

## Objective latitude (DR) assessment of motion/still picture digital cameras

Rank according to high quality dynamic range versus noise expressed in f-stops  
Left is better

Quality of Latitude in F-stops	VaricamF Frec 045MG DarkComp.tif	RED ONE According to Jim & Graeme Nattress	Leica M8.tif	VaricamF Frec 035MG DarkComp ETEKT.tif	RED ONE 24/11/2008 A.Parra B17 REDLog.tif	RED ONE 14/3/2008 Evan. A. B14 Log685.tif	Nikon D80.JPG	Canon EOS 5D.tif	Alfonso Parra F23 test Slog.tif	HVX 200 latitude Cine D.tif	Cinealta HG3.tif	Cinealta HG4 ETEKT.tif
High	8,09	8,05	7,73	7,12	6,66	6,69	6,6	6,5	6,31	5,64	5,55	4,58
Mid High	9,23	9,26	9,16	8,86	8,16	8,17	7,94	8,19	8,38	7,44	6,91	5,96
Medium	10,1	9,71	10,1	9,71	9,68	8,9	9,07	9,05	9,5	8,97	8,34	7,04
Low	11,1	11,1	-	9,89	10	9,98	9,87	9,78	10,6	10	9,22	8,35
Total	12	11,4	10,7	10,2	9,97	9,97	10,5	10,6	12,6	10,6	11,6	8,84

“Very good quality”	High	< 0,1 F-stop noise level
“Usable quality”	Mid-High	< 0,25 F-stop noise level
“Very problematic quality”	Medium	< 0,5 F-stop noise level
“Very Bad quality”	Low	< 1 F-stop noise level
“Crap...!”	Total	all visible steps up to 5 F-stops noise ceiling

### The technical base behind the comparison

The following dynamic range or latitude objective test is being done with transmissive test charts capable of exposing latitude higher than 14 F-stops

All tests have being analyzed according to [www.imatest.com](http://www.imatest.com) software.

Follows analysis of why latitude should be measured according to noise levels.

This is from Iimatest web site under, step chart measurement tour:

[http://www.imatest.com/docs/tour\\_q13.html](http://www.imatest.com/docs/tour_q13.html)

#### “Why measure noise in f-stops?”

Because the human eye responds to relative luminance differences. That's why we think of exposure in terms of zones, f-stops, or EV (exposure value), where a change of one unit corresponds to halving or doubling the exposure.

The eye's relative sensitivity is expressed by the Weber-Fechner law,

$$\Delta L \approx 0.01 L \quad \text{–or–} \quad \Delta L/L \approx 0.01$$

where  $\Delta L$  is the smallest luminance difference the eye can distinguish. (This equation is approximate; effective  $\Delta L$  tends to be larger in dark areas of scenes and prints due to visual interference from bright areas.)

Expressing noise in relative luminance units, such as f-stops, corresponds more closely to the eye's response than standard pixel or voltage units.

Noise in f-stops is obtained by dividing the noise in pixels by the number of pixels per f-stop. (I use "f-stop" rather than "zone" or "EV" out of habit; any of them are OK.)

$$\text{noise in f-stops} = \text{noise in pixels} / (d(\text{pixel})/d(\text{f-stop})) = 1/\text{SNR}$$

where  $d(\text{pixel})/d(\text{f-stop})$  is the derivative of the pixel level with respect to luminance measured in f-stops ( $\sim \log_2(\text{luminance})$ ). SNR is the Signal-to-Noise Ratio.

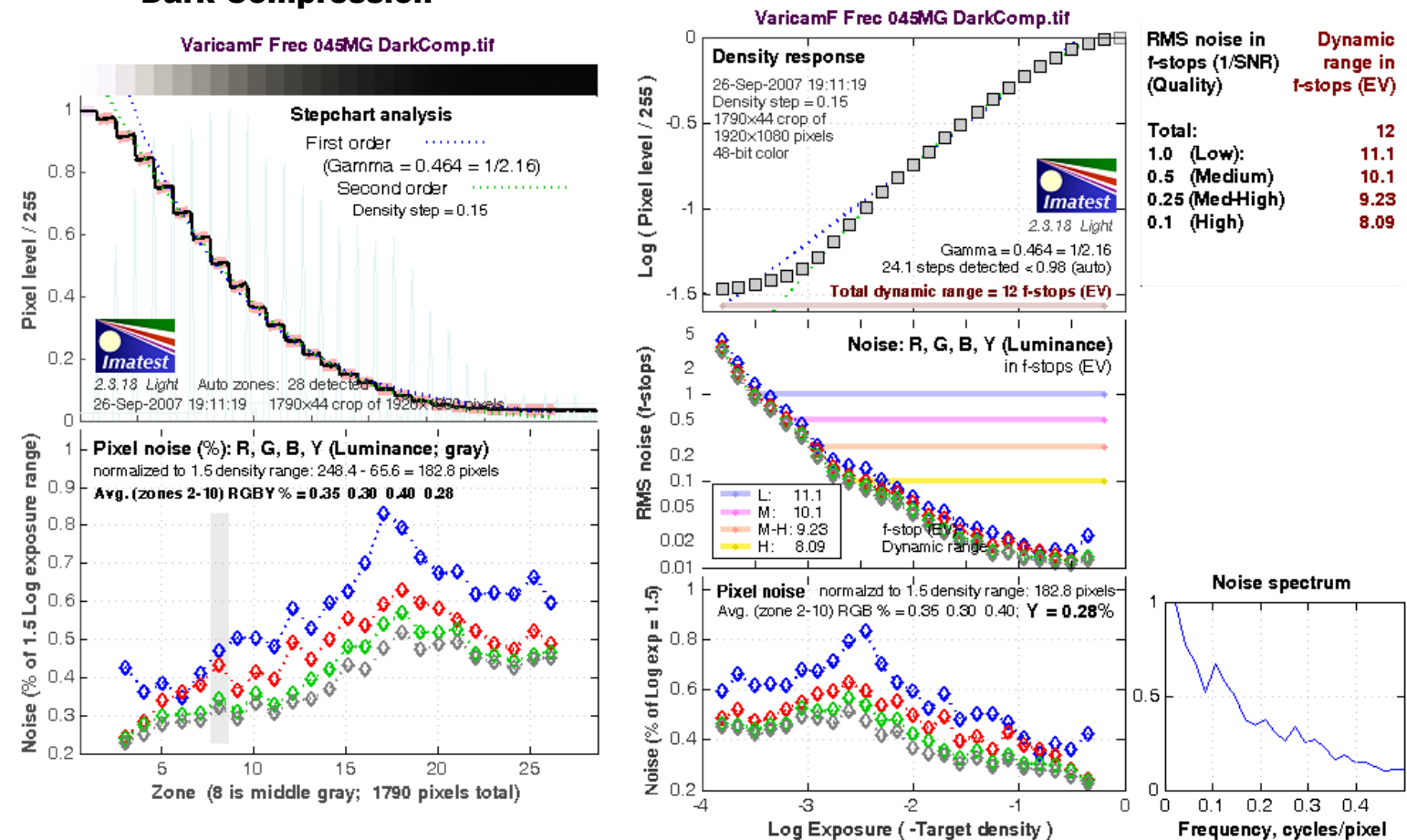
Since luminance noise (measured in f-stops) is referenced to relative scene luminance, independently of electronic processing or pixel levels, it is a universal measurement that can be used to compare digital sensor quality."

