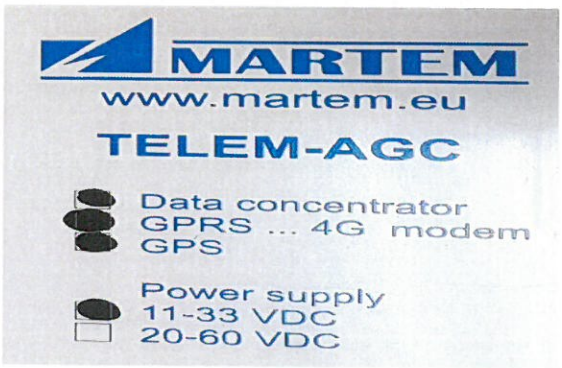
TEST REPORT No KA-161-18-038

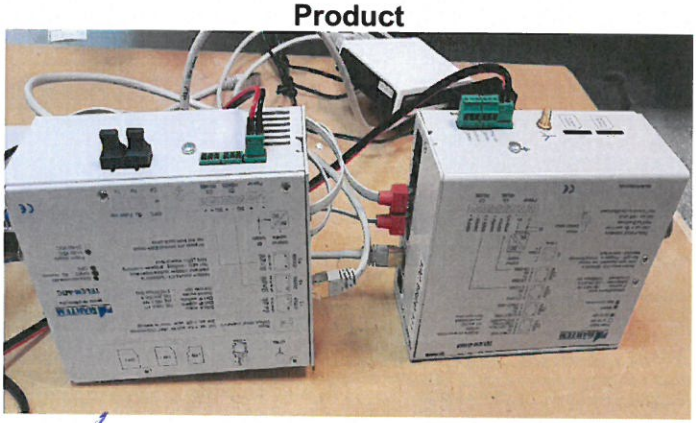
30.10.2018

Product:	Data Concentrator TELEM-AGC
Name and address of the applicant:	Martem AS, Laki 25, 12915 Tallinn, Estonia
Country of the manufacturer:	Estonia
Name and address of the manufacturer:	Martem AS, Laki 25, 12915 Tallinn, Estonia
Rating and principal characteristics:	30 VDC, 2 A
Normative references:	EN55032:2015/AC:2016 EN61000-6-1:2007 EN61000-6-3:2007+A1:2011+AC:2012
Test method:	User Test Program
Date(s) of the test(s)	22.10.2018- 29.10.2018
Test scope:	
Trade mark (if any):	-
Model/type reference:	TELEM-AGC
Note	The test results relate only to the sample tested.
Additional information:	Appendix 1

Product label



Product



Tested by: Peeter Konjuhhov
Expert

Confirmed by: Raivo Roasto
Head of Electrical Department

Inspecta Estonia OÜ
Teaduspargi 8, 12618 Tallinn, Eesti
Tel +372 659 9470
estonia@inspecta.com
Laboratory address: Telliskivi 59, 10412 Tallinn

30.10.2018

1. EMC tests results

Test	Result – Remark	Verdict
Electromagnetic compatibility EMC EMISSION TESTS	**EVS-EN 55032: 2015/AC2016**	P
Mains terminal disturbance 150 kHz - 500 kHz 500 kHz - 5 MHz 5,0 MHz - 30,0 MHz	Complies with the Class A limits	P
Radiated Disturbance field strength in the frequwncy range 30 MHz to 1000 MHz	Radiated Disturbance field strength, Class A	P
EMC immunity tests	**EVS-EN 61000-6-1:2007**	
EMC immunity tests EN 61000-4-2:2009		P
Air discharge	8 kV	P
Contact discharge	4 kV	P
EMC immunity test EN 61000-4-3:2006 +A2:2010 Electromagnetic field immunity	3 V/m, 80-1000 MHz	P
EMC immunity test EN 61000-4-4:2012 Fast transient immunity	1 kV L-N	P
EMC immunity test EN 61000-4-5:2014+ A1:2017 Surge immunity	1kV L-N	P
EMC immunity test EN 61000-4-6:2014 Conducted disturbance	3 V_{rms} f res sweep (0.15-80 MHz)	P
EMC immunity test EN 61000-4-8:2010 Power frequency magnetic field	30_{+1} A/m 50 Hz	P
EMC immunity test EN 61000-4-11:2004+ A1:2017 Voltage dips and interrupts	See Table 4	P

