

# Electromagnetic Compatibility EMC TEST REPORT COVER PAGE 288663-1

<b>Test laboratory</b>	TL-0005 (Finland)
<b>Original test report number</b>	288663-1
<b>Issued date of original report</b>	2017-06-22
<b>Total pages</b>	cover page + 21

<b>TEST SPECIFICATION</b>	UN Regulation No.10 Revision 4 and 5
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## SUMMARY

In regard to the performed tests the EUT fulfils the requirements of the UN Regulation No.10 Revision 4 and 5.

## Reviewed by:

Janne Nyman  
Compliance Specialist  
SGS Fimko Oy, TL-0005



# **Electromagnetic Compatibility EMC TEST REPORT 288663-1**

# Test Report

*Electromagnetic Compatibility (EMC)*



Equipment Under Test (EUT): LED light unit  
Trademark: 5 WATTS  
Type: ZAURAC 4-30  
Manufacturer: Five Watts Oy  
Piispankyläntie 10 5A  
FI-01730 Vantaa  
FINLAND  
Customer: Five Watts Oy  
Piispankyläntie 10 5A  
FI-01730 Vantaa  
FINLAND

TL-0005

**The EUT was tested according to the UN Regulation No.10 Revision 4.**

Date: 22 June 2017

Issued by:

A blue ink signature of Pekka Kälviäinen.

Pekka Kälviäinen  
Testing Engineer

Date: 22 June 2017

Checked by:

A blue ink signature of Rauno Repo.

Rauno Repo  
Testing Engineer

## Table of Contents

PRODUCT DESCRIPTION .....	4
Equipment Under Test (EUT) .....	4
Description of the EUT .....	4
Power requirements .....	4
Cable Lengths and Types .....	4
Disclaimer .....	5
TEST CONDITIONS .....	6
Performance Criteria A for Immunity Testing .....	6
Performance Criteria B for Immunity Testing .....	6
Performance Criteria C for Immunity Testing .....	6
Performance Criteria D for Immunity Testing .....	6
EUT Test Conditions during EMC-Testing .....	6
Photographs of the EUT .....	7
SUMMARY OF TESTING .....	11
Test Suite .....	11
EMISSION TEST RESULTS .....	12
Radiated Emissions .....	12
Conducted disturbances emission test .....	15
IMMUNITY TEST RESULTS .....	16
Immunity to Electromagnetic Radiation .....	16
Conducted Transient Immunity .....	18
TEST EQUIPMENT .....	21
Radiated Emissions .....	21
Radiated RF-field Immunity Test .....	21
Conducted Transient Immunity .....	21

**Equipment Under Test (EUT)**

LED light unit

Trademark: 5 WATTS

Type: ZAURAC 4-30

Serial Number: -

**Description of the EUT**

LED light unit.

**Power requirements**

Rated voltage: 12 - 24V

Rated frequency: DC

Rated power: -

**Cable Lengths and Types**

<b>Cable:</b>	<b>Length:</b>	<b>Type:</b>
DC power	1.7 or 0.5 m	Unshielded, 2-wire

## **Disclaimer**

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**Performance Criteria A for Immunity Testing**

All functions of a EUT perform as designed during and after exposure to disturbance. EUT may not change its state. Maximum change of +/- 10% of light intensity is allowed.

**Performance Criteria B for Immunity Testing**

All functions of EUT perform as designed during and after exposure. Change in the light intensity and state is allowed but all functions and light intensity must return automatically to within normal limits after exposure is removed.

**Performance Criteria C for Immunity Testing**

One or more functions of EUT do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

**Performance Criteria D for Immunity Testing**

One or more functions of EUT do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple "operator/use" action.

**EUT Test Conditions during EMC-Testing**

Light was on.

At the radiated emission and field immunity test the DC supply was fed through the LISN (5 $\mu$ H/ 50 $\Omega$ ). The performance of the EUT was monitored visually during the testing.

