EKTOS
Testing & Reliability Services
A. C. Meyers Vænge 15
2450 Copenhagen SV
Denmark
+45 7070 1499
info@ektos.net

Test Report

of

M1845006 AMP-X300

according to

EN 55032:2012+AC:2013, Class B
EN 55024:2010+A1:2015
EN 55035:2017

Performed by

Volodymyr Hraivoronskyi
Test Engineer, M. Sc. EE.

Examined by

David Busk
Lab. Manager, M. Sc. EE.

Report no.:	P19-0165-1 rev. 2	**Report date:**	2019-10-24
Test started:	2019-09-20	**Test ended:**	2019-10-01
Test laboratory:	EKTOS TRS A/S Test Laboratory TLC: A. C. Meyers Vænge 15 2450 Copenhagen SV Denmark Test Laboratory TLS: Peter Bangs Vej 17 7600 Struer Denmark	**Client:**	ICEpower A/S Vandtårnsvej 62A. 3B 2860 Søborg Denmark
Contact person:	Henrik Brosbøl	**Contact person:**	Thomas Forstberg Petersen
Test specimens:	Model: M1845006 SKU: AMP-X300		
Test specifications:	EN 55032:2012+AC:2013: “Electromagnetic compatibility of multimedia equipment - Emission Requirements”. EN 55024:2010 + A1:2015: “Information technology equipment – Immunity characteristics – Limits and methods of measurement”. EN 55035:2017: “Electromagnetic compatibility of multimedia equipment – Immunity requirements”. The tests relevant for the test specimens are listed in *section 1.1*.		
Documentation:	P19-0165-1 rev. 2 supersedes P19-0165-1 rev. 1 issued 2019-10-22. Changes: Model name stated by client was updated. This test report shall not be reproduced except in full, without written approval of the laboratory. The complete test documentation is archived for 10 years at the testing laboratory.		
Test results:	The test specimen complies with relevant parts of the test specifications. The test results relate only to the specimen tested.		
Test personnel:	David Busk Martin Kirov		Volodymyr Hraivoronskyi

CONTENTS

1 SUMMARY

1.1 Test plan

The test plan is made according to the most severe test specifications from the following standards:

EN 55032:2012+AC:2013

EN 55024:2010+A1:2015
EN 55035:2017

Test method	Name of the test	Test	Result
EN 55032:2012+AC:2013, Class B	Radiated emission	X	PASSED
EN 55032:2012+AC:2013, Class B	Conducted emission	X	PASSED
EN 61000-4-3:2006+A1+A2	Radio frequency electromagnetic field	X	PASSED
EN 61000-4-2:2009	Electrostatic discharge	X	PASSED
EN 61000-4-4:2012	Fast transients	X	PASSED
EN 61000-4-5:2014+A1	Surge	X	PASSED
EN 61000-4-6:2014	Radio frequency common mode	X	PASSED
EN 61000-4-8:2010	Power frequency magnetic field	NR[1]	-
EN 61000-4-11:2004+A1	Voltage dips and interruptions	X	PASSED
EN 61000-3-2:2014	Harmonic current	X	PASSED
EN 61000-3-3:2013	Voltage fluctuations and flicker	X	PASSED

PASSED	The test specimen complies with the essential requirements in the standard.
FAILED	The test specimen does not comply with the essential requirements in the standard.
REF	The test is covered by a test in another report and/or on a similar test specimen.
NR	The test is not relevant for the test specimen or has been waived by the manufacturer.
X	The test is performed.

Note 1: The test specimen has no magnetisable parts and is not susceptible to magnetic fields.

Measuring uncertainties are listed on the last page of the report.

1.2 Test Specimens

1.2.1 Test specimen 1

Manufacturer	ICEpower A/S
Model	M1845006 SKU: AMP-X300
Serial no.	EUT Nr. 4059
Part no.	-
Software	-
Details	Used during Radiated immunity, ESD, Burst and Voltage dips tests
Supply voltage	230 VAC 50 Hz
Operational mode	Channels 1-2: Sum, 8Ω, LoZ, maximum gain. Channels 3-4: Stereo, 8Ω, LoZ, maximum gain.

Photo 1. Test specimen.

1.2.2 Test specimen 2

Manufacturer	ICEpower A/S
Model	M1845006 SKU: AMP-X300
Serial no.	1937IPS00006 AMP-X300
Part no.	6510866 Modified to AMP-X300, EUT Nr. 4060
Software	-
Details	Used for Radiated emission, Conducted emission and immunity, Surge, Harmonic current and Flicker tests
Supply voltage	230 VAC 50 Hz
Operational mode	1 channel and Hi-Z loaded by BTL-16Ω

Photo 2. Test specimen.

1.3 Auxiliary Equipment

1.3.1 Mobile Phone

Manufacturer	Samsung
Model	Galaxy S6
Serial no.	
Software	Android 7.1
Details	-
Supply voltage	-
Operational mode	Used as the tone/noise generator for Emission tests

1.3.2 Loads

Manufacturer	ICEpower A/S
Model	2 x 8 Ohm
Serial no.	N/A
Details	Used in a serial connection for 16 Ω output and separately for 8 Ω outputs

1.4 I/O ports / cables to test specimens

I/O Port Cable	Type	Shielding	Max Cable length
AC Power	3 Wire	Unshielded	<3 m
Unbalanced Input	1 Wire	Shielded	<3 m
Balanced Input	3 Wire	Shielded	<3 m
Output	2 Wire	Unshielded	<30 m

Cables shorter than 3 m are not exposed to Radio frequency common mode test, Fast transients test and Surge tests.

Conducted emission test, Radio frequency common mode test, Fast transients test and Surge tests are performed on AC power port.

1.5 Test set-up

The test set-up with 1 channel and Hi-Z loaded by BTL-16Ω is selected during Radiated emission pre-tests as the worst case.

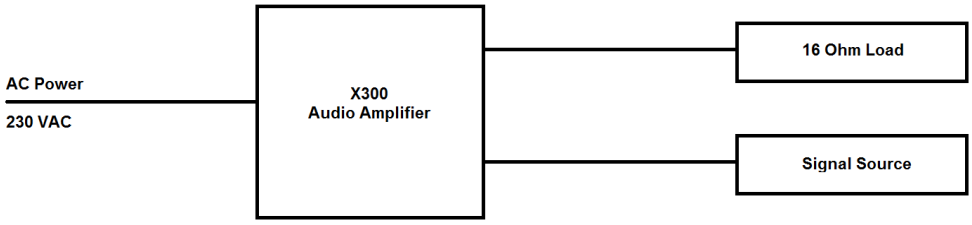

Figure 1. Test set-up for Conducted and Radiated emission, Conducted immunity and Surge.

The test set-up for immunity tests consists of 4 8Ω Loads on channels 1-4, Control speaker on Channel 2, terminated Balanced input 2, terminated unbalanced RCA inputs 1-4.

The amplifier is set to:

Channels 1-2: Sum LoZ, maximum gain.

Channels 3-4: Stereo LoZ, maximum gain.

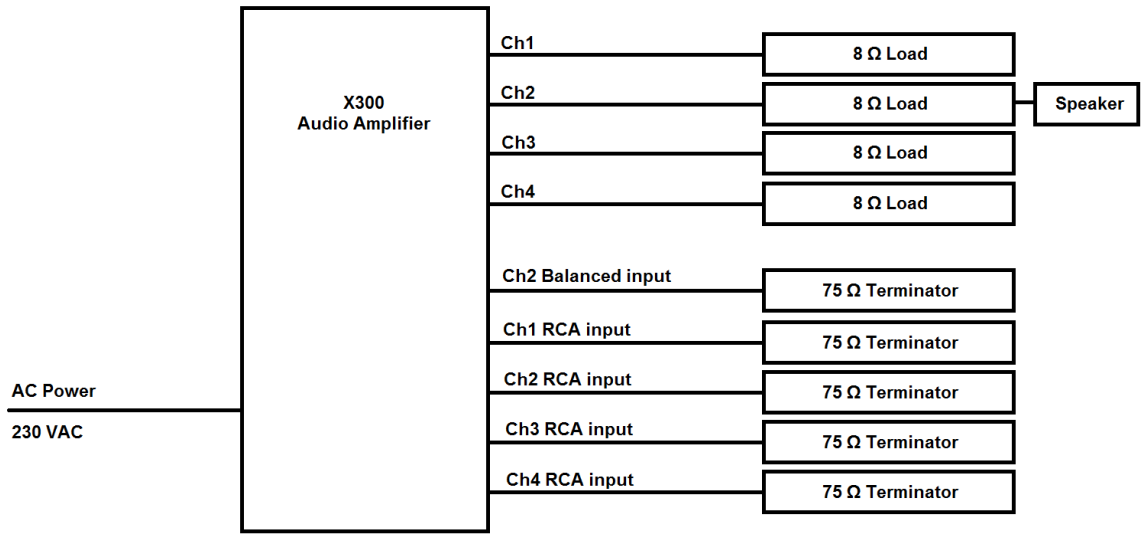

Figure 2. Test set-up for immunity tests.

