

Head Office:

#51-19, Sanglim 3-ri, Docheokmyun, Kwangju-shi, Kyunggi-do 464-881, Korea Tel: (82)-31-763-6709 Fax: (82)-31-764-6709 Web site: www.emc.re.kr e-mail: ktimin@chollian.net #51-19, Sanglim 3-ri, Docheokmyun, Kwangju-shi, Kyunggi-do 464-881, Korea EMC Test Lab: Tel: (82)-31-763-6709 Fax: (82)-31-764-6709

Electromagnetic Compatibility **Test Report**

Test of:	EP-PTC HEATING FILM
Model Number:	EP-PTC-305
Applicant:	ENERPIA CO., LTD.
Test Type:	Compliance
Test Specification(s):	EN 61000-3-2 : 2014 EN 61000-3-3 : 2013 EN 55014-1 : 2011 EN 55014-2 : 2015
Report Number:	KTI18EC05002
Date of Receipt:	April 25, 2018
Date of Test(s):	May 6 to May 10, 2018
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Page 1 of 41



CONTENTS

	Page Nun	nber
1.	Client Information	3
2.	Equipment Under Test (EUT)	3
	2.1 Identification of EUT	3
	2.2 Model Difference	3
3.	Test Specification, Methods and Procedures	4
	3.1 Test Specification(s)	4
	3.2 Purpose of Test	4
	3.3 Methods and Procedures	5
4.	Deviations or Exclusions from the Test Specifications	5
5.	Operation of the EUT During Testing	6
	5.1 Configuration and Peripherals	6
	5.2 Monitoring of The EUT	6
	5.3 Operation Mode and Environmental Conditions	6
	5.4 Performance Criteria for Immunity Tests	6
6.	Test Results	7
	6.1 General Comments	7
	6.2 Modifications Made to the EUT	7
	6.3 Summary of Test Results	8
	6.4 Uncertainty	8
	6.5 Harmonics Emission Test Results	9
	6.6 Flicker Test Results	. 10
	6.7 Terminal Disturbance Voltages Test Results	11
	6.8 Radiated Emission Test Results	16
	6.9 Discontinuous disturbance Emission Tests	19
	6.10 Electrostatic Discharge Test Results	. 22
	6.11 Radiated Immunity Test Results	. 25
	6.12 Fast Transients Test Results	. 28
	6.13 Surge Immunity Test Results	. 31
	6.14 Conducted Immunity Test Results	. 34
	6.15 Voltage dips and Interruption Test Results	. 37
7.	Product Photo	10



1. Client Information

Company Name:	ENERPIA CO., LTD.
Address:	349-13, Samunjin-Ro, Hwawon-eup, Dalseong-gun, Daegu, Korea

2. Equipment Under Test (EUT)

2.1 Identification Of EUT

Model Number:	EP-PTC HEATING FILM
Unique Identifier:	Sample as supplied by client
Description of EUT:	heating film
Supply Voltage:	230VAC, 50Hz
Support Equipment or Peripherals Required:	Control Box : UTH-170 Type N/A
Derived Model difference	EP-PTC-308, EP-PTC-310

3. Test Specification, Methods and Procedures

3.1 Test Specification(s)

Standard	Title
EN 61000-3-2: 2014	Electromagnetic Compatibility (EMC)-
	Part 3-2: Limit- Limit for harmonic current emissions (equipment input current up to and including 16A per phase)
EN 61000-3-3: 2013	Electromagnetic Compatibility (EMC)-
	Part 3. Limit Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current \leq 16A per phase and not subject to conditional connection
EN 55014-1 : 2011	Electromagnetic Compatibility (EMC)- Radio disturbance characteristics- Limits and methods of measurement
EN 55014-2 : 2015	Electromagnetic compatibility (EMC) - Immunity characteristics- Limits and methods of measurement



3.2 Purpose Of Test

To perform the relevant tests and assess the product for compliance with the above specification.