**Note 1:** All the tests except Alfonso Parra test have been done with a diffused backlit Danes Picta transmissive step chart with 28 0,15D steps, a total of 14 F-stops, in a darkened room with first step to reach >98% level of the total brightness level of the camera measured.

**Note 2:** ETEKT stands for Greek Union of Film and Audiovisual Technicians (ETEKT-OT)

### The measurements

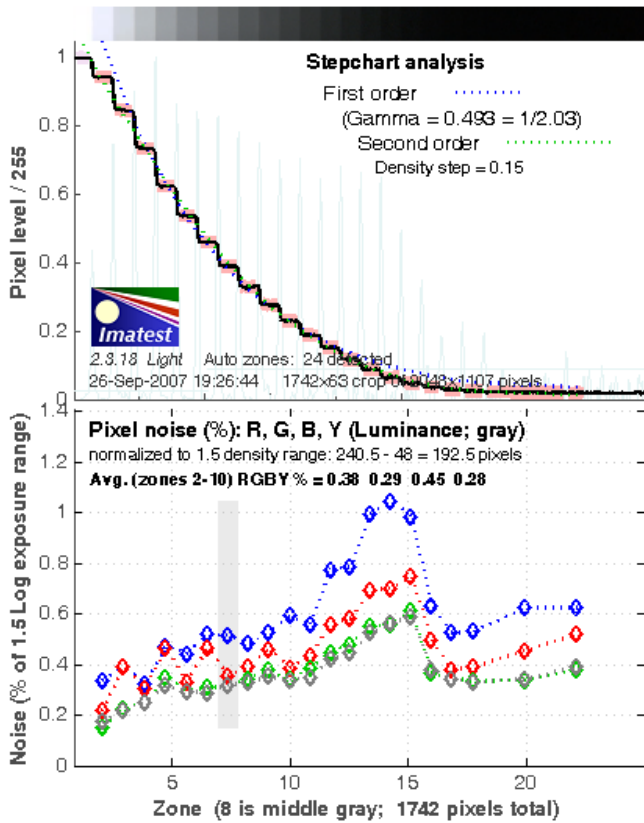
#### VaricamF F-Rec Master Gamma 0,45 DL 500% -3Db BS 0% Dark Compression



