F23 HyperGamma Curves Analysis

by Alfonso Parra AEC

The HyperGamma curves we study here are the four Sony developed for the F23 camera. The common characteristic to all of them is that they provide a wider dynamic range comparing to the standard video curves, better preserving detail in highlights and shadows. There must be taken into account that these curves need some work in the grading process because they don't have a linear response.

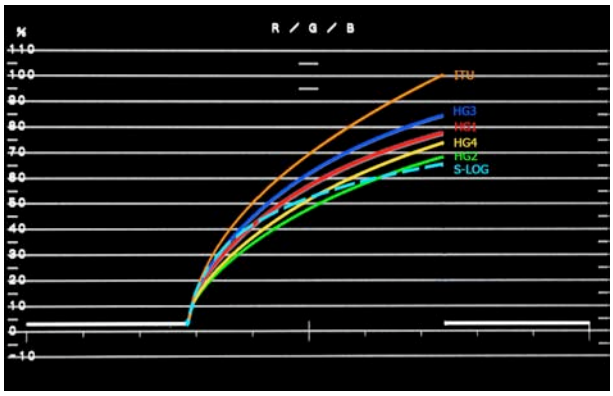
For the test we shot a translucent ESSER gray Test Chart 223 (Contrast Ratio 200:1) mounted on a light sphere LV5 with the four curves at the same T stop. We used the Imatest software capturing a Stouffer Transmission Step Wedge T4110. We also recorded a still life scene with different elements and a DSC Labs Chart , also at the same T stop for all curves.

For the DSC Labs and the grey scale Charts we recorded on the SRW-1 mounted on camera, HDCAM SR format, 4:4:4 SQ mode in RGB and 10bits. The images were post produced in Evasion, captured from a Sony SRW-1+SRPC-1 in RGB, dual link 4:4:4 SQ output via a CVS Centaurus card. The video images are converted to data, DPX format 10 bits. The data is stored locally in Baselight, where we proceeded to analyze the images.

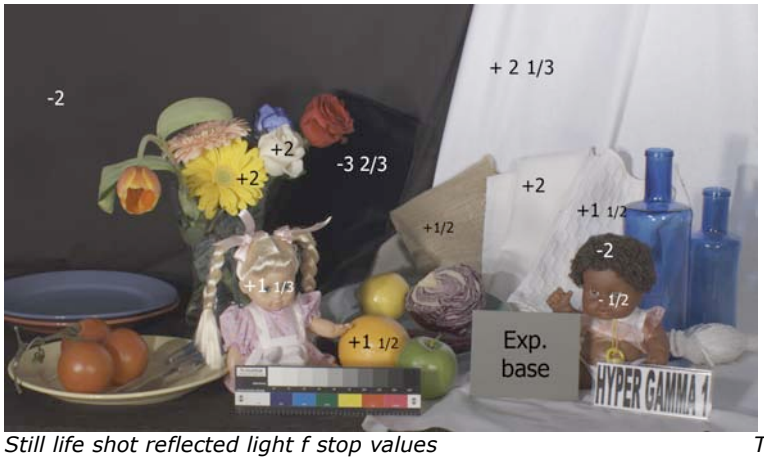
The Stouffer Wedge was recorded correcting the T stop for each curve in order to obtain the best dynamic range possible, this is, adjusting the white (1) at the highest point before the clip. The frames were captured via a Cinetal Cinemage monitor in Tiff format.

For adjusting the light and evaluation of the recorded images we used a waveform vectorscope Astro WM-3208 and a Cinetal Cinemage monitor with 4:4:4 waveform monitor incorporated. We also used a Sekonic L-558/Cine and the Minolta color meter IIIF, all of them suitably calibrated.

As we see on the image on the right we can divide the curves into 2 groups, the ones that enhance the middle tones and the ones that give more latitude. Curves 1 and 3 belong to the first group and curves 2 and 4 to the second one.



We also show the ITU standard curve as well as the S-Log. We can observe the ITU curve reaches the 100% white level while the rest of the curves reach different lower values, been the S-Log the lowest one.



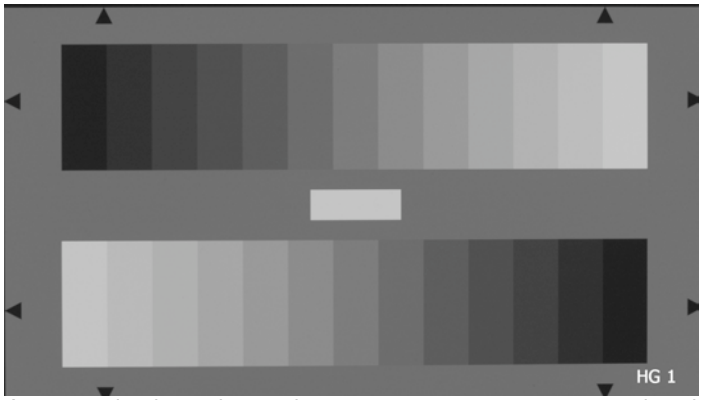
Still life shot reflected light f stop values

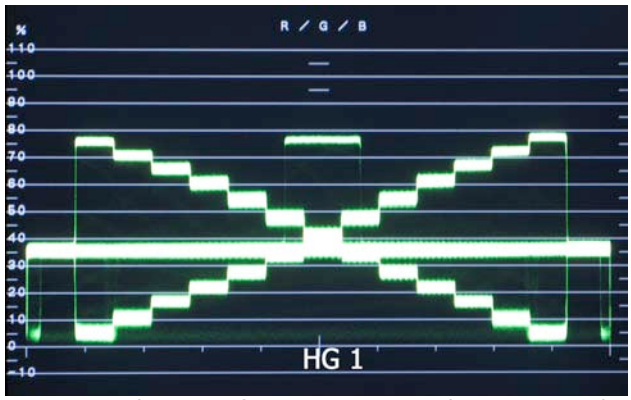
Test room at Info Tv during Still Life shots. In the picture, Ramiro Sabell, First Assistant Camera

Let's see now the curves one by one and then we'll compare them.