3.3 Methods and Procedures

The standards Listed on the previous page refer to the following tests :

Basic Standard	Date	Description
EN 61000-3-2	2014	Limit for harmonic current emissions (equipment input current up to and including 16A per phase)
EN 61000-3-3	2013	Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current \leq 16A
EN55014-1 +A1 +A2	2006 2009 2011	Requirements for household appliances, electric tools and similar apparatus <i>Terminal disturbance voltages</i> <i>Disturbance power</i> <i>Radiated Emission</i>
EN 61000-4-2	2009	Testing and measurement techniques. Electrostatic discharge immunity test
EN 61000-4-3 +A1 +A2	2006 2008 2010	Testing and measurement techniques Radiated, radio-frequency, electromagnetic field immunity test.
EN 61000-4-4	2012	Testing and measurement techniques. Electrical fast transient/burst immunity test
EN 61000-4-5	2014	Testing and measurement techniques. Surge immunity test
EN 61000-4-6	2013	Testing and measurement techniques. Immunity to conducted disturbances induced by radio frequency fields
EN 61000-4-11	2004	Testing and measurement techniques. Voltage dips, short interruptions and voltage variations immunity test

4. Deviations or Exclusions from the Test Specifications

There were no deviations from the test specifications.



5. Operation of the EUT During Testing

5.1 Configuration and Peripherals

The configuration used for each individual test is described in the test results section of this report.



5.2 Monitoring of the EUT

The operation status of the EUT was Experiment was performed in a continuous operation state.

5.3 Operation Mode and Environmental Conditions

The operation modes and environmental conditions used for each individual test are described in the test results section of this report.

5.4 Performance Criteria for Immunity Tests

Criterion A

The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases 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 then either of these may be derived from the product description and documentation and what the user may expert from the apparatus if used as intended.

Criterion B



The apparatus continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases 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 operation state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Criterion C

Temporary loss of function is allowed, provided the function is self recoverable or can be restored by operation of the controls.

6. Test Results

6.1 General Comments

None

6.2 Modifications made to the EUT

No modifications were made to the EUT



6.3 Summary of	l est Results	
Basic Standard	Test	Result
EN 61000-3-2	Limit for harmonic current emissions (equipment input current up to and including 16A per phase)	None
EN 61000-3-3	Limitation of voltage fluctuations and flicker in low- voltage supply systems for equipment with rated current \leq 16A	None
EN55014-1 +A1 +A2	Requirements for household appliances, electric tools and similar apparatus	
172	Terminal disturbance voltages Disturbance power Radiated Emission	Complied
EN 61000-4-2	Testing and measurement techniques	Complied
	Electrostatic discharge immunity test	Complied
EN 61000-4-3 +A1	Testing and measurement techniques	
+A2	Radiated, radio-frequency, electromagnetic field immunity test	Complied
EN 61000-4-4	Testing and measurement techniques	Complied
	Electrical fast transient/burst immunity test	Complied
EN 61000-4-5	Testing and measurement techniques	Complied
	Surge immunity test	Complied
EN 61000-4-6	Testing and measurement techniques	
	Immunity to conducted disturbances induced by radio frequency fields	Complied
EN 61000-4-11	Testing and measurement techniques	
	Voltage dips, short interruptions and voltage variations immunity test	Complied

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Result:

In the configuration tested, the EUT complies with the test standards listed above. Full details of all tests can be found in the test results section of this report.

6.4 Uncertainty

1) Radiated Emissions from 30 MHz to 6000 MHz

Expanded Uncertainty

 $U = k \times Uc(xi) = 2 \times 2.61 = \pm 5.22 \text{ dB}$ (for 30 MHz to 1000 MHz) $U = k \times Uc(xi) = 2 \times 2.53 = \pm 5.06 \text{ dB}$ (for 1000 MHz to 6000 MHz) The coverage factor k = 2 yields approximately a 95 % level of confidence.



