

Department for Materials  
Laboratory for Polymers

**ZAG**

ZAVOD ZA  
GRADBENIŠTVO  
SLOVENIJE

SLOVENIAN  
NATIONAL BUILDING  
AND CIVIL ENGINEERING  
INSTITUTE

Dimičeva ulica 12  
1000 Ljubljana  
Slovenija

info@zag.si  
www.zag.si

Ljubljana, 19<sup>th</sup> January 2017

## TEST REPORT

**No. P 0081/17-460-1**

Light transmittance of 4-layer visors

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**Applicant:** VEPLAS RTM d.o.o., Cesta Simona Blatnika 11, SI-3320 Velenje, Slovenia  
**Order Form:** No. 4/16 from 23/01/2017

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**Task Carrier:**

Peter Nadrah, Ph.D.



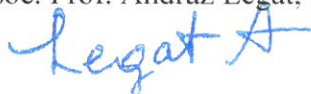
**Head of Laboratory:**

Andrijana Sever Škapin, Ph.D.



**Director:**

Assoc. Prof. Andraž Legat, Ph.D.



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number of annexes: -.

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Form. P.S. 12-001-01/2

## 1. INTRODUCTION

According to the applicant order we determined light transmittance of 4-layer visors.

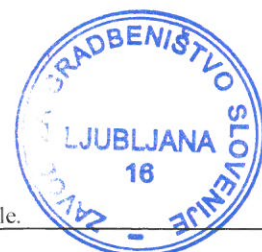
<b>Applicant</b>	VEPLAS d.d., Cesta Simona Blatnika 11, SI-3320 Velenje, Slovenia
<b>Sample</b>	<b>4-layer visor</b>
Type of product	visor for head protection
Packaging / form of delivery	Samples were delivered packaged in a protective foil
Internal sample designation	<b>ZAG D17-4</b>
<b>Date of sample receipt</b>	17/01/2017
<b>Date of tests</b>	17/01/2017-18/01/2017

## 2. COURSE OF TEST

The test was carried out by placing the visor between the light source (Newport 300 W xenon lamp) and the detector with the outer side (the convex side) facing the light source. Light source emitted light in ultraviolet and visible regions of the spectrum as depicted in Figure 1. Irradiance flux density of the light source was  $196 \text{ Wm}^{-2}$  and  $179 \text{ Wm}^{-2}$  for the intervals 300-800 nm and 400-800 nm, respectively. Five visor samples were tested. The light transmittance was measured using Ocean Optics USB2000+RAD spectrometer on 9 point spots on each visor in 5 subsequent measurements. The spots were placed on the left side, centre and right side of the visor with 3 spots evenly spaced across the height of the visor as depicted in Figure 2. The distance between the light source and the detector was 10.5 cm. The distance between the light source and the visor was 3.5 cm and 6.0 cm for spots 4, 5, 6 and spots 1, 2, 3, 7, 8, 9, respectively.

Measurement uncertainty was determined to be 0.36 % calculated as standard deviation of 5 subsequent measurements averaged across 9 points spots on one visor averaged across wavelength interval 300-800 nm and multiplied by 2.

Relative uncertainty of  $\pm 5 \%$  required by EN 167:2001 is assured.