HyperGamma 1 curve

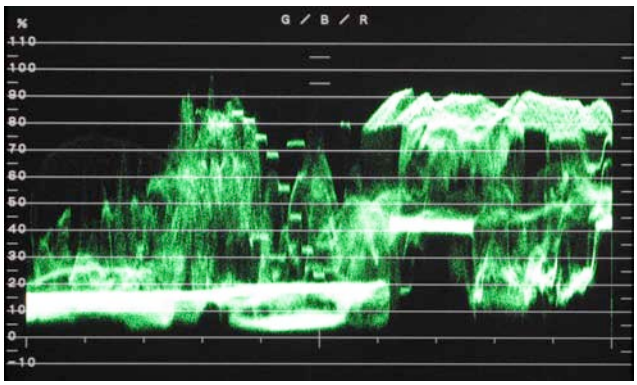
It's a curve that clips the highlights at 100% and enhances the detail in the middle tones. With this curve the sensitivity of the camera is 250 Asa under tungsten lighting.



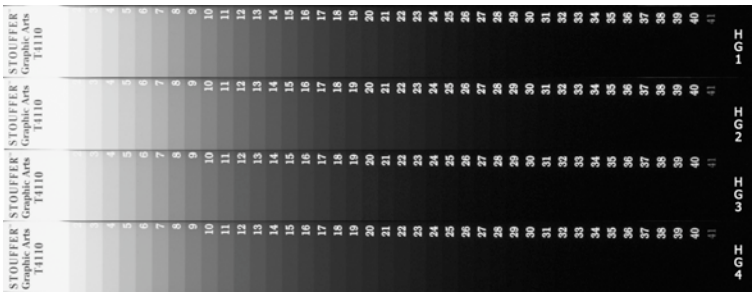


(Grey Scale chart shot with a Digiprime 40mm at T5.6+1/3. The T stop is the same for every curve and it was set taking the S-Log value as reference).

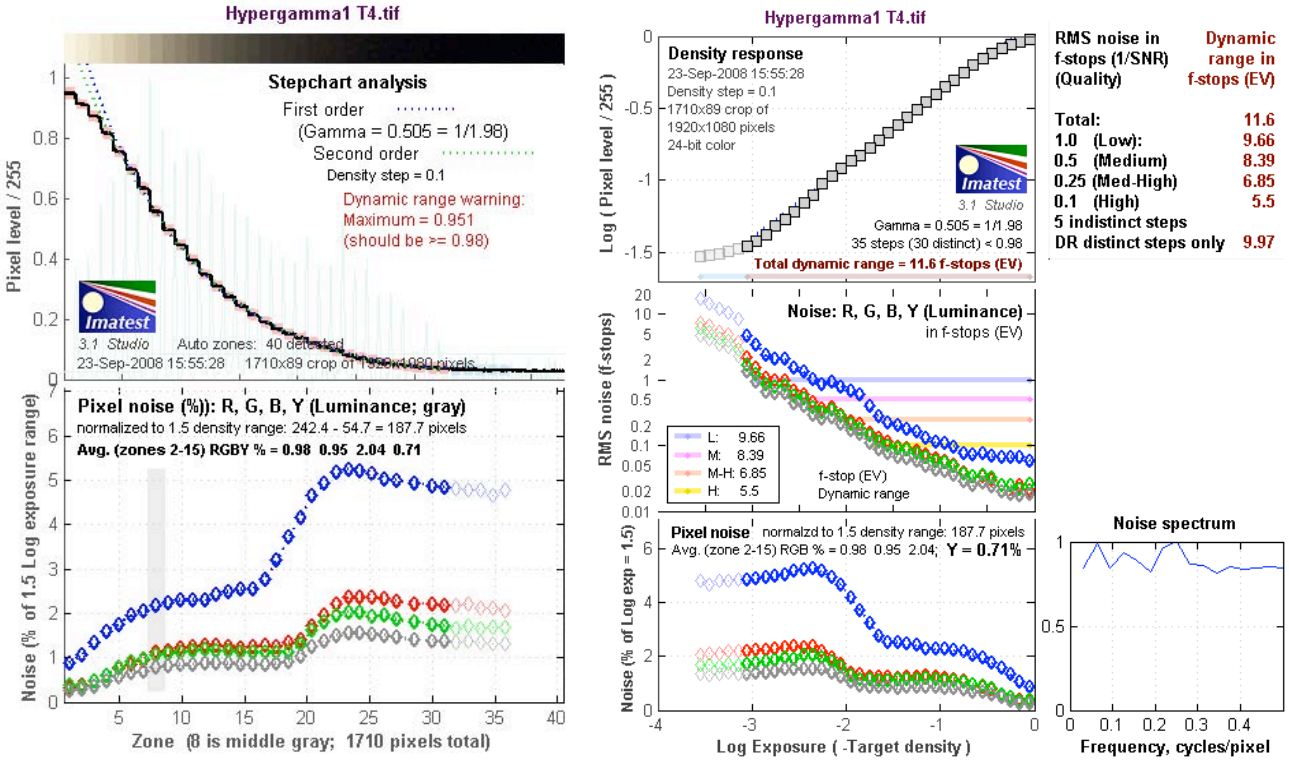
Grey Scale image and it's representation in the Waveform monitor. We can see the gray of 18% reflection rate falls between 35% and 40% in the waveform monitor and the white slightly below 80%.



In the still life shot we can see different areas represented in the waveform monitor. We see the gray chart over 40%. The values for the white fabrics are slightly over 90% and the black fabrics around 15%, being the black velvet at 0.5%.
The latitude (Dynamic Range) results of the Imatest software with the Stouffer T4110 Wedge, that represents 13.3 stops, are as follows:



(On the left, preparing the test with the Stouffer Wedge. On top, the four Stouffer Wedges, one for each Hypergamma curve)



The curve can see 11.6 stops, although analyzing the dynamic range in relation to the noise we get different values. In order to compare the curves we took the Medium value, that with this curve is 8.39 stops. In the graphic (middle right) we see the noise considering it's different values. The graphic at the bottom shows the noise in RGB where we can see the difference between the blue channel comparing to red and green. The noise level is in relation to the exposure and the % of the logarithm of the exposure, being this value standardized at a 1.5 density value.