2) Conducted missions from 150 kHz to 30 MHz

Expanded uncertainty

 $U = k \times Uc(xi) = 2 \times 1.40 = \pm 2.8 \text{ dB}$

The coverage factor k = 2 yields approximately a 95 % level of confidence.

3) EMS Uncertainty

All parameters are within the tolerances required by the standard, reduced by the tolerances

required on the calibration certificate, so this laboratory has confidence that the EMS Test

equipment is in compliance with the standard with X % confidence level.

- ESD (IEC/EN 61000-4-2): 95 % (k = 2, confidence level is 95 %)
- Radiated immunity (IEC/EN 61000-4-3): 2.14 dB (k = 2, confidence level is 95 %)
- EFT (IEC/EN 61000-4-4): 95 % (k = 2, confidence level is 95 %)
- SURGE (IEC/EN 61000-4-5): 95 % (k = 2, confidence level is 95 %)
- Conducted immunity (IEC/EN 61000-4-6): 1.17 dB (k = 2, confidence level is 95 %)
- Voltage dip (IEC/EN 61000-4-11): 95 % (k = 2, confidence level is 95 %)
- Harmonics : 1.28 % (K = 2)
- Flicker : 8.26 % (K = 2)



6.5 Harmonics Emissions Test Results

Port:	AC Mains
Basic Standard:	EN 61000-3-2: 2014
Limit Table:	Class B

Operation Mode

NONE

Test Results

This test is not applicable because the rated power is not 75 W unit or less.

Harmonics test Environmental Conditions

Power Supply	AC 230 V
Temperature	C
Relative Humidity	%
Barometric Pressure	mbar

Equipment Type	Model Number
Harmonic & Flicker Test System	EM TEST type AC POWER SOURCE
Harmonic & Flicker Test System	EM TEST type DIGITAL POWER ANALYZER(HAR)



6.6 Flicker Test Results

Port:	AC mains
Basic Standard:	EN 61000-3-3: 2013
Limit Table:	Pst: 1.00 Plt: 0.65 dc(%): 3.30 dmax(%): 4.00 d(t)>3.30%(ms): 500

Operation Mode

NONE

Test Results

This test is not applicable because the rated power is not 75 W unit or less.

Harmonics test Environmental Conditions

Power Supply	AC 230 V, 50 Hz
Temperature	Ĉ
Relative Humidity	%
Barometric Pressure	mbar

Equipment Type	Model Number
Harmonic & Flicker Test System	EM TEST type AC POWER SOURCE
Harmonic & Flicker Test System	EM TEST type DIGITAL POWER ANALYZER(HAR)



6.7 Terminal Disturbance Voltages Test Results

Port:	AC mains
Basic Standard:	EN 55014-1: 2006+A1:2009+A2:2011
Frequency:	0.15 to 30 MHz
Test Voltage	220 V / 50 Hz

Operation Mode

The EUT was tested in the following modes:

1. Normal operating

Remark: At the 160kHz, Maximum value of the voltage 207-253V is 43.5dBuV at 235V. Refer to the bellow Test Voltage Reference.