## Photographs of the EUT



Photograph 1. The EUT



Photograph 2. The EUT





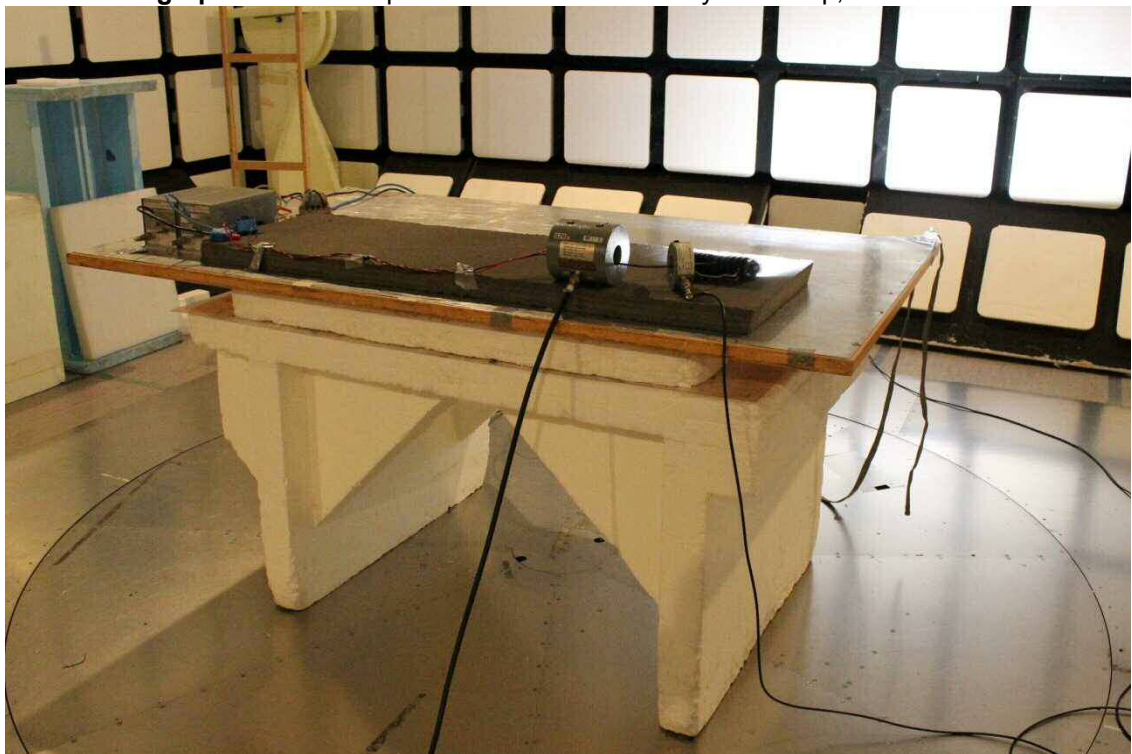
**Photograph 3.** Radiated emission test setup.



