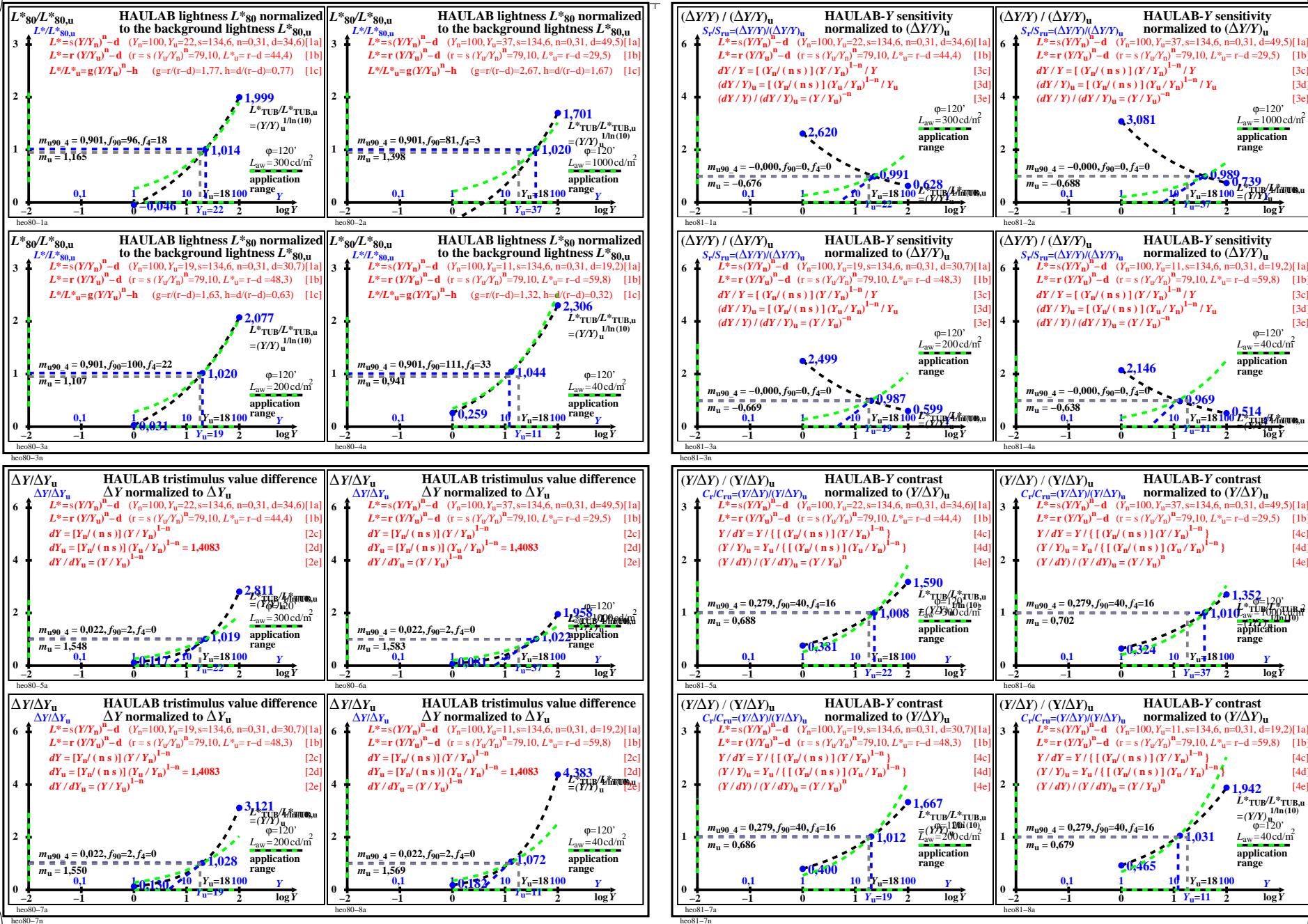TUB registration: 20241201-heo8/heo8l0na.txt /.ps

application for evaluation and measurement of display or print output

TUB material: code=rha4ta

HAULAB lightness L^*_{80} normalized to the background lightness $L^*_{80,u}$

$L^*_{80}/L^*_{80,u}$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=22, s=134,6, n=0,31, d=34,6)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=44,4)$ [1b]
$L^*/L^*_u=g(Y/Y_u)^n-h$ $(g=r/(r-d)=1,77, h=d/(r-d)=0,77)$ [1c]

