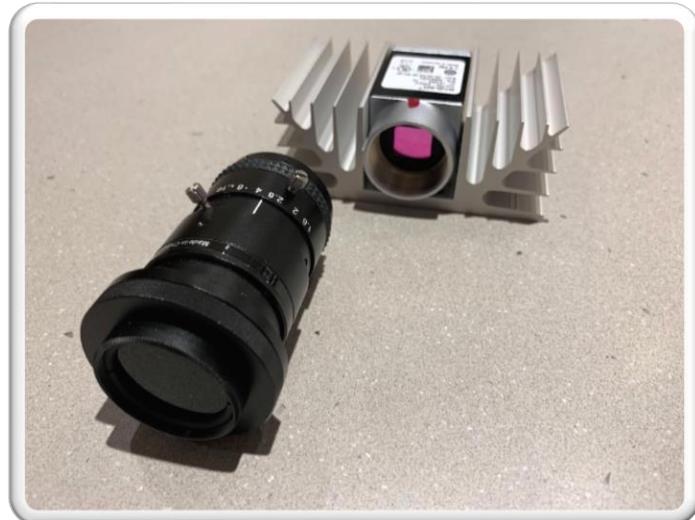


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# NEEA TV Energy Assessment System (NEEA TV EASY)

## User Manual 3.18.10.4



For NEEA TV EASY software version 3.18.10.4

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## Contents

1	Introduction .....	8
1.1	Purpose and Scope.....	8
1.2	NEEA TV Energy Assessment System Software Overview.....	8
1.3	Camera Technical Information .....	8
2	Glossary.....	8
2.1	Definitions .....	8
2.2	Symbols and Abbreviations .....	9
2	PCL TV Test Kit Equipment .....	10
2.1	Basic Test Kit .....	10
2.2	Other Required Equipment .....	12
3	Prepare for Your First Test .....	12
3.1	Install or Update Your Software .....	13
3.1.1	Install NEEA TV EASY.....	13
3.1.2	Activate NI Vision Development Module.....	14
3.1.3	Install Wireshark.....	15
3.2	Configure Your Software .....	15
3.2.1	Prepare Instruments to Connect to NEEA TV EASY .....	15
3.2.2	Configure Devices in NEEA TV EASY .....	20
3.2.3	Run Wireshark.....	23
3.3	Check Lab Conditions .....	25
3.4	Mount and Connect Your Camera .....	25
3.5	Prepare Your ABC Lamp .....	25
3.6	Prepare Your Media Player.....	26
3.7	Prepare Your AC Power Supply.....	26
3.8	Prepare Your Power Meter.....	26
3.9	Set Up the TV .....	26
4	Conduct Your First Test .....	26
4.1	Use Automated Mode .....	27
4.1.1	Enter Equipment Details.....	28
4.1.2	Position Equipment .....	28
4.1.3	Set Test Mode and Output Folders and Enter Metadata .....	32



4.1.4	Update TV Software .....	33
4.1.5	Record TV Configuration.....	34
4.1.6	Configure Screen for Measurements .....	35
4.1.7	List Preset Picture Settings.....	36
4.1.8	Determine Brightest SDR Preset Picture Setting.....	37
4.1.9	Record “Backlight” Controls.....	39
4.1.10	Configure Smart Wake Features .....	39
4.1.11	Configure Quickstart and MDD .....	40
4.1.12	Confirm Information.....	41
4.1.13	Select Tests .....	42
4.1.14	Begin Conducting Measurements .....	44
4.1.15	Navigate While Conducting Tests.....	46
4.2	Use Manual Mode.....	47
4.2.1	Use Fixed Time Test.....	47
4.2.2	Use Custom Sequence Test.....	47
5	Generate a Report .....	49
5.1	Configure Report Generation .....	49
5.2	Configure a NEEA Report.....	50
5.3	Results of Report Generation .....	51
6	Automated Test Repair and Retest.....	51
6.1	Edit Metadata .....	51
6.2	Redo Parts of a Test .....	54
6.2.1	Back up during testing .....	54
6.2.2	Repeat one or more test steps after stopping or completing a test .....	54
	Appendix A: Setup Checklist .....	56
	Appendix B: Basic Example Custom Test Sequence .....	57
	Appendix C: Test Names and Descriptions .....	58
	Appendix D: Dimming Switch Low End Trim Adjustment.....	59
	Appendix E: Errata.....	60
	Appendix F: Advanced Ethernet Port Settings for GigE Cameras .....	61
	Introduction .....	61
	Dell Latitude 14 1700 series.....	62
	Disable Firewall.....	62



Configure ethernet adapter .....	66
Set packet size .....	71
IBM ThinkPad T450.....	73
Disable Firewall.....	73
Configure ethernet adapter .....	77
Set packet size .....	84
IdeaPad 5 Pro 14 with Realtek USB GbE adapter .....	85
Disable Firewall.....	85
Update ethernet adapter drivers .....	89
Configure ethernet adapter .....	90
Set packet size .....	95
Tip: Display scaling.....	95
Appendix G: Luminance Measurement Check.....	97
Data drop-out check .....	97
Calibration drift check .....	97

## Tables

Table 1: Basic Test Kit Contents .....	10
Table 2: Video Clips .....	11
Table 3: Video Clip Folders.....	11
Table 4: Other Required Equipment.....	12
Table 5: Which Test Modes are suitable for which report types .....	50
Table 6: Metadata Editing Instructions .....	52
Table 7: Test Names and Explanations .....	58

## Figures

Figure 1: Overall lab setup .....	13
Figure 2: How to dismiss Windows Defender warning.....	14
Figure 3: Navigate to “view network connections” in Windows .....	16
Figure 4: Right click on the Ethernet device and select Properties.....	16
Figure 5: Open the properties menu for the TCP/IPv4 protocol.....	17
Figure 6: Set the properties of the TCP/IPv4 protocol .....	18
Figure 7: Locate the camera device in Pylon IP Configurator .....	19
Figure 8: Set the IP address of the camera .....	19
Figure 9: Pre-Test Menu (Left) Devices popup (Right) .....	20
Figure 10: Camera configuration menu in NEEA TV EASY .....	21
Figure 11: List of currently supported power meter devices.....	22



Figure 12: Select a COM port to connect to an HPM 100-A .....	23
Figure 13: Open Wireshark, select the network interface connected to the test LAN, and start recording. ....	24
Figure 14: Stop capturing packets. ....	24
Figure 15: Connections of a PoE injector.....	25
Figure 16: Choose between Manual Mode and Automated Mode .....	27
Figure 17: Choose new test or load test. ....	27
Figure 18: Enter the make and model of certain lab equipment. ....	28
Figure 19: Physical Setup step of new test creation .....	29
Figure 20: Front view of equipment positions .....	29
Figure 21: Side view of equipment positions.....	30
Figure 22: Where in the lens assembly to measure distance from the TV screen.....	30
Figure 23: Center the camera .....	31
Figure 24: Basic test information and output folders .....	32
Figure 25: Detailed metadata .....	33
Figure 26: Update the TV software .....	34
Figure 27: Configure the TV, documenting your choices .....	35
Figure 28: Screen configuration (before). ....	36
Figure 29: Screen configuration (after) .....	36
Figure 30: Enter PPS names .....	37
Figure 31: Measure luminance of each non-HDR PPS.....	38
Figure 32: Click “Start” to begin recording dynamic luminance of a PPS .....	38
Figure 33: Record Backlight Control .....	39
Figure 34: Check which Smart Wake features are enabled .....	40
Figure 35: Check Quickstart and MDD settings.....	41
Figure 36: Review new test information .....	42
Figure 37: Turn on or off specific tests .....	43
Figure 38: Popup shown before starting measurements .....	44
Figure 39: dark_current test step.....	45
Figure 40: stabilization test step popup .....	45
Figure 41: Numbered key to the measurements screen .....	46
Figure 42: Configuring a Set Time test .....	47
Figure 43: Configuring a Custom Sequence Test.....	48
Figure 44: Basic elements of the Generate Report page.....	49
Figure 45: NEEA Policy Proposal report settings.....	50
Figure 46: Select previous test folders .....	54
Figure 47: Select the tests to redo .....	55
Figure 48: Instructions for low-end trimming adjustment to dimmer switch .....	59
Figure 49: Signs of camera data drop-out .....	61
Figure 50: Disable firewall, step 1 .....	62
Figure 51: Disable firewall, step 2 .....	63
Figure 52: Disable firewall, step 3 .....	64
Figure 53: Disable firewall, step 4 .....	65
Figure 54: Configure ethernet adapter, step 1 .....	66



Figure 55: Configure ethernet adapter, step 2 .....	67
Figure 56: Configure ethernet adapter, step 3 .....	68
Figure 57: Configure ethernet adapter, step 4 .....	69
Figure 58: Configure ethernet adapter, step 5 .....	70
Figure 59: Configure ethernet adapter, step 6 .....	71
Figure 60: Set TV EASY packet size .....	72
Figure 61: Disable firewall, step 1 .....	73
Figure 62: Disable firewall, step 2 .....	74
Figure 63: Disable firewall, step 3 .....	75
Figure 64: Disable firewall, step 4 .....	76
Figure 65: Configure ethernet adapter, step 1 .....	77
Figure 66: Configure ethernet adapter, step 2 .....	78
Figure 67: Configure ethernet adapter, step 3 .....	79
Figure 68: Configure ethernet adapter, step 4 .....	80
Figure 69: Configure ethernet adapter, step 5 .....	81
Figure 70: Configure ethernet adapter, step 6 .....	82
Figure 71: Configure ethernet adapter, step 7 .....	83
Figure 72: Configure ethernet adapter, step 8 .....	83
Figure 73: Set TV EASY packet size .....	84
Figure 74: Disable firewall, step 1 .....	85
Figure 75: Disable firewall, step 2 .....	86
Figure 76: Disable firewall, step 3 .....	87
Figure 77: Disable firewall, step 4 .....	88
Figure 78: Update adapter driver.....	89
Figure 79: Configure ethernet adapter, step 1 .....	90
Figure 80: Configure ethernet adapter, step 2 .....	91
Figure 81: Configure ethernet adapter, step 3 .....	92
Figure 82: Configure ethernet adapter, step 4 .....	93
Figure 83: Configure ethernet adapter, step 5 .....	94
Figure 84: Set TV EASY packet size .....	95
Figure 85: Adjust display scaling, step 1 .....	96
Figure 86: Adjust display scaling, step 2 .....	96
Figure 87: Circle.mp4 video clip .....	98

## Revision History

v9 – Gregg Hardy, 11/14/20	Major edits
V10 – Ben Hardy, 11/15/20	Mostly Minor Edits, Clean up section 6 Test Kit Operation
v12-Gregg Hardy, 11/16/20	Replaced equipment tables and made minor edits.
V13 – Ben Hardy, 11/18/20	Added table of contents for tables. Laptop password included. Rough additions to 6.2 Error Mitigation.
V14 – Gregg Hardy, 11/19/20	Disable local dimming during CCF. Discussion about how to confirm settings in each PPS. Added error code troubleshooting section



	Updated risk mitigation section.
v15 – Gregg Hardy, 11/25/20	Added test clips tables that show when to use each clip.
v16 – Gregg Hardy, 12/2/20	Modified demo video note.
V17 – Ben Hardy, 12/14/20	Modified software setup and test kit operation to reflect v3-11-1 GUI changes.
V18 – Ben Hardy, Trevor Swope 1/5/21	Updated manual testing mode features according to v3-16-0. Added multicast generation walkthrough.
V19 – Ben Hardy, 1/19/21	General revisions. Updated reflective card placement and local dimming requirements. Added Definitions, Symbols and Abbreviations.
V20 – Ben Hardy, 1/22/21	Removed dead link to test clips (can relink if uploaded), added clarification in camera setup for having the whole screen in camera FOV, added CCF results menu, V10 CTA references, trim reflective card,
V21 – Ben Hardy, 3/1/21	Added appendix for Low End Trim adjustment (need to add cross reference within body).
V22 – Ben Hardy, 4/5/21	Incorporating Sony feedback.
V23 – Ben Hardy, 4/19/21	Updating for customer provided computer and power meter. Software install guide.
V24 – Trevor Swope, 8/23/21	Additional edits to mention camera calibration step
V25 – Trevor Swope, 9/23/21	Additional instructions on ethernet port configuration, and fixed references
V26 – Trevor Swope, Gregg Hardy, 10/8/21	Removal of CCF instructions, updated screenshots
V27 – Trevor Swope, Gregg Hardy, 10/21/21	Clarification of various prompts and test flow
V29 – Gregg Hardy, 11/18/21	Clarified PacketSender file import instructions.
V30 – Gregg Hardy, 4/17/22	Updated video clip filenames.
V32 – Felix Tyson, 7/6/22	Many updates that provide clarifications per WG13 discussions about 2037D.
V33 – Felix Tyson, 10/21/22	Update to reflect major changes to software.
V3.18.10.4 – Gregg Hardy, 11/7/2022	Added Appendices F and G



## 1 Introduction

### 1.1 Purpose and Scope

This manual provides an overview of the Pacific Crest Labs (PCL) TV Test Kit contents, guidance on setup, and operational instructions targeted at two emerging policy initiatives ([ENERGY STAR® v9](#) and a [potential U.S. Voluntary Agreement \(VA\)](#)). The manual is intended for use in first-time setup and operation and as a reference for continued use. The Appendices provide useful checklists for use in everyday testing.

### 1.2 NEEA TV Energy Assessment System Software Overview

The NEEA TV Energy Assessment System (NEEA TV EASY) software simplifies the process of testing TV power consumption in compliance with ANSI/CTA-2037-D, ANSI/CTA-2037-C, or both. ANSI/CTA-2037-C is the test method currently required by ENERGY STAR® Televisions v9.0. ANSI/CTA-2037-D is the successor to ANSI/CTA-2037-C and is used to determine compliance to the NEEA Policy Proposal (in support of VA development).

The software does this by providing three services: it guides testers through the testing process, collects the required data, and generates a compliance report. Reports can be generated to show compliance to ENERGY STAR® Televisions v9.0 or to the NEEA Policy Proposal, or both.

### 1.3 Camera Technical Information

The technical details of the camera photometer testing method utilized by the PCL TV Test Kit are thoroughly documented. Our Camera Technical White Paper can be found on our website at <https://www.pacificcrestlabs.com/documents>. It explains the hardware's technical capabilities, the image processing techniques employed, our calibration approach, and measurement uncertainty.

## 2 Glossary

### 2.1 Definitions

**Automatic brightness control** – Feature that senses ambient light conditions and changes display brightness accordingly, in most cases reducing power consumption.

**Brightest selectable preset picture setting** – This is the user-selectable, preset picture setting that produces the highest luminance picture in Home Configuration.

**Forced menu** – Configuration selections required of the user when a television set is turned on for the first time that forces the user to make several setup configuration decisions when prompted.

**Home configuration** – The configuration most likely to be chosen for home use. This configuration selection is sometimes named “home.” If there is no associated forced menu selection, the unit is in Home Configuration if it is not in Retail Configuration. Home Configuration corresponds to Normal Configuration as defined in IEC 62087.

**Illuminance** – Photometric measure of the total luminous flux incident on a surface, per unit area, expressed in lux.



**Luminance** – Photometric measure of the luminous intensity per unit area of light traveling in a given direction, expressed in units of candelas per square meter (cd/m<sup>2</sup> or nit).

**Neutral density filter (ND filter)** – Optical device that reduces the light intensity in the visible wavelength region.

**Preset picture setting** – TV picture setting that is selectable by a user from a set of manufacturer-defined picture settings.

**Standby Mode** – A category of Power Mode for which the television set is connected to an external power source and does not provide picture or sound. The television set can be switched into another mode with the remote-control unit (among other ways). This is the mode the TV is in when it is powered down with the remote control.

**Quick start** – Function that reduces the television’s resume time, which is the length of time required for the television to display content when switching from Standby Mode to On Mode.

**Retail configuration** – Configuration most likely to be chosen for use in a retail environment. This configuration selection is generally recommended by the manufacturer for presentation in a public space when the television set is offered for sale and might be named “Retail,” “Store,” “Shop,” or equivalent.

**Wake-By-Remote-Control-App** – The ability to wake a TV using any network-connected device not physically connected to the TV.

**Wake-by-Smart-Speaker** – The ability to wake a TV by voice command to a smart speaker.

**Wake-on-cast** – The ability to wake a TV by choosing to cast streaming audio or video from a mobile device.

## 2.2 Symbols and Abbreviations

ABC	Automatic brightness control
cd/m <sup>2</sup>	Candela per square meter
cm	Centimeters
CTA	Consumer Technology Association
FOV	Field of view
HDMI®	High-Definition Multimedia Interface
HDR	High dynamic range
HEVC	High efficiency video coding
Hz	Hertz
IEC	International Electrotechnical Commission
IP	Internet Protocol
LAN	Local area network
LCD	Liquid crystal display



LED	Light-emitting diode
lx	Symbol for lux, the SI derived unit of illuminance
ND	Neutral density
NEEA	Northwest Energy Efficiency Alliance
PPS	Preset picture setting
QS	Quick Start
SDR	Standard dynamic range
TV	Television set
TV EASY	TV Energy Assessment System
US	United States
USB	Universal Serial Bus
V	Volts
W	Watts
WAN	Wide Area Network

## 2 PCL TV Test Kit Equipment

### 2.1 Basic Test Kit

Table 1: Basic Test Kit Contents

Equipment	Features	Photo
NEEA TV EASY software	<ul style="list-style-type: none"> <li>Measures dynamic luminance and power at 1 second intervals</li> <li>Includes 20 uses per year of Automated Mode</li> </ul>	
Basler Camera Photometer	<ul style="list-style-type: none"> <li>Includes ND, IR and photopic filters</li> <li>Includes lens cap</li> <li>Requires PoE injector (included)</li> <li>Requires computer and test software</li> <li>Locked aperture</li> <li>Requires annual calibration</li> <li>Meets ANSI/CTA-2037-D section 7.1.4</li> </ul>	
Power over Ethernet (PoE) Injector for GigE Cameras	<ul style="list-style-type: none"> <li>Provides power to GigE camera photometers</li> <li>Includes 2 ethernet cables</li> <li>Includes external power adapter</li> </ul>	



USB Thumb Drive	<ul style="list-style-type: none"> <li>Contains test clips listed below</li> <li>Meets ANSI/CTA-2037-D</li> </ul>	
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Also in the Basic Test Kit are the video clips required to use the software, including the test clips required for ANSI/CTA-2037-D testing (these are the Referenced IEC Test Media, which are also available for free here).

Table 2: Video Clips

Name and Description <sup>1</sup>	Resolutions	Thumbnail
Dots_resolution_v2.mp4	SD, HD	
Focus_resolution_v2.mp4	SD, HD	
Lum_resolution_v2.mp4	SD, HD	
IEC_Broadcast_resolution_5994p_SDR_HEVC_AAC.MP4	SD, HD	
IEC_Broadcast_resolution_5994p_HDR10_HEVC_AAC.MP4	HD, UHD	

Table 3: Video Clip Folders

Folder	File Name <sup>1</sup>
SD TV Testing	Dots_SD_v2.mp4
	Focus_SD_v2.mp4
	Lum_SD_v2.mp4

<sup>1</sup> In PCL material and in the IEC source material, there are instances where the “p” is omitted after “5994”. The clips are the same, whether a “p” is present or not.



	IEC_Broadcast_SD-5994p_SDR_HEVC_AAC.MP4
HD TV Testing	Dots_HD_v2.mp4
	Focus_HD_v2.mp4
	Lum_HD_v2.mp4
	IEC_Broadcast_HD_5994p_SDR_HEVC_AAC.MP4
	IEC_Broadcast_HD_5994p_HDR10_HEVC_AAC.MP4
UHD & 8K TV Testing	Dots_HD_v2.mp4
	Focus_HD_v2.mp4
	Lum_HD_v2.mp4
	IEC_Broadcast_HD_5994p_SDR_HEVC_AAC.MP4
	IEC_Broadcast_UHD_5994p_HDR10_HEVC_AAC.MP4

## 2.2 Other Required Equipment

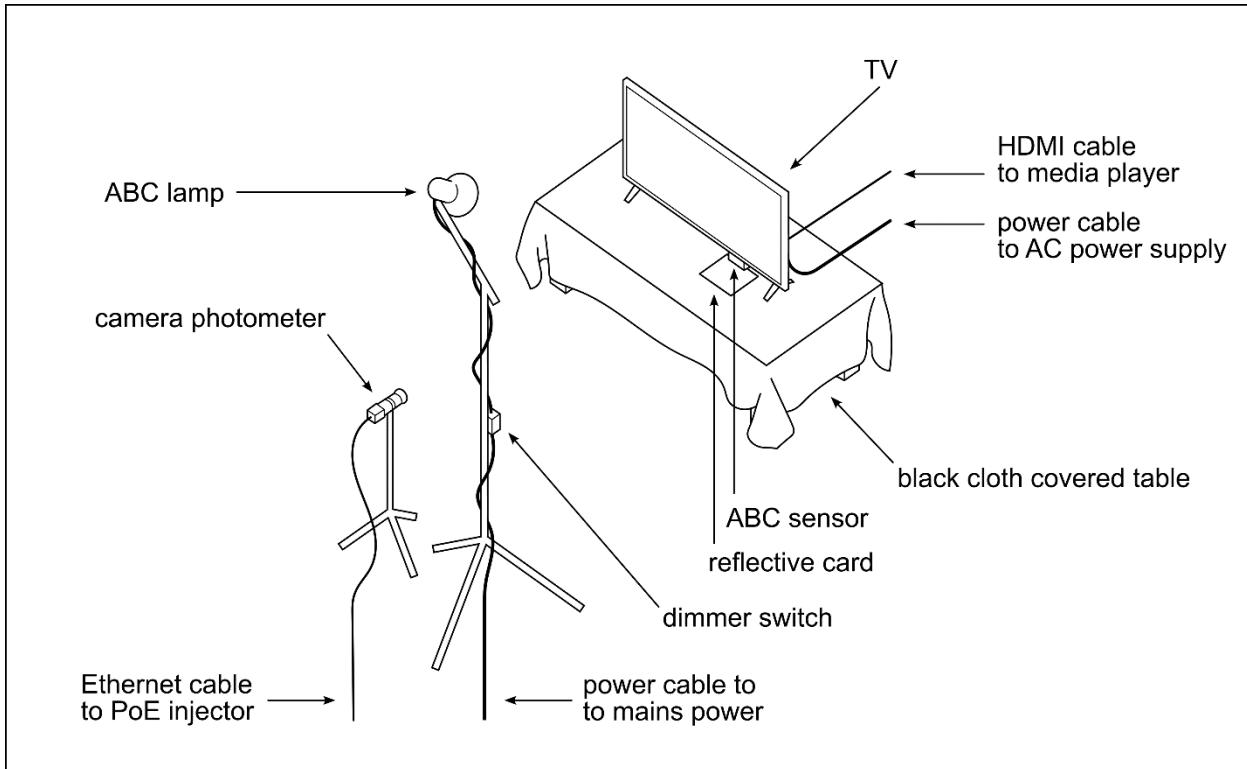
*Table 4: Other Required Equipment*

Equipment	Spec Requirements
Reflective Card	ANSI/CTA-2037-D section 8.2.1
USB Thumb Drive	ANSI/CTA-2037-D section 7.1.5
AC Power Source	ANSI/CTA-2037-D section 7.1.1
Power Meter	ANSI/CTA-2037-D section 7.1.2
Illuminance Meter	ANSI/CTA-2037-D section 7.1.3
ABC Light Source and Dimmer Switch	Informative requirements in ANSI/CTA-2037-D section 7.1.9
Table Covered by Minimally Reflective Black Cloth	ANSI/CTA-2037-D section 7.1.10
Illuminance Meter Mount	Used to position illuminance meter as required by ANSI/CTA-2037-D section 8.1.2
Media Player	ANSI/CTA-2037-D section 7.1.6
LAN and WAN Network Equipment	ANSI/CTA-2037-D section 7.1.8.1
Smart Speaker(s) and Mobile Device	ANSI/CTA-2037-D section 7.1.8.3–4
Computer to run the software and network traffic generator	<ul style="list-style-type: none"> <li>• Screen resolution of at least 1600×900 pixels</li> <li>• i7 processor or equivalent &amp; 8 GB RAM</li> <li>• Windows 10 or 11</li> </ul>
Camera Stands/Tripods used for Camera Photometer and ABC Lamp, including lamp mounting hardware	Used to position equipment as required by ANSI/CTA-2037-D section 8.1.1

## 3 Prepare for Your First Test

The overall lab setup is shown below in Figure 1.





*Figure 1: Overall lab setup*

### 3.1 Install or Update Your Software

If using a new PCL laptop, the steps in this section were completed by PCL prior to shipment with the possible exception of NI license activation, which is described below.

Your lab can use a laptop provided by PCL or its own computer. If using your own computer, you will need to complete these steps on that computer, which must support editing of .csv documents and reading of Microsoft Word and/or PDF files.

When new versions of NEEA TV EASY are released, you will need to repeat the steps in Section 3.1.1 to upgrade to the new version.

#### 3.1.1 Install NEEA TV EASY

NEEA TV EASY can be downloaded from the software page of the PCL website [here](#). That page provides a link to download the NEEA TV EASY installers, brief instructions regarding the installation, and recent patch notes.

Take note of the following while installing NEEA TV EASY.

1. Make sure to run the installer as an administrator.
2. Windows Defender typically warns the user when running the NEEA TV EASY installer. You can dismiss this warning by clicking where shown in Figure 2.



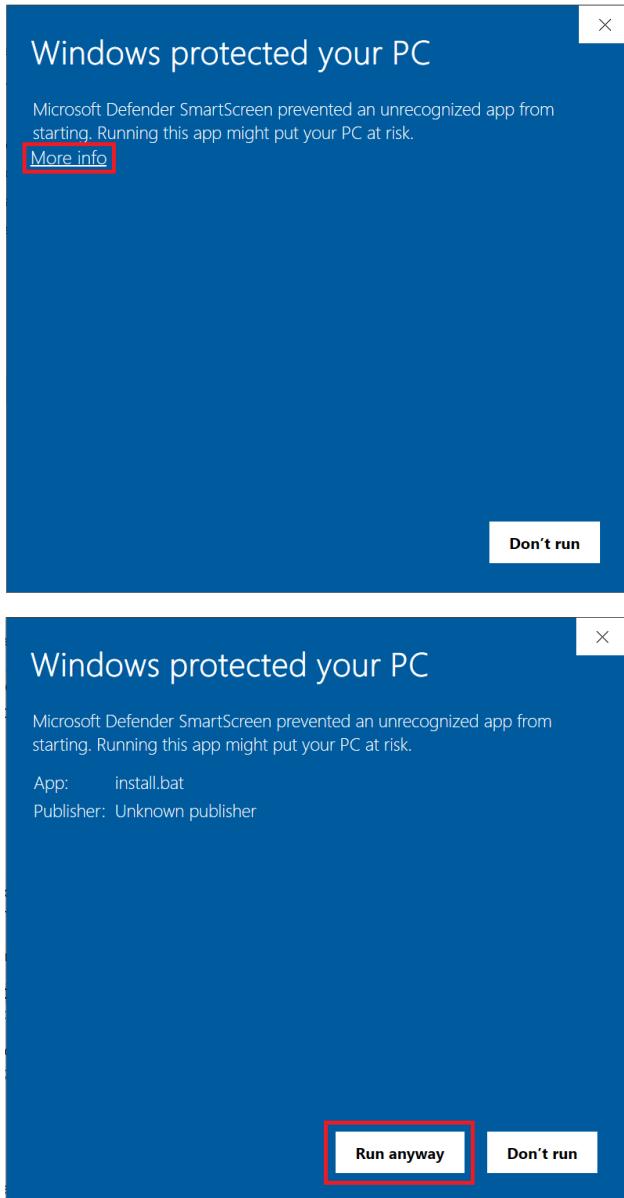


Figure 2: How to dismiss Windows Defender warning

3. Options throughout the installer can be left in their default setting.

#### 3.1.2 Activate NI Vision Development Module

The NI Vision Development Module Deployment license is required to use NEEA TV EASY. This license must be installed through the NI License Manager program. NI License Manager is installed automatically when installing NEEA TV EASY. NI License Manager can also be installed from [here](#).

If an NI license was not purchased through PCL, for example if your lab already has spare Vision Development Module Deployment licenses, you will need to activate the license on the computer on which NEEA TV EASY is installed. The license can be purchased [here](#).



### 3.1.3 Install Wireshark

Wireshark is used to record a log of network traffic on the LAN of the TV during testing. When testing Wi-Fi connected TVs, Wireshark can be run on the same computer which runs NEEA TV EASY.

To install Wireshark, visit its website at <https://www.wireshark.org/>, download the latest Windows version of Wireshark, and run the installer.

## 3.2 Configure Your Software

If using a new PCL laptop, the steps in this section were completed by PCL prior to shipment.

The steps below require your devices to be connected to the computer. Instructions for this are provided later in Section 3.

### 3.2.1 Prepare Instruments to Connect to NEEA TV EASY

Your camera and power meter need to be configured before using them with NEEA TV EASY.

#### 3.2.1.1 *Configure Camera Connection*

The cameras provided by PCL connect via Ethernet, so it is necessary to configure a “network” consisting of the computer and the camera.

##### Configure the Computer’s Ethernet Connection

Complete the following steps to prepare an Ethernet connection for the camera.

1. Click Start and type “view network connections.” In the search results click View Network Connections (Figure 3).



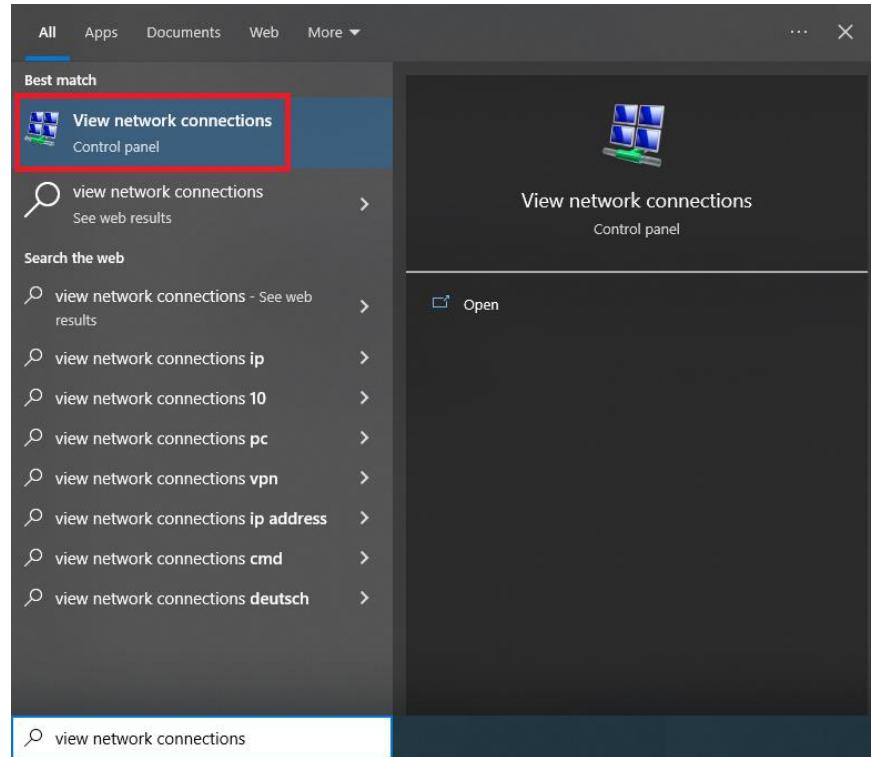


Figure 3: Navigate to “view network connections” in Windows

2. Right click on Ethernet (Local Area Connection) and click Properties (Figure 4).

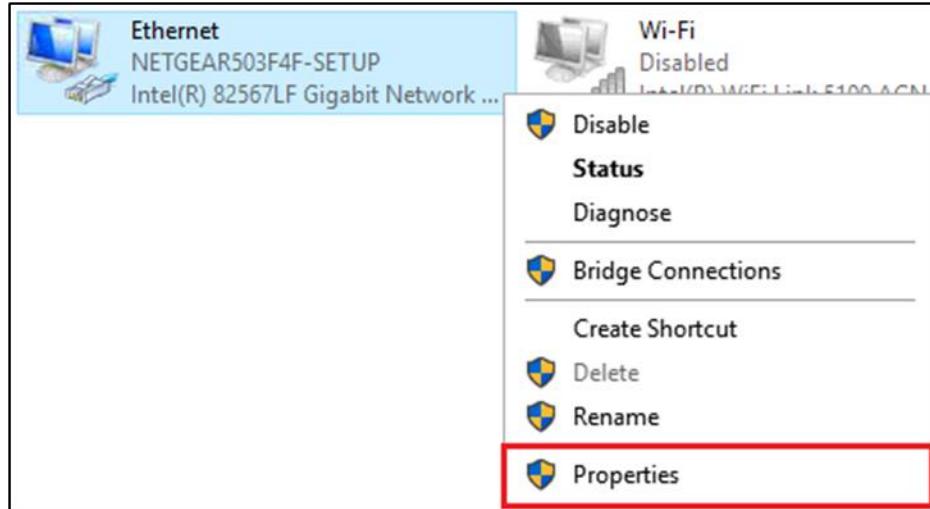


Figure 4: Right click on the Ethernet device and select Properties

3. Select Internet Protocol Version 4 (TCP/IPv4) and click Properties (Figure 5).



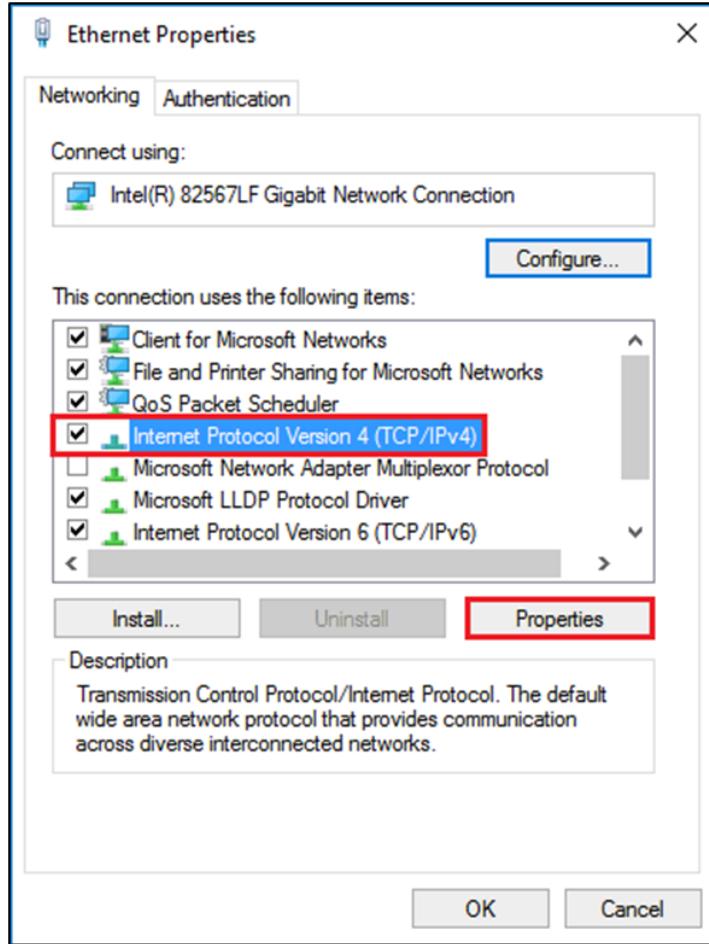


Figure 5: Open the properties menu for the TCP/IPv4 protocol

4. Select “Use the following IP address”. Enter an IP address of the form 10.0.0.x where x is a number in the range 2–14 or 16–254. (The choices x = 0, 1, or 255 are often given a special purpose in networking and so we exclude them. The choice x = 15 is excluded because PCL uses this IP address for its cameras.) This will now be the static IP address associated with that Ethernet port of the computer. Enter 255.255.255.0 in the subnet mask field. Click OK twice. See Figure 6 (in which x = 210).