Supplied Voltage(V)	Level(Q.P [dBµV])
208	39.1
220	39.0
235	39.5
249	38.9



Test Results

<Line>



QP

Frequency (MHz)	MaxPeak (dB¥iV)	QuasiPeak (dB¥iV)	CAverage (dB¥i V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dB¥i V)	Comment
0.150000		50.4	40.4	1000.0	9.000	L1	9.9	15.6	66.0	
0.178000		47.1	37.7	1000.0	9.000	L1	9.9	17.5	64.6	
0.210000		44.7	35.7	1000.0	9.000	L1	9.9	18.5	63.2	
0.238000	122	41.9	33.3	1000.0	9.000	L1	10.0	20.2	62.2	
0.270000	0.00	40.3	32.4	1000.0	9.000	L1	10.0	20.8	61.1	
0.330000	222	35.0	27.6	1000.0	9.000	L1	10.0	24.4	59.5	
0.658000	نيب نيب	20.6	12.3	1000.0	9.000	L1	10.0	35.4	56.0	
0.866000		22.5	11.6	1000.0	9.000	L1	10.0	33.5	56.0	
1.434000		22.8	18.6	1000.0	9.000	L1	10.0	33.2	56.0	
1.974000		25.1	23.1	1000.0	9.000	L1	10.0	30.9	56.0	
3.106000		20.8	14.4	1000.0	9.000	L1	10.0	35.2	56.0	
4.186000	<u>. 522</u>	23.6	18.2	1000.0	9.000	L1	10.1	32.4	56.0	
5.858000	(aa)	23.9	16.1	1000.0	9.000	L1	10.1	36.1	60.0	
7.026000		24.6	17.3	1000.0	9.000	L1	10.1	35.4	60.0	
11.242000	ينبين	25.3	20.6	1000.0	9.000	L1	10.1	34.7	60.0	
16.478000	-	15.2	11.1	1000.0	9.000	L1	10.2	44.8	60.0	
22.346000		11.3	6.2	1000.0	9.000	L1	10.2	48.7	60,0	
28,146000		19.2	10.6	1000.0	9,000	11	10.1	40.8	60.0	

CAV

Frequency (MHz)	MaxPeak (dB¥iV)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - CAV (dB)	Limit - CAV (dB¥i V)	Comment
0.150000	1222	50.4	40.4	1000.0	9.000	L1	9.9	15.6	56.0	1
0.178000	1222	47.1	37.7	1000.0	9.000	L1	9.9	16.9	54.6	1
0.210000	1000 (2002) 1000 (2002)	44.7	35.7	1000.0	9.000	L1	9.9	17.5	53.2	î î
0.238000		41.9	33.3	1000.0	9.000	L1	10.0	18.9	52.2	1
0.270000		40.3	32.4	1000.0	9.000	L1	10.0	18.7	51.1	÷
0.330000		35.0	27.6	1000.0	9.000	L1	10.0	21.8	49.5	8
0.658000		20.6	12.3	1000.0	9.000	L1	10.0	33.7	46.0	2
0.866000		22.5	11.6	1000.0	9.000	L1	10.0	34.4	46.0	
1.434000	. <u>222</u>	22.8	18.6	1000.0	9.000	L1	10.0	27.4	46.0	
1.974000	1222	25.1	23.1	1000.0	9.000	L1	10.0	22.9	46.0	1
3.106000	(aa)	20.8	14.4	1000.0	9.000	L1	10.0	31.6	46.0	1 1
4.186000		23.6	18.2	1000.0	9.000	L1	10.1	27.8	46.0	1
5.858000		23.9	16.1	1000.0	9.000	L1	10.1	33.9	50.0	÷
7.026000		24.6	17.3	1000.0	9.000	L1	10.1	32.7	50.0	1
11.242000		25.3	20.6	1000.0	9.000	L1	10.1	29.4	50.0	
16.478000		15.2	11.1	1000.0	9.000	L1	10.2	38.9	50.0	
22.346000	. <u>2263</u>	11.3	6.2	1000.0	9.000	L1	10.2	43.8	50.0	
28,146000	1222	19.2	10.6	1000.0	9.000	11	10.1	39.4	50.0	1





