

**Grant Agreement number: 248752**

**Project acronym: PRIAM**

**Project title: Printable functionalities for truly autonomous, intelligent lighting and signalling systems**

**Funding Scheme: ICT-2009.3.3**

**Start date of Project: 01.01.2010**

**Duration: 36 months**

# **WP05**

## **Deliverable D5.3**

### **Result of prototype characterization assessment**

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**Document Name:** D5.3PU Result of prototype characterization assessment

**Revision:** 0

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**Due date of deliverable:** December 2012

**Actual submission date:** January 2013

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Project co-funded by the European Commission within the 7 FP		
Dissemination Level		
<b>PU</b>	Public	X
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission Services)	
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	

## Content

1. Summary and objectives .....	3
2. Validation tests .....	3
3. Test Result for INFO-PANEL .....	4
4. Test Result for HIGH MOUNT STOP LAMP .....	6

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## 1. Summary and objectives

During the project, PRIAM consortium developed and realized two demonstrators, one related to public information application and one to automotive application. At the end of the project some functional, environmental and stress tests have been performed on demonstrators in order to characterize and validate the solution and also to assess the achievement of the project objectives.

## 2. Validation tests

PRIAM consortium identify all tests required by European regulations in terms of public information application and automotive application.

The list of tests which have been performed are the following:

- **Humidity and Storage (HS) 85°C/85%:** verify functional performance of component after exposing to high temperature and high humidity (85°C and 85% RH) for a specified time to simulate accelerated test condition for temperature and humidity experienced during the vehicle's service life.
- **Thermal Cycle (-40°C/+85°C):** Verify functional performance of component after exposing to thermal cycling from -40°C to 85°C for specified thermal cycles to simulate accelerated test condition for temperature changes experienced during the vehicle's service life. The test allows to discover the defects in the manufacturing process of the component and the variation of its functional parameters.
- **ESD Test:** verify the resistance to electrostatic discharge between contact pads and air.
- **Vibration Test:** verify the resistance of the electronic components and interconnections to the vibrations.
- **UV Test:** verify the resistance of the plastic parts to the UV light.
- **Working Temperature - info panel (Cold Cycle -40°C and Dry Heat Cycle +55°C):** verify functional performances of entire product at temperature of -40°C and +85°C. The test allows to discover the thermal behaviour of the device at extreme cold temperature and at temperature of 55°C and notice defects on displayed information and the variation of its functional parameters.
- **Autonomy test:** Verify the autonomy of the device
- **Degree of Protection:** Verify the protection level of device against water and dust.
- **Salt test – info panel:** Verify the resistance of the device to salt ambient
- **Corrosion agents - Automotive demonstrator:** Verify the resistance of the device to corrosive agents as H<sub>2</sub>S
- **Optical Test - Info Panel:** Measurement of optical performances of the demonstrator

### 3. Test Result for INFO-PANEL

The following tables summarize the result obtained by testing the info panel demonstrator and a comparison between these results and the target objective.

#### Legend:

- ✓ Ok for regulation and project objective
- ✓ Ok for regulation but not for project objective
- ✗ No test performed but confident in good results
- ✗ Test performed with bad result both for project objective and regulation

#### INFO PANEL

		Performed Tests and objectives	Deviations and Consideration	Result
1	Temperature	Working Temperature: -40°C/+55°C (Class T2 and T3 of the regulation EN12966-1)	NO	✓
2	Protection Degree	NONE	Test has not yet performed because it is mainly related to packaging aspects. A type of packaging has been designed and SOLARI is confidential to reach IP55 degree of protection with the designed packaging	✗
3	Optical tests and characterizations	<b>Luminance:</b> +30% compare to the actual devices at the same drive current (measured according to regulation EN12966-1)	<b>Luminance level:</b> is in according with EN12966-1 and compared with existing products the value of luminance for both colors is >30% as expected	✓
		<b>Chromatic coordinate:</b> Class C2 of the regulation EN12966-1	<b>Chromatic Coordinate:</b> class C2 of EN12966-1 has been reached	✓
		<b>Visible angle:</b> Class B6: +15°/-15° horizontal; 0°/-10° vertical (measured according to regulation EN12966-1); Class B4: +10°/-10° horizontal; 0°/-10° vertical (measured according to regulation EN12966-1)	<b>Visible angle:</b> Class B6 of EN12966-1 has been reached	✓

