CCTV Labs

Test Chart

v.1.3

Instructions

for

setup and usage

Produced by

Please handle your Test Chart with care.

The CCTV Labs Test Chart was designed primarily for indoor use,

and although it can be used outside,

please avoid direct exposure to water, rain and snow,

as well as long periods of exposure to direct sunlight.

Although the CCTV Labs Test Chart has been designed

specifically for the CCTV Industry,

it can be used to verify the quality of other visual,

transmission and recording systems.

CCTV Labs Pty. Ltd. has designed this chart with the best intentions to offer an objective and independent measurement of various video signal characteristics, and although all the details are as accurate as we can make them, we do not take any responsibility for any damage or loss resulting from the use of the chart.

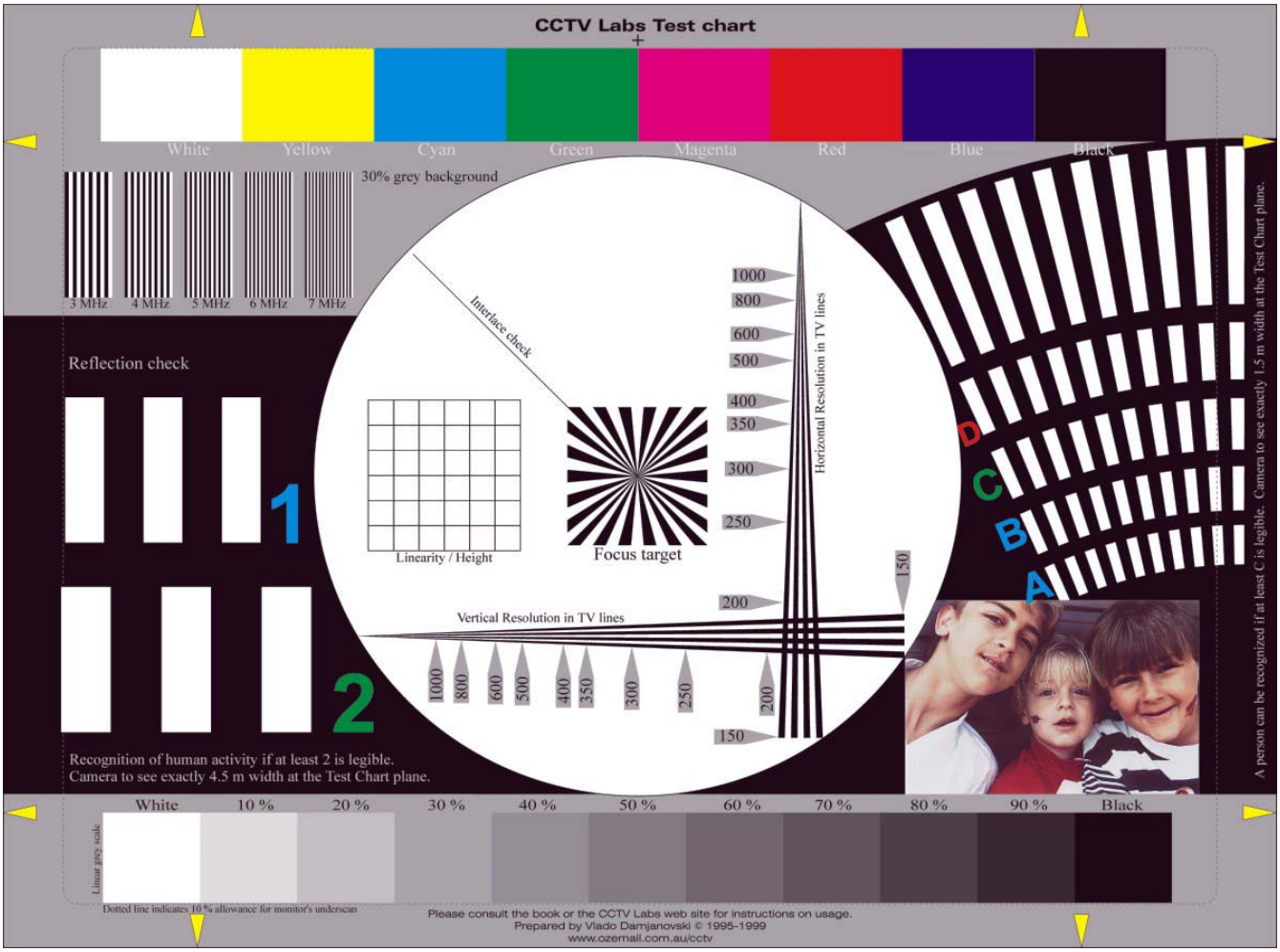
The CCTV Test Chart

In order to help you determine your camera resolution, as well as check other video details, CCTV Labs Pty. Ltd. has designed this special test chart in A3 format, which also appears on the back cover of the book “CCTV” by Vlado Damjanovski.