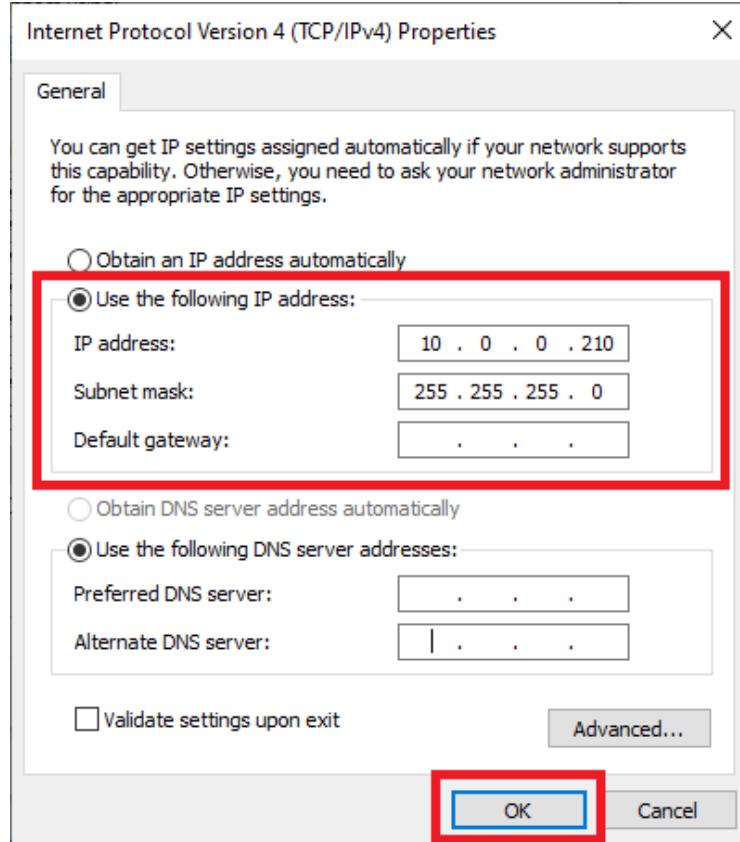


Figure 6: Set the properties of the TCP/IPv4 protocol

- Finally, Basler provides [guidance on advanced ethernet port configuration](#), but their instructions may result in data drop-out. The appropriate settings are dependent on the ethernet adapter in use. We refer the reader to Appendix F: Advanced Ethernet Port Settings for GigE Cameras for detailed ethernet port set-up instructions for the laptop models that PCL distributes. These instructions may be useful in configuring other computers and ethernet adapters. PCL can provide custom support for other computer models by video teleconference.

#### Set the IP Address of the Camera

The tool used to set the IP address of the Basler camera provided by PCL is called Pylon IP Configurator. Pylon IP Configurator is part of a suite of tools which can be downloaded [here](#). Laptops from PCL come with the suite installed. Cameras from PCL typically come with their IP address set to 10.0.0.15.

To set the IP address of the camera, the camera must be connected to a computer via a PoE injector. See Section 3.4 for instructions on setting up a PoE injector.

Complete the following steps to set the IP address of the camera.

- Open Pylon IP Configurator. Under Ethernet, there should be a camera device (Figure 7). If no device shows up, the camera is likely not properly connected to the computer.



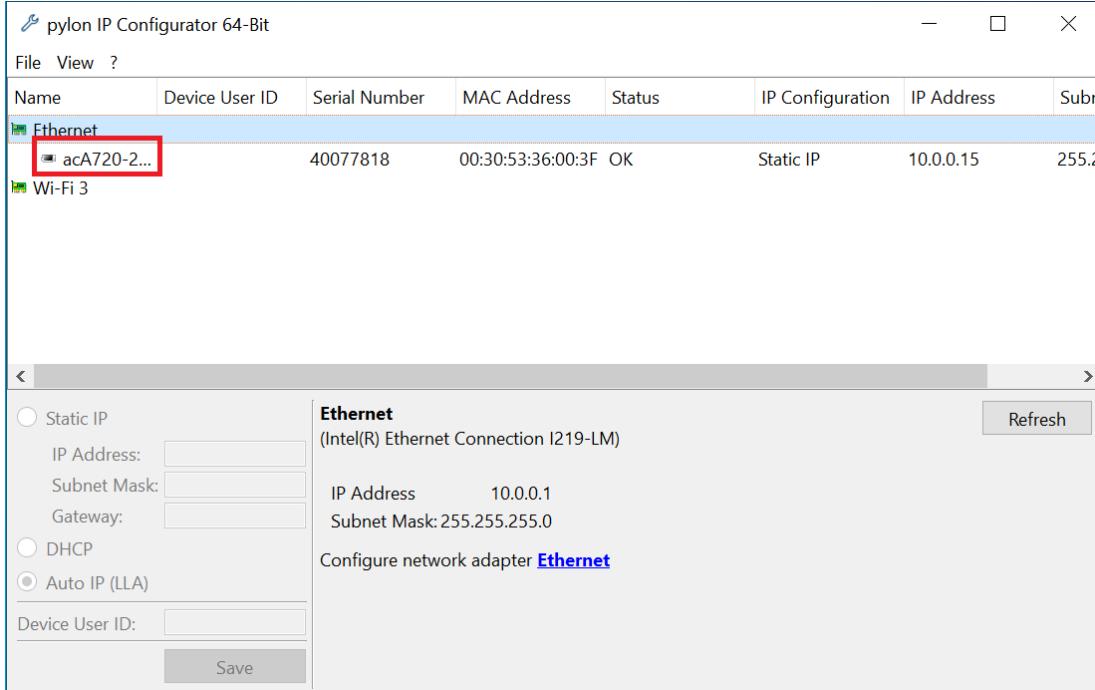


Figure 7: Locate the camera device in Pylon IP Configurator

2. Select the camera device. Click Static IP. Set the IP address to 10.0.0.15 (or any address of the form 10.0.0.y where y ≠ x chosen above), the subnet mask to 255.255.255.0, and the gateway to 0.0.0.0. Click Save to save these settings to the camera. See Figure 8.

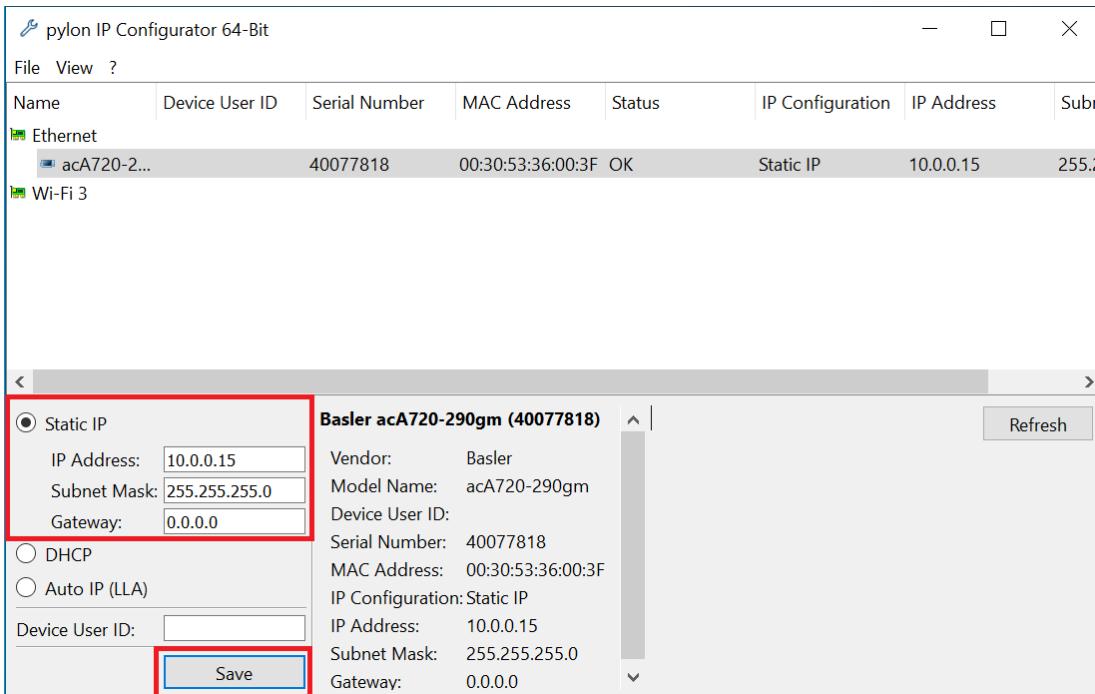


Figure 8: Set the IP address of the camera



### 3.2.1.2 Configure Power Meter Connection

The process for configuring a power meter to connect to NEEA TV EASY varies by model. If you are using an HPM 100-A Wattman power meter, complete the following steps to configure it.

If you are using a kit from PCL which includes an HPM-100A, the following steps were already completed prior to shipment.

1. Set the device baud rate to 19200.
  - a. Press and hold the “COST SET” button until “log” is displayed in the lower left corner.
  - b. Select “conn” → “select baud” → 19.20.
2. Set the bus protocol to AD.02.
  - a. Press and hold the “COST SET” button until “log” is displayed in the lower left corner.
  - b. Select “conn” → “node” → ad.02.

### 3.2.2 Configure Devices in NEEA TV EASY

Once your instruments are prepared to connect to NEEA TV EASY, open NEEA TV EASY and open the Devices popup (Figure 9). This can be done in advance of testing.

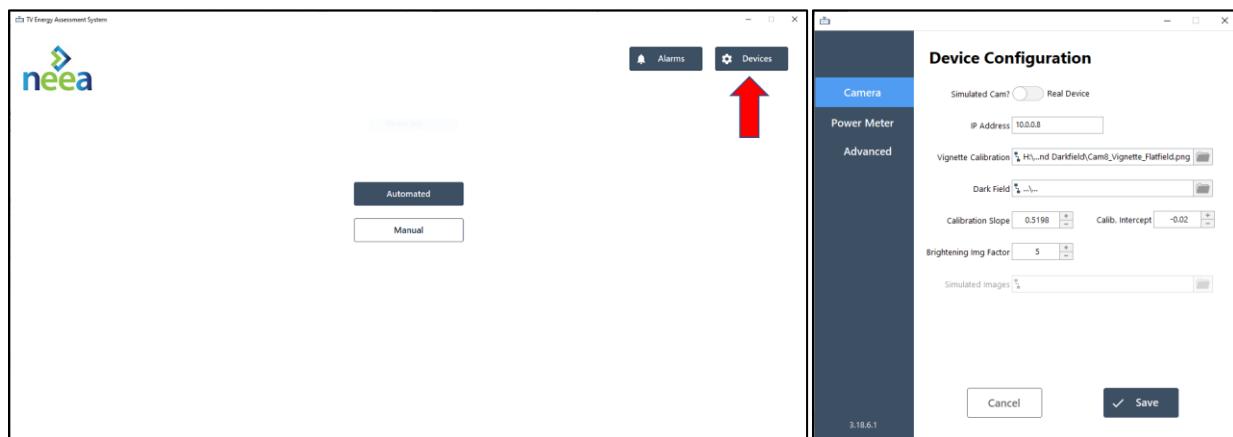


Figure 9: Pre-Test Menu (Left) Devices popup (Right)

#### 3.2.2.1 Configure Camera in NEEA TV EASY

Figure 10 gives a number to each setting in the Camera tab of the Devices popup. For each setting, see the instructions in the list below.



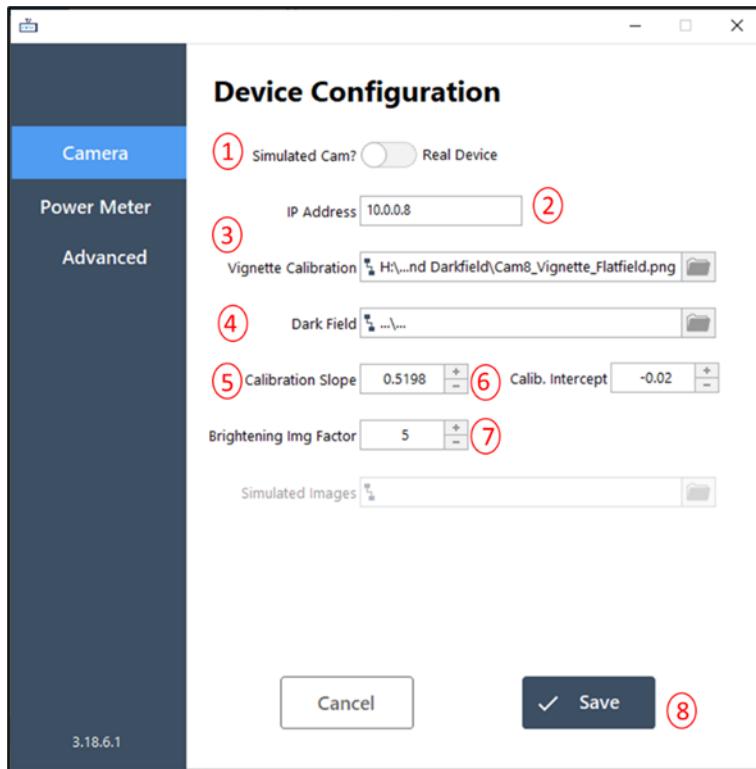


Figure 10: Camera configuration menu in NEEA TV EASY

1. Toggle the “Simulated Cam?” setting to “Real Device” as shown above.
2. Enter the static IP address provided with the Basler camera photometer. This is recorded in the cover sheet of the certificate of calibration for the camera. It is usually 10.0.0.15, but there are a few older cameras deployed with different static IPs.
3. Select the vignette calibration file associated with the camera.<sup>2</sup>
4. Select the dark field calibration associated with the camera.
5. Ensure the calibration slope is set to the calibration slope provided with the camera. The test kit will include this information on a sheet of paper and in the calibration folder on the provided USB stick.
6. Ensure the calibration intercept matches the intercept provided with the camera on the calibration certification sheet.
7. Choose a brightening image factor. This only affects the camera display visible during testing and does not affect the data collected. We recommend setting this to be within the range of 5-10; however, this can be set as low or as high as the tester wants. This setting can easily be changed if the camera feed is too bright or too dark. PCL recommends adjusting this setting while the camera is viewing the TV with the Focus\_xx.mp4 clip playing.
8. Save the settings configuration.

<sup>2</sup> These calibration files are stored by default in a new PCL TV Test Kit’s laptop in a “Camera Calibrations” folder on the Desktop. For kits without an included laptop, the calibration files will be provided on the USB stick included in the test kit.



### 3.2.2.2 Configure Power Meter in NEEA TV EASY

The process for configuring a power meter device in NEEA TV EASY varies by power meter model (Figure 11).

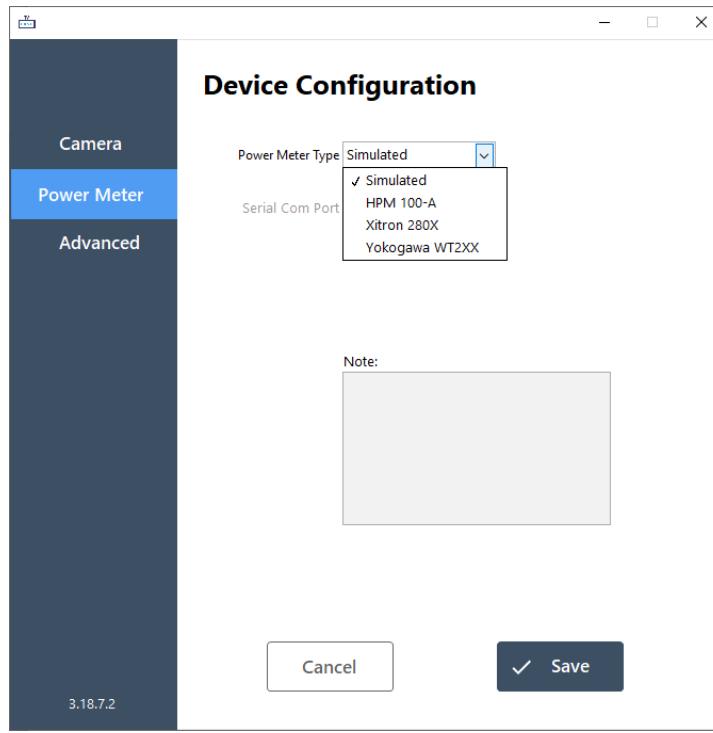


Figure 11: List of currently supported power meter devices

If you are using an HPM 100-A Wattman power meter, select “HPM 100-A” from the “Power Meter Type” drop-down list. Then open the “Serial Com Port” drop-down menu. For a laptop with only one serial device connected to it, only one option will appear here. You may need to click “Refresh” at the bottom of the list to see the currently available COM ports (Figure 12).



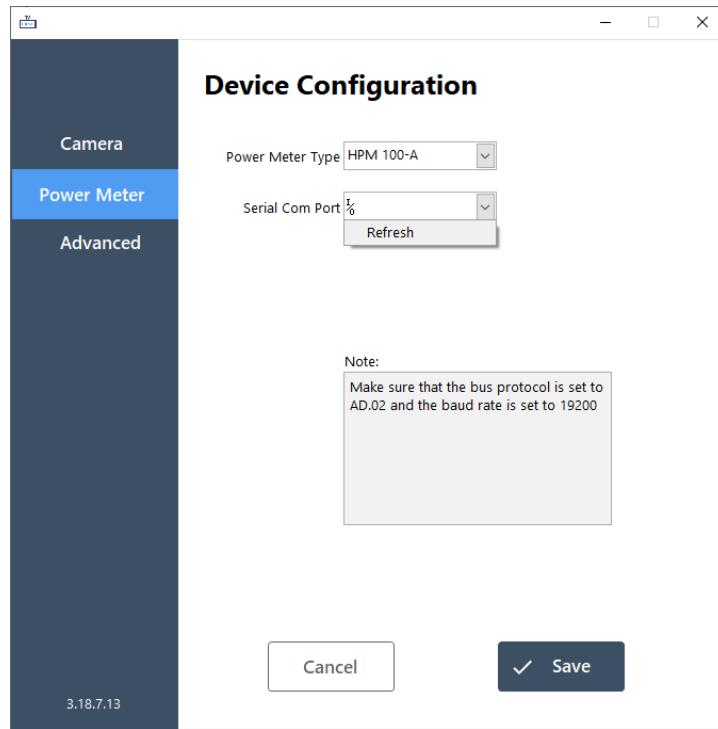


Figure 12: Select a COM port to connect to an HPM 100-A

### 3.2.3 Run Wireshark

ANSI/CTA-2037-D requires a log be recorded of all network traffic on the LAN of the TV. A log of network traffic can be recorded using packet sniffing software. PCL recommends Wireshark for this purpose.

Before beginning each test, complete the following steps to use Wireshark to record a network traffic log.

1. Open Wireshark.
2. Select the Wi-Fi network connected to the test LAN.
3. Click the shark fin icon to start recording packets.



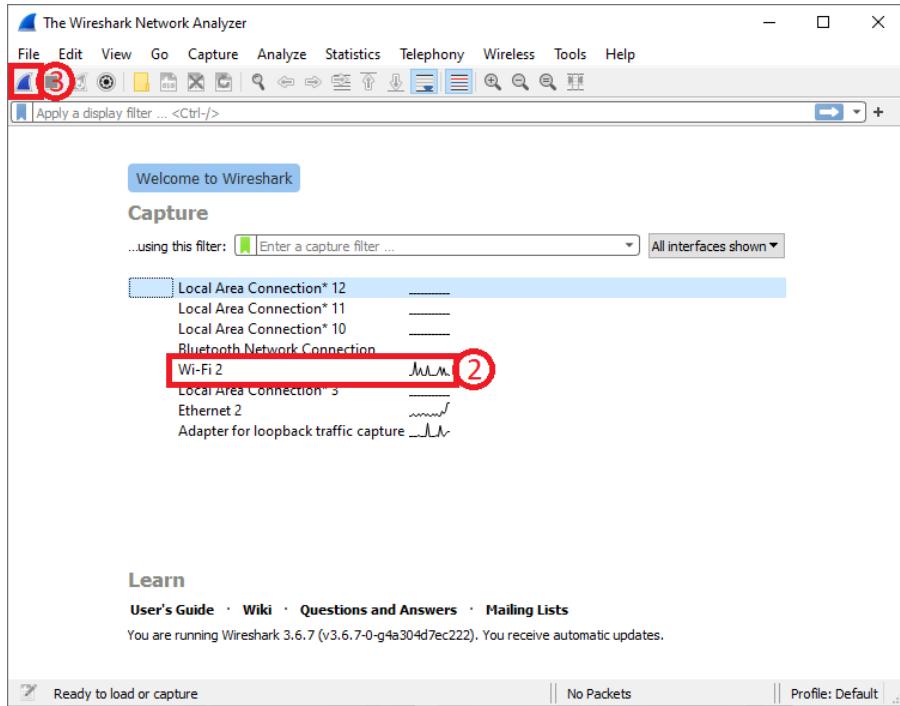


Figure 13: Open Wireshark, select the network interface connected to the test LAN, and start recording.

Once you have completed all tests including On Mode and Standby tests,

4. Click the red rectangle icon to stop recording (Figure 14).
5. Save the traffic log file to the data output folder of the test by selecting File → Save As...

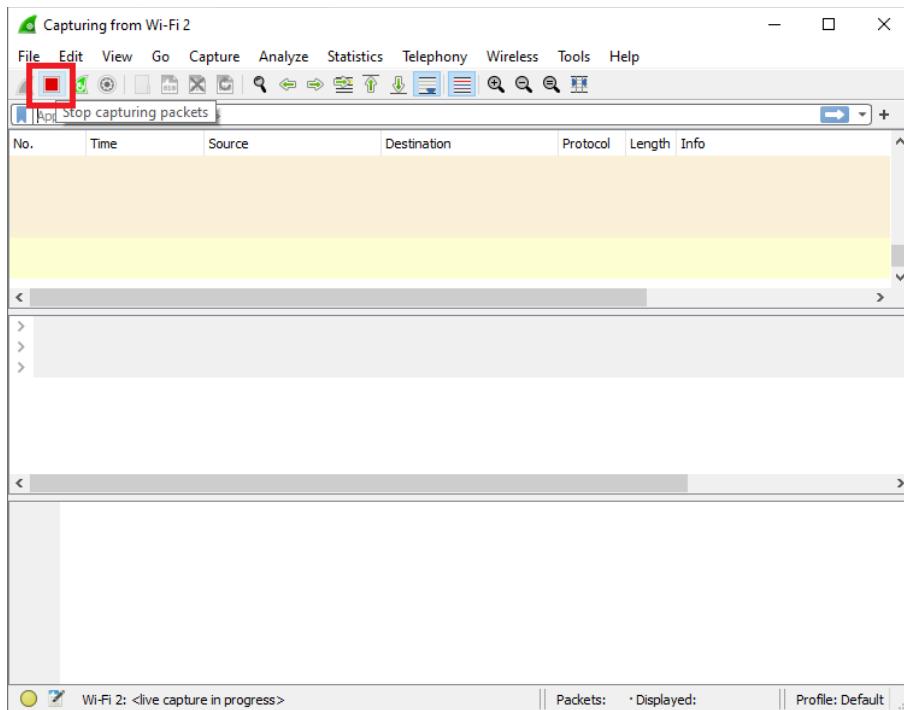


Figure 14: Stop capturing packets.



### 3.3 Check Lab Conditions

Make sure your test room can achieve ambient light conditions less than 1 lx measured at the ABC sensor with the ABC lamp off. Check that the temperature in the test room can be maintained at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the relative humidity can be kept between 10% and 80% per ANSI/CTA-2037--D.

Most TVs are tested standing on a table surface. The table must be covered in black cloth.

### 3.4 Mount and Connect Your Camera

Complete the following steps to prepare your camera for testing.

1. Mount the camera on an adjustable tripod or camera stand.
2. Connect the camera to a PoE injector with an Ethernet cable. The camera should be connected to the PoE port labeled “Power + Data Out.” With another Ethernet cable, connect the computer used for testing to the PoE injector port labeled “LAN in.”



*Figure 15: Connections of a PoE injector*

3. Supply power to the camera by connecting the PoE injector to wall power.
4. Once the camera is powered, allow it to warm up for 1 hour prior to testing. Open TV EASY during warmup and navigate to Create New Test or, if you are continuing or repairing a previous test, Load Prev Test. Once on these pages of TV EASY the camera will be recording frames and achieve the desired stable temperature.

It is a good idea to complete these steps ahead of other preparations. That way, the camera can warm up while other tasks are being completed.

### 3.5 Prepare Your ABC Lamp

If you are doing ABC testing, complete the following steps to prepare the lamp.

1. Connect the dimmer switch in-line with the lamp power cord and socket. Test kits from PCL can be ordered which include a dimmer switch kit. Depending on your jurisdiction, you may be required to have a licensed electrician assemble the dimmer switch kit components. PCL cannot assemble the components for regulatory reasons.
2. Mount the ABC lamp and dimmer switch/power cord assembly on a tripod or lamp stand. Depending on your lab space, a boom arm may be necessary to position the ABC lamp.
3. Connect the dimmer switch/power cord assembly to wall power.



4. Turn the lamp on at full brightness to start it warming up before testing.

### 3.6 Prepare Your Media Player

Connect the media player used to play test clips to wall power. Connect the USB drive containing the test clips to the media player.

### 3.7 Prepare Your AC Power Supply

Turn on your AC power supply and configure it to supply 115 V at 60 Hz. This will be used to power the TV. Other test components shall not be connected to the same controlled power circuit as the TV so that the TV has a known stable power source.

### 3.8 Prepare Your Power Meter

Configure your power meter so that the TV is powered by the controlled AC power supply. Connect the power meter to the computer used for testing with a data cable suitable for data logging (e.g. USB, serial port, ethernet).

### 3.9 Set Up the TV

Set the TV on the cloth covered table per the instructions in ANSI/CTA-2037-D.<sup>3</sup>

If you are doing ABC testing, locate the ABC sensor of the TV. Center the reflective card under the sensor and adjust it 2 cm forward (such that the x coordinate value of card center is 2 cm).

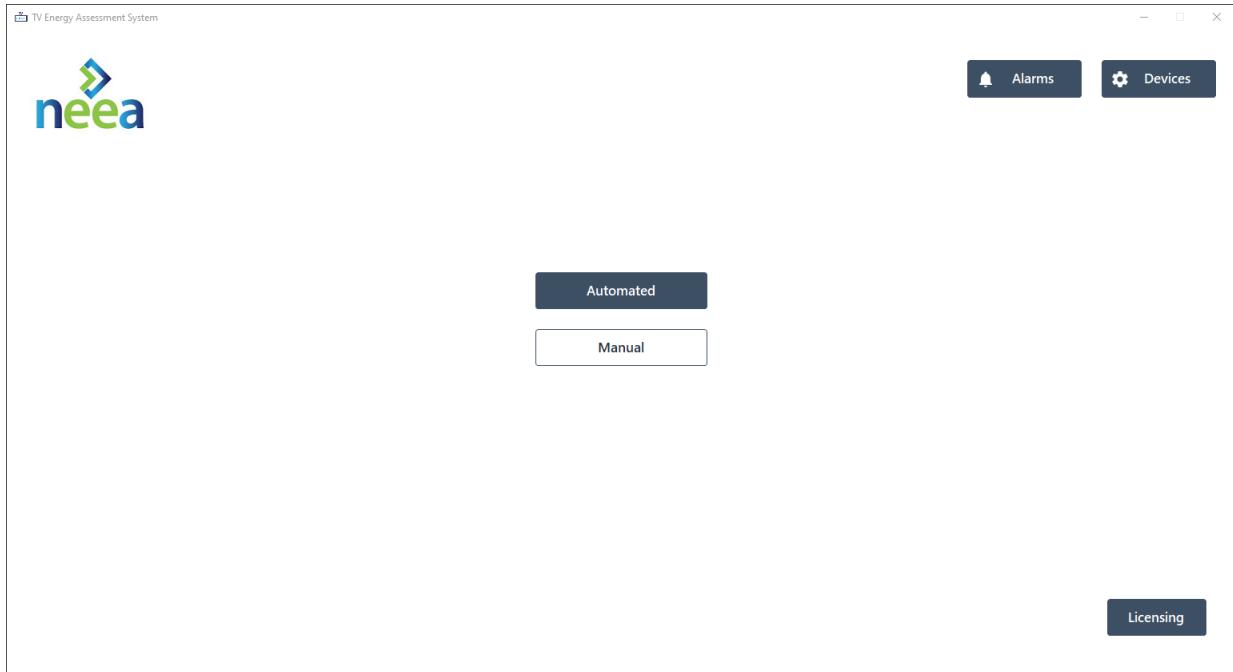
## 4 Conduct Your First Test

When you run NEEA TV EASY, your first choice is between Manual Mode and Automated Mode (Figure 16). Using Automated Mode saves data analysis time by automating report generation, achieves more reproducible test results, and enables sophisticated debug tools, including photo capture throughout the test to resolve any questions about how the TV was configured at every step of the test sequence.

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<sup>3</sup> For a TV which does not stand up on a table surface, see sections 8.2.2 and 8.2.3 of ANSI/CTA-2037-D for requirements.

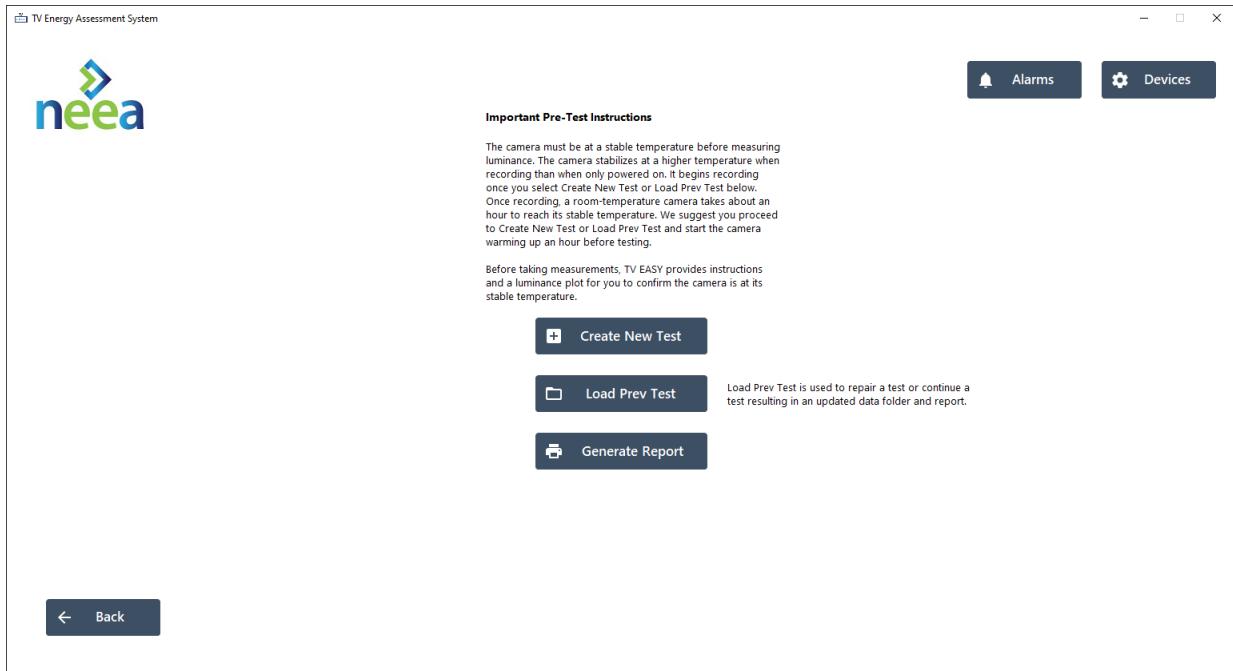




*Figure 16: Choose between Manual Mode and Automated Mode*

#### 4.1 Use Automated Mode

Upon selecting Automated Mode, you may choose to create a new Automated Mode test or to load a previous test (Figure 17). From this page you can also generate a report for a previously conducted test (see Section 5).



*Figure 17: Choose new test or load test.*

When creating a new Automated Mode test, NEEA TV EASY will guide you through the following steps.



#### 4.1.1 Enter Equipment Details

ANSI/CTA-2037-D requires the make and model of certain lab equipment to be recorded. This first step records these and other useful details to be included in generated reports.

