

# Test Your CCTV Lens Quality

Lens quality and lens adjustment are probably some of the most important factors to ensure you obtain a good quality CCTV image yet both are probably the most overlooked factors by many consultants, installers and end users. So, how do you avoid poor quality images due to your lenses?

Several years ago I wrote a CCTV lens article for SE&N titled "Glass, Plastic or Coke Bottles" which caused a stir with some CCTV lens manufacturers. More recently, in an article titled "Megapixels and Image Quality", I voiced concern about the quality of some lenses being used on megapixel cameras.

It is unfortunate that some in the CCTV/security industry forget that the first port of call for any CCTV camera image is the lens. The lens quality and lens set up can be the weakest link in a CCTV system. It does not matter if it is an analogue camera, a HD, or a megapixel camera, a low quality and badly set-up lens equals a poor quality image.

In this article I will mention some of the reasons that lenses reduce the quality of a CCTV image. My

comments will be made taking dome optical distortions, dirty domes, dirty lenses, cobwebs, dirty camera housing face plates and high, or extreme, video compression out of the equation.

I will also suggest some camera test charts which will help you evaluate camera/lens "sharpness" and please note the word "resolution" in this article will be related to camera pixel count.

CCTV camera technology and CCTV camera quality has improved over the past few years, but it appears that lens quality has dropped (notwithstanding some new megapixel lenses), this loss of quality is basically due to some new players in the lens industry not understanding lens technology and a few old lens manufacturers who have allowed their quality to be reduced as they cater to the cost driven low quality sector of the CCTV/security market.

It has been known for some time that normal CCTV lens sharpness varies between 350 TVL and 480 TVL (there are a few variations). In basic terms the higher sharpness is about half the resolution

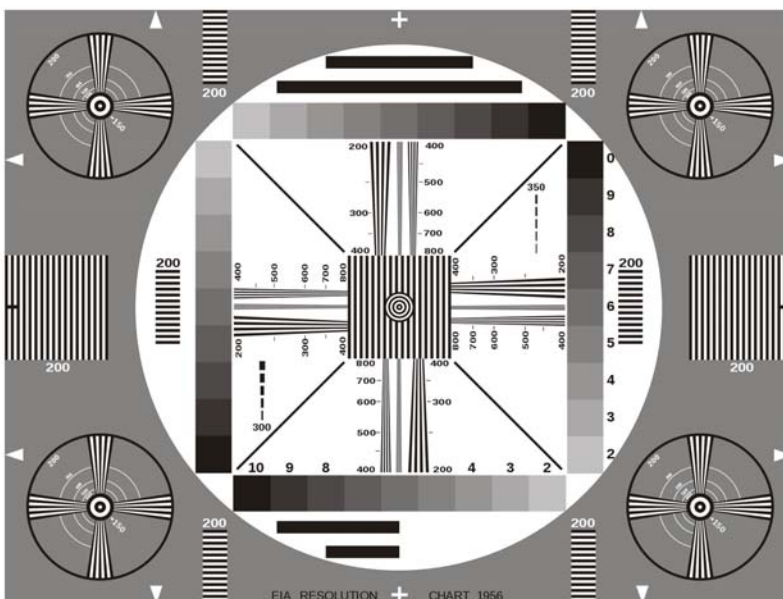
you would expect from a 1.5 megapixel camera. So, you don't have to be Einstein to realise that standard CCTV lenses are not an option if you want performance equal to the megapixels you have purchased.

Unfortunately, many purveyors of megapixel cameras are selling "pixels", not "image quality". They may, or may not, be aware of lens and camera quality issues. So buyer, beware!