1.6 Functional test procedure

The Monitoring Speaker is used for checking the output during Conducted and Radiated Immunity, ESD, Burst and Voltage dips tests.

In addition, Oscilloscope is used to monitor the output during Surge, Radiated and Conducted immunity tests.

1.7 Performance criteria

General performance criteria by the client:

No change or distortions are allowed during continuous phenomena immunity tests.

No change or distortions are allowed after removing the transient phenomena.

The generic performance criteria for compliance from EN 55024:2010+A1:2015 and EN 55035:2017 are in force during the EMC immunity testing:

Performance criterion	Description
A	The EUT shall continue to operate as intended during and after the test without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the EUT if used as intended.
B	The EUT shall continue to operate as intended after the test without operator intervention. No degradation of performance or loss of function is allowed after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed to persist after the test. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and by what the user may reasonably expect from the EUT if used as intended.
C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls. A reboot or re-start operation is allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

2 TESTS

2.1 Radiated emission

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4060
Test specification	EN 55032:2012+AC:2013
Test method	EN 55032:2012+AC:2013
Frequency range	30-1000 MHz
Limits	EN 55032:2012+AC:2013, Class B, Distance 3 m
Comments	The test is performed in TLC Test Laboratory Pre-tests were done in various modes of channels: 1, 2 and 4 Channels. And in various modes of loads: SE-4Ω, SE-8Ω, BTL-4Ω, BTL-8Ω, Hi-Z BTL-16Ω, Hi-Z BTL-32Ω. The worst case was found to be 1 channel and Hi-Z BTL-16Ω
Temperature / Humidity	22°C / 51%RH
Date of measurements	2019-09-24
Test personnel	David Busk

2.1.1 Test setup

A measuring distance of 3 m was used during the tests.

The EUT was placed 80 cm above ground on a non-conductive table.

The auxiliary equipment was positioned on the table.

Exploratory radiated emission measurements in the frequency range 30 – 1000 MHz with reflective floor were made by rotating the turntable between 0-360° and variating the antenna height between 1-4 m, in both horizontal and vertical antenna polarization.

Based on the preliminary measurements the frequencies with the highest emissions are selected for final radiated emission measurements. Final measurements were made by rotating the turntable and changing the height of the antenna to maximize the emission level.

Photo 3. Radiated emission test setup. 30 - 1000 MHz.

2.1.2 Test results

The measured test results were below the limits.
The measurement time during final measurements were 15 s.

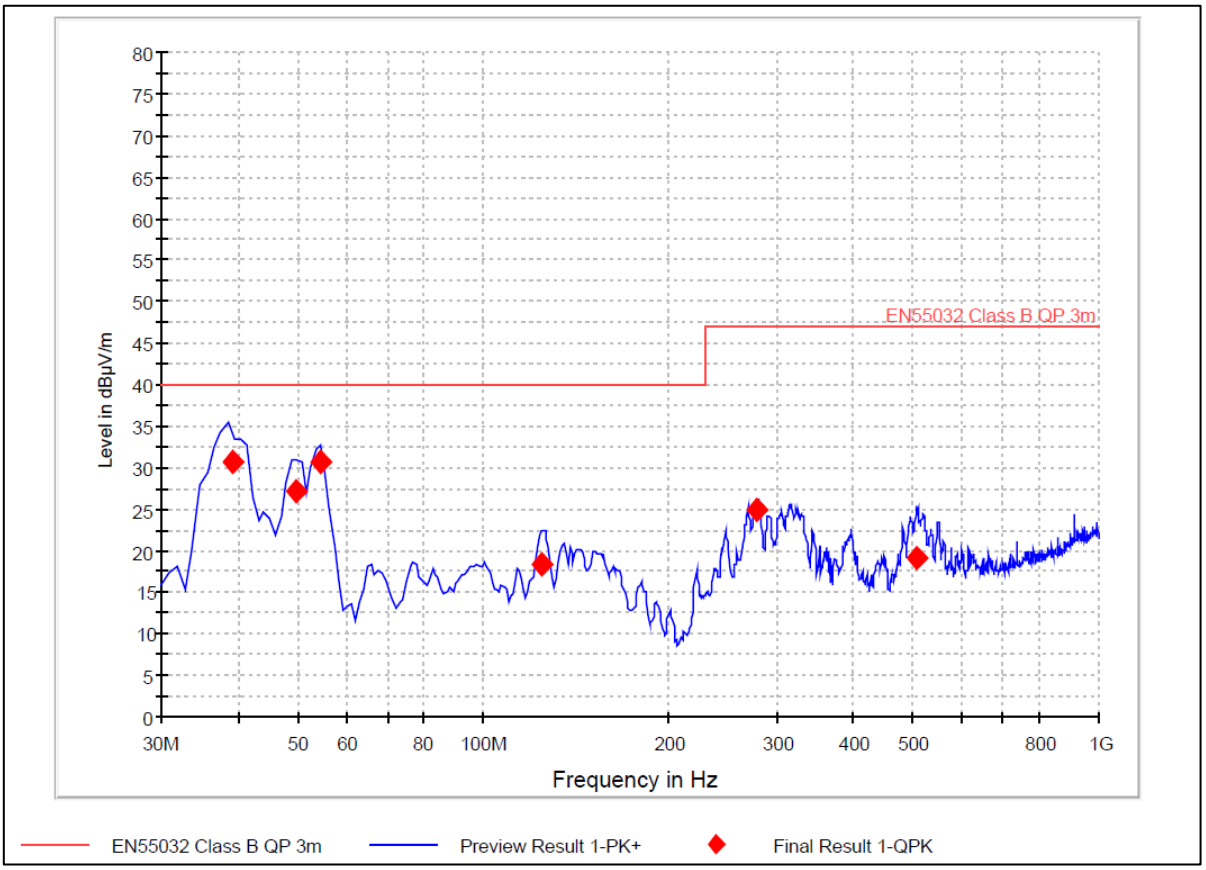

Figure 3. Radiated emission test results. 30 - 1000 MHz.

Frequency [MHz]	QP [dBµV/m]	BW [kHz]	Height [cm]	Pol.	Azimuth [deg]	Margin [dB]	Limit [dBµV/m]	Result
39.166954	30.7	120.0	100.0	V	157.0	9.30	40.00	PASSED
49.737675	27.3	120.0	100.0	V	90.0	12.70	40.00	PASSED
54.468978	30.8	120.0	100.0	V	271.0	9.20	40.00	PASSED
125.062144	18.3	120.0	100.0	V	196.0	21.70	40.00	PASSED
278.699198	24.8	120.0	100.0	H	271.0	22.20	47.00	PASSED
506.836032	19.2	120.0	100.0	V	215.0	27.80	47.00	PASSED

Table 1. Radiated emission test results. 30 - 1000 MHz.

2.1.3 Test equipment

Description	Supplier	Model	Tag no.
Antenna, Ultra Broadband, 30 MHz-3 GHz	Rohde&Schwarz	HL562	19830
Amplifier 30 MHz – 3 GHz	Miteq	AFS3-00100400-18-ULN	50084
Analyzer 20 Hz-26.5 GHz	Rohde&Schwarz	ESI26	20763

Table 2. Radiated emission test equipment.

2.2 Conducted emission

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4060
Test specification	EN 55032:2012+AC:2013
Test method	EN 55032:2012+AC:2013
Frequency range	0.15 - 30 MHz
Limits	EN 55032:2012+AC:2013, Class B
Comments	The test is performed in TLC Test Laboratory Tested at 1 channel and Hi-Z BTL-16Ω
Temperature / Humidity	22°C / 51%RH
Date of measurements	2019-09-24
Test personnel	David Busk

2.2.1 Test setup

The AC power port on the Test Specimen was tested.