# VaricamF F-Rec Master Gamma 0,35 DL 500% -3Db BS 0%

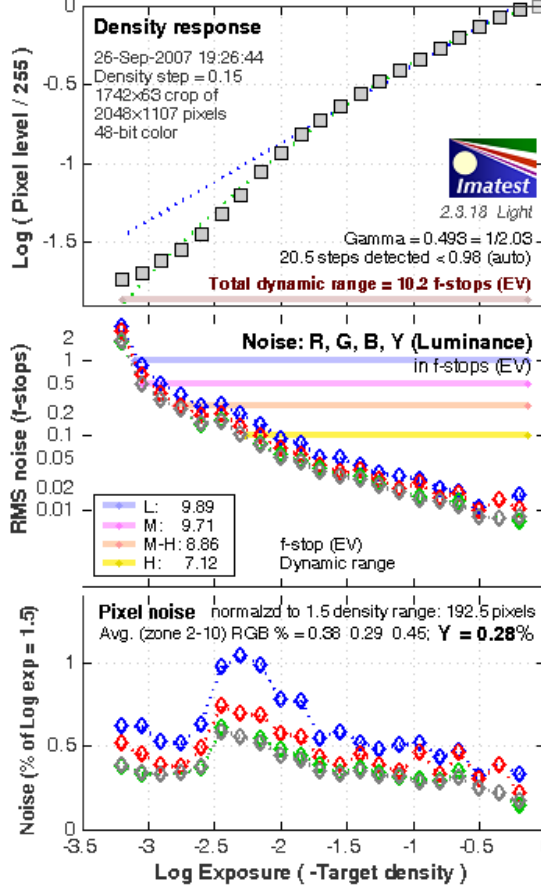
## Dark Compression Test ETEKT

VaricamF Frec 035MG DarkComp ETEKT.tif

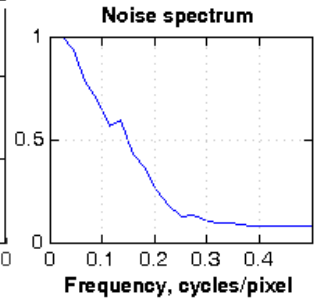


Cinealta F900R HG3 -3Db

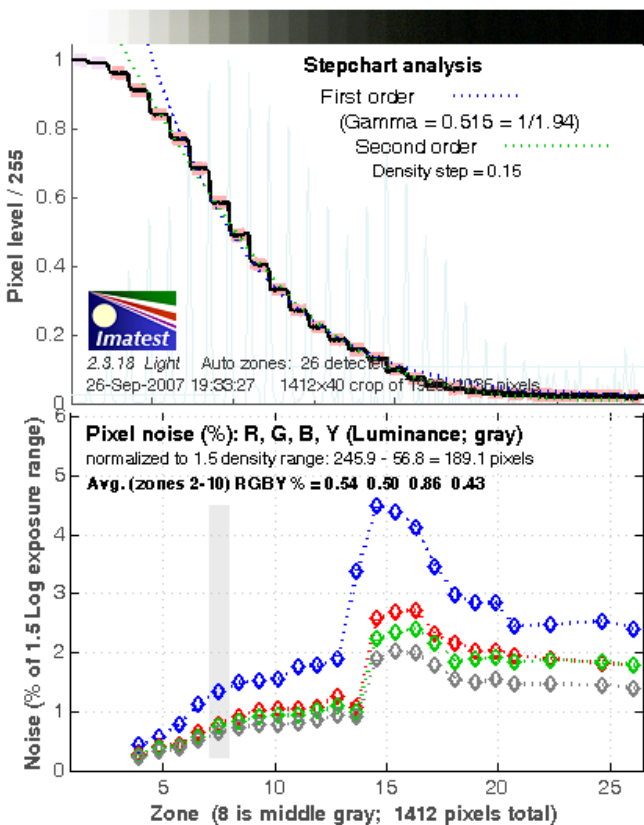
VaricamF Frec 035MG DarkComp ETEKT.tif



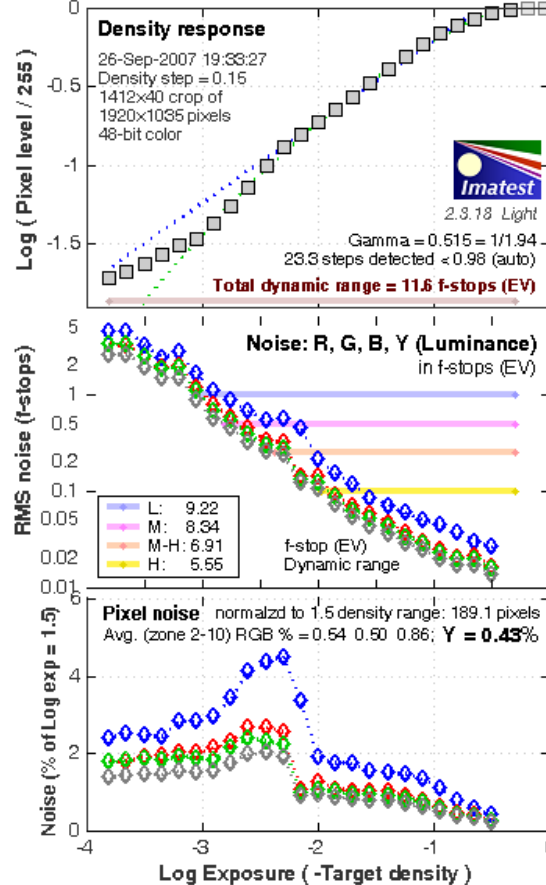
RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
<b>Total:</b>	<b>10.2</b>
<b>1.0 (Low):</b>	<b>9.89</b>
<b>0.5 (Medium)</b>	<b>9.71</b>
<b>0.25 (Med-High)</b>	<b>8.86</b>
<b>0.1 (High)</b>	<b>7.12</b>



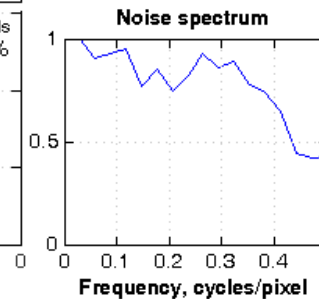
Cinealta HG3.tif



Cinealta HG3.tif

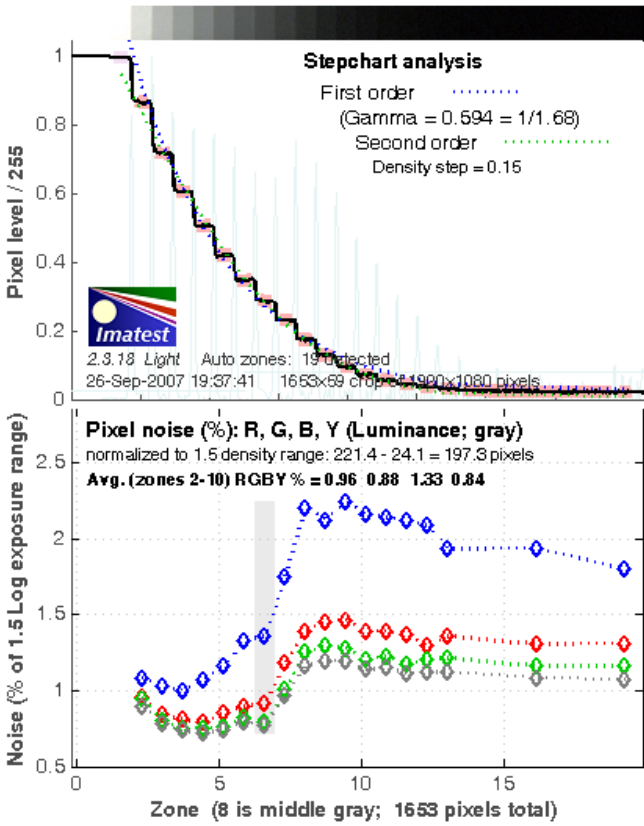


RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
<b>Total:</b>	<b>11.6</b>
<b>1.0 (Low):</b>	<b>9.22</b>
<b>0.5 (Medium)</b>	<b>8.34</b>
<b>0.25 (Med-High)</b>	<b>6.91</b>
<b>0.1 (High)</b>	<b>5.55</b>