Test case verdicts:
test case does not apply to the test object: N/A
test object does meet the requirement: P (Pass)
test object does not meet the requirement: F (Fail)

2. EMC Tests Results

Environmental conditions during EMC testing

- Ambient temperature: 22 ^{0}C to 25 ^{0}C;
- Relative humidity: 40% to 60% RH
- Atmospheric pressure: 101 kPa ± 0,5 kPa
- Mains supply voltage: 230 V ± 4%;
- Mains frequency: 50 Hz ± 0,2 Hz

The electromagnetic environment of laboratory did not influence the test results

3.1 Radiated Emission Disturbance

Test set-up for radiated emissions at range 30 MHz to 1 GHz.
The EUT was placed into 3 m FAR on a non-metallic support so that the boundary of EUT was more than 1,2 m distance from closed surface and distance from receive antenna reference point 3 m ± 3 cm by antenna high 1,5 m with ± 4 dB deviation estimated that the E-field in 3 m FAR higher than 10 m OATS.
Note: For measurements at 3 m distance in 3 m FAR the limits was changed in accordance the EN61000-6-3:2007+A1:2011 Table 1 cl.1.2 and method from CISPR16-1-4 cl 5.8
Note1: Amplifier + 30 dB used.
Note2: Red limit line – Class B level.

Test Equipment

Equipment	Manufacturer	Model	Serial No.	Cal. Due
Antenna	Schaffner	CBL6112D	22246	10.2024
Test Receiver	R&S	ESPI 3	101282	07.2019
FAR	Rainford EMC	Smartshield 3 m FAR	152P	10.2024