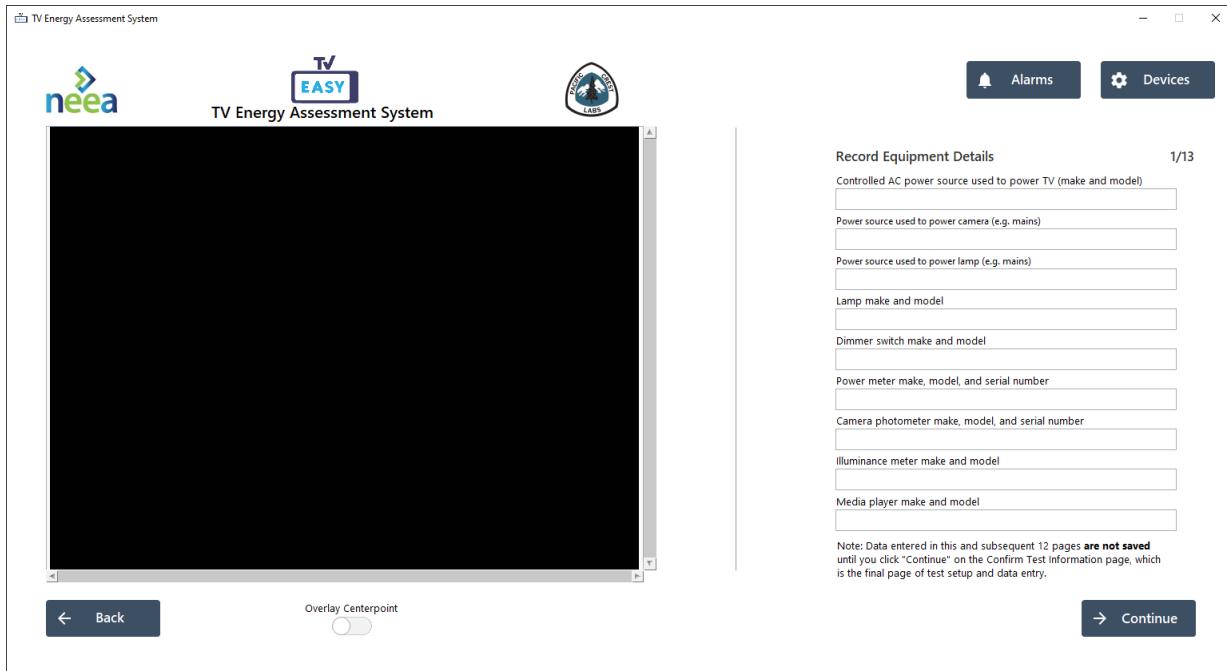


Figure 18: Enter the make and model of certain lab equipment.

#### 4.1.2 Position Equipment

This step guides you in positioning the camera photometer, setting its focus, and recording certain details about the lab environment (Figure 19).



Figure 19: Physical Setup step of new test creation

This is the typical point in the testing process to finish precisely positioning equipment. ANSI/CTA-2037-D specifies the final positions of equipment within an (x, y, z) coordinate system. In that coordinate system, the x direction points away from the TV screen, the y direction points to the right, and the z direction points up. The coordinate system originates at the center-bottom of the TV screen. Figure 20 and Figure 21 show the specified positions of equipment from the front and side, respectively.

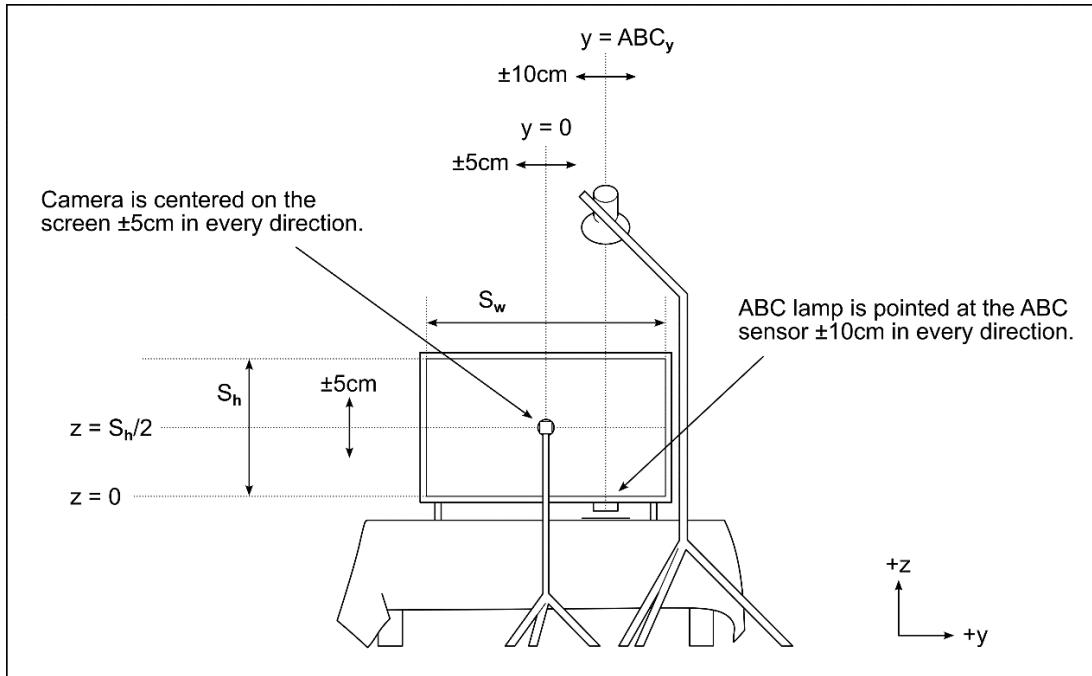
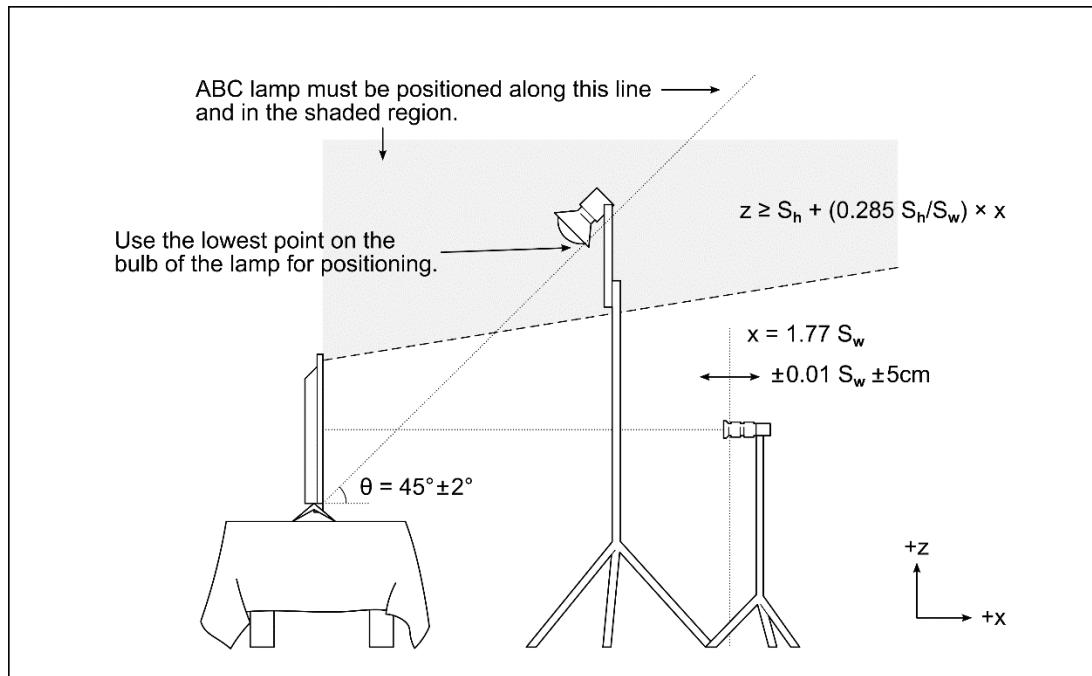


Figure 20: Front view of equipment positions



*Figure 21: Side view of equipment positions*

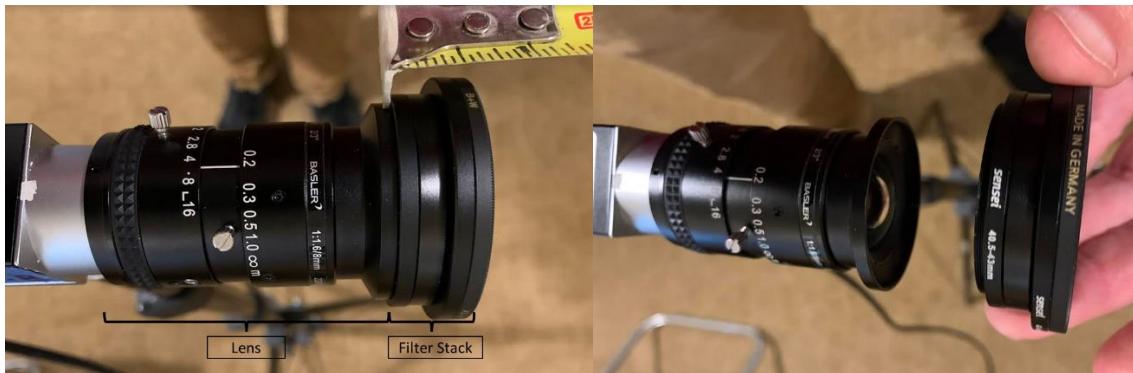
The ABC lamp position is restricted to the shaded region in Figure 21 so that no part of the lamp is reflected in any part of the TV from the perspective of the camera.

#### *4.1.2.1 Position and Defocus the Camera*

ANSI/CTA-2037-D requires the camera to be defocused during testing. This prevents a moiré pattern from occurring and affecting measurements.

Complete the following steps to position and defocus the camera.

1. Ensure the camera frame rate is set correctly in Devices → Advanced.
2. Measure the width of the TV screen ( $S_w$ ) in inches and enter it into NEEA TV EASY (Figure 19). TV EASY will then calculate and display  $x\_focus$  for you.
3. Turn on Overlay Centerpoint with the toggle below the camera view.
4. Place the camera at a distance of  $x\_focus$  from the TV. The distance is measured from the plane of the TV screen to the center of the camera lens (Figure 22). To avoid scratching the TV screen, PCL recommends using a tape measure with masking tape covering its metal end.

*Figure 22: Where in the lens assembly to measure distance from the TV screen*

5. Center the camera on the TV screen. This can be achieved through the following steps.
  - a. Measure the distance from the camera to the upper left and upper right corners of the TV. Adjust the camera so that these distances are within  $\frac{1}{4}$  inch (Figure 23).
  - b. Level the camera using a bubble level placed across the top of its heat sink.
  - c. Aim the camera at the center of the focus pattern.



Figure 23: Center the camera

6. Focus the camera and tighten the focus thumbscrew (the thumbscrew closest to the lens cap).  
[Note: ensure that the other thumbscrew for lens aperture adjustment remains tight at all times so that it doesn't fall out]
7. Now position the camera at x\_test by the same process.

Do not adjust the aperture of the camera with the iris ring. This will invalidate the camera calibration. PCL uses thread-locked screws and nail polish to lock the aperture for this reason.

#### 4.1.2.2 Position the ABC Lamp

If performing ABC testing, position the ABC lamp by completing the following steps.

1. Position the lamp at the same y coordinate as the TV's ABC sensor (Figure 20).
2. Angle the lamp downwards at a 45° angle and move the lamp stand toward or away from the TV until the lamp points directly at the ABC sensor (Figure 21).
3. Ensure that the lamp positioning is such that no light rays emitted by any part of the lamp reflect off the TV screen and directly into the camera field of view, which can be confirmed by examining the NEEA TV EASY camera display window.

To prevent any reflection of the lamp from affecting measurements, the lamp's minimum distance in the z direction above the top of the TV must be at least

$$0.285 \times \frac{\text{TV Screen Height}}{\text{TV Screen Width}} \times \text{Lamp } x \text{ Coordinate},$$



that is, the light-emitting part of the lamp must be within the shaded region of Figure 21. In some cases, this procedure is not possible. For example, if there is not enough vertical space in the test environment to raise the lamp above the top of the TV. In such cases, see ANSI/CTA-2037-D section 8.1.1 for requirements.

#### 4.1.3 Set Test Mode and Output Folders and Enter Metadata

Enter the information requested in Figure 24.

Take note of the following:

1. For most TVs, the serial number can be found on the back.
2. Do not include the bezel when measuring width and height of the TV; measure only the screen.
3. The screen resolution and technology type of a TV can typically be found by an online search for its specs.
4. In laptops ordered from PCL, the output folders (Figure 24) are set by PCL. They are located on the desktop.

If you are using your own computer, set the output folders to a convenient location. The default location is in C:\Users\<User>, which is inconvenient to access in Windows.

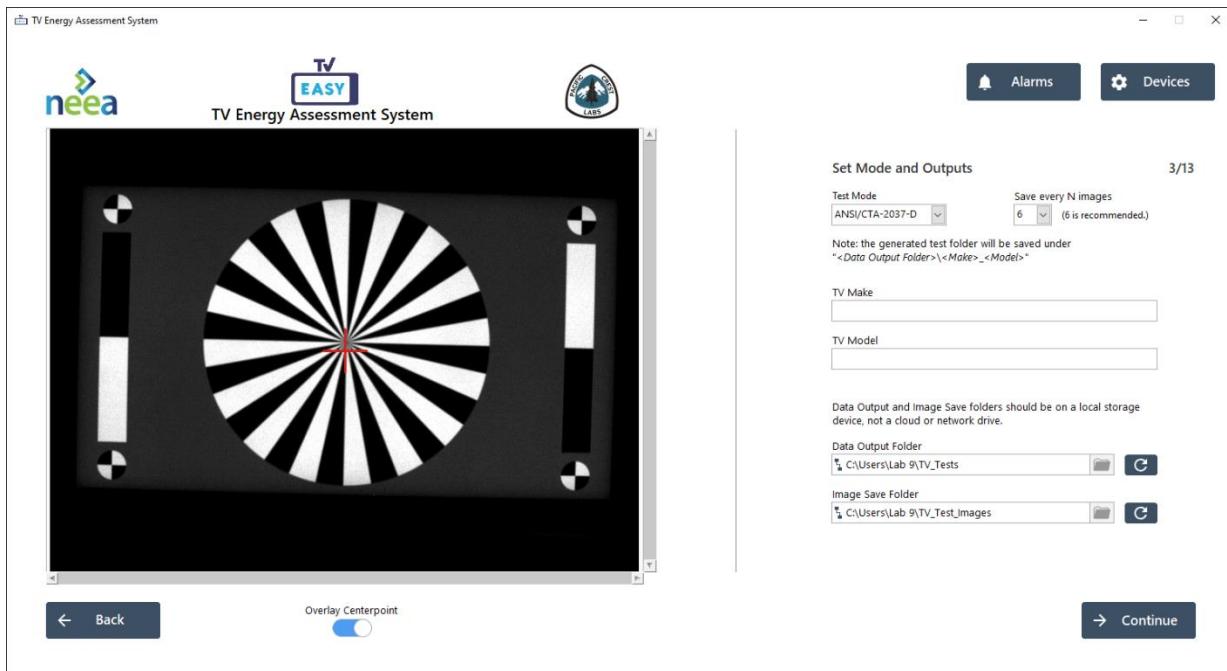


Figure 24: Basic test information and output folders

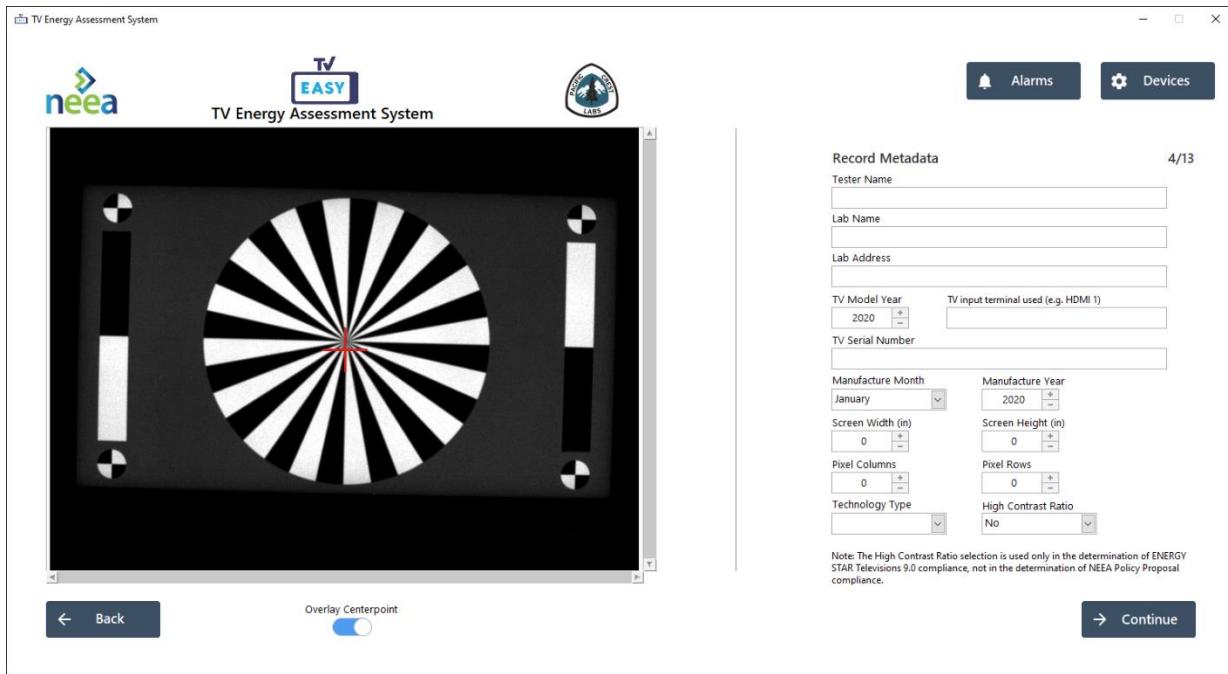


Figure 25: Detailed metadata

#### 4.1.4 Update TV Software

This step ensures the TV has the most up-to-date software available. There are multiple ways to do so, depending on the state of the TV (Figure 26).

1. If the TV is already set up, navigate to the “software update” part of its menu and, if a newer version is available, update the software and record the new version number. Then factory reset the TV before continuing to the next step, which involves recording the choices you make during set-up prompts.
2. If the TV is being tested out-of-the-box, you may or may not know whether there is a software update available for the TV.
  - a. If you know the TV already has the latest software and cannot be updated, just record the version number and continue to the next step.
  - b. Otherwise, set up the TV starting from its out-of-the-box state. Your choices in the initial setup prompts do not matter, so just skim through them quickly. Once the TV is set up, update its software as described in 1 above. Then factory reset the TV before continuing to the next step.



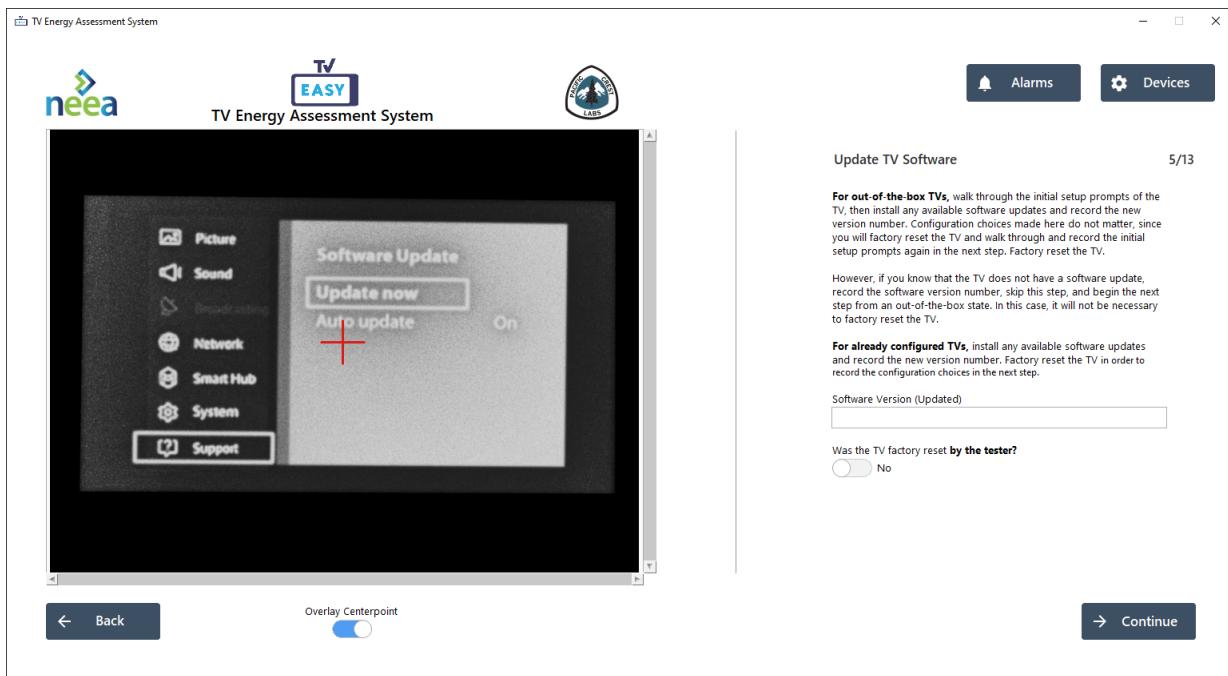


Figure 26: Update the TV software

#### 4.1.5 Record TV Configuration

The TV should now have the most recent software and be in the factory default state. Walk through the initial setup screens. Each time you make a choice between configuration options, take a picture of the TV screen with your choice highlighted by clicking the “Capture Image” button (Figure 27). This step can involve 8 or more image captures.

When you are forced to make a choice between configuration options, choose according to the following principles per ANSI/CTA-2037-D:

1. Choose the most power consumptive option. You can achieve this by choosing options which enable more power-consuming features.

Except,

2. Decline to download additional content, install additional apps, or scan for additional channels.
3. Do not enable power consumptive options which make TV content accessible to hearing- or vision-impaired users.



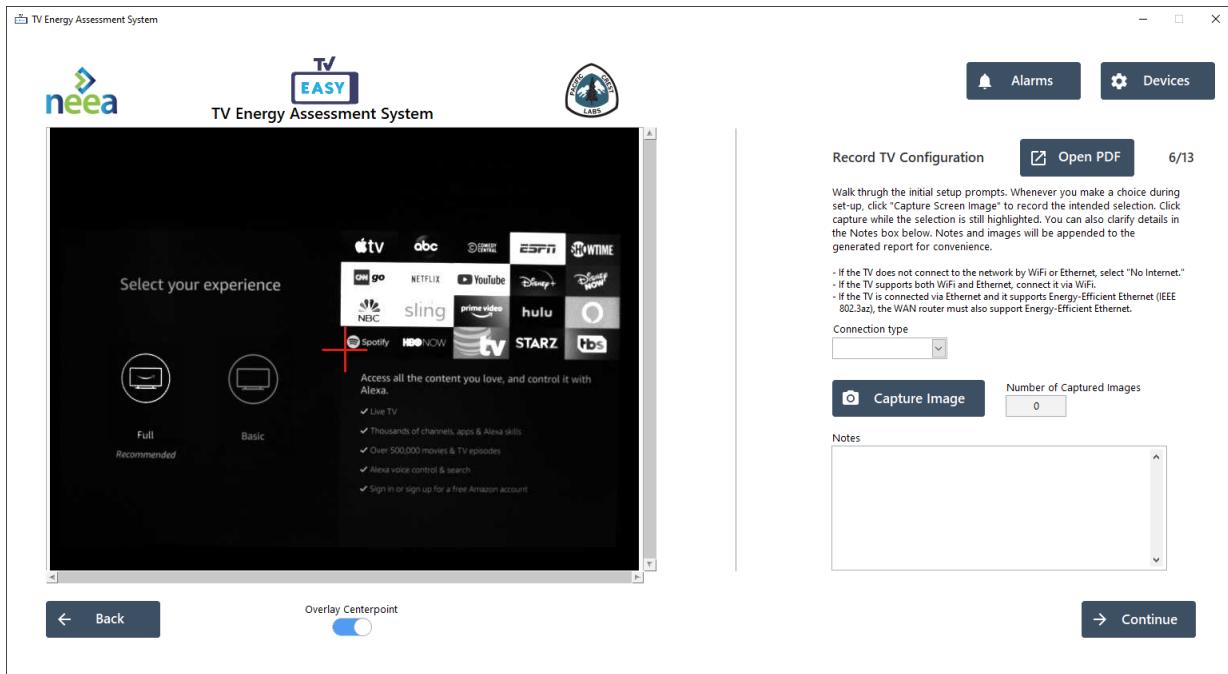


Figure 27: Configure the TV, documenting your choices

Once the TV is setup, prepare the TV and media player to play clips from the USB drive.

#### 4.1.6 Configure Screen for Measurements

The next steps will involve measuring screen luminance. To prepare for these measurements, the geometry of the image of the TV screen is corrected by NEEA TV EASY to be centered and rectangular. Play Dots\_resolution\_v2.mp4, pause it, allow any overlays to disappear, and click Start Config (Figure 28 and Figure 29).



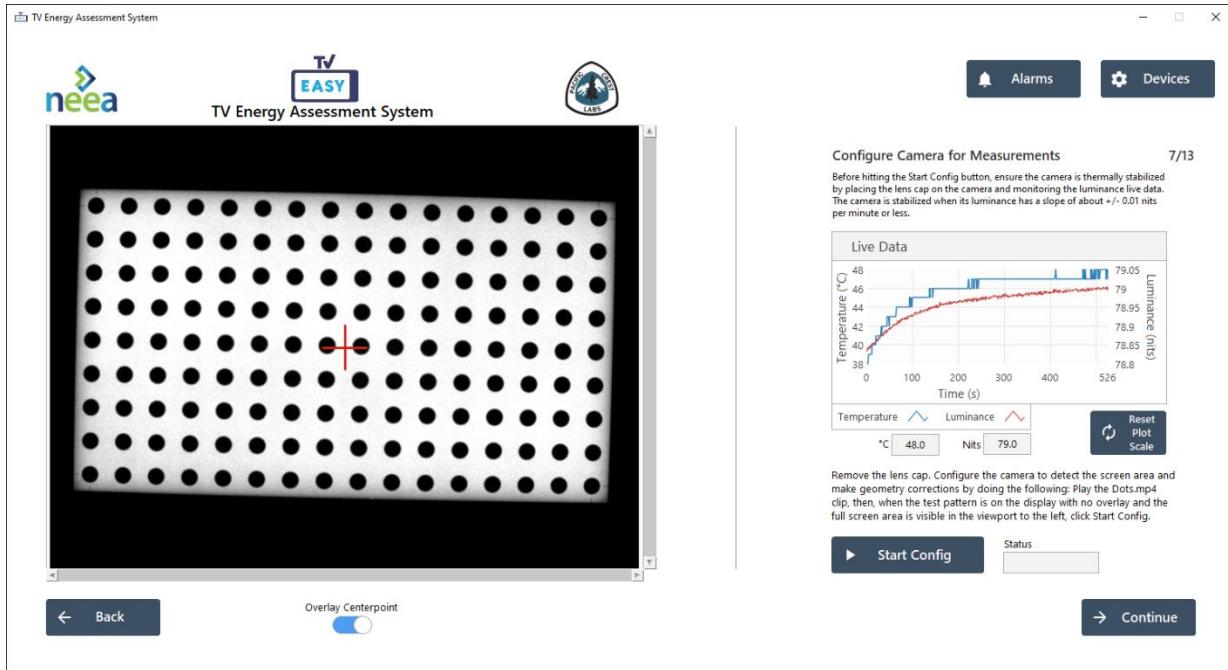


Figure 28: Screen configuration (before)

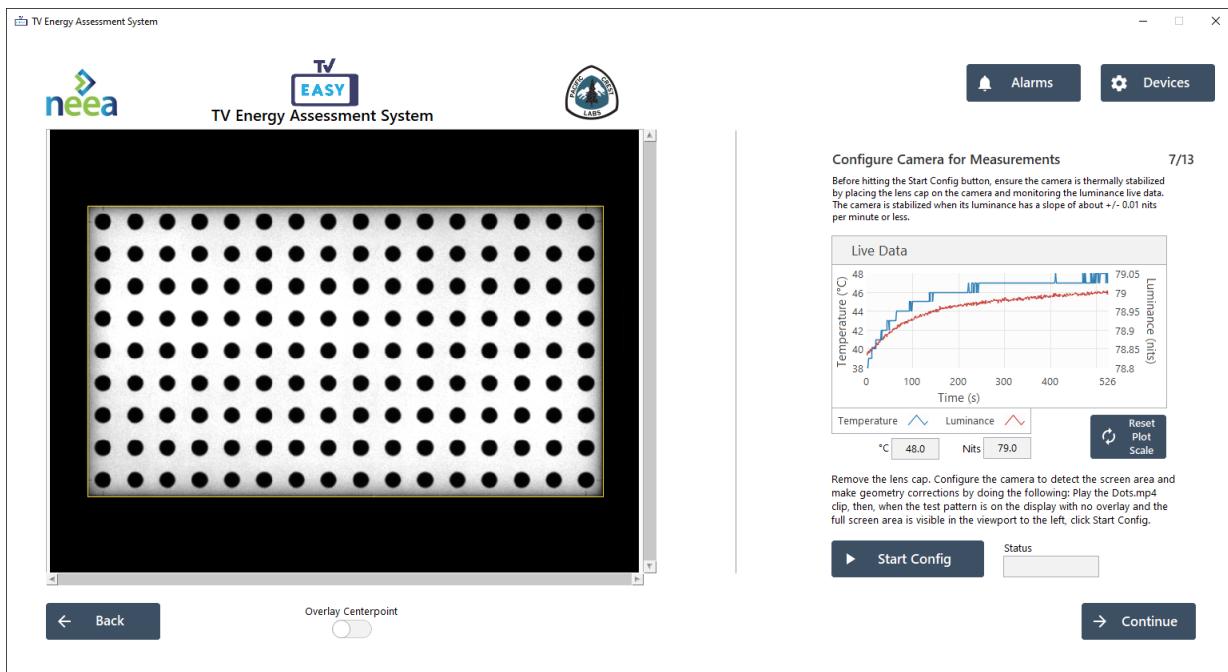


Figure 29: Screen configuration (after)

#### 4.1.7 List Preset Picture Settings

The next steps exist to determine which PPS will be used as the default SDR, brightest SDR, and default HDR PPSs for conducting measurements. Open the settings menu of the TV to view its available PPSs and enter these into the “Default SDR PPS” and “Other SDR PPS Names” fields in NEEA TV EASY (Figure 30).



To determine the default HDR PPS, complete the following steps.

1. Put the TV into its default SDR PPS.
2. Use the media player to play the appropriate HDR10 test clip: (i.e. IEC\_Broadcast\_resolution\_5994p\_HDR10\_HEVC\_AAC.MP4).
3. Open the picture settings menu and identify the name of the HDR10 PPS selected by default.
4. Enter the name of that PPS into the “Default HDR PPS” field in NEEA TV EASY.

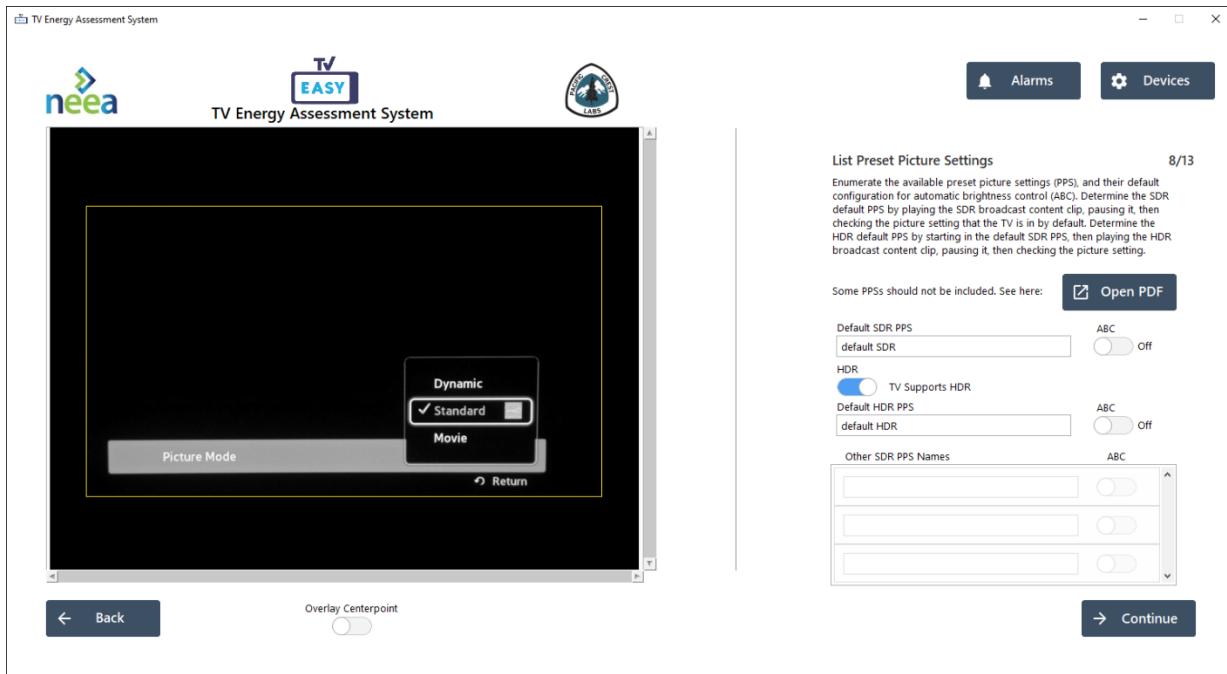


Figure 30: Enter PPS names

#### 4.1.8 Determine Brightest SDR Preset Picture Setting

To determine the brightest SDR PPS, the dynamic luminance of each PPS needs to be measured (Figure 31).



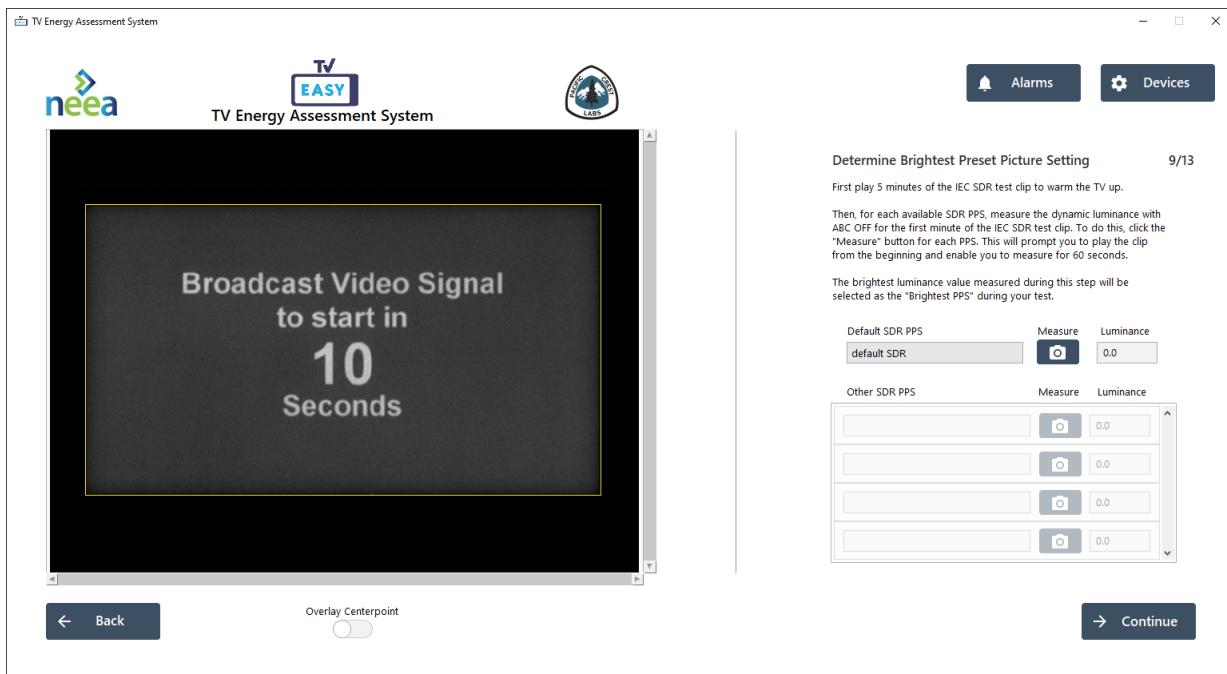


Figure 31: Measure luminance of each non-HDR PPS

To do so, complete the following steps for each PPS, except those noted below:

1. Put the TV into the PPS under consideration.
2. Disable ABC.
3. Play *IEC\_Broadcast\_resolution\_5994p\_SDR\_HEVC\_AAC.MP4* and click the “Measure” button to the right of the PPS you entered per Figure 31.
4. Once the countdown reaches zero, begin measuring dynamic luminance by clicking the “Start” button in the pop-up window (Figure 32).