**Photograph 4.** Test set-up for radiated field immunity test setup, 80-1000MHz.



**Photograph 5.** Test set-up for radiated field immunity test setup, 1000-2000 MHz.

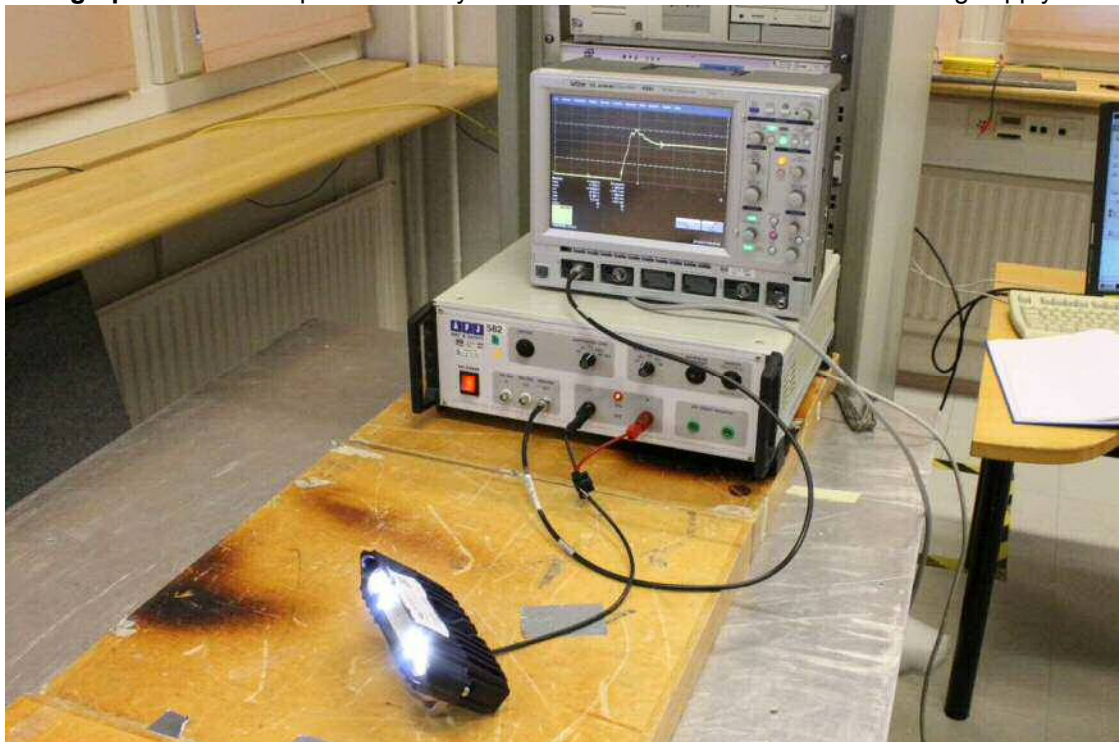


**Photograph 6.** Test set-up for Narrowband radiated electromagnetic energy, bulk current injection, 20-80 MHz.





**Photograph 7.** Test set-up for Immunity to transient disturbances conducted along supply lines.



**Photograph 8.** Test set-up for Conducted Emissions test.

**Test Suite**

Measurement/Test	Reference standard	Test site	Result
Conducted Emissions	ISO 7637-2:2004, Amendment 1:2008		<b>PASS</b>
Radiated Emissions	CISPR 25:2002, Corrigendum 2004	<b>5m</b>	<b>PASS</b>
Immunity to Electromagnetic Radiation	ISO 11452-2:2004 ISO 11452-4:2005, Corrigendum 1:2009	<b>5m</b>	<b>PASS</b>
Conducted Transient Immunity	ISO 7637-2:2004, Amendment 1:2008		<b>PASS</b>

**Testing location:**

<input type="checkbox"/> CB Testing Laboratory:	
<input type="checkbox"/> Testing Location / address:	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address:	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND
<input type="checkbox"/> Testing Location / address:	SGS Fimko Ltd Kalliotie 2 FI-04360, TUUSULA FINLAND

## Radiated Emissions

**Product family standard:** CISPR 25  
**Tested by:** PKA  
**Date:** 13 June 2017  
**Temperature:** 22 °C  
**Humidity:** 41 % RH  
**Barometric pressure:** 999 hPa  
**Measurement uncertainty:**  $\pm 5.1$  dB (30 - 200 MHz)    Level of confidence 95 % (k = 2).  
 $\pm 4.2$  dB (0.2 - 1 GHz)

