

**Colourimetric scaling of achromatic colours between peak white and black.  
Relations between tristimulus value  $Y$ , luminance  $L$ , and lightness  $L^*$  of ISO-standards**

| Colour (light or paper)           | tristimulus values | HDR display luminance       | relative luminance   |                      | CIELAB <sub>U</sub> lightness               | TUBLOG <sub>U</sub> lightness               |
|-----------------------------------|--------------------|-----------------------------|----------------------|----------------------|---|---|
| <b>Contrast W:N (25:1=90:3,6)</b> | $Y$                | $L$<br>[cd/m <sup>2</sup> ] | $L_{rU}$<br>$=L/L_U$ | $L_{rW}$<br>$=L/L_W$ | $L^*_{CIELABU}$<br>$=d_U L_{nU}^{1/3} - 16$ | $L^*_{TUBLOGU}$<br>$=t_U \log(L_{nU}) + 52$ |
| White P2 (light)                  | 360<br>=18*20      | 800<br>=40*20               | 25                   | 2,24                 | 161=50+111<br>$=c(20,00)^{1/3} - 16$        | 141=50+91<br>$=t \log(20,00) + 52$          |
| White P1 (light)                  | 180<br>=18*10      | 400<br>=40*10               | 20                   | 1,00                 | 125=50+75<br>$=c(10,00)^{1/3} - 16$         | 120=50+70<br>$=t \log(10,00) + 52$          |
| White W (fluorescent paper)       | 90<br>=18*5        | 200<br>=40*5                | 5                    | 0,45                 | 95=50+45<br>$=c(5,00)^{1/3} - 16$           | 98=50+48<br>$=t \log(5,00) + 52$            |
| Grey U (paper)                    | 18<br>=18*1        | 40<br>40*1                  | 1                    | 0,20                 | 49=50-0<br>$=c(1,00)^{1/3} - 16$            | 48=50-1<br>$=t \log(1,00) + 52$             |
| Black N (paper)                   | 3,6<br>=18/5       | 8<br>40/5                   | 0,20                 | 0,09                 | 22=50-27<br>$=c(0,20)^{1/3} - 16$           | -1=50-51<br>$=t \log(0,20) + 52$            |
| Black p1 (glossy paper)           | 2,5<br>=18/7       | 5,7<br>40/7                 | 0,14                 | 0,04                 | 17=50-32<br>$=c(0,14)^{1/3} - 16$           | -12=50-62<br>$=t \log(0,14) + 52$           |
| Black p2 (glossy paper)           | 1,8<br>=18/10      | 4<br>40/10                  | 0,10                 | 0,022                | 14=50-35<br>$=c(0,10)^{1/3} - 16$           | -22=50-72<br>$=t \log(0,10) + 52$           |

It is valid: CIELAB<sub>U</sub>:  $d_U=d=66$ , TUBLOG<sub>U</sub>:  $t_U=t=50/\log(5)=72$