QP

Frequency (MHz)	MaxPeak (dB¥iV)	QuasiPeak (dB¥iV)	CAverage (dB¥i V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dB¥i V)	Comment
0.150000		48.3	38.7	1000.0	9.000	N	9.9	17.7	66.0	
0.178000		45.7	36.4	1000.0	9.000	N	9.9	18.9	64.6	
0.210000	<u>.</u>	44.2	34.8	1000.0	9.000	N	9.9	19.0	63.2	Ĩ.
0.270000	000	41.5	32.8	1000.0	9.000	N	10.0	19.6	61.1	
0.390000	(35.4	27.1	1000.0	9.000	N	10.0	22.7	58.1	ĵ.
0.482000		35.3	25.5	1000.0	9.000	N	10.0	21.0	56.3	2
0.750000		25.3	14.8	1000.0	9.000	N	10.0	30.7	56.0	
1.554000		16.8	12.1	1000.0	9.000	N	10.0	39.2	56.0	2
2.066000		22.6	21.2	1000.0	9.000	N	10.0	33.4	56.0	
2.662000		23.1	17.9	1000.0	9.000	N	10.0	32.9	56.0	
3.146000	<u>. 568</u>	26.8	25.0	1000.0	9.000	N	10.0	29.2	56.0	
4.430000	E.	27.4	20.8	1000.0	9.000	N	10.1	28.6	56.0	
5.542000	(29.2	25.4	1000.0	9.000	N	10.1	30.8	60.0	
8.810000	- and the second se	25.8	21.0	1000.0	9.000	N	10.1	34.2	60.0	
11.386000	ł	26.5	21.3	1000.0	9.000	N	10.2	33.5	60.0	3
17.642000		18.1	12.4	1000.0	9.000	N	10.3	41.9	60.0	2
23.510000		13.1	5.8	1000.0	9.000	N	10.3	46.9	60.0	
28.146000		21.3	13.2	1000.0	9.000	N	10.4	38.7	60.0	

CAV

Frequency (MHz)	MaxPeak (dB¥iV)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - CAV (dB)	Limit - CAV (dB¥i V)	Comment
0.150000	·	48.3	38.7	1000.0	9.000	N	9.9	17.3	56.0	
0.178000		45.7	36.4	1000.0	9.000	N	9.9	18.2	54.6	· · · ·
0.210000		44.2	34.8	1000.0	9.000	N	9.9	18.4	53.2	8 2
0.270000		41.5	32.8	1000.0	9.000	N	10.0	18.3	51.1	
0.390000		35.4	27.1	1000.0	9.000	N	10.0	21.0	48.1	
0.482000	2222	35.3	25.5	1000.0	9.000	N	10.0	20.8	46.3	
0.750000) (1112)	25.3	14.8	1000.0	9.000	N	10.0	31.2	46.0))
1.554000	(222)	16.8	12.1	1000.0	9.000	N	10.0	33.9	46.0	1
2.066000		22.6	21.2	1000.0	9.000	N	10.0	24.8	46.0	1
2.662000		23.1	17.9	1000.0	9.000	N	10.0	28.1	46.0	· · · ·
3.146000		26.8	25.0	1000.0	9.000	N	10.0	21.0	46.0	£
4.430000		27.4	20.8	1000.0	9.000	N	10.1	25.2	46.0	
5.542000		29.2	25.4	1000.0	9.000	N	10.1	24.6	50.0	
8.810000	. <u>223</u>	25.8	21.0	1000.0	9.000	N	10.1	29.0	50.0	
11.386000	(<u>111</u>)	26.5	21.3	1000.0	9.000	N	10.2	28.7	50.0]]
17.642000	(2222)	18.1	12.4	1000.0	9.000	N	10.3	37.6	50.0	
23.510000		13.1	5.8	1000.0	9.000	N	10.3	44.2	50.0	-
28.146000	1222	21.3	13.2	1000.0	9.000	Ň	10.4	36.8	50.0	· · · ·



Terminal Disturbance Voltages Test Configuration





Terminal Disturbance Voltages Environmental Conditions

Power Supply	AC 230 V
Temperature	19 °C
Relative Humidity	40 %
Barometric Pressure	1009 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
EMI RECEIVER	Rohde & Schwarz	ESCI	100025	2017.11.02	2018.11.02
LISN	AFJ INSTRUMENTS	AFJ LS16C	1601132 8326	2017.12.06	2018.12.06
LISN	Rohde & Schwarz	ESH2-Z5	100017	2017.07.21	2018.07.21



6.8 Radiated Emission Test Results

Port:	AC mains
Basic Standard:	EN 55014-1: 2006+A1:2009+A2:2011
Limit Table	Group1, Class B
Distance between EUT and Antenna	10 m
Height of antenna	1 - 4 m

Operation Mode

The EUT was tested in the following modes: 1. Normal Operating.

