EMC Test Report

According to

EN 301 489-1 V2.2.3 and
EN 301 489-19 V2.1.1

Section 8.2 Enclosure port of ancillary equipment measured on a stand alone basis
Section 8.4 AC mains power input/output ports
Section 8.5 Harmonic current emission (AC mains input port)
Section 8.6 Voltage fluctuations and flicker (AC mains input ports)
Section 9.2 Radio frequency electromagnetic field (80 MHz to 6 000 MHz)
Section 9.3 Electrostatic discharge
Section 9.4 Fast transients common mode
Section 9.5 Radio frequency common mode
Section 9.7 Voltage dips and interruptions
Section 9.8 Surges, line to line and line to ground

DUT Name:	Heliomotion Tracker
Model No. :	Tacker Z
Customer:	HelioZenit Ab
Address:	Mörbyvägen 152, 22240 Hammarland, Åland
Summary:	IN COMPLIANCE
Date of Reception:	7.1.2020
Date(s) of Test(s):	10.1.2020 – 17.7.2020

Tested by (Test Engineer)

Tero Sipari

Approved by (Technical Manager)

Jukka Rauma

Contents

1. General Information

Test Engineer(s):	Tero Sipari and Lauri Soininen
Location:	Grant4Com Oy Yrttipellontie 6 FI-90230 Oulu G4C EMC Laboratory F016-019
Customer:	HelioZenit Ab Ray Olsson Mörbyvägen 140 22240 Hammarland, Åland
Climate Conditions:	Temperature: 15 - 35 °C Air pressure: 860 - 1060 hPa Humidity: 30-60 rH% These limits were not exceeded during testing.

2. Test Samples

General description: Heliomotion Tracker is the solar tracking unit of a Heliomotion solar power plant. Device supports GPS L1 GNSS signal. The GPS module model is VK2527T1G5L by V.KEL Electronics, which has an internal industry standard GPS antenna (25x25x4mm).

Test samples:

G4C Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version	Comments
1543ER001	Z19025	HelioZenit Ab	Heliomotion Solar Tracker	Tracker Z	Z-L	58	Connected to junction box with 24 VDC transformer and load breaker (already CE certified)

Supported GNSS signals:

GNSS	GNSS Signals
GPS	L1

Accessories / Monitoring devices:

G4C Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version	Comments
1543ER002			USB 3.0 cable 1 m				
G4CER006	G4C-L027	HP	EMC Test PC2	EliteBook 820		Windows 10	Monitoring tool / AE

3. Configuration and Operation Modes

Operation Mode	Description
OM1	EUT on and GPS fixed. Normal operation state.
OM2	EUT on and motor turning continuously at speed 1. EUT operated via PC with Heliocom v0.98 - test software. GPS fixed.

4. Performance Criteria for Immunity Tests

According to EN 301 489-1:

6.1 Performance criteria for continuous phenomena

During the test, the equipment shall:

- continue to operate as intended;
- not unintentionally transmit;
- not unintentionally change its operating state;
- not unintentionally change critical stored data.

6.2 Performance criteria for transient phenomena

For all ports and transient phenomena with the exception described below, the following applies:

- The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.
- After application of the transient phenomena, the equipment shall operate as intended.

For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:

- For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.
- For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

According to EN 301 489-19:

6.2 Performance criteria for Continuous phenomena applied to ROMES and ROGNSS receivers (CR) For the EUT, excluding spot frequency tests as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2):

- the general performance criteria set out in clause 6.1;
- during the test no false calls shall occur;
- at the conclusion of the test comprising the series of individual exposures the EUT shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer. For the spot frequency test as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal

6.3 Performance criteria for Transient phenomena applied to ROMES and ROGNSS receivers (TR) For the EUT:

- the general performance criteria set out in clause 6.1;
- during the test no false calls shall occur;
- at the conclusion of the test comprising the series of individual exposures, the EUT shall operate as intended with no loss of function and/or stored data (messages), as declared by the manufacturer.

6.4 Performance criteria for equipment which does not provide a continuous communication link The provision of ETSI EN 301 489-1 [1], clause 6.3 shall apply with the following modifications. For EUTs of a specialized nature and/or ancillary equipment tested on a stand alone basis the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. Under these circumstances the manufacturer will also provide the following information:

- the primary functions of the equipment to be tested during and after EMC stress;
- the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;
- the pass/failure criteria for the equipment;
- the method of observing a degradation of performance of the equipment. The assessment of the performance or the degradation of performance which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational

5. Monitoring During Immunity Tests

Operation mode(s)	Continuous phenomena
OM2	EUT motor movement and GPS fix monitored via PC with Heliocom v0.98 -test software.

Operation mode(s)	Transient phenomena
OM2	EUT motor movement verified before and after the test, and GPS fix monitored via PC with Heliocom v0.98 -test software.

6. Uncertainties

6.1. Emission measurement uncertainties

Test	Frequency [MHz]	Polarization	Expanded Uncertainty [dB] (k=2)
Radiated Emission AEC 30 - 1000 MHz (CISPR 16-4-2)	30 - 200 200 - 1000 30 - 200 200 - 1000	Vertical Vertical Horizontal Horizontal	3,49 4,62 2,57 2,87
Radiated Emission AEC over 1 GHz (CISPR 16-4-2)	1000 - 6000 1000 - 6000	Vertical Horizontal	5,72 5,70
Conducted disturbances using a 50 Ω /50 µH AMN (CISPR 16-4-2)	0.01 - 0.15		2,80
Conducted disturbances using a 50 Ω /50 µH AMN (CISPR 16-4-2)	0.15 - 30		2,24
Conducted disturbances using Current Probe (CISPR 16-4-2)	0.15 - 30		24,53
Conducted disturbances Telecommunication CAT6 (unshielded) using an AAN (CISPR 16-4-2)	0.15 - 30		4,29
Conducted disturbances Telecommunication CAT6 (shielded) using an AAN (CISPR 16-4-2)	0.15 - 30		4,29
Conducted disturbances Telecommunication CAT5 using an AAN (CISPR 16-4-2)	0.15 - 30		3,78
Conducted disturbances Telecommunication CAT3 using an AAN (CISPR 16-4-2)	0.15 - 30		3,30
Audio Breakthrough - Uplink			2,65
Audio Breakthrough - Downlink			1,74

6.2. Immunity test uncertainties

Test	Standard requirement	Equipment calibration
ESD 61000-4-2	Rise time ≤ ±25 % Ipeak ≤ ±15 % I at 30 ns ≤ ±30 % I at 60 ns ≤ ±30 %	< 3.4 % < 11.3 % < 16.9 % < 22.0 %
Voltage dips and interruptions 61000-4-11	Power supply 230 V / 115 V, +10 / -15 %	< ±10 %
Surges 61000-4-5	Voltage Uopen circuit, ±10 % Rise time open circuit, ±30 % Pulse duration open circuit, ±20 % Current short circuit, ±10 % Rise time short circuit, ±30 % Pulse duration short circuit, ±20 %	< ±10 % < ±10 % < ±20 % < ±10 % < ±10 % < ±20 %
Electrical fast transient/burst 61000-4-4	Voltage, ±10 % Wave shape, ±20 % Source impedance, ±20 % Pulse rise time, ±20 % Pulse width, ±20 % Pulse width for pulse 5, ±10 %	< ±10 % < ±20 % < ±20 % < ±20 % < ±20 % < ±10 %
Magnetic field 61000-4-8 & -9	AC voltage, ±2 % AC Current, ±2 %	< 0.23% < 0.2%

Test	Frequency [MHz]	Polarization	Expanded Uncertainty [dB] (k=2)
Conducted Immunity RF Field	CDN EM Clamp Current Clamp Direct inj.		1,36 3,19 3,27 3,07
Radiated Immunity RF Field	80 – 6000		1,92

7. Radiated Emissions

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 55032:2015/AC: 2016

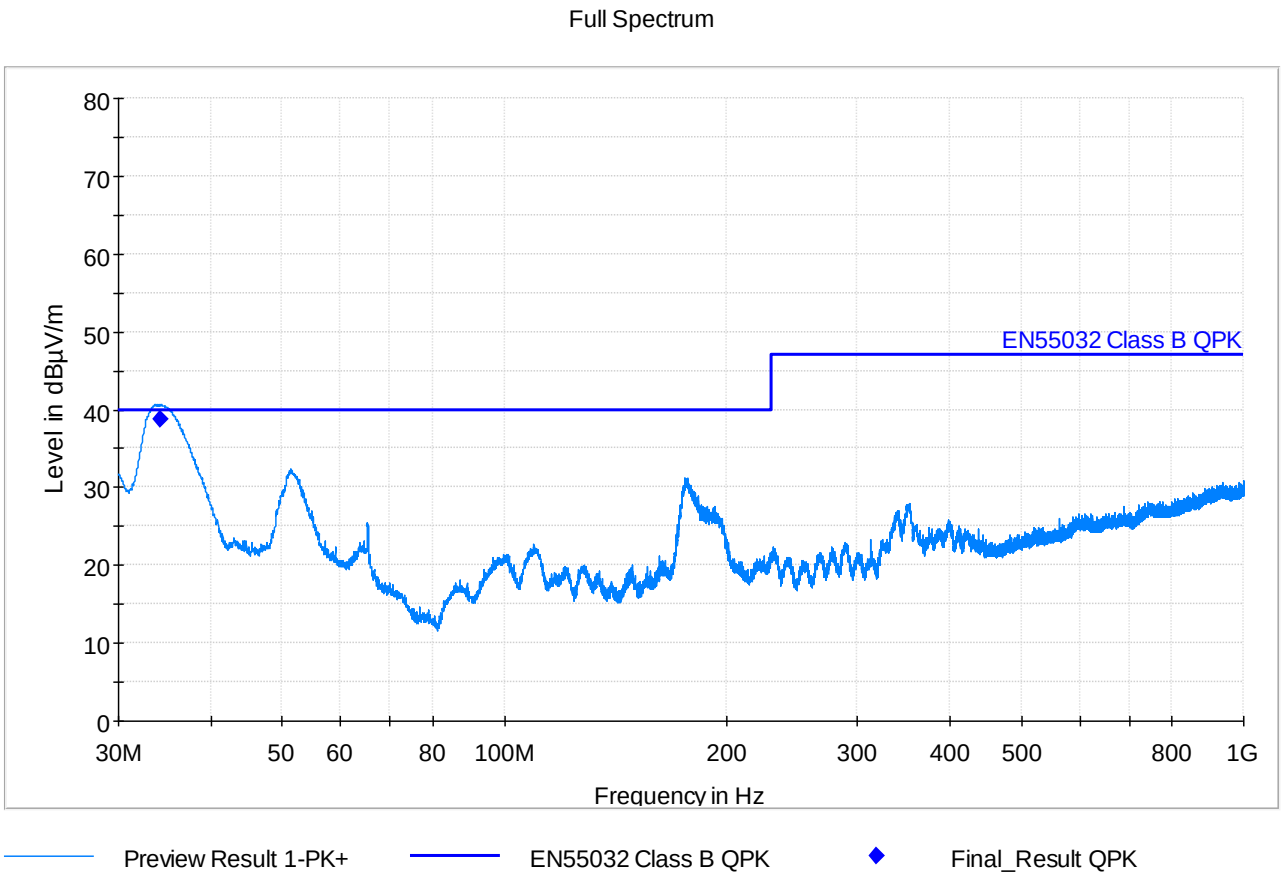
Limits:	EN 55032:2015 / AC:2016, Class B		
Frequency	Quasi peak limit	Average limit	Peak limit
30 – 230 MHz	40 dBuV/m		
230 – 1000 MHz	47 dBuV/m		
1000 – 3000 MHz		50 dBuV/m	70 dBuV/m
3000 – 6000 MHz		54 dBuV/m	74 dBuV/m