The AC power port test was performed with Mains connected to an Artificial Mains Network. Excess lengths of cables were bundled at the cable center.

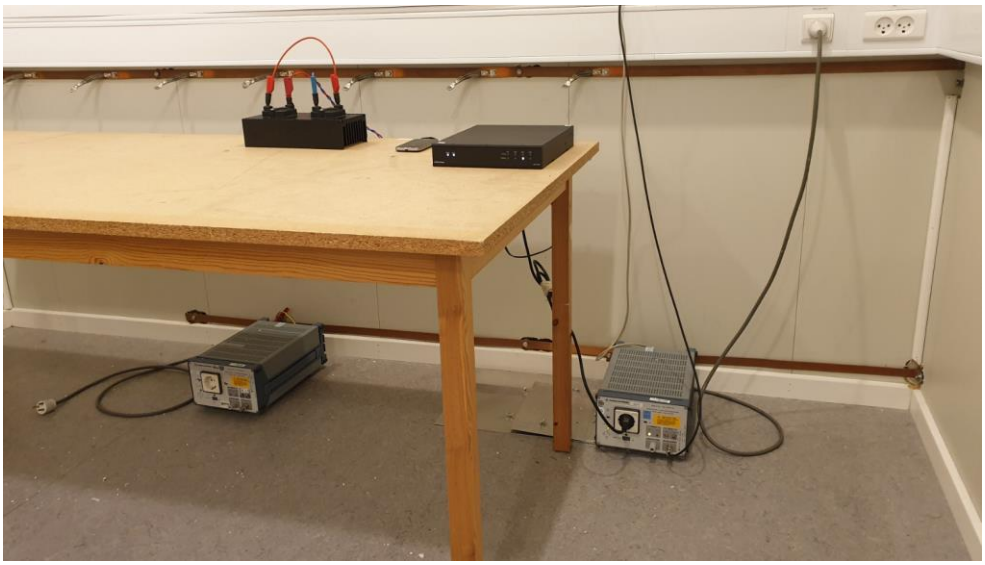

Photo 4. Conducted emission test setup.

2.2.2 Test results

The measured test results were below the limits.
The measurement time during final measurements were 15 s.

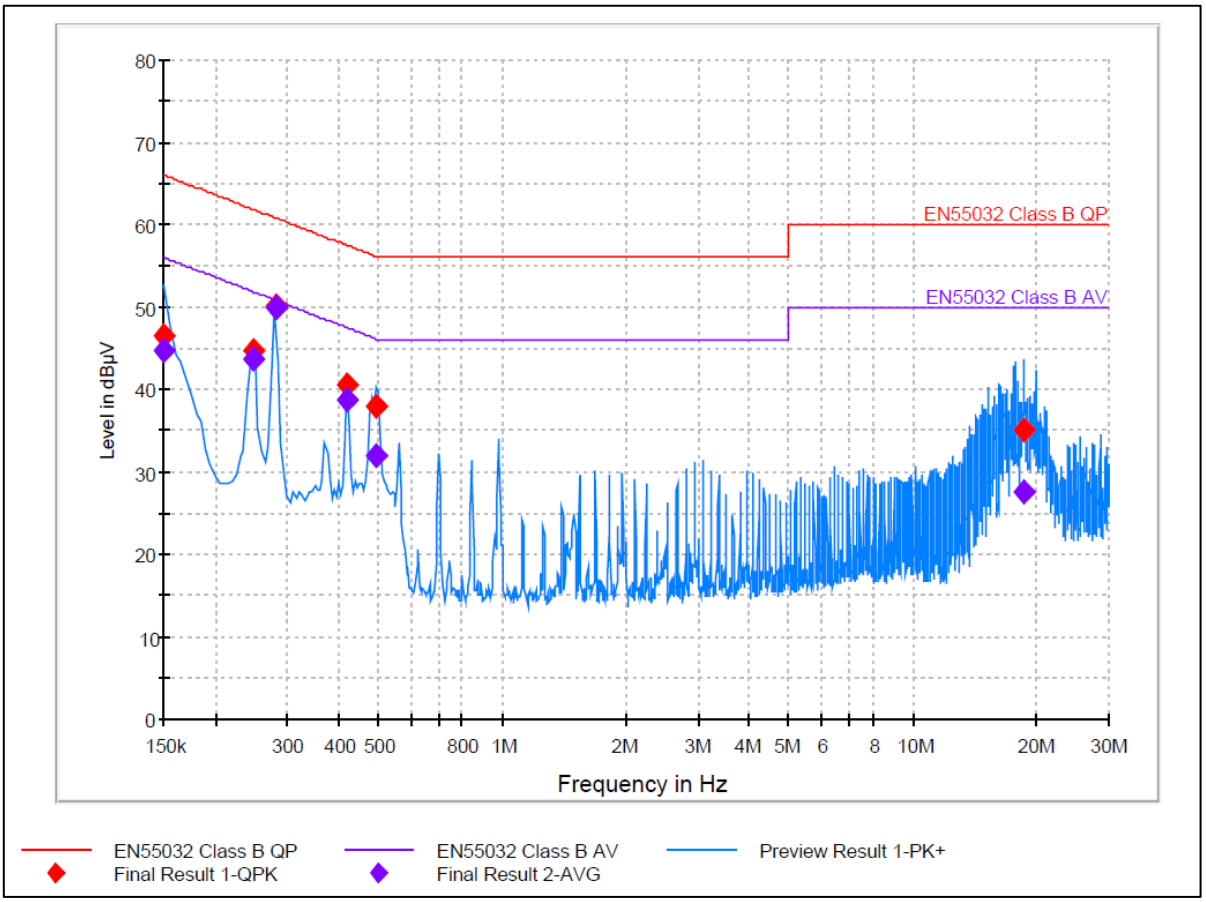

Figure 4. Conducted emission test results. AC Power Port.

Frequency [MHz]	QuasiPeak [dBµV]	BW [kHz]	Line	Margin [dB]	Limit [dBµV]	Result
0.150100	46.4	9.000	N	19.60	66.00	PASSED
0.248700	44.6	9.000	L1	17.20	61.80	PASSED
0.280700	50.2	9.000	L1	10.60	60.80	PASSED
0.420600	40.6	9.000	L1	16.80	57.40	PASSED
0.495400	38.0	9.000	N	18.10	56.10	PASSED
18.646700	35.0	9.000	L1	25.00	60.00	PASSED

Table 3. Conducted emission test results. AC Power Port. Quasi Peak detector.

Frequency [MHz]	Average [dBµV]	BW [kHz]	Line	Margin [dB]	Limit [dBµV]	Result
0.150100	44.7	9.000	N	11.30	56.00	PASSED
0.248700	43.7	9.000	L1	8.10	51.80	PASSED
0.280700	49.8	9.000	L1	1.00	50.80	PASSED
0.420600	38.8	9.000	L1	8.60	47.40	PASSED
0.495400	31.9	9.000	N	14.20	46.10	PASSED
18.646700	27.6	9.000	L1	22.40	50.00	PASSED

Table 4. Conducted emission test results. AC Power Port. Average detector.

2.2.3 Test equipment

Description	Supplier	Model	Tag no.
Pulse Limiter 9 KHz-30 MHz	Rohde&Schwarz	ESH3-Z2	13513
V-network Two Line	Rohde&Schwarz	ESH3-Z5	13935
Receiver EMI Test 20 Hz-26.5 GHz	Rohde&Schwarz	ESIB 26	18880

Table 5. Conducted emission test equipment.

2.3 Radio frequency electromagnetic field

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4059
Test specification	EN 55024:2010+A1:2015 EN 55035:2017
Test method	EN 61000-4-3:2006+A1+A2
Performance criterion	A
Frequency range	80 MHz to 1000 MHz and 1000 MHz to 6000 MHz
Field strength	80 MHz to 1000 MHz: 3 V/m 1000 MHz to 6000 MHz: 3 V/m
Modulation	80% AM, 1000 Hz sine wave
Step size / dwell time	1% / 1 s
Comments	The test is performed in TLS Test Laboratory
Temperature / Humidity	26°C / 42%RH
Date of measurements	2019-09-20
Test personnel	Volodymyr Hraivoronskyi

2.3.1 Test setup

The tests were performed in a semi anechoic chamber with absorbers on the floor. The test specimen was placed on a non-conductive foam table.