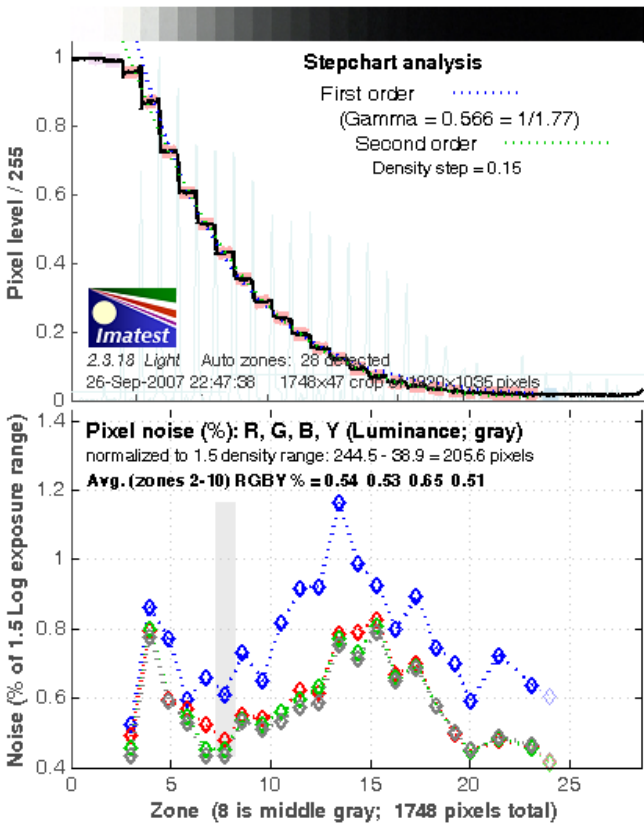
# Cinealta F900R HG4 -3Db Test ETEKT

Cinnealta HG4 ETEKT.tif

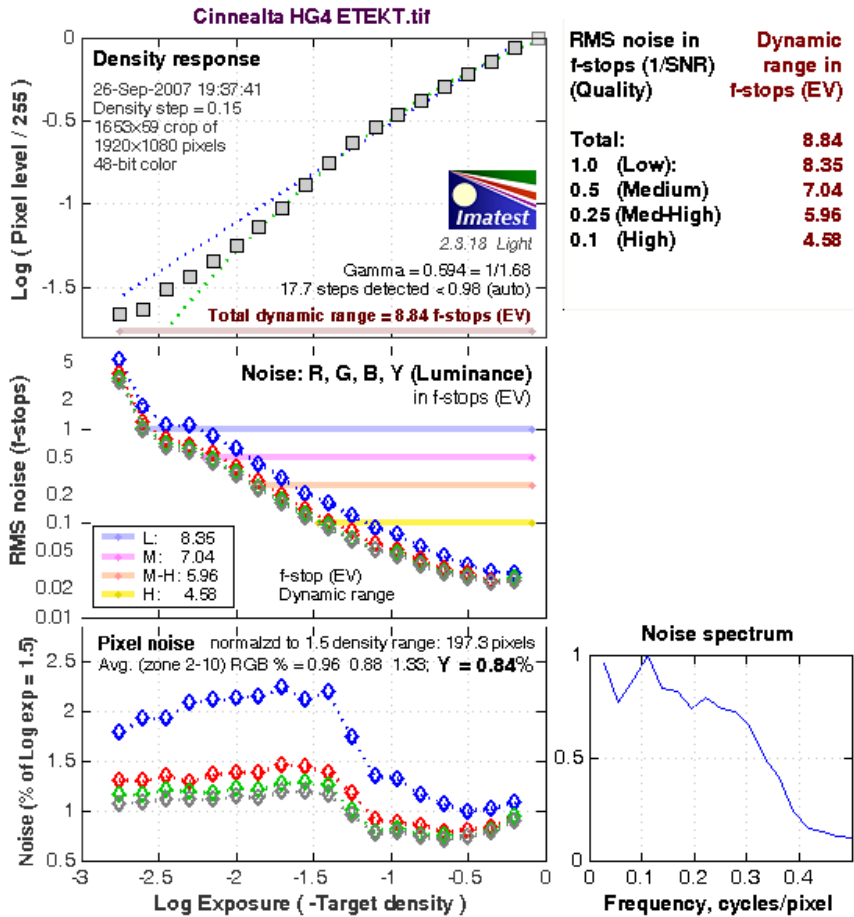


## HVX 200 Cinelike D

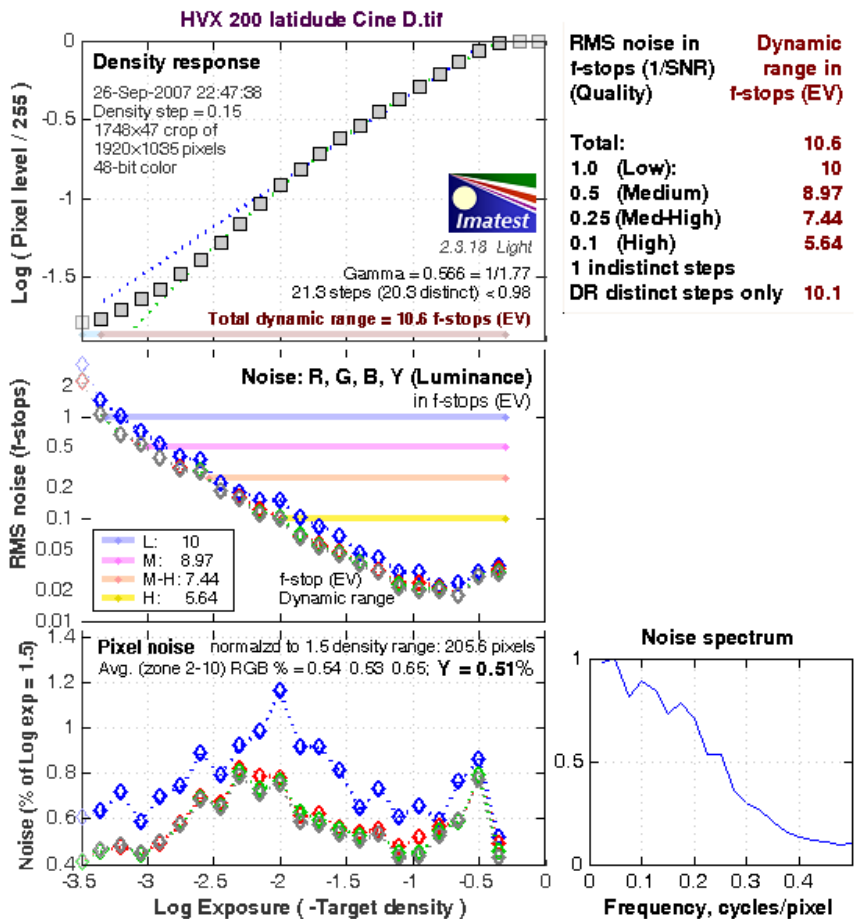
HVX 200 latitude Cine D.tif



## HVX 200 Cinelike D



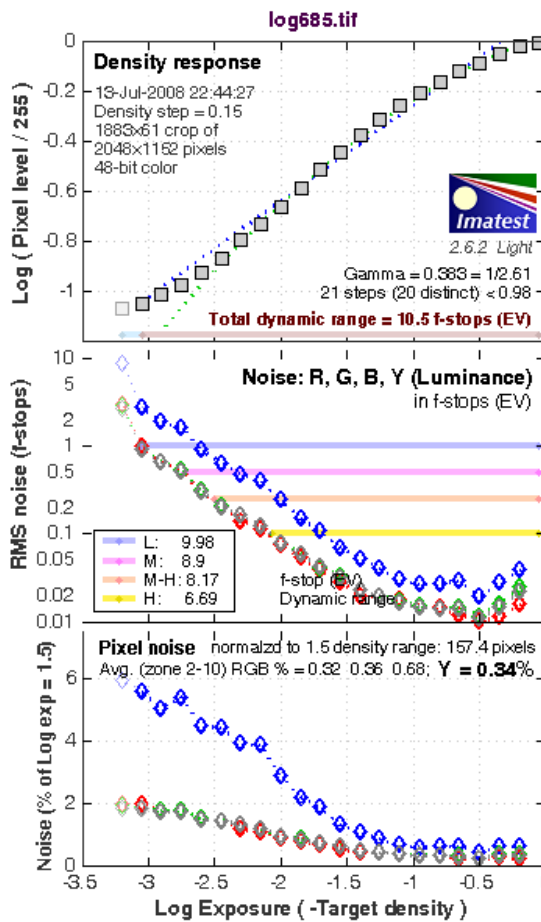
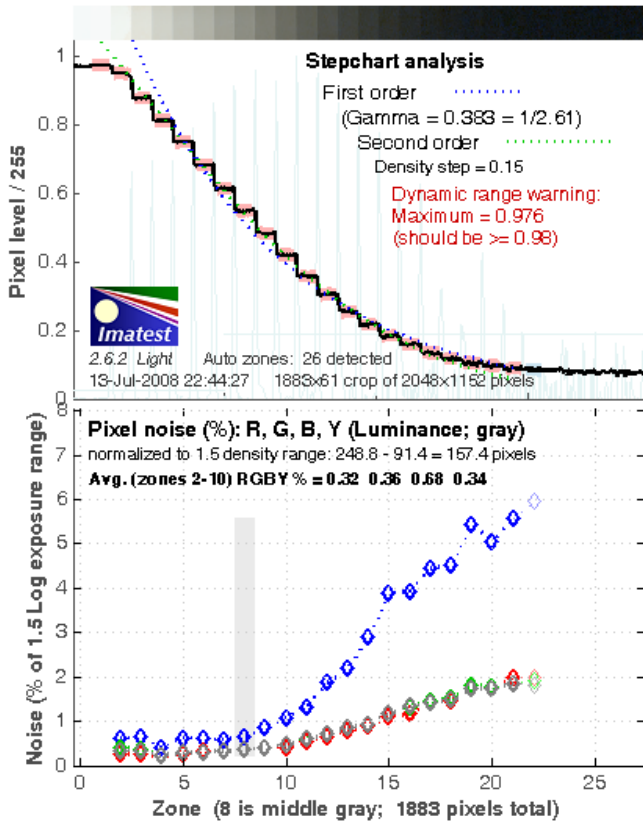
RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
<b>Total:</b>	<b>8.84</b>
<b>1.0 (Low):</b>	<b>8.35</b>
<b>0.5 (Medium)</b>	<b>7.04</b>
<b>0.25 (Med-High)</b>	<b>5.96</b>
<b>0.1 (High)</b>	<b>4.58</b>



RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
<b>Total:</b>	<b>10.6</b>
<b>1.0 (Low):</b>	<b>10</b>
<b>0.5 (Medium)</b>	<b>8.97</b>
<b>0.25 (Med-High)</b>	<b>7.44</b>
<b>0.1 (High)</b>	<b>5.64</b>
<b>1 indistinct steps</b>	
<b>DR distinct steps only</b>	<b>10.1</b>