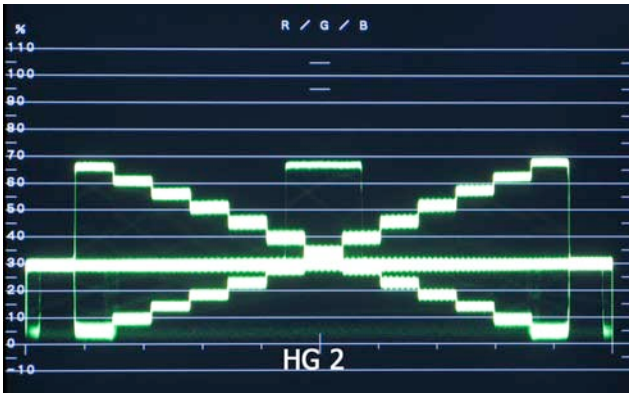
Here we show the original still life frame and the graded frame.

(Original Camera image)

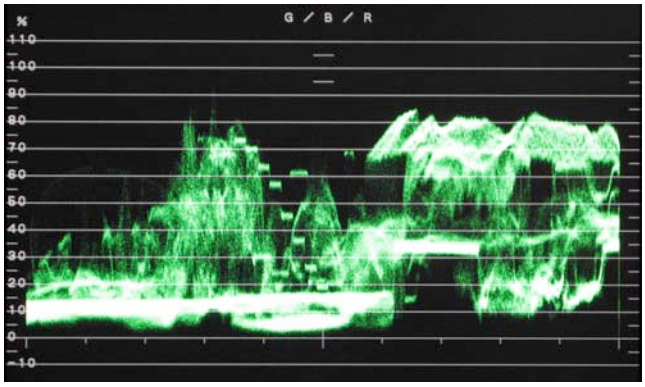
(Graded image)

Hypergamma 2 Curve

This curve clips the highlights at 100% and enhances the highlight detail more than the first HG1, therefore it can deal with higher contrast situations.
The sensitivity of the camera with this curve sits between 160 and 200 Asa under Tungsten lighting.

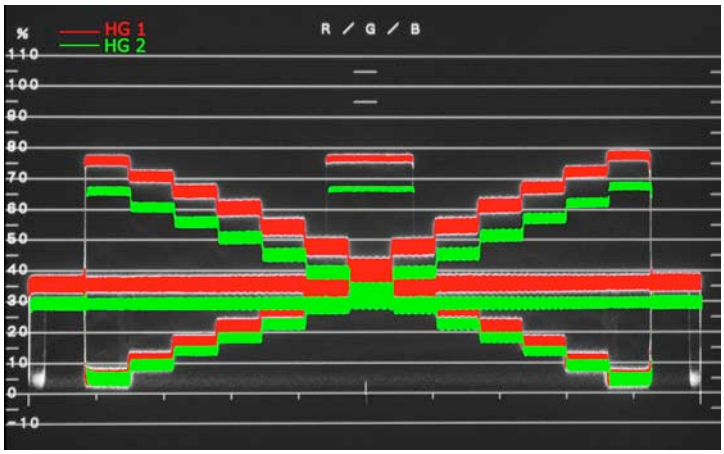


In the chart we see the gray of 18% reflection rate is at 30% in the waveform monitor, lower than with HG1, as well as the white that sits at 70%. In the shadows, steps number 1 and 2 are similar in both curves, from the third one HG2 shows lower values.