Tested sample(s): 1543ER001
Operation mode(s) tested: OM1
Test results: PASS

Test data:

Operation mode(s)	Configuration	Test Verdict
OM1	1543ER001	PASS

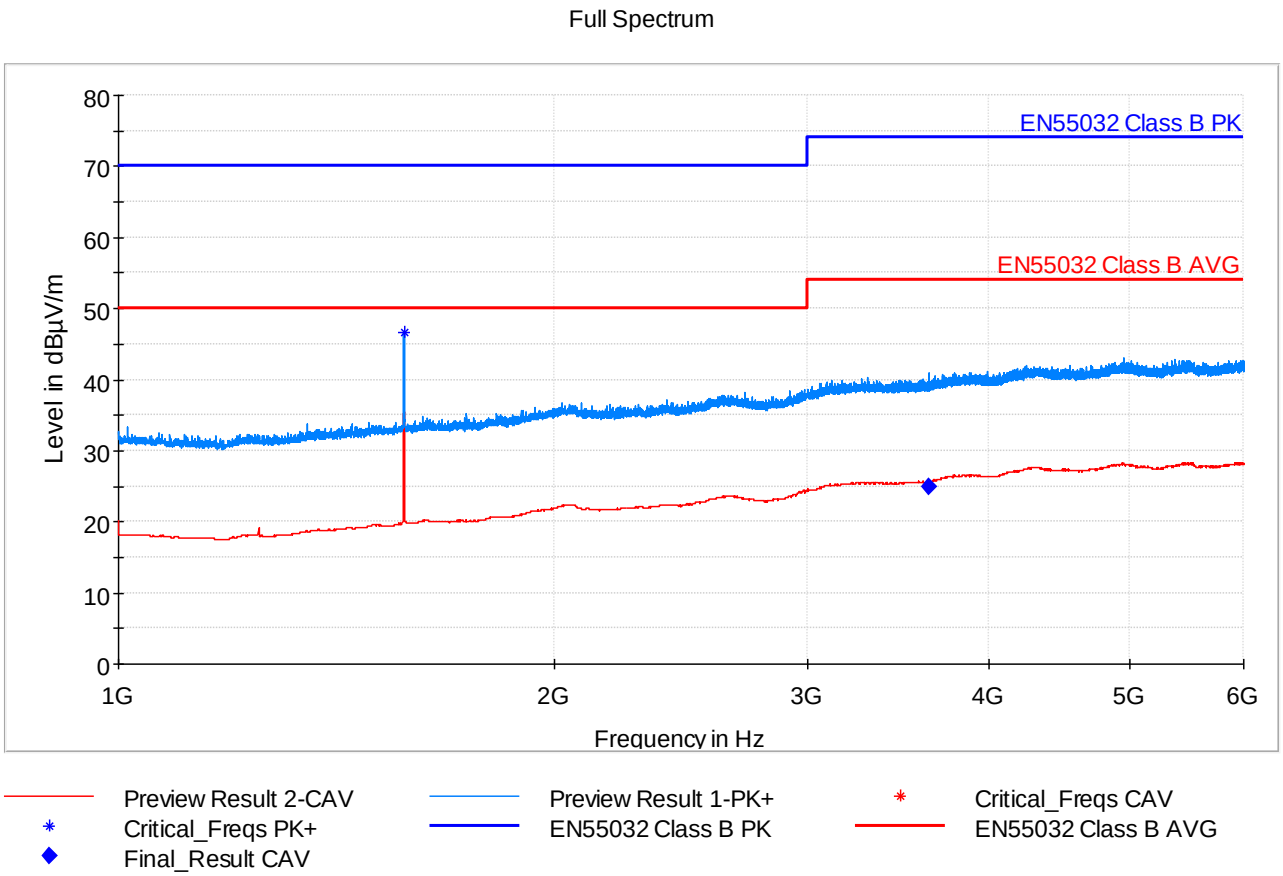
Graph and final result table for 30 MHz – 1 GHz:



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)	Comment
34.210000	38.72	40.00	1.28	15000.0	120.000	106.0	V	202.0	-17.2	PASS

Graph and final result table for 1 GHz – 6 GHz:



Note! Frequency 1575,5 MHz is due the system (GPS test signal), therefore ignored.

Final_Result

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3636.250000	25.01	74.00	48.99	15000.0	1000.000	235.0	H	22.0	-1.6	PASS

8. Conducted Emissions, AC mains power port

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 55032: 2015/AC: 2016

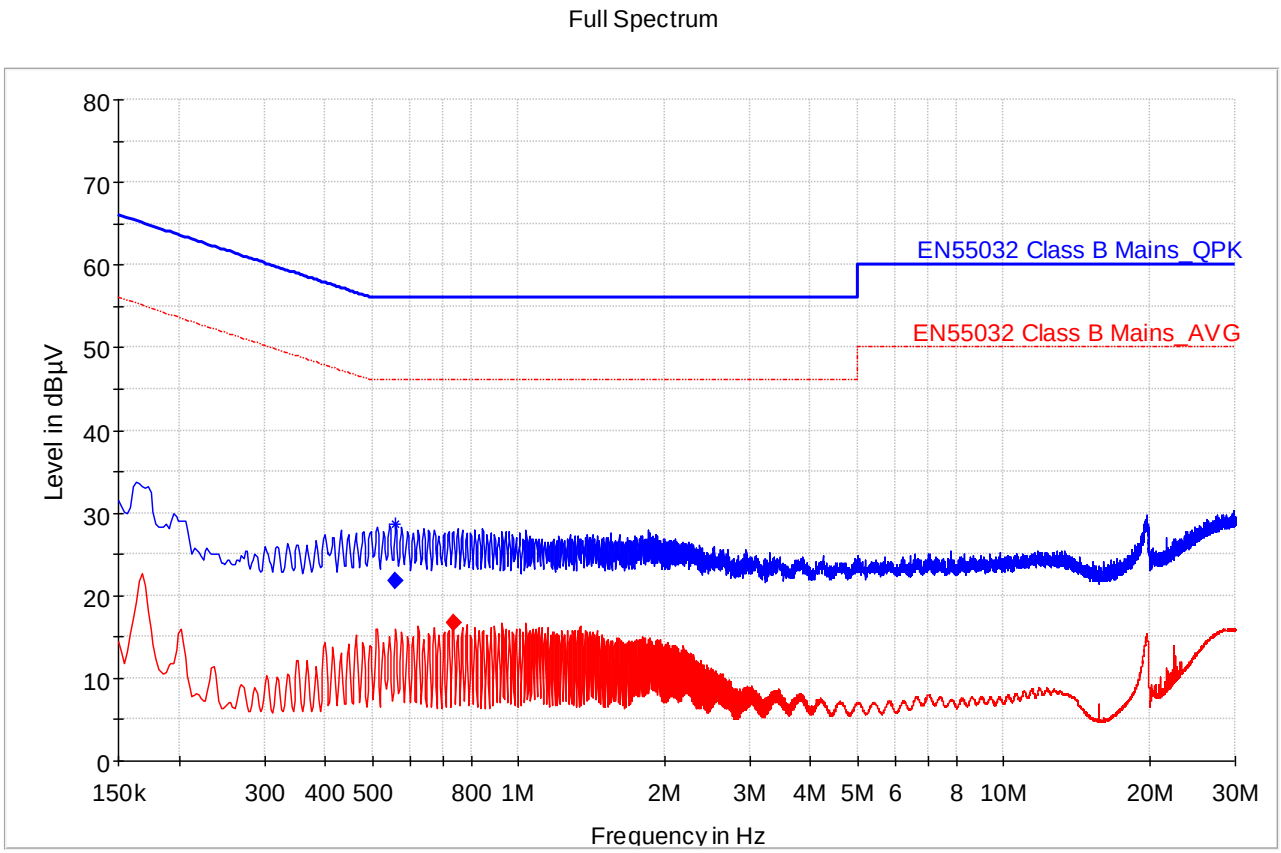
Limits:	EN 55032:2015 / AC:2016, Class B	
Frequency	Quasi peak limit	Average limit
0.15 – 0.50 MHz	66 to 56 dBuV	56 to 46 dBuV
0.50 – 5 MHz	56 dBuV	46 dBuV
5 – 30 MHz	60 dBuV	50 dBuV

Tested sample(s): 1543ER001
Operation mode(s) tested: OM1
Test results: PASS

Test data:

Operation mode(s)	Configuration	Test Verdict
OM1	1543ER001	PASS

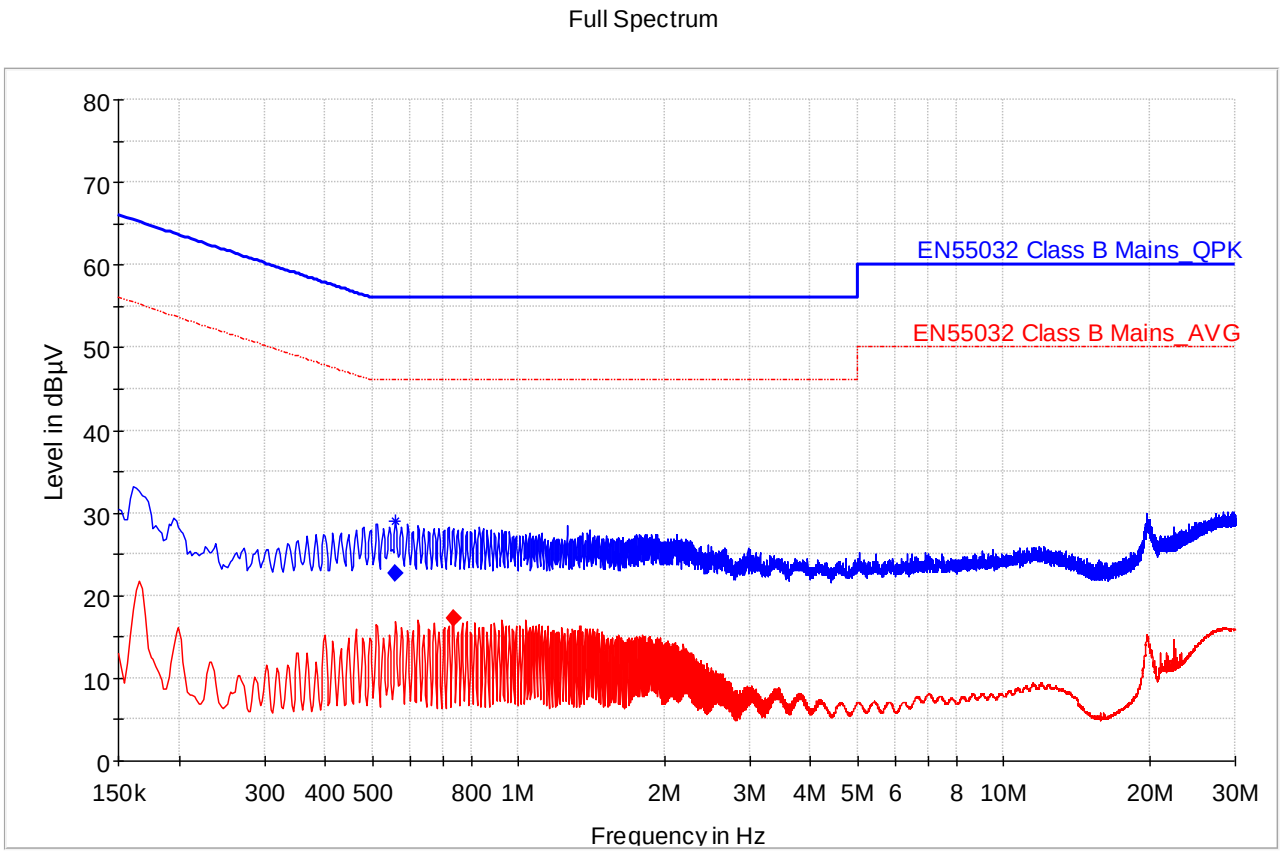
Graph and final result for frequency range 150kHz-30MHz, Phase:



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
0.559500	21.70	---	56.00	34.30	15000.0	9.000	L1	ON	9.9	PASS
0.735000	---	16.72	46.00	29.28	15000.0	9.000	L1	ON	9.9	PASS

Graph and final result for frequency range 150kHz-30MHz, Neutral:



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
0.559500	22.66	---	56.00	33.34	15000.0	9.000	N	ON	9.9	PASS
0.735000	---	17.22	46.00	28.78	15000.0	9.000	N	ON	9.9	PASS

9. Harmonic current emissions

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-3-2: 2014

Limits:	Maximum permissible harmonic Current
Harmonic Order [n]	Class A [A]
2	1,08
3	2,30
4	0,43
5	1,14
6	0,30
7	0,77
8 ≤ n ≤ 40 (even)	$0{,}23 \times \frac{8}{n}$
9	0,40
11	0,33
13	0,21
15 ≤ n ≤ 39 (odd)	$0{,}15 \times \frac{15}{n}$

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Observation period: 2min 20sek
Test results: PASS

Test data:

Operation mode(s)	Configuration	Test Verdict
OM2	1543ER001 + 1543ER002 + G4CER006	PASS

Measured values	
Fundamental Current	0,089 A
Active Input Power	14,895 W
Circuit Power Factor	0,423

Current test result:

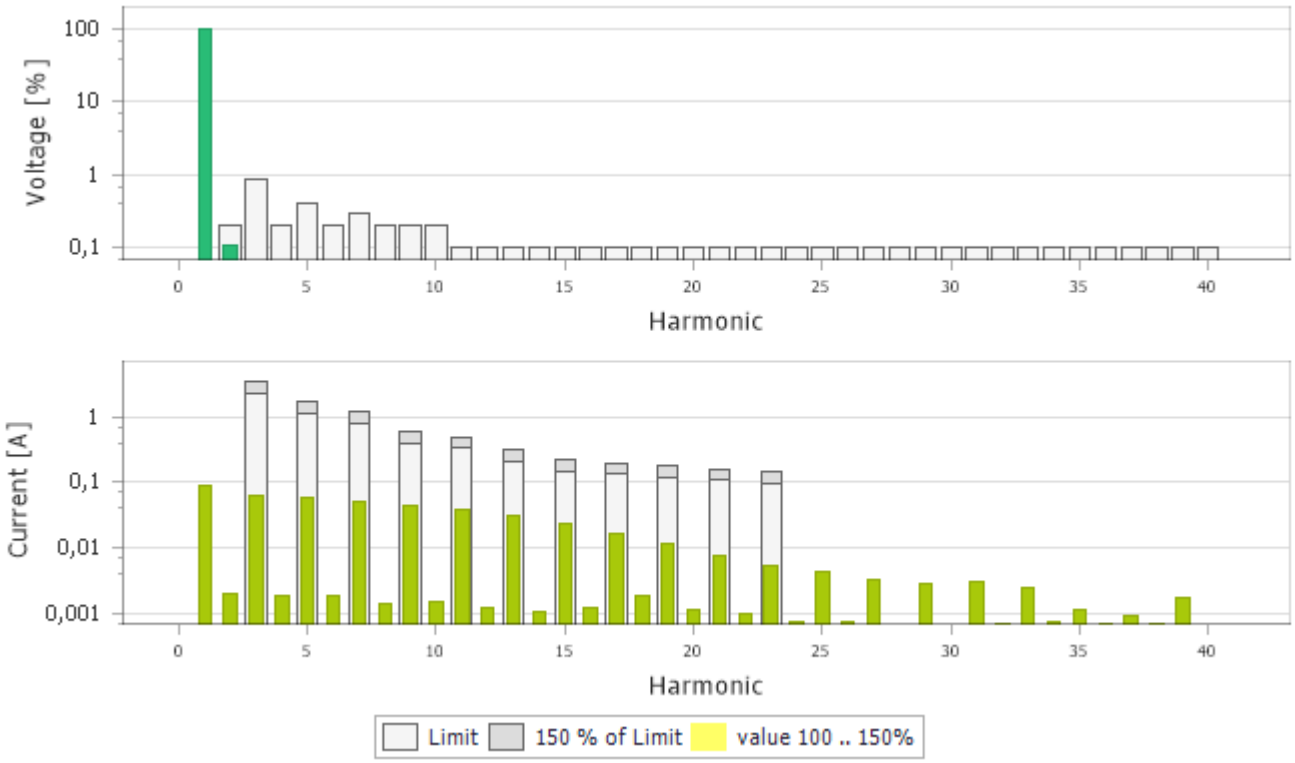
Average and Maximum harmonic current results									
Hn	Average				Maximum				Harmonic
	Ieff [A]	Ieff [%]	Limit [A]	Result	Ieff [A]	Ieff [%]	Limit [A]	Result	Result
1	0,089	100,000			0,089	100,000			
2	0,002	2,099	1,080	Disregard	0,002	2,232	1,620	Disregard	Disregard
3	0,061	68,541	2,300	PASS	0,061	68,786	3,450	PASS	PASS
4	0,002	1,982	0,430	Disregard	0,002	2,104	0,645	Disregard	Disregard
5	0,057	64,588	1,140	PASS	0,058	64,802	1,710	PASS	PASS
6	0,002	1,976	0,300	Disregard	0,002	2,084	0,450	Disregard	Disregard
7	0,052	58,318	0,770	PASS	0,052	58,499	1,155	PASS	PASS
8	0,001	1,531	0,230	Disregard	0,001	1,626	0,345	Disregard	Disregard
9	0,045	50,848	0,400	PASS	0,045	50,878	0,600	PASS	PASS
10	0,001	1,576	0,184	Disregard	0,001	1,659	0,276	Disregard	Disregard
11	0,038	43,016	0,330	PASS	0,038	42,965	0,495	PASS	PASS
12	0,001	1,336	0,153	Disregard	0,001	1,422	0,230	Disregard	Disregard
13	0,031	34,770	0,210	PASS	0,031	34,697	0,315	PASS	PASS
14	0,001	1,115	0,131	Disregard	0,001	1,214	0,197	Disregard	Disregard
15	0,023	26,319	0,150	PASS	0,023	26,320	0,225	PASS	PASS
16	0,001	1,300	0,115	Disregard	0,001	1,384	0,173	Disregard	Disregard
17	0,017	19,083	0,132	PASS	0,017	19,133	0,199	PASS	PASS
18	0,002	2,061	0,102	Disregard	0,002	2,156	0,153	Disregard	Disregard
19	0,011	12,932	0,118	PASS	0,012	13,059	0,178	PASS	PASS
20	0,001	1,189	0,092	Disregard	0,001	1,280	0,138	Disregard	Disregard
21	0,008	8,593	0,161	PASS	0,008	8,731	0,161	PASS	PASS
22	0,001	1,002	0,084	Disregard	0,001	1,120	0,125	Disregard	Disregard
23	0,005	6,012	0,147	PASS	0,005	6,132	0,147	PASS	PASS
24	0,001	0,744	0,077	Disregard	0,001	0,821	0,115	Disregard	Disregard
25	0,004	4,841	0,135	Disregard	0,004	4,947	0,135	Disregard	Disregard
26	0,001	0,735	0,071	Disregard	0,001	0,818	0,106	Disregard	Disregard
27	0,003	3,577	0,125	Disregard	0,003	3,721	0,125	Disregard	Disregard
28	0,001	0,654	0,066	Disregard	0,001	0,755	0,099	Disregard	Disregard
29	0,003	2,966	0,116	Disregard	0,003	3,189	0,116	Disregard	Disregard
30	0,001	0,669	0,061	Disregard	0,001	0,756	0,092	Disregard	Disregard
31	0,003	3,220	0,109	Disregard	0,003	3,349	0,109	Disregard	Disregard
32	0,001	0,695	0,058	Disregard	0,001	0,777	0,086	Disregard	Disregard