Figure 1. Radiated disturbance emission, horizontal polarisation

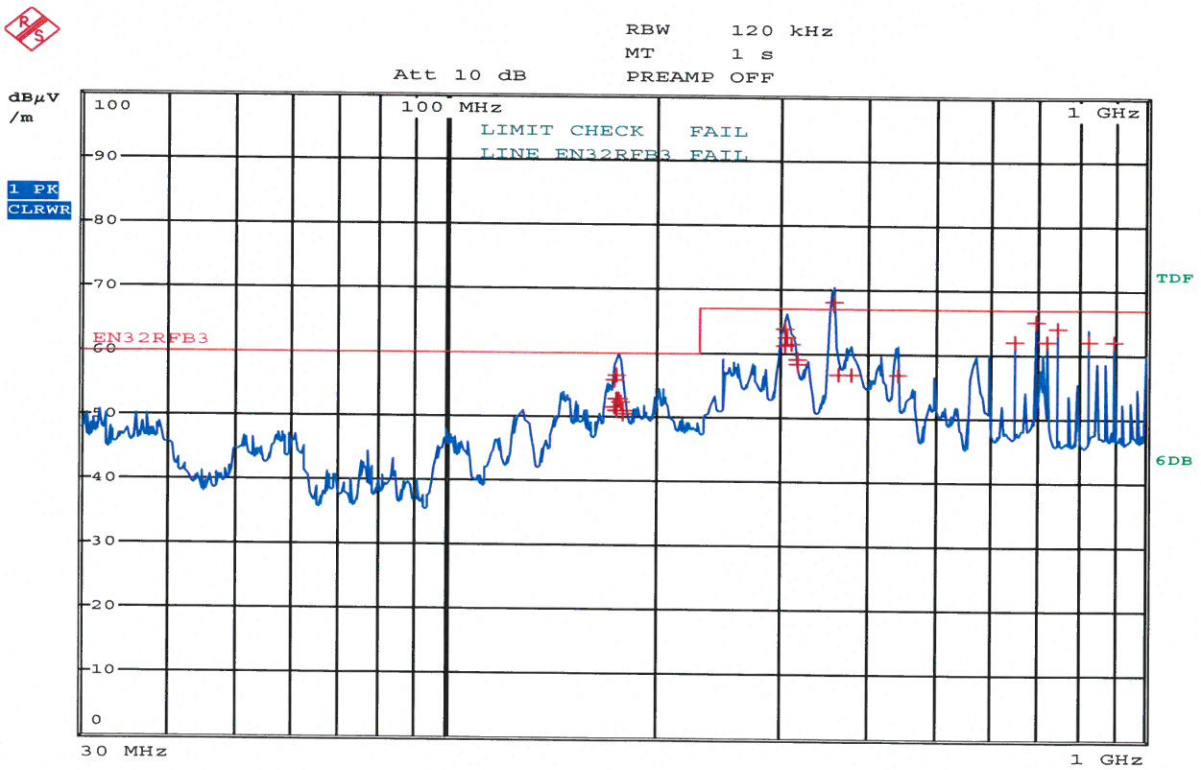


Figure 2. Radiated disturbance emission, horizontal polarisation, mesaurement results

EDIT PEAK LIST (Final Measurement Results)

Trace1: EN32RFB3
Trace2: ---
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1	Quasi Peak	174.28 MHz	51.53	-8.46
1	Quasi Peak	174.96 MHz	55.84	-4.16
1	Quasi Peak	175.52 MHz	56.48	-3.51
1	Quasi Peak	175.96 MHz	51.07	-8.92
1	Quasi Peak	176.52 MHz	52.87	-7.12
1	Quasi Peak	177.08 MHz	53.01	-6.98
1	Quasi Peak	178.16 MHz	52.37	-7.62
1	Quasi Peak	178.72 MHz	50.43	-9.56
1	Quasi Peak	179.24 MHz	51.02	-8.97
1	Quasi Peak	304.88 MHz	61.29	-5.71
1	Quasi Peak	306.76 MHz	63.93	-3.06
1	Quasi Peak	308.84 MHz	62.67	-4.32
1	Quasi Peak	312.8 MHz	61.61	-5.38
1	Quasi Peak	316.92 MHz	59.28	-7.71
1	Quasi Peak	318 MHz	58.33	-8.66
1	Quasi Peak	357.92 MHz	68.00	0.99
1	Quasi Peak	364.92 MHz	56.81	-10.19
1	Quasi Peak	379.08 MHz	56.71	-10.28
1	Quasi Peak	442.6 MHz	56.89	-10.10
1	Quasi Peak	650 MHz	62.18	-4.81