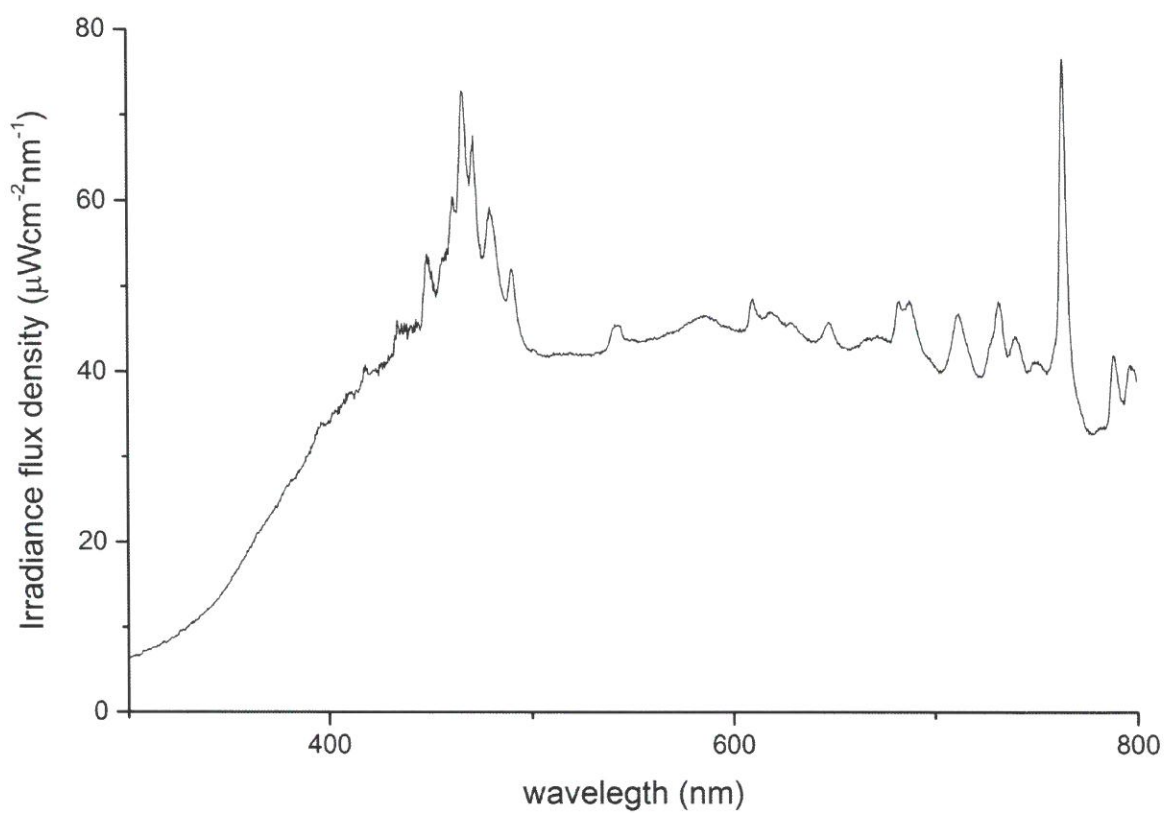