# RED ONE March test build 14

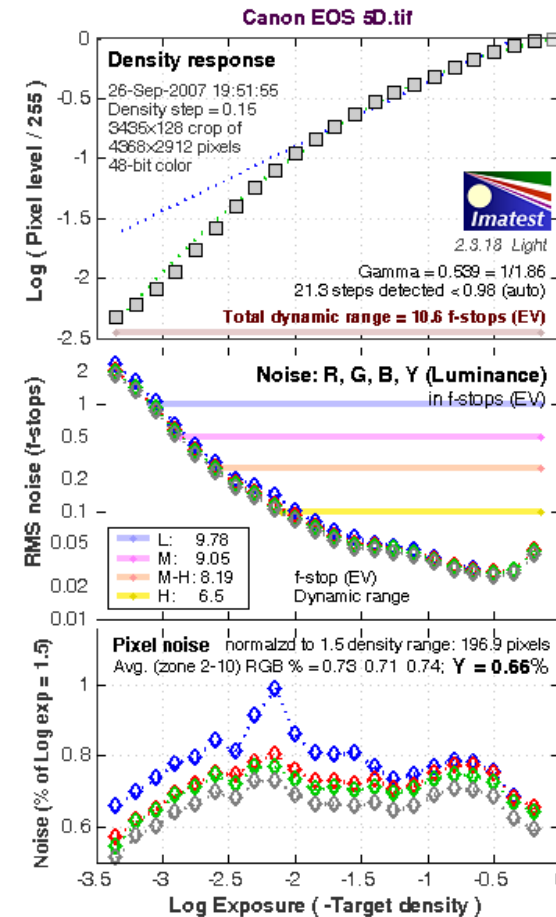
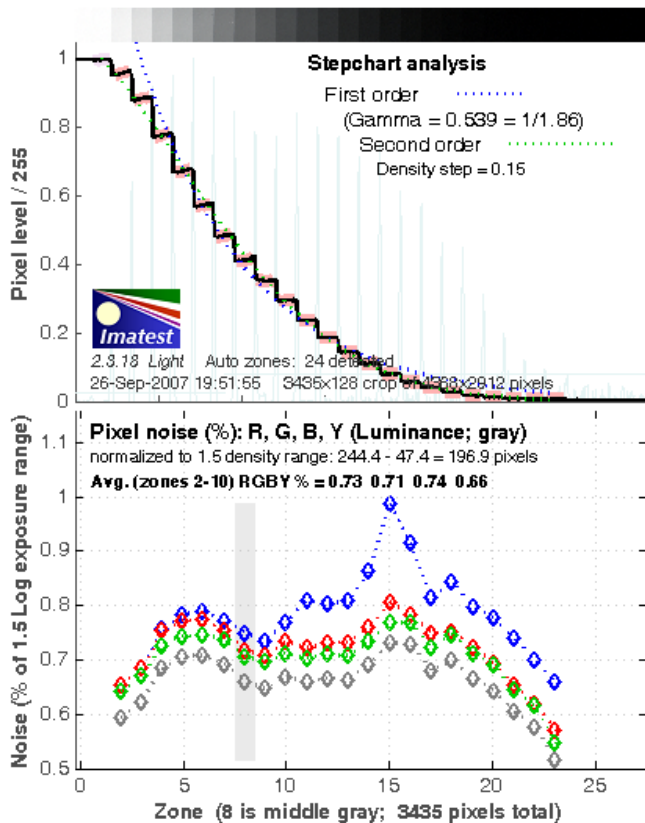
log685.tif



RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
Total:	10.5
1.0 (Low):	9.98
0.5 (Medium)	8.9
0.25 (Med-High)	8.17
0.1 (High)	6.69
1 indistinct steps	
DR distinct steps only	9.97

# Canon EOS 5D

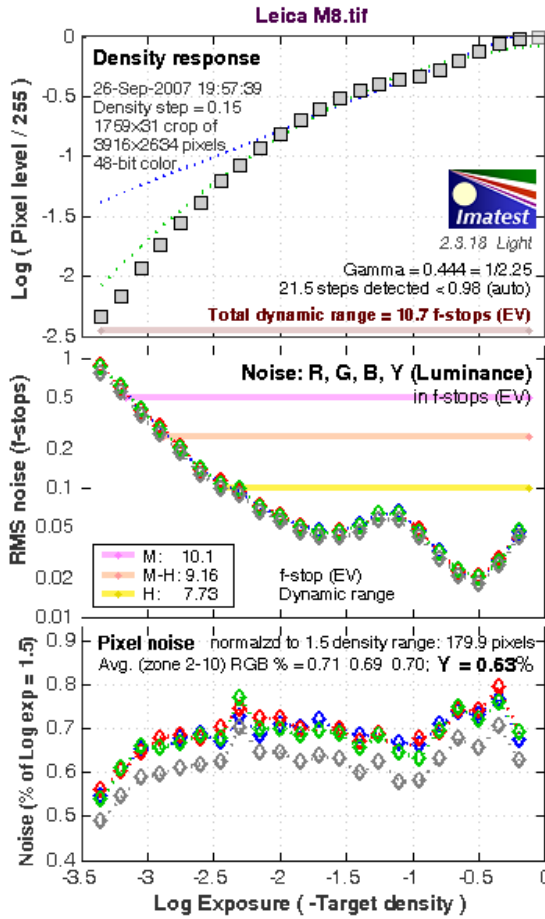
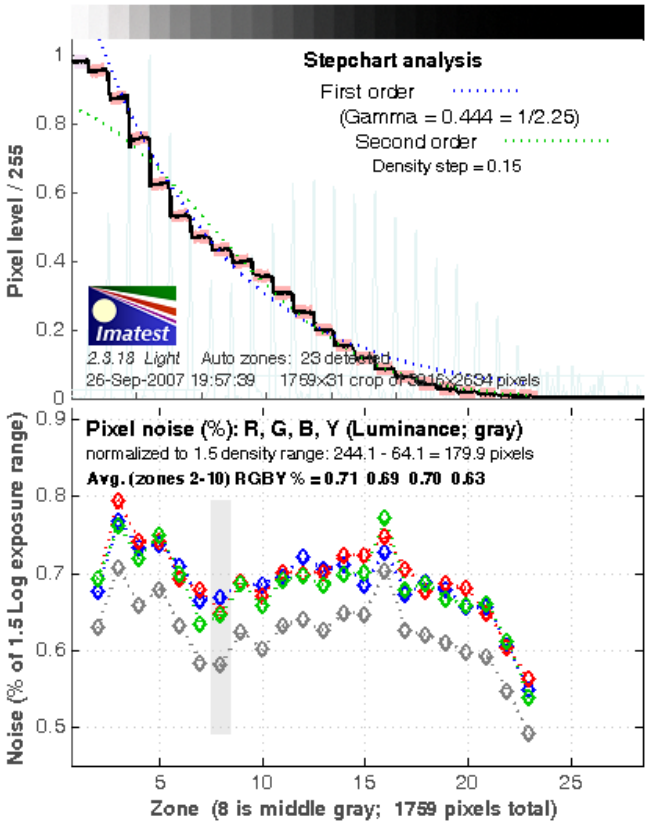
Canon EOS 5D.tif



RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
Total:	10.6
1.0 (Low):	9.78
0.5 (Medium)	9.05
0.25 (Med-High)	8.19
0.1 (High)	6.5

# LEICA M8

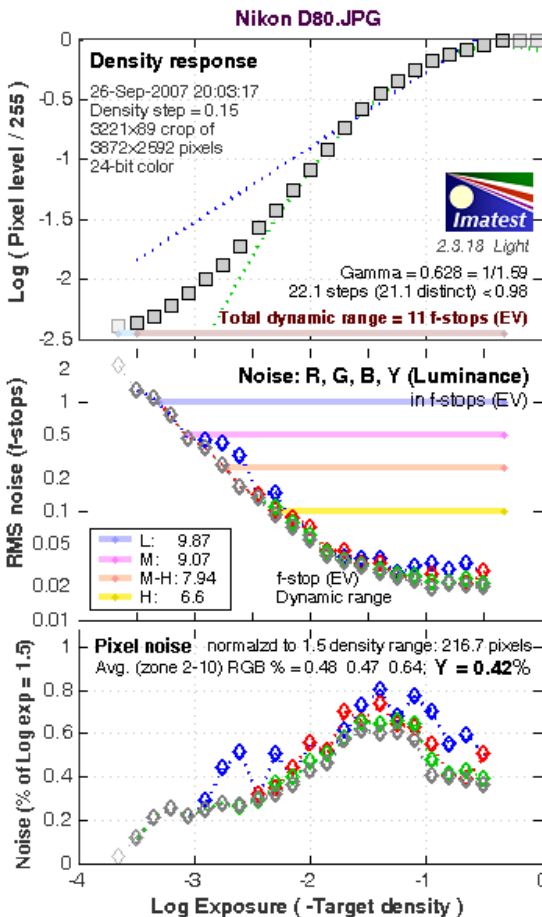
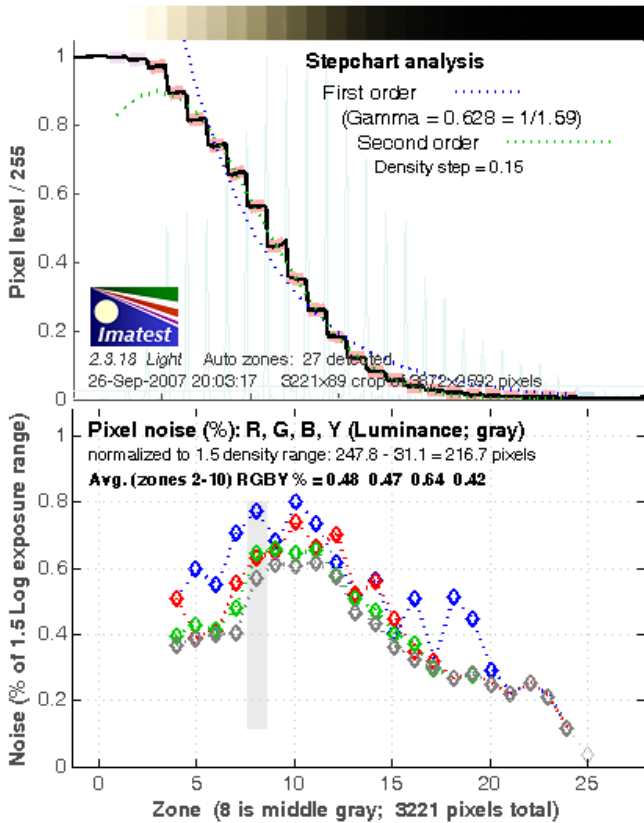
Leica M8.tif



RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
<b>Total:</b>	<b>10.7</b>
<b>1.0 (Low):</b>	-
<b>0.5 (Medium)</b>	<b>10.1</b>
<b>0.25 (Med-High)</b>	<b>9.16</b>
<b>0.1 (High)</b>	<b>7.73</b>

# Nikon D80

Nikon D80.JPG

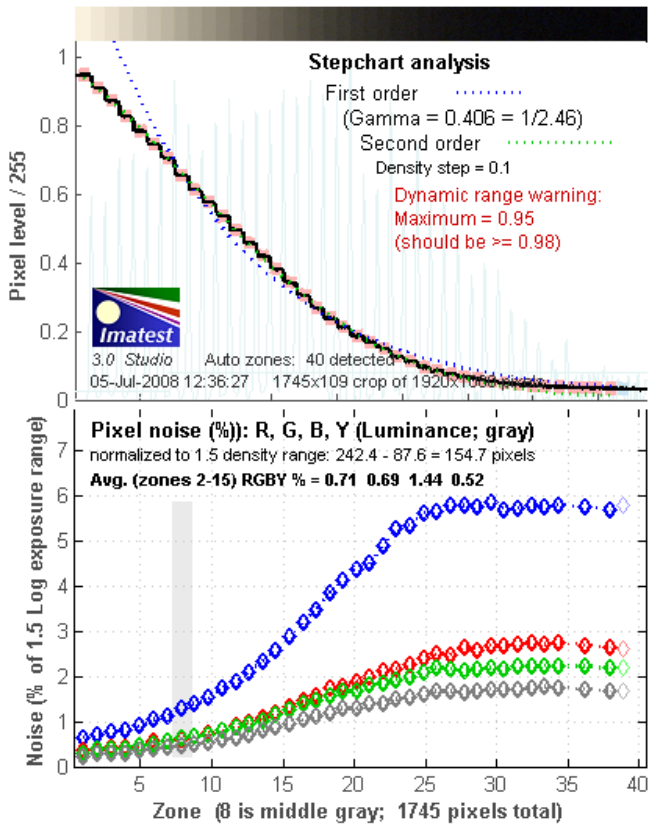


RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
<b>Total:</b>	<b>11</b>
<b>1.0 (Low):</b>	<b>9.87</b>
<b>0.5 (Medium)</b>	<b>9.07</b>
<b>0.25 (Med-High)</b>	<b>7.94</b>
<b>0.1 (High)</b>	<b>6.6</b>
<b>1 indistinct steps</b>	
<b>DR distinct steps only 10.5</b>	