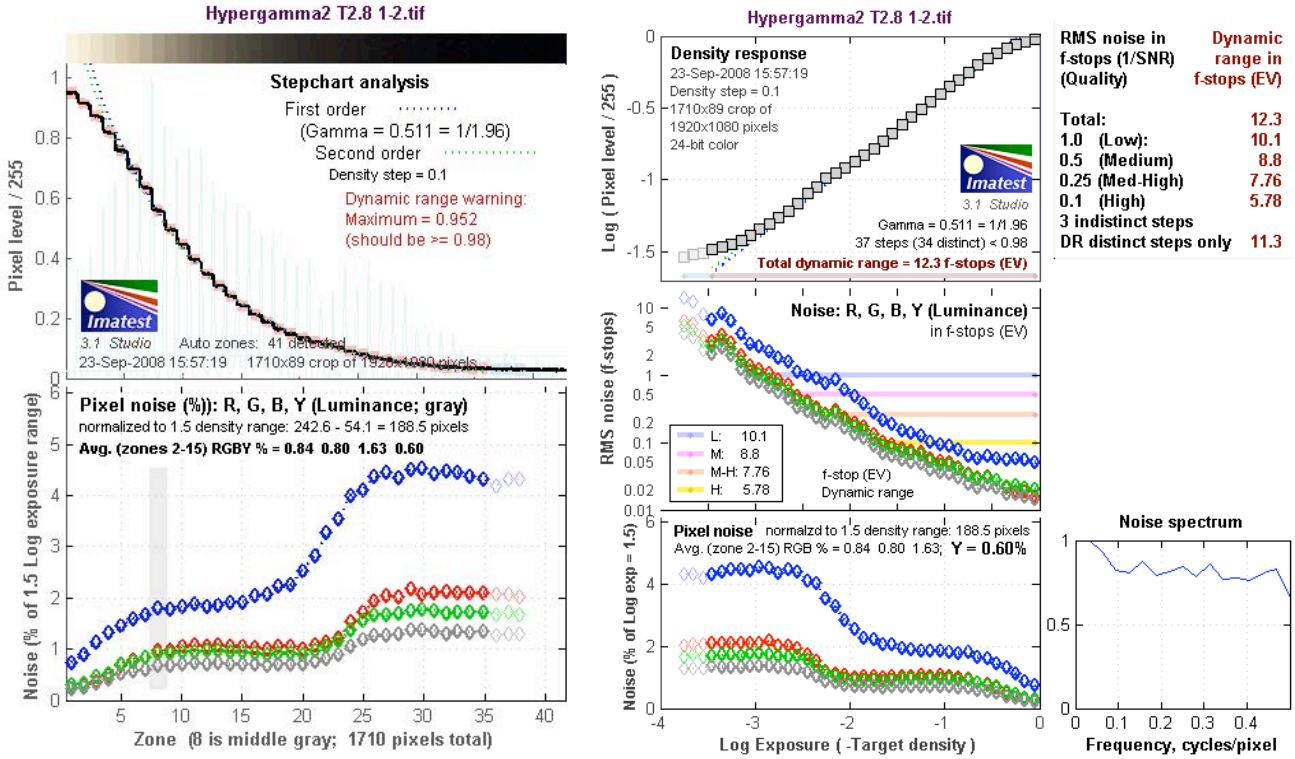


In the still life shot we observe the gray chart is between 30% and 35%, 10% below the value for HG1 curve. We also see the values for the white fabrics reach the 80% and the black fabrics and velvet in the same value as with HG1.

In the image on the right we see both curves overlapped in the waveform monitor. The gray of 18% reflection rate is 5% higher for HG1 and in highlights the difference is 10%.



The dynamic range according to the Imatest Software capturing the Stouffer Wedge is as follows:



In whole the curve can see 12.3 stops, this is lightly higher than HG1. The value (Medium) is 8.8 stops; the curve can capture ½ stop more than HG1 (and with less noise) and 1 stop more than HG3. In the graphic below the Y value for the HG2 is 0.60% against the 0.71% of HG1.

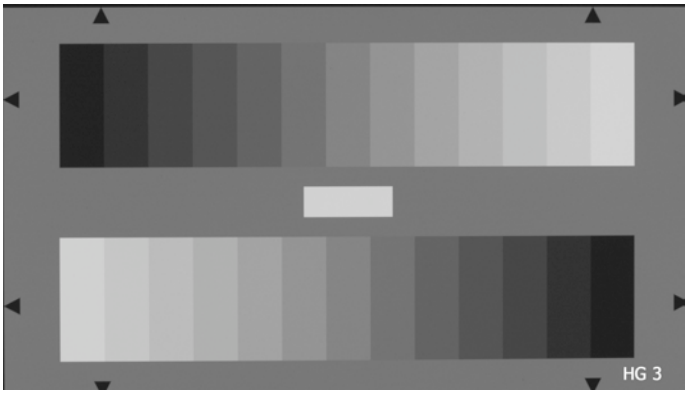
(Original Camera image)

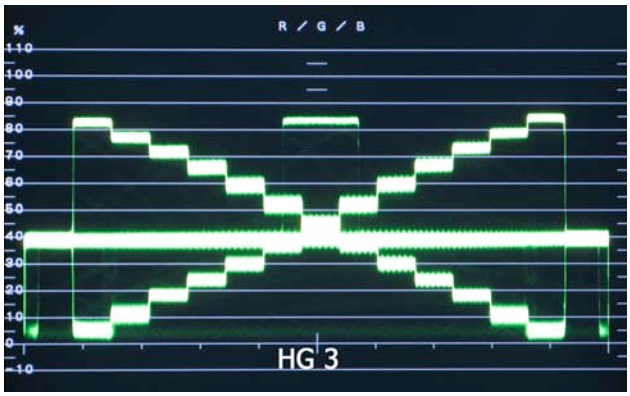
(Graded image)

HyperGamma 2 retained the texture in the white fabrics better than HG1 but we had to raise the middle tones a little bit.

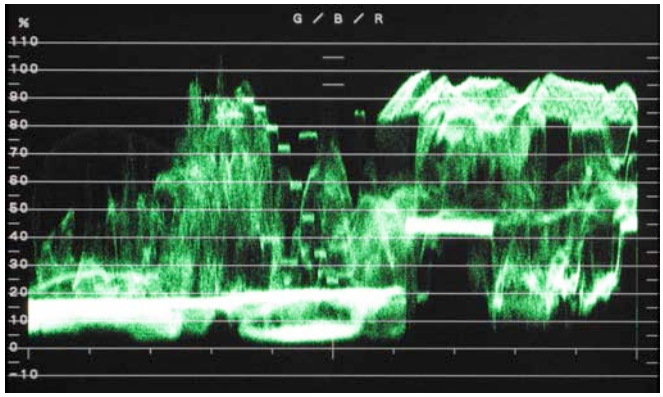
Hypergamma 3 Curve

This curve clips the highlights at 109% and enhances the detail in the middle tones like HG1. The sensitivity is 320 Asa under tungsten lighting, this is 1/3 stop more than HG1 and ½+ stop more than HG2.

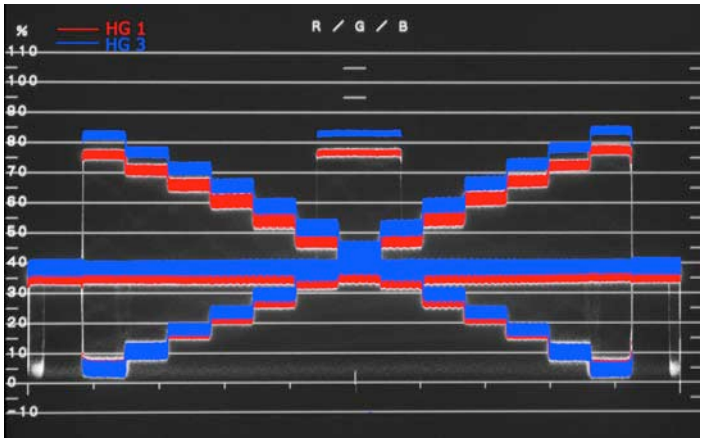




In the gray scale chart we see the gray of 18% reflection rate sits at 40% in the waveform monitor, higher than with HG1 and HG2. The white is at 85%. In the shadows, steps 1 and 2 are similar in the three curves though in this one we see some more noise, from third step HG3 show higher values than HG2 and HG1.