33	0,002	2,662	0,102	Disregard	0,002	2,792	0,102	Disregard	Disregard
34	0,001	0,738	0,054	Disregard	0,001	0,822	0,081	Disregard	Disregard
35	0,001	1,137	0,096	Disregard	0,001	1,304	0,096	Disregard	Disregard
36	0,001	0,722	0,051	Disregard	0,001	0,807	0,077	Disregard	Disregard
37	0,001	0,939	0,091	Disregard	0,001	1,019	0,091	Disregard	Disregard
38	0,001	0,716	0,048	Disregard	0,001	0,801	0,073	Disregard	Disregard
39	0,002	1,905	0,087	Disregard	0,002	2,009	0,087	Disregard	Disregard
40	0,001	0,648	0,046	Disregard	0,001	0,728	0,069	Disregard	Disregard

Voltage source verification:

Harmonic voltage results				
Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	230,793	100,345		
2	0,252	0,110	0,200	PASS
3	0,064	0,028	0,900	PASS
4	0,063	0,027	0,200	PASS
5	0,071	0,031	0,400	PASS
6	0,031	0,014	0,200	PASS
7	0,079	0,034	0,300	PASS
8	0,021	0,009	0,200	PASS
9	0,040	0,018	0,200	PASS
10	0,019	0,008	0,200	PASS
11	0,072	0,031	0,100	PASS
12	0,019	0,008	0,100	PASS
13	0,039	0,017	0,100	PASS
14	0,030	0,013	0,100	PASS
15	0,087	0,038	0,100	PASS
16	0,023	0,010	0,100	PASS
17	0,102	0,044	0,100	PASS
18	0,013	0,006	0,100	PASS
19	0,025	0,011	0,100	PASS
20	0,016	0,007	0,100	PASS
21	0,085	0,037	0,100	PASS
22	0,009	0,004	0,100	PASS
23	0,016	0,007	0,100	PASS
24	0,007	0,003	0,100	PASS

25	0,083	0,036	0,100	PASS
26	0,012	0,005	0,100	PASS
27	0,035	0,015	0,100	PASS
28	0,006	0,003	0,100	PASS
29	0,063	0,027	0,100	PASS
30	0,009	0,004	0,100	PASS
31	0,058	0,025	0,100	PASS
32	0,007	0,003	0,100	PASS
33	0,049	0,021	0,100	PASS
34	0,010	0,004	0,100	PASS
35	0,061	0,026	0,100	PASS
36	0,008	0,003	0,100	PASS
37	0,025	0,011	0,100	PASS
38	0,016	0,007	0,100	PASS
39	0,065	0,028	0,100	PASS
40	0,012	0,005	0,100	PASS



10. Voltage fluctuations and flicker

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-3-3: 2013

Limits:	
Pst	1
Plt	0,65
dc	3,3 %
dmax	4 %
Tmax	0,5 s

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Observation time: 12 x 10min
Test results: PASS

Test data:

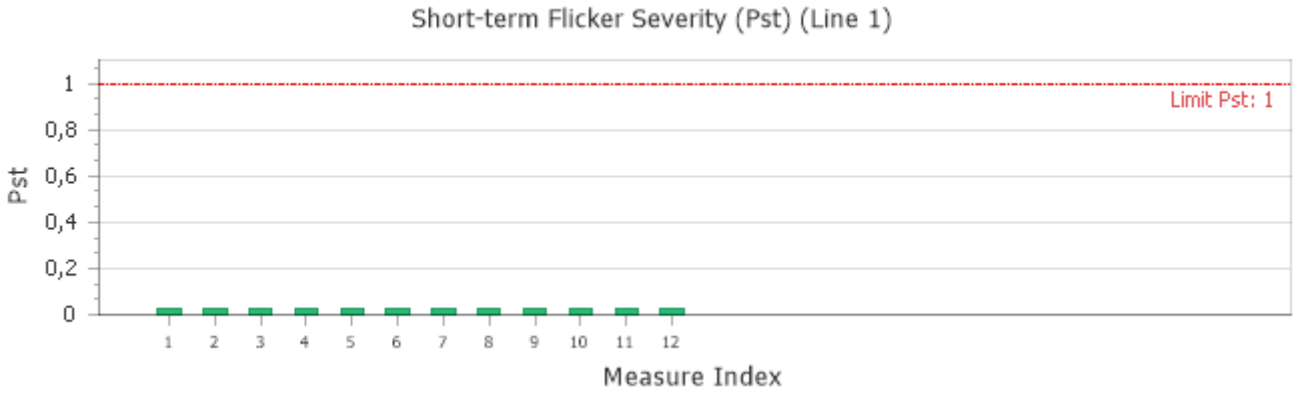
Operation mode(s)	Configuration	Test Verdict
OM2	1543ER001 + 1543ER002 + G4CER006	PASS

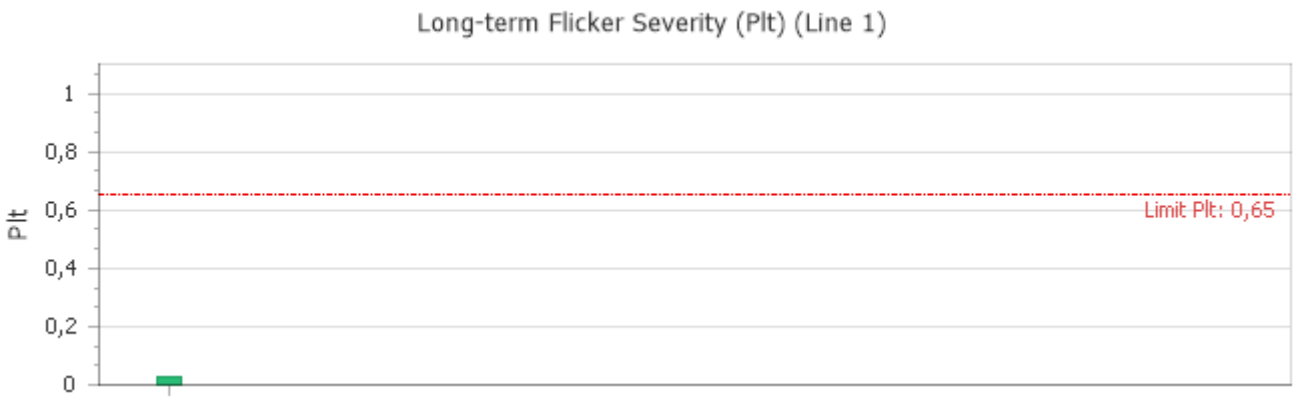
Flicker measurement data	
Pst	0,028
Plt	0,028
dc	0,01 %
dmax	0,121 %
Tmax	0 s

Pst Data

Flicker (Line 1)

Meas. Number	P0,1	P1s	P3s	P10s	P50s	Pst	dc [%]	dmax [%]	Tmax [s]
1	0	0	0	0,001	0,005	0,028	0	0,121	0
2	0	0	0	0,001	0,005	0,028	0,009	0,084	0
3	0	0	0	0,001	0,005	0,028	0	0,083	0
4	0	0	0	0,001	0,005	0,028	0	0,081	0
5	0	0	0	0,001	0,005	0,028	0,009	0,083	0
6	0	0	0	0,001	0,005	0,028	0	0,083	0
7	0	0	0	0,001	0,005	0,028	0	0,081	0
8	0	0	0	0,001	0,005	0,028	0,01	0,081	0
9	0	0	0	0,001	0,005	0,028	0	0,083	0
10	0	0	0	0,001	0,005	0,028	0	0,081	0
11	0	0	0	0,001	0,005	0,028	0,008	0,083	0
12	0	0	0	0,001	0,005	0,028	0	0,083	0





11. RF Electromagnetic Field

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-4-3: 2006, A1: 2008 and A2: 2010

Limits:	EN 301 489-1 V2.2.3		
Frequency	Modulation	Step	Stress level
80-6000 MHz	AM 1 kHz 80 %	LOG 1 %	3 V/m
No testing at exclusion bands			

Limits:	Spot frequency test according to EN 301 489-19 V2.1.1	
Frequency	Modulation	Stress level
80 MHz	AM 1 kHz 80 %	3 V/m
104 MHz	AM 1 kHz 80 %	3 V/m
136 MHz	AM 1 kHz 80 %	3 V/m
165 MHz	AM 1 kHz 80 %	3 V/m
200 MHz	AM 1 kHz 80 %	3 V/m
260 MHz	AM 1 kHz 80 %	3 V/m
330 MHz	AM 1 kHz 80 %	3 V/m
430 MHz	AM 1 kHz 80 %	3 V/m
560 MHz	AM 1 kHz 80 %	3 V/m
715 MHz ± 1 MHz	AM 1 kHz 80 %	3 V/m
920 MHz ± 1 MHz	PM 200Hz 100%	3 V/m

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Performance criteria: A
Monitoring: During the application of the test field, the operation of the EUT is examined and compared against expected performance
Test results: PASS

Test data:

Operation modes	Tested EUT sides	Polarization	Configuration	Test Verdict
OM2	1, 2, 3, 4	H, V	1543ER001 + 1543ER002 + G4CER006	PASS

12. Electrostatic Discharge

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-4-2: 2009

Test method:	Test level:
Direct contact discharge	±4 kV
Indirect contact discharge	±4 kV
Air discharge	±8 kV

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Performance criteria: B
Monitoring: Before and after of the test discharges, the operation of the EUT is examined and compared against expected performance
Number of discharges per test point / polarity / level: 10
Test results: PASS

Test data:

Operation mode(s)	Configuration	Test Verdict
OM2	1543ER001 + 1543ER002 + G4CER006	PASS

13. Conducted RF

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-4-6:2014

Limits:	EN 61000-4-6: 2009		
Frequency	Modulation	Step	Stress level
0.15 - 80MHz	AM 1 kHz 80 %	LOG 1 %	3 V/m
No testing at exclusion bands			

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Performance criteria: A
Monitoring: During the application of the test field, the operation of the EUT is examined and compared against expected performance
Test results: PASS

Test data:

Operation mode(s)	Tested ports	Configuration	Test Verdict
OM2	AC port	1543ER001 + 1543ER002 + G4CER006	PASS

14. Fast transients, common mode

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-4-4: 2012

Limits:	According to Draft EN 301 489-1 V2.2.3	
AC power supply line	±1kV level	5kHz repetition rate
DC power supply line	±0.5kV level	5kHz repetition rate
Communication lines	±0.5kV level	5kHz repetition rate