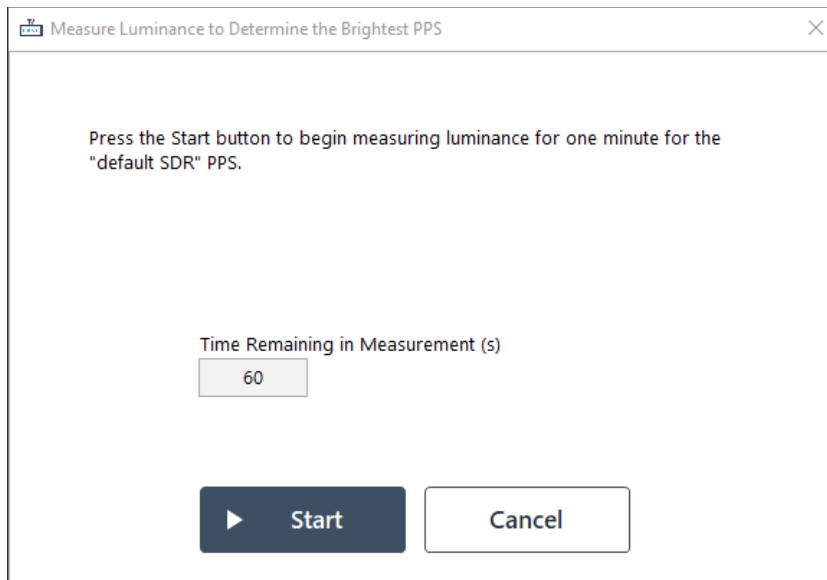


Figure 32: Click “Start” to begin recording dynamic luminance of a PPS



Do not include any of the following PPSs in the list of “Other SDR PPSs”:

1. PPSs called “PC” or “Computer” or otherwise intended for the use case where the UUT is to be used as a monitor connected to a computer.
2. PPSs called “Game” or “Gaming” or otherwise intended for low latency use when the UUT is connected to a gaming console.
3. PPSs called “Accessibility” or “Low Vision” or otherwise intended to produce high contrast pictures explicitly for use by viewers with limited vision.
4. PPSs called “Filmmaker mode” or similar. However, *do* include PPSs such as “Movie mode,” “Cinema mode,” or similar.

#### 4.1.9 Record “Backlight” Controls

For each of the default SDR, brightest SDR, and default HDR PPSs, enter the TV menu control used to adjust the “backlight” of the TV (Figure 33). This setting is usually called “backlight” for LED TVs but sometimes goes by other names. The goal is to find the control that results in a change in both luminance and power. OLED TVs sometimes call this control “Luminance” or “Pixel Brightness”. To check if a candidate control affects both power and luminance, examine the Live Data plot shown in this step. Figure 33 shows an example of a plot in which both power and luminance have both changed in response to a backlight control.

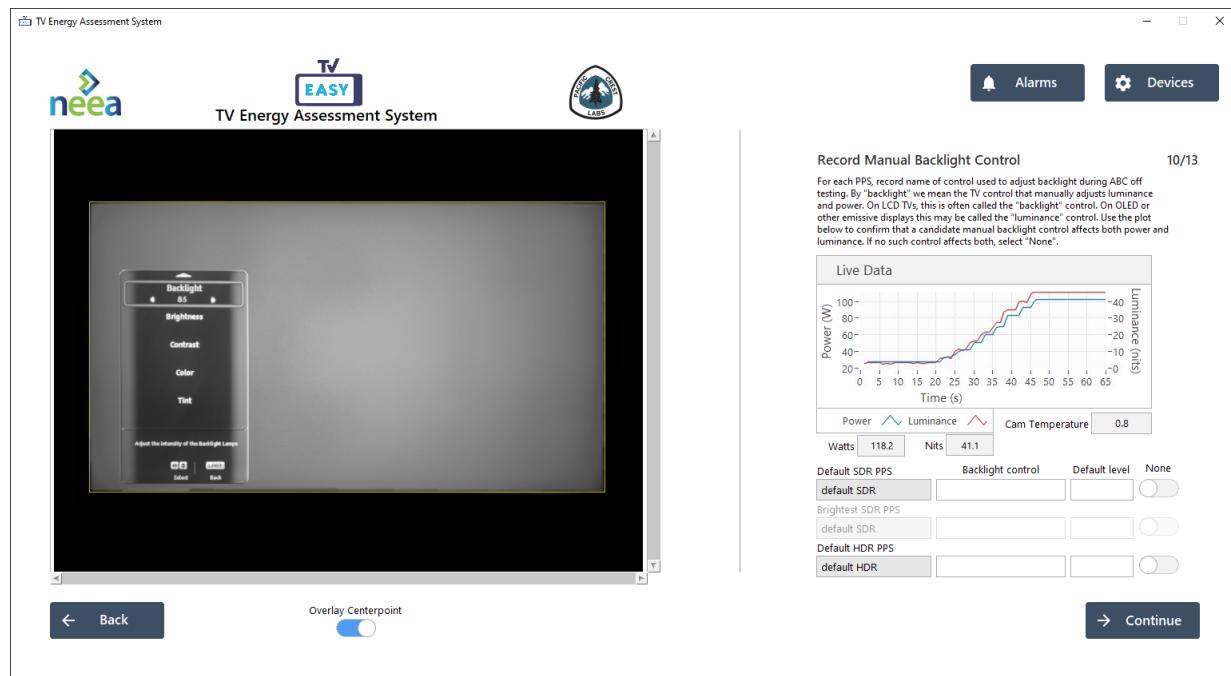


Figure 33: Record Backlight Control

#### 4.1.10 Configure Smart Wake Features

Standby results are labeled differently depending on which smart wake features the TV supports and which can be confirmed by a 5-second test. Details are recorded in this step to correctly label standby results in the generated report (Figure 34).



First, using one or two smart speaker options and a mobile device like a smart phone, try to configure as many of the three smart wake features identified in Figure 34 as the TV manufacturer advertises to work.

For each smart wake feature advertised, check the corresponding toggle in the first column of toggle switches in Figure 34. Then perform a 5-second power-down test to confirm that the smart wake feature works. If the feature is confirmed, check the corresponding toggle in the right column.

To perform a 5-second test, power down the TV using the physical TV remote control, wait 5 seconds, and then try to power the TV on using the smart wake feature. If the TV powers on, the feature is confirmed.

Leave smart wake devices on and TV smart wake features enabled throughout On and Standby Mode testing.

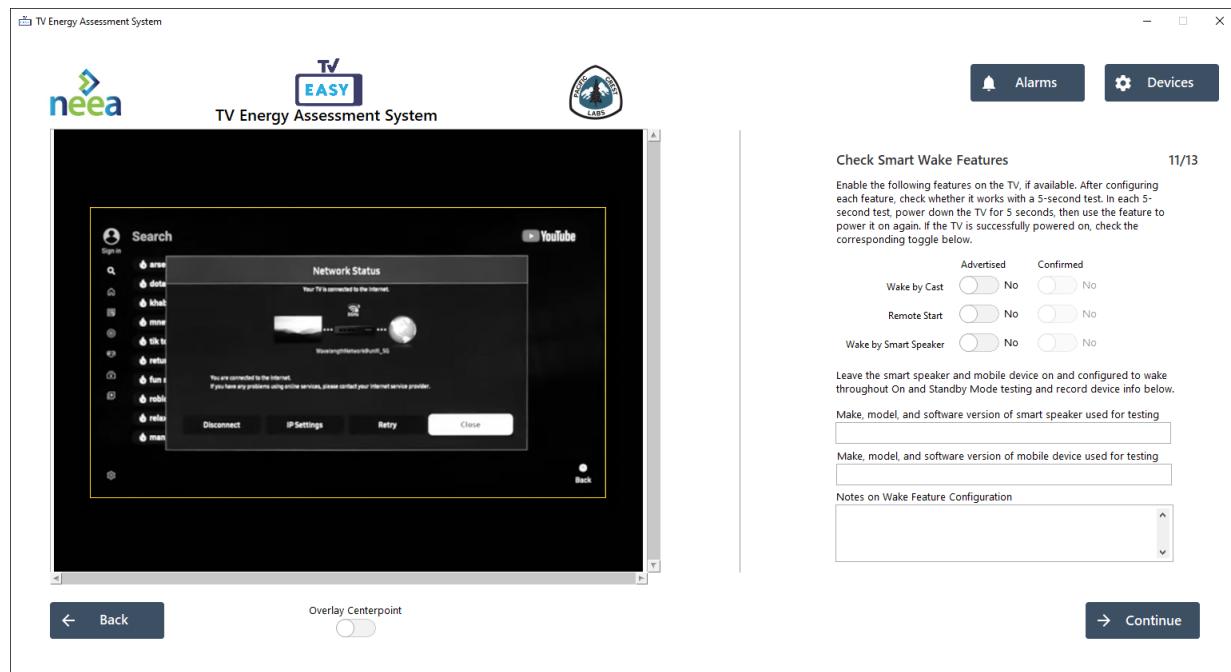


Figure 34: Check which Smart Wake features are enabled

#### 4.1.11 Configure Quickstart and MDD

After completing Smart Wake configuration (4.1.10), configure Quickstart and MDD per the instructions below (Figure 35).

##### Quickstart

1. Determine if the TV supports Quickstart.
  2. If Quickstart is not supported, set the Quickstart toggle to “Not Available.”
  3. If Quickstart is supported, set the Quickstart toggle to “Available.”
- a. If Quickstart is enabled, leave it enabled for testing, set the second toggle to “On by Default”, and continue to the test step described in section 4.1.12 of this manual, skipping the wake time test.



- b. If Quickstart is not enabled, set the second toggle to “Off by Default” and Measure Wake Time using the procedure below.
- If the wake time is < 10 seconds, then leave Quickstart off during testing.
  - If the wake time is  $\geq$  10 seconds, then test the TV with Quick Start adjusted to provide the shortest possible resume time.

#### Quickstart wake time procedure

- Play IEC\_Broadcast\_resolution\_5994p\_SDR\_HEVC\_AAC.MP4 using the media player connected to the TV via HDMI.
- With the clip still playing, power-off the TV using its remote control.
- Leave the TV powered off for 20 minutes.
- Press the power button on the remote control and measure the time it takes after that instant for the TV to resume displaying the video. If the TV cannot be configured to automatically resume displaying video on the input terminal connected to the media player, measure instead to the point in time when it becomes possible to select an input using the remote.

Enter MDD information in the final two toggles shown in Figure 35.

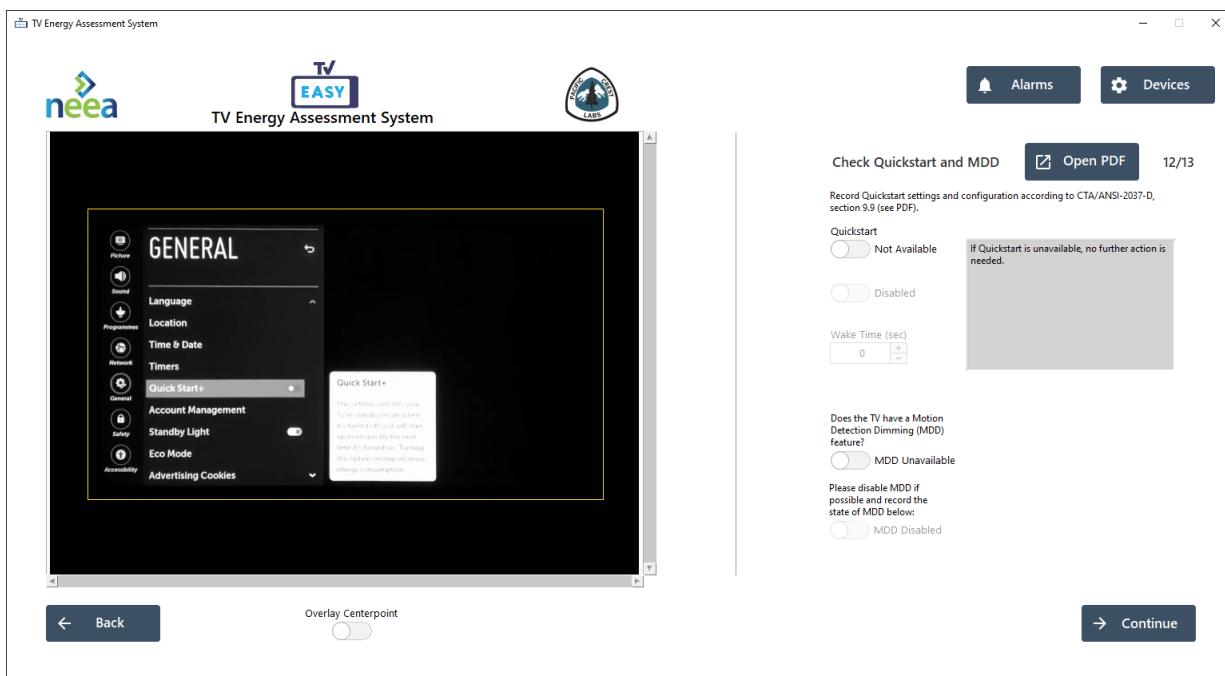


Figure 35: Check Quickstart and MDD settings

#### 4.1.12 Confirm Information

The last step in creating a new Automated Mode allows you to review the information entered in previous steps (Figure 36).



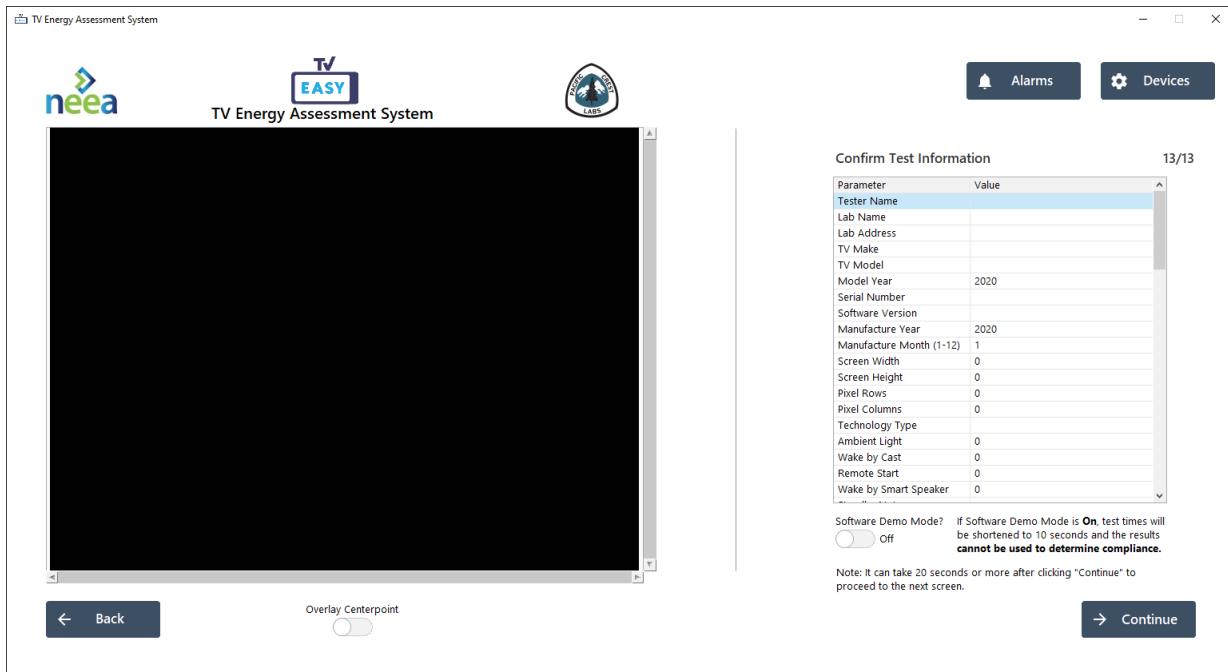


Figure 36: Review new test information

This step also lets you enable Software Demo Mode. Software Demo Mode is disabled by default. When enabled, test times are shortened to 10 seconds. This allows you to quickly step through the test process to familiarize yourself with it before conducting a compliance test.

#### 4.1.13 Select Tests

Before beginning the sequence of tests, you can choose which ones to conduct (Figure 37). By default, all tests are selected. Toggle-off any test steps you wish to skip. Scroll up and down to see the full list of test steps.



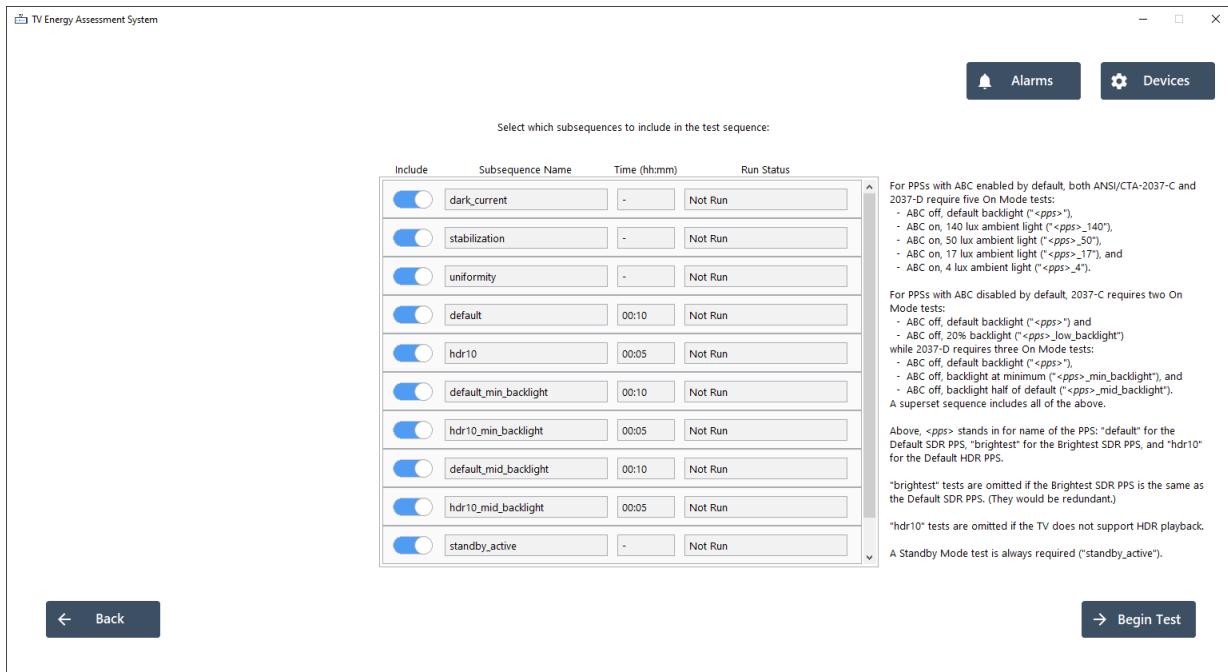


Figure 37: Turn on or off specific tests

The following is a high-level overview of the tests completed in the test system software to meet the requirements set forth by ANSI/CTA-2037-D:

1. Dark Current Compensation
2. Screen Config
3. Stabilization
4. Luminance Profile/Uniformity (optional)
5. ABC off tests (default backlight for all 3 PPSs)
  - a. SDR Default PPS
  - b. SDR Brightest PPS
  - c. HDR10 Default PPS
6. ABC off tests (20% backlight setting - for PPSs where ABC is not enabled by default)
  - a. SDR Default PPS
  - b. SDR Brightest PPS
  - c. HDR10 Default PPS
7. ABC on tests (for PPSs where ABC is enabled by default)
  - a. 140 lux  $\pm$  5%
    - i. SDR Default PPS
    - ii. SDR Brightest PPS
    - iii. HDR10 Default PPS
  - b. 50 lux  $\pm$  5%
    - i. SDR Default PPS
    - ii. SDR Brightest PPS
    - iii. HDR10 Default PPS
  - c. 17 lux  $\pm$  5%



- i. SDR Default PPS
- ii. SDR Brightest PPS
- iii. HDR10 Default PPS
- d. 4 lux ± 5%
  - i. SDR Default PPS
  - ii. SDR Brightest PPS
  - iii. HDR10 Default PPS
- 8. Standby Mode test<sup>4</sup>

#### 4.1.14 Begin Conducting Measurements

After selecting “Begin Test,” you will be greeted with the popup shown in Figure 38. Complete the instructions shown. Once you have dismissed the pop-up window, click “Start” to begin the test sequence.

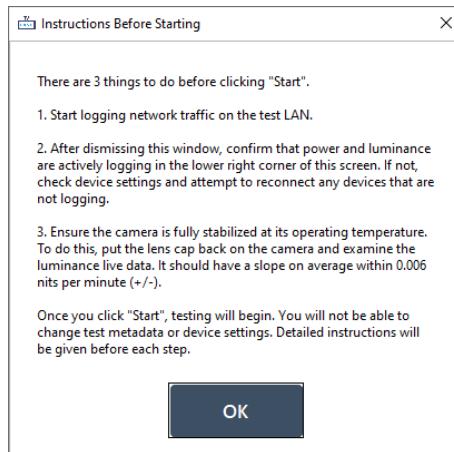


Figure 38: Popup shown before starting measurements

The first test step compensates for dark current in the camera sensor (Figure 39).<sup>5</sup> For this step only, the lens cap should be put on the camera. Remove the lens cap after the step is complete.

---

<sup>4</sup> Test name is “standby\_active” for historical reasons.

<sup>5</sup> Camera sensors internally correct for dark current, most commonly during camera resets. This is desired in most camera applications but when measuring screen average dynamic luminance, it can introduce measurement error. NEEA TV EASY takes this correction into account by resetting the calibration intercept immediately before testing.



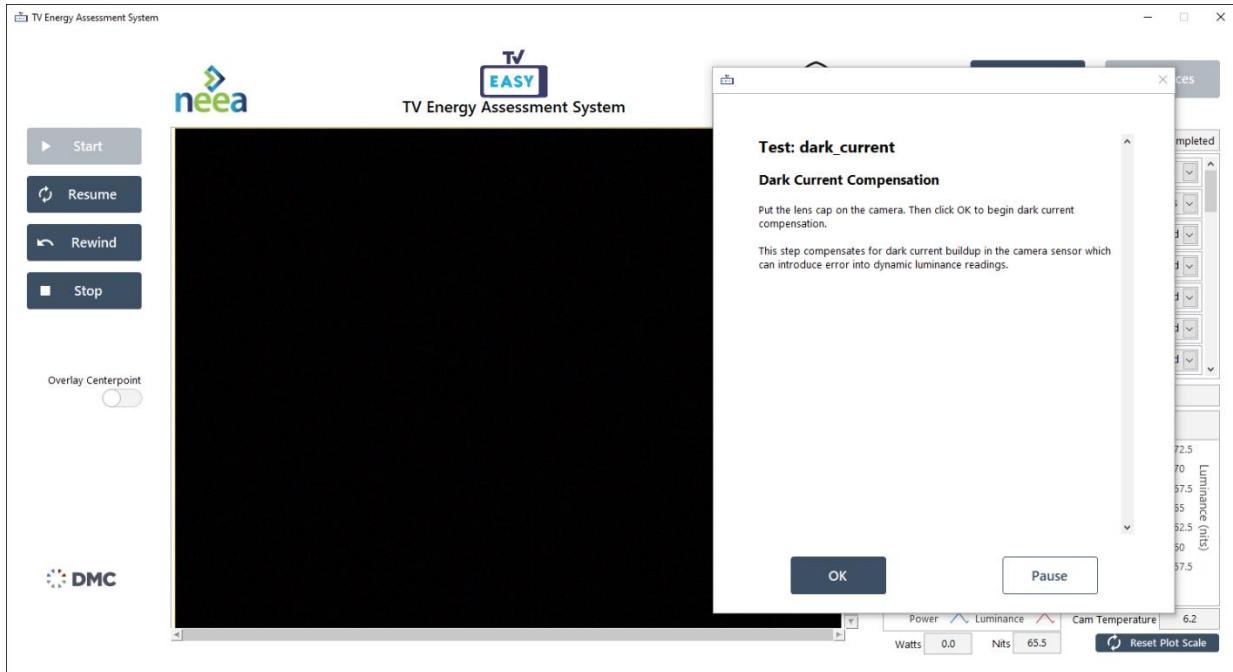


Figure 39: dark\_current test step

The remaining test step prompts are similar to each other: once the previous test step is complete, a window will pop up with instructions (e.g., Figure 40). Each popup will contain instructions specific to the test step. It will specify which video clip to play, which PPS to select, whether to enable or disable ABC, and which backlight setting to select, if applicable, or else the ambient light level to achieve for ABC-on tests.

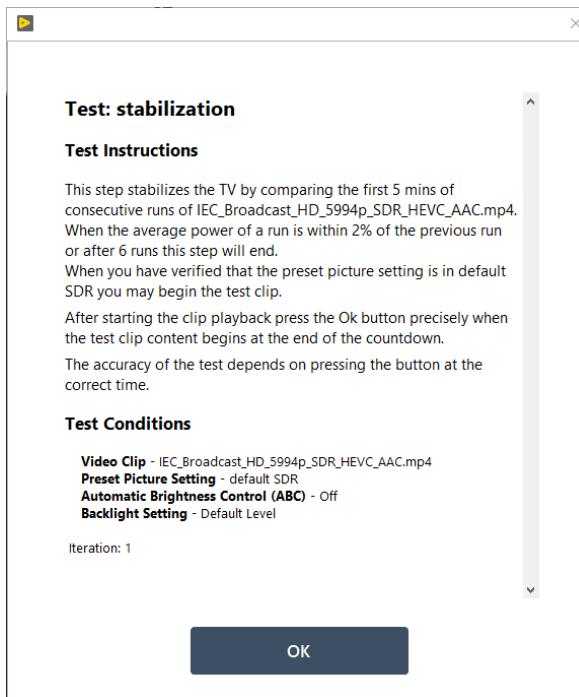


Figure 40: stabilization test step popup



#### 4.1.15 Navigate While Conducting Tests

Figure 41 gives a number to each part of the screen shown while conducting tests. For each item, see the instructions in the list below.

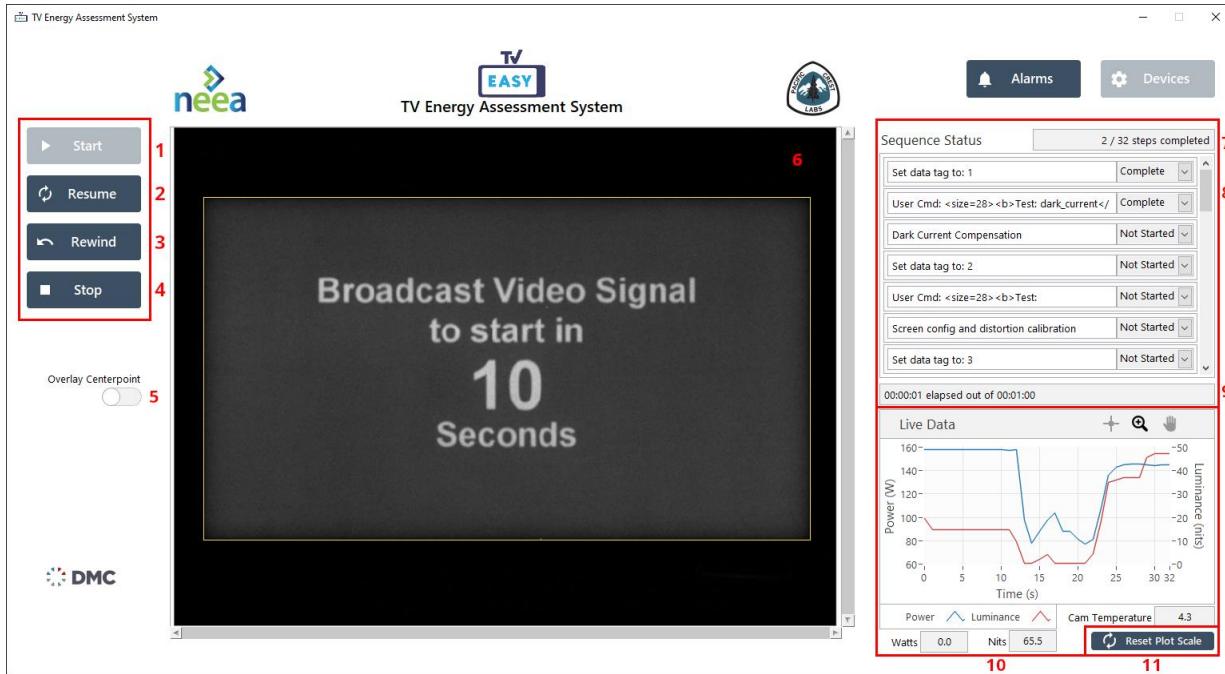


Figure 41: Numbered key to the measurements screen

1. The “Start” button. This button starts the test sequence.
2. The “Resume” button. This button resumes the sequence after pausing or rewinding.
3. The “Rewind” button. If clicked while a test step is running, this button pauses and returns to the beginning of the step. You can then click “Resume” and the instructions for that step will pop up again. If instead you click “Rewind” again, the test will rewind an additional step each time you click it. For example, if you are in the middle of the 10th step and you click “Rewind” 11 times, you will be back at the very start of the test.
4. The “Stop” button. This button ends the test, with the option to generate a report based on complete or partial data.
5. The “Overlay Centerpoint” toggle. This switch turns on or off a crosshair in the center of the camera view.
6. Camera live view. The center display shows a live feed from the camera. A yellow rectangle delineates the area of the screen.
7. Test step status bar. This indicator shows how many test steps have been completed out of the total.
8. The queue of individual commands that make up a sequence, presented in the order that NEEA TV EASY will run them.
9. Time elapsed counter. This status bar shows the time elapsed in certain tests.
10. This box plots luminance and power over time, as well as reporting the camera temperature (Camera temperature should remain stable during testing.)

11. The “Reset Plot Scale” button. This button resets the Time axis of the plot to begin from 0 again. It does not affect logged data. It only changes how the data is presented in the plot.

## 4.2 Use Manual Mode

In NEEA TV EASY, Manual Mode is useful for checking your devices and for taking ad hoc measurements without a test sequence.

Manual Mode enables the tester to identify the border of a TV screen in the camera’s field of view, perform geometry correction, and record power and luminance at one second intervals. It does not generally guide the tester through the test process or generate reports as does the Automated Mode.

There are two test types in Manual Mode: Set Time and Custom Sequence.

### 4.2.1 Use Fixed Time Test

A Set Time test simply records power and dynamic luminance at 1 second intervals for a fixed duration of time. Figure 42 shows the configuration options for a Set Time test.



Figure 42: Configuring a Set Time test

### 4.2.2 Use Custom Sequence Test

A Custom Sequence test requires a custom test sequence. This is a feature for advanced users of NEEA TV EASY. See Appendix B: Basic Example Custom Test Sequence for an example of a basic custom test sequence.





Figure 43: Configuring a Custom Sequence Test



## 5 Generate a Report

The Generate Report page lets you configure and generate a report. This page is shown immediately after finishing a test. You can also access it from the page shown in Figure 17.

### 5.1 Configure Report Generation

Select Test Data Folder and Report Destination 1

Generate the following reports:

ENERGY STAR 2

NEEA 3

This space is used to input NEEA Policy Proposal compliance levels when you select the NEEA toggle in the upper left.  
ENERGY STAR parameters are fixed by ENERGY STAR Televisions v9.0.

Include supplemental sections?  
These include  
(a) Plots of APL vs power for each On Mode test and  
(b) A heatmap of screen luminance uniformity.  
 Yes 4

[Back](#) [Back to home page](#) 5 [Generate](#)

Figure 44: Basic elements of the Generate Report page

To generate a report, enable one or both of the ENERGY STAR and NEEA toggles.

1. Use the “Select Test Data and Report Destination” box to select the data output folder of the test for which you want to generate a report. If you just completed a test, this box isn’t shown. In that case, it is set to the data output folder for the just-completed test.

Automated Mode tests’ data folders are organized into nested folders. To find a particular test, first navigate to the top-level data folder set in Figure 24. In this folder is a sub-folder for each TV. In each TV folder are the data output folders for individual tests.

2. If the “ENERGY STAR” toggle is enabled, a report is generated to show compliance to ENERGY STAR® Televisions 9.0.
3. If the “NEEA” toggle is enabled, a report is generated to show compliance to the NEEA Policy Proposal.

NEEA TV EASY attempts to generate a report whether or not suitable data is present in the data output folder. If the right data isn’t present in the data folder, report generation might fail. If it succeeds, a warning will be included that the report is not suitable for determining compliance.

When you select a test mode (Figure 24), NEEA TV EASY will record only the data which the selected standard requires. Table 5 shows which reports you can generate after completing a test of each Test Mode.



Table 5: Which Test Modes are suitable for which report types

Test Mode	Report Type
ANSI/CTA-2037-C	ENERGY STAR® Televisions 9.0 reports only
ANSI/CTA-2037-D	NEEA Policy Proposal reports only
Superset of ANSI/CTA-2037-C and -D	Either or both reports

4. If the “Include supplemental sections?” toggle is enabled, as it is by default, the two sections listed will be included in the report. PCL recommends including these sections.
5. The “Generate” button. Once you have selected which reports to generate and configured their settings, click this button to start generating them.

## 5.2 Configure a NEEA Report

When the NEEA report toggle is enabled, the settings for a NEEA Policy Proposal report are shown (Figure 45).

