Relating ABI Specifications of Noise and Instrument Max Scene Temperature to Maximum and Minimum Radiance
[Radiance units: mW/… = mW/(m^2·sr·cm^{-1})]

ABI Band	Central Wavelength (µm)	Spec NedN[1] (mW/…)	Instrument Maximum Scene Temperature[2] (K)	Maximum Scene Temperature (K) for Scaling[3]	Max Scene Radiance plus 5x noise (mW/…) for Scaling[4]
7	3.9	0.004	400	410	25.0
8	6.185	0.05	300	310	28.1
9	6.95	0.09	300	310	45.3
10	7.34	0.1	320	330	80.2
11	8.5	0.13	330	340	135.4
12	9.61	0.16	300	310	109.2
13	10.35	0.17	330	340	184.4
14	11.2	0.17	330	340	200.0
15	12.3	0.17	330	340	213.2
16	13.3	0.53	305	315	171.7

[1] From Radiometric Precision Table of *ABI Performance and Operational Requirements Document (PORD), 2004*.
[2] From Dynamic Range Table of *ABI Performance and Operational Requirements Document (PORD), 2004*.
[3] Instrument Maximum Scene Temperature plus 10 K, based on *GVAR IR Scale Factor Coefficient memo, 1991*.
[4] Five times multiplication factor for the Spec Noise, based on *GVAR IR Scale Factor Coefficient memo, 1991*.

ABI Band	Central Wavelength (µm)	Spec NEdN (mW/…)[1]	Instrument Minimum Scene Temperature (K)[2]	Minimum Scene Temperature (K) for Scaling[5]	Min Scene Radiance minus 5x noise (mW/…) for Scaling[4]
7	3.9	0.004	4	0	-0.020
8	6.185	0.05	4	0	-0.25
9	6.95	0.09	4	0	-0.45
10	7.34	0.1	4	0	-0.5
11	8.5	0.13	4	0	-0.65
12	9.61	0.16	4	0	-0.80
13	10.35	0.17	4	0	-0.85
14	11.2	0.17	4	0	-0.85
15	12.3	0.17	4	0	-0.85
16	13.3	0.53	4	0	-2.65

[5] Radiance from space assumed to be zero for all bands, based on *GVAR IR Scale Factor Coefficient memo, 1991*.

Relating ABI Specifications to Required Bit Depth
[Radiance units: mW/… = mW/(m^2·sr·cm^{-1})]

ABI Band	Central Wavelength (µm)	Spec NEdN (mW/…)[1]	Target Delta Radiance per Count Step: NedN/2.5[6] (mW/…)	Radiance Range (mW/…) for Scaling[7]	Minimum Number of Bits Required[8]	Resulting Delta Radiance per Count Step[9] (mW/…)
7	3.9	0.004	0.0016	25.0	14	0.0015
8	6.185	0.05	0.020	28.4	11	0.014
9	6.95	0.09	0.036	45.8	11	0.022
10	7.34	0.1	0.040	80.7	11	0.039
11	8.5	0.13	0.052	136.1	12	0.033
12	9.61	0.16	0.064	110.0	11	0.053
13	10.35	0.17	0.068	185.2	12	0.045
14	11.2	0.17	0.068	200.4	12	0.049
15	12.3	0.17	0.068	214.0	12	0.052
16	13.3	0.53	0.21	174.3	10	0.17

[6] Factor of 2.5 based on e-mail from Mike Weinreb, 2004.
[7] Radiance Range between Max and Min Scene Radiances with noise.
[8] Radiance Range divided by Target Delta Radiance and rounded up to next whole bit.
[9] Delta Radiance based on rounded whole bits.

From ITT via Jeff K: 0.47, 0.86, 1.38, 1.61, 2.26: 10 bits
6.18, 6.95, 9.61, 13.3: 11 bits
0.64, 7.34, 8.5, 10.35, 11.20, 12.30: 12 bits
3.90: 14 bits

Relating Instrument Maximum Scene Temperature and Number of Bits to Quantization Noise for Cold Cloud Tops