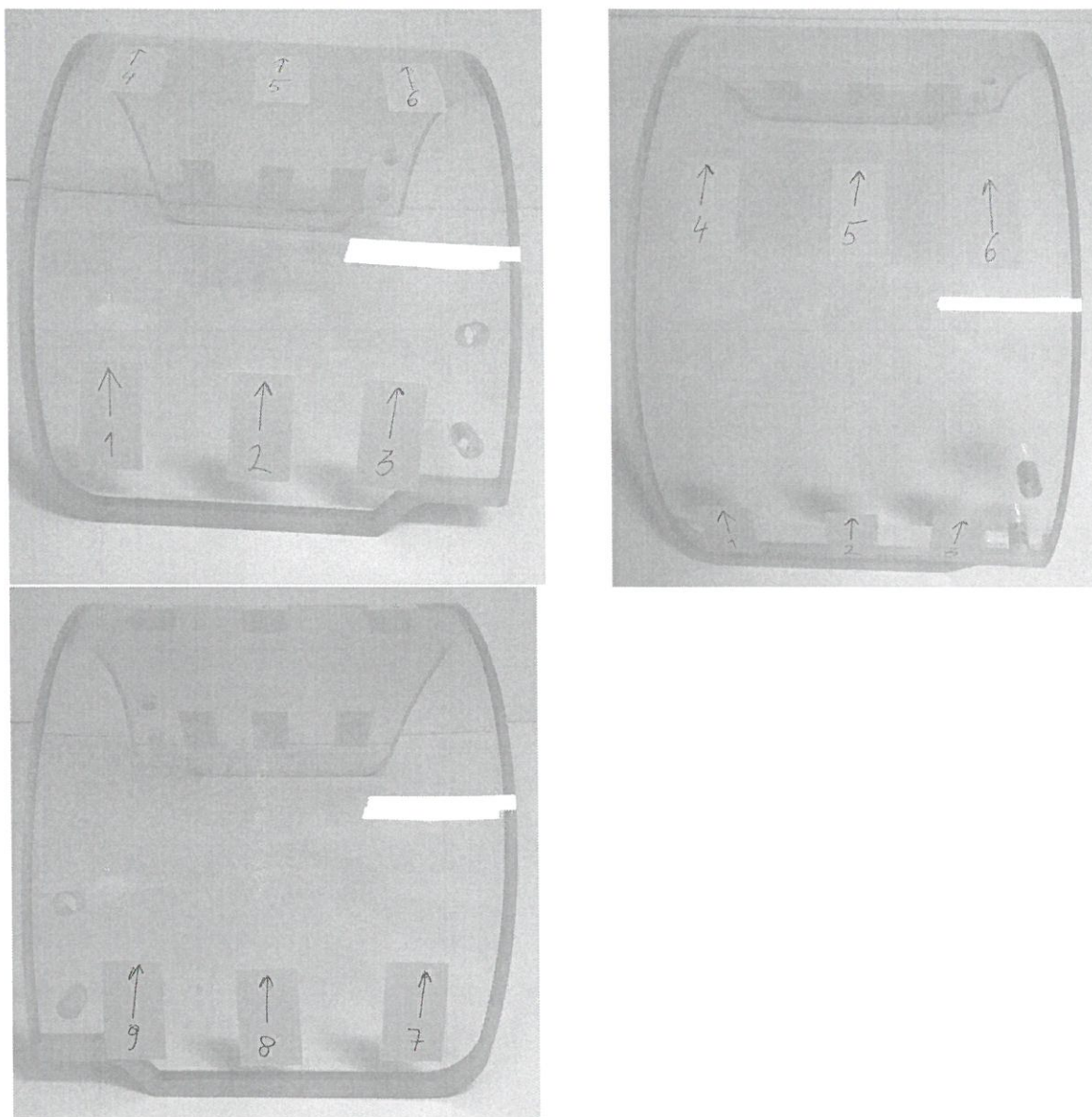