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Performance criteria: B
Monitoring: During the application of the test field, the operation of the EUT is examined and compared against expected performance
Test results: PASS

Test data:

Operation mode(s)	Tested ports	Configuration	Test Verdict
OM2	AC port	1543ER001 + 1543ER002 + G4CER006	PASS

15. Surges, line to line and line to ground

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN 61000-4-5:2014 + A1:2017

Limits:	According to Draft EN 301 489-1 V2.2.3	
Mode	Line to line	Line to ground
Ac power supply lines	1kV	2kV
Dc power supply lines	1kV	2kV
I/O signal/ control lines (including functional earth)	0.5kV	1kV
I/O signal/ control connected directly to mains supply	0.5kV	1kV

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Performance criteria: B
Monitoring: During the application of the test field, the operation of the EUT is examined and compared against expected performance
Test results: PASS

Test data:

Operation mode(s)	Tested ports	Configuration	Test Verdict
OM2	AC port	1543ER001 + 1543ER002 + G4CER006	PASS

16. Voltage dips and interruptions

Product standard: EN 301 489-1 V2.2.3 and EN 301 489-19 V2.1.1
Test Standard: EN61000-4-11:2004 + A1:2017

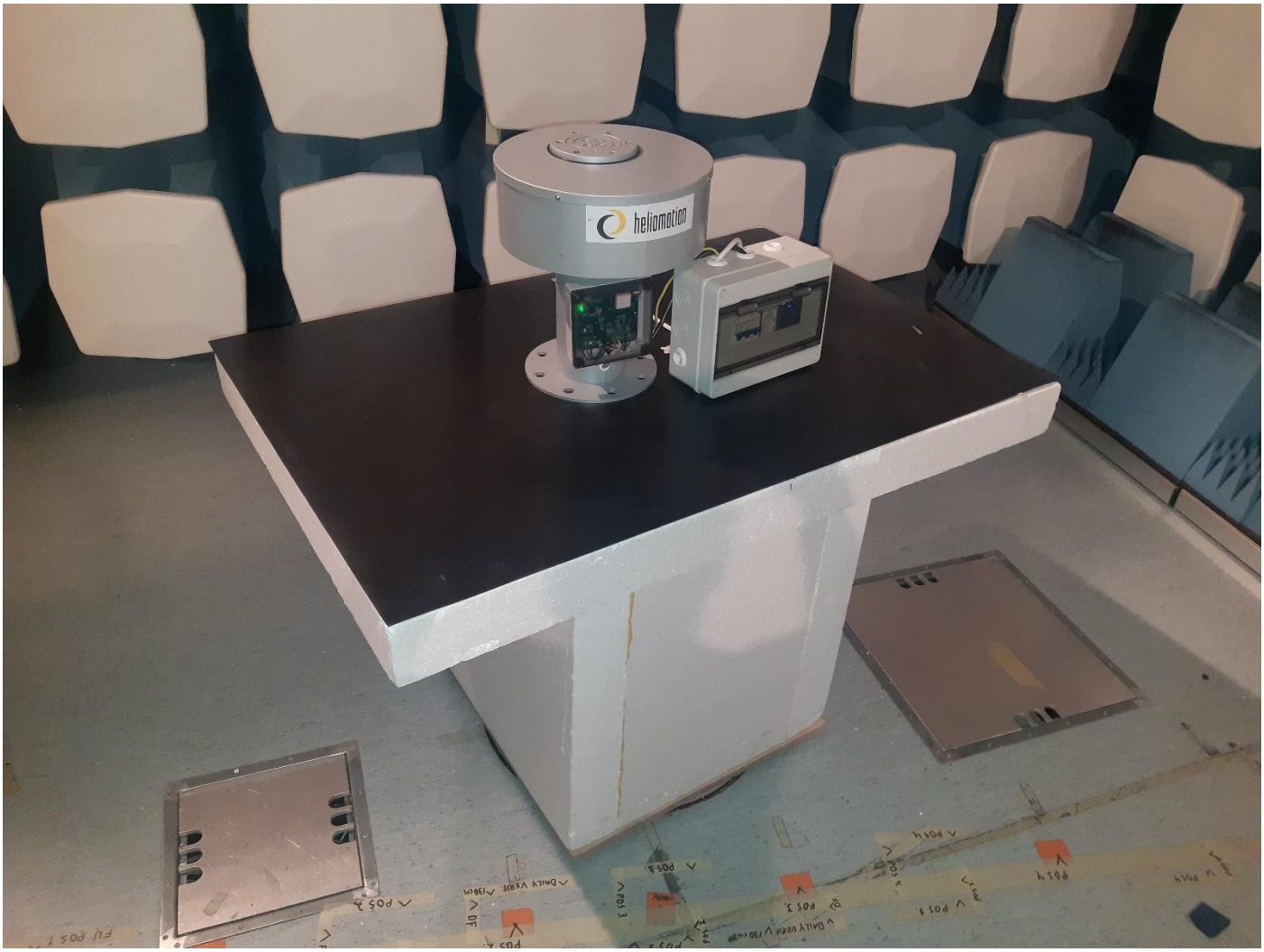
Limits:	According to EN 301 489-1 V2.2.3
voltage dip: 0 % residual voltage for 0,5 cycle	
voltage dip: 0 % residual voltage for 1 cycle	
voltage dip: 70 % residual voltage for 25 cycle (at 50 Hz)	
voltage interruption: 0 % residual voltage for 250 cycles (at 50 Hz)	

Tested sample(s): 1543ER001
Operation mode(s) tested: OM2
Performance criteria: B
Monitoring: During the application of the test field, the operation of the EUT is examined and compared against expected performance
Test results: PASS

Test data:

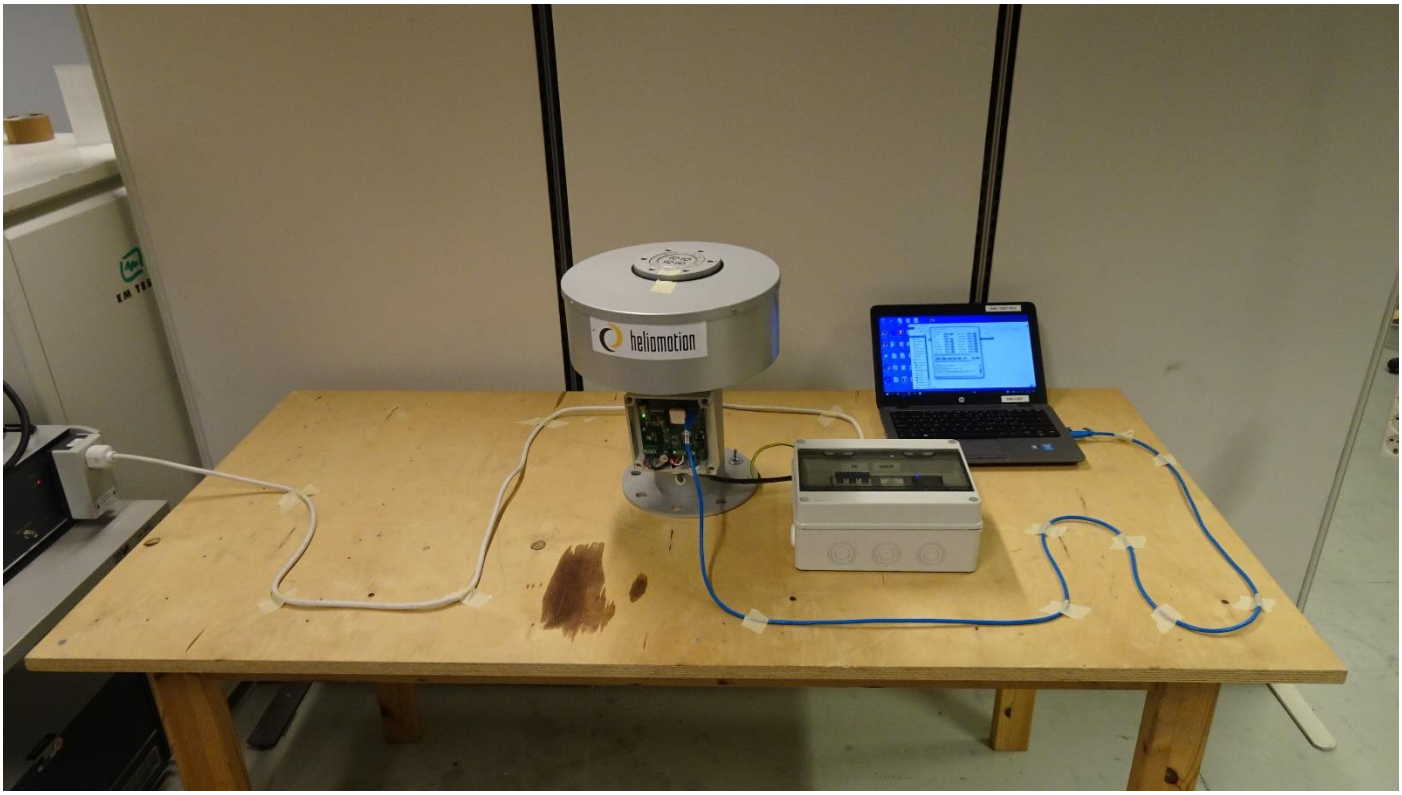
Operation mode(s)	Tested ports	Configuration	Test Verdict
OM2	AC port	1543ER001 + 1543ER002 + G4CER006	PASS