Test Results

Frequency [MHz]	Field Strength Q.P [dB μ V/m]	Polarization	Limit Q.P [dB µ V/m]	Margin [dB]
46.24	26.3	V	30.0	3.7
57.56	12.3	V	30.0	17.7
413.36	10.0	V	37.0	27.0
554.48	15.1	V	37.0	21.9
616.64	18.2	V	37.0	18.8
748.08	18.0	V	37.0	19.0

Note: The worst cases emissions are recorded.

The field strength is calculated by adding the antenna factor and cable factor.

* H: Horizontal, V: Vertical



Radiated Emission Test Configuration





Radiated Emission Environmental Conditions

Power Supply	AC 230 V
Temperature	18 °C
Relative Humidity	69 %
Barometric Pressure	1007 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
EMI RECEIVER	Rohde & Schwarz	ESIB40	100093	2017.07.11	2018.07.11
Biconic Logarithmic Periodic Antenna	Schwarzbeck	VULB9163	9163-281	2016.11.21	2018.11.21
Amplifier	HP	8447F	2805A02 702	2017.05.26	2018.05.26
TURNTABLE	KTI	K401	K100	N/A	N/A
ANTENNA MAST	KTI	K402	K200	N/A	N/A
CONTORLLER	KTI	K401OS	K300	N.A	N.A



6.9 Discontinuous disturbance Emission Tests

Port:	AC mains
Basic Standard:	EN 55014-1: 2006+A1:2009+A2:2011
Limit Table	Group1, Class B

Operation Mode

The EUT was tested in the following modes:

1. Normal Operating.

Test Results

Mode Click Rate	9		
Type of Eut Indoo	r Heater		
Rx 150 KHz Att. [dB]	25	Rx 500 kHz Att. [dB]	15
Rx 1.4 MHz Att. [dB]	15	Rx 30 MHz Att. [dB]	20
Rx 150 kHz Input Offset [dB]	0	Rx 500 kHz Input Offset [dB]	0
Rx 1.4 MHz Input Offset [dB]	0	Rx 30 MHz Input Offset [dB]	0
External Att. [dB]	NONE		

External Att. [dB] NONE

Remote

LISN LS16 - NEUTRAL

	150 kHz	500 kHz	1.4 MHz	30 MHz
First Run				
Short	0	0	0	0
Long	0	0	0	0
Fast Long	0	0	0	0
Total Clicks	0	0	0	0
Events	0	0	0	0
Time(s)	0.00	0.00	0.00	0.00
Sw.Op.	0	0	0	0
4.2.3.4 events	0	0	0	0
Limit dBuV	66	56	56	60
N	0.00	0.00	0.00	0.00



Discontinuous disturbance Emission Test Configuration





Discontinuous disturbance Emission Test Environmental Conditions

Power Supply	AC 230 V
Temperature	18 °C
Relative Humidity	39 %
Barometric Pressure	1022 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
LISN	AFJ INSTRUMENTS	AFJ LS16C	1601132 8326	2017.12.06	2018.12.06
Click Meter	AFJ CL55C	AFJ INSTRUM ENTS	5504134 8240	2017.12.14	2018.12.14



6.10 Electrostatic Discharge Test Results

Port:	Enclosure
Basic Standard:	EN 61000-4-2: 2009
Performance Criteria:	В
Number of Discharges:	Contact: 10 per polarity / test point Air: 10 per polarity / test point
Test level:	± 4 kV Contact discharge ± 8 kV Air discharge

Operation Mode

The EUT was tested in the following modes:

1. Normal operating.

Monitoring of the EUT

The operation status of the EUT was monitored by observation of Heating.