Figure 1: Irradiance flux density of the light source.



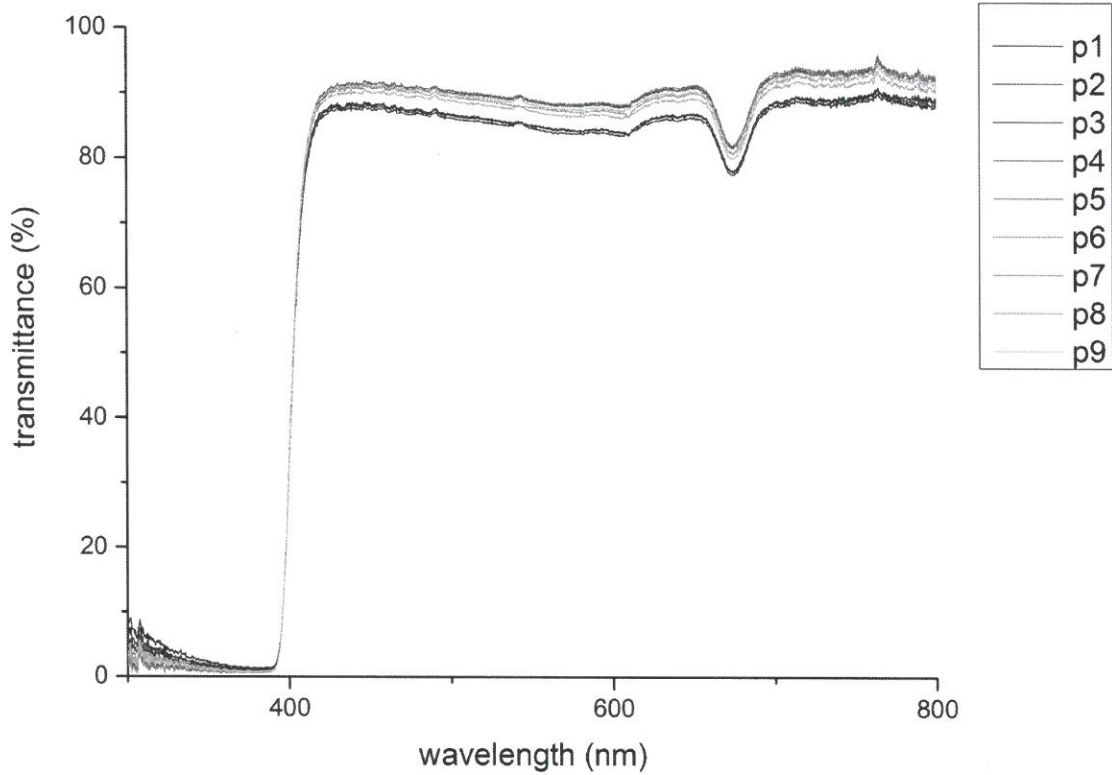


**Figure 2:** Placement of the spots on the visor.

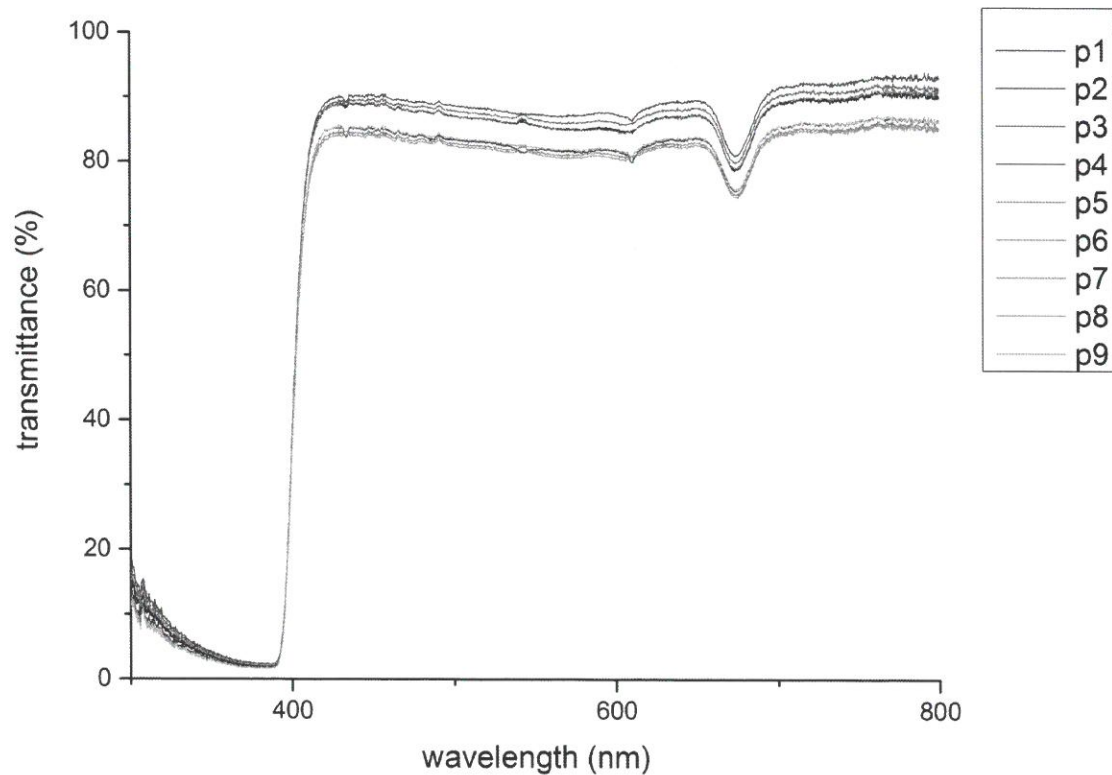