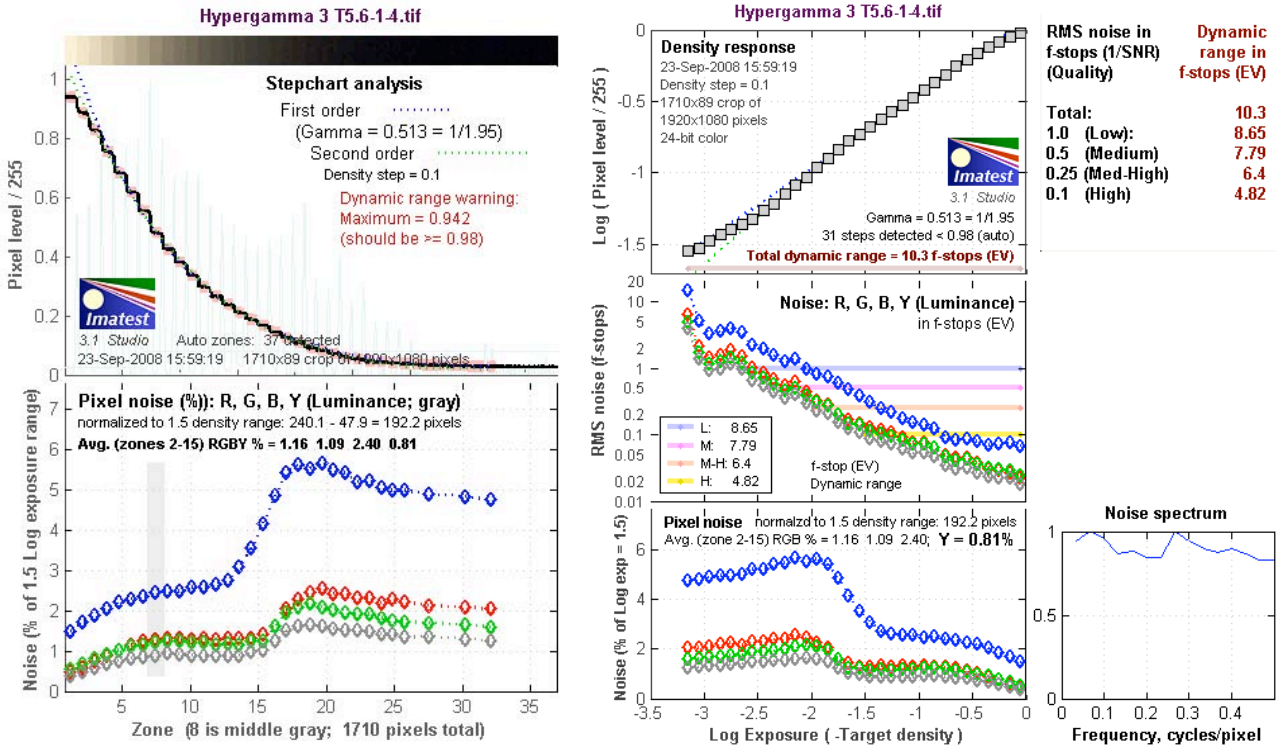
In the still life shot we observe the gray chart is at 45%, slightly higher than HG1. The values for the white fabrics reach 100% and the black fabrics and velvet in the same value as with HG1.



Since HG1 and HG3 are similar in the enhancement of the middle tones with the difference HG1 clips at 100% and HG2 at 109%, we'll compare their gray scale charts.

Values for the shadows (steps 1 and 2) are similar. From third step HG3 gives higher values than HG1. Then, the middle tones are lighter and with some more contrast in HG3.

The latitude response according to the Imatest software is as follows:



In whole, the curve can see 10.3 stops, this is lower than HG1 and HG2. The value (Medium) is 7.79 stops. The camera can see some more detail in the low light areas but increasing the noise, so it could be advisable to use gain at -3dB.

The Y value in the graphic is 0.81% against the 0.60% (HG2) and 0.71% (HG1).

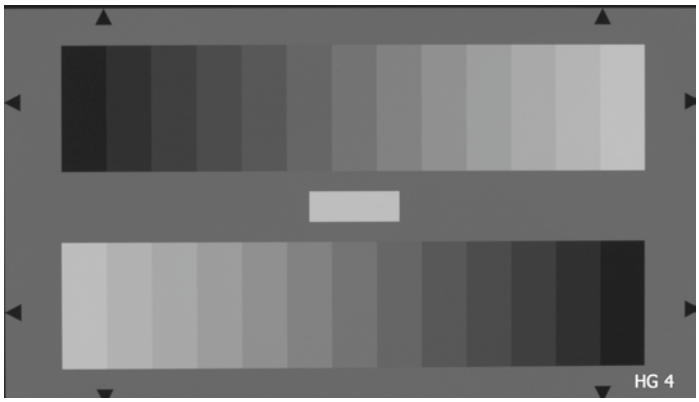
(Original Camera image)

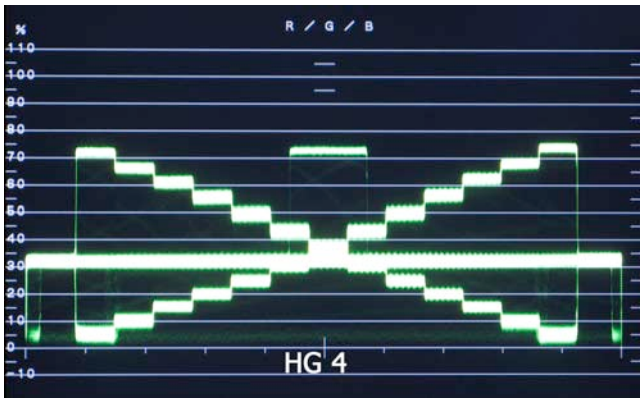
(Graded image)

Hypergamma 3 allows to recover less texture in the white fabrics and so a minimum exposure error means loosing detail in highlights. The middle tones are lighter and in general we obtain more contrast.