Figure 3. Radiated disturbance emission, vertical polarisation

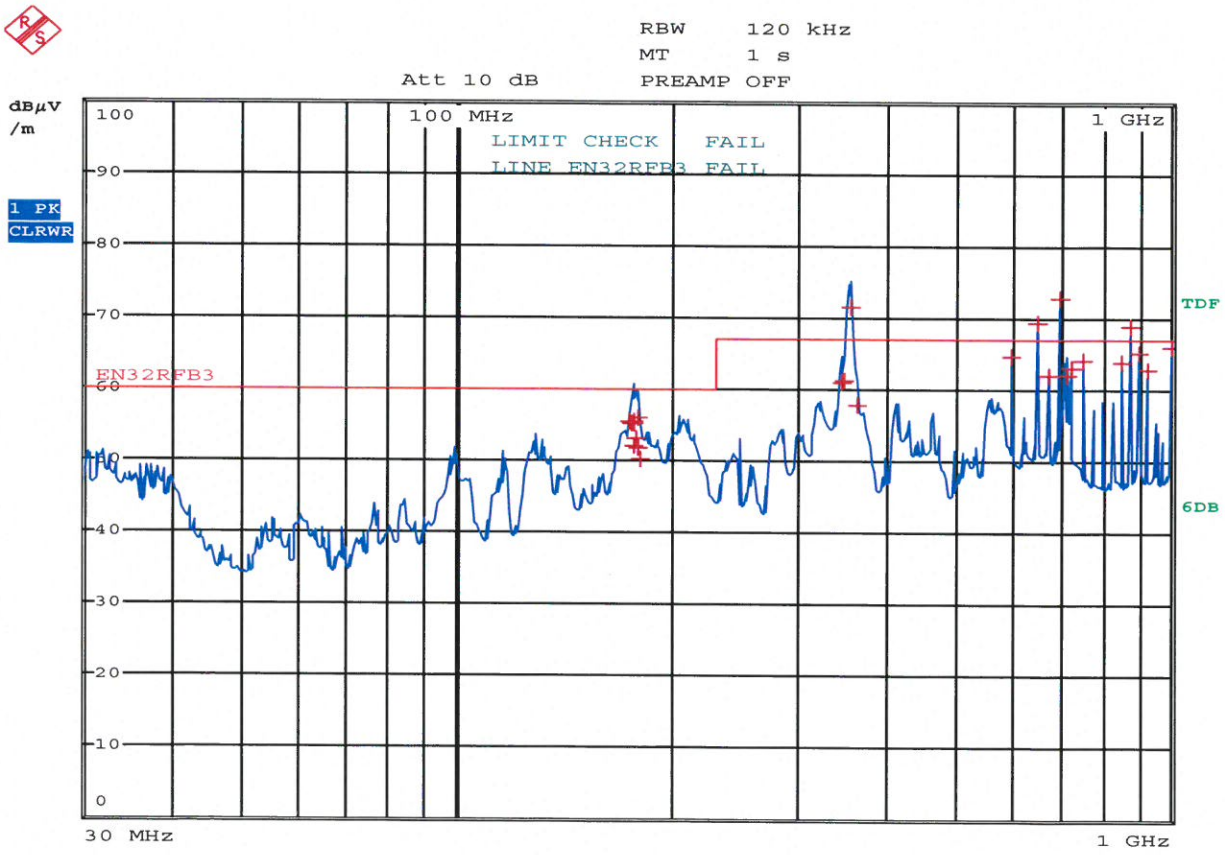


Figure 4. Radiated disturbance emission, vertical polarisation, measurement results

EDIT PEAK LIST (Final Measurement Results)

Trace1: EN32RFB3
Trace2: ---
Trace3: ---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	175.44 MHz	55.50	-4.49
1 Quasi Peak	176 MHz	55.12	-4.87
1 Quasi Peak	176.56 MHz	55.42	-4.57
1 Quasi Peak	177.08 MHz	55.32	-4.67
1 Quasi Peak	177.56 MHz	52.09	-7.90
1 Quasi Peak	178.12 MHz	53.23	-6.76
1 Quasi Peak	178.76 MHz	55.94	-4.05
1 Quasi Peak	179.24 MHz	51.78	-8.21
1 Quasi Peak	180.32 MHz	50.20	-9.79
1 Quasi Peak	347.56 MHz	61.06	-5.93
1 Quasi Peak	349.08 MHz	61.30	-5.69
1 Quasi Peak	355.8 MHz	71.61	4.61
1 Quasi Peak	364.04 MHz	57.83	-9.16
1 Quasi Peak	600 MHz	64.69	-2.30
1 Quasi Peak	650 MHz	69.48	2.48
1 Quasi Peak	675 MHz	61.97	-5.02
1 Quasi Peak	700 MHz	72.73	5.73
1 Quasi Peak	712.32 MHz	62.11	-4.88
1 Quasi Peak	725 MHz	63.16	-3.83
1 Quasi Peak	750 MHz	64.26	-2.73

3.2 Conducted Emission

Disturbance emission of the mains terminals

Test set-up for conducted emissions at range 0,15 MHz to 30 MHz

The EUT was placed into 3 m FAR on a non-metallic support so that the boundary of EUT was more than 1,2 m distance from closed surface (EVS EN 61000-6-4 tab.2). The V- type artificial mains network was 0,8 m distance of EUT and EUT was put into operation according to the specified operating mode.

Test equipment

Equipment	Manufacturer	Type
Main network:	Schaffner	MN2050D
Test receiver:	R&S	ESPI 3

Figure 5. Disturbance emission of the mains terminals, frequency range 150 kHz- 30 MHz, Mode 0