### 3. TEST RESULTS

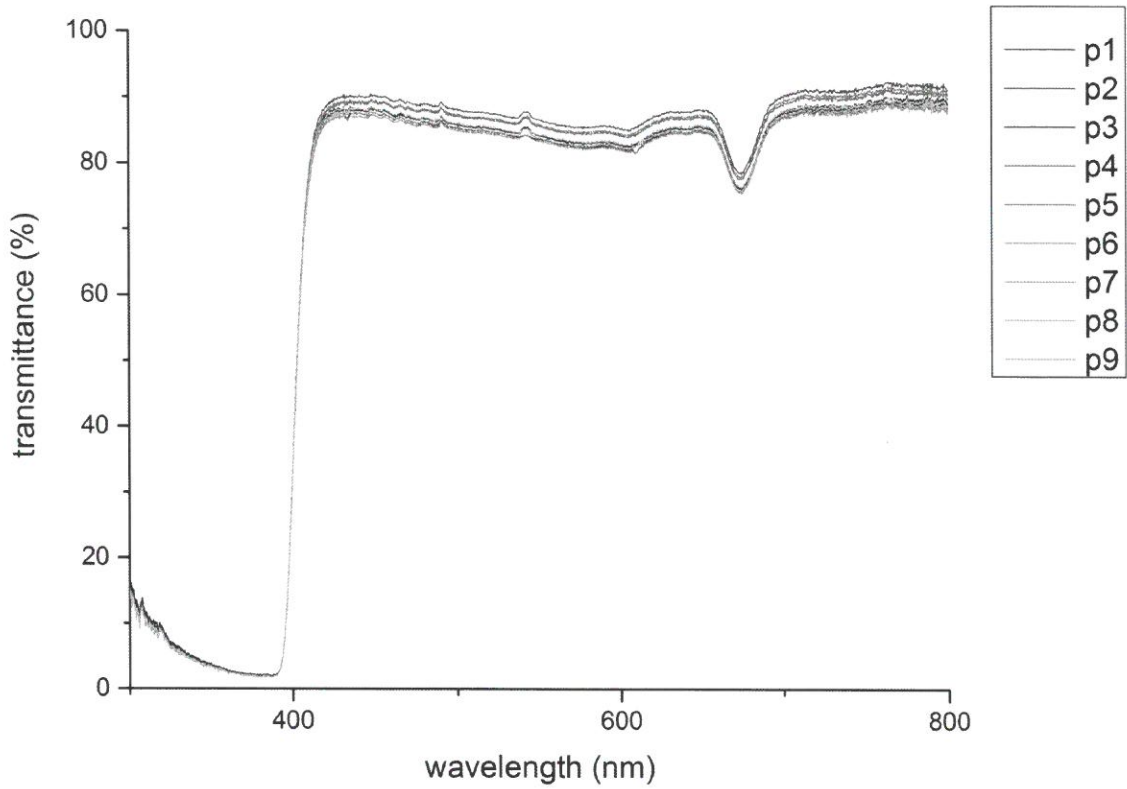


**Figure 3:** Transmittance of the visor 1 at point spots p1 through p9 (below 350 nm there is significant noise present in transmittance spectra).