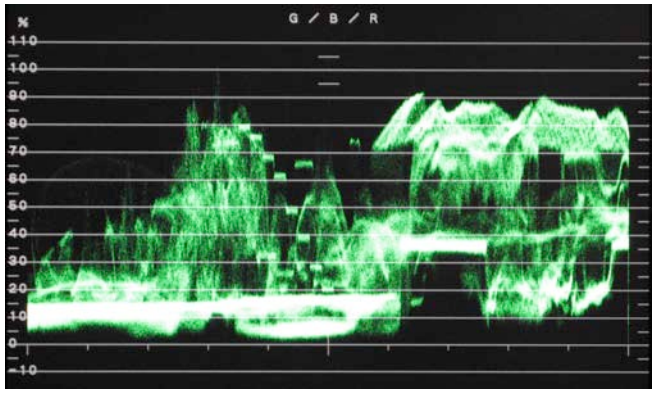
Hypergamma 4 Curve

This curve also clips the highlights at 109%, enhancing the detail in the highlights like HG2. With this curve the sensitivity is 200 Asa under tungsten lighting, so it's lighter than HG2, slightly less than HG1 and below HG3.

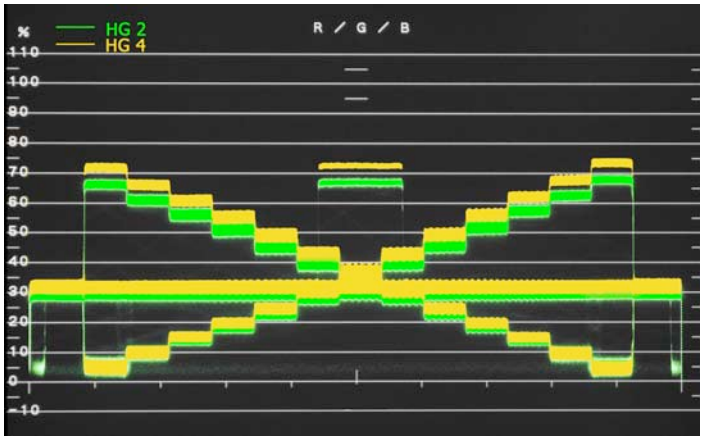




In the chart we see the gray of 18% reflection rate is between 30% and 35% in the waveform monitor. The white is between 70% and 75%. In the shadows, from third step values are a little bit lighter than with HG2.



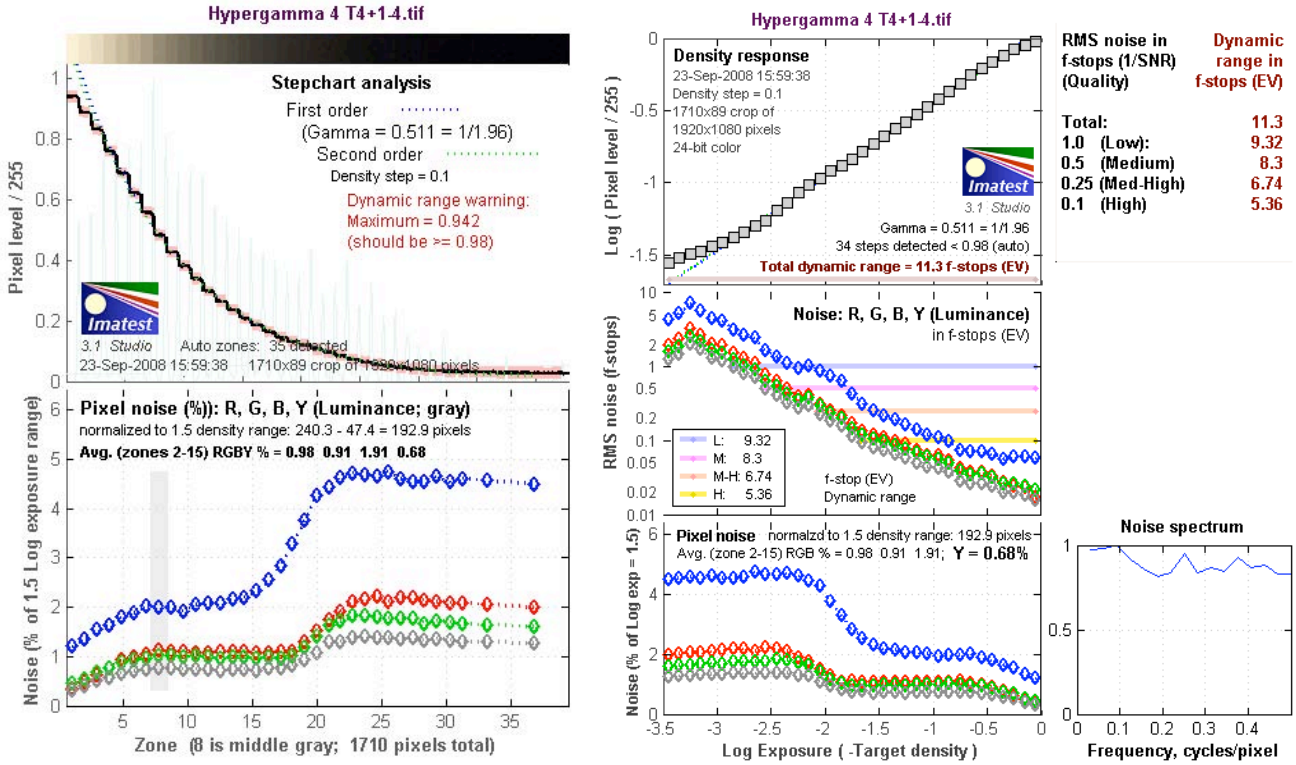
In the still life shot we see the gray chart is between 35% and 40%, 10% below the value for HG1. The values for the white fabrics reach 90% and the black fabrics and velvet similar to the other 3 curves.



In the picture on the left we compare HG2 and HG4. This curves are designed to deal with high contrast situations. As we said before, HG2 clips at 100% and HG4 at 109%.

The values for the shadows (steps 1 and 2) are similar; from third step HG4 gives lighter values so the middle tones are lighter and with more contrast in general.