**Limit:** UN Reg. No.10 Rev. 4.

**Test result:** **PASS**

## Test plan

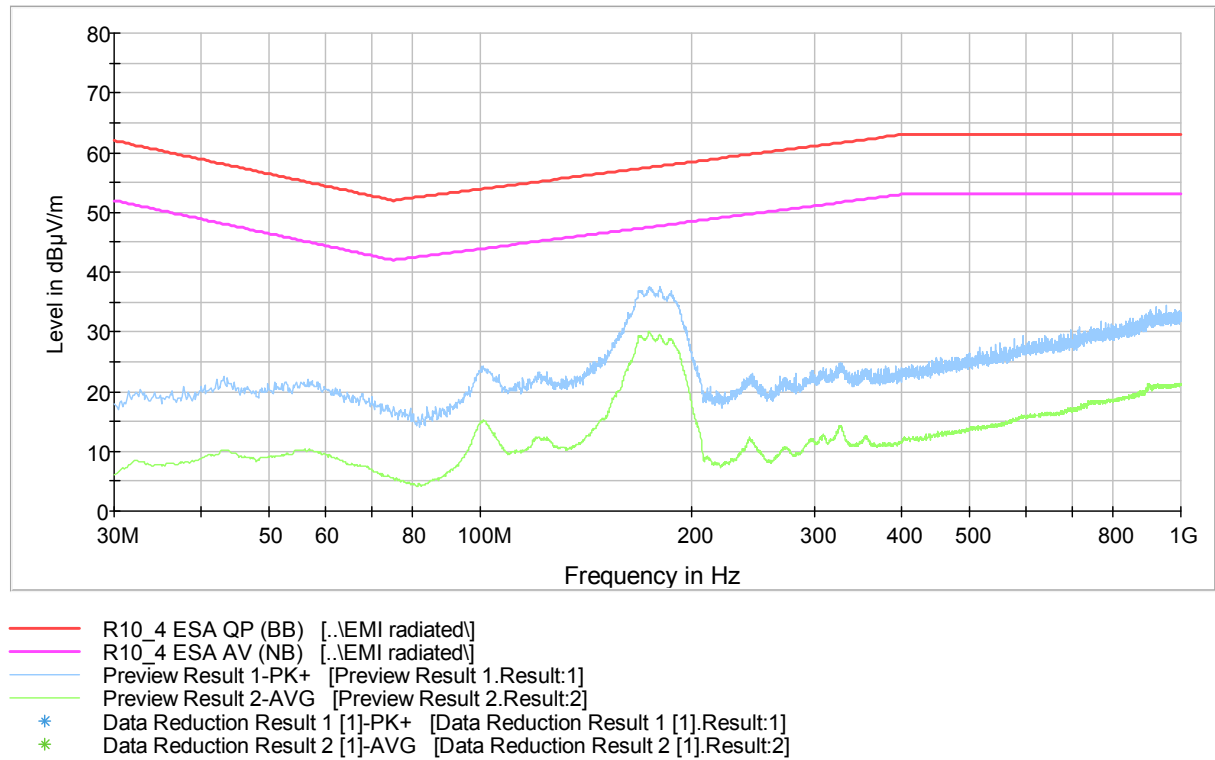
The radiated emission measurements were done within a semi-anechoic chamber. The distance between the test harness and the measuring antenna was 1.0 m. The measuring antenna was set at the fixed height of 1.02 m and both horizontal and vertical polarisation was measured. DC-supply was fed through the LISN (5 $\mu$ H/50  $\Omega$ ). The EUT and test harness was placed 50 mm above the metal ground plane which is placed on a wooden table 1.0 m above the floor of the test chamber.

First preliminary measurement was performed with Peak- and Average detectors. After finishing preliminary measurement, final measurement was made with Quasipeak- and Average detectors, if there are peaks over the relevant limit line (limits for broadband and narrowband emission).