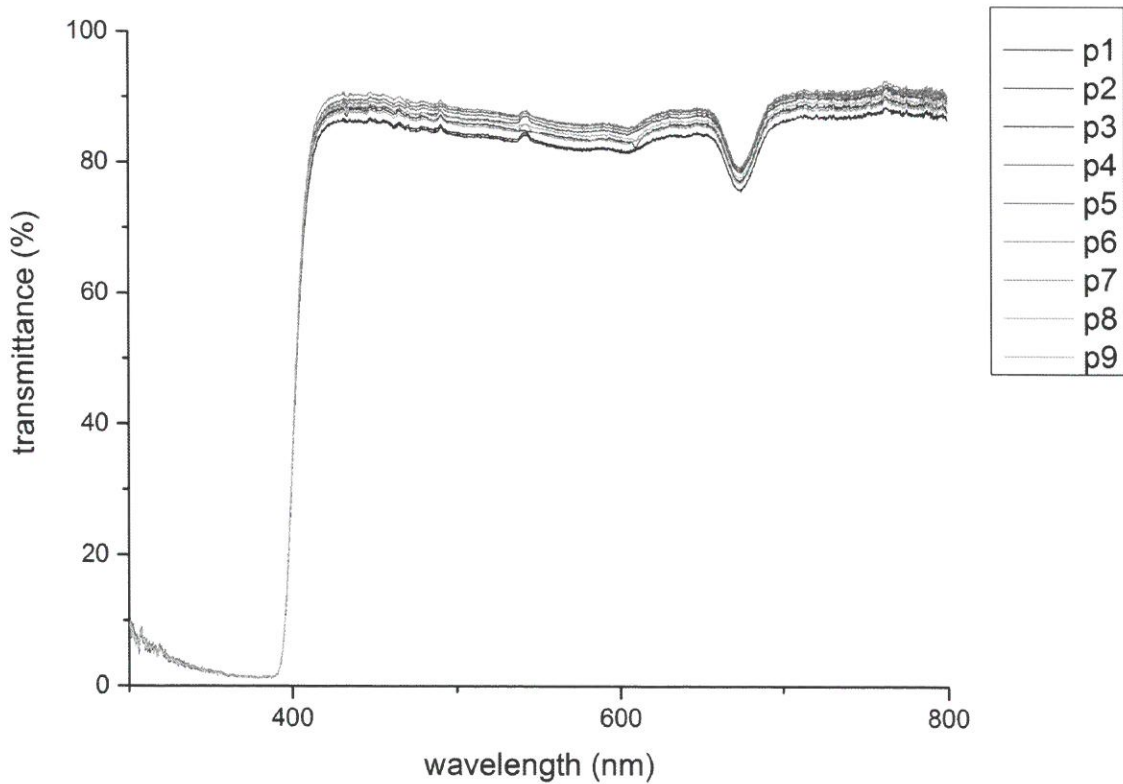


**Figure 4:** Transmittance of the visor 2 at point spots p1 through p9 (below 350 nm there is significant noise present in transmittance spectra).



