CAM4	2 x 0.75mm ² + RG187 A/U coax, shielded
I/O port + DC power port	USB OTG	2 x AWG28 twisted + 2 x AWG24, shielded
I/O port + DC power port	USB HOST	2 x AWG28 twisted + 2 x AWG24, shielded
I/O port + DC power port	SLAVE INTERFACE	2 twisted pair 2 x 0.14mm ² , shielded
I/O port	ETHERNET	2 twisted pair 2 x 0.14mm ² , shielded, 100-BaseTX

Table 3: Cable configuration

3.3 Standards / Documents

[1] **Code of Federal Regulations**

Title 47 - Telecommunication
Chapter I - FEDERAL COMMUNICATIONS COMMISSION
Subchapter A - GENERAL
Part 15 - RADIO FREQUENCY DEVICES

[2] **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

[3] **CISPR 16-1-1:2010-11**

Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1-1: Radio Disturbance and Immunity Measuring Apparatus - Measuring Apparatus, Ed. 3.1

[4] **CISPR 16-1-2:2006-08**

Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1-2: Radio Disturbance and Immunity Measuring Apparatus - Ancillary equipment - Conducted disturbances, Ed. 1.2

[5] **CISPR 16-1-4:2010-04**

Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1-4: Radio Disturbance and Immunity Measuring Apparatus - Ancillary equipment - Radiated disturbances, Ed. 3

[6] **CISPR 16-2-1:2008 + A1:2010 + A2:2013**

Specification for radio disturbance and immunity measuring apparatus and methods Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements

[7] **CISPR 16-2-3:2010 + A1:2010 + A2:2014**

Specification for radio disturbance and immunity measuring apparatus and methods Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements

3.4 Date and location of the measurements and tests

Date: 10 February 2020

Location: Semi anechoic chamber (SAC3)
EMC-Test Laboratory
2444 Seibersdorf
Austria

Temperature: 21°C – 25°C

Humidity: 35% - 50 % rel.

4. Measurements and tests – parameters and results

All indications of Pass/Fail in this report are opinions expressed by Seibersdorf Laboratories based on interpretations and/or observations of test results.

4.1 Radiated emissions measurement

4.1.1 Equipment

ID-No.	Identification	Type	SNo	Calibration Date	Calibration Interval	Manufacturer
E0540	Antenna (DRG Horn)	3115	9112/3767	10 May 2019	2 years	EMCO
E0736	Pre-Amplifier	DBL-0218N308	018 0217	16 May 2018	2 years	Narda DBS Microwave
E0915	EMC Measurement Software EMC32	V 10.40.10	100280/101333	---	---	Rohde & Schwarz
E1142	Thermo-Hygrometer SAC	608-H1	34803704	04 Jul. 2019	3 years	testo
E1677	Antenna (BiLog)	CBL6143A	32401	29 May 2018	2 years	Teseq
LE0116	Semi Anechoic Chamber with Control Room, Test room 1 and Amplifier Room	SAC3+CR, TR1, AR	P28090	26 Jan. 2018	5 years	Albatross Projects
LE0139	EMI Test Receiver	ESW44	101676	27 Dec. 2019	1 year	Rohde & Schwarz

Table 4: Equipment

4.1.2 Procedure and setup

The measurement was done inside the Semi anechoic chamber (SAC3) of the EMC-Test Laboratory Seibersdorf.

Measurement procedure and setup were according to the standard ANSI C63.4.

Frequency range	30 to 1000 MHz
Bandwidth	120 kHz
Step size	40 kHz
Detector measurement	QPK
Measurement distance	3 m
Measurement time	1 s
Orientations	0° - 360°
Height scan	1 m – 4 m
Antenna mast tilted	NO

Table 5: Parameters from 30 – 1000 MHz

Frequency range	1000 to 18000 MHz
Bandwidth	1 MHz
Step size	400 kHz
Detector measurement	AVG
Measurement distance	3 m
Measurement time	1 ms
Orientations	0° - 360°
Height scan	1 m – 4 m
Antenna mast tilted	YES

Table 6: Parameters from 1000 – 18000 MHz

Frequency range (MHz)	Measurement uncertainty (dB)
30 – 200	+4.03 / -4.03
200 – 1000	+3.31 / -3.35
1000 – 6000	+4.59 / -4.75
1000 – 18000	+4.73 / -4.81