The auxiliary equipment (passive loads) were positioned on the floor.

The auxiliary equipment (oscilloscope and monitoring speaker) were positioned outside the chamber in a control room.

From 80 - 1000 MHz the distance was 2.5 m and antenna height was 1.55 m.

From 1 - 6.0 GHz the distance was 2.5 m and antenna height was 1.30 m.

The immunity field was applied to 2 sides of the test specimen: Left side and back.

Functional tests were performed before, during and after testing.

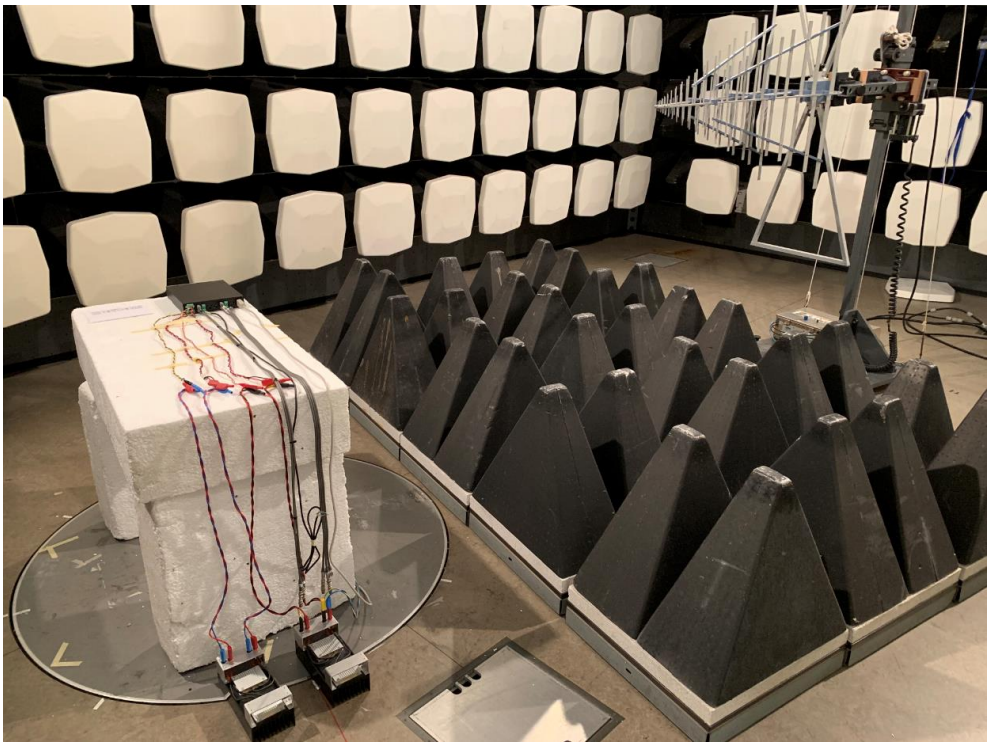

Photo 5. Radio frequency electromagnetic field test setup. 80 MHz – 1000 MHz. Left side.

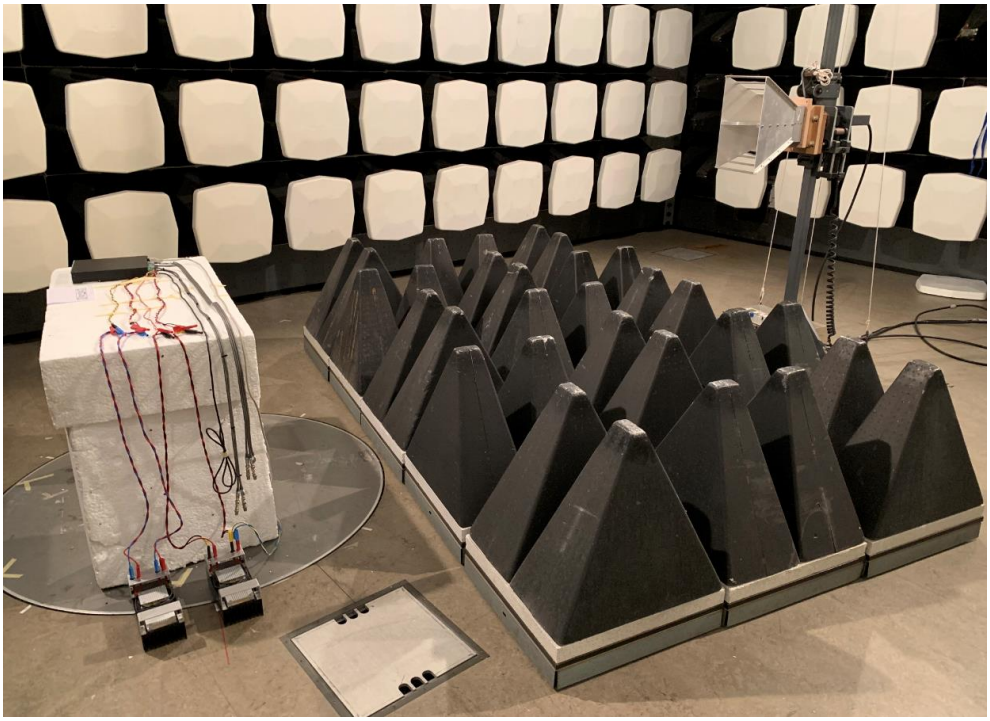

Photo 6. Radio frequency electromagnetic field test setup. 1 GHz – 6 GHz. Back side.

2.3.2 Test results

No change in actual operating state or stored data was observed. The test specimen continued to operate as intended before, during and after the test.

Frequency [MHz]	Specimen side facing antenna	Field strength [V/m]	Result
80 - 1000	0° (Left)	3	PASSED
80 - 1000	90° (Back)	3	PASSED
1000 - 6000	0° (Left)	3	PASSED
1000 - 6000	90° (Back)	3	PASSED

Table 6. Radio frequency electromagnetic field test results.

2.3.3 Test equipment

Description	Supplier	Model	Tag no.
Amplifier 80-1000 MHz	Bonn Amplifiers	BLWA 0810-160/75D	30090179
Amplifier 1 GHz - 6 GHz	Rfenable	RFe-700-6000	30090410
Directional Coupler	AtlanTecRF	AS7854-30	30090412
Power Meter Digital	Rohde&Schwarz	NRVD	30114078
Power Probe 10 MHz-18 GHz	Rohde&Schwarz	NRV-Z1	30090413
Signal generator 10 kHz – 20 GHz	Rohde&Schwarz	SMP02	30113357
Antenna Horn 1-6 GHz	Rfenable	3115	30090411
Antenna Ultra Broadband 30 MHz – 3 GHz	Rohde&Schwarz	HL562	30090226

Table 7. Radiated radio frequency interference test equipment.

2.4 Electrostatic discharge

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4059
Test specification	EN 55024:2010+A1:2015 EN 55035:2017
Test method	EN 61000-4-2:2009
Performance criterion	B
Discharges	Cont. discharge: ±4 kV Air discharge: ±2 kV, ±4 kV, ±8 kV
Comments	The test is performed in TLS Test Laboratory
Temperature / Humidity	25°C / 50%RH
Atmospheric pressure	1003 hPa
Date of measurements	2019-09-27
Test personnel	Volodymyr Hraivoronskyi

2.4.1 Test setup

Indirect discharges were performed on the vertical and horizontal coupling planes.

Conductive parts were investigated with an contact discharge tip at the specified levels.

There are no non-conductive accessible parts of the test specimen available for testing with air discharge tip.

Only surfaces accessible during normal use was investigated.

Functional tests were performed before, during and after testing.