		<b>Contrast:</b> +30% compare to the actual devices at 40.000lux of illumination (measured according to regulation EN12966-1)	<b>Contrast Ratio:</b> R2 Level of EN12966-1 has been reached modifying the demonstrator with the implementation of a black mask. In this case no improvement has been reached compare to existing device. An improvement could be reached modifying the material of the mask or painted the substrate with non reflective paint in order to decrease the level of reflection.	✓
		<b>Uniformity:</b> Ratio onto 12% of the pixels 1,5 (measured according to regulation EN12966-1)	<b>Uniformity Ratio</b> is in accordance with the regulation	✓
4	Lifetime from LED data	Lifetime from LED data	The data will be carried out for the data sheet commercially available estimated 15000h lifetime. Thanks to optimization of heat disposal in consideration of particular design of the contact pads	✓
5	UV resistance	UV tests 100h of UV exposure	The tests has been performed on bare demonstrator without packaging and no damage has been notice	✓
6	Thermal Cycle	Verify functional performance of single components after exposing to thermal cycling from -40°C to 85°C	The tests has been performed and luminous flux derating has been evaluated. -20% of derating in luminous flux is well accepted for the application considering the number of cycle (1000)	✓
7	Salt test	NONE	Test has not yet performed because it is mainly related to packaging aspects. Type of packaging has been designed and described in this deliverable at point 2.7. SOLARI is confidential to pass the test with the designed packaging	✗
8	Vibration	Vibration Test according to EN12966	NO	✓
9	ESD	Electrostatic discharge resistance	The test has been performed on demonstrator without any damage	✓
10	Storage Temperature	HS test to verify the performance of the demonstrator after exposure to 85°C and 85% humidity for ~1500h	The test has been performed and derating of luminous flux has been evaluated. -20% of derating in luminous flux is well accepted for the application.	✓
11	Autonomy	Fully charge-fully discharge test  Continues running test	15h autonomy from fully charge to fully discharge has been reached.	✓

## 4. Test Result for HIGH MOUNT STOP LAMP

The following tables summarize the result obtained by testing the automotive demonstrator and a comparison between these results and the target objective.

### Legend:

- ✓ Ok for regulation and project objective
- ✓ Ok for regulation but not for project objective
- ✗ No test performed but confident in good results
- ✗ Test performed with bad result both for project objective and regulation

### HIGH MOUNT STOP LAMP

		Performed Tests and objectives	Deviations and consideration	Result
1	Temperature	Temperature -40°+55° C High Temperature Operating Endurance (HTOE)  Thermal Cycles: Verify functional performance of single components after exposing to thermal cycling from -40°C to 85°C	The tests has been performed at 85°C as upper limit without batteries building block The derating of luminous flux has been evaluated. -20% of derating in luminous flux is well accepted for the application considering the number of cycle (1000) Issue is represented by batteries operating temperature which is maximum 60°C	✓
2	Vibration tests	X, Y, Z vibration for approx. 48 h	NO	✓
3	Humidity	Humidity 85/85 (85°±85%RH) Verify functional performance of component after exposing to high temperature and high humidity (85°C and 85% RH)	NO	✓
4	Electrostatic discharges	ESD test Test to verify the resistance of the electronic components to electrostatic discharges	NO	✓
5	Degree of Protection	Water IP65 (to be defined due to the used packaging)  NO TEST PERFORMED	Test has not yet performed because it is mainly related to packaging aspects. Type of packaging has been designed and described in this deliverable at point 2.7. CRP-CRF is confidential to pass the test with the designed packaging	✗
6	Corrosion	Verify the effects caused by the influence of corrosive environmental (H <sub>2</sub> S) that can damage the electrical contacts and connections. e.g. Corrosion FIAT 9.9010  NO TEST PERFORMED	Test has not yet performed because it is mainly related to packaging aspects. Type of packaging has been designed and described in this deliverable at point 2.7. CRP-CRF is confidential to pass the test with the designed packaging	✗

7	UV resistance	UV test FIAT 9.93346 Test to verify the resistance of the plastic parts to the UV light.	The tests has been performed on bare demonstrator without packaging and no damage has been notice	✓
8	Autonomy	15h expected  Fully charge-fully discharge test  Test based on average absorbed power to simulate the stop lamp activation during the use of the vehicle.	The size and quantity of the thin film batteries, due to their efficiency, permitted to reach 10h of autonomy. The solution is to increase the batteries size.	✗