Table 7: Extended measurement uncertainty

4.1.3 Results

Orientation [°]	Polarization	Frequency range [MHz]	Data see chapter 5.2	Result
0 - 360	Horizontal	30 - 1000	Chart 1, Table 9	PASS
0 - 360	Vertical	30 - 1000	Chart 2, Table 10	PASS
0 - 360	Horizontal	1000 - 18000	Chart 3, Table 11	PASS
0 - 360	Vertical	1000 - 18000	Chart 4, Table 12	PASS

Table 8: Results FCC

5. Annex

5.1 Photos of the DUT and the configuration

Photo 1: DUT - front side	13
Photo 2: DUT – back side	13
Photo 3: Setup in the Semi anechoic chamber (SAC3) radiated emissions measurement (30 MHz – 1000 MHz)	14
Photo 4: Setup in the Semi anechoic chamber (SAC3) radiated emissions measurement (1000 MHz – 18000 MHz)	14

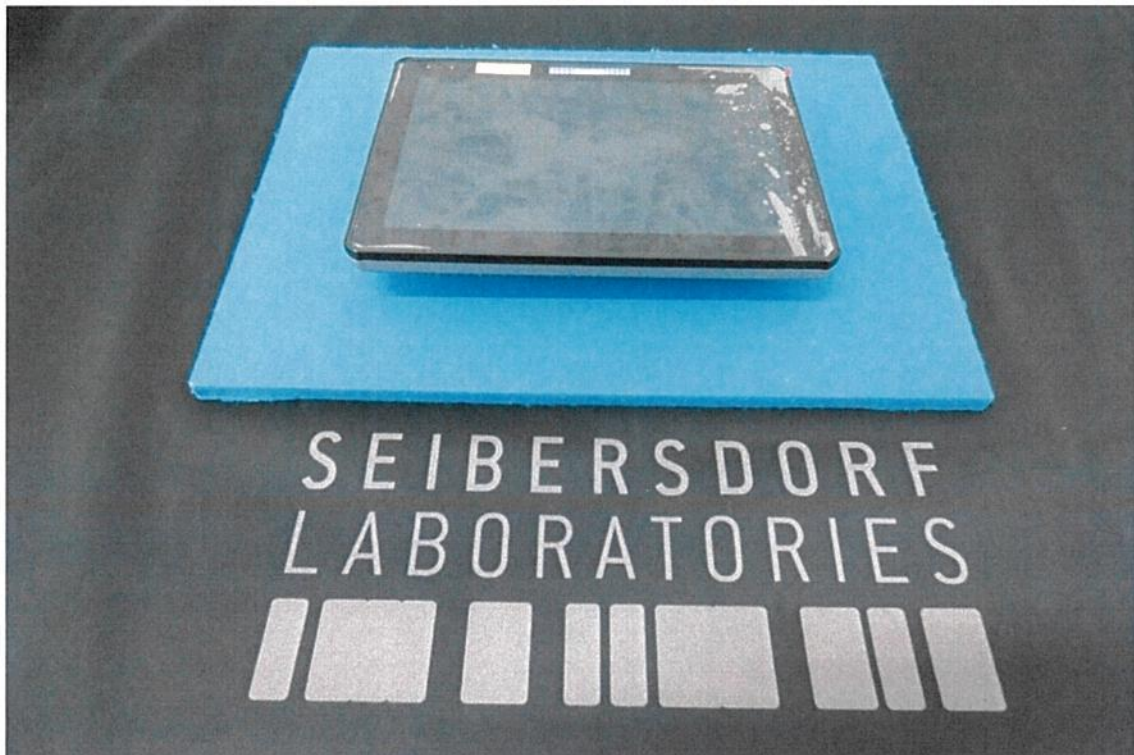


Photo 1: DUT - front side

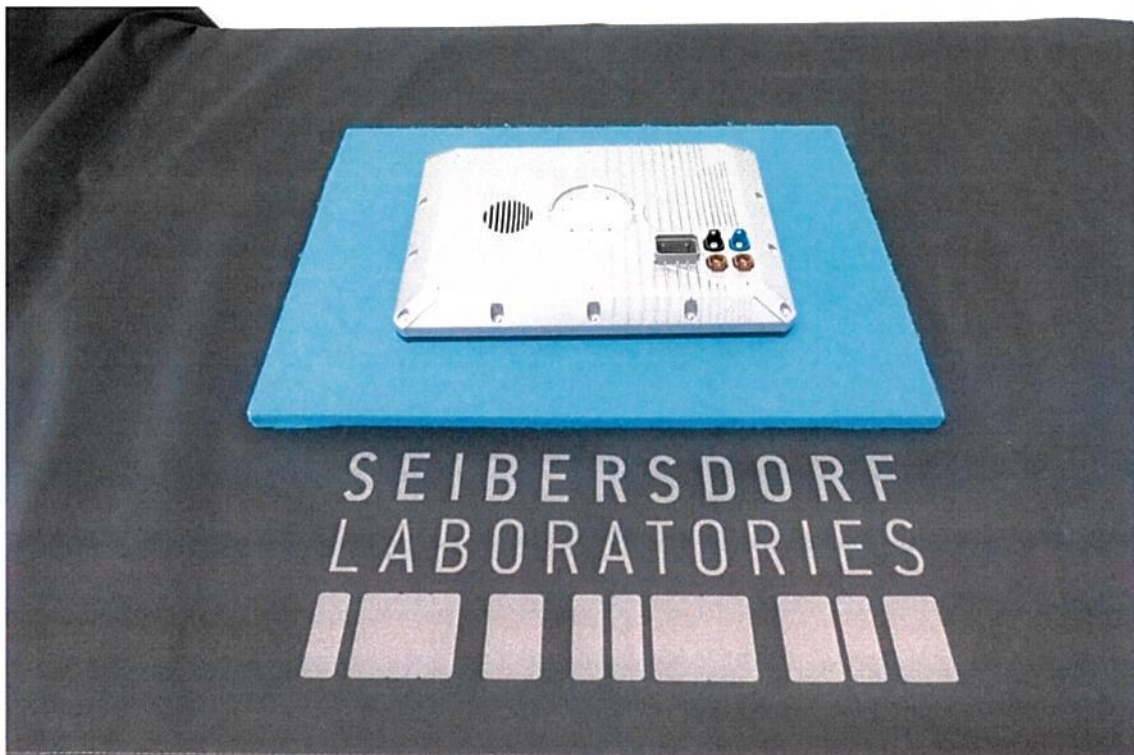
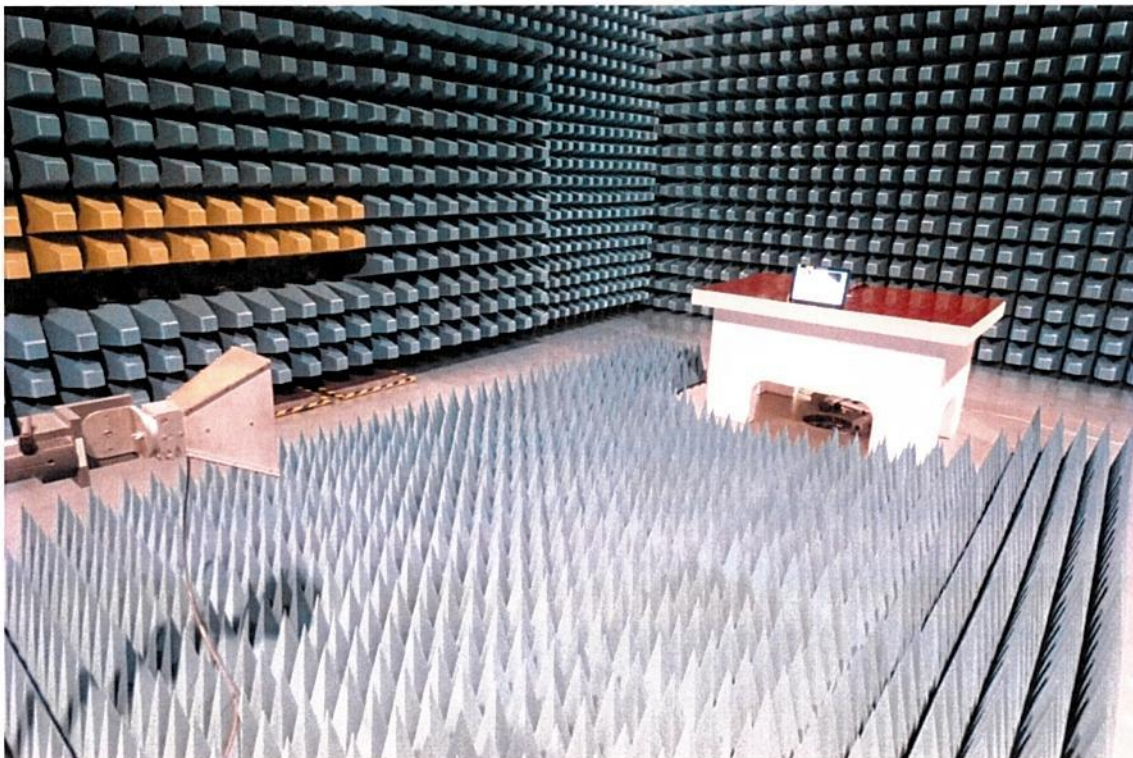