## Radiated Emission Results In The Frequency Range 30 MHz - 1000 MHz

24V

UN 10 Rev.4 Electric Field Strength

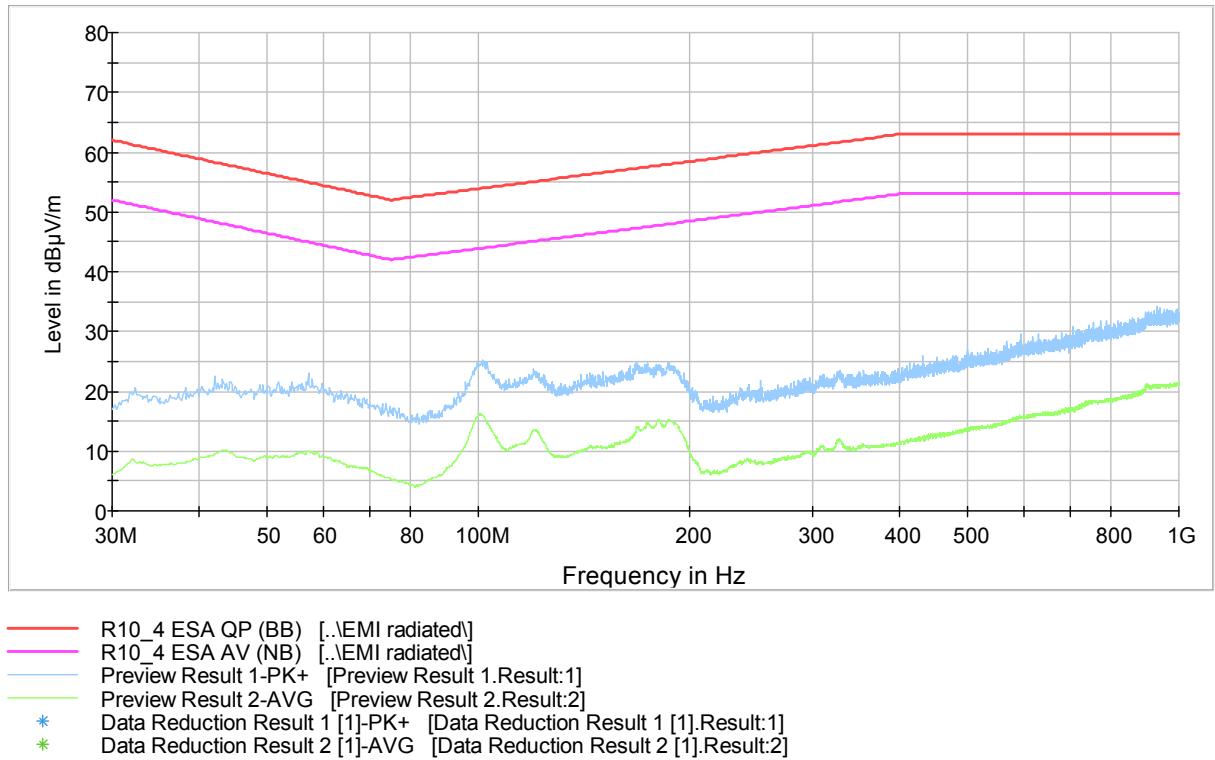


**Figure 1.** The measured curve measured with peak- and average detectors.

No final peaks were measured.

12V

UN 10 Rev.4 Electric Field Strength



**Figure 2.** The measured curve measured with peak- and average detectors.

No final peaks were measured.

## Conducted disturbances emission test

**Product family standard:** ISO 7637-2:2004/Amd.1:2008  
**Tested by:** PKA  
**Date:** 14 June 2017  
**Temperature:** 22 °C  
**Humidity:** 27 % RH  
**Barometric pressure:** 999 hPa

**Limit:** UN Reg. No.10 Rev. 4.

**Test result:** **PASS**

## Test plan

The EUT was placed on a non-conductive support 0.05 m above the RGP. The EUT was connected to the car tester unit and the measurement was performed from the measuring port of the car tester unit by using an oscilloscope.

## 27VDC

**Table 1.** Test results

Input voltage / mode	Measured max. Level [V]	Limit level [V]	Remarks	Conclusion Pass/Fail
27 V	+7.4 V	+ 150	–	Pass
	0 V	- 450	–	Pass
13.5 V	+4.5 V	+ 75	–	Pass
	0 V	- 100	–	Pass



## Immunity to Electromagnetic Radiation

**Reference document:** ISO 11452-2:2004      ISO 11452-4:2005, Cor 1:2009  
**Tested by:** MIH  
**Date:** 21 June 2017  
**Temperature:** 22 °C  
**Humidity:** 42 % RH  
**Barometric pressure:** 993 hPa  
  
**Performance criteria:** A  
**Test result:** **PASS**

### Test plan

Test was done in an anechoic chamber. The EUT was placed 50 mm above the metal ground plane which was placed on a wooden table 1.0 m above the floor of the test chamber. Frequency range from 20 to 80 MHz was tested with bulk current injection method. The substitution method was used with current injection probe in three different positions (15, 45 and 75 cm apart from the EUT). Frequency range from 80 MHz to 2000 MHz was tested with the antenna method. The distance between the test harness and the measuring antenna was 1.0 m. The test was performed with the transmitting antenna being vertical polarisation. The phase centre of the antenna for frequencies 80 to 1000 MHz was in line with the centre of the longitudinal part of the wiring harness. The phase centre of the antenna for frequencies above 1000 MHz was in line with the EUT. Test was performed with 27 and 13.5 VDC. The EUT was monitored with a camera.

### Test results

#### 27V

**Frequency range:** 20 - 80 MHz  
**Modulation:** 80% AM with 1 kHz modulation frequency  
**Test level:** 150 mA  
**Step size:** 20 – 80 MHz 5 % logarithmic  
**Dwell time:** 3 s  
**Test remarks:** No loss of function was observed.

**Frequency range:** 80 - 800 MHz  
**Antenna height:** 125 cm vertical  
**Modulation:** 80% AM with 1 kHz modulation frequency  
**Test level:** 30 V/m  
**Step:** 2 % logarithmic  
**Dwell time:** 3 s  
**Test remarks:** No loss of function was observed.