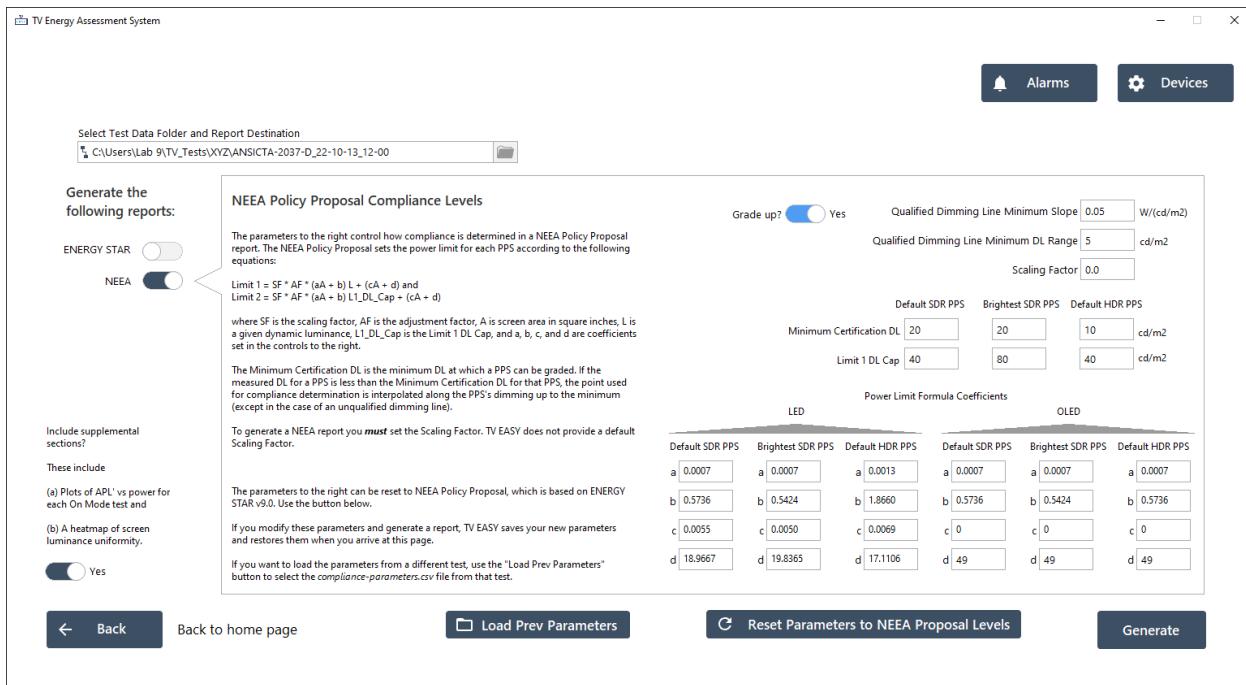


Figure 45: NEEA Policy Proposal report settings

See the NEEA Policy Proposal for complete details on how these settings affect compliance.

You *must* choose a Scaling Factor.  
NEEA TV EASY does not provide a default choice.

The “Load Prev Parameters” button allows you to use parameters which were used to generate a report previously. After clicking it, you are prompted to select the “compliance-parameters.csv” file from a previous test’s data folder. The “compliance-parameters.csv” file is only created when you generate a NEEA report.



The “Reset Parameters to NEEA Proposal Levels” resets all the parameters to those used in the NEEA Policy Proposal. It also resets the Scaling Factor to 0.

### 5.3 Results of Report Generation

Once report generation is complete, the data output folder will pop up (if it’s not already open in the background). There you can find PDFs containing the reports, as well as a CSV file with “results-summary” in its name.

For NEEA reports the results-summary file is called “results-summary-neea.csv” and for ENERGY STAR reports it is called “results-summary-estar.csv”. Each row of the results-summary file corresponds to an individual test step. It contains the following columns:

1. *tag*: This column contains the tag NEEA TV EASY uses internally to distinguish data taken during different tests. This corresponds to the tag column of datalog files and the test-status.csv file.
2. *test\_name*: This column contains the name of the test step.
3. *test\_time*: This column contains the duration of the test step in seconds. The duration only reflects time spent taking measurements and excludes time when the instructions prompt was open.
4. *preset\_picture*: This column records which PPS was selected during the measurement.
5. *video*: This column records which video test clip was used during the measurement.
6. *abc*: This column records whether ABC was enabled during the measurement.
7. *lux*: For ABC-on tests, this column records the ambient light condition for the measurement.
8. *watts*: This column contains the average power in Watts measured in the test step.
9. *nits*: This column contains the average dynamic luminance measured in the test step.
10. *APL'*: This column contains the average power level of the video clip used during the measurement.
11. *waketime*: This column is deprecated and will be removed in a future version of NEEA TV EASY.

## 6 Automated Test Repair and Retest

The sections below describe how to change or finish entering test information (i.e. test metadata like TV make and model), and how to finish test steps at a later time or redo errant tests either during the test flow or after testing is complete. If you have inadvertently entered incorrect information that affects what steps of the test sequence are performed (e.g. you said the default SDR PPS has ABC enabled and it does not) a repair is not possible if the sequence has already been started (i.e. the “Start” button has been pressed) (Section 4.1.14). In the case, a whole test needs to rerun from the start.

### 6.1 Edit Metadata

It is possible to correct some metadata (like a misspelled lab address) during and after a test. This section describes what changes are permissible, when they are permissible, and what the impact of a change will be.

#### **When you can edit metadata information**

After metadata has been entered in the Automated test flow and the metadata file has been written (i.e. after hitting the “Continue” button shown in Figure 35), the editable metadata file named “test-metadata.csv” can be found in the data output folder for that test. Make a backup of “test-



metadata.csv" before editing the file. Editing this file with a spreadsheet or text editor allows you to repair a report if certain parts of its metadata are wrong or incomplete. It is not possible to change the metadata of a test by backing up in the NEEA TV EASY wizard once you have started recording power and luminance data (i.e. after pressing "Start" button in Figure 38). However, before pressing the "Start" button you can hit the "Back" button to correct information entered on previous pages of the test wizard.

You can edit the "test-metadata.csv" file any time after its creation (i.e. after hitting the "Continue" button shown in Figure 35) except while reports are being generated. So, you can edit this file while measuring power and luminance, after you've completed testing and before you generate a report. Another example would be to edit the file a week after testing before you create an updated report.

### Which fields you can edit and how to edit

Text fields can be edited per the instructions in Table 6 below. For most of the fields below, editing the data will only change information in the Metadata table in the test PDF report that NEEA TV EASY generates, which orders the metadata differently than in the .csv file. Other fields, like screen resolution, affect compliance determination. Some (e.g. screen width) affect test instructions and compliance determination. In the last case, a complete re-test may be required. It is not permitted to change any of the text in the "Label" column.

*Table 6: Metadata Editing Instructions*

Label	Editing Instructions
Tester Name	Enter any text.
Lab Name	Enter any text.
Lab Address	Enter any text.
TV Make	Enter any text.
TV Model	Enter any text.
Model Year	Enter any text.
Serial Number	Enter any text.
Software Version	Enter any text.
Manufacture Year	Enter any text.
Manufacture Month (1-12)	Enter month number (1-12).
Screen Width	Enter width in inches. TV EASY software uses this number to instruct the tester where to place the camera. If you had entered incorrect information before camera positioning and had positioned the camera per the NEEA TV EASY wizard instructions, then you must rerun On Mode testing steps by running a new test or by repairing all On Mode parts of the TV test.
Screen Height	Enter height in inches. TV EASY software uses this quantity in combination with the Screen Width quantity to calculate the power-luminance limit lines for compliance calculations.
Pixel Rows	Enter the number of pixel rows. Changing this number will affect compliance determination during report generation since it affects the resolution adjustment factor.
Pixel Columns	Same as note above.



Technology Type	Enter "OLED", "QLED", "LED" or a custom entry if none of these apply.
Ambient Light	Enter any number per Section 4.1.2.
Wake by Cast	Enter "0" if feature could not be confirmed and "1" if it was confirmed by a 5-second test.
Remote Start	Enter "0" if feature could not be confirmed and "1" if it was confirmed by a 5-second test.
Wake by Smart Speaker	Enter "0" if feature could not be confirmed and "1" if it was confirmed by a 5-second test.
Standby Notes	Enter any text.
High Contrast Ratio	Enter "Yes" or "No".
MDD Availability	"0" for MDD Unavailable, "1" for MDD Available
MDD Configuration	"0" for MDD Disabled, "1" for MDD Enabled for testing
x_focus	Camera focus distance in inches. This value was used to position equipment for On Mode testing. If it is inaccurate, you will need to redo On Mode testing.
x_test	Camera test distance in inches. This value was used to position equipment for On Mode testing. If it is inaccurate, you will need to redo On Mode testing.
Initial TV Setup Notes	Enter any text.
Power supply make and model	Enter any text.
Internet connection type	Enter "WiFi" or "Ethernet" or "No Internet".
ABC lamp model	Enter any text.
ABC dimmer switch model	Enter any text.
Wake by Cast advertised	"0" for no, "1" for yes.
Remote Start advertised	"0" for no, "1" for yes.
Wake by Smart Speaker advertised	"0" for no, "1" for yes.
Quickstart On by Default	"0" for no, "1" for yes.
Wake Time (sec)	Enter number of seconds.
Quickstart Available	"0" for no, "1" for yes.
Input terminal	Enter any text.
Smart Speaker used for testing	Enter any text.
Mobile Device used for testing	Enter any text.
Backlight control	Enter any text.
Power source used to power camera	Enter any text.
Power source used to power lamp	Enter any text.
Camera photometer make model and serial number	Enter any text.
Illuminance meter make and model	Enter any text.
Media player make and model	Enter any text.
TV EASY version number	Do not edit.
Default backlight level	Enter any text.
Minimum temperature (°C)	Enter a temperature in °C.
Maximum temperature (°C)	Enter a temperature in °C.



Minimum humidity (%)	Enter a relative humidity in %.
Maximum humidity (%)	Enter a relative humidity in %.

## 6.2 Redo Parts of a Test

There are two ways to repair a test, repeat a step during the test sequence, and repeat one or more steps after stopping or completing a test.

### 6.2.1 Back up during testing

If you realize that there is an error with a test step while you are conducting that test step (e.g. you clicked “OK” before the dynamic broadcast clip countdown timer had completed its countdown so your timing is off), you can back up and start the step over again (or start from any previous step) by using the “Rewind” button.

If you realize you need to back up while looking at an instructions prompt, click “Pause” on the prompt then “Rewind” to back up.

### 6.2.2 Repeat one or more test steps after stopping or completing a test

This can be done if you notice, post-test, that some of your data is bad, or if for some reason you had to stop the test partway through and you wish to continue the test. In either case, you can load a previous test and redo test steps or complete them. Here you cannot make changes that would affect the test sequence (e.g. changing a PPS to reflect ABC enabled vs. disabled by default).

To do this, navigate to Automated Mode as in Section 4.1, then select “Load Prev Test.”

You can then select the data output and image save folders associated with the test that you wish to repair or continue (Figure 46).



Figure 46: Select previous test folders



Then select the test steps you want to rerun. These will overwrite any previous data for these tests in reports generated after this point (Figure 47).

The screenshot shows a software window titled "TV Energy Assessment System". At the top right are "Alarms" and "Devices" buttons. Below the title bar is a header "Select which subsequences to include in the test sequence". A table lists nine subsequences with columns: "Include" (checkbox), "Subsequence Name", "Time (hh:mm)", and "Run Status". The "Run Status" column shows "Not Run" for all. The "Include" column has checkboxes for each row. The "Subsequence Name" column contains: stabilization, uniformity, default, hdr10, default\_low\_backlight, default\_mid\_backlight, hdr10\_low\_backlight, hdr10\_mid\_backlight, and standby\_active. The "Time (hh:mm)" column shows: -, -, 00:10, 00:05, 00:10, 00:10, 00:05, 00:05, and -. A note at the bottom right states: "Note: Mid backlight tests are required for draft ANSI/CTA-2037-D testing, not ANSI/CTA-2037-C testing." At the bottom left is a "Back" button with a left arrow icon, and at the bottom right is a "Begin Test" button with a right arrow icon.

Include	Subsequence Name	Time (hh:mm)	Run Status
<input type="checkbox"/>	stabilization	-	Not Run
<input type="checkbox"/>	uniformity	-	Not Run
<input type="checkbox"/>	default	00:10	Not Run
<input type="checkbox"/>	hdr10	00:05	Not Run
<input checked="" type="checkbox"/>	default_low_backlight	00:10	Not Run
<input type="checkbox"/>	default_mid_backlight	00:10	Not Run
<input type="checkbox"/>	hdr10_low_backlight	00:05	Not Run
<input type="checkbox"/>	hdr10_mid_backlight	00:05	Not Run
<input checked="" type="checkbox"/>	standby_active	-	Not Run
<input type="checkbox"/>			

Figure 47: Select the tests to redo



## Appendix A: Setup Checklist

Before beginning Automated Mode test wizard, check off the following (Sections 3.2.3–3.9):

1. Device configuration
  - a. Power meter → laptop connection
  - b. Power meter device configuration
  - c. Camera → PoE → laptop connection
  - d. Camera device configuration
  - e. Camera has been plugged in and warming up for at least 1 hour
2. Room conditions
  - a. Ambient light, temperature, humidity
  - b. Table covered in black cloth
  - c. AC power source set to 115 V and 60 Hz
3. TV setup
  - a. TV positioned per ANSI/CTA-2037-D Section 8.2
  - b. AC power source → power meter → TV connection

Then, the Automated Mode test setup wizard (Section 4.1) guides completion of the following:

4. Enter equipment details
5. Position equipment
  - a. Position camera
  - b. Position ABC lamp if doing ABC testing
  - c. Start warming up ABC lamp
6. Set mode and outputs
7. Enter metadata
8. Update TV software if necessary
9. Record TV initial setup prompt choices
10. Run screen correction
11. List PPSs
12. Identify brightest PPS
13. Record “backlight” control
14. Configure smart wake
15. Configure Quickstart and MDD
16. Confirm test information
17. Select test steps to run
18. Start the test sequence



## Appendix B: Basic Example Custom Test Sequence

Here is an example of a Manual Test Sequence that can be copied into a CSV file and used for Manual testing. When copying into a csv, ensure that "#Config" is in the A1 cell. This sequence will complete the normal screen config process in which the camera photometer finds the edges of the screen and then logs data for 30 minutes. The wait time can be changed to any length of time desired. Enter the desired time in seconds.

#Config	
Macro File	
#Sequence	
tag	0
user_command	Ensure the TV has ABC off\n Ensure the TV is in the desired picture setting
user_command	Play the Dots_xx.mp4 clip\n then press OK
screen_config	screen_config
user_command	Press OK to begin manual test
tag	manual_test
Wait	1800

Any command used in Automated Mode be used included in a custom sequence as well.



## Appendix C: Test Names and Descriptions

NEEA TV Energy Assessment System Software prompts users to walk through a series of tests based on a TV's features. The table below represents an example of a test sequence with descriptions for each test. These descriptions should enable the reader to understand the test names used in any test sequence.

*Table 7: Test Names and Explanations*

Test Name	Description
screen_config	Basler camera photometer finds the outline of the screen when playing the dots pattern and makes geometry corrections.
stabilization	TV is stabilized by playing the first 5 minutes of the SDR dynamic test clip until the software determines that a stabilization run has an average power level that is within 2% of the previous run.
uniformity	The Basler camera photometer writes pixel-level luminance data to a CSV file for the purpose of making a luminance heat map.
default	Measure average power and luminance while playing the 10-minute IEC SDR dynamic test clip in the default SDR PPS with ABC off.
brightest	Measure average power and luminance while playing the 10-minute IEC SDR dynamic test clip in the brightest SDR PPS with ABC off.
hdr10	Measure average power and luminance while playing the 5-minute IEC HDR10 dynamic test clip in the default HDR10 PPS with ABC off.
default_low_backlight	Same as <b>default</b> but with TV backlight set to 20% (for 2037-C testing) or to its minimum (for 2037-D testing).
brightest_low_backlight	Same as <b>brightest</b> but with TV backlight set to 20% (for 2037-C testing) or to its minimum (for 2037-D testing).
default_mid_backlight <sup>6</sup>	Same as <b>default</b> but with TV backlight set to a level that is approximately halfway between the default and minimum levels (needed for 2037-D testing only).
brightest_mid_backlight <sup>6</sup>	Same as <b>brightest</b> but with TV backlight set to a level that is approximately halfway between the default and minimum levels (needed for 2037-D testing only).
default_140	Measure average power and luminance while playing the 10-minute IEC SDR dynamic test clip in the default SDR PPS with ABC on and ambient light set to 140 lux. First SDR ABC test.
hdr10_140	Measure average power and luminance while playing the 5-minute IEC HDR10 dynamic test clip in the default HDR10 PPS with ABC on and ambient light set to 140 lux. First HDR10 ABC test.
default_50	Additional SDR ABC test at 50 lux.
hdr10_50	Additional HDR10 ABC test at 50 lux.
default_17	Additional SDR ABC test at 17 lux.
hdr10_17	Additional HDR10 ABC test at 17 lux.
default_4	Additional SDR ABC test at 4.
hdr10_4	Additional HDR10 ABC test at 4 lux.
standby_active	Measure Standby per 2037-D section 11.2. [Note: we plan to change this test name to "standby" in the next major release to better reflect the meaning of this test result.]

<sup>6</sup> Only used in ANSI/CTA-2037-D testing.



## Appendix D: Dimming Switch Low End Trim Adjustment

The dimming switch available through PCL requires a low-end trim adjustment in order to reach the low lux measurements during ABC testing. This can be achieved by following the instructions from the following page out of the dimming switch manual. Other dimming switches may have a similar consideration to keep in mind.

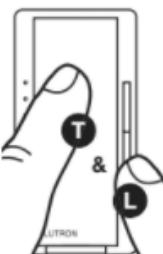
Application Note #459

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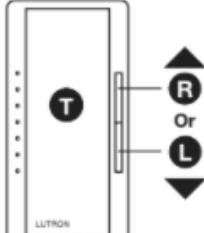
**Low-End Trim Shortcut (Entry into Advanced Programming Mode is not required)**

For quick changes to the Low-End Trim, a shortcut method has been created that bypasses the APM.

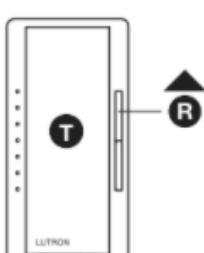
1. Press and hold the **Tap** button and the **Lower** button until an Indicator Light (IL) blinks. The Load will turn OFF and then turn ON to Low-End.



2. Adjust light output using **Raise/Lower** button until stable and not flickering. Press and release the **Tap** button to save setting.



3. Press and release **Tap** button to turn load OFF, then press **Raise** button once. If load does not turn ON or remains unstable repeat and in Step 2 increase light with **Raise** button.




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**LUTRON.**

13

Technical Support – 800.523.9466

Figure 48: Instructions for low-end trimming adjustment to dimmer switch



## Appendix E: Errata

1. The file “pps\_3bar\_luminance.csv” is so named because, in previous test methods, a video clip showing three solid, black and white bars was used to measure the luminance of a SDR PPS. Now, IEC\_Broadcast\_resolution\_5994p\_SDR\_HEVC\_AAC.MP4 is used, but the filename still reflects the older method.



## Appendix F: Advanced Ethernet Port Settings for GigE Cameras

### Introduction

We provide these instructions to help test kit customers reduce packet drops when taking luminance measurements.

**Problem description:** In some cases, it's clear that camera data intermittently drops-out because there are black streaks across the camera readout and associated downward spikes in luminance (about 0.5 cd/m<sup>2</sup> or so). See photo below, which was taken during a long test where the camera was recording video, pointed randomly in a lit room.

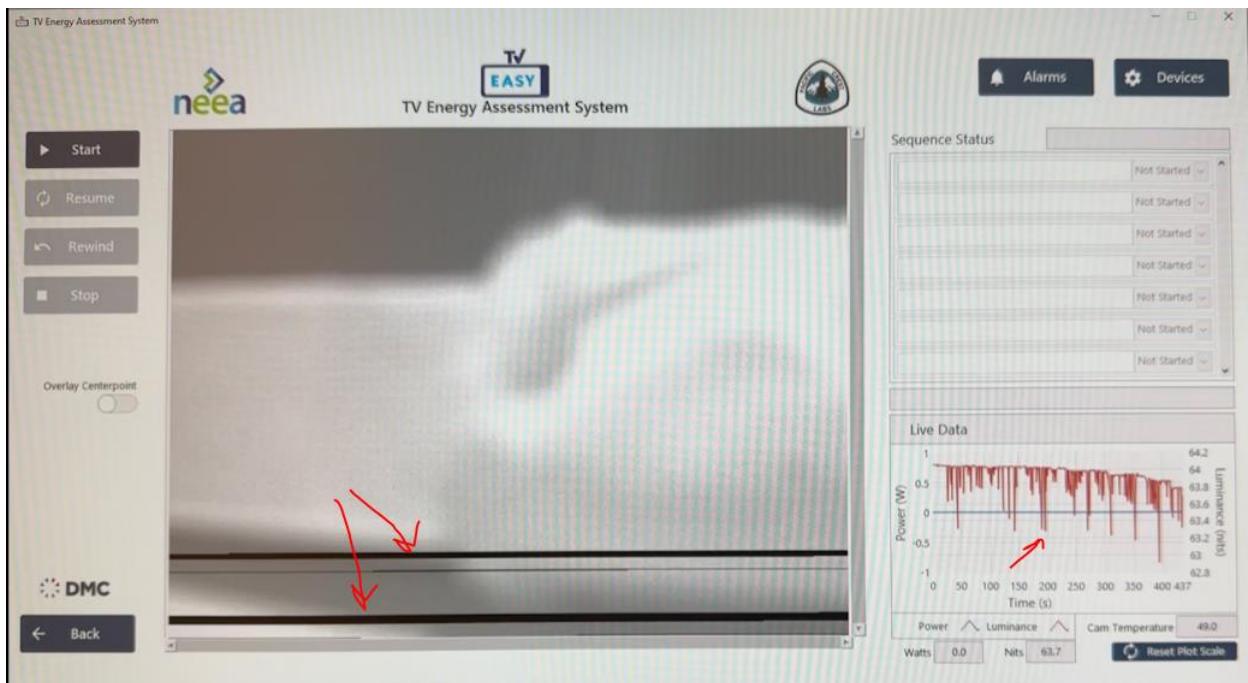


Figure 49: Signs of camera data drop-out

**Impact:** The impact of data drop-out depends on the ethernet card configuration and the number apps running the background in addition to TV EASY. To quantify the impact for your configuration, you can follow the instructions in Appendix G: Luminance Measurement Check. While some of the laptops we have distributed do not exhibit data drop-out with no other applications running, **we strongly recommend updating all previously deployed PCL test kit laptops so that they can run TV EASY without data loss while also running a Zoom meeting, which will be important for support calls and lab qualification activities as well as reducing measurement uncertainty.**

**Corrective Action:** To fix the problem, follow the steps below and reach-out to PCL for support if needed.



## Dell Latitude 14 1700 series

### Disable Firewall

Activate Windows Defender Firewall except for ethernet port: After hitting the Windows Start button, type “windows defender firewall with advanced security” and hit select application.

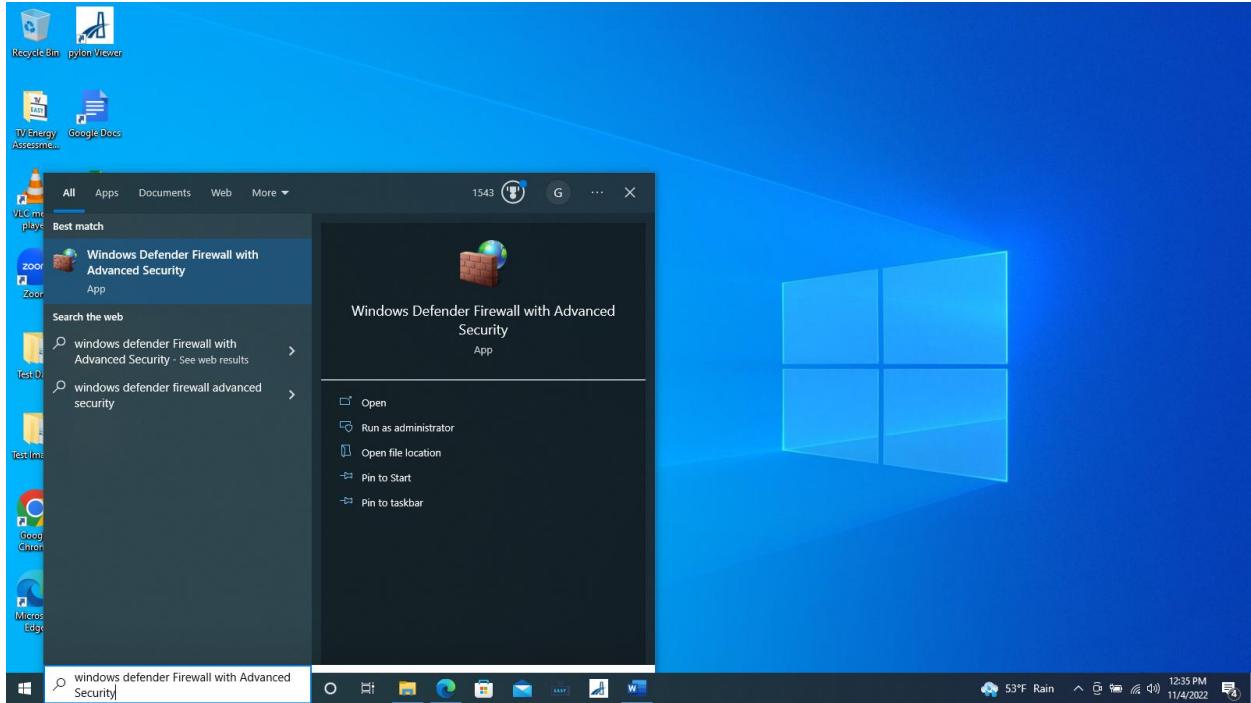


Figure 50: Disable firewall, step 1



Confirm that firewall is on for domain, private and public profiles, and click on properties.

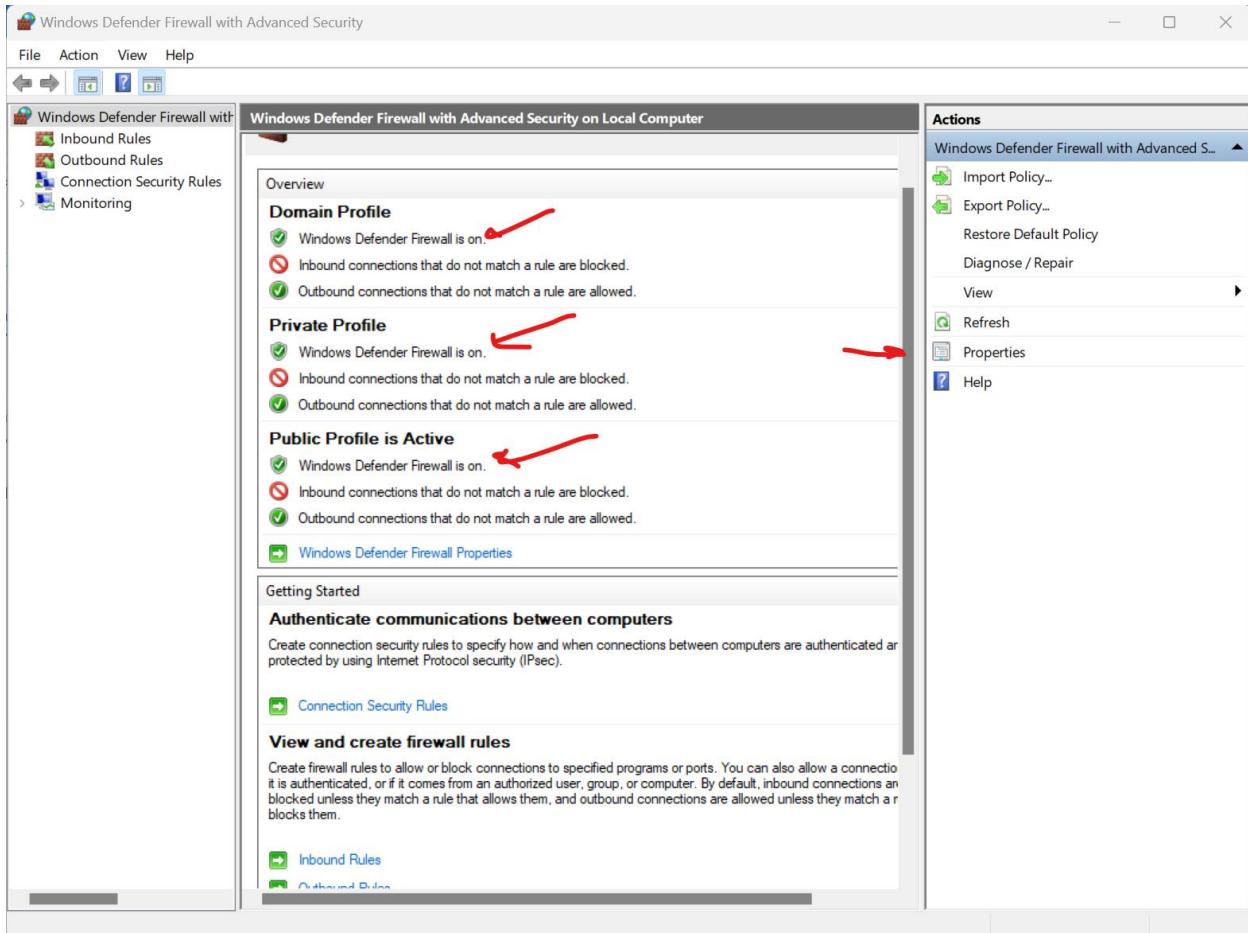


Figure 51: Disable firewall, step 2



For each of the three tabs (domain, private and public) click on “customize” and deselect ethernet.

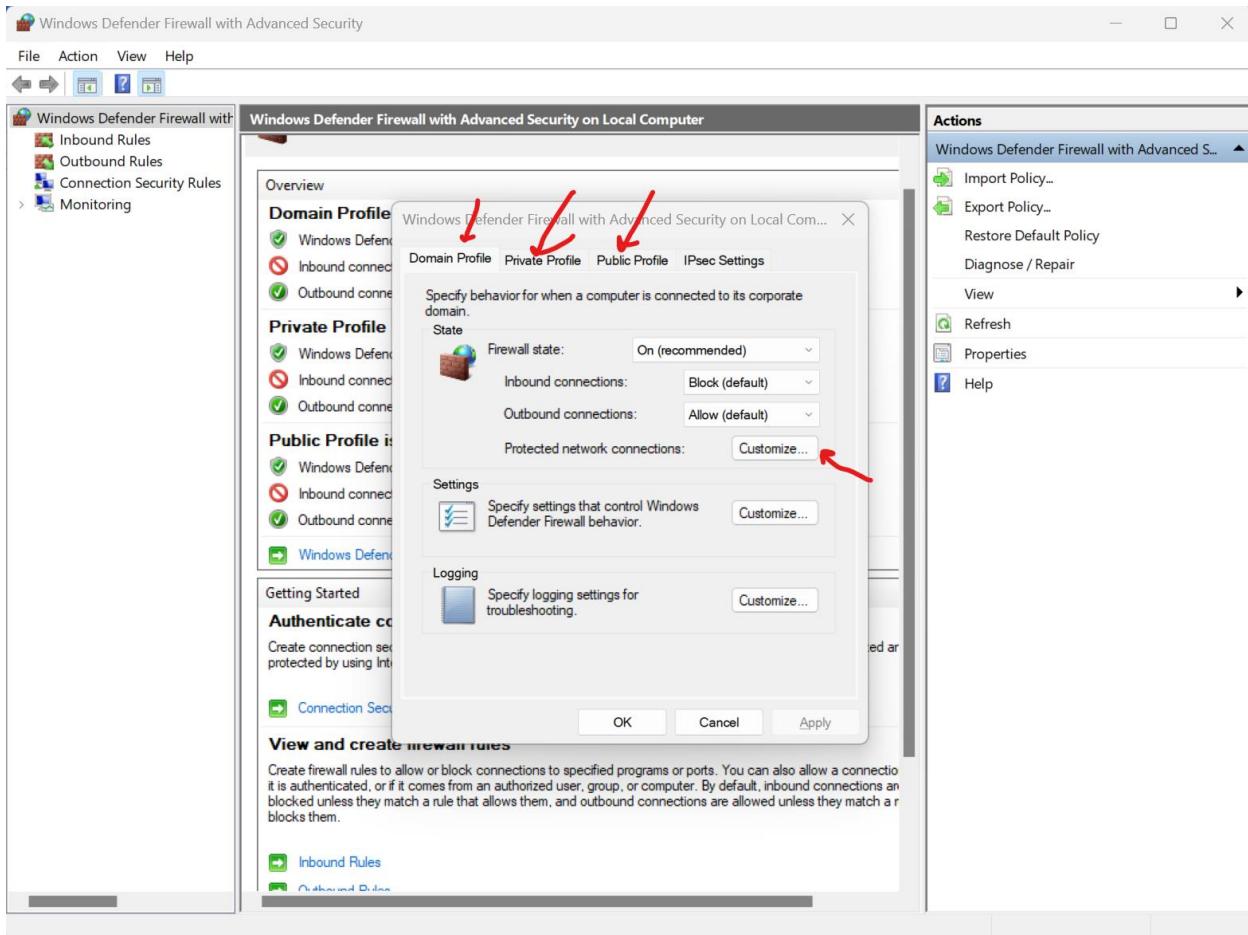


Figure 52: Disable firewall, step 3



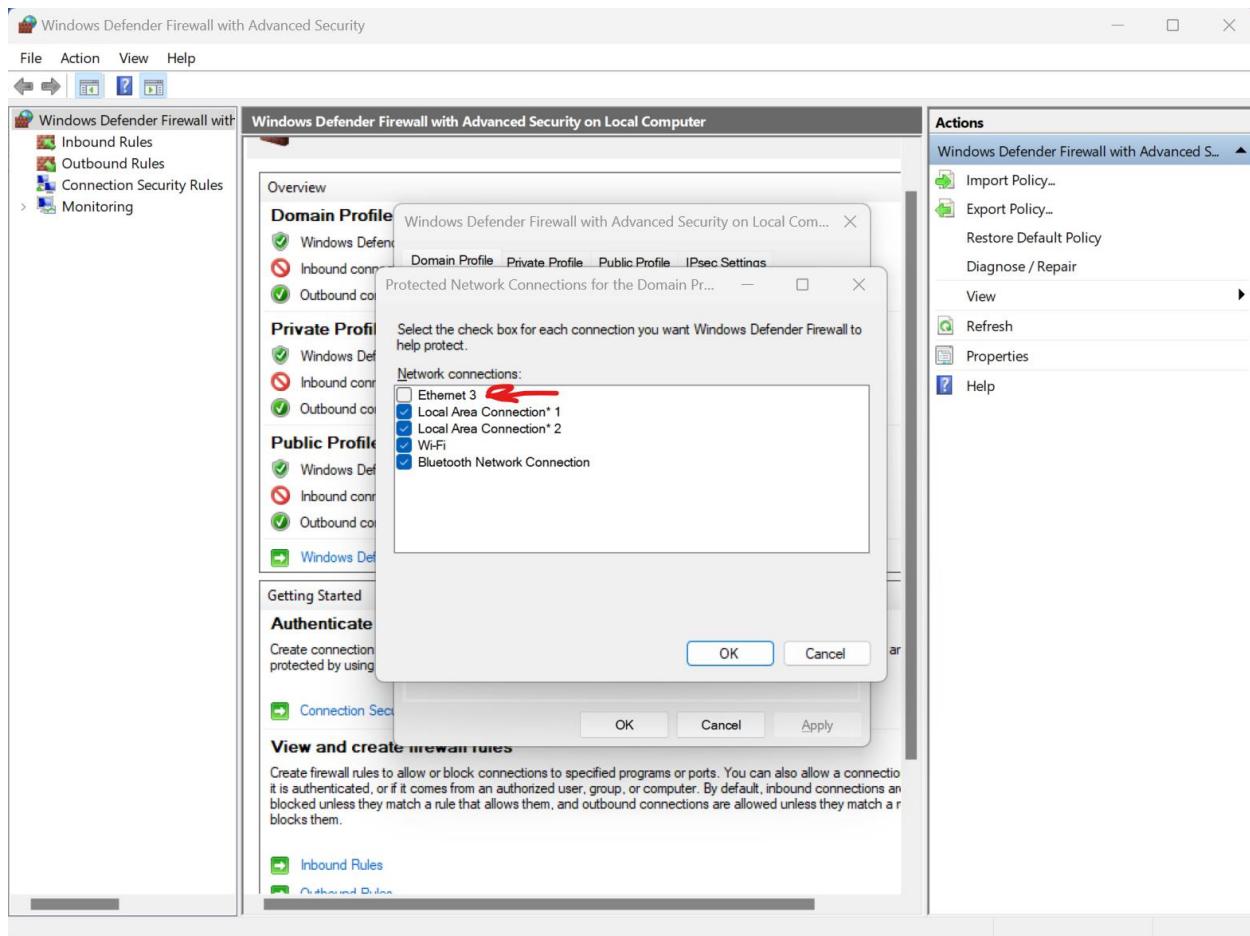


Figure 53: Disable firewall, step 4



## Configure ethernet adapter

Click on Windows Start button, type “view network connections”, and run the app by that name.