Photo 2: DUT – back side



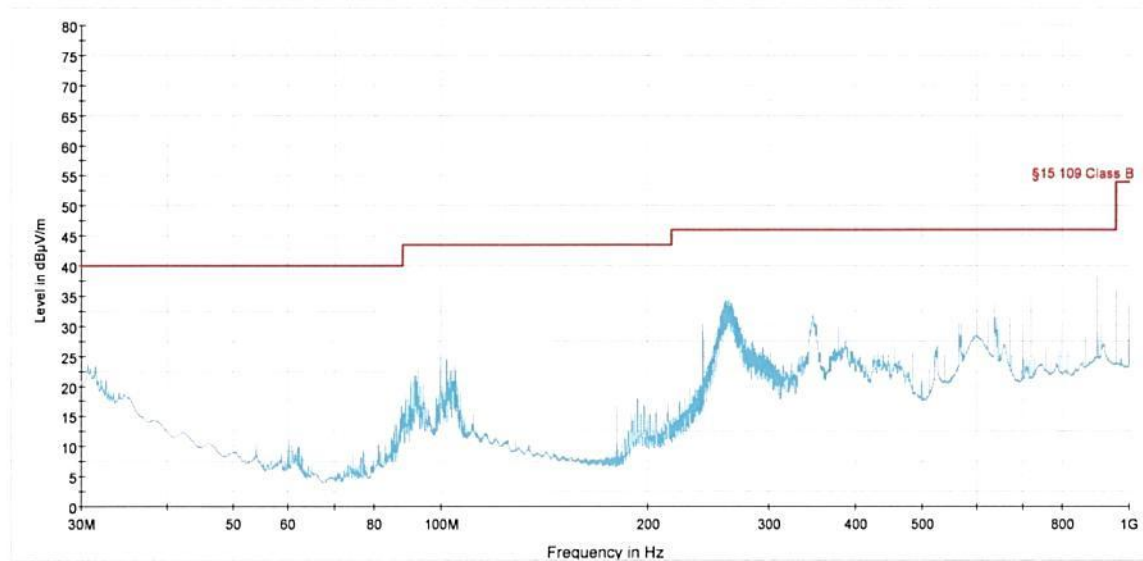
**Photo 3: Setup in the Semi anechoic chamber (SAC3)
radiated emissions measurement (30 MHz – 1000 MHz)**



**Photo 4: Setup in the Semi anechoic chamber (SAC3)
radiated emissions measurement (1000 MHz – 18000 MHz)**

5.2 Charts

Chart 1: Radiated emissions, 30 - 1000 MHz, horizontal.....	16
Chart 2: Radiated emissions, 30 - 1000 MHz, vertical.....	17
Chart 3: Radiated emissions, 1000 - 18000 MHz, horizontal.....	18
Chart 4: Radiated emissions, 1000 - 18000 MHz, vertical.....	19