We have tried to make it as accurate and informative as possible and although it can be used in the broadcast applications it should not be taken as a substitute for the various broadcast test charts. It should be used for CCTV applications only and as a guide in comparing different equipment and/or transmission media.

This test chart has been updated with some new features compared to the previous edition. This addition refers primarily to the white lines which will allow you to check whether you can recognize a person at a certain distance. This procedure is based on the recommendations of VBG (Verwaltungs-Berufsgenossenschaft): Installationshinweise für Optische Raumüberwachungs-anlagen (ORÜA) SP 9.7/5.

With this chart you can check a lot of other details of a video signal, primarily the resolution, but also bandwidth, monitor linearity, gamma, color reproduction, impedance matching, reflection and digital recorders picture quality at various compression levels.



Before you start testing

For the best quality picture reproduction of your camera you first have to select a very good lens (that has much better resolution than the CCD chip itself). In order to be able to control the optical resolution of the lens, the best choice would be a fixed focal length manual iris lens.

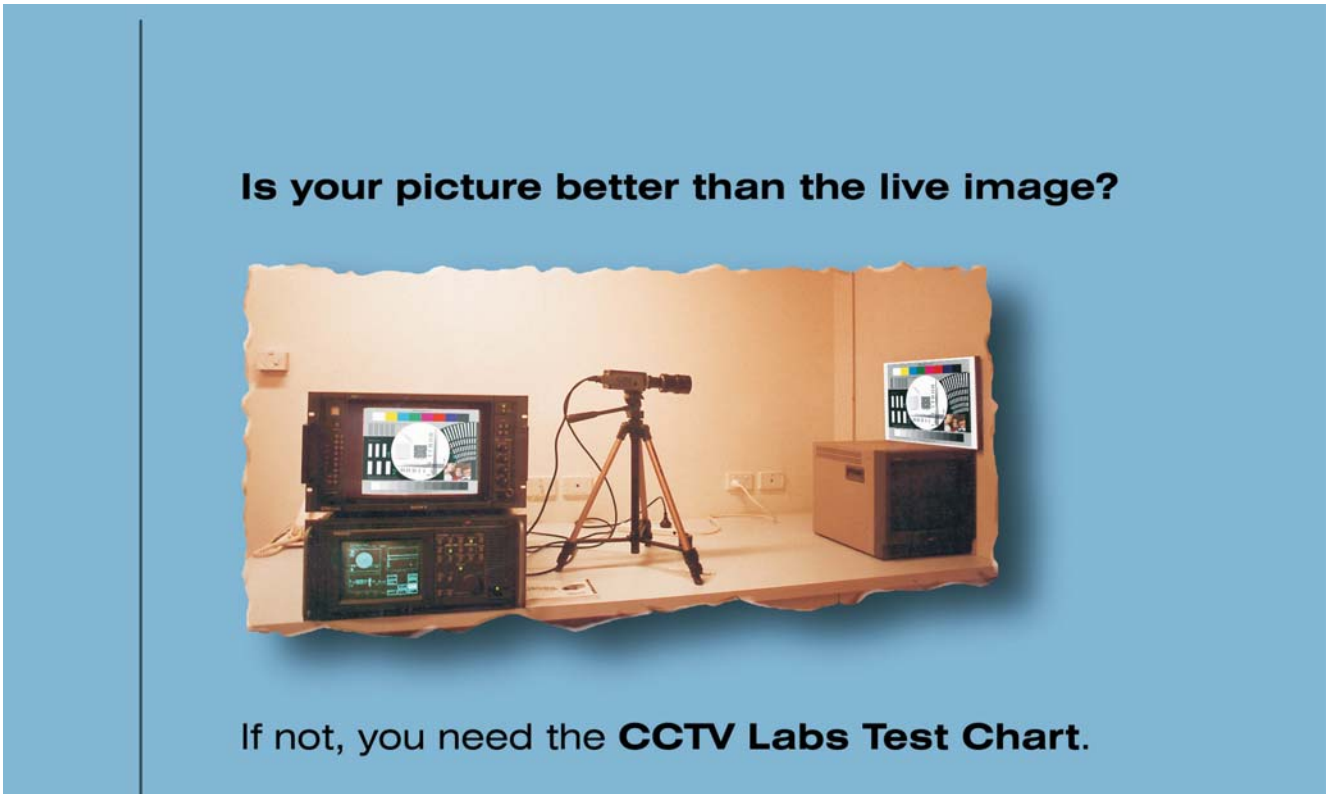
Shorter focal lengths, showing angles of view wider than 30°, should usually be avoided because of the spherical image distortion they may introduce. A good choice for 1/2" CCD cameras would be an 8 mm, 12 mm, 16 mm, or 25 mm lens. For 1/3" CCD cameras a good choice would be when 6mm, 8mm, 12mm or 16mm lens is used.