1,999
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u^{1/ln(10)}$
$\varphi=120'$
$L_{aw}=300cd/m^2$
application range
$m_{u90\_4}=0,901, f_{90}=96, f_4=18$
$m_u=1,165$ 1,014
0,1 1 10 $Y_u=18$ 100
$-0,046$ $Y_u=22$ log Y
heo80−1a

HAULAB lightness L^*_{80} normalized to the background lightness $L^*_{80,u}$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=37, s=134,6, n=0,31, d=49,5)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=29,5)$ [1b]
$L^*/L^*_u=g(Y/Y_u)^n-h$ $(g=r/(r-d)=2,67, h=d/(r-d)=1,67)$ [1c]

1,701
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u^{1/ln(10)}$
$\varphi=120'$
$L_{aw}=1000cd/m^2$
application range
$m_{u90\_4}=0,901, f_{90}=81, f_4=3$
$m_u=1,398$ 1,020
0,1 1 10 $Y_u=18$ 100
$Y_u=37$ log Y
heo80−2a

HAULAB-Y sensitivity normalized to $(\Delta Y/Y)_u$

$(\Delta Y/Y)/(\Delta Y/Y)_u$
$S_r/S_{ru}=(\Delta Y/Y)/(\Delta Y/Y)_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=22, s=134,6, n=0,31, d=34,6)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=44,4)$ [1b]
$dY/Y=[(Y_n/(ns))(Y/Y_n)^{1-n}/Y$ [3c]
$(dY/Y)_u=[(Y_n/(ns))(Y_u/Y_n)^{1-n}/Y_u$ [3d]
$(dY/Y)/(dY/Y)_u=(Y/Y_u)^{-n}$ [3e]

2,620
$\varphi=120'$
$L_{aw}=300cd/m^2$
application range
$m_{u90\_4}=-0,000, f_{90}=0, f_4=0$
$m_u=-0,676$ 0,991 0,628
0,1 1 10 $Y_u=18$ 100
$Y_u=22$ log Y
heo81−1a

HAULAB-Y sensitivity normalized to $(\Delta Y/Y)_u$

$(\Delta Y/Y)/(\Delta Y/Y)_u$
$S_r/S_{ru}=(\Delta Y/Y)/(\Delta Y/Y)_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=37, s=134,6, n=0,31, d=49,5)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=29,5)$ [1b]
$dY/Y=[(Y_n/(ns))(Y/Y_n)^{1-n}/Y$ [3c]
$(dY/Y)_u=[(Y_n/(ns))(Y_u/Y_n)^{1-n}/Y_u$ [3d]
$(dY/Y)/(dY/Y)_u=(Y/Y_u)^{-n}$ [3e]

3,081
$\varphi=120'$
$L_{aw}=1000cd/m^2$
application range
$m_{u90\_4}=-0,000, f_{90}=0, f_4=0$
$m_u=-0,688$ 0,989 0,739
0,1 1 10 $Y_u=18$ 100
$Y_u=37$ log Y
heo81−2a

HAULAB lightness L^*_{80} normalized to the background lightness $L^*_{80,u}$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=19, s=134,6, n=0,31, d=30,7)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=48,3)$ [1b]
$L^*/L^*_u=g(Y/Y_u)^n-h$ $(g=r/(r-d)=1,63, h=d/(r-d)=0,63)$ [1c]

2,077
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u^{1/ln(10)}$
$\varphi=120'$
$L_{aw}=200cd/m^2$
application range
$m_{u90\_4}=0,901, f_{90}=100, f_4=22$
$m_u=1,107$ 1,020
0,1 1 10 $Y_u=18$ 100
$-0,031$ $Y_u=19$ log Y
heo80−3n

HAULAB lightness L^*_{80} normalized to the background lightness $L^*_{80,u}$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=11, s=134,6, n=0,31, d=19,2)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=59,8)$ [1b]
$L^*/L^*_u=g(Y/Y_u)^n-h$ $(g=r/(r-d)=1,32, h=d/(r-d)=0,32)$ [1c]

2,306
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u^{1/ln(10)}$
$\varphi=120'$
$L_{aw}=40cd/m^2$
application range
$m_{u90\_4}=0,901, f_{90}=111, f_4=33$
$m_u=0,941$ 1,044
0,1 0,259 10 $Y_u=18$ 100
$Y_u=11$ log Y
heo80−4a