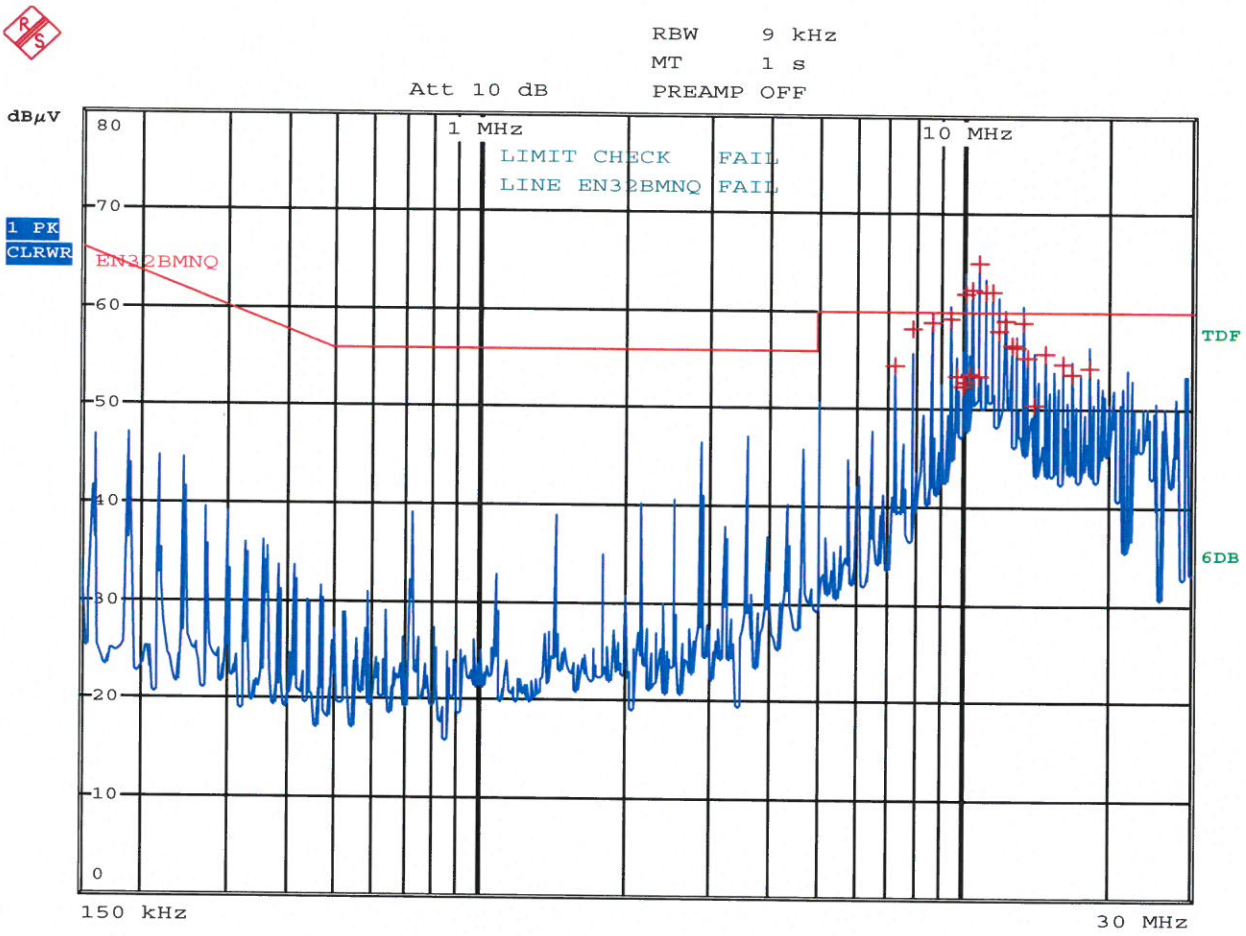


Figure 6. Disturbance emission of the mains terminals, Mode 0. Measurements results

EDIT PEAK LIST (Final Measurement Results)