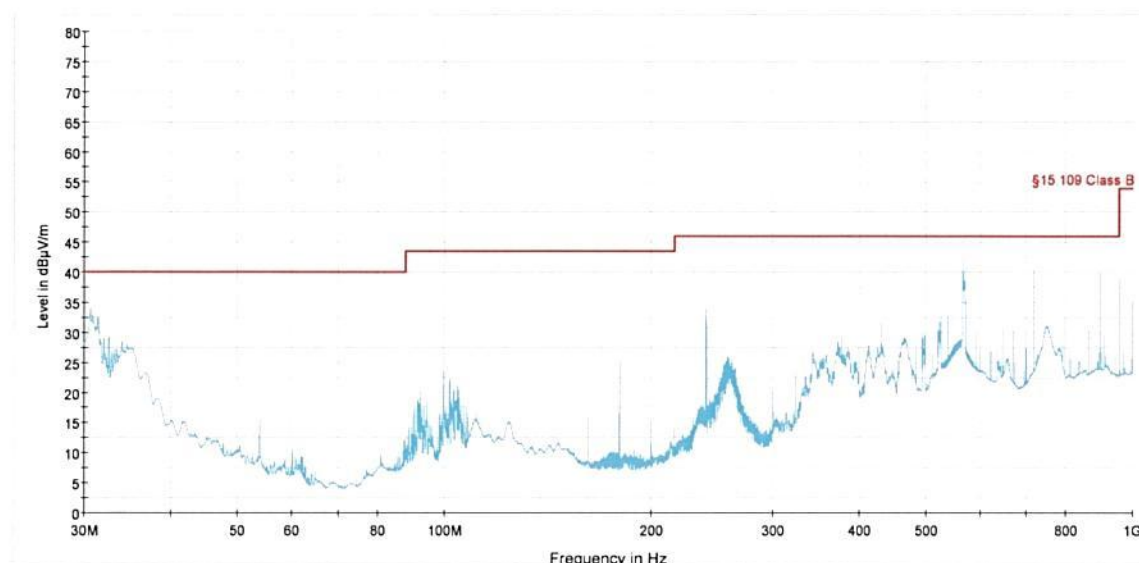
E-2673_2 TTTech 10.02.2020 MS/MCI
Vision312Plus (High End, #12)
Normal use
02 0°-360° 1m-4m H

Preview Result 1H-QPK
§15 109 Class B
Final_Result QPK

Chart 1: Radiated emissions, 30 - 1000 MHz, horizontal

Frequency [MHz]	QPK [dBµV/m]	Meas. Time [s]	Bandwidth [kHz]	Azimuth [deg]	Height [cm]	Margin –QPK [dB]	Limit – QPK [dBµV/m]
99.99	36.1	1	120	270	250	7.4	43.5
100.02	35.8	1	120	270	250	7.7	43.5
899.97	38.1	1	120	270	100	7.9	46.0
900.00	38.4	1	120	270	100	7.6	46.0
900.03	38.5	1	120	270	100	7.5	46.0
900.06	38.4	1	120	270	100	7.6	46.0
900.09	38.1	1	120	270	100	7.9	46.0

Table 9: Quasi-Peak result, 30-1000 MHz, horizontal



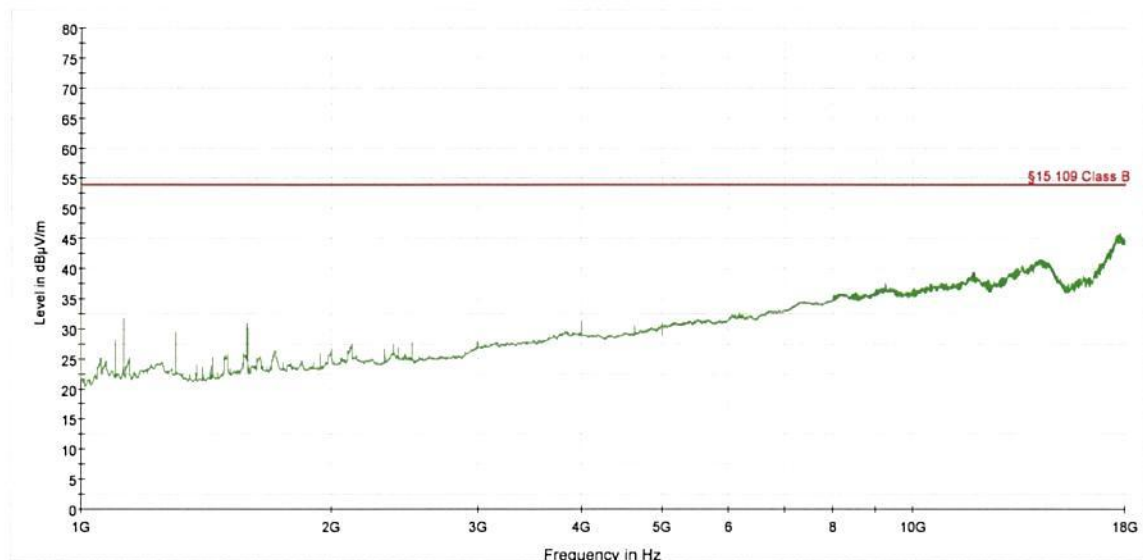
E-2673_2 TTTech 10.02.2020 MS/MCI
Vision312Plus (High End, #12)
Normal use
01 0°-360° 1m-4m V