HAULAB-Y sensitivity normalized to $(\Delta Y/Y)_u$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=19, s=134,6, n=0,31, d=30,7)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=48,3)$ [1b]
$dY/Y=[(Y_n/(ns))(Y/Y_n)^{1-n}/Y$ [3c]
$(dY/Y)_u=[(Y_n/(ns))(Y_u/Y_n)^{1-n}/Y_u$ [3d]
$(dY/Y)/(dY/Y)_u=(Y/Y_u)^{-n}$ [3e]

2,499
$\varphi=120'$
$L_{aw}=200cd/m^2$
application range
$m_{u90\_4}=-0,000, f_{90}=0, f_4=0$
$m_u=-0,669$ 0,987 0,599
0,1 1 10 $Y_u=18$ 100
$Y_u=19$ log Y
heo81−3n

HAULAB-Y sensitivity normalized to $(\Delta Y/Y)_u$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=11, s=134,6, n=0,31, d=19,2)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=59,8)$ [1b]
$dY/Y=[(Y_n/(ns))(Y/Y_n)^{1-n}/Y$ [3c]
$(dY/Y)_u=[(Y_n/(ns))(Y_u/Y_n)^{1-n}/Y_u$ [3d]
$(dY/Y)/(dY/Y)_u=(Y/Y_u)^{-n}$ [3e]

2,146
$\varphi=120'$
$L_{aw}=40cd/m^2$
application range
$m_{u90\_4}=-0,000, f_{90}=0, f_4=0$
$m_u=-0,638$ 0,969 0,514
0,1 1 10 $Y_u=18$ 100
$Y_u=11$ log Y
heo81−4a

HAULAB tristimulus value difference ΔY normalized to ΔY_u

$\Delta Y/\Delta Y_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=22, s=134,6, n=0,31, d=34,6)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=44,4)$ [1b]
$dY=[Y_n/(ns)](Y/Y_n)^{1-n}$ [2c]
$dY_u=[Y_n/(ns)](Y_u/Y_n)^{1-n}=1,4083$ [2d]
$dY/dY_u=(Y/Y_u)^{1-n}$ [2e]

2,811
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u$
$\varphi=120'$
$L_{aw}=300cd/m^2$
application range
$m_{u90\_4}=0,022, f_{90}=2, f_4=0$
$m_u=1,548$ 1,019
0,1 $-0,117$ 10 $Y_u=18$ 100
$Y_u=22$ log Y
heo80−5a

HAULAB tristimulus value difference ΔY normalized to ΔY_u

$\Delta Y/\Delta Y_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=37, s=134,6, n=0,31, d=49,5)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=29,5)$ [1b]
$dY=[Y_n/(ns)](Y/Y_n)^{1-n}$ [2c]
$dY_u=[Y_n/(ns)](Y_u/Y_n)^{1-n}=1,4083$ [2d]
$dY/dY_u=(Y/Y_u)^{1-n}$ [2e]

1,958
$\varphi=120'$
$L_{aw}=1000cd/m^2$
application range
$m_{u90\_4}=0,022, f_{90}=2, f_4=0$
$m_u=1,583$ 1,022
0,1 $-0,081$ 10 $Y_u=18$ 100
$Y_u=37$ log Y
heo80−6a

HAULAB-Y contrast normalized to $(Y/\Delta Y)_u$

$(Y/\Delta Y)/(Y/\Delta Y)_u$
$C_r/C_{ru}=(Y/\Delta Y)/(Y/\Delta Y)_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=22, s=134,6, n=0,31, d=34,6)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=44,4)$ [1b]
$Y/dY=Y/\{[(Y_n/(ns))(Y/Y_n)^{1-n}]\}$ [4c]
$(Y/Y)_u=Y_u/\{[(Y_n/(ns))(Y_u/Y_n)^{1-n}]\}$ [4d]
$(Y/dY)/(Y/dY)_u=(Y/Y_u)^n$ [4e]

1,590
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u$
$\varphi=120'$
$L_{aw}=300cd/m^2$
application range
$m_{u90\_4}=0,279, f_{90}=40, f_4=16$
$m_u=0,688$ 1,008 0,381
0,1 1 10 $Y_u=18$ 100
$Y_u=22$ log Y
heo81−5a

HAULAB-Y contrast normalized to $(Y/\Delta Y)_u$

$(Y/\Delta Y)/(Y/\Delta Y)_u$
$C_r/C_{ru}=(Y/\Delta Y)/(Y/\Delta Y)_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=37, s=134,6, n=0,31, d=49,5)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=29,5)$ [1b]
$Y/dY=Y/\{[(Y_n/(ns))(Y/Y_n)^{1-n}]\}$ [4c]
$(Y/Y)_u=Y_u/\{[(Y_n/(ns))(Y_u/Y_n)^{1-n}]\}$ [4d]
$(Y/dY)/(Y/dY)_u=(Y/Y_u)^n$ [4e]