The dynamic range response is as follows:



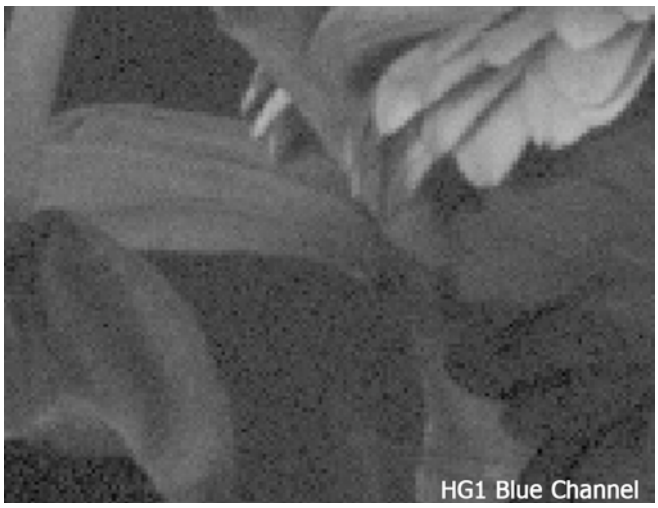
In whole HG4 can see 11.3 stops, very similar to HG1 but with less noise. Y value is 0.68, higher then HG2 and lower than HG1 and HG3. The value (Medium) is 8.3 stops.

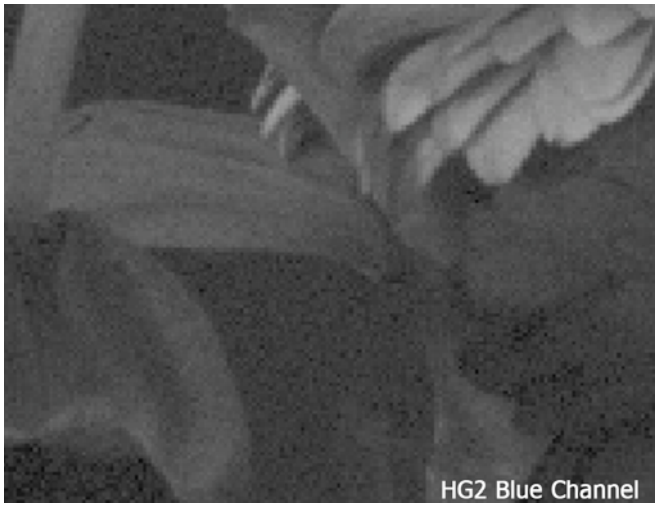
(Original Camera image)

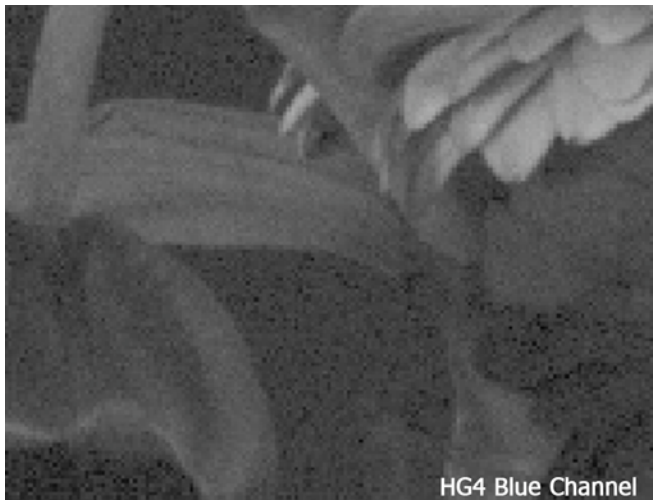
(Graded image)

Comparing the noise

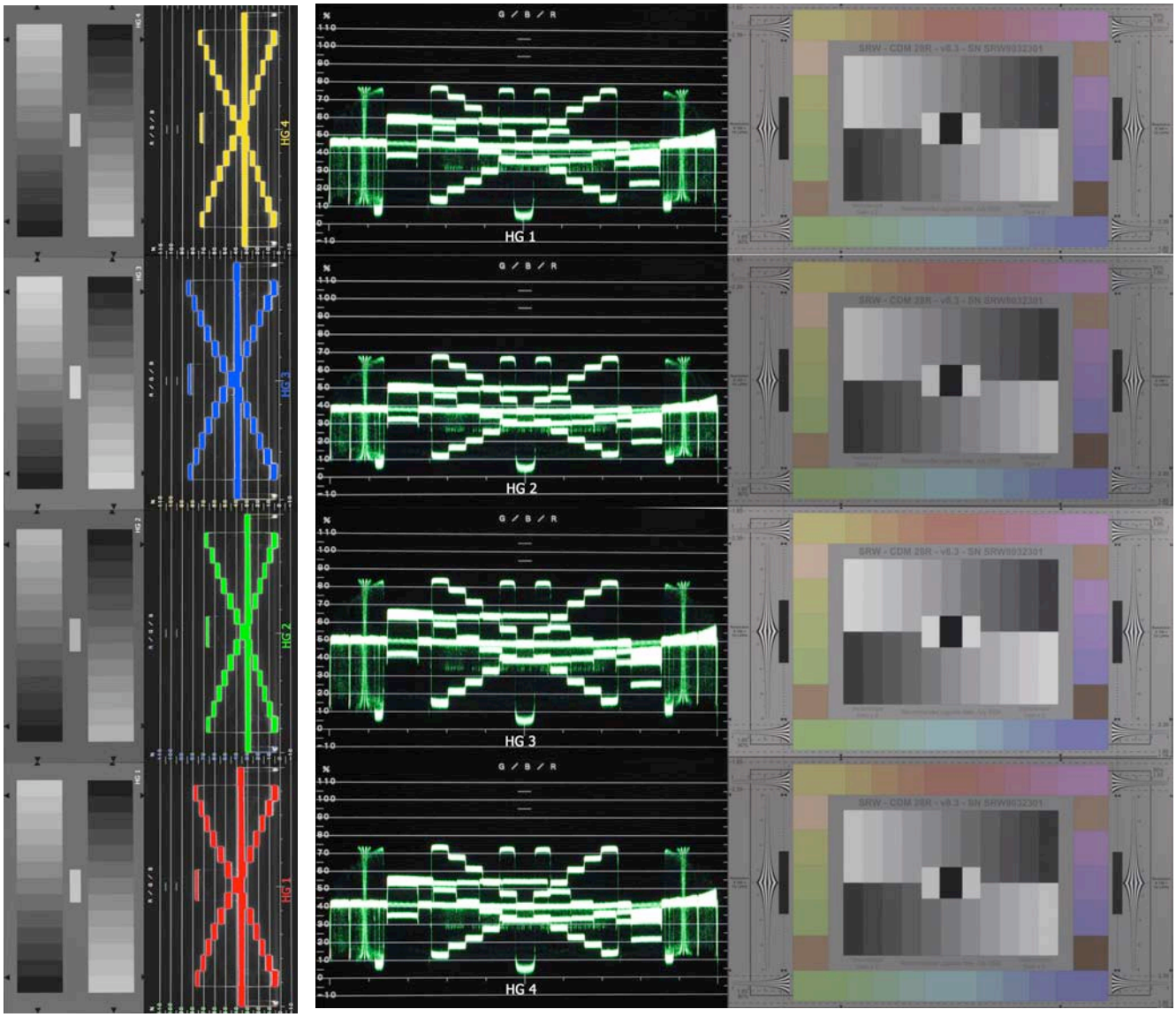
Now we'll show the blue channel with the four HyperGammas 250% magnified.