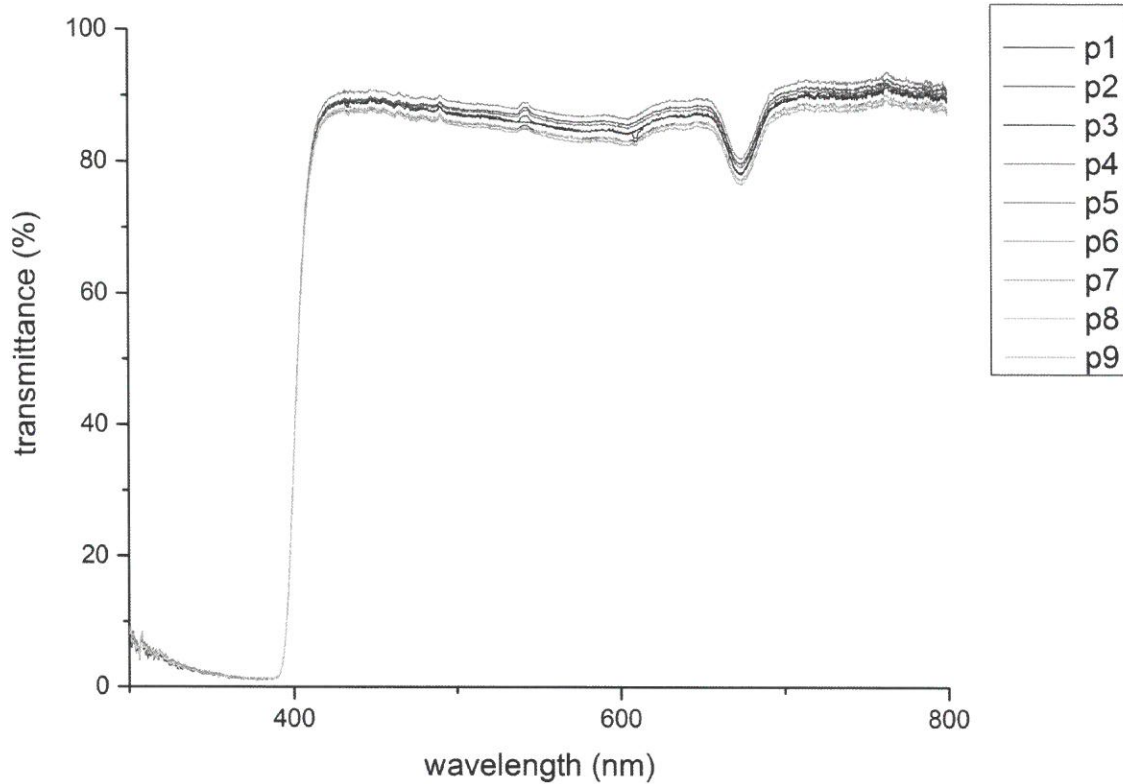


**Figure 5:** Transmittance of the visor 3 at point spots p1 through p9 (below 350 nm there is significant noise present in transmittance spectra).



**Figure 6:** Transmittance of the visor 4 at point spots p1 through p9 (below 350 nm there is significant noise present in transmittance spectra).





**Figure 7:** Transmittance of the visor 5 at point spots p1 through p9 (below 350 nm there is significant noise present in transmittance spectra).

**Table 1:** Average values of transmittance for each point spot on each visor; averages for each visor and averages for each point spot for wavelength range 300-800 nm.

	visor 1	visor 2	visor 3	visor 4	visor 5	spot average transmittance [%]	standard deviation of the spot average [%]
spot 1	70.70	71.66	70.57	68.90	70.15	70.39	1.00
spot 2	70.08	71.61	70.35	69.01	71.05	70.42	0.99
spot 3	70.35	68.55	69.92	70.27	71.19	70.06	0.96
spot 4	73.36	73.43	72.28	71.12	71.98	72.43	0.98
spot 5	73.13	72.53	71.40	71.86	71.65	72.11	0.71
spot 6	73.43	71.77	71.65	71.54	72.76	72.23	0.83
spot 7	72.72	68.01	69.64	72.14	70.13	70.53	1.92
spot 8	72.07	67.67	69.99	70.01	69.72	69.89	1.56
spot 9	72.87	68.62	70.47	70.73	70.14	70.57	1.53
visor average transmittance [%]	72.08	70.43	70.70	70.62	70.97		
standard deviation of visor average [%]	1.35	2.19	0.89	1.17	1.02		



**Table 2:** Average values of transmittance for each point spot on each visor; averages for each visor and averages for each point spot for wavelength range 400-800 nm.

	visor 1	visor 2	visor 3	visor 4	visor 5	spot average transmittance [%]	standard deviation of the spot average [%]
spot 1	85.99	86.69	85.36	83.81	85.40	85.45	1.06
spot 2	85.37	86.66	85.13	83.94	86.50	85.52	1.11
spot 3	85.79	83.02	84.63	85.46	86.68	85.12	1.38
spot 4	89.68	88.65	87.53	86.48	87.63	87.99	1.21
spot 5	89.43	87.62	86.48	87.37	87.22	87.62	1.09
spot 6	89.82	86.76	86.79	86.97	88.57	87.78	1.37
spot 7	88.78	82.40	84.33	87.74	85.32	85.72	2.58
spot 8	88.04	82.03	84.77	85.16	84.85	84.97	2.13
spot 9	89.04	83.19	85.34	86.03	85.38	85.80	2.11
visor average transmittance [%]	87.99	85.22	85.59	85.89	86.39		
standard deviation of visor average [%]	1.79	2.53	1.09	1.41	1.26		

**Table 2:** Overall average values of transmittance.

	Overall average transmittance [%]	Standard deviation [%]	Relative standard deviation [no unit]
300-800 nm	70.96	1.46	0.02
400-800 nm	86.22	1.89	0.02

Test report prepared by:

Peter Nadrah, Ph.D.