17. Photographs

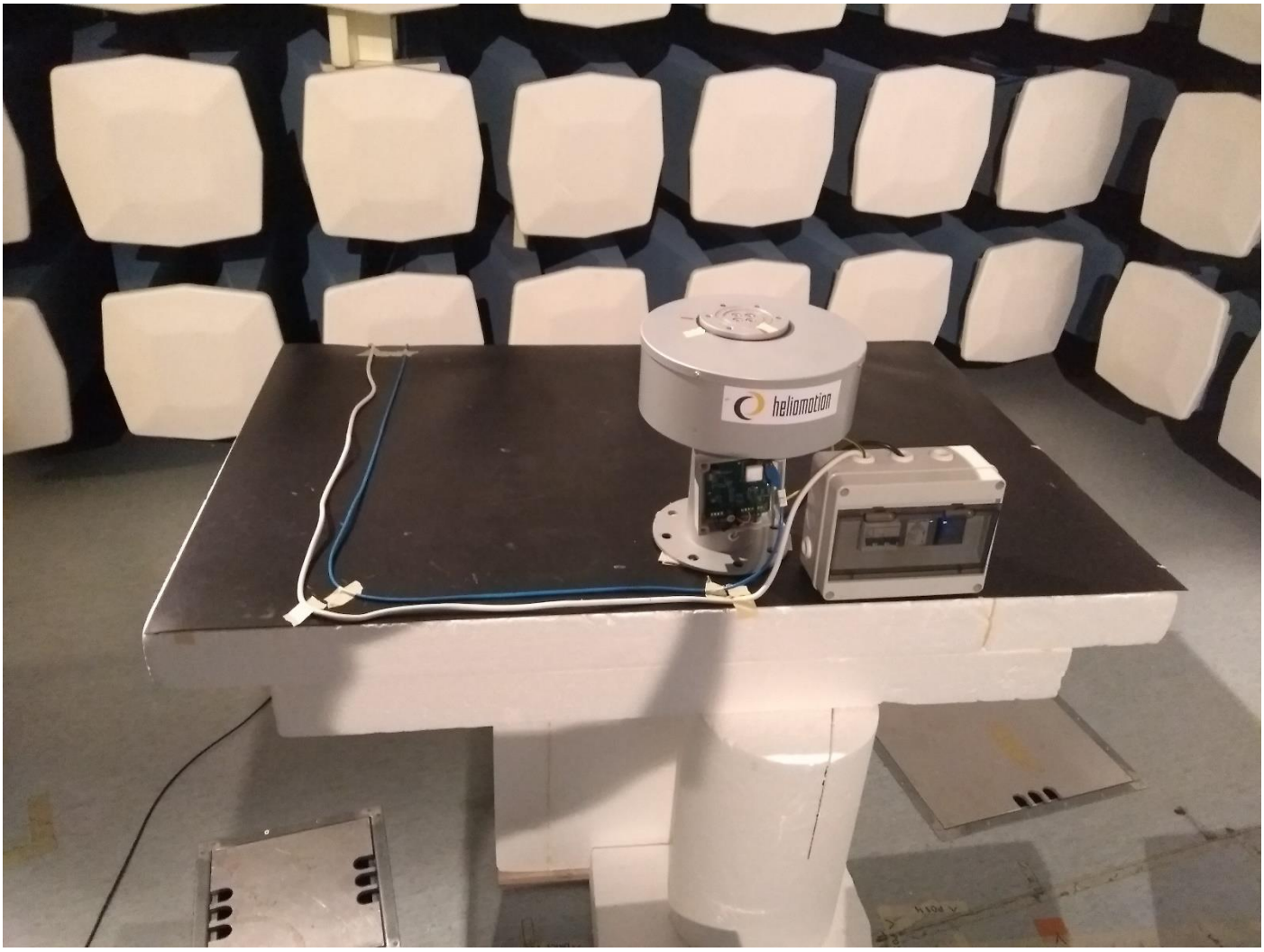


Picture 1 Radiated Emissions

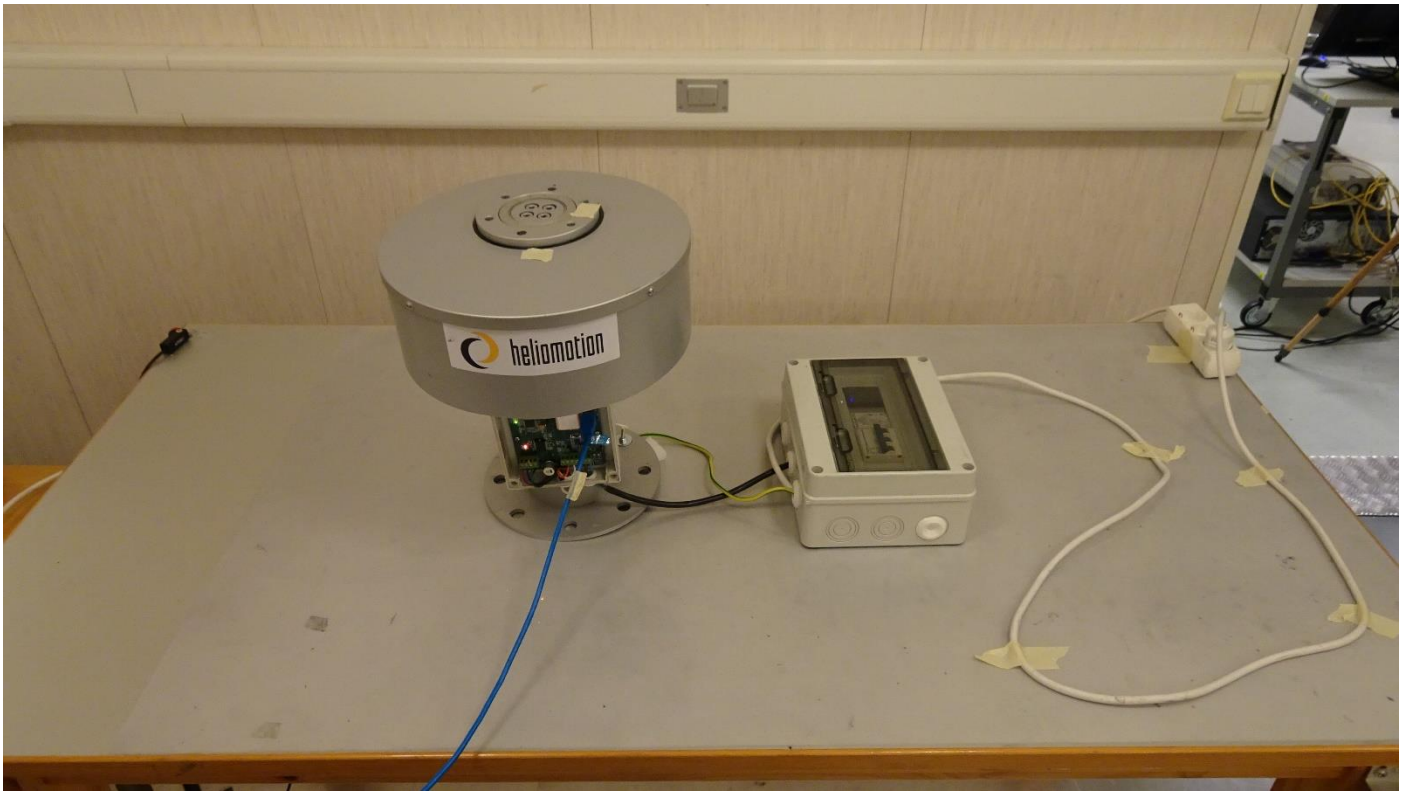
Picture 2 Conducted Emissions



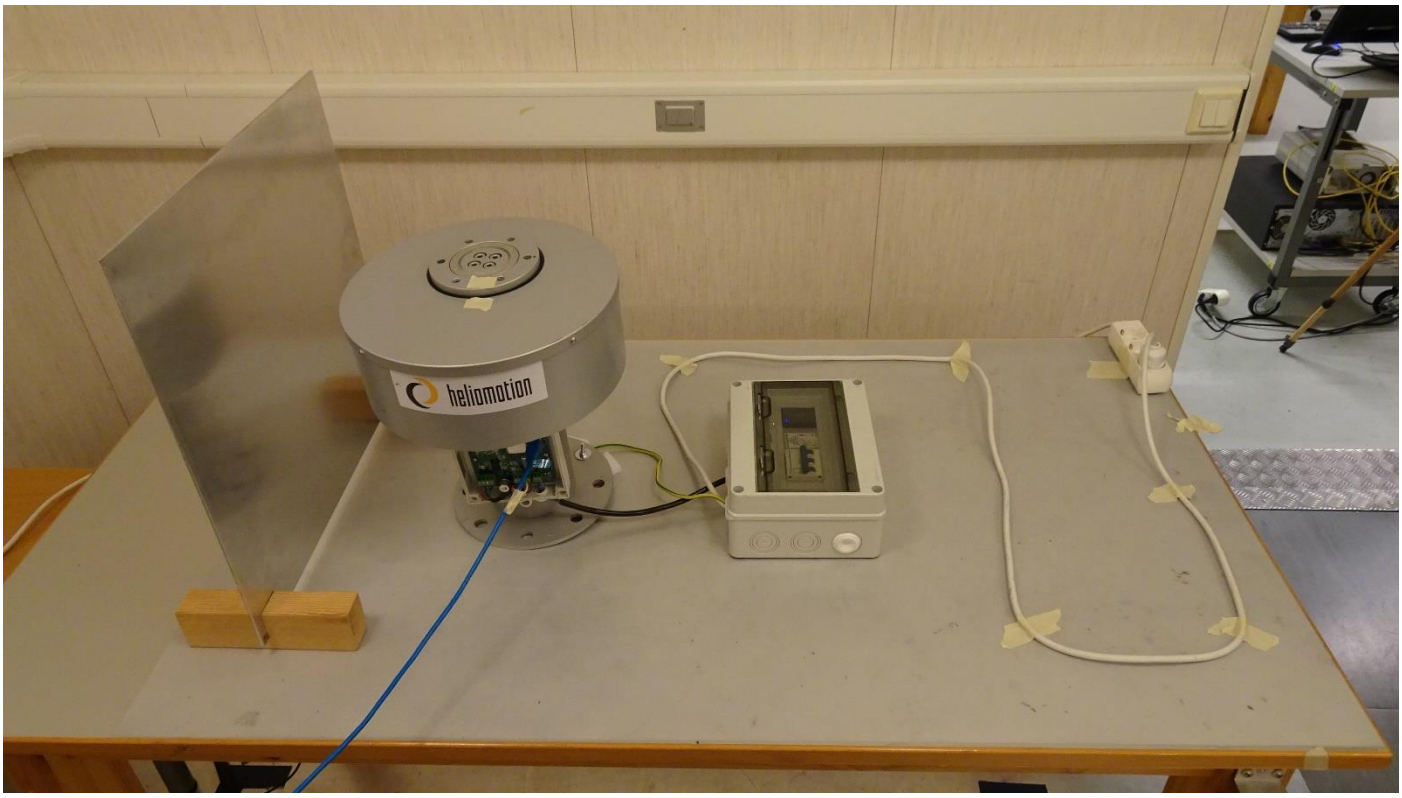
Picture 3 Harmonic Current Emissions & Voltage fluctuations and flicker