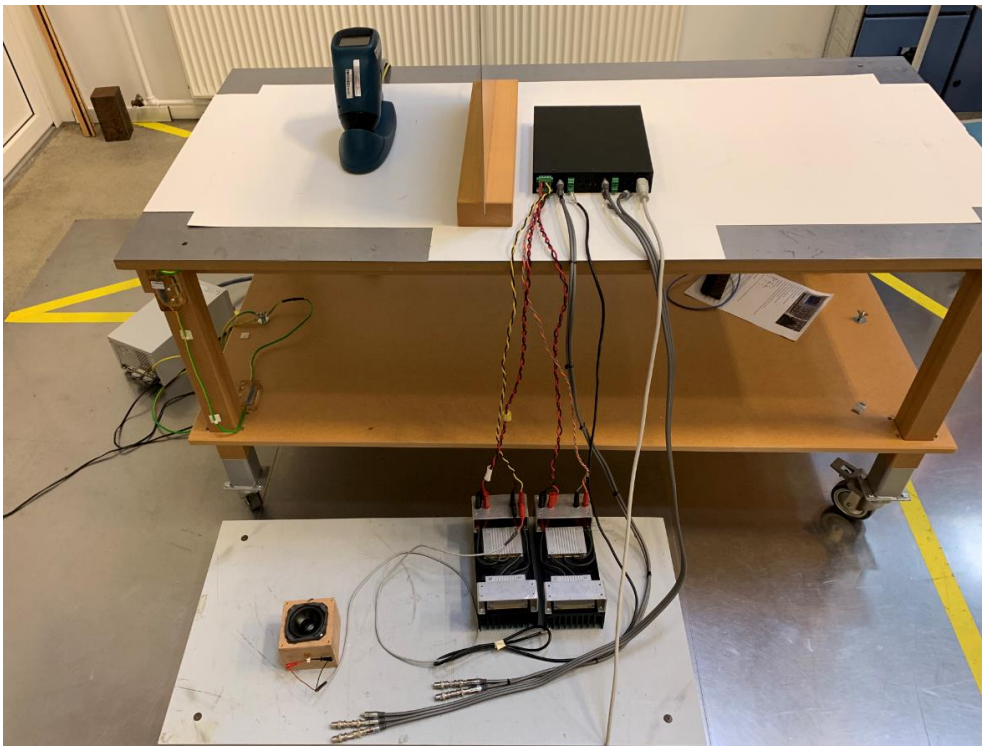

Photo 7. Electrostatic discharge test setup.

2.4.2 Test results

No change in actual operating state or stored data was observed. The test specimen continued to operate as intended before and after the test.

Red arrows show conductive points for direct contact discharge.
Air discharges were not possible at any of the non-conductive parts of the test specimen.

Photo 8. Discharge points for electrostatic discharge tests.

Direct contact discharge		Indirect contact discharge		Air discharge	
Voltage	**Result**	**Voltage**	**Result**	**Voltage**	**Result**
±4 kV	PASSED	±4 kV	PASSED	±2 kV	PASSED
				±4 kV	PASSED
				±8 kV	PASSED

Table 8. Electrostatic discharge test results.

2.4.3 Test equipment

Description	Supplier	Model	Tag no.
ESD Simulator	Schaffner	NSG 438	30090242

Table 9. Electrostatic discharge test equipment.

2.5 Fast transients

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4059
Test specification	EN 55024:2010+A1:2015 EN 55035:2017
Test method	EN 61000-4-4:2012
Performance criterion	B
Amplitude	±1 kV common mode on power ports ±0.5 kV common mode on signal ports
Pulse rise time / duration	5 ns / 50 ns
Repetition rate	5 kHz
Application	15 ms burst every 300 ms
Duration	1 minute for each polarity
Comments	The test is performed in TLS Test Laboratory
Temperature / Humidity	25°C / 48%RH
Date of measurements	2019-09-25
Test personnel	Volodymyr Hraivoronskyi

2.5.1 Test setup

The test specimen was powered through the test generator.

The length of the power cable was 0.5 m.

The test specimen, the auxiliary equipment and the cables were raised 10 cm above the ground reference plane on foam.

The tests are performed on AC Power Port and Audio Output Port. Channel 2 is selected while the amplifier is set in a mix mode (Signals mixed from balanced and unbalanced inputs).

Input ports are terminated with 75 Ohm loads.

The output ports are loaded with 8 Ohm loads.

Functional tests were performed before and after testing.

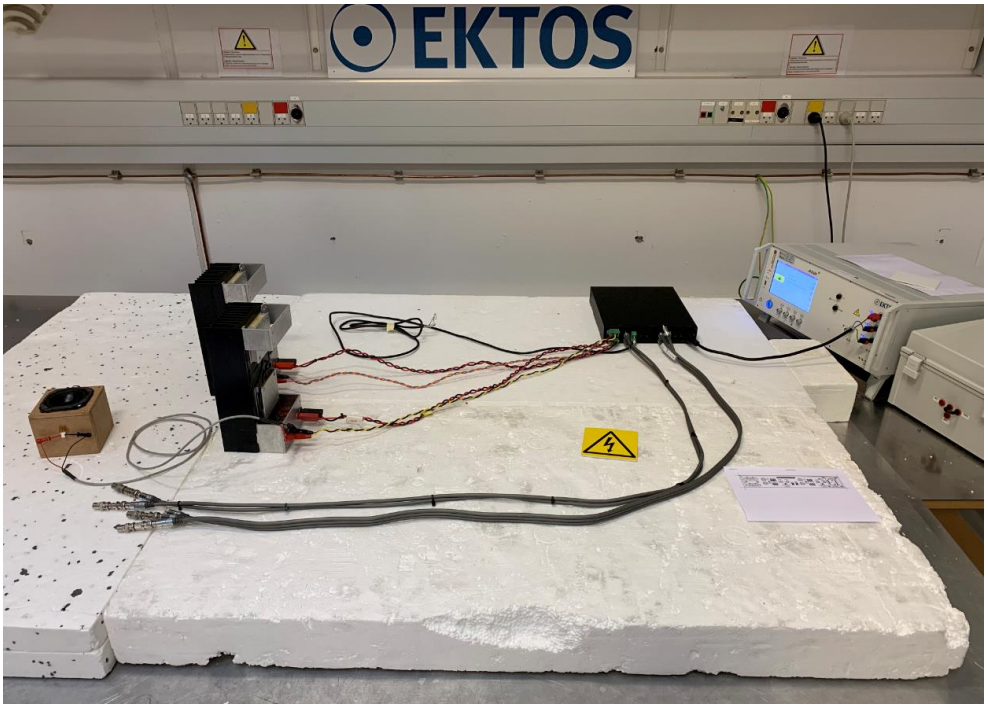

Photo 9. Fast transients test setup. Power ports.

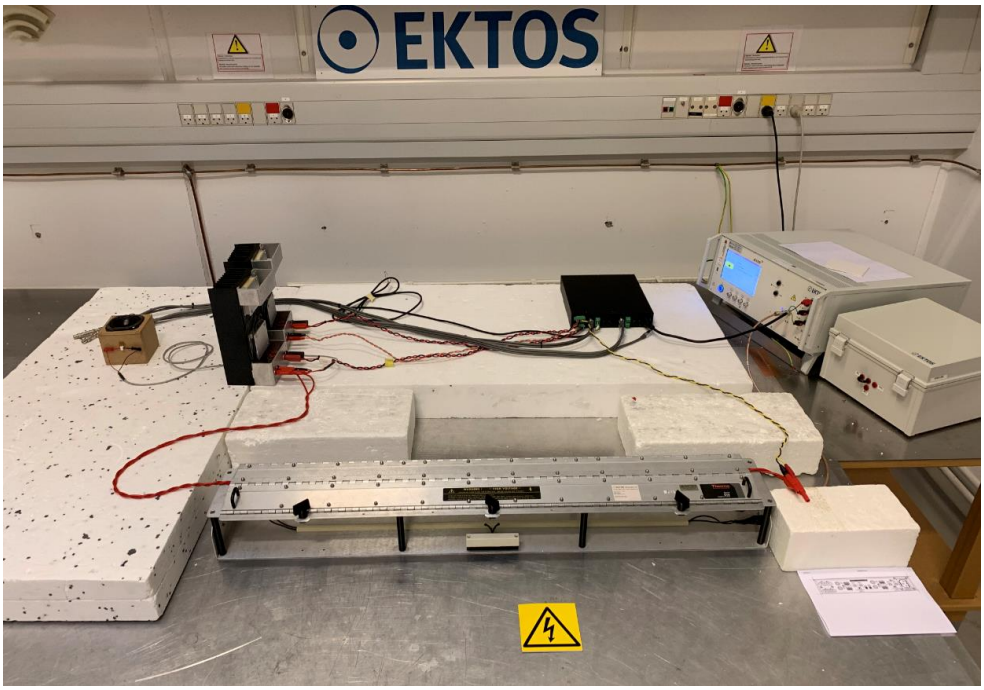

Photo 10. Fast transients test setup. Signal ports. Audio Output Port Channel 2.