Trace1: EN32BMNQ
Trace2: ---
Trace3: ---

TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Quasi Peak	7.238 MHz	54.45	-5.54
1 Quasi Peak	7.954 MHz	58.23	-1.76
1 Quasi Peak	8.678 MHz	58.83	-1.16
1 Quasi Peak	9.406 MHz	59.25	-0.74
1 Quasi Peak	9.77 MHz	53.35	-6.64
1 Quasi Peak	10.078 MHz	52.32	-7.67
1 Quasi Peak	10.13 MHz	61.88	1.88
1 Quasi Peak	10.174 MHz	52.90	-7.09
1 Quasi Peak	10.438 MHz	53.58	-6.41
1 Quasi Peak	10.49 MHz	62.17	2.17
1 Quasi Peak	10.802 MHz	53.47	-6.52
1 Quasi Peak	10.85 MHz	64.93	4.93
1 Quasi Peak	11.21 MHz	62.00	2.00
1 Quasi Peak	11.574 MHz	62.06	2.06
1 Quasi Peak	11.938 MHz	58.11	-1.88
1 Quasi Peak	12.298 MHz	59.07	-0.92
1 Quasi Peak	12.654 MHz	56.56	-3.43
1 Quasi Peak	13.022 MHz	56.31	-3.68
1 Quasi Peak	13.382 MHz	58.91	-1.08
1 Quasi Peak	13.742 MHz	55.29	-4.70

Figure 7. Disturbance emission of the mains terminals, frequency range 150 kHz- 30 MHz, Mode 1

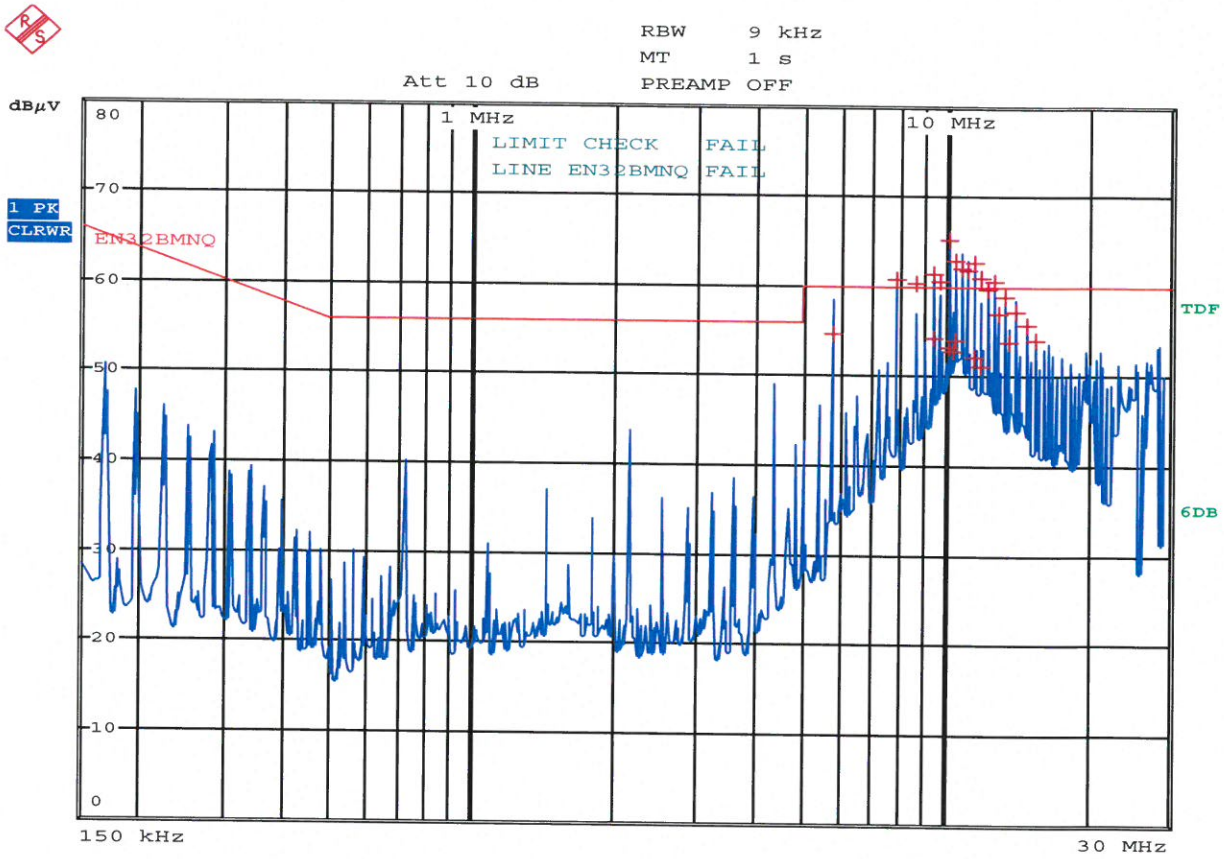


Figure 8. Disturbance emission of the mains terminals, Mode 0. Measurements results

