External Quantum Efficiency, $\mathrm{EQE} = \frac{Number\ of\ Photons\ emitted\ from\ the\ surface\ of\ the\ device}{Number\ of\ electron\ injected\ into\ the\ device}$ ………… (1)

We have optical power, $P = \frac{I_{photo}}{R_{det}}$ ………………… (2)

Where, I_{photo} is the photo current

R_{det}, responsivity of the photodiode given by the expression

$$R\mathrm{det} = \frac{\int I_{EL}(\lambda)R(\lambda)d\lambda}{\int I_{EL}(\lambda)d\lambda}\ (A/W)$$

I_{EL} is the emission spectra of the OLED

R is the response of the photodiode at a given wavelength

Number of photons, $Nphoto = \frac{P}{Ephoto}$ ………………… (3)

Where, E_{photo}, the average photon energy

$$Ephoto = \frac{\int E(\lambda)I_{EL}(\lambda)d\lambda}{\int I_{EL}(\lambda)d\lambda}$$

Responsivity of the eye, $\Phi = \frac{\int I_{EL}(\lambda)P(\lambda)d\lambda}{\int I_{EL}(\lambda)d\lambda}$ (lm/W), where P(λ) (lm/W) is the photopic response.

Brightness, $B = \left(\frac{\Phi}{R_{det}}\right) I_{photo}$ lm

Where, $R_{det} = \frac{\int I_{EL}(\lambda)R(\lambda)d\lambda}{\int I_{EL}(\lambda)d\lambda}$ A/W

I_{EL} (λ) is the EL spectrum and R (λ) is taken from the calibration curve (A/W) of the Si detector as supplied by the manufacturer.

Number of electrons injected, $n_e = \frac{i_d}{q}$ .... (4)

where, i_d – Current through the device at a given voltage V
q – charge of the carrier

Using eqns. 1,2,3 & 4,
External quantum efficiency,

$$EQE = \frac{q\ Iphoto_{\text{郗}}\lambda\ IE\mathrm{L}(\lambda)d\lambda hc\ idIE\mathrm{L}\lambda\ R\mathrm{det}\lambda\ d\lambda}{\times 100 \qquad (\%)}$$

where, I_{photo} – Photocurrent at given voltage V
I_{EL} – Spectral emission of the device at a given voltage V
R_{det} – Photodiode responsivity
λ – Wavelength