Preview Result IV-QPK
§15 109 Class B
Final_Result QPK

Chart 2: Radiated emissions, 30 - 1000 MHz, vertical

Frequency [MHz]	QPK [dBµV/m]	Meas. Time [s]	Bandwidth [kHz]	Azimuth [deg]	Height [cm]	Margin -QPK [dB]	Limit - QPK [dBµV/m]
566.16	41.2	1	120	0	100	4.8	46.0
566.19	41.7	1	120	0	100	4.3	46.0
566.22	42.0	1	120	0	100	4.0	46.0
566.25	42.3	1	120	0	100	3.7	46.0
566.28	42.5	1	120	0	100	3.5	46.0
566.31	42.5	1	120	0	100	3.5	46.0
566.34	42.3	1	120	0	100	3.7	46.0
566.37	42.0	1	120	0	100	4.0	46.0
566.40	41.5	1	120	0	100	4.5	46.0
566.73	41.3	1	120	0	100	4.7	46.0
566.76	41.3	1	120	0	100	4.7	46.0

Table 10: Quasi-Peak result, 30-1000 MHz, vertical



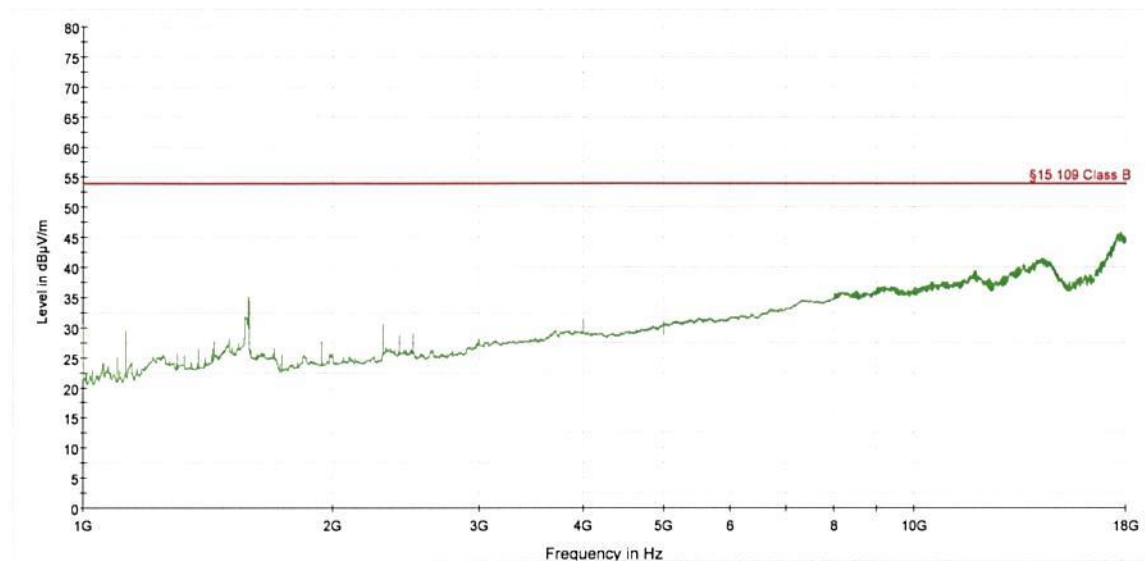
E-2673_2 TTTech 10.02.2020 MS/MCI
Vision312Plus (High End, #12)
Normal use
04 0°-360° 1m-4m H

Preview Result 2-AVG
§15.109 Class B

Chart 3: Radiated emissions, 1000 - 18000 MHz, horizontal

Frequency [MHz]	MaxAVG [dBµV/m]	Meas. Time [ms]	Bandwidth [kHz]	Azimuth [deg]	Height [cm]	Margin – AVG [dB]	Limit – AVG [dBµV/m]
no emissions with margin < 10dB to the limit or noise level							

Table 11: Average result, 1000 - 18000 MHz, horizontal



E-2673_2 TTTech 10.02.2020 MS/MCI
Vision312Plus (High End, #12)
Normal use
03 0°-360° 1m-4m V

Preview Result 2-AVG
§15.109 Class B

Chart 4: Radiated emissions, 1000 - 18000 MHz, vertical

Frequency [MHz]	MaxAVG [dBµV/m]	Meas. Time [ms]	Bandwidth [kHz]	Azimuth [deg]	Height [cm]	Margin – AVG [dB]	Limit – AVG [dBµV/m]
no emissions with margin < 10dB to the limit or noise level							

Table 12: Average result, 1000 - 18000 MHz, vertical