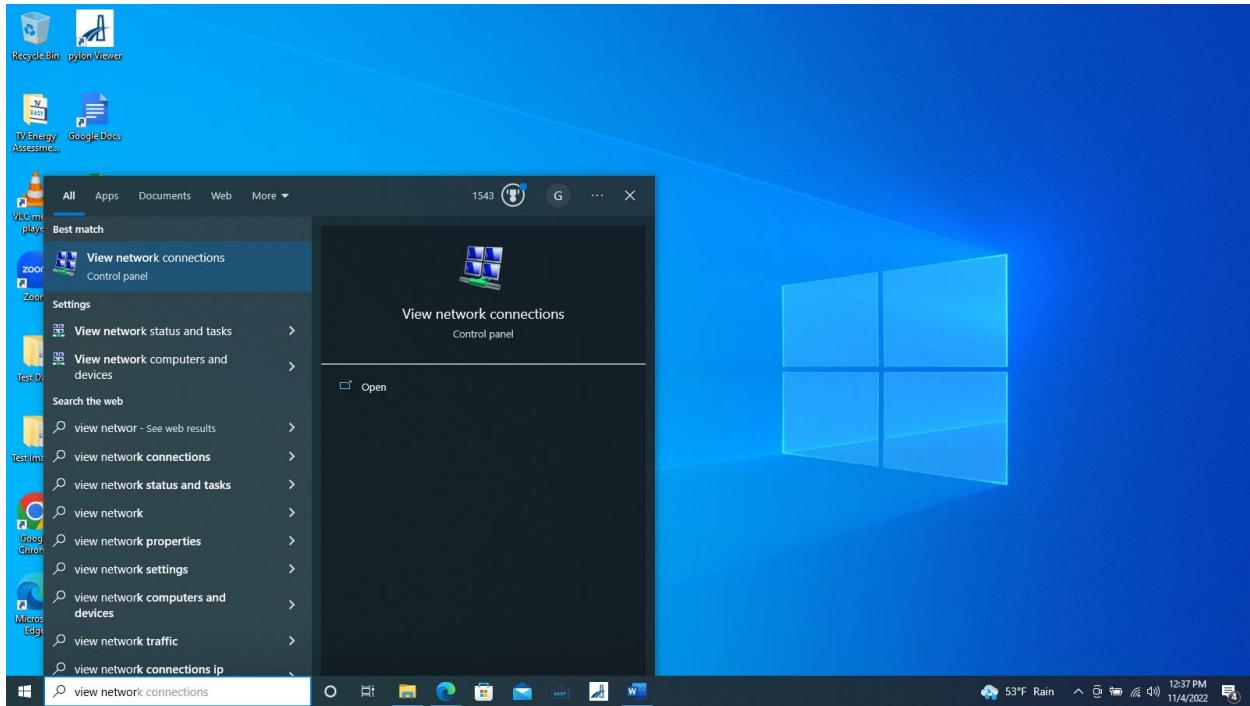


Figure 54: Configure ethernet adapter, step 1

Right click on “Ethernet” and select “properties”

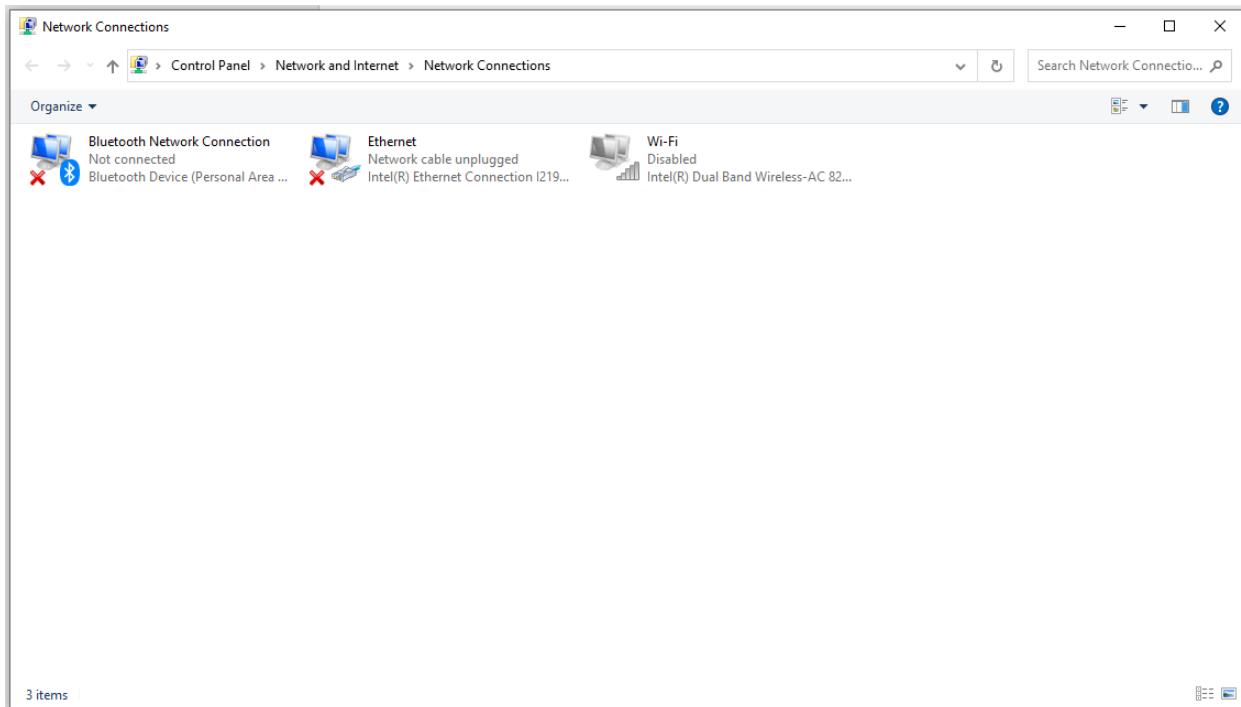


Figure 55: Configure ethernet adapter, step 2



De-select all items except “Pylon GigE Vision Driver” and “TCP/IPv4”. Scroll down to deselect the items that are not initially in view.

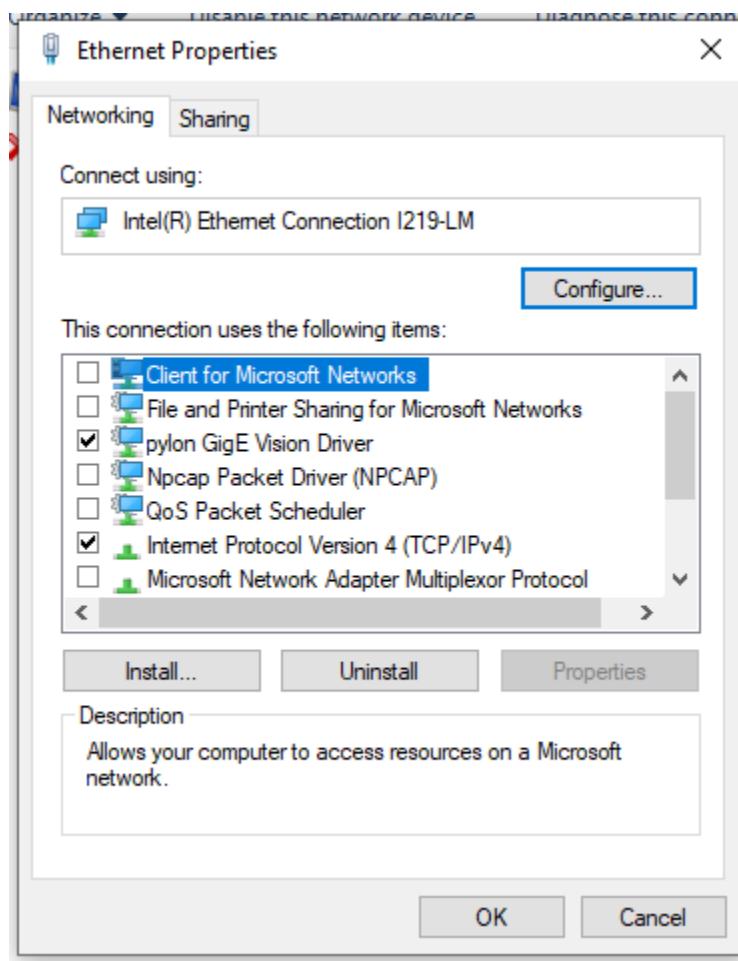


Figure 56: Configure ethernet adapter, step 3



Click the “configure” button (it doesn’t matter which of the items in the box below are selected when you do so). Go to the “advanced” tab and disable “Energy Efficient Ethernet”

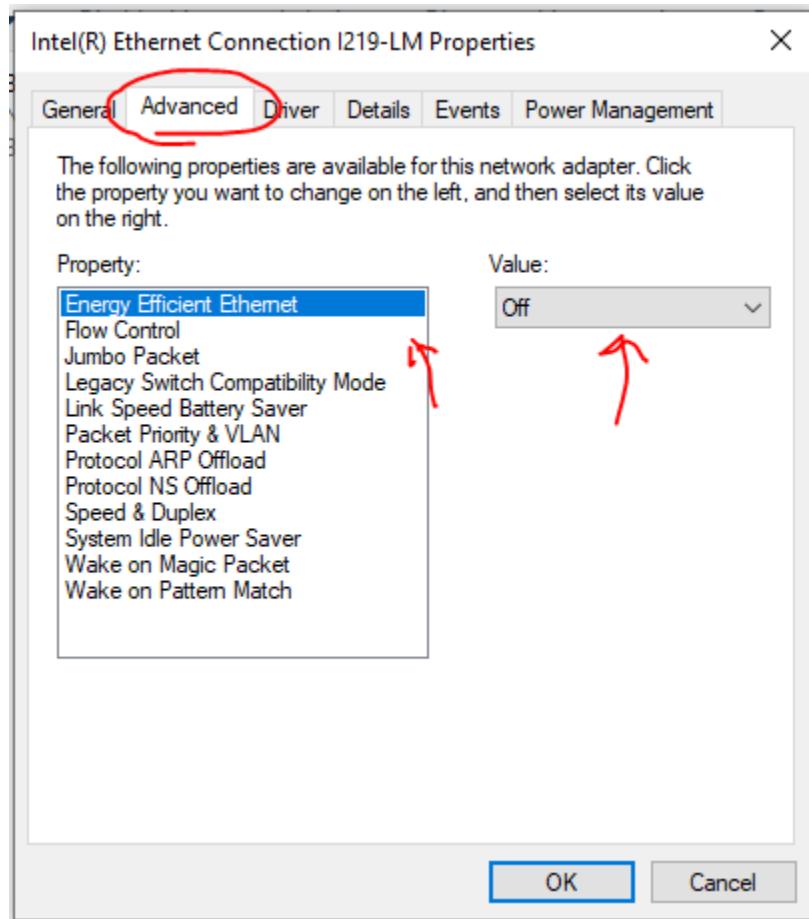


Figure 57: Configure ethernet adapter, step 4



Set Jumbo frames to 9014.

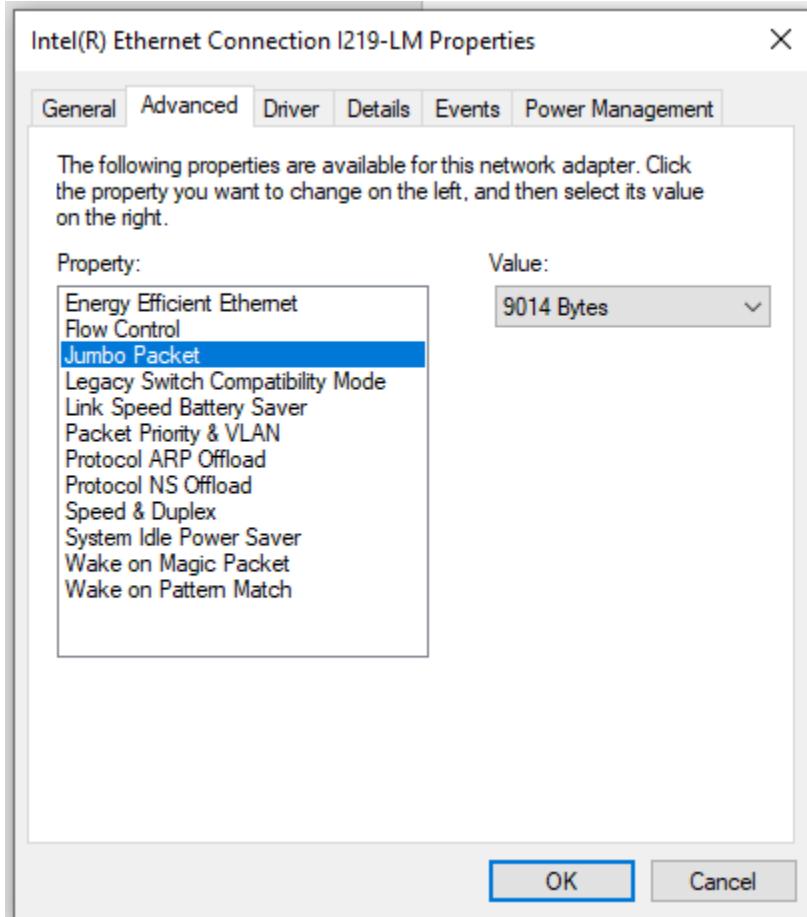


Figure 58: Configure ethernet adapter, step 5



Ensure that speed & duplex is set to “auto negotiation”

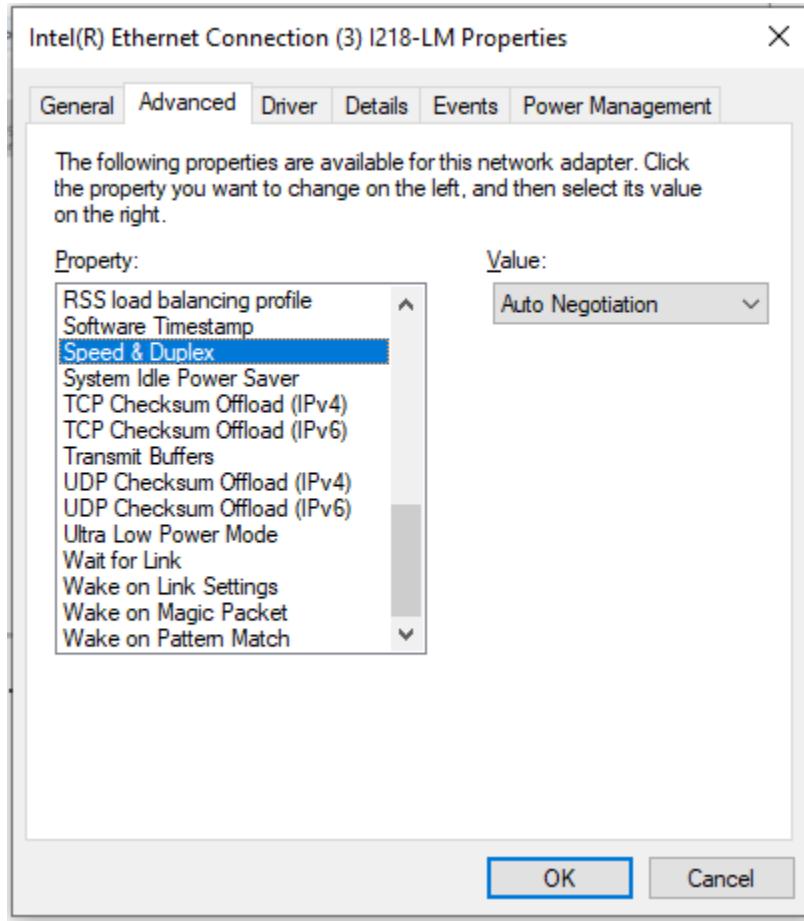


Figure 59: Configure ethernet adapter, step 6

Hit “OK” to save settings.

Restart computer

Set packet size

Click on “Devices”, go to the “Advanced” tab and set the “Packet Size” to 9014.



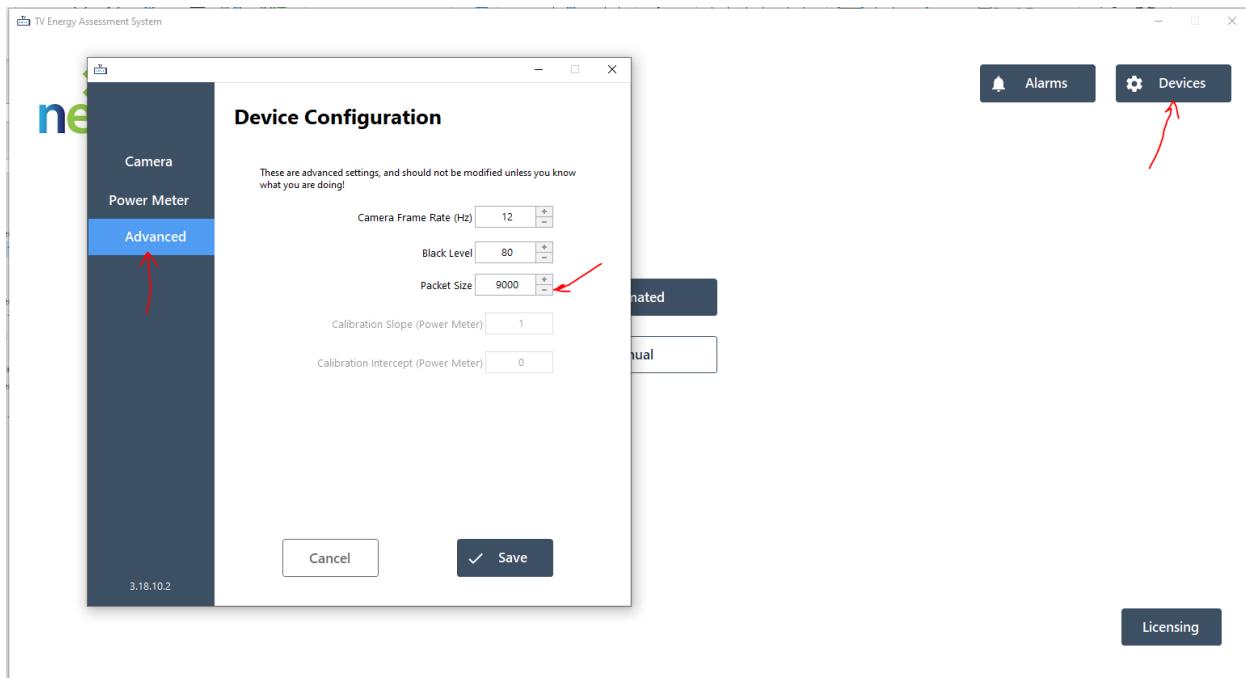


Figure 60: Set TV EASY packet size



## IBM ThinkPad T450

### Disable Firewall

Activate Windows Defender Firewall except for ethernet port: After hitting the Windows Start button, type “windows defender firewall with advanced security” and hit select application.

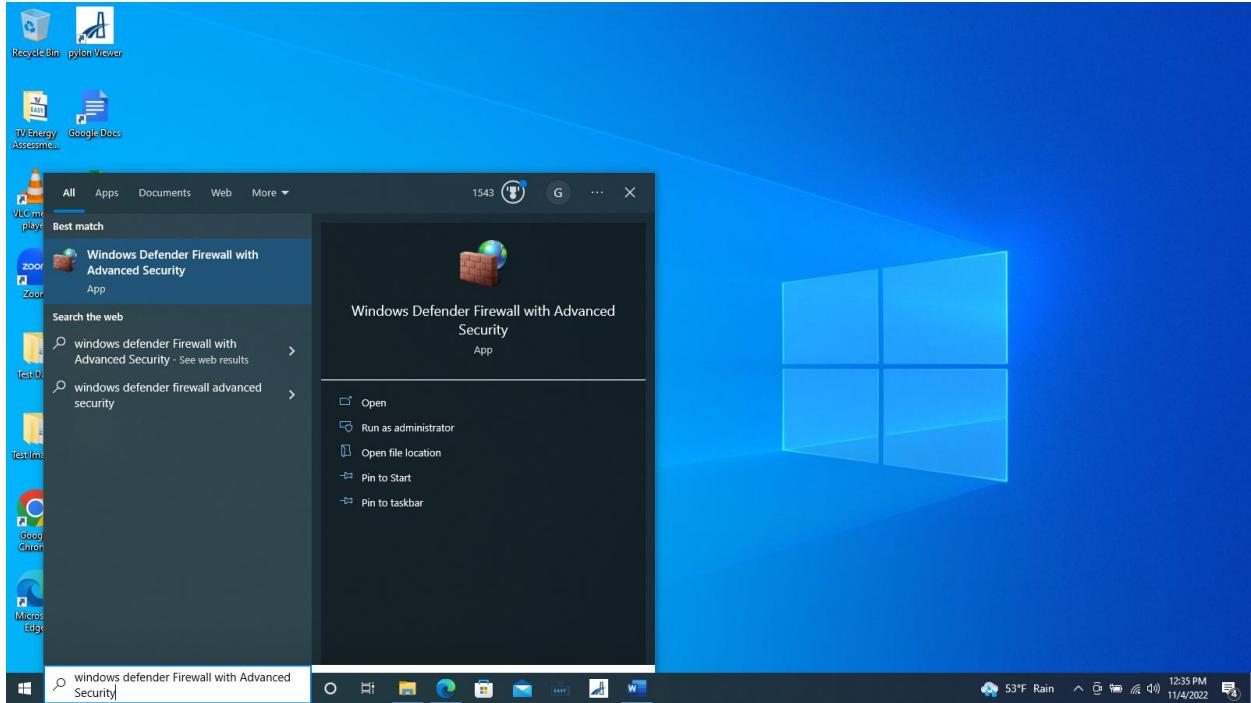


Figure 61: Disable firewall, step 1

Confirm that firewall is on for domain, private and public profiles, and click on properties.

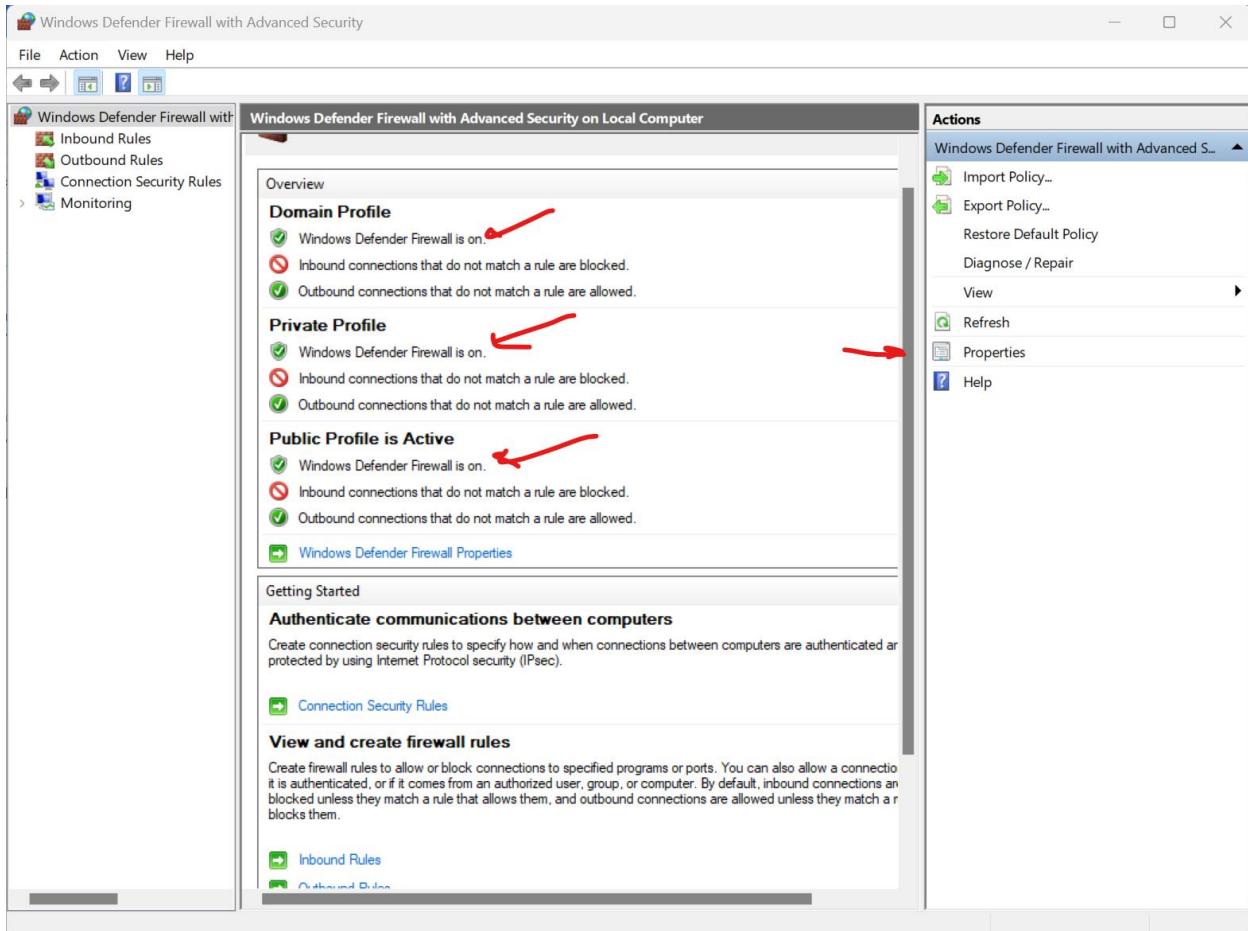


Figure 62: Disable firewall, step 2



For each of the three tabs (domain, private and public) click on “customize” and deselect ethernet.

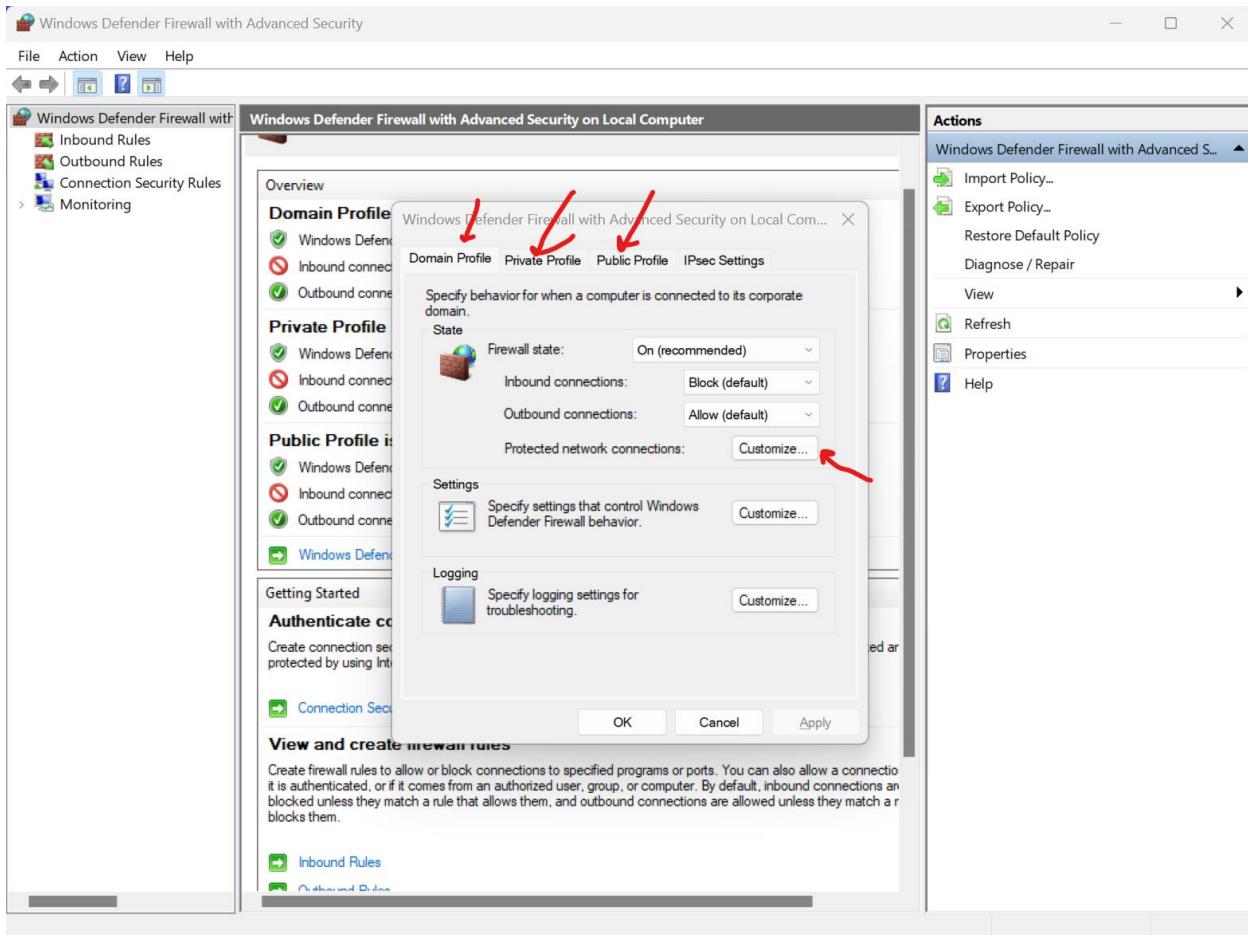


Figure 63: Disable firewall, step 3



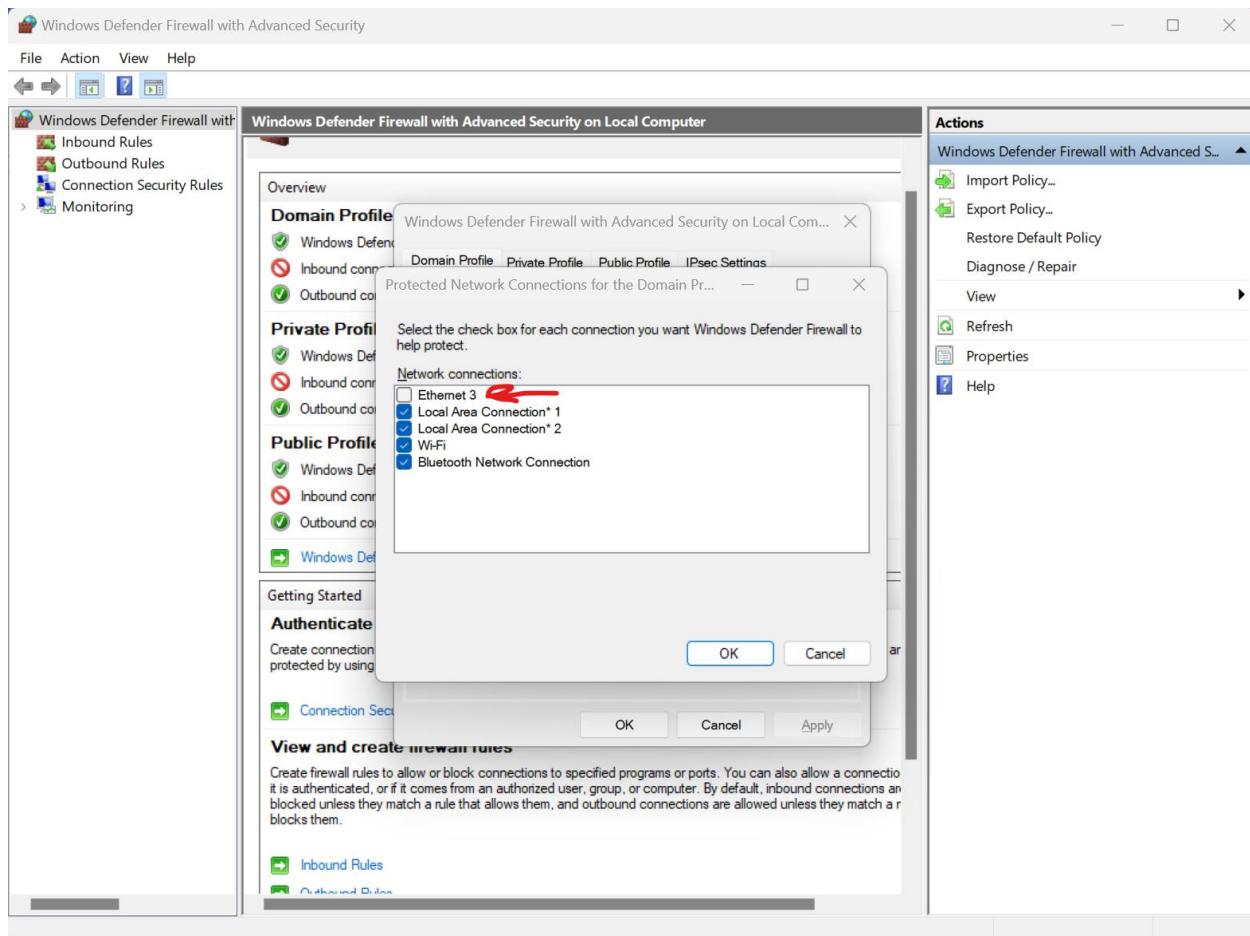


Figure 64: Disable firewall, step 4



## Configure ethernet adapter

Click on Windows Start button, type “view network connections”, and run app by that name.