The longer focal length will force you to position the camera further away from the test chart. For this purpose it is recommended that you get a photographic tripod for the camera.

Next, you must use a high resolution monitor with an underscan feature. Most standard CCTV monitors don't have this feature, but there are brands that have it.

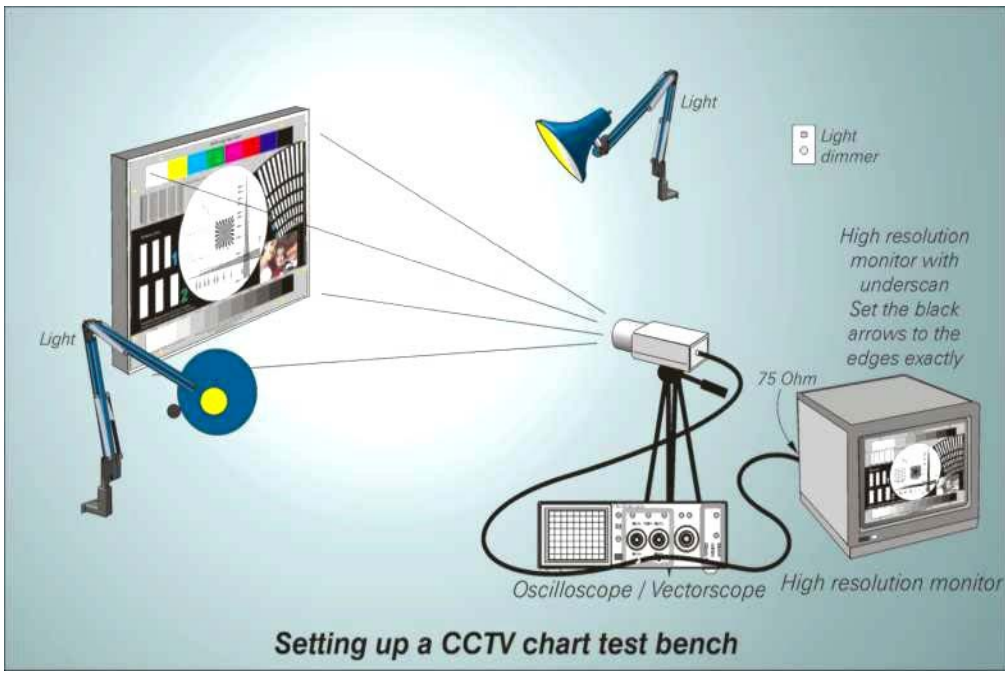
When testing camera resolution the best choice would be a high quality monochrome (B/W) monitor since their resolution reaches 1000 TV lines in the center.

Color monitors are acceptable only if they are of broadcast, or near-broadcast, quality. To qualify for this, a monitor should have at least 500 TV lines of horizontal resolution. Understandably, B/W cameras having over 500 TV lines of horizontal resolution cannot have their resolution tested with such a monitor, but the majority of color cameras (which have up to 480 TV lines) should be OK for testing with such a monitor.