2.5.2 Test results

No change in actual operating state or stored data was observed. The test specimen operated as intended before and after the test.

Port	Level	Injection method	Result
AC Power	±1 kV	CDN	PASSED
Audio Output Channel 2	±0.5 kV	Capacitive clamp	PASSED

Table 10. Fast transients test results.

2.5.3 Test equipment

Description	Supplier	Model	Tag no.
Transients Generator	Haefely-Hipotronics	AXOS5	30091387
Capacitive Coupling Clamp	Thermo	CCL	30090015
Decoupling Network	FCC INC	F-203I-DCN-23mm	30090230

Table 11. Fast transients test equipment.

2.6 Surge

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4060
Test specification	EN 55024:2010+A1:2015 EN 55035:2017
Test method	EN 61000-4-5:2014+A1
Performance criterion	B
Test level	AC power: ±2 kV line-to-ground / ±1 kV line-to-line (Including all levels below)
Source impedance	AC power: 2 Ω line to line / 12 Ω line to ground
Pulse rise time / duration	1.2 µs / 50 µs
Time between pulses	60 s
Number of surges	AC power: 5 at each polarity at 0°, 90°, 180° and 270°
Comments	The test is performed in TLC Test Laboratory
Temperature / Humidity	22°C / 54%RH
Date of measurements	2019-09-24
Test personnel	David Busk, Martin Kirov

2.6.1 Test setup

The test specimen was powered through the test generator.
The length of the power cable was 0.5 m.

The test specimen, auxiliary equipment and cables were placed on foam 10 cm above the ground reference plane.
Surges on AC power were done according to figure 5 in EN 61000-4-5:2014.

Functional tests were performed before and after testing.

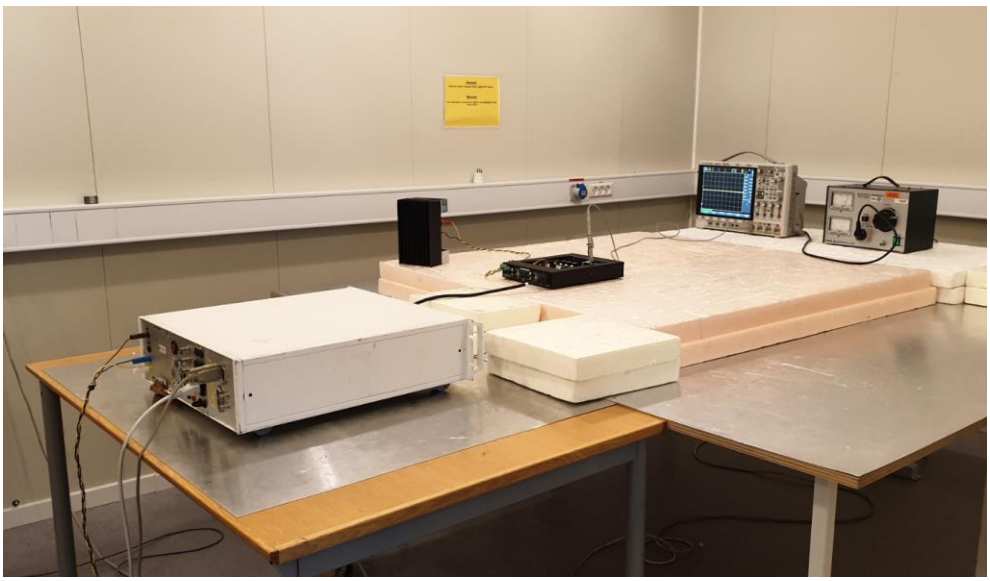

Photo 11. Surge test setup. AC power.

2.6.2 Test results

No change in actual operating state or stored data was observed. The test specimen operated as intended before and after the test.

Port	Test level	Results
AC Power	±0.5 kV, ±1 kV, ±2 kV (Line – ground) ±0.5 kV, ±1 kV (Line – neutral)	PASSED

Table 12. Surge test results.

2.6.3 Test equipment

Description	Supplier	Model	Tag no.
Ultra Compact Simulator	EM Test	UCS500	13504
VarioVolt	Blickfeld	260-3	16241

Table 13. Surge test equipment.

2.7 Radio-frequency common mode

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4060
Test specification	EN 55024:2010+A1:2015 EN 55035:2017
Test method	EN 61000-4-6:2014
Performance criterion	A
Frequency range	150 kHz – 80 MHz
Voltage level (U_0)	3 Vrms
Modulation	80% AM, 1000 Hz sine wave
Step size / dwell time	1% / 1 s
Comments	The test is performed in TLC Test Laboratory
Temperature / Humidity	23°C / 46%RH
Date of measurements	2019-10-01
Test personnel	David Busk

2.7.1 Test setup

The test specimen was raised 10 cm above the ground reference plane on foam.
All cables were decoupled during testing.
The output was monitored with both an oscilloscope and voltmeter.

Port	Injection method	Decoupling device terminated in 50 Ω
AC Power	CDN-M3	CDN-M1 at shield of unbalanced input
Output	CDN-M2	CDN-M3 at Power port
Balanced input	Screen injection	CDN-M3 at Power port
Unbalanced input	Screen injection	CDN-M3 at Power port

Table 14. Injection methods and decoupling devices terminated.

Functional tests were performed before, during and after testing.

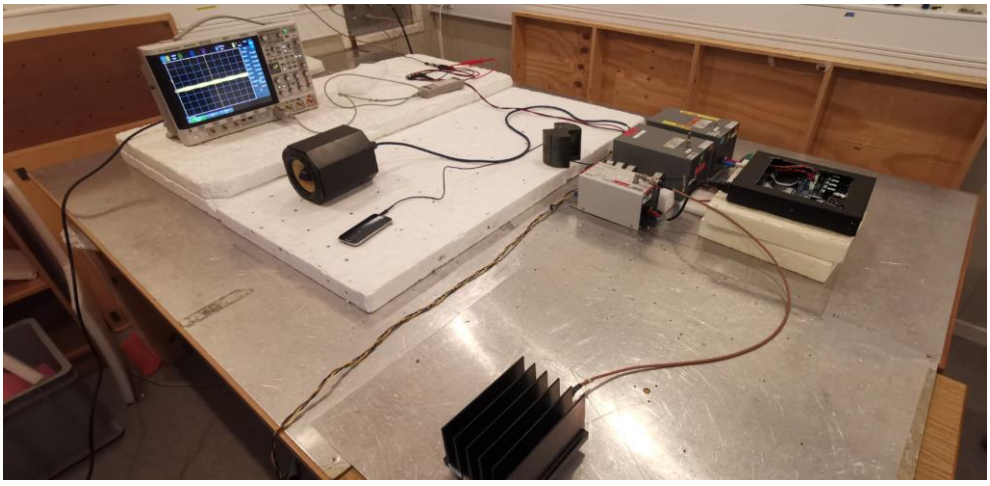

Photo 12. Radio frequency common mode test setup. AC Power Port. CDN injection.

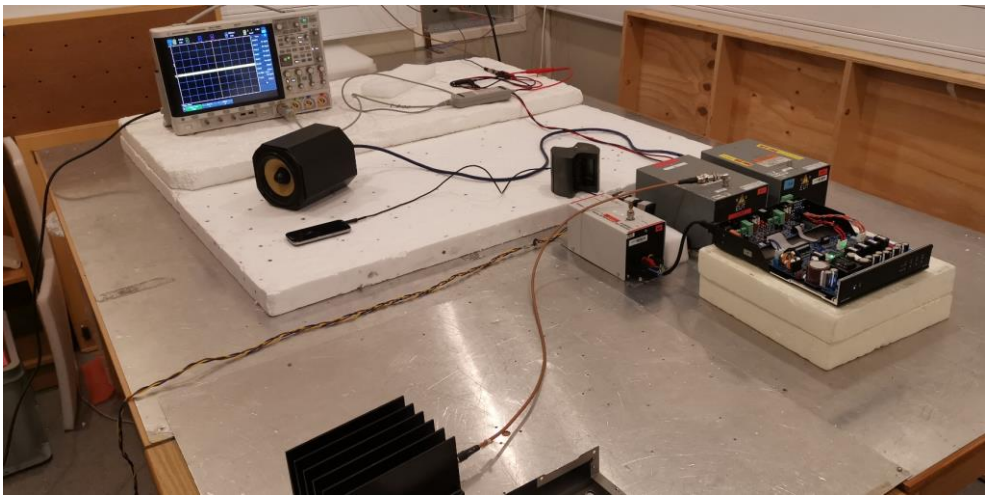

Photo 13. Radio frequency common mode test setup. Balanced input, CDN injection.