1,352
$\varphi=120'$
$L_{aw}=1000cd/m^2$
application range
$m_{u90\_4}=0,279, f_{90}=40, f_4=16$
$m_u=0,702$ 1,010 0,324
0,1 1 10 $Y_u=18$ 100
$Y_u=37$ log Y
heo81−6a

HAULAB tristimulus value difference ΔY normalized to ΔY_u

$\Delta Y/\Delta Y_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=19, s=134,6, n=0,31, d=30,7)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=48,3)$ [1b]
$dY=[Y_n/(ns)](Y/Y_n)^{1-n}$ [2c]
$dY_u=[Y_n/(ns)](Y_u/Y_n)^{1-n}=1,4083$ [2d]
$dY/dY_u=(Y/Y_u)^{1-n}$ [2e]

3,121
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u$
$\varphi=120'$
$L_{aw}=200cd/m^2$
application range
$m_{u90\_4}=0,022, f_{90}=2, f_4=0$
$m_u=1,550$ 1,028
0,1 $-0,150$ 10 $Y_u=18$ 100
$Y_u=19$ log Y
heo80−7n

HAULAB tristimulus value difference ΔY normalized to ΔY_u

$\Delta Y/\Delta Y_u$
$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=11, s=134,6, n=0,31, d=19,2)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=59,8)$ [1b]
$dY=[Y_n/(ns)](Y/Y_n)^{1-n}$ [2c]
$dY_u=[Y_n/(ns)](Y_u/Y_n)^{1-n}=1,4083$ [2d]
$dY/dY_u=(Y/Y_u)^{1-n}$ [2e]

4,383
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u$
$\varphi=120'$
$L_{aw}=40cd/m^2$
application range
$m_{u90\_4}=0,022, f_{90}=2, f_4=0$
$m_u=1,569$ 1,072
0,1 $-0,182$ 10 $Y_u=18$ 100
$Y_u=11$ log Y
heo80−8a

HAULAB-Y contrast normalized to $(Y/\Delta Y)_u$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=19, s=134,6, n=0,31, d=30,7)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=48,3)$ [1b]
$Y/dY=Y/\{[(Y_n/(ns))(Y/Y_n)^{1-n}]\}$ [4c]
$(Y/Y)_u=Y_u/\{[(Y_n/(ns))(Y_u/Y_n)^{1-n}]\}$ [4d]
$(Y/dY)/(Y/dY)_u=(Y/Y_u)^n$ [4e]

1,667
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u$
$\varphi=120'$
$L_{aw}=200cd/m^2$
application range
$m_{u90\_4}=0,279, f_{90}=40, f_4=16$
$m_u=0,686$ 1,012 0,400
0,1 1 10 $Y_u=18$ 100
$Y_u=19$ log Y
heo81−7a

HAULAB-Y contrast normalized to $(Y/\Delta Y)_u$

$L^*=s(Y/Y_n)^n-d$ $(Y_n=100, Y_u=11, s=134,6, n=0,31, d=19,2)$[1a]
$L^*=r(Y/Y_u)^n-d$ $(r=s(Y_u/Y_n)^n=79,10, L^*_u=r-d=59,8)$ [1b]
$Y/dY=Y/\{[(Y_n/(ns))(Y/Y_n)^{1-n}]\}$ [4c]
$(Y/Y)_u=Y_u/\{[(Y_n/(ns))(Y_u/Y_n)^{1-n}]\}$ [4d]
$(Y/dY)/(Y/dY)_u=(Y/Y_u)^n$ [4e]

1,942
$L^*_{TUB}/L^*_{TUB,u}$ =$(Y/Y)_u^{1/ln(10)}$
$\varphi=120'$
$L_{aw}=40cd/m^2$
application range
$m_{u90\_4}=0,279, f_{90}=40, f_4=16$
$m_u=0,679$ 1,031 0,465
0,1 1 10 $Y_u=18$ 100
$Y_u=11$ log Y
heo81−8a

TUB-test chart heo8; HAULAB, adaptation W Lwu=300, 1000, 200, 40, Haubner (1980) & equations
lin[lightness L^*, threshold ΔY, sensitivity $\Delta Y/Y$, contrast $Y/\Delta Y$, normalized for grey U]