EDIT PEAK LIST (Final Measurement Results)

Trace1: EN32BMNQ
Trace2: ---
Trace3: ---

TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Quasi Peak	7.238 MHz	54.45	-5.54
1 Quasi Peak	7.954 MHz	58.23	-1.76
1 Quasi Peak	8.678 MHz	58.83	-1.16
1 Quasi Peak	9.406 MHz	59.25	-0.74
1 Quasi Peak	9.77 MHz	53.35	-6.64
1 Quasi Peak	10.078 MHz	52.32	-7.67
1 Quasi Peak	10.13 MHz	61.88	1.88
1 Quasi Peak	10.174 MHz	52.90	-7.09
1 Quasi Peak	10.438 MHz	53.58	-6.41
1 Quasi Peak	10.49 MHz	62.17	2.17
1 Quasi Peak	10.802 MHz	53.47	-6.52
1 Quasi Peak	10.85 MHz	64.93	4.93
1 Quasi Peak	11.21 MHz	62.00	2.00
1 Quasi Peak	11.574 MHz	62.06	2.06
1 Quasi Peak	11.938 MHz	58.11	-1.88
1 Quasi Peak	12.298 MHz	59.07	-0.92
1 Quasi Peak	12.654 MHz	56.56	-3.43
1 Quasi Peak	13.022 MHz	56.31	-3.68
1 Quasi Peak	13.382 MHz	58.91	-1.08
1 Quasi Peak	13.742 MHz	55.29	-4.70

4. EMC Immunity Tests

4.1 Electrostatic Discharge Immunity Test

4.1.1 Air discharge

Test set-up

The EUT was placed on a non-metallic support 0,8 m above a reference ground plane in accordance of Fig. 5 EN 61000-4-2 and was put into operation according to the specified operating mode. Horizontal reference ground plane 1,0 m × 1,25 m.

Test Equipment

Equipment	Manufacturer/Model	Serial No.	Next Calibration
Test generator:	Schaffner NSG 432 PS	4029	10.2021
Test finger and coupler:	Schaffner NSG 432 Static Discharge Simulator	1315	10.2021

Test conditions

Test level:	8,0 kV air discharge
Position:	Parts of enclosures
Repetition ratio:	10 discharges per s
Application:	10 single contact discharges 0,1 m from EUT
Duration of each test:	2s

Test results

Test No	EUT part	Criterion	Comment
1	Surface of equipment	A	Normal operation. Pass

4.1.2 Contact discharge

Test conditions

Test level:	6,0 kV Contact discharge
Position:	Indirect to coupling plane direct to enclosure
Repetition ratio:	10 discharges per s
Application:	10 single contact discharges 0,1 m from EUT
Duration of each test:	2s

Test equipment

Equipment	Manufacturer	Type
Test generator:	Schaffner	NSG 432
Contact discharge adapter R_V = 0 Ω:	Schaffner	402-664D

Test results

Test No	EUT	Criterion	Comment
1	Surface of equipment	A	Normal operation. Pass

4.2 Radiated, Radio – Frequency, Electromagnetic Field Immunity Test

Test set-up

The EUT was placed into 3 m FAR on a non-metallic support 0,8 m above a reference ground plane in accordance of Fig. 6 EN 61000-4-3 and was put into operation according to the specified operating mode. Field strength control by isotropic antenna Schaffner EMC 20. Distance from antenna top to EUT - 2 m.

Test equipment

Equipment	Manufacturer	Type	Serial No.	Cal. Due
Amplifier and test generator:	Bonn Elektronik R&S	BSA 1501-10 SML 01	066216 104397	01.2022 01.2022
Antenna	Schaffner	CBL 6111D		10.2020
EM field monitoring device:	Schaffner	EMC 20	2244-29	10.2020

Test conditions

Test level:	3 V/m	f sweep 80- 1000 MHz, step 1MHz
AM modulation:	1 kHz, 80%	
Application:	Antenna vertical and horizontal polarization	
Duration:	20 min	
Ports for test:	All ports and enclosure	

Test results

Test No	Port/Cable	Criterion	Comment
1	All ports and enclosure	A	Normal operation. Pass

4.3 Electrical Fast Transient/Burst Immunity Test

Test set-up

The EUT was placed on a non-metallic support 0,1 m above a reference ground plane in accordance of Fig. 9 from EVS-EN 61000-4-4 and was put into operation according to the specified operating mode. CDN for DC input port PNW 2225.