2.7.2 Test results

No change in actual operating state or stored data was observed. The test specimen operated as intended before, during and after the test.

Port	Voltage level	Results
AC Power	3 Vrms	PASSED
Output	3 Vrms	PASSED
Balanced input	3 Vrms	PASSED
Unbalanced input	3 Vrms	PASSED

Table 15. Radio frequency common mode test results.

2.7.3 Test equipment

Description	Supplier	Model	Tag no.
Amplifier 10 kHz-220 MHz	Amplifier Research	75A220	13367
Power Meter Digital	Rohde&Schwarz	NRVD	13857
Power Sensor 1 uW-100 mW DC-18 GHz	Rohde&Schwarz	NRV-Z51	13858
Directional Coupler Dual 0,1-1000 MHz 40 dB	Amlifier Research	DC3002	13859
Signal Generator	Rohde&Schwarz	SME03	15328
Power Sensor 100 pW-20 mW 100 kHz-6 GHz	Rohde&Schwarz	NRV-Z4	17472
Attenuator 300 W 6 dB	Bird	300WA-FFN06	20109
CDN Power Line	TESEQ	CDN M316	50052
CDN Power Line	Fischer Custom Comm.	FCC-801-M1-10A	18401
CDN Signal Line	Fischer Custom Comm.	FCC-801-AF2	14427
Multimeter	Hewlett Packard	34401A	14118

Table 16. Radio frequency common mode test equipment.

2.8 Voltage dips and interruptions

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4059
Test specification	EN 55024:2010+A1:2015 EN 55035:2017
Test method	EN 61000-4-11:2004+A1
Performance criterion	Dips, 100% voltage reduction: B Dips, 60% and 40% voltage reduction: C Interrupts, 100% voltage reduction: C
Comments	The test is performed in TLS Test Laboratory
Temperature / Humidity	25°C / 48%RH
Date of measurements	2019-09-25
Test personnel	Volodymyr Hraivoronskyi

2.8.1 Test setup

The mains supply was connected to the AXOS5 test generator. The level of the reduced voltage taken from KeyTek Voltage Dips Transformer.
Voltage dips are selected from all combinations listed in all test specifications.

Input ports are terminated with 75 Ohm loads.
The output ports are loaded with 8 Ohm loads.
Unbalanced input 2 is used for audio test signal.

Functional tests were performed before and after testing.

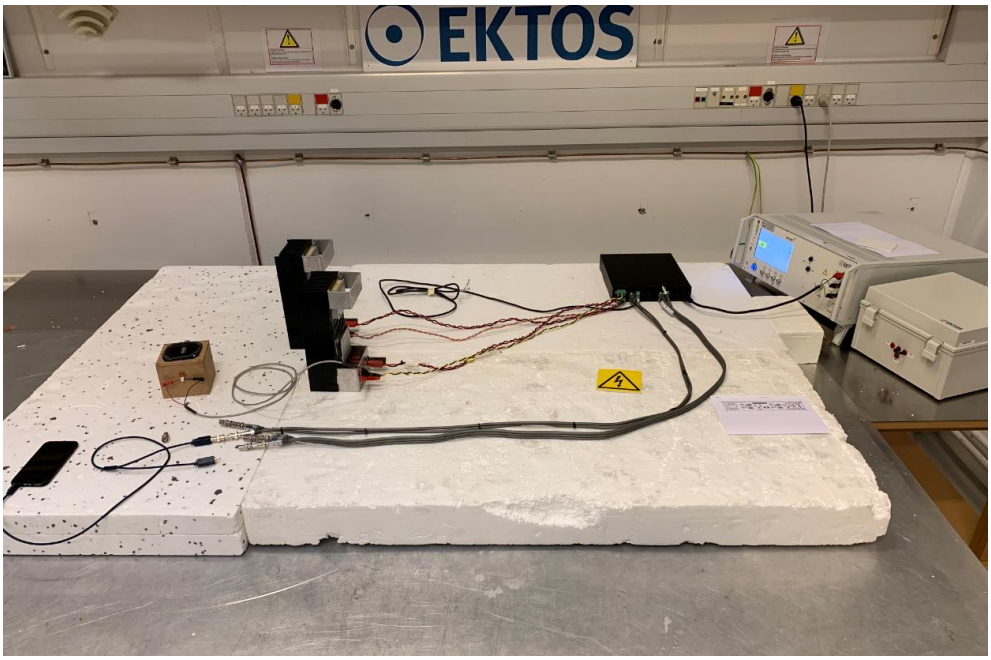

Photo 14. Voltage dips and interruptions test setup.

2.8.2 Test results

No change in actual operating state or stored data was observed. The test specimen operated as intended before and after the test.

Supply voltage	Voltage reduction	Residual voltage	Voltage test level	Duration	Result
230 VAC	100%	0%	0 VAC	10 ms	PASSED
230 VAC	100%	0%	0 VAC	20 ms	PASSED
230 VAC	60%	40%	92 VAC	200 ms	PASSED
230 VAC	30%	70%	161 VAC	500 ms	PASSED

Table 17. Voltage dips test results.

Supply voltage	Residual voltage	Voltage test level	Duration	Result
230 VAC	0%	0 VAC	5 s	PASSED

Table 18. Interruptions test results.

2.8.3 Test equipment

Description	Supplier	Model	Tag no.
Transients Generator	Haefely-Hipotronics	AXOS5	30091387
Dips Transformer	Keytek/EKTOS	N/A	30091395

Table 19. Voltage dips and interruptions test equipment.

2.9 Harmonic current emission

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4060
Test specification	EN 61000-3-2:2014
Test method	EN 61000-4-7:2002+A1:2009
Emission Class	A
Measurement duration	150 seconds
Comments	The test is performed in TLC Test Laboratory
Temperature / Humidity	22°C / 51%RH
Date of measurements	2019-09-24
Test personnel	David Busk, Martin Kirov

2.9.1 Test setup

The test object was subjected to the harmonic current emissions measurement on AC Power Port. The specimen is powered from AC Power Source with ideal sinus output.

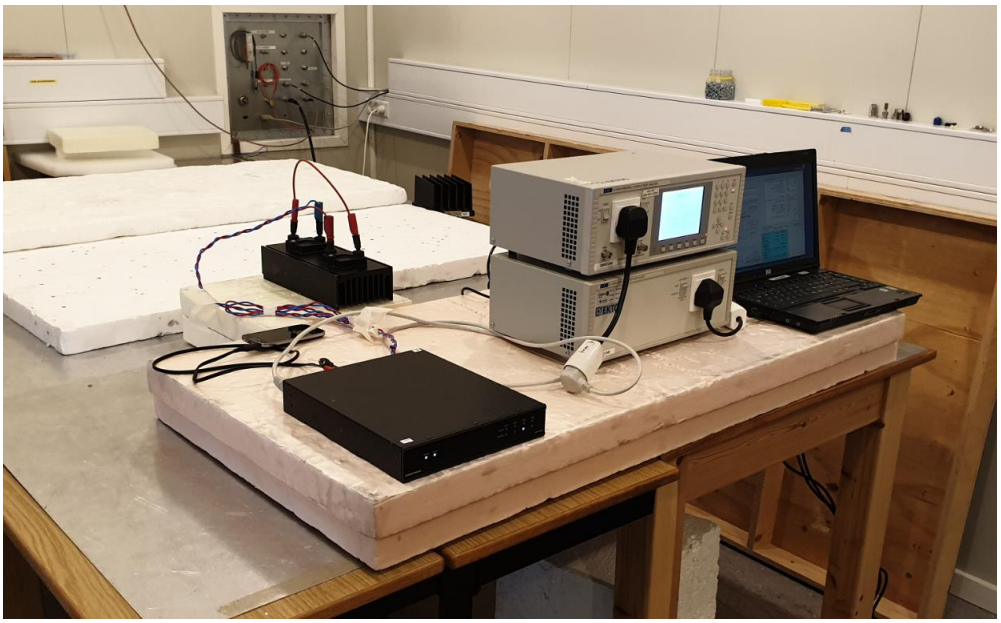

Photo 15. Harmonic current measurement test setup.