**Frequency range:** 800 - 1000 MHz  
**Antenna height:** 125 cm vertical  
**Modulation:** PM modulation, t on 577 us, period 4600 us  
**Test level:** 30 V/m  
**Step:** 1 % logarithmic  
**Dwell time:** 3 s  
**Test remarks:** No loss of function was observed.

**Frequency range:** 1000 - 2000 MHz  
**Antenna height:** 115 cm vertical  
**Modulation:** PM modulation, t on 577 us, period 4600 us  
**Test level:** 30 V/m  
**Step:** 1 % logarithmic  
**Dwell time:** 3 s  
**Test remarks:** No loss of function was observed.

**13.5V**

<b>Frequency range:</b>	20 - 80 MHz
<b>Modulation:</b>	80% AM with 1 kHz modulation frequency
<b>Test level:</b>	150 mA
<b>Step size:</b>	20 – 80 MHz 5 % logarithmic
<b>Dwell time:</b>	3 s
<b>Test remarks:</b>	No loss of function was observed.
<b>Frequency range:</b>	80 - 800 MHz
<b>Antenna height:</b>	125 cm vertical
<b>Modulation:</b>	80% AM with 1 kHz modulation frequency
<b>Test level:</b>	30 V/m
<b>Step:</b>	2 % logarithmic
<b>Dwell time:</b>	3 s
<b>Test remarks:</b>	No loss of function was observed.
<b>Frequency range:</b>	800 - 1000 MHz
<b>Antenna height:</b>	125 cm vertical
<b>Modulation:</b>	PM modulation, t on 577 us, period 4600 us
<b>Test level:</b>	30 V/m
<b>Step:</b>	1 % logarithmic
<b>Dwell time:</b>	3 s
<b>Test remarks:</b>	No loss of function was observed.
<b>Frequency range:</b>	1000 - 2000 MHz
<b>Antenna height:</b>	115 cm vertical
<b>Modulation:</b>	PM modulation, t on 577 us, period 4600 us
<b>Test level:</b>	30 V/m
<b>Step:</b>	1 % logarithmic
<b>Dwell time:</b>	3 s
<b>Test remarks:</b>	No loss of function was observed.

## Conducted Transient Immunity

**Reference document:** ISO 7637-2:2004/Amd.1:2008  
**Tested by:** PKA  
**Date:** 14 June.2017  
**Temperature:** 22 °C  
**Humidity:** 27 % RH  
**Barometric pressure:** 999 hPa

**Test result:** **PASS**

### Test plan

Tests will be done to DC-power supply port with the test levels for 24 V and 12V systems.

### Test results

#### Passing beam 24 V DC (U<sub>A</sub> 27V DC)

<u>Pulse 1</u>	Test level:	-450 V, Ri 50Ω
	Number of pulses:	5000
	Burst cycle:	1 s
	Test remarks:	EUT shut off and restarted during the burst cycle. No loss of function was observed after the test.
	Performance criteria:	C
<u>Pulse 2a:</u>	Test level:	+37 V, Ri 2Ω
	Number of pulses:	5000
	Burst cycle:	200 ms
	Test remarks:	No loss of function was observed during or after the test.
	Performance criteria:	B
<u>Pulse 2b:</u>	Test level:	+20 V
	Number of pulses:	10
	Burst cycle:	500 ms
	Test remarks:	EUT shut OFF and restarted after the burst cycle. No loss of function was observed after the test.
	Performance criteria:	C
<u>Pulse 3a:</u>	Test level:	-150 V
	Coupling duration:	60 min
	Burst cycle:	10/90 ms
	Test remarks:	No loss of function was observed during or after the test.
	Performance criteria:	A

**Conducted Transient Immunity**

Pulse 3b:                      Test level:                      +150 V  
Coupling duration:              60 min  
Burst cycle:                      10/90 ms  
Test remarks:                      No loss of function was observed during or after the test.  
Performance criteria:              A

Pulse 4:                      Test level:                      -12V 50ms/-5 V 5s  
Number of pulses:                1  
Test remarks:                      No loss of function was observed during or after the test.  
Performance criteria:              C