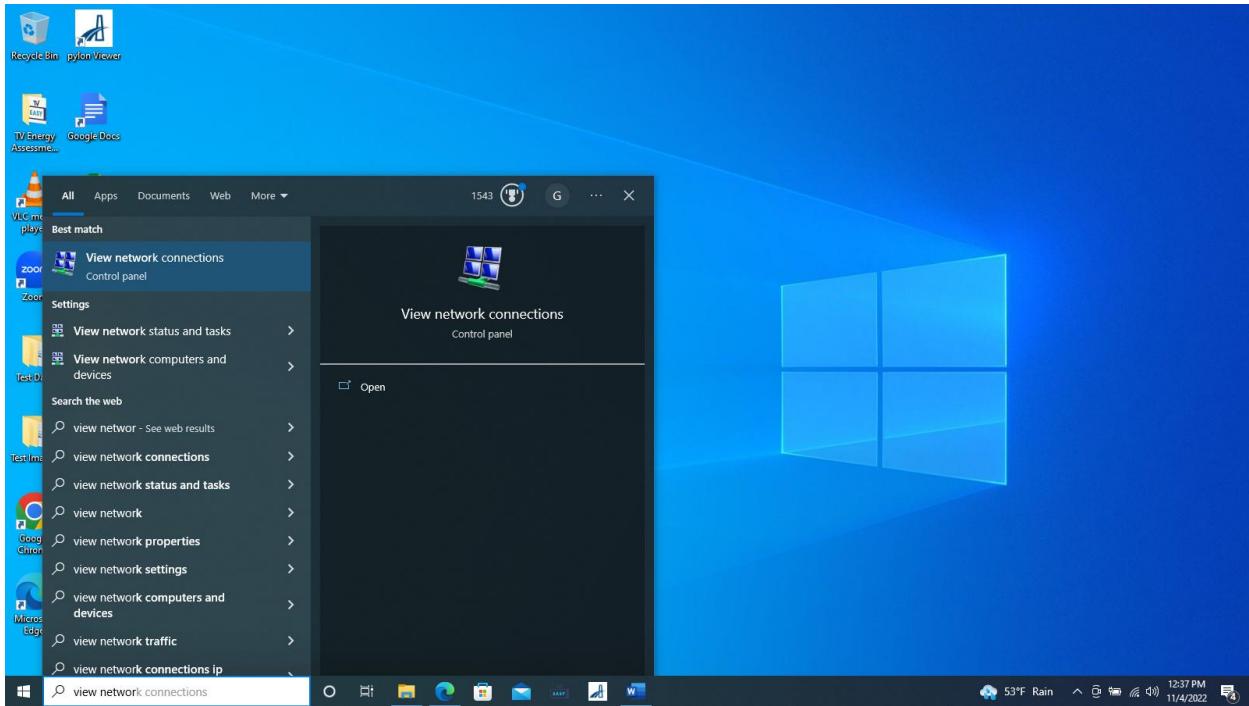


Figure 65: Configure ethernet adapter, step 1



Right click on “Ethernet” and select “properties”.

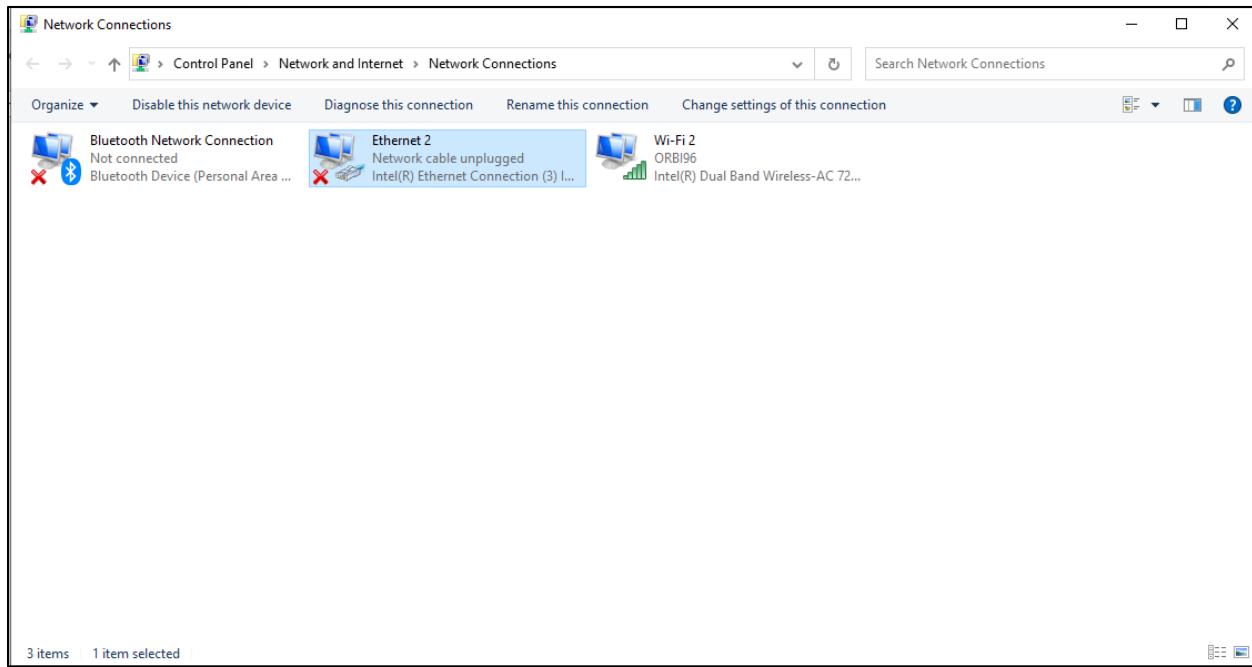


Figure 66: Configure ethernet adapter, step 2



De-select all items except “Pylon GigE Vision Driver” and “TCP/IPv4”. Scroll down to deselect the items that are not initially in view.

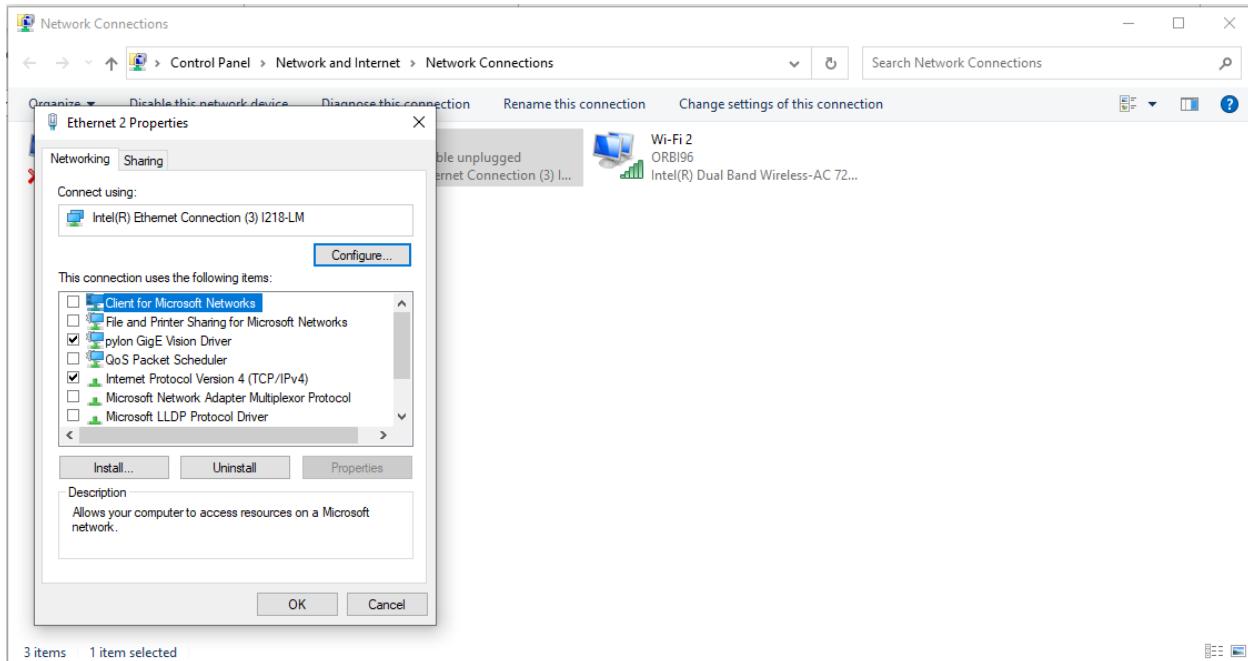


Figure 67: Configure ethernet adapter, step 3



Click the “configure” button (it doesn’t matter which of the items in the box below are selected when you do so). Go to the “advanced” tab and disable “Energy Efficient Ethernet”.

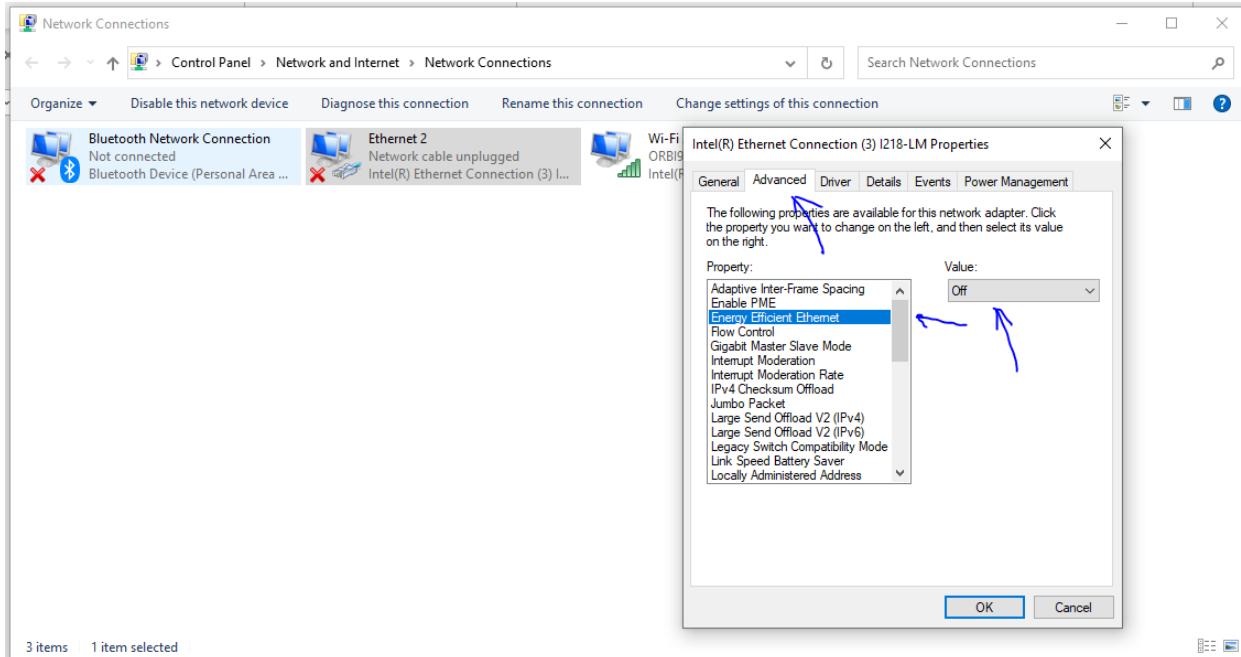


Figure 68: Configure ethernet adapter, step 4



Set Interrupt moderation to disable.

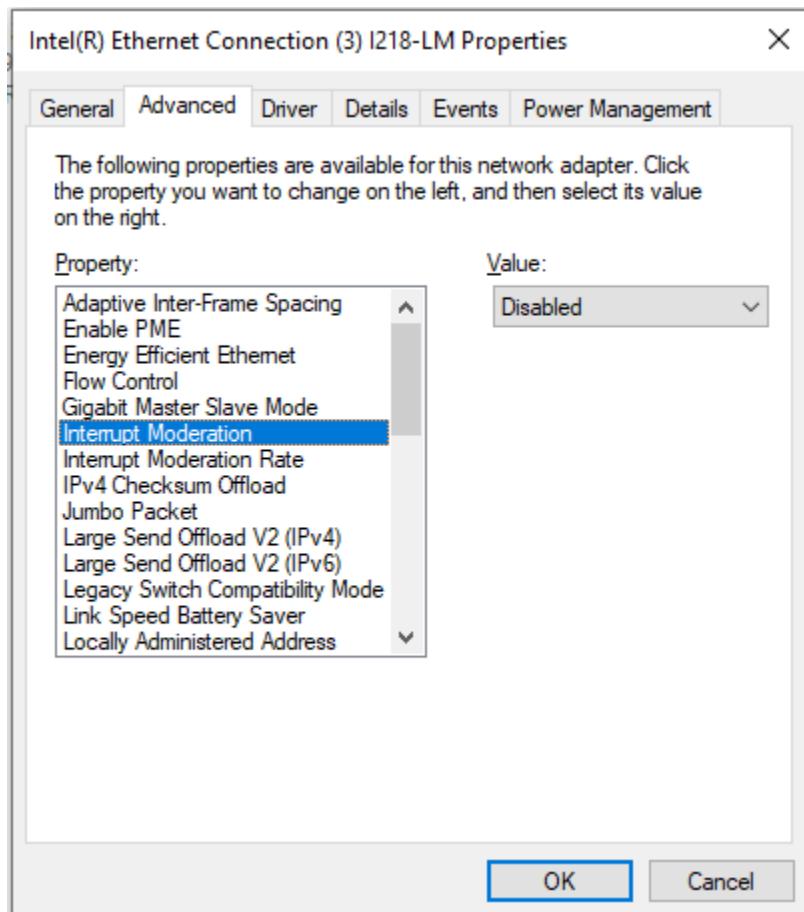


Figure 69: Configure ethernet adapter, step 5



Set Jumbo frames to 4088.

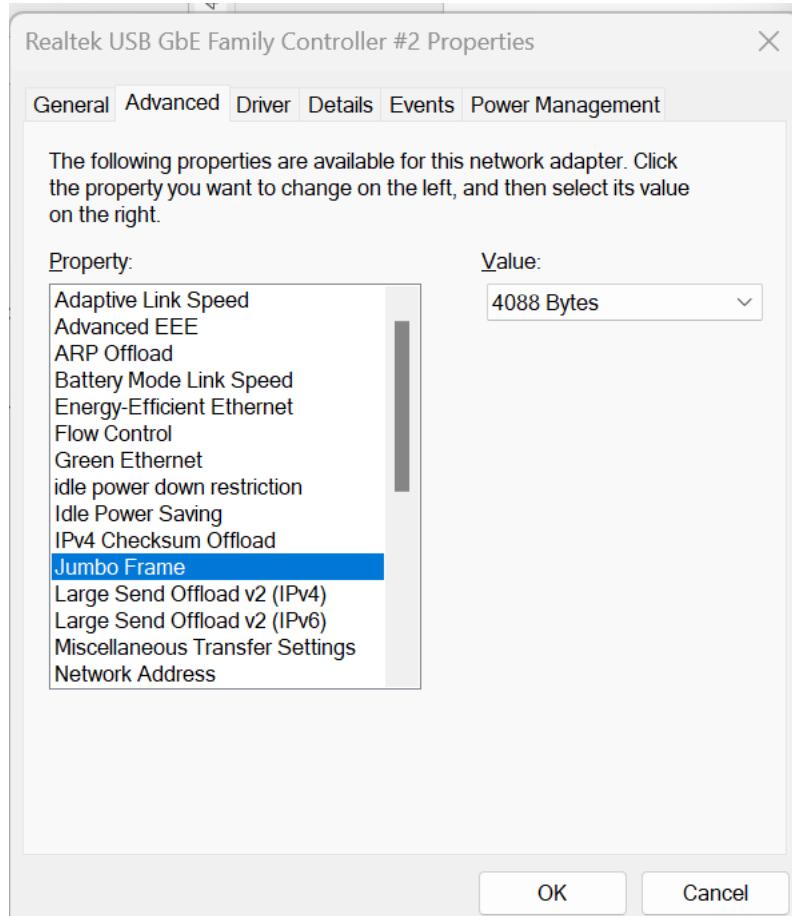


Figure 70: Configure ethernet adapter, step 6



Set receive buffers to 1024.

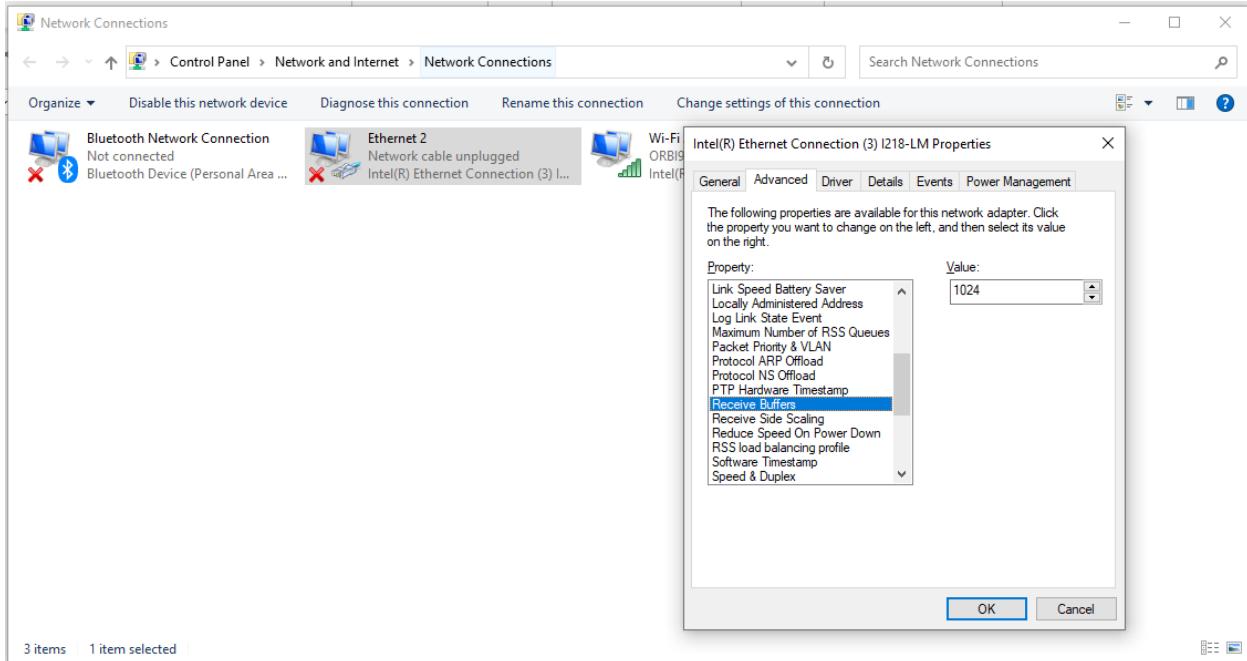


Figure 71: Configure ethernet adapter, step 7

Ensure that speed & duplex is set to “auto negotiation”.

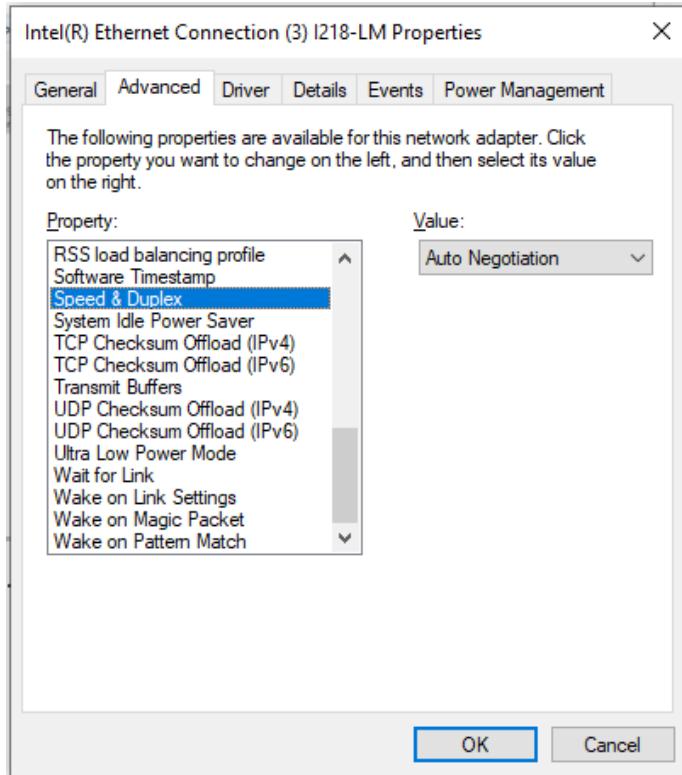


Figure 72: Configure ethernet adapter, step 8



Hit “OK” to save settings.

Restart computer

Set packet size

Click on “Devices”, go to the “Advanced” tab and set the “Packet Size” to 4000.

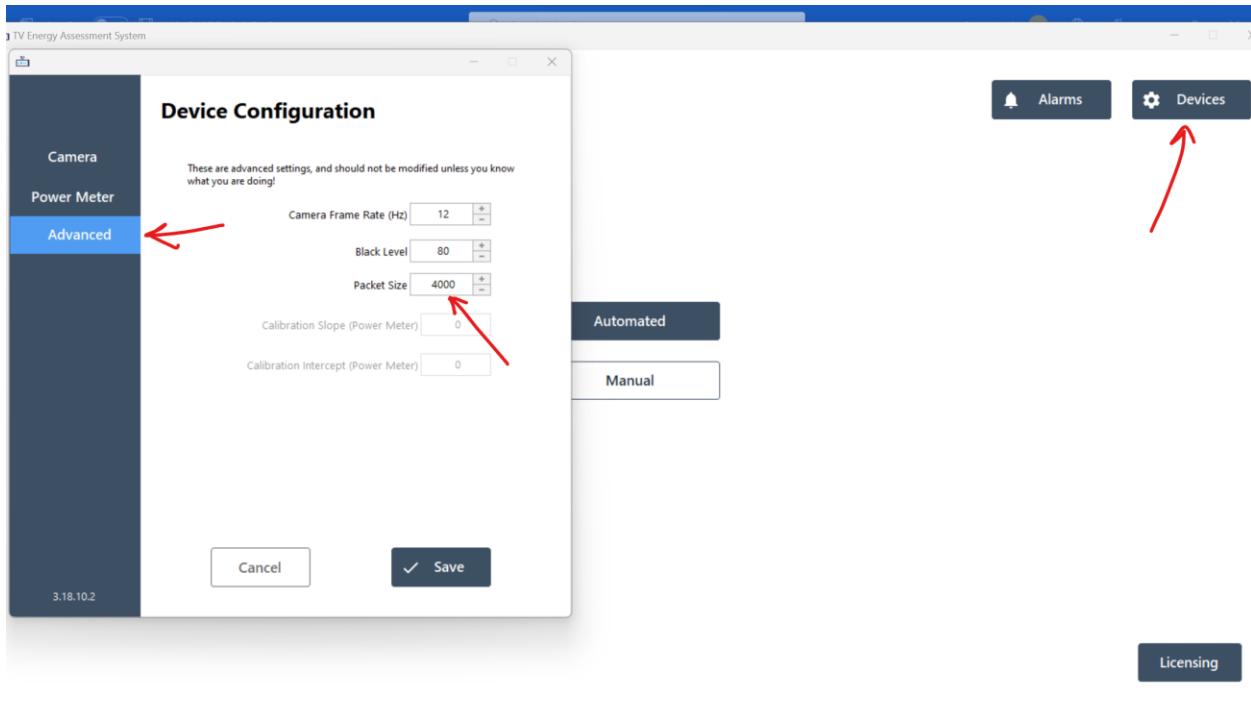


Figure 73: Set TV EASY packet size



## IdeaPad 5 Pro 14 with Realtek USB GbE adapter

Only one of these laptops is deployed in the field with a PCL test kit.

### Disable Firewall

Uninstall McAfee software using “Add or remove programs” if this has not already been done.

Activate Windows Defender Firewall except for ethernet port: After hitting the Windows Start button, type “windows defender firewall with advanced security” and hit select application.

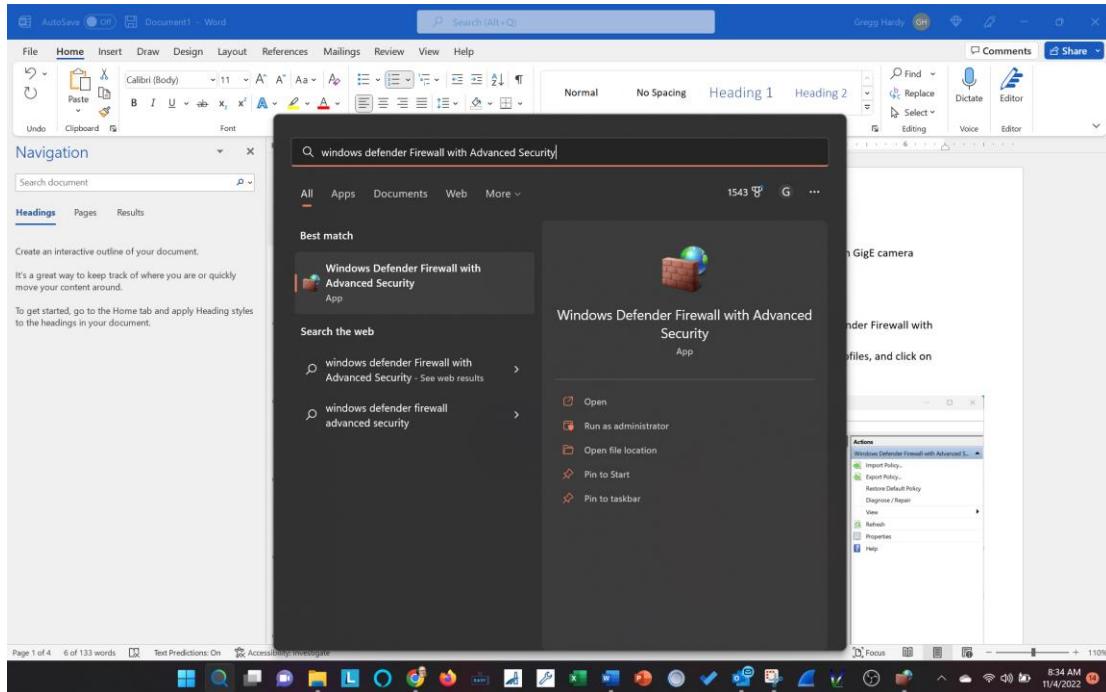


Figure 74: Disable firewall, step 1



Confirm that firewall is on for domain, private and public profiles, and click on properties

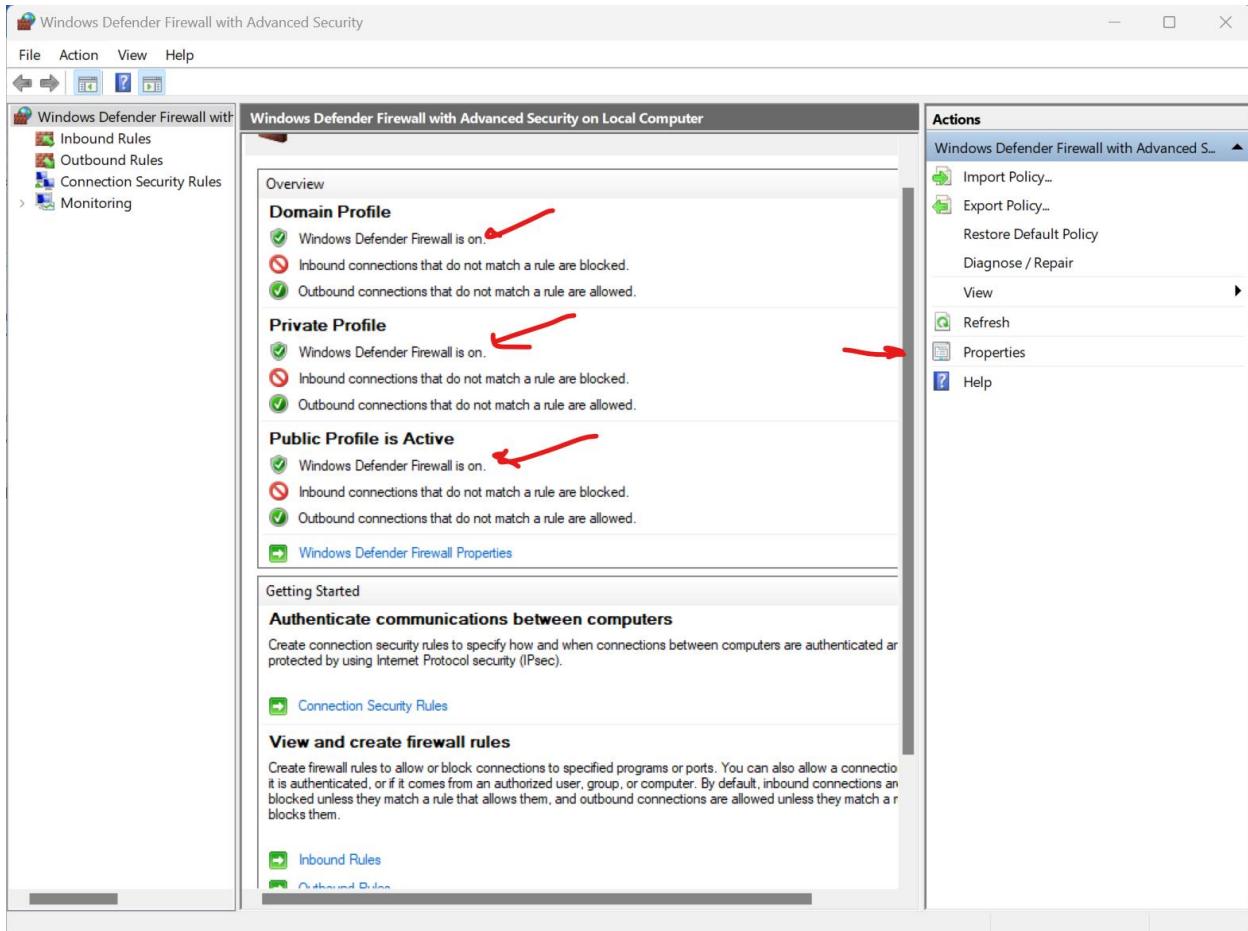


Figure 75: Disable firewall, step 2



For each of the three tabs (domain, private and public) click on “customize” and deselect ethernet.