2.9.2 Test results

Harmonic Number	Limit Current, mA	Average, mA	%Limit	Max Value, mA	%Limit	Result
2	1080	3.9	0.4	5.5	0.5	PASSED
3	2300	281.2	12.2	281.2	12.2	PASSED
4	430	3.5	0.8	5.1	1.2	PASSED
5	1140	262.2	23	262.2	23	PASSED
6	300	3.1	1	4.4	1.5	PASSED
7	770	235.5	30.6	235.5	30.6	PASSED
8	230	2.6	1.1	3.5	1.5	PASSED
9	400	202.9	50.7	202.9	50.7	PASSED
10	184	1.8	1	2.6	1.4	PASSED
11	330	166.6	50.5	166.6	50.5	PASSED
12	153.3	1.3	0.8	1.8	1.2	PASSED
13	210	129.2	61.5	129.3	61.6	PASSED
14	131.4	0.8	0.6	1.1	0.8	PASSED
15	150	93.1	62.1	93.1	62.1	PASSED
16	115	0.7	0.6	0.9	0.8	PASSED
17	132.3	60.1	45.4	60.1	45.4	PASSED
18	102.2	0.8	0.8	1.1	1.1	PASSED
19	118.4	32	27	32	27	PASSED
20	92	0.8	0.9	1.2	1.3	PASSED
21	107.1	11.2	10.5	11.2	10.5	PASSED
22	83.6	0.8	1	1.3	1.6	PASSED
23	97.8	10.2	10.4	19.7	20.1	PASSED
24	76.7	0.8	1	1.1	1.4	PASSED
25	90	19	21.1	24	26.7	PASSED
26	70.8	0.7	1	0.9	1.3	PASSED
27	83.3	23.3	28	24	28.8	PASSED
28	65.7	0.4	0.6	0.6	0.9	PASSED
29	77.6	23.4	30.2	23.4	30.2	PASSED
30	61.3	0.3	0.5	0.4	0.7	PASSED
31	72.6	19.7	27.1	19.8	27.3	PASSED
32	57.5	0.2	0.3	0.4	0.7	PASSED
33	68.2	14.3	21	14.3	21	PASSED
34	54.1	0.3	0.6	0.6	1.1	PASSED
35	64.3	8	12.4	8.1	12.6	PASSED
36	51.1	0.4	0.8	0.7	1.4	PASSED
37	60.8	2.3	3.8	6	9.9	PASSED
38	48.4	0.4	0.8	0.7	1.4	PASSED
39	57.7	3	5.2	8.3	14.4	PASSED
40	46	0.3	0.7	0.6	1.3	PASSED
21 - 39:	251.4	48.6	19.3	48.7	19.4	-

Table 20. Harmonic current emission test results.

2.9.3 Test equipment

Description	Supplier	Model	Tag no.
Power analyzer	TTI	HA1600	30091244
Power source	TTI	AC1000	30091245

Table 21. Test equipment for harmonic current emission test.

2.10 Voltage fluctuations and flicker

Test specimen	M1845006 SKU: AMP-X300
EUT no.	4060
Test specification	EN 61000-3-3:2013
Test method	EN 61000-3-3:2013
Measurement duration	600 seconds
Comments	The test is performed in TLC Test Laboratory
Temperature / Humidity	22°C / 51%RH
Date of measurements	2019-09-24
Test personnel	David Busk, Martin Kirov

2.10.1 Test setup

The test object was subjected to the voltage fluctuations and flicker measurement on AC Power Port. The specimen is powered from AC Power Source with ideal sinus output.

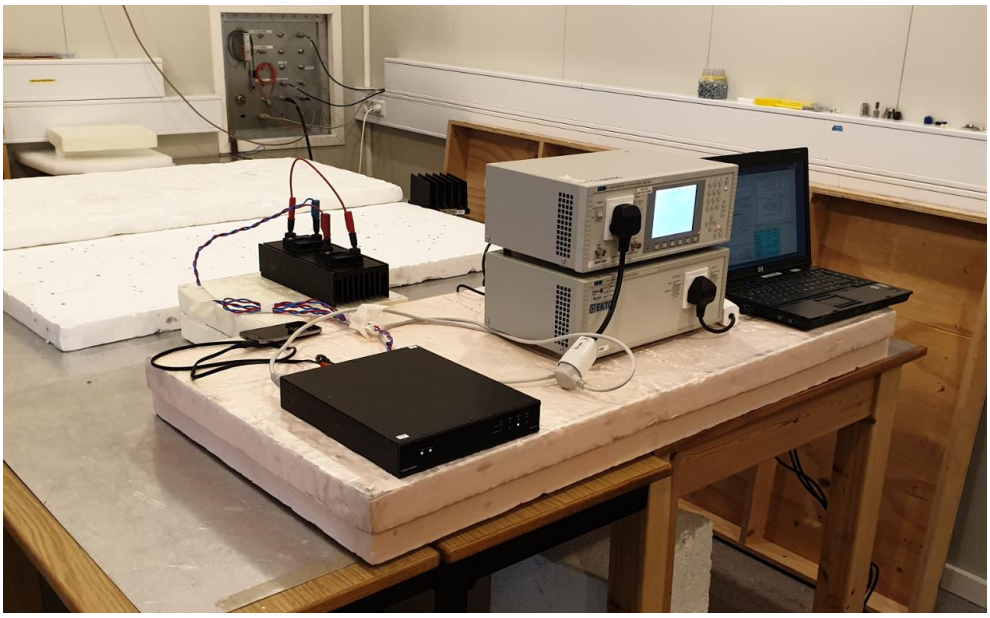

Photo 16. Voltage fluctuations and flicker measurement test setup.

2.10.2 Test results

Load Power:	0.069 kW	0.149 kVA	Power Factor 0.463
Load Current:	0.6 Arms	2.4 Apk	Crest Factor 3.713
Nominal Voltage:	230 Vrms		
Highest Half-cycle level:	+0.01%		
Lowest Half-cycle level:	+0.05%		
d(max):	0.00%	Limit: 4%	PASSED
t(max):	0.00 seconds	Limit: 500 ms	PASSED
Steady State definition:	>1000ms within +/- 0.2%		
Largest d(c) change down:	0.00%		
Largest d(c) change up:	+0.00%		
Largest d(c) change:	0.00%	Limit: 3.3%	PASSED

Table 22. Voltage fluctuations test results.

Duration	Flicker
0.10%	0
0.70%	0
1.00%	0
1.50%	0
2.20%	0
3%	0
4%	0
6%	0
8%	0
10%	0
13%	0
17%	0
30%	0
50%	0
80%	0

Table 23. Flicker test results.

2.10.3 Test equipment

Description	Supplier	Model	Tag no.
Power analyzer	TTI	HA1600	30091244
Power source	TTI	AC1000	30091245

Table 24. Test equipment for voltage fluctuations and flicker test.

3 MEASURING UNCERTAINTIES

Compliancy evaluation is based on a shared risk principle with respect to the measurement uncertainty.

3.1 EMC

EMC tests	Frequency [MHz]	Polarization	Expanded Uncertainty [dB] (k=2)
Radiated emission	30 - 200	Vertical	**4.73**
	200 - 3000	Vertical	**4.97**
	3000-6000	Vertical	**3.76**
	30 - 200	Horizontal	**4.72**
	200 - 3000	Horizontal	**5.08**
	3000-6000	Horizontal	**3.77**
Conducted emission	0.01 - 30		**3.44**
Conducted Immunity			**2.90**
Radiated Immunity			**1.92**
Electrostatic discharge	Ipeak, ±10 % I at 30 ns, ±30 % I at 60 ns, ±30 %		
Surges, common and differential mode	Voltage Uopen circuit, ±10% Current Ishort circuit, ±10% Wave shape, ±20% Source impedance 2 Ohm, ±20%		
Electrical fast transients/burst	Voltage Uopen circuit, ±10 % Voltage Uat 50 ohm, ±10 % Wave shape 5/50 ns, ±20 % Source impedance Zq, ±20 %		
Voltage dips and short interruptions	Supply voltage: +10 / -15 %		
Power-frequency magnetic field	Magnetic field: ± 1.6 dB		
Pulsed magnetic field	Surge current front time, 8.95 µs Peak of surge current, 8.6% of 1.15 kV Current impulse width, 22.3 µs		
Harmonics	1%		
Flicker	6%		