**Driving beam 12 V DC (U<sub>A</sub> 13.5 DC)**

Pulse 1                      Test level:                      -75 V, Ri 10Ω  
Number of pulses:                5000  
Burst cycle:                      0.5 s  
Test remarks:                      EUT shut off and restarted during the burst cycle. No loss of function was observed after the test.  
Performance criteria:              C

Pulse 2a:                      Test level:                      +37 V, Ri 2Ω  
Number of pulses:                5000  
Burst cycle:                      200 ms  
Test remarks:                      No loss of function was observed during or after the test.  
Performance criteria:              B

Pulse 2b:                      Test level:                      +10 V  
Number of pulses:                10  
Burst cycle:                      2000 ms  
Test remarks:                      EUT shut OFF and restarted after the burst cycle. No loss of function was observed after the test.  
Performance criteria:              C

Pulse 3a:                      Test level:                      -112 V  
Coupling duration:                60 min  
Burst cycle:                      10/90 ms  
Test remarks:                      No loss of function was observed during or after the test.  
Performance criteria:              A

Pulse 3b:                      Test level:                      +75 V  
Coupling duration:                60 min  
Burst cycle:                      10/90 ms  
Test remarks:                      No loss of function was observed during or after the test.  
Performance criteria:              A

<u>Pulse 4:</u>	Test level:	-6V 25ms/-2.5 V 5s
	Number of pulses:	1
	Test remarks:	EUT shut OFF and restarted after the burst cycle. No loss of function was observed after the test.
	Performance criteria:	C

## Radiated Emissions

Equipment	Manufacturer	Type	Serial no	Inv.no
TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	100185	8453
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-
ANTENNA (30-1000 MHz)	SCHWARZBECK	VULB 9168	8168-503	8911
ANTENNA MAST	MATURO	TAM 4.0E	107	10181
TURNTABLE	MATURO	DS430 upgraded	-	10181
MAST & TURNTABLE CONTROLLER	MATURO	NCD	10183	-
LISN	ROHDE & SCHWARZ	ESH3-Z6	100142	9105
LISN	ROHDE & SCHWARZ	ESH3-Z6	100143	9106

## Conducted disturbances emission test

Equipment	Manufacturer	Type	Serial no	Inv.no
AUTOMOTIVE ELECTRONIC SWITCH	ZENONE ELETTRONICA	SWE-25A	499	9566
OSCILLOSCOPE	LECROY	WAVESURFER 42Xs	LCRY0304M15037	9737
VOLTAGE DROP SIMULATOR	EM TEST	VDS 200B	0301-02	5284

## Radiated RF-field Immunity Test

Equipment	Manufacturer	Type	Serial no	Inv.no
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-
ANTENNA (80-1300 MHz)	ROHDE & SCHWARZ	HL 023 A1	354135/016	8015
ANTENNA (1-4.2GHz)	AMPLIFIER RESEARCH	AT4002	20738	8014
AMPLIFIER 60W	AMPLIFIER RESEARCH	60S1G3	313200	7915
AMPLIFIER 200W	AMPLIFIER RESEARCH	200W 1000M2A	-	5027
SIGNAL GENERATOR	AGILENT	E8257C	MY43320718	7292
ANTENNA	A.H. SYSTEMS	SAS-200/518	199	7873
POWER METER	BOONTON	4300	87105ED	5029
POWER SENSOR	BOONTON	51013-4E	29017	5030
SPECTRUM ANALYZER	AGILENT	E7405A	MY45107081	9746
ANTENNA MAST	MATURO	TAM 4.0E	107	10181
MAST & TURNTABLE CONTROLLER	MATURO	NCD	10183	-
LISN	ROHDE & SCHWARZ	ESH3-Z6	100142	9105
LISN	ROHDE & SCHWARZ	ESH3-Z6	100143	9106

## Conducted Transient Immunity

Equipment	Manufacturer	Type	Serial no	Inv.no
VOLTAGE DROP SIMULATOR	EM TEST	VDS 200B	0301-02	5284
BURST GENERATOR	EM TEST	EFT 200 A / B	0301-05	5285
MICROPULSE GENERATOR	EM TEST	MPG 200B	1000-16	5286
LOAD DUMP GENERATOR	EM TEST	LD200B	0101-03	5287
TEST SOFTWARE	EM TEST	ISMISO	VER. 3.62	-

All measurement equipment used were calibrated (if required).