

Advantech AE Technical Share Document

Date	2021/7/9	Release Note	<input type="checkbox"/> Internal <input checked="" type="checkbox"/> External
Category	<input checked="" type="checkbox"/> FAQ <input type="checkbox"/> SOP	Related OS	
Abstract	How to calculate the bandwidth requirement of a camera?		
Keyword	GigE, USB, camera, bandwidth, framerate, resolution		
Related Product	PCIE-1672, PCIE-1674, PCIE-1154, QUARTZ		

■ **Problem Description:**

How do I determine the bandwidth of a camera running at the given framerate and resolution?

■ **Brief Solution - Step by Step:**

1. Find out the image resolution (width and height in pixels) and framerate (fps) information of the camera. If not manually set, a camera is typically operating at its native resolution and maximum framerate.
2. Find out the image bit depth information. There are Mono8/10/12 formats for gray scale images and Bayer8/10/12, RGB8, packed YUV and so on for color images. Each format has different bit depth, meaning the number of bits used to indicate the color/grayscale of a pixel is different. For example, a Mono8 image allows $2^8 = 256$ different intensities (grayscale) in a pixel.

3. Plug in the numbers in the following equation:

$$\text{Bandwidth (bit/s)} = \text{image width (pixel)} \times \text{image height (pixel)} \times \text{framerate (fps)} \times \text{bit depth}$$

Common Pixel Format:

- Mono8, bit depth = 8
- Mono10, bit depth = 10
- Bayer8, bit depth = 8
- RGB8, bit depth = 24
- YUV, bit depth = 24
- YCbCr, bit depth = 24

4. For example, if I am using a QCAM-GM1600-060DE camera.

Resolution: 1600 (width) x 1200 (height)

Framerate: 60 fps

Image format: Mono8

Bandwidth = $1600 \times 1200 \times 60 \times 8 = 921,600,000$ (bits/s) = $115,200,000$ (Bytes/s) = 109.86 (MB/s)

If using a QCAM-UC0640-750CE camera.

Resolution: 640 (width) x 480 (height)

Framerate: 750 fps

Image format: Bayer BG8

Bandwidth = $640 \times 480 \times 750 \times 8 = 1,843,200,000$ (bits/s) = $230,400,000$ (Bytes/s) = 219.72 (MB/s)

5. Theoretical bandwidth of GigE interface: 1 Gbps = 125,000,000 Bytes/s = 119.21 MB/s,
bandwidth of USB3 Vision interface: 5 Gbps = 625,000,000 Bytes/s = 596.04 MB/s

■ **Reference:**