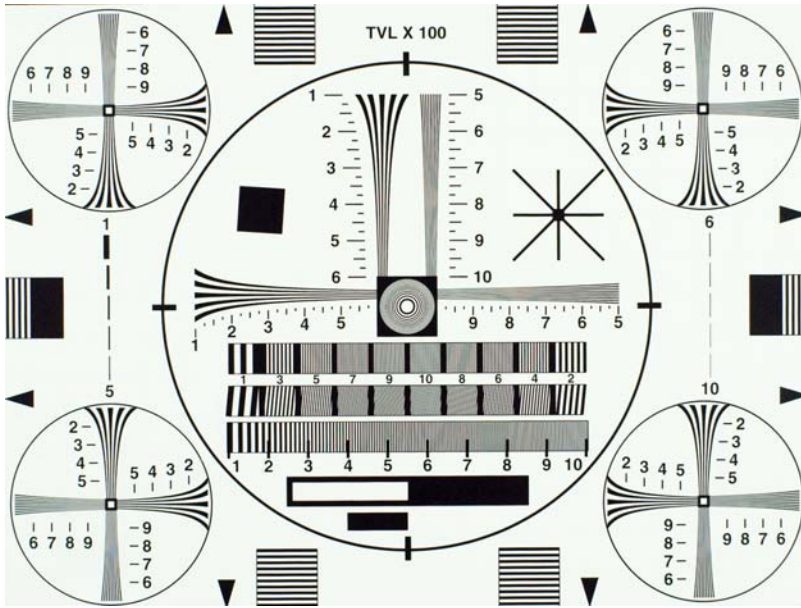
The major CCTV lens manufacturers are now supplying megapixel lenses but in some cases they are not stating how many megapixels a particular lens is manufactured for. There would be a great difference in the quality of a lens manufactured for 1.5 megapixel cameras and a lens manufactured for 5 megapixel cameras. The major CCTV lens manufacturers might be a reasonable place to start, but make sure you know how many megapixels the lens is actually manufactured for. Reputable megapixel camera brands with built in megapixel lenses can also be considered a reasonable place to start.

In some cases instead of testing the camera we are actually testing the lens because some lenses are of such poor quality they mask a CCTV camera's performance. If this is the case you might ask why spend big dollars on high resolution cameras? Well there are still good lens manufacturers out there and I suggest that when you perform a camera shoot out you also carry out a camera/proposed lens combination shoot out. You will be amazed at the difference a good quality and correctly set up lens can make when combined with a high performance CCTV camera.

When we are asked to test a camera for a client we ask if they wish to actually test the camera, or the camera/lens combination, as the results can be vastly different. Up until recently we used a few trusty glass lenses from "real lens manufacturers", but even with these lenses we were not sure if we were



EIA resolution chart which many 4:3 aspect ratio television test charts originated from.



IEEE resolution test chart is a relative newcomer, but with 1000 TVL.

for a "CCTV camera". With this in mind we purchased a Schneider Cinegon 8 mm f1.4 Manual Iris lens which is a very high quality C mount lens for use with high quality analogue cameras.

Tests have shown that standard analogue cameras are impacted by the use of some low quality lenses. If this concerns you, it might frighten you when you see some consultants specify, and some contractors install, these same low quality lenses on a 1.5, or higher, megapixel CCTV camera, or even use a supplied integrated lens on a 1.5, or higher, megapixel CCTV camera which has not been manufactured by a recognised lens manufacturer. It is of no use at all to use a 1.5, or higher, megapixel CCTV camera and then use a lens which does not perform at least equally, or better than the camera resolution.