Setup procedure

Position the chart horizontally and perpendicular to the optical axis of the lens (see the diagram on the next page). The camera has to see a full image of the chart exactly to the yellow triangular arrows. To see this you must switch the monitor to the underscan position so you can see 100% of the image.



Setting up a CCTV chart test bench

If you do not have a monitor with an underscanning feature the dotted line around the perimeter of the chart indicates 10% narrower view, which might be close to what a normal overscanning monitor would show. This is, however, not precise for checking resolution. So, if you only have a standard monitor, the following little trick might substitute the more expensive underscanning monitor:

Position the camera with its tripod as closely to displaying the full image as possible. Set the vertical hold on the monitor in such a position to view the vertical blanking sync signal (the horizontal black bar in between TV fields). You should be able to set the V-hold button to such a position to have a steady horizontal bar somewhere in the middle of the screen. Then, try to adjust the camera with its tripod and/or lens so you can see both the top and bottom positional triangles on the test chart touching the edge of the black vertical blanking bar. Once you adjust the vertical camera position it is easy to adjust the horizontal so the test chart picture is in the middle of the monitor screen. Then, and only then, can you read precise data from the test chart.

Illuminate the chart with two diffused lights on both sides, while trying to avoid light reflection off the chart. It would be an advantage to have

these two lights controlled by a light dimmer, because then, you can also test the camera's minimum illumination. Naturally, if this needs to be tested, this whole operation would need to be conducted in a room without any additional light. Also, if you want to check the low light level performance of your camera you would need to obtain a precise lux-meter.

When using colour camera, please note that the camera needs to be switched on after the lights have been turned on, so that the colour white balance circuit detects its white point.

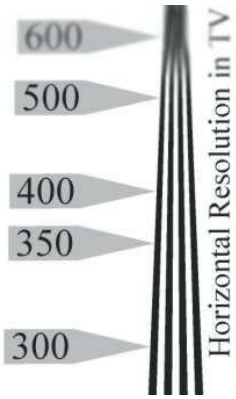
Position the camera on a tripod, or a fixed bracket, at a distance which will allow you to see a sharp image of the full test chart. The best focus sharpness can be achieved by seeing the centre of the "Focus target" section. Make sure the yellow arrows' tips touch the underscanned picture edge or the black vertical sync bar, if you are using the alternative method described above.

Set the lens' iris to the middle position (F/5.6 or F/8) as this is the best optical resolution in most lenses and then adjust the light dimmer to get a full dynamic range video signal. In order to see this, an oscilloscope will be necessary.

Don't forget to switch off all the video processing circuits in the camera you are testing, i.e., AGC, CCD-iris, BLC.

Make sure that all the impedances are matched, i.e., the camera sees 75 Ohms at the end of the coaxial line.

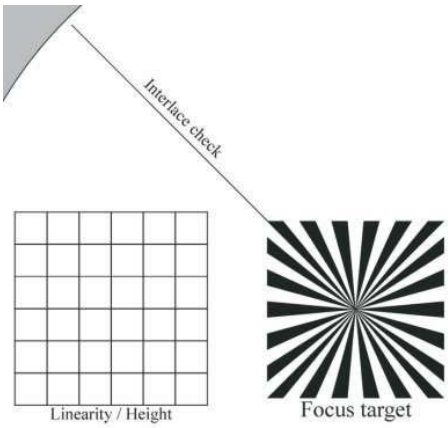
What you can test



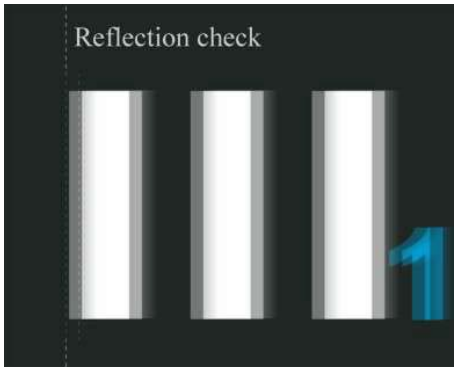
To check the camera resolution (either vertical or horizontal) you have to determine the point at which the four sharp triangular lines inside the circle converge into three. That is the point where the resolution limits can be read off the chart. The example on the right shows a horizontal resolution of approximately 550 TV lines. For a more precise reading of the horizontal resolution, as per the broadcast definition, you would need an oscilloscope with a line selection feature.