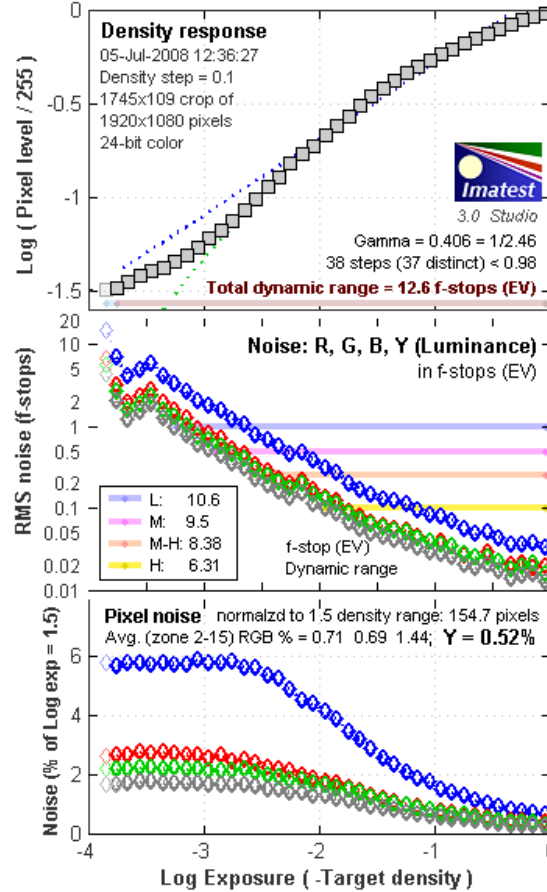
**Selected EXIF data**  
 File: 2007:04:27 19:17:16  
 Make: NIKON CORPORATION  
 Model: NIKON D80  
 Taken: 2007:04:27 19:17:16  
 Res: 3872 x 2592  
 FL:  
 Exp: 0.0100 s (1/100)  
 Aper: f/4.0  
 ISO: 100

# Sony F23 SLog Test from Alfonso Parra AEC

Test F23 SLog Stepchart.tif



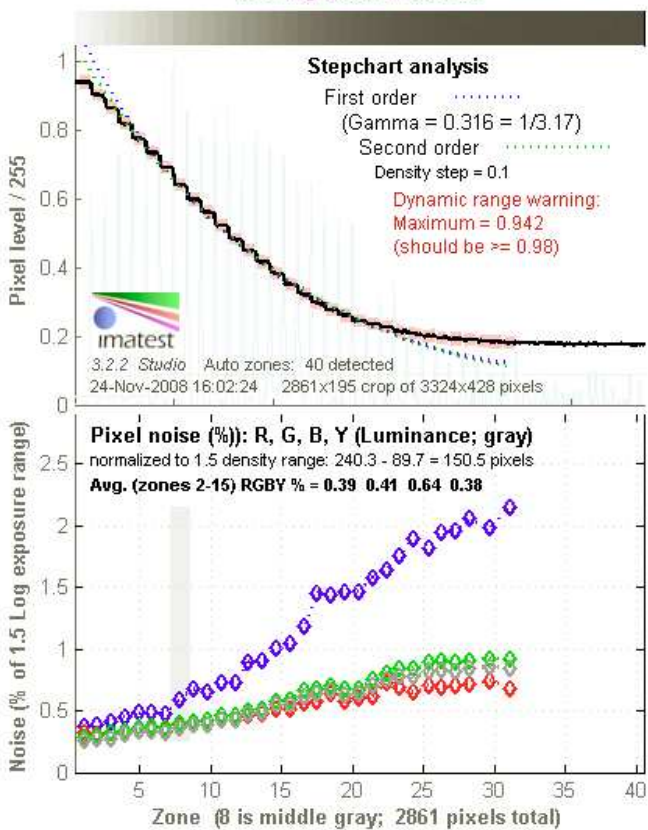
Test F23 SLog Stepchart.tif



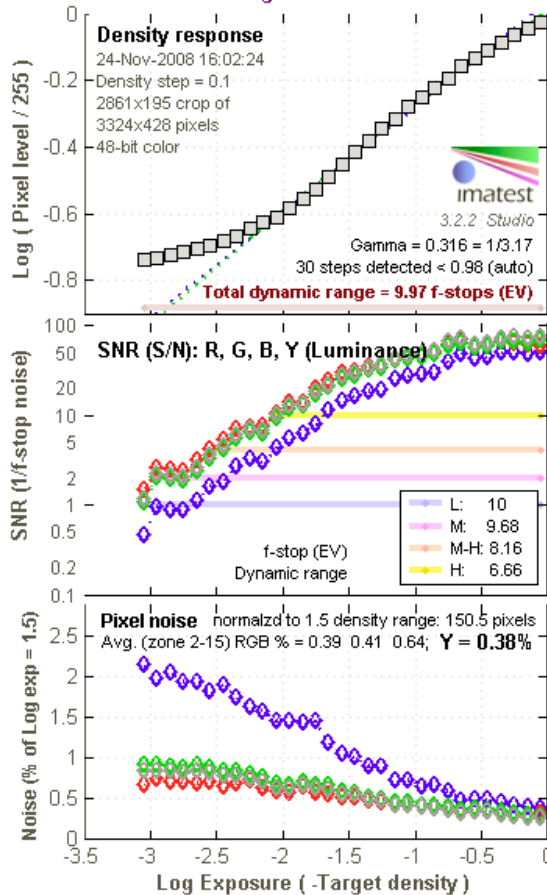
RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
Total:	12.6
1.0 (Low):	10.6
0.5 (Medium)	9.5
0.25 (Med-High)	8.38
0.1 (High)	6.31
1 indistinct steps	
DR distinct steps only	12.3

# RED ONE build 17 Test from Alfonso Parra AEC

REDLog Stauffer RGB.tif



REDLog Stauffer RGB.tif



RMS noise in f-stops (1/SNR) (Quality)	Dynamic range in f-stops (EV)
Total:	9.97
1.0 (Low):	10
0.5 (Medium)	9.68
0.25 (Med-High)	8.16
0.1 (High)	6.66