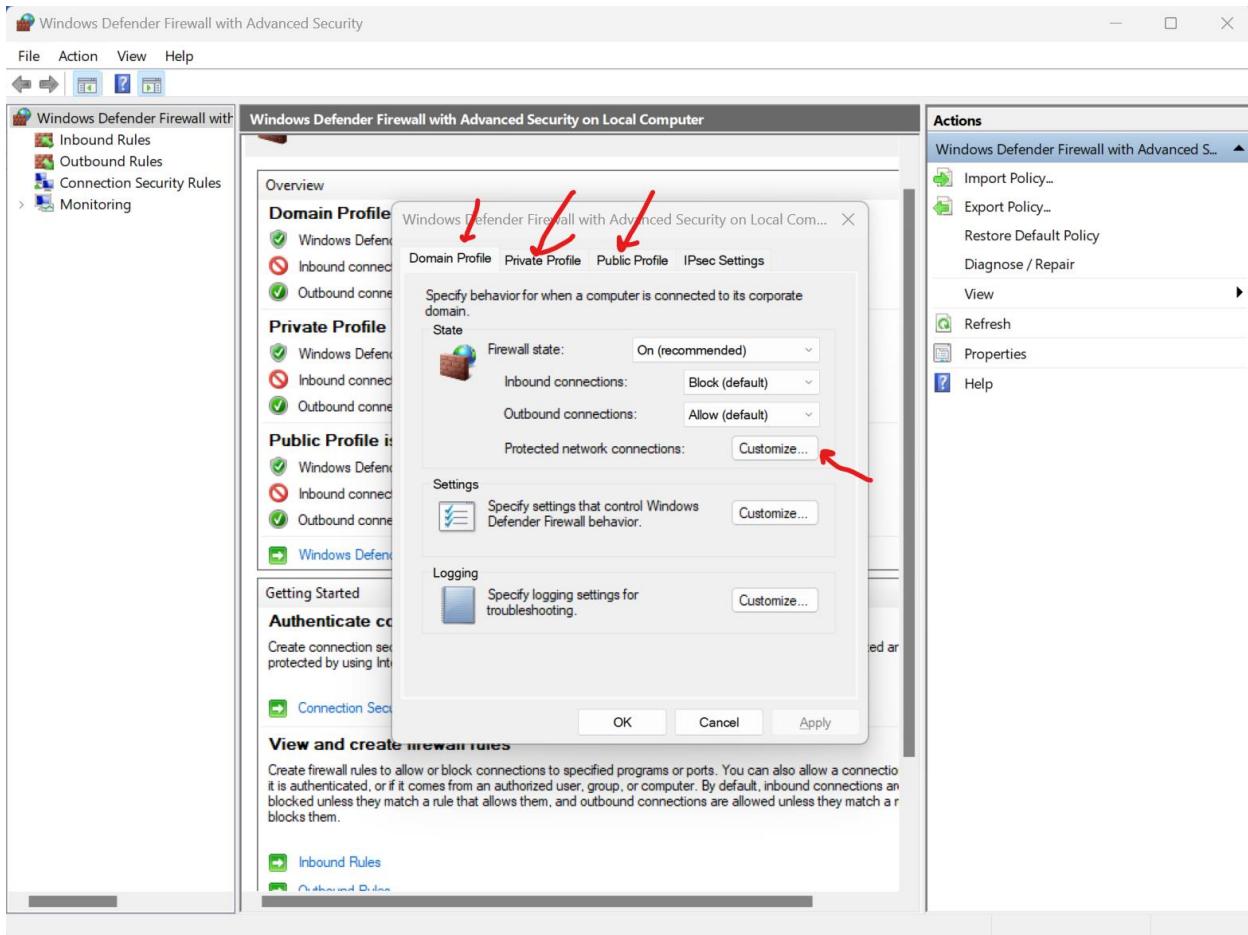


Figure 76: Disable firewall, step 3



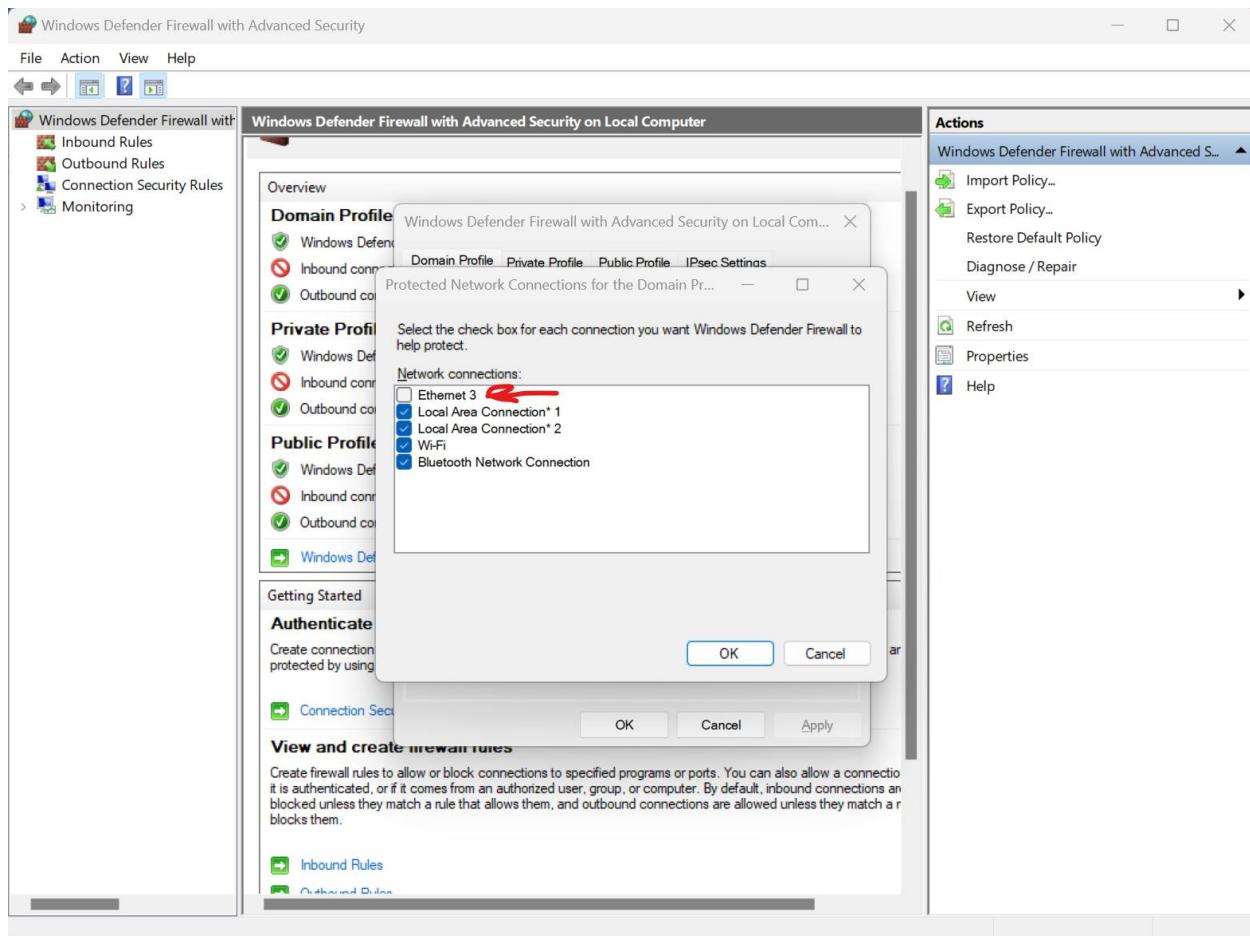


Figure 77: Disable firewall, step 4



## Update ethernet adapter drivers

Download and install “Win11 Auto Installation Program (NetAdapterCx)” from

<https://www.realtek.com/en/component/zoo/category/network-interface-controllers-10-100-1000m-gigabit-ethernet-usb-3-0-software> with adapter plugged into USB C port.

Download	Description	Version	Update Time	File Size
<a href="#"></a>	Win11 Auto Installation Program (NetAdapterCx)	1152.9.20 , 1153.9.20 , 1155.8.20 , 1156.8.20	2022/10/26	5 MB
<a href="#"></a>	Win10 Auto Installation Program	10.55.20	2022/10/26	5 MB
<a href="#"></a>	Diagnostic Program for Win7/Win8/Win10/Win11	2.0.7.3	2022/08/09	6 MB
<a href="#"></a>	Win7 and Server 2008 R2 Auto Installation Program	7.61.20	2021/12/28	5 MB
<a href="#"></a>	Win8, Win8.1 and Server 2012 Auto Installation Program	8.68.20	2021/12/28	5 MB
<a href="#"></a>	Vista and Server 2008 Auto Installation Program	6.27	2018/03/06	9 MB
<a href="#"></a>	WinXP Auto Installation Program for FE/GBE	5.23	2018/03/06	9 MB

Figure 78: Update adapter driver



## Configure ethernet adapter

Click on Windows Start button, type “view network connections”, and run app by that name.

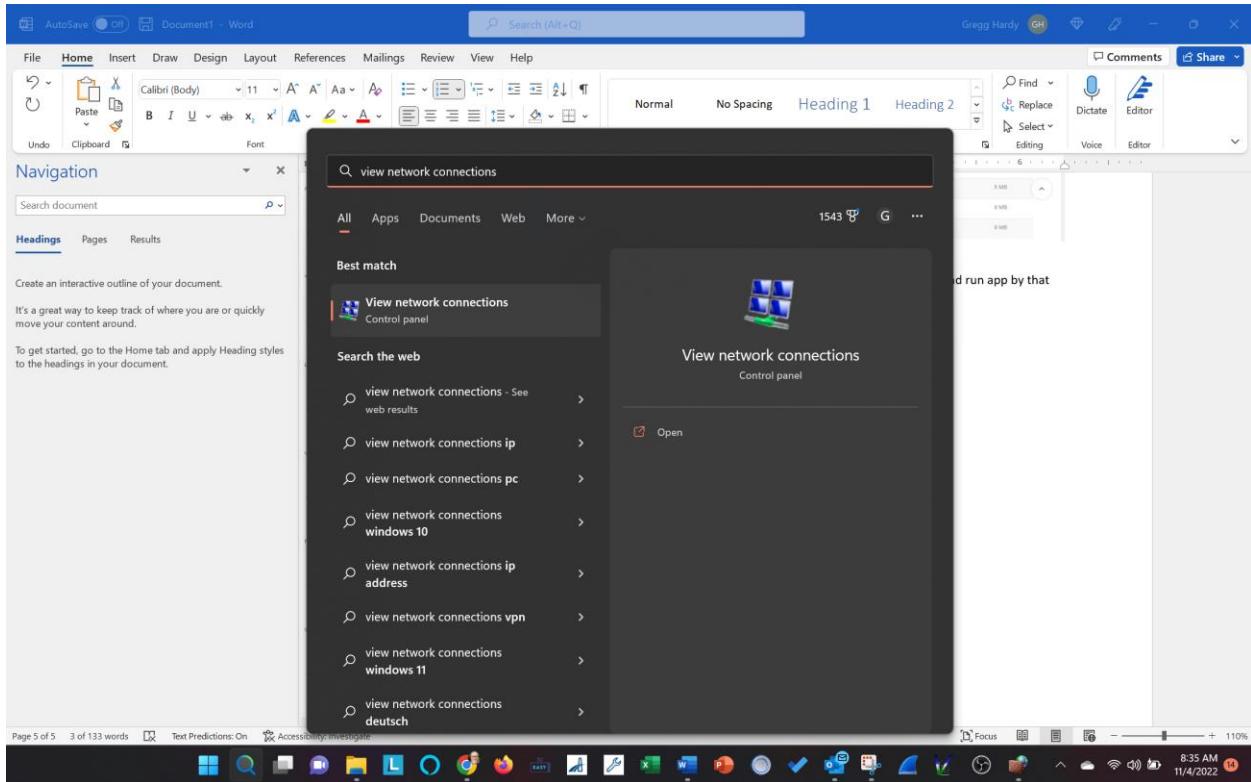


Figure 79: Configure ethernet adapter, step 1



Right click on “Ethernet” and select “properties”.

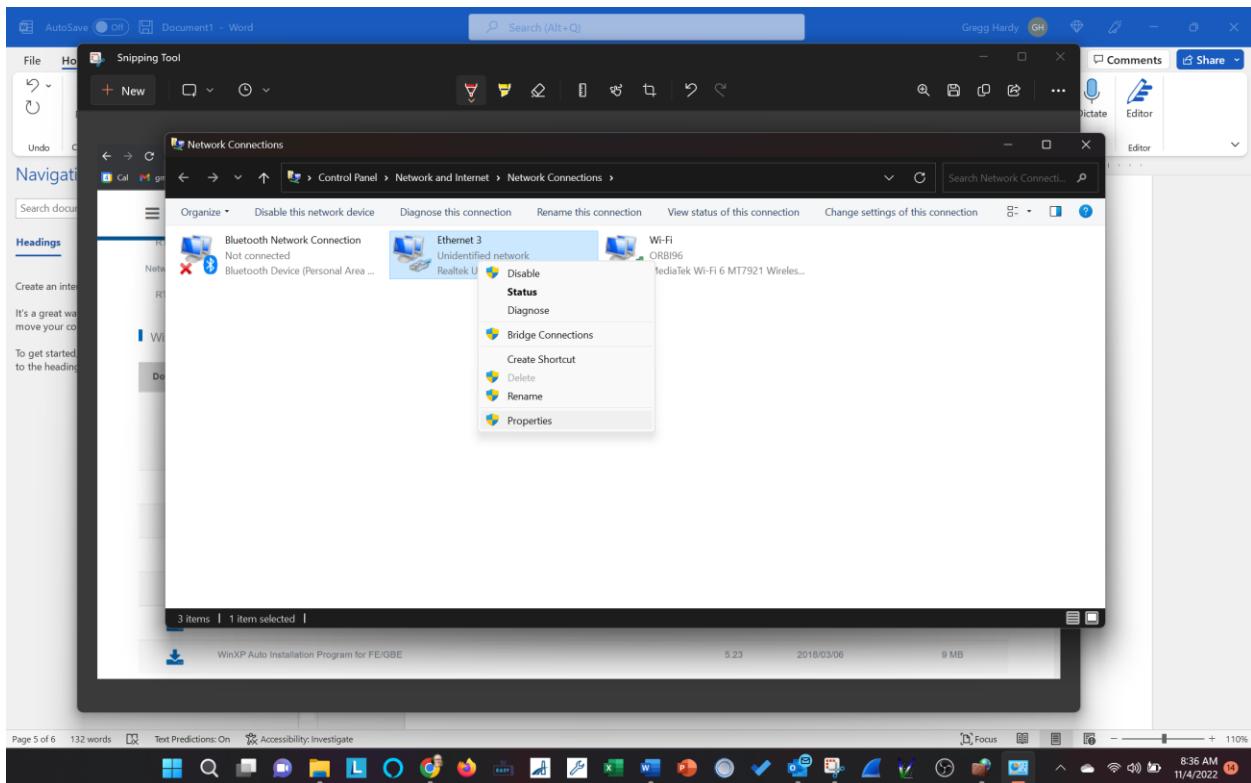


Figure 80: Configure ethernet adapter, step 2



De-select all items except “Pylon GigE Vision Driver” and “TCP/IPv4”. Scroll down to deselect the items that are not initially in view.

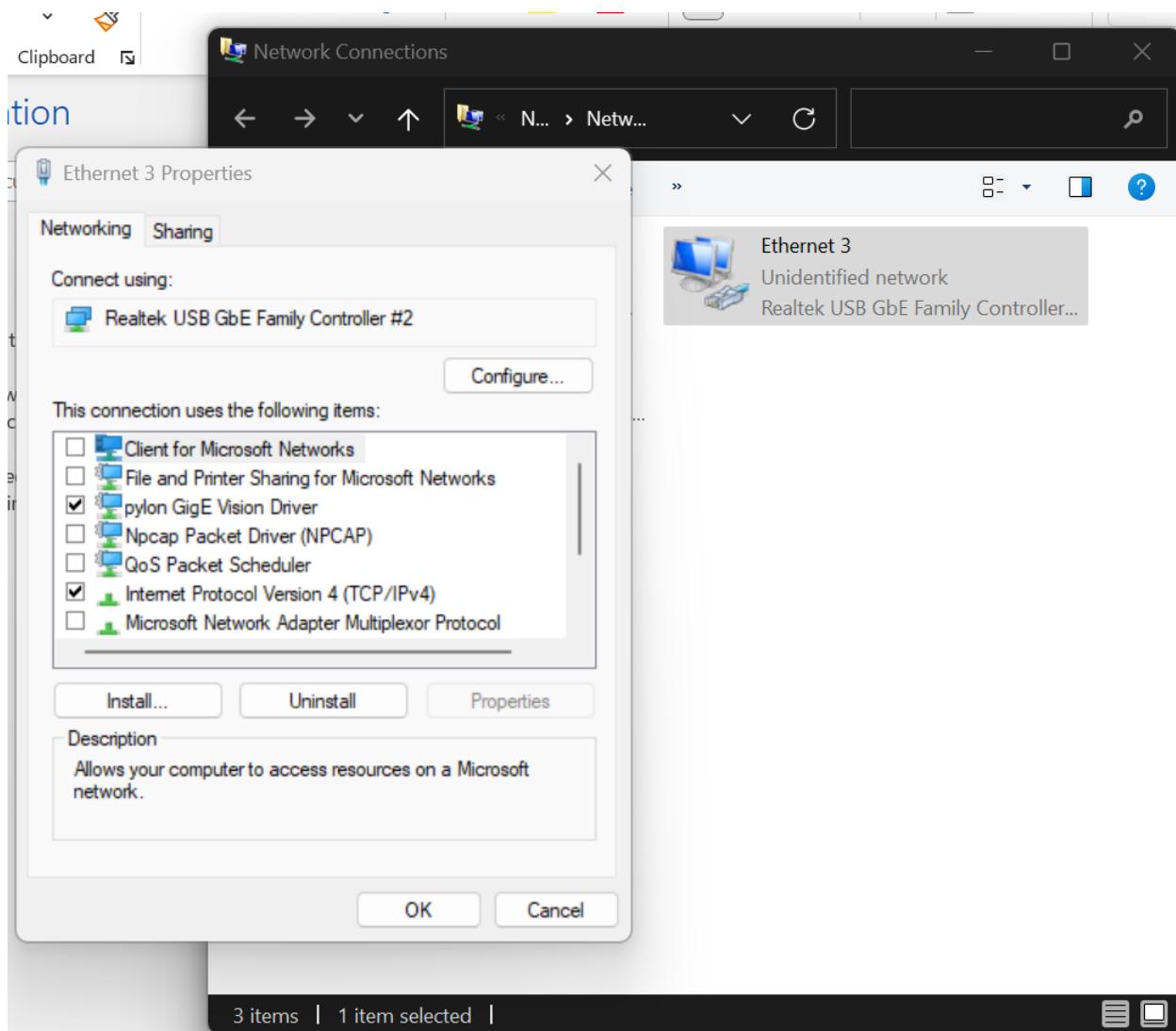


Figure 81: Configure ethernet adapter, step 3

Click the “configure” button (it doesn’t matter which of the items in the box below are selected when you do so). Go to the “advanced” tab and disable “Energy Efficient Ethernet”.

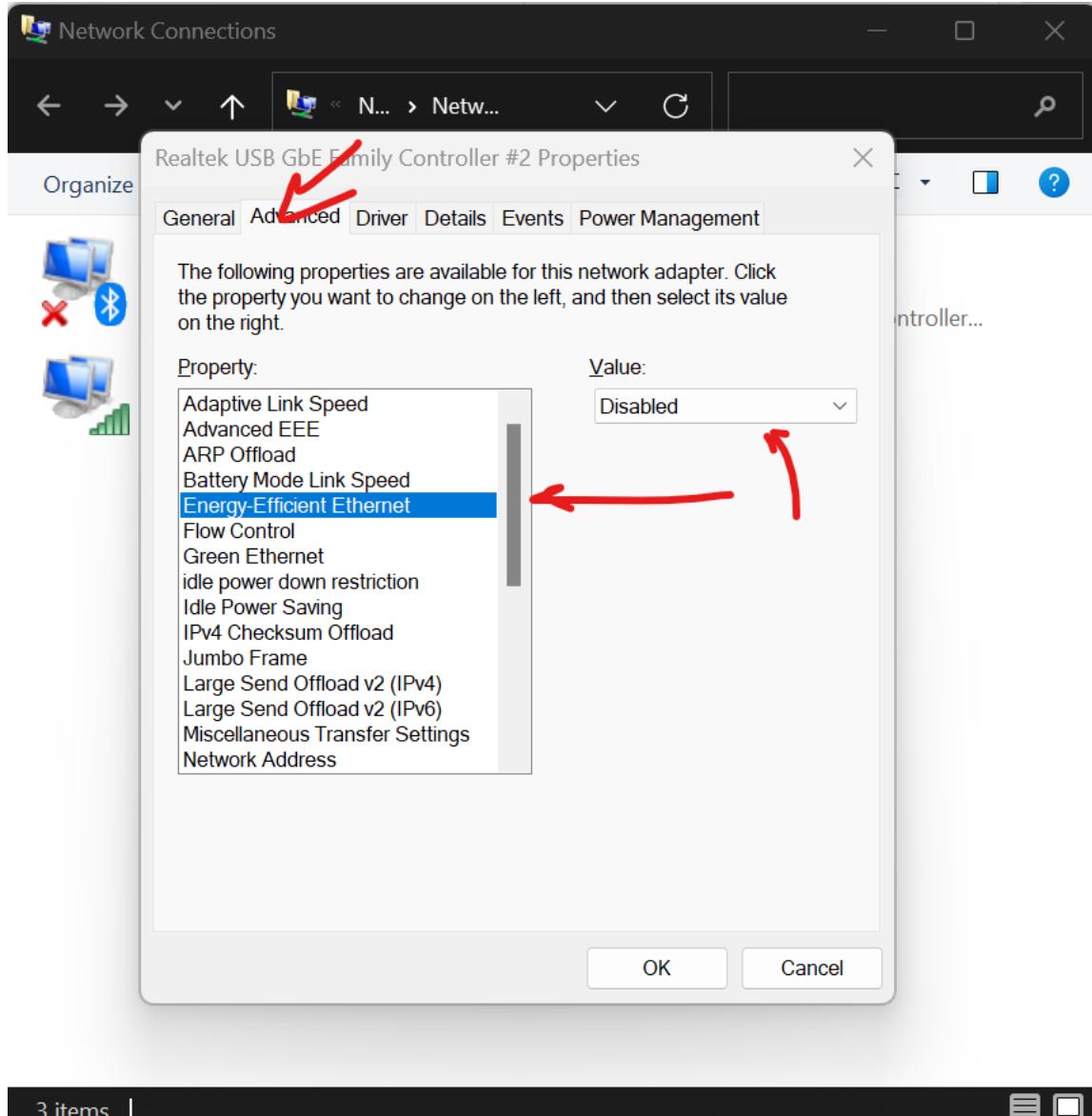


Figure 82: Configure ethernet adapter, step 4

Set Jumbo frames to 4088.

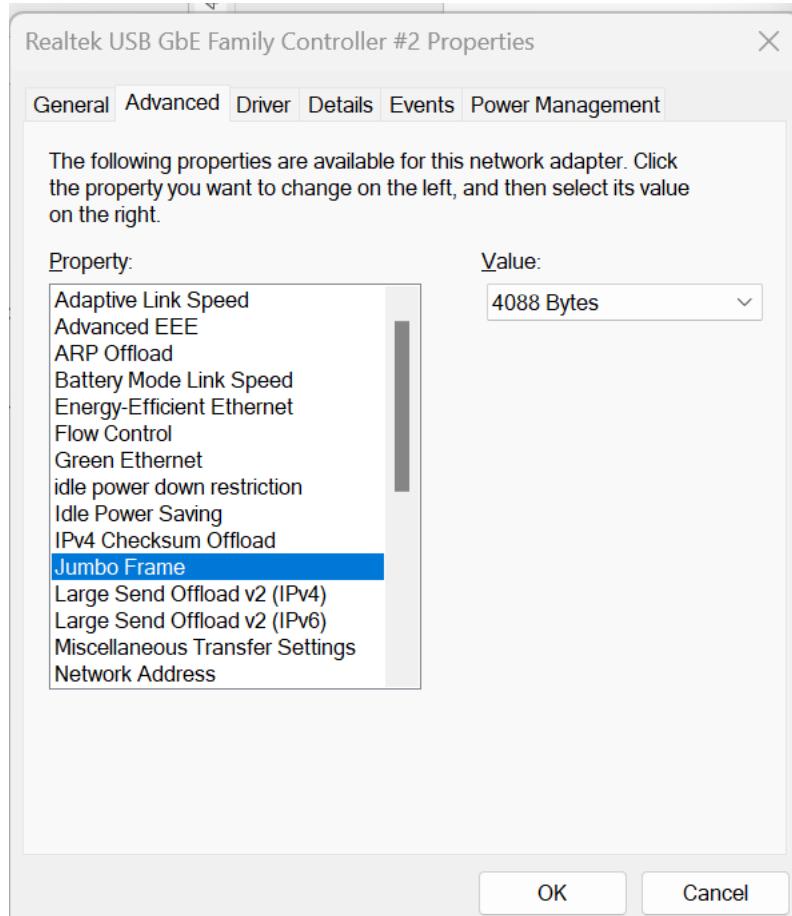


Figure 83: Configure ethernet adapter, step 5

Hit "OK" to save settings.

Restart computer



## Set packet size

Click on “Devices”, go to the “Advanced” tab and set the “Packet Size” to 4000.

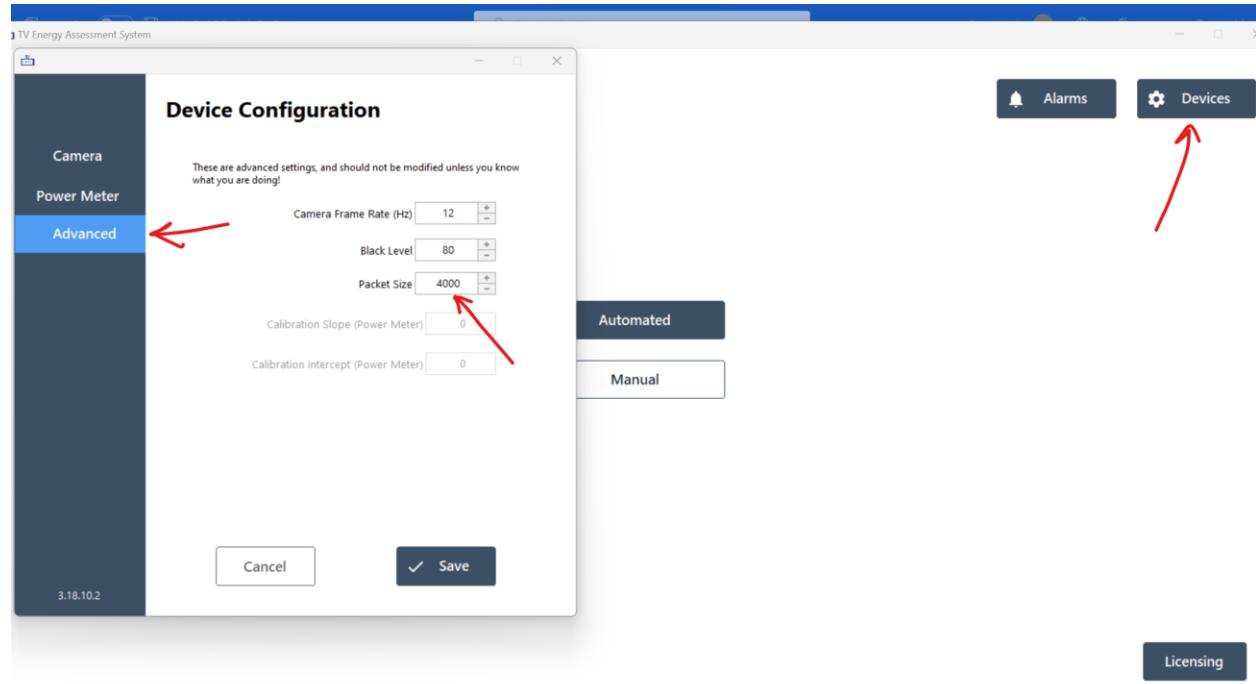


Figure 84: Set TV EASY packet size

## Tip: Display scaling

To adjust the size of the TV EASY user interface on the IdeaPad 5 or any other high resolution display, right click on the desktop and select “Display Settings”. Setting to 125% results in TV EASY taking up only part of the screen. Setting to 150% means TV EASY will take up a little more than the whole screen.



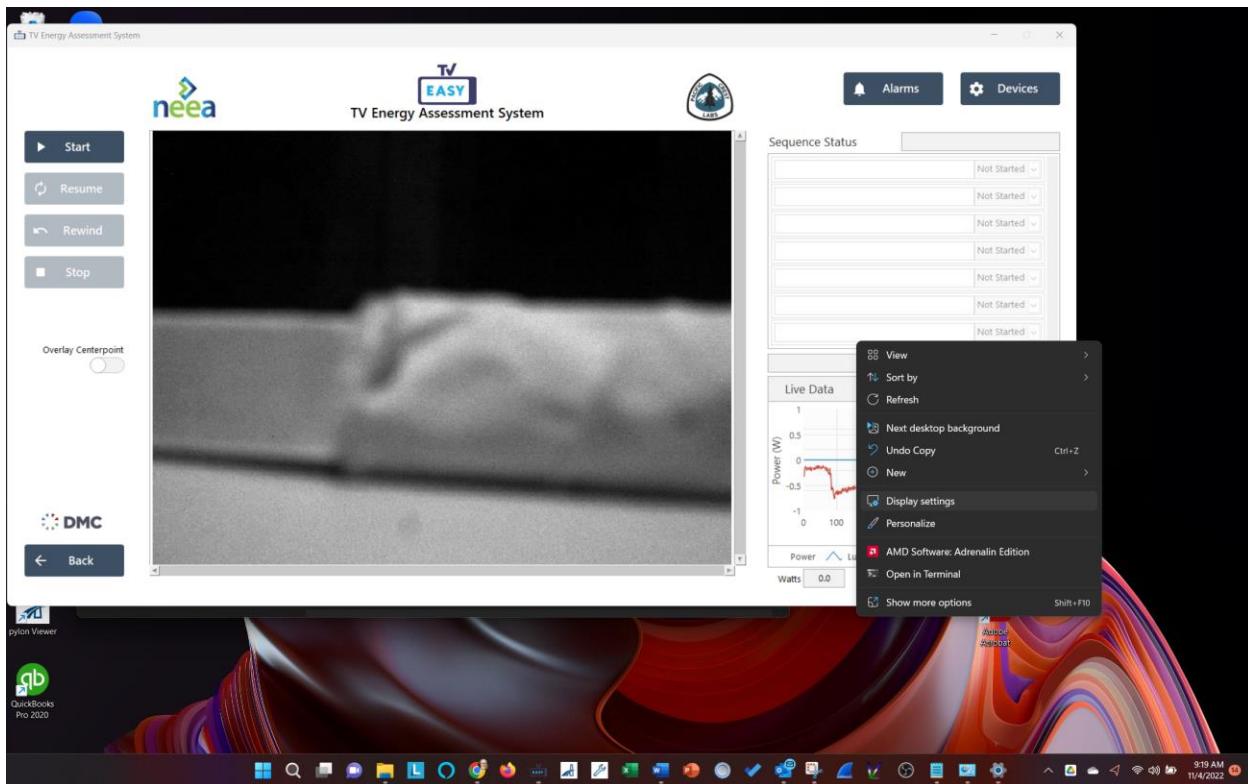


Figure 85: Adjust display scaling, step 1

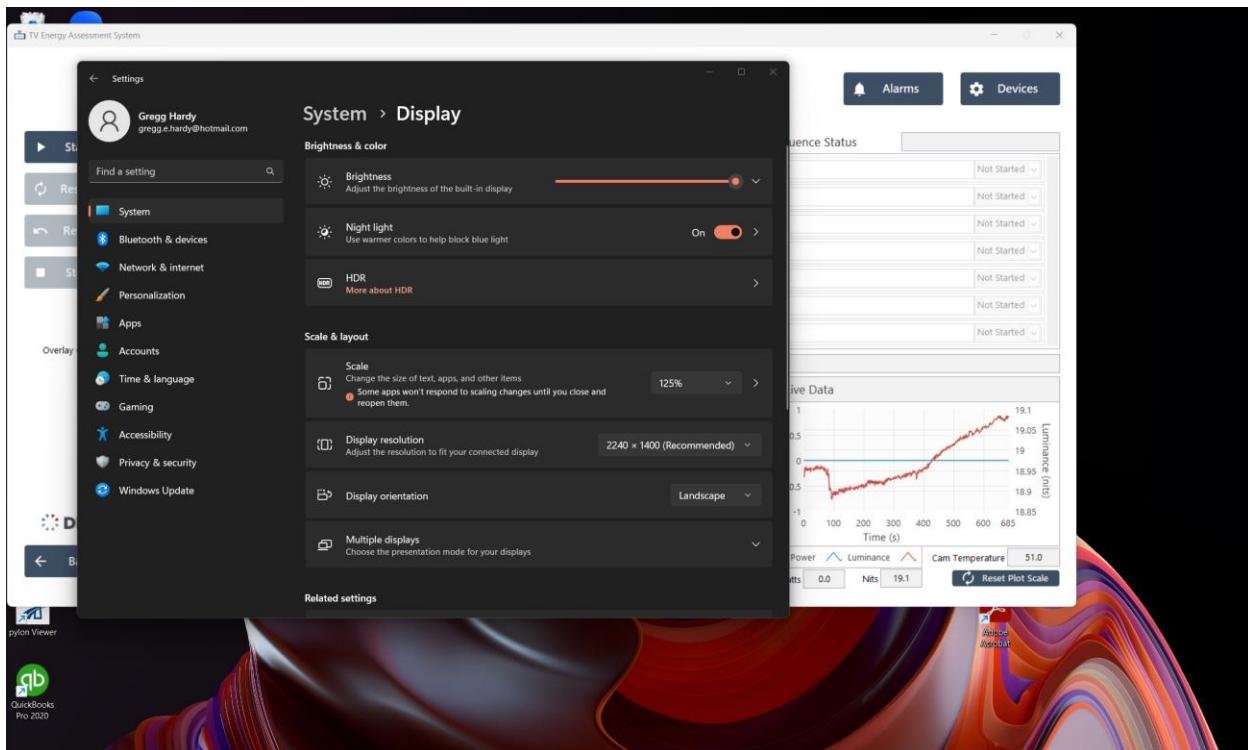


Figure 86: Adjust display scaling, step 2

## Appendix G: Luminance Measurement Check

This appendix provides information about how to check camera luminance measurements for either data drop-out or calibration drift. The former problem is described in the *Introduction* section of Appendix F: Advanced Ethernet Port Settings for GigE Cameras. Calibration drift trend analysis is a core part of ISO/IEC 17025 accreditation programs and should be conducted monthly or quarterly by all test labs, regardless of accreditation status, to ensure that camera photometers have not drifted out of calibration and to determine the appropriate camera calibration interval.

For check tests, use a TV that is known to have stable luminance. We avoid the use of OLEDs here because they often have automatic brightness limiting (ABL) that results in unstable luminance. The TV PCL uses has light output that exhibits a one sigma deviation of  $0.16 \text{ cd/m}^2$  during approximately minute-long stable periods separated by short-term drops in luminance. We monitor the TV EASY live plot—while running the custom test sequence discussed below—to ensure that we take measurements during these stable periods.

### Data drop-out check

Load and run the “[full\\_screen\\_manual.csv](#)” custom test sequence via the manual test mode of TV EASY (section 4.2.2) while playing the “Lum\_HD\_v2.mp4” or “Lum\_SD\_v2.mp4” test clip that came with the test kit.

The software will instruct you to:

1. Position the camera as you normally would for TV testing.
2. To identify the screen perimeter (screen config) please play the Dots video clip with Automatic Brightness Control (ABC) off.
3. Play then pause the “Lum\_HD\_v2.mp4” or “Lum\_SD\_v2.mp4” clip. Hit enter when ready to measure screen-average luminance. Measure luminance when the TV is stable, and calculate average luminance using the data output file or just log the result by hand by looking at the TV EASY display screen. The test sequence lasts an hour, but you can hit "Stop" at any time to end the test and save your data.

### Calibration drift check

Load and run the “[peak\\_manual.csv](#)” custom test sequence via the manual test mode of TV EASY (section 4.2.2) using the “circle.mp4” video clip to align both the camera and reference photometer on screen center. The software will instruct you to:

1. Position the camera as you normally would for TV testing.
2. To identify the screen perimeter (screen config) please play the Dots video clip with Automatic Brightness Control (ABC) off.
3. Play then pause the “[Circle.mp4](#)” clip. Hit enter when ready to measure spot luminance which uses a yellow outline to indicate the measurement area. Measure luminance when the TV is stable, and calculate average luminance using the data output file or just log the result by hand by looking at the TV EASY display screen. Compare these results to a calibrated spot photometer reading of the center of the same “Circle.mp4” video clip. The test sequence lasts an hour, but you can hit "Stop" at any time to end the test and save your data.



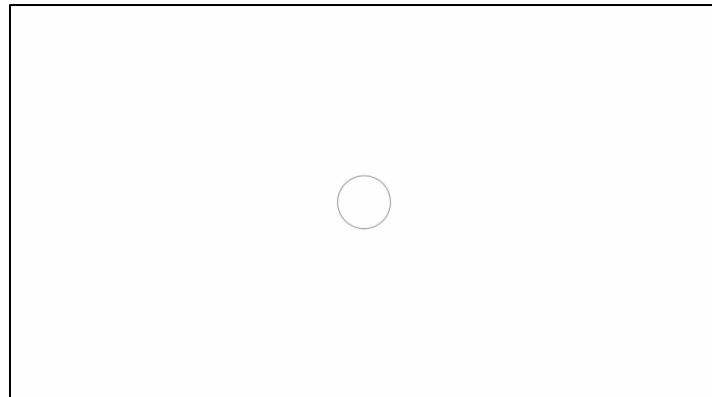


Figure 87: Circle.mp4 video clip