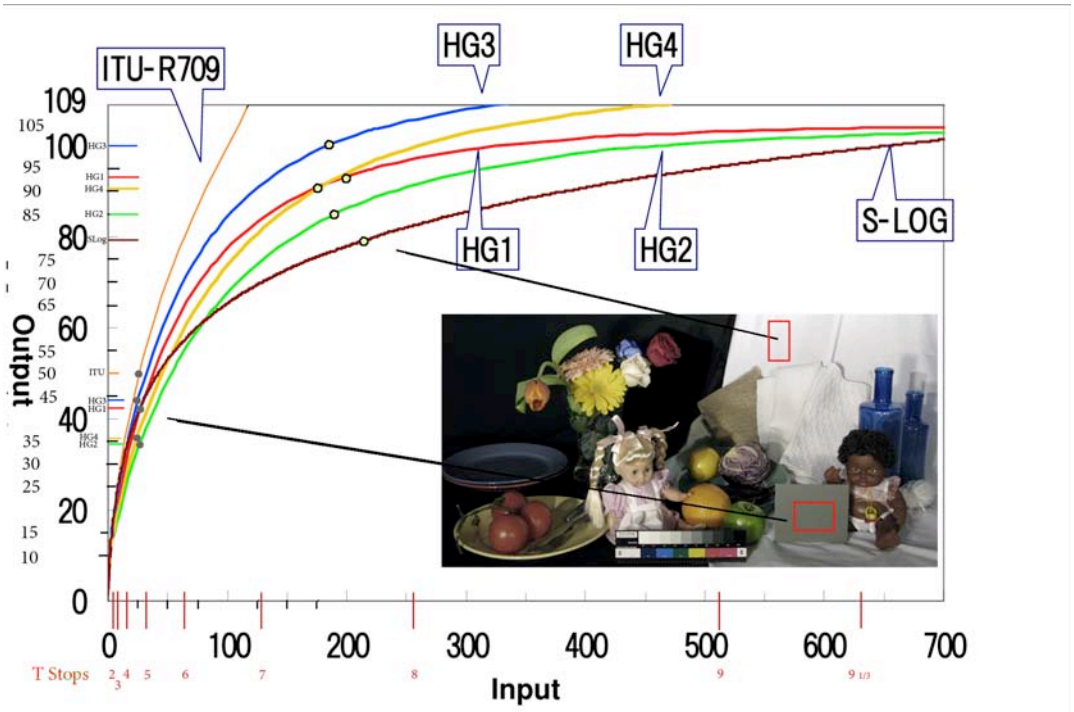




The noise is slightly higher in HG1 and HG3, being the HG3 the more noisy one in the 3 channels. It's true that HG3, enhancing the middle tones, makes the noise more noticeable, so it's advisable to use gain at -3dB. HG1 is very similar in noise to HG3 being the first one less noisy in highlights and shadows. From 3 stops of underexposure the noise in the blue channel with HG3 is higher than with the rest of the curves, specially compared to HG2.
HG2 and HG4 show less noise, and HG4 a little bit more than HG2. In the middle tones the noise is very similar but HG4 shows some more noise in highlights. Between 3 and 6 stops under the base, HG4 is more noisy than HG2.



For a quick understanding of the differences between curves, we show here images from the DSC Labs and gray scale charts. Also a graphic with some values from the Still Life Shots with all curves.



As a conclusion, we show this table:

Curve	Sensitivity. Relative Asa value	Dynamic range F(stop) (Medium)*	Noise Y(%) Zones average (2-15)	When to use it	Remarks
HyperGamma1	250	8.39	0.71	When need for more detail in shadows, in high contrast situations	Clips at 100%. Advisable to use -3dB if the camera is in Extend Dynamic Range.
HyperGamma2	160-200	8.8	0.60	In high contrast scenes	Clips at 100%. The one that gives more latitude
HyperGamma3	320	7.79	0.81	If need for more detail in shadows and middle tones in moderate contrast situations,	Clips at 109%. Is the more noisy curve. Advisable to use -3dB if the camera is in Extend Dynamic Range.
HyperGamma4	200	8.3	0.68	In high contrast scenes that need more detail in the middle tones.	Clips at 109%

**According to Imatest analysis software.*

Technical notes
Camera Sony F23 24psf 172,8º 4:4:4 HdcamSR 16:9
Color Space: Wide
Dynamic Range: Extend
Paint menu settings: off
Digiprime lens
Cine-tal Monitor.

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