If you want to check the video bandwidth of the signal, read the megahertz number next to the finest group of lines where black and white lines are distinguishable.

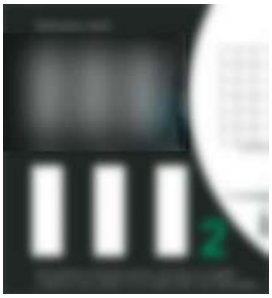
The small concentric lines in the center square of the test chart can be used for easy focusing and/or back-focus adjustments. Prior to doing this, you should check the exact distance between the camera and the test chart. In most cases, the distance should be measured to the plane where the CCD chip resides. Some lenses though, may have the indicator of the distance referring to the front part of the lens.



The circle reproduction below will show you the linearity of your monitor only, since CCD cameras have no geometrical distortion by design. Sometimes, linearity can be more easily checked by measuring the vertical and horizontal length of the 6 × 6 squares, left of the focus square.



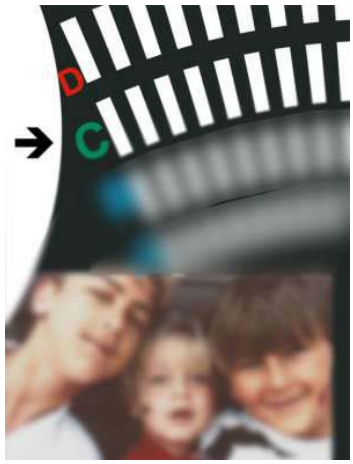
The wide black and white bars on the left-hand side have twofold function. Firstly, they will show you if your impedances are matched properly or if you have signal reflection, i.e., if you have a spillage of the white into the black area (and the other way around), which is a sign of reflections from the end of the line. The same can be used to test long cable run quality, VCR playback and other transmission or reproduction media.



Secondly, you can determine whether your camera/lens combination gives sufficient details to recognize human activity, such as intrusion or holdup. For this reason you must position the camera at such a distance to see 3 m width at the test chart plane. If you can distinguish the bars, then your camera/lens combination is good for recognizing activity. Obviously, reading bars at number 1 is better than number 2. Use one of the

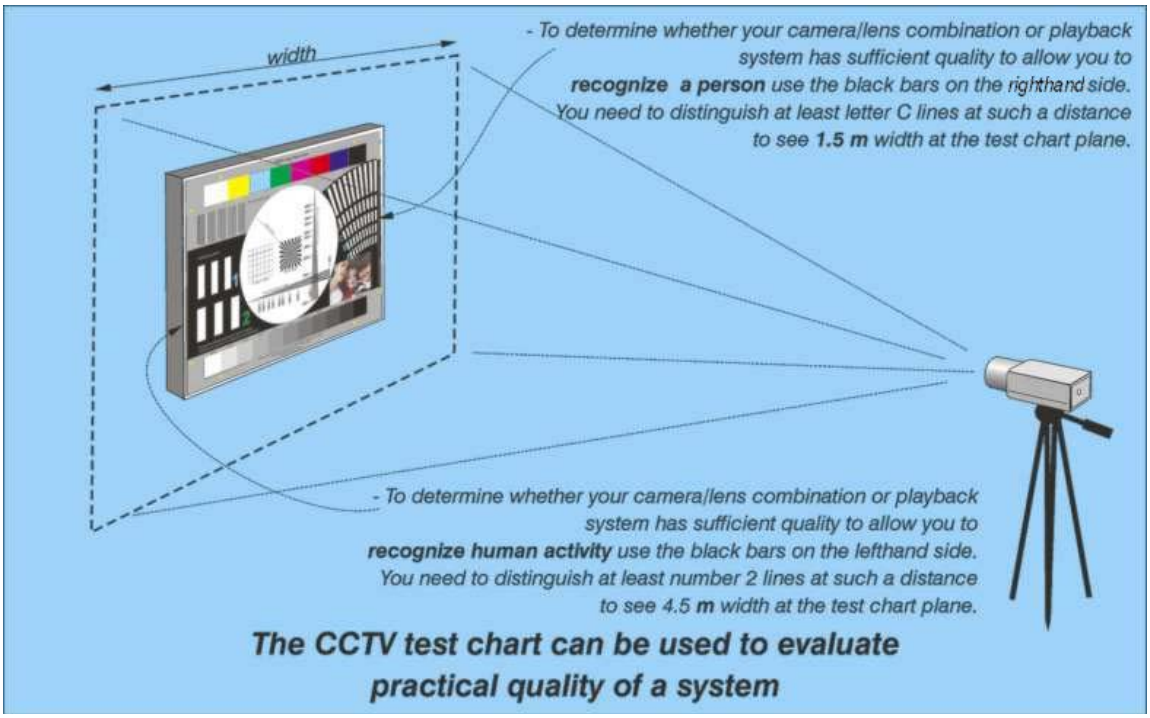
formulas described under the focal length section to find out the distance you have to go to with the lens you have.