Test Results

Test Point	± kV	Air/ Contact	Criteria	Observation
Plastic Case	± 8	Air	A	Note 1
HCP/VCP	± 4	Contact	А	Note 1

VCP = Vertical Coupling Plane

HCP = Horizontal Coupling Plane

Note 1: No degradation in performance was observed during the test.



Electrostatic Discharge Test Configuration





Electrostatic Discharge Environmental Conditions

Power Supply	AC 230 V
Temperature	19 °C
Relative Humidity	40 %
Barometric Pressure	1014 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
ESD Simulator	NoiseKen	ESS-2000	ESS0473 141	2017.11.03	2018.11.03
ESD Mouse	NoiseKen	TC-815R	-	2017.11.03	2018.11.03



6.11 Radiated Immunity Test Results

Port:	Enclosure
Basic Standard:	EN 61000-4-3: 2006+A1:2008+A2:2010
Performance Criteria:	А
Frequency range:	80 - 1000 MHz
Test Level:	3 V/m
Dwell Time:	3 seconds
Frequency Step Size:	1 %
Modulation:	1 kHz, 80 % amplitude modulated

Operation Mode

The EUT was tested in the following modes:

1. Normal operating.

Monitoring of the EUT

The operating status of EUT was monitored by Heating

Test Results (Radiated Immunity 80-1000 MHz)

EUT Position	Polarity	Criteria	Observations
Front	Horizontal	A	Note 1
	Vertical	A	Note 1
Rear	Horizontal	A	Note 1
	Vertical	А	Note 1
Left side	Horizontal	A	Note 1
	Vertical	A	Note 1
Right side	Horizontal	A	Note 1
	Vertical	А	Note 1

Note 1: No degradation in performance was observed during both tests.



Radiated Immunity Environmental Conditions

Power Supply	AC 230 V
Temperature	23 °C
Relative Humidity	40 %
Barometric Pressure	1015 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
Signal Generator	Rohde & Schwarz	SMR20	100362	2018.01.11	2019.01.11
Amplifier	AR	250W1000AM2	312495	N / A	N / A
Amplifier	AR	100L	13314	N / A	N / A
Amplifier	AR	60S1G4AM3	304211	N / A	N / A
Biog Antenna	Schaffner	CBL6140A	1217	N / A	N / A
EUT Monitoring system	КТ	K4010T	KTI-OS001	N / A	N / A
Power Sensor	BOONTON	51013	29103	2017.05.16	2018.05.16
Power Sensor	BOONTON	51013	31653	2017.05.16	2018.05.16
Power Meter	BOONTON	5232	130003	2017.05.16	2018.05.16



Radiated Immunity Test Configuration





6.12 Electrical Fast Transient/Burst Immunity Test Results

Port:	AC power
Basic Standard:	EN 61000-4-4: 2012
Performance Criterion:	В
Test Duration (per cable/line):	2 minute
Burst duration:	15 ms
Spike Frequency:	5 kHz
Test level:	Power Line: ± 1 kV

Operation Mode

The EUT was tested in the following modes:

1. Normal operating.

Monitoring of the EUT

The operation status of the EUT was monitored by observation of Heating.

Test Results

Line	Test Voltage [±kV]	Coupling (Direct/Clamp)	Criteria	Observations
Phase (L1)	1	Direct	A	Note 1
Neutral (L2)	1	Direct	A	Note 1
L1 - L2	1	Direct	A	Note 1
L1 - L2 - PE	1	Direct	A	Note 1

Note 1: No degradation in performance was observed during the test.