Test conditions

Test level:	1kV – L-N for AC ports,
Repetition ratio:	5 kHz
Application:	15 ms (75 spikes) burst every 300 ms
Polarity:	Alternative (±)
Duration of each test:	720s for operating mode and 480s for none operating mode

Test equipment

Equipment	Manufacturer	Type	Serial No.	Cal. Due
Test generator including CDN:	Schaffner	NSG 2050, PNW 2225	315	10.2019

Test results

Test No	MODE	Criterion	Comment
1	All ports	A	Normal operation. Pass

4.4 Surge Immunity Test

Test set-up

The EUT was placed on a non-metallic support 0,8 m above a reference ground plane in accordance of Fig. 7 EN 61000-4-5 and was put into operation according to the specified operating mode.

Test equipment

Equipment	Manufacturer	Type	Serial No.	Cal. Due
Test generator including CDN:	Schaffner	NSG 2050 PNW 2055	315 169	10.2019 10.2021

Test conditions

Test level:	2,0 kV for test AC port L-PE ; 1,0 kV L-N
Impedance:	2 Ω for AC port tests;
Application:	5 pulses pos. + 5 pulses neg. synchronous
Phase angles:	0^0, 90^0, 180^0, 270^0 (versus supply voltage)
Number of cycles:	5
Duration of each test:	240s

Test results

Test No	Port/Cable	Criterion	Comment
1	All ports	A	Normal operation. Pass

4.5 Immunity to Conducted Disturbances, Induced By Radio - Freqency Field

Test set-up

The EUT was placed on a non-metallic support 0,1 m above a reference ground plane in accordance of Fig. 6 EN 61000-4-6 and was put into operation according to the specified operating mode. Injection clamp 0,2 m from EUT. Monitoring probe was between EUT and injection clamp.

Test equipment

Equipment	Manufacturer	Type	Serial No.	Cal. Due
Test generator with injection clamp	Schaffner	NSG 420	237	01.2022
Injection clamp	TESEQ	KEMZ801	26881	09.2022

Test conditions

Test level:	3 V_{rms} f res sweep (0.15-80 MHz)
AM modulation:	80% 1 kHz
Application:	150 Ω
Mode:	Common mode (2 – 3 turns)

Test results

Test No	Port/Cable	Criterion	Comment
1	AC power port	A	Normal operation. Pass
2	AC input ports	B	Pass
3	Communication ports	A	Normal operation. Pass

4.6 Immunity to Power Frequency Magnetic Field

Test conditions

Test level:	30_{+1} A/m 50 Hz
Application:	Table-top
Mode:	All axes immersion method

Test equipment

Equipment	Manufacturer	Type	Serial No.	Cal.Due
Test generator	Schaffner	NSG1003	261	10.2023
Immersion coil	TKK	∅ 1 m 400 turns	001	10.2023

Test results

Test no	Port/Cable	Criterion	Comment
1	All ports, enclosure	A	Normal operation. Pass

4.7 Voltage dips, short interruption, voltage variations

Test set-up

The EUT was placed on a non-metallic support in accordance of EN 61000-4-11 and was put into operation according to the specified operating mode.

Test equipment

Test equipment	Manufacturer	Type
Test generator including CDN:	Schaffner	NSG 1003 NSG 642

Test conditions

Test level 1:	Dips 100%, 0,5 cycle, repetition time 10 000 ms, Criterion B
Test level 2:	Dips 100%, 1 cycle, repetition time 10 000 ms, Criterion B
Test level 3:	Dips 30%, 25 cycle, Criterion C
Test level 4	interruptions 100%, 250 cycle, Criterion C
Duration of every test:	-

Test results

Test No	Test level	Criterion	Comment
1	1	A	Normal operation. Pass
2	2	A	Pass
3	3	B	Pass
4	4	B	Pass