Camera Gain for Augmented Reality Background Transition Point

Item Under Test: Augmented Reality camera

Test Revision Number: 1.1

Test Revision Date: 2/25/2021

Authored: Collin Hurley

Summary: The quality of an image from the augmented reality CMOS camera can be estimated with the automatically determined camera gain parameter internal to the camera. This estimate can be used to provide a transition point where the thermal image is more valuable to the driver than the generic augmented reality camera.

Method: Test

Applicable requirements:

Purpose and Scope: This test is to be conducted for any new augmented reality camera model to determine the appropriate camera parameters (Likely camera Gain) and value to use as the transition point when selecting between the CMOS camera and the Far Infra-red (FIR) camera. Because of the inherent differences between cameras there is not a universal conversion for gain between cameras therefore, the signal to noise ratio of a known target in a controlled environment shall be used.

Items under test: The new Augmented Reality camera part number

Data Recordings: Ensure all images used in calculation are captured uncompressed

Precautions:

1. The images for the SNR capture
2. The test environment must be controlled for light and measured at the target
3. The target should be centered in the camera

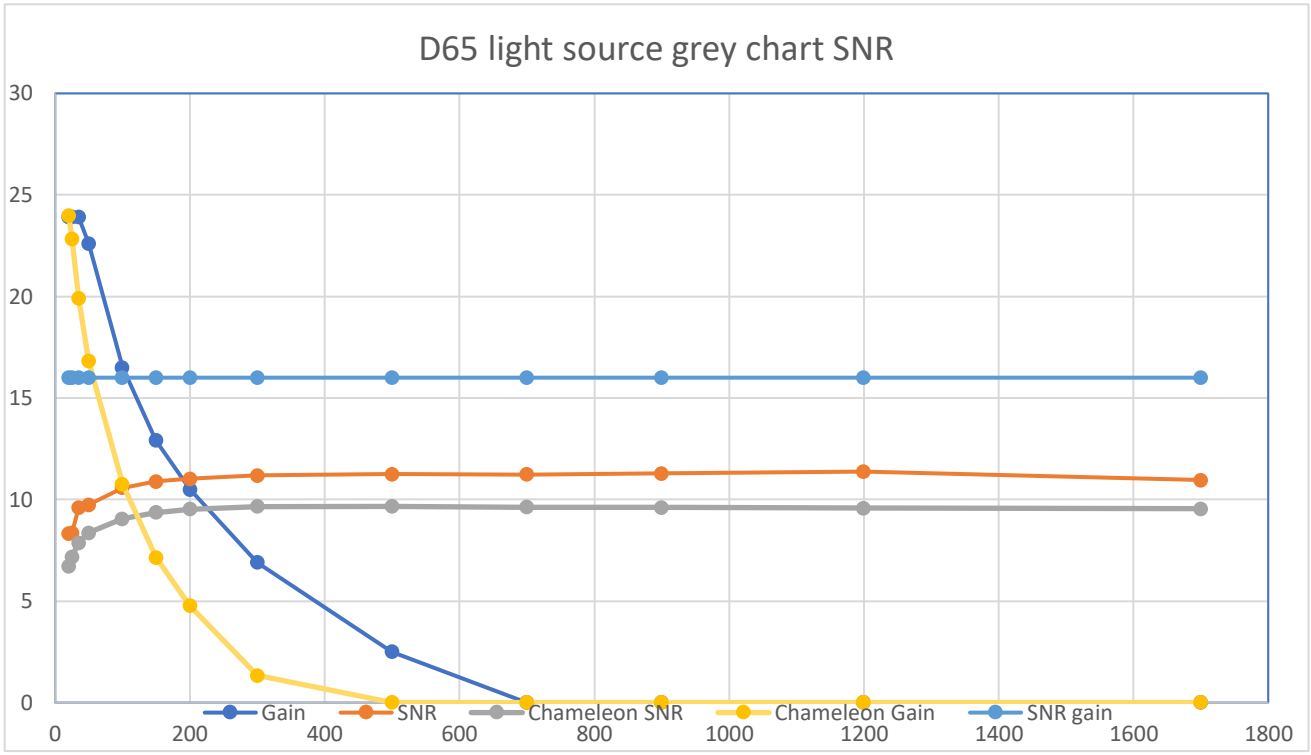
Special considerations/ Limitations: Ensure that the images captured behind the glass at the same angle that they will be mounted at in the vehicle.

Equipment/ Facilities: Lighting controlled lab or light box for the cameras being tested, 17% grey SNR target, Calibrated Lux meter, ImageJ image processing software

Procedures:

1. Bring the new Augmented reality camera into a controlled lab environment or light box where the Lux level can be controlled
2. Collect images of the calibrated target centered in the scene where the region to be determined will fill approximately 30% of the image area (TBR)
3. Capture 10 frames at the brightest light setting (TBR) or at least 1000 lux
    a. Ensure that while capturing these frames that the camera parameters (gain) are being recorded as well.
4. Lower the light level one step (Depends on control level in the new lab we will be going to TBR)
5. Grab 10 frames

6. Repeat steps 4 and 5 until the light level in the controlled environment is at its lowest setting possible where the target is still visible.
7. Once all the data is collected analyze the data in ImageJ
    a. Open the first frame of the brightest image set in ImageJ
    b. Select the uniform region of interest of the calibrated target that will be used to calculate the SNR
    c. In image J perform the measure action on that region of interest and make sure that both the Sigma (Standard Deviation) and the Average of the region are measured
    d. Perform this measurement on all ten frames
    e. Save that data and import into excel
    f. For each of the measurements divide the average by the standard deviation
    g. Average for all the frames measured at an individual light level
    h. Repeat for all light levels
    i. Once a SNR is calculated for all light levels ensure that the general trend is that as the environment gets darker the SNR will get smaller
        i. If not ensure that the target is positioned correctly and ensure that the target meets the requirements of the target (The target must not be the source of noise in the image)
    j. Match up the point the camera SNR levels off with the corresponding gain transition point.
        i.



    k. Matchup the determined SNR requirement with the specific camera gain recorded on this camera model.

Post Test Activity: This Calculated Gain value must now be added to the transition point requirement for TEV MVP as the correct value to be used for this specific camera model ensure that the part number is appropriately noted