The white tilted bars on the right-hand side have a similar purpose as the thicker ones on the left-hand side. If you recognize the lines near the green letter C, or even better B and A when the camera is at a distance to see 1 m width at the chart, then you can recognize a person at such a distance. A is better than B, which is better than C. Again, to find out at what distance you need to position the camera so as to see 1 meter width, use the same formula mentioned earlier. This test can be very useful to find out if your camera/lens combination gives sufficient details. Such measurement is even more informative in determining the playback quality of a digital video recorder since there is no objective method of determining compression/decompression quality in CCTV.

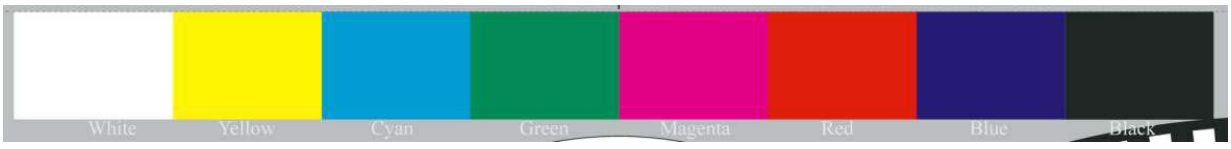


The color picture of the three kids will give you a good indication of the color of human flesh, so if you are using a color camera you can check the light source color temperature and the automatic white balance of the camera, if any. Have in mind in that case to take into account the color temperature of your light source, which, in the case of tungsten globes, is 2800° K.

For an even more accurate color test of your camera, use the color scale on the top of the chart, which are printed colors matching the color bars produced by a typical broadcast test gen-

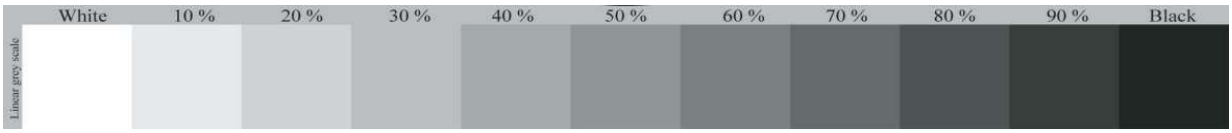


erator. If you have a vectorscope you can check the color output on one of the lines scanning the color bar. Like with any color reproduction system, the color temperature of the source is very



important and in most cases it should be a daylight source.

The gray background is set to be exactly 30% gray, which, together with the gray scale at the



bottom, can be used to check the gamma setting of the camera/monitor. This gray scale is a linear one, as opposed to some logarithmic scales you may find. The reason for choosing a linear scale is the fact that the majority of today's cameras are with linear response and this makes it easy to adjust various levels on an oscilloscope. The gray scale can also be used to set up the optimum contrast/brightness of a monitor.

To have the best possible picture setting on a monitor follow these steps:

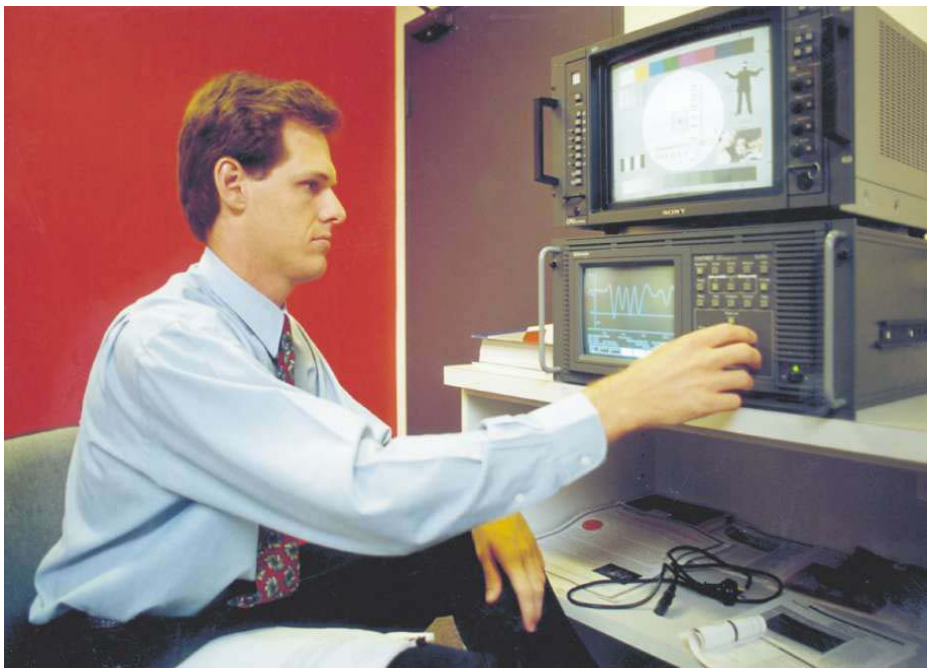
- Set the camera to 1 Vpp video signal, while viewing the full image of the CCTV Labs test chart.

- Set the monitor contrast pot in the middle position.

- Set the brightness pot to see all steps of the gray scale. While doing this, readjust the contrast pot if necessary.

- Observe and note the light conditions in the room while setting this up, as this dictates the contrast/brightness setting combination.

- Always use minimum amount of light in the monitor room so that you can set the monitor brightness pot at the lowest position. When this is the case the sharpness of the electron beam of the monitor's CRT is maximum since it uses less electrons. The monitor picture is then, not only sharper, but the lifetime expectancy of the phosphor would be prolonged.



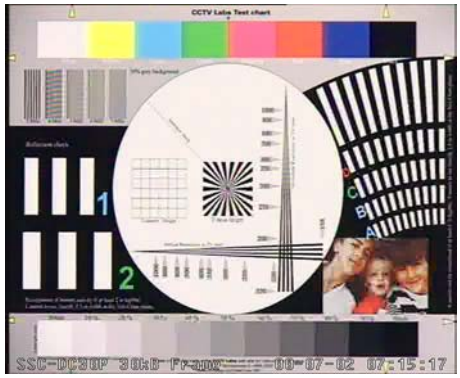
Measurement of the digital image compression quality

The CCTV Labs test Chart can also be used to determine and compare the quality of various digital compression techniques.

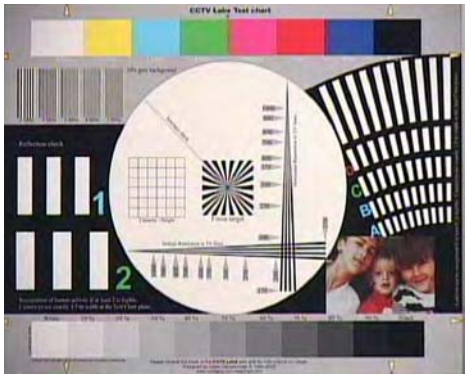
To do this, set up a camera to see 100% of the test Chart (use underscanning monitor). Adjust the camera and lens parameters to produce best quality picture (1Vpp video signal, focus adjusted on the "Focus Target", lens iris at the middle setting).

Record the video signal on the (digital) recording equipment and then play it back and export a selected image of the full test chart. When exporting, select BMP format for maximum picture quality (BMP does not compress, in addition to the compression used in the recorder). Copy the file(s) onto a PC and open them with Photo Editing software (Photo Shop, Photo Paint and alike). Open all the images that you want to compare and select full screen display. Switch between various compressions, and images using "Ctrl-Tab" for easiest comparison.

Various compression schemes have various compression artefacts. JPG for example produces blockiness in 8X8 pixels block sizes, while Wavelet smears the low detail areas. The children faces in the Test Chart is the area where compression quality can be determined easier. Other parts of the chart however, will give you other valuable details about a certain picture quality, resulted from the recording/compression quality. This can only be learned by experimenting.



JPG example (30kB)



Wavelet example (30kB)