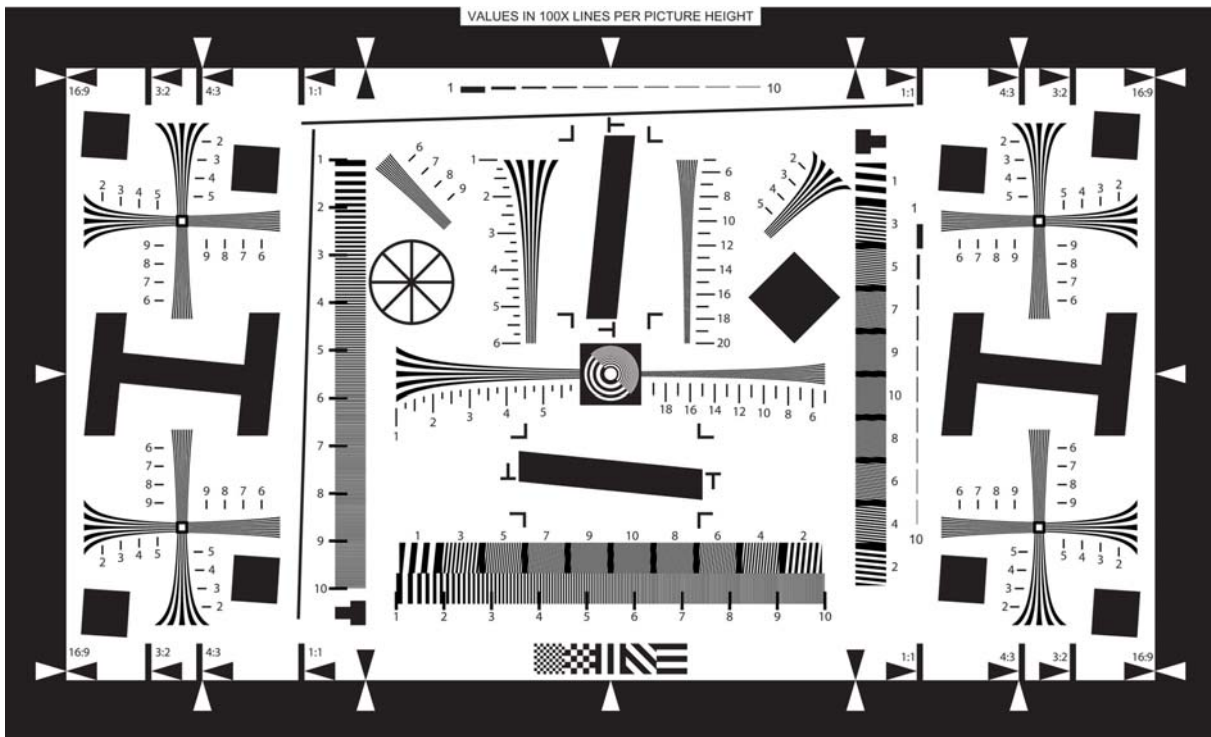
testing the camera or the camera/lens combination. As it turns out we were fairly close.

But close isn't good enough when you might be testing cameras for a CCTV system with camera quantities in the hundreds or thousands. Suppliers and manufacturers are not known for their benevolence towards those who recommend against their cameras or other CCTV products so you need accu-

rate test results and plenty of armour. Also, it is not fair to suppliers and manufacturers to eliminate a camera from a test if you have any doubt about the quality and/or calibration of your own test lens, or test equipment.

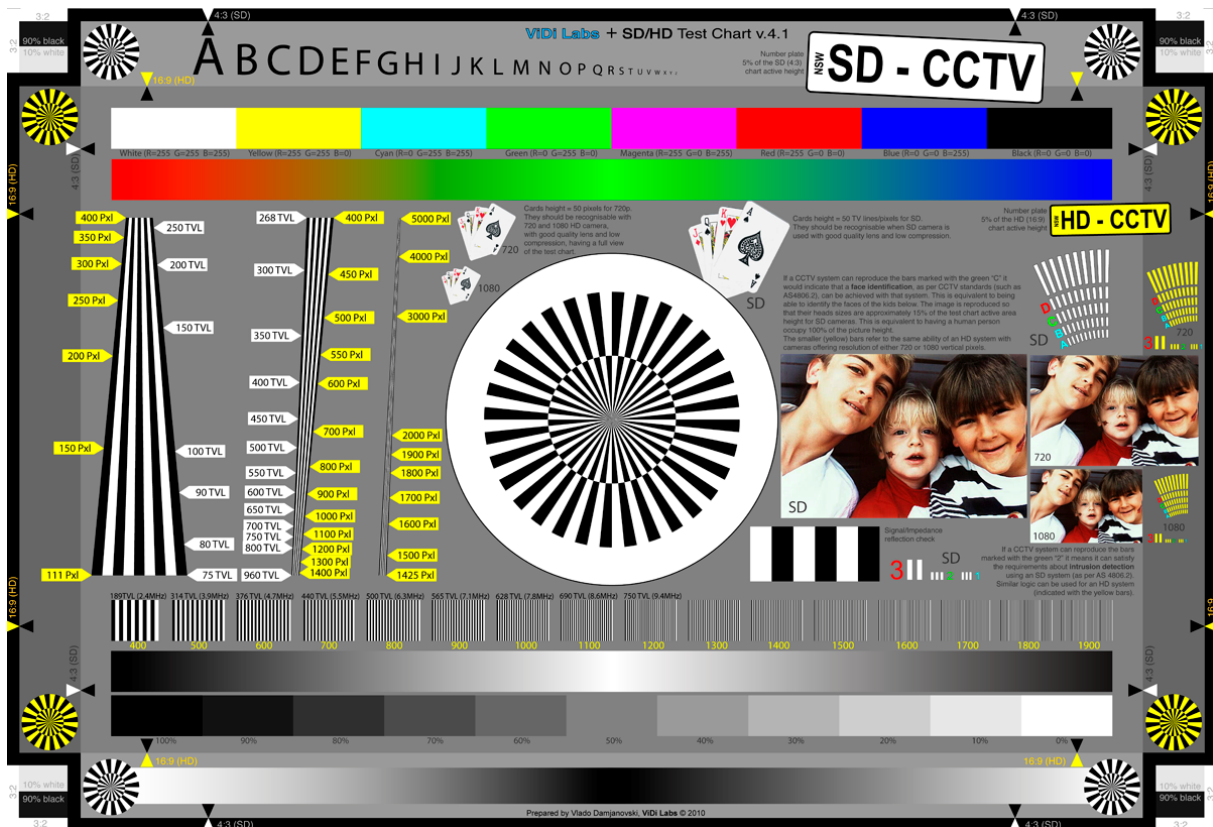
A number of years ago we searched for test lenses that would be transparent to camera performance and allow us to truly say these are the performance results