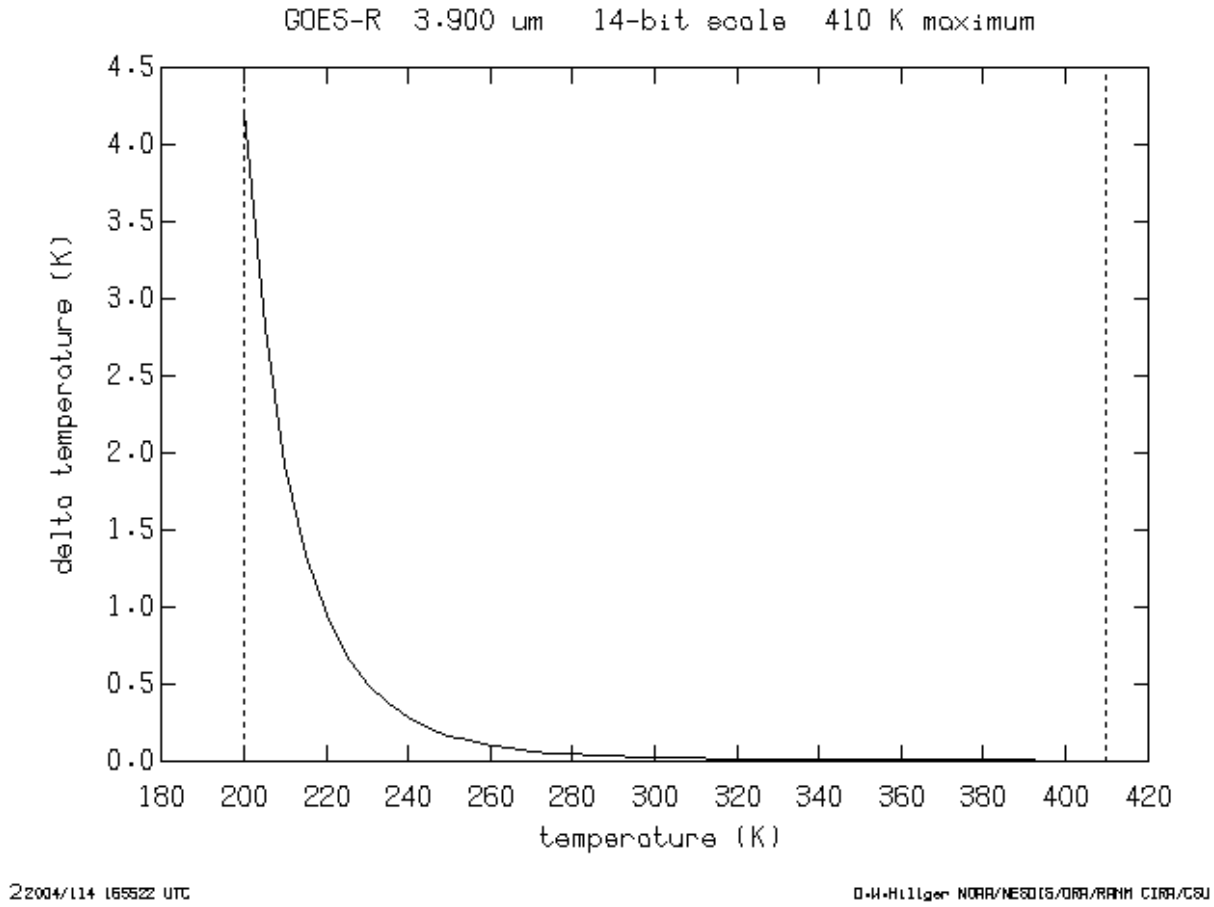
Quantization Noise (K) @ 200 K ABI band-7 (3.9 µm)		Number of Bits			
		10-bit (0-1023)	12-bit (0-4095)	14-bit (0-16,383)	16-bit (0-65,535)
Maximum Temperature (K)	350	28.4	4.9	1.2	0.30
	375	∞	9.9	2.3	0.58
	400	∞	21.2	4.2	1.0

Notes:
- Current-GOES quantization noise is 13.8 K @ 200 K (utilizing a 10-bit scale and a maximum scene temperature of 335 K).
- ABI noise spec (0.1 K @ 300 K and 1.4 K @ 240 K) is equivalent to a noise of 32.1 K @ 201 K.

Relating Instrument Maximum Scene Temperature and Number of Bits to Quantization Noise for Warm Scenes

Quantization Noise (K) @ 300 K ABI band-7 (3.9 µm)		Number of Bits			
		10-bit (0-1023)	12-bit (0-4095)	14-bit (0-16,383)	16-bit (0-65,535)
Maximum Temperature (K)	350	0.093	0.023	0.0058	0.0015
	375	0.18	0.045	0.011	0.0028
	400	0.32	0.081	0.020	0.0051

Notes:
- Current-GOES quantization noise is 0.060 K @ 300 K (utilizing a 10-bit scale and a maximum scene temperature of 335 K).
- ABI noise spec (0.1 K @ 300 K)



Example: Quantization noise (in temperature units) as a function temperature for ABI band-7 (3.9 μm) for a 14-bit scale. A 14-bit scale is the minimum number of bits needed to meet the target delta radiance per count step (based on the requirements of specified noise and desired maximum scene temperature of 400 K). This scale results in a quantization noise per count step of 4.2 K @ 200 K.