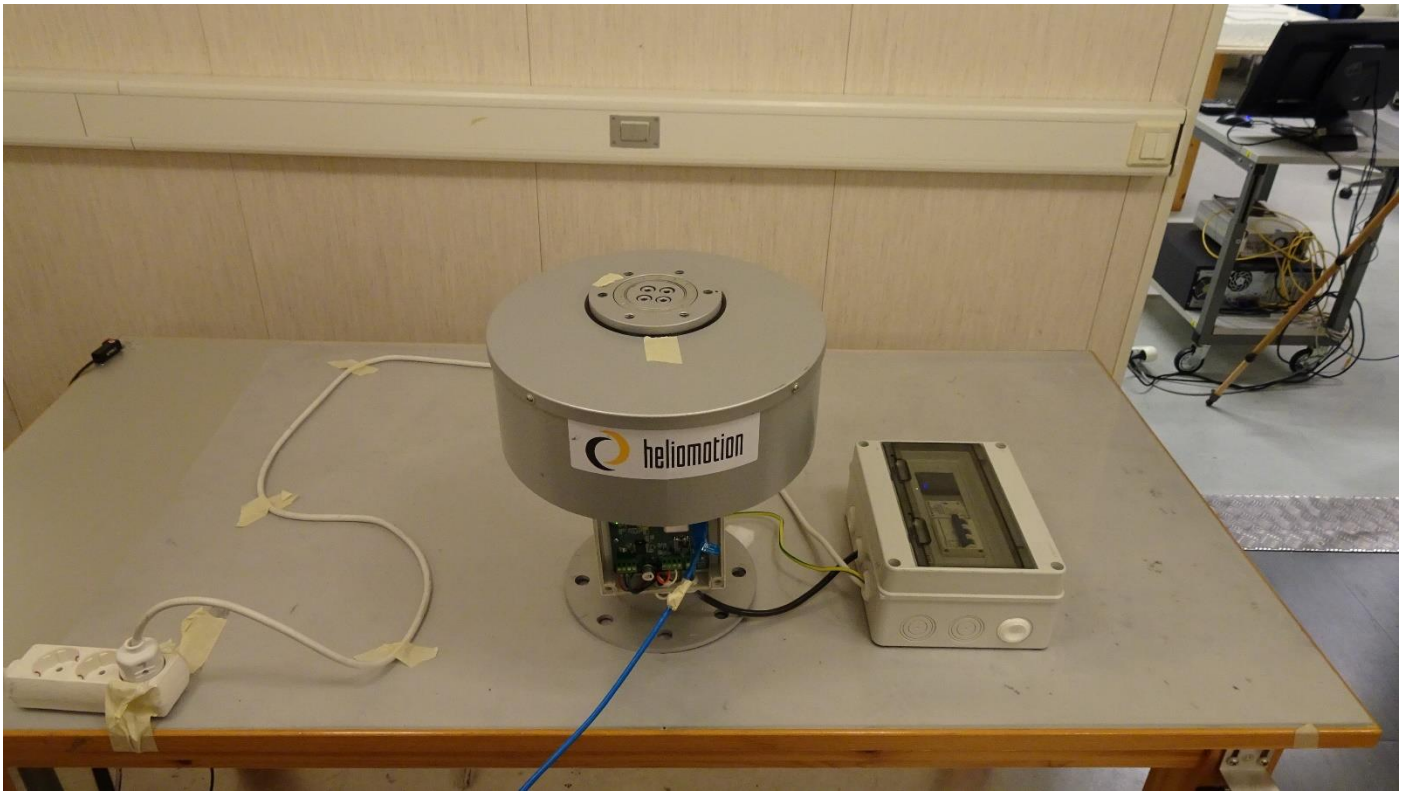
Picture 4 RF electromagnetic field



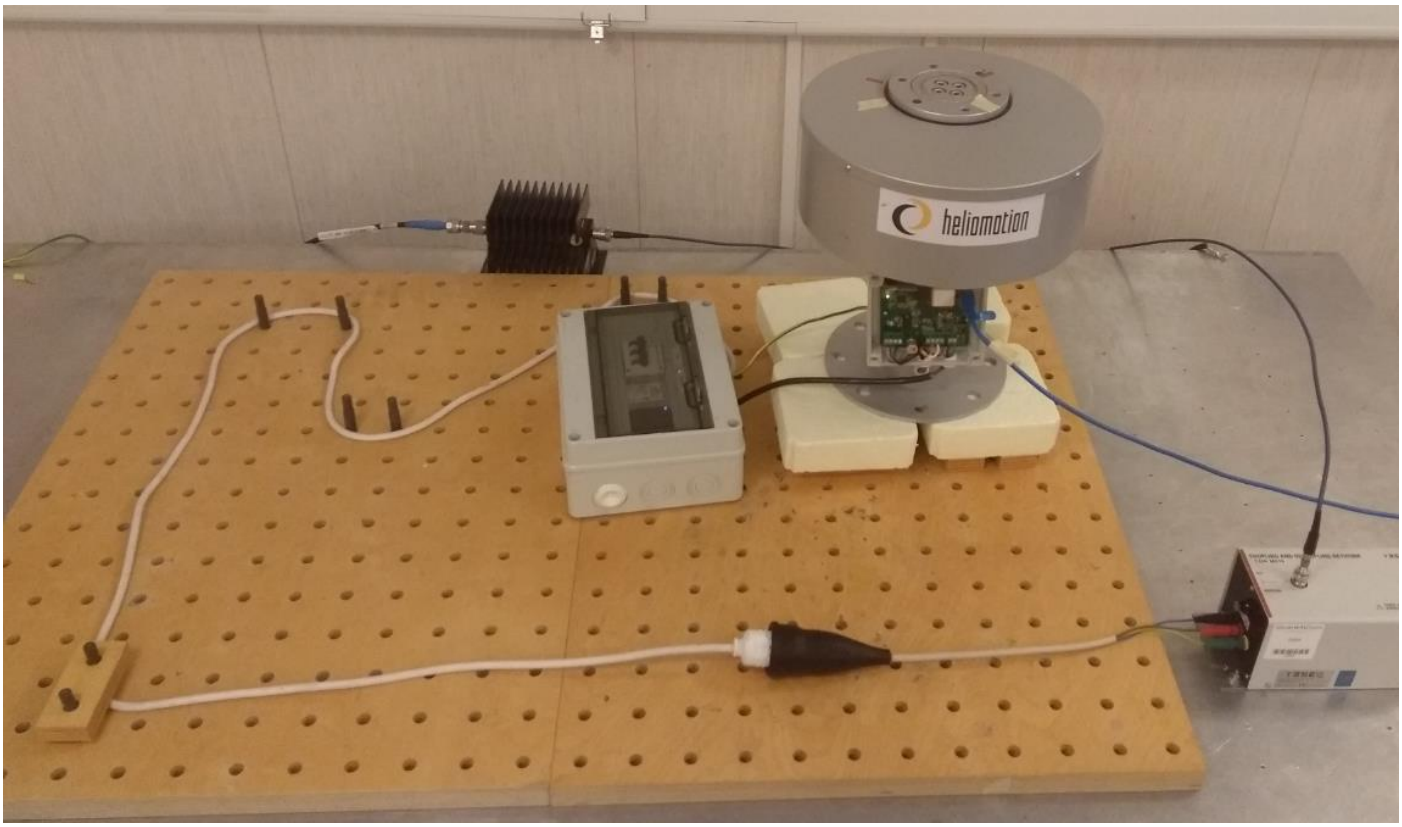
Picture 5 Electrostatic direct contact discharge, AC-Power



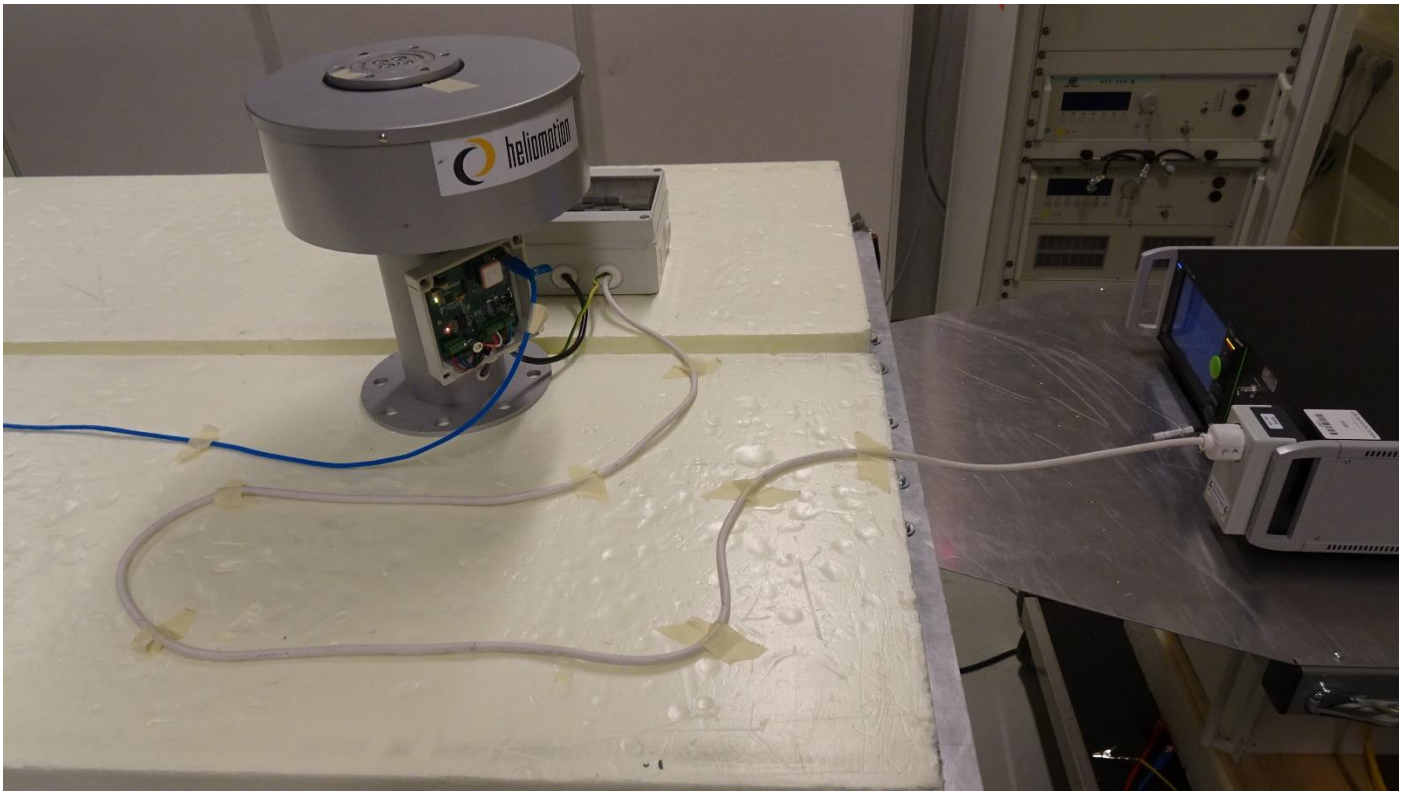
Picture 6 Electrostatic in-direct contact discharge VCP