So where to from here? Maybe it is time for you to take some control yourself! Why not obtain a good quality camera test chart and subjectively evaluate various camera/lens combinations yourself? There are some very complex formulae behind optics, but these formulae are not a factor when you carry out basic subjective tests with a good quality test chart and your eyes. You will be surprised with



Drawn by Stephen H. Westin ©Cornell University This test chart is for use with ISO 12233 Photography - Electronic still picture cameras - Resolution measurements Chart Serial No. \_\_\_\_\_ Printed by \_\_\_\_\_

ISO 12233 test chart which has been made for electronic still imaging cameras and can be used for all electronic imaging devices.



The latest ViDi Labs test chart is suitable for SD, HD and Megapixel CCTV camera sharpness testing and much more.

the outcomes with an honest and commonsense approach.

For many years television camera sharpness has been evaluated by the 4:3 aspect ratio EIA Resolution (Sharpness) test chart and variations of it, such as the RETMA and Esser Universal test charts. It has horizontal and vertical sharpness up to 800 TVL and while there are still 4:3 aspect ratio cameras around there will be camera test charts similar to these available.

A recent newcomer is the IEEE Resolution Test Chart, it has horizontal and vertical sharpness up to 1000 TVL and while there are still 4:3 aspect ratio cameras around there will be camera test charts similar to this available.

The ISO standard for measuring resolution (sharpness) of "electronic still imaging" cameras is 12233, it is available from the International Standards Organization and under copyright protection, but the design of the test chart does not appear to be protected; its description has been available on the web for sometime. Even though this test chart has been made for electronic still imaging cameras it can be used for

all electronic imaging devices, including video, in the commonly used aspect ratios of 4:3, 16:9 and 3:2. It has a horizontal and vertical sharpness up to 1000 TVL.

The latest ViDi Labs test chart is developed specifically for the CCTV industry for both Standard Definition (SD) and High Definition (HD) testing. It is suitable for SD, HD and megapixel cameras with aspect ratios 4:3, 16:9 and 3:2. It has a SD horizontal sharpness of 960 TVL and a HD resolution of up to 5000 pixels. The chart is self explanatory, it has many other important CCTV features, is easy to use and comes with a detailed instruction manual. Available from <http://www.vidilabs.com/>.

If possible try and comply with the following basic EN61146.1 standards for shooting reflective camera test charts:

The subject illumination of a reflective test chart shall be 2000 lux +/- 5%.

The non-uniformity of the subject illumination shall be less than 5%.

The correlated colour temperature of the light source shall be 3100 K

+/- 100 K.

The camera white balance shall be set manually or automatically to 3100 K +/- 100 K. The test chart shall be shot by the camera so that the frame limited by the arrows coincides exactly with the edges of the picture displayed on the video monitor in under-scan mode.

The focus control shall be in auto or manual mode, and shall be set for optimal focus.

Have fun with your test charts.

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