Signal to noise ratio

Signal:-

The signal is the response of an analyte produced by the detector.

The higher the response, the greater the signal.

Noise:-

Noise is the unavoidable disturbances produced by the base line within the chromatogram

Signal to noise ratio:-

Signal to Noise ratio is the detector signal to the disturbances produced within the chromatogram.

Signal to noise ratio is calculated by using the formulae

$$\text{Signal to Noise ratio} = 2H/h$$

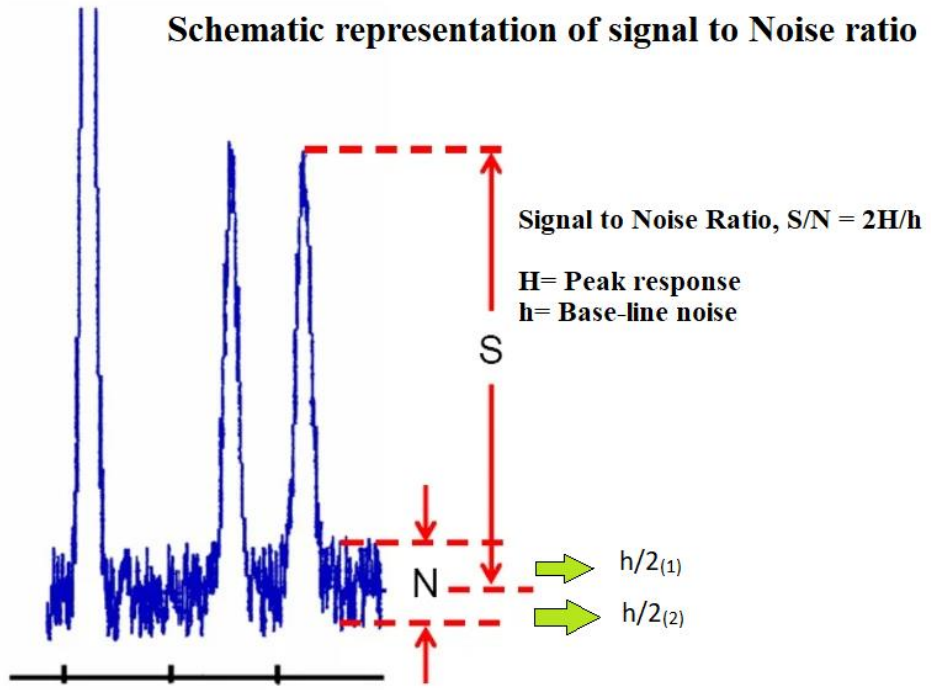
Where,

H = Peak Height

h = Noise of the base line.

Determination of s/n ratio:

Consider the analyte has shown a sufficient amount of response for the given concentration,



Where S = Height of the peak response (signal) and

N = height of the base-line (noise).

If the height of the base line noise can be taken into two halves by dividing them, where the first half of the base line is showing interference with the peak response and below half of the noise of the base-line is not interfered with the response of the peak.

Now, we could write an equation,

Height of the base line noise (N) = $h/2_{(1)} + h/2_{(2)}$

Where,

$h/2_{(1)}$ = Height of the baseline interfere with the peak response.

$h/2_{(2)}$ = Height of the baseline that has no interference with the peak response.

As the $h/2_{(2)}$ shows no effect with the peak response, we could nullify the effect of particular height of the base line noise.

Therefore,

Height of the base line noise (N) = $h/2_{(1)} + h/2_{(2)}$ could be written as

$$(N) = h/2_{(1)} + 0$$

Summation of above formulae results, $(N) = h/2_{(1)}$

By simplification, we could write (N) = h/2

Applying signal to noise ratio, Signal/Noise

$$S/N = (H)/(h/2)$$

By simplification, S/N = 2H/h

The determination of the Signal to noise ratio can be done as shown above.

Significance: -

Signal to Noise ratio determines the Limit of Detection and Limit of Quantification of the analyte (main substances and Impurities).

As per ICH guidelines, the signal to noise ratio for the given analyte (main peak or the impurity)

- Limit of Detection (LOD) is 3 :1
- Limit od Quantification (LOQ) is 10:1