Fast Transients Test Configuration





Fast Transients Environmental Conditions

Power Supply	AC 230 V
Temperature	19 °C
Relative Humidity	40 %
Barometric Pressure	1014 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
EFT Generator	Thermo KeyTek	PK1001D	0408327	2017.09.19	2018.09.19



6.13 Surge Immunity Test Results

Port:	AC power
Basic Standard:	EN 61000-4-5: 2014
Performance Criteria:	В
Test times:	5 times per each polarity / angle
Repetition rate:	1 per minute
Synchro angle:	0 ° , 90 ° , 180 ° , 270 °
Test level:	Line to Line: ± 1 kV Line to Eaeth: ± 2 kV

Operation Mode

The EUT was tested in the following modes:

1. Normal operating.

Monitoring of the EUT

The operation status of the EUT was monitored by observation of Heating.

Test Results

Line	Test Voltage [± kV]	Observations
Phase (L1) - Neutral (L2)	1	Note 1
Phase (L1) - Neutral (L2) - PE	2	Note 1

Note 1: No degradation in performance was observed during the test.



Surge Immunity Test Configuration





Surge Immunity Test Environmental Conditions

Power Supply	AC 230 V
Temperature	20 °C
Relative Humidity	39 %
Barometric Pressure	1022 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
EFT Generator	Thermo KeyTek	PK1001D	0408327	2017.09.19	2018.09.19



6. 14 Conducted Immunity Test Results

Port:	AC power
Basic Standard:	EN 61000-4-6: 2013
Performance Criteria:	А
Frequency range:	0.15 to 80MHz
Test Level:	3 V
Dwell Time:	3seconds
Frequency Step Size:	1 %
Modulation:	1 kHz, 80% amplitude modulated

Operation Mode

The EUT was tested in the following modes:

1. Normal operating.

Monitoring of the EUT

The operation status of the EUT was monitored by observation of Heating.

Test Results

Cable Tested	Test Voltage	Frequency	Criteria	Observation
Supply	3 V	0.15 – 80 MHz	А	Note 1

Note 1: No degradation in performance was observed during the test.



Conducted Immunity Test Configuration





Conducted Immunity Environmental Conditions

Power Supply	AC 230 V
Temperature	20 °C
Relative Humidity	40 %
Barometric Pressure	1024 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
Signal Generator	Hewlett Packard	657D	3145A0028 5	2017.09.20	2018.09.20
RF Power Amplifier	Amplifier Research	100L	E017	N / A	N / A
Power Sensor	BOONTON	51013	29103	2017.05.16	2018.05.16
Power Sensor	BOONTON	51013	31653	2017.05.16	2018.05.16
Power Meter	BOONTON	5232	130003	2017.05.16	2018.05.16
Coupling Decoupling Network	Fisher Corp	FCC-801-M3-16 A	9919	2018.01.17	2019.01.17



6.15 Voltage dips and Interruptions Test Results

Port:	AC power
Basic Standard:	EN 61000-4-11: 2004
Test level and Performance criteria:	0%, 0.5 period: C 40%, 10 periods: B 70%, 50 periods: C

Operation Mode

The EUT was tested in the following modes:

1. Normal operating.

Monitoring of the EUT

The operation status of the EUT was monitored by observation of Heating.

Test Results

Test level %U⊤		Duration (in period)	Criteria	Observation	
Interruptions	0	0.5	А	Note 1	
Dips	40	10	А	Note 1	
	70	25	A	Note 2	

Note 1: No degradation in performance was observed during the test.

Note 2: Temporary loss of function in performance was observed during the test and was self recovered after the test.



Voltage dips and Interruptions Test Configuration





Voltage dips and Interruptions Environmental Conditions

Power Supply	AC 230 V, 50 Hz
Temperature	20 °C
Relative Humidity	40 %
Barometric Pressure	1024 mbar

Equipment	Manufacturer	Model	Serial no.	Cal date.	Cal due.
DIP Generator	Thermo KeyTek	PK1001D	0408327	2017.09.19	2018.09.19



7. Product Photo

External Photo (Front)



External Photo (Rear)





ControlBox Board Photo (Front)



ControlBox Board Photo (Rear)





ControlBox LCD Board Photo (Front)



ControlBox LCD Board Photo (Rear)