Picture 7 Electrostatic in-direct contact discharge HCP



Picture 8 Conducted RF, AC-Power



Picture 9 EFT, Surge, Dips and interruptions, AC-Port

18.Test Equipment List

New ID	Manufacturer	Equipment type	Description	Serial	Calibration information	Next calibration
G4C070	Rohde & Schwarz	NRP-Z21	AVG Power sensor 10MHz-18GHz	100982	3.6.2020	3.6.2022
G4C099	Bruel & Kjaer	4227	Mouth simulator	2129887	N/A	N/A
G4C130	Rohde & Schwarz	CBT	Bluetooth tester	100267	18.2.2020	31.7.2022
G4C167	Bruel & Kjaer	4231	94dB SPL-1000Hz Sound calibrator	2327015	28.5.2020	28.5.2022
G4C198	Rohde & Schwarz	SMR27	Microwave Signal Generator 10MHz-27GHz	100067	23.1.2018	23.1.2021
G4C199	Rohde & Schwarz	SML01	Signal generator 9kHz-1.1GHz	101266	23.1.2018	23.1.2021
G4C206	Amplifier recearch	100A250AM1	RF amplifier 10kHz-250MHz	306546	N/A	N/A
G4C209	Agilent	B8363B, (N4692-60003)	10MHz -40GHz Vector Network Analyzer, 2port, 4 receiver, (inc. N4692 CALIBRATION MODULE)	MY43030330, (887)	26.2.2019	26.2.2023
G4C212	Rohde & Schwarz	HFH2-Z2	Active Loop Antenna 9kHz-30MHz	100124	30.1.2018	30.1.2021
G4C217	Rohde & Schwarz	HF907	Double-Ridged Waveguide Horn Antenna 800MHz-18GHz	100164	6.6.2017	31.10.2020
G4C218	NoiseKen	ESS-2000, (TC-815R)	ESD Generator, (inc. ESD Discharge Unit)	ESS07Y7629, (ESS07Y7656)	7.7.2020	7.7.2021
G4C227	Amplifier recearch	150W1000M3	RF Amplifier 0.8-1GHz	301795	N/A	N/A
G4C229	Rohde & Schwarz	NRVD	Dual-Channel Power Meter	100583	28.2.2020	31.7.2022
G4C237	Fluke	43	Power Quality Analyzer	DM7270067	8.7.2020	8.7.2022
G4C249	EM Test	DPA 500N	Single phase harmonics and flicker analyzer	P1720198097	20.9.2017	20.9.2020
G4C250	EM Test	ACS 500N6	Single phase AC voltage source 6 KVA	P1729201376	20.9.2017	20.9.2020
G4C251	EM Test	CNI 508N2	Coupling/decoupling assembly for unshielded and shielded high-speed communication lines up to 1GBit/s	P1735202535	23.8.2017	18.6.2021
G4C252	EM Test	SPN 508N1	Surge Protection Network for unshielded and shielded high-speed communication lines	P1736202732	20.9.2017	18.6.2021
G4C253	EM Test	CNV 504N1	Coupling / decoupling networks for signal/data lines	P1710194355	18.8.2017	18.6.2021
G4C254	EM Test	MS 100N	Magnetic field antenna	P1732202172	8.7.2020	8.7.2023
G4C255	EM Test	MC 2630	Current transformer for magnetic field antenna	P1719197586	8.7.2020	8.7.2023
G4C256	EM Test	MC 26100	Current transformer for magnetic field antenna	P1706192654	8.7.2020	8.7.2023
G4C257	EM Test	HFK	Capacitive Coupling Clamp	0605/4	14.6.2018	14.6.2021
G4C258	EM Test	CA EFT Kit	Calibration set for EFT/Burst generators	-	N/A	N/A
G4C259	Schwarzbeck	STLP 9129	Stacked Log. Periodic Antenna	9129 047	17.8.2017	17.8.2020
G4C261	Rohde & Schwarz	BB150	Broadband amplifier 80 MHz to 1.0 GHz / 500W	102671	28.6.2017	28.6.2020
G4C262	Rohde & Schwarz	BB150	Broadband amplifier 0.69 GHz to 3.2 GHz / 200W	102672	28.6.2017	28.6.2020
G4C263	Rohde & Schwarz	BB150	Broadband amplifier 2.5 GHz to 6.0 GHz / 200W	102673	28.6.2017	28.6.2020
G4C264	Rohde & Schwarz	CMW500	Wideband radio communication tester	126426	10.6.2020	10.6.2021
G4C265	Rohde & Schwarz	ESW26	EMI test receiver	101324	12.9.2019	11.9.2020
G4C266	Rohde & Schwarz	ESH3-Z6	Single-Line V-Network, 150 A 100 kHz to 200 MHz	101516	18.2.2020	31.7.2021
G4C267	Rohde & Schwarz	ESH3-Z6	Single-Line V-Network, 150 A 100 kHz to 200 MHz	101404	18.2.2020	31.7.2021
G4C268	Rohde & Schwarz	ENY81-CA6	Coupling Networks	101657	19.2.2020	31.7.2021
G4C269	Rohde & Schwarz	ENY81	Coupling Networks	100172	20.2.2020	31.7.2021
G4C270	Rohde & Schwarz	NRP-Z91	Power-Sensor	103852	4.7.2019	4.7.2021
G4C271	Rohde & Schwarz	NRP-Z91	Power-Sensor	103851	5.7.2019	5.7.2021
G4C273	Frankonia	ALX-4000E	Broadband Antenna, 25MHz-4GHz with 6dB (50-A-MFN-06) att.	00816+1531	2.6.2017	31.10.2020
G4C274	Fluke	80i-500s	AC Current Clamp	490030	8.7.2020	8.7.2022
G4C275	Schaffner	MD 101	ESD target	80910214810	N/A	N/A
G4C277	Bruel & Kjaer	4192	½" microphone	2729239	4.5.2018	4.5.2021
G4C278	Bruel & Kjaer	2669	½" microphone pre-amplifier	2732059	4.5.2018	4.5.2021
G4C282	Rohde & Schwarz	HZ-9	DC power supply	100218	N/A	N/A
G4C290	Rohde & Schwarz	TS-RSP	RF system panel (relay box)	100305	N/A	N/A
G4C389	EM Test	UCS500-M, MV2616	EM Test AC immunity tester	UCS500-M:(ser.V0520100374, V3.06a02s02), MV2616:(ser.V0520100375)	14.6.2018	N/A
G4C472	Teseq	USB 3.0	Coupling/Decoupling Network	54565	15.7.2019	15.7.2021
G4C473	Teseq	CMAD 20B	Common Mode Absorption Device	54553	9.7.2019	9.7.2021
G4C474	Teseq	CMAD 20B	Common Mode Absorption Device	54542	9.7.2019	9.7.2021
G4C475	Teseq	CMAD 20B	Common Mode Absorption Device	54554	9.7.2019	9.7.2021
G4C476	Teseq	ST08-10	Coupling/Decoupling Network	54466	15.7.2019	15.7.2022
G4C477	York EMC Service	HFG02	Harmonics and Flicker Generator	2758	23.4.2019	23.4.2021
G4C479	EM Test	MV2616	Motorized Variac	0600-11	4.7.2019	4.7.2021
G4C480	EM Test	NX5	Compact NX Generator	P1913228434	18.6.2019	18.6.2021
G4C481	Rohde & Schwarz	ENY-ITS	Option to ENY21/41/81-CA6	101478	19.2.2020	31.7.2021
G4C482	Tektronix	TDS7404B	Digital Phosphor Oscilloscope	B0102207	5.7.2018	5.7.2021
G4C485	Rohde & Schwarz	EZ-17	Current Probe 20Hz-100MHz	100088	21.2.2019	21.2.2021
G4C486	Teseq	KEMZ 801	Electromagnetic - Injection Clamp	17644	27.9.2018	27.9.2021
G4C493	EM Test	CTR 2	Calibration target for ESD pulse verification, 20dB att. +1m coaxial cable	P1720198089	4.12.2017	-
G4C494	Teseq	M016	Coupling Decoupling Network	49348	23.3.2018	23.3.2021
G4C503	Rohde & Schwarz	ESIB26	EMI Test Receiver 20Hz...26.5GHz	100263	12.2.2019	31.7.2021
G4C504	Rohde & Schwarz	CMU200	Communication tester	102347	14.2.2020	31.7.2022
G4C509	Rohde & Schwarz	URV5-Z4	Power sensor 100kHz-3GHz	100399	28.2.2020	31.7.2022
G4C510	Rohde & Schwarz	URV5-Z4	Power sensor 100kHz-3GHz	100103	28.2.2020	31.7.2022
G4C512	ETS-Lindgren	HI-6105	Electric Field Probe 100kHz-6GHz (inc. HI-6113)	61031	8.6.2020	8.6.2021
G4C515	Rohde & Schwarz	ENV216	Two-line V-Network LISN	101472	12.2.2020	31.7.2021
G4C523	Schaffner	CDN S1/50	Coupling/Decoupling Network	15035	25.1.2018	25.1.2021
G4C525	Schaffner	CDN USB/p	Coupling/Decoupling Network	19395	26.1.2018	26.1.2021
G4C534	Schaffner	CIP9136	Current Injection Probe	1102	25.1.2018	25.1.2021
G4C535	Agilent	6813B	AC Power Source / Analyzer 300V RMS, 1750VA	MY41000218	28.2.2018	28.2.2021
G4C560	Bruel & Kjaer	Nexus 2690	Conditioning Amplifier	2340586	24.5.2018	24.5.2021
G4C576	Rohde & Schwarz	HF907	Double-Ridged Waveguide Horn Antenna 800MHz-18GHz	100163	10.9.2019	9.9.2022
G4C585	Rohde & Schwarz	HF906	Horn Antenna 1GHz-18GHz	100012	1.5.2018	1.5.2021
G4C586	Rohde & Schwarz	SMT06	Signal Generator 5kHz-6GHz	100389	3.6.2020	3.6.2022
G4C594	Schaffner	NSG 435	ESD Simulator	208	20.2.2019	N/A