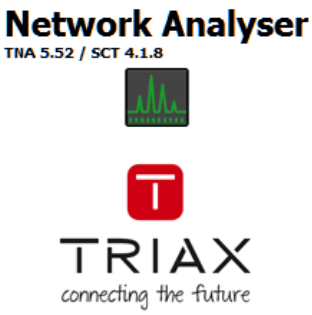
TRIAX Network Analyser (TNA)



TNA User Guide v1.00

TNA 5.56 / SCT 4.1.8

MSG April 20 - 2021

Table of Context

List of abbreviations and acronyms

CFR	Channel Frequency Response
DM	G.hn Domain Master
EP	G.hn End Point
NIC	Network Interface Card
P2MP	Point-to-Multi-Point (shared media)

1. Preface

TNA Use Cases

The TRIAX Network Analyser tool has three main use cases:

1) Pre-qualification of new customer sites using the EoC Kit Analyser and a laptop computer.
   Pre-qualification using the EoC Kit
2) Generate Network Report / Acceptance Report once installation has been completed.
   Create a Network Report
3) Troubleshooting during installation or on an existing installation.
   Appendix B - Troubleshooting

Each of these use cases will be covered in this manual, but first let's get TNA installed.

Prerequisites before running TNA for the first time

1) TNA currently runs under MS Windows only.

2) TNA is a Java application. Java SE Runtime or JDK from OpenJDK **must be installed**.
   For copyright and licensing reasons neither Java SE or the JDK are provided by TRIAX; they may be download at the links below:
   Java SE: https://www.java.com/en
   OpenJDK: https://openjdk.java.net

3) The packet capture driver (WinPcap, included in the WinPcap folder) **must be installed** and running on the PC connected to the EoC Controller. Step 1: Install WinPcap

4) MS Excel is required to automatically view generated reports. If MS Excel is not installed, the reports are generated but not opened automatically.

5) **VLAN pass-through** must be enabled on the EoC Controller port connected to the PC.
   Step 3: Enabling VLAN pass-through

6) It is **highly recommended** that the PC Network Interface connected to the EoC Controller has a **static IP address** on a Net ID different from other IP nets used on the site.

   Example site network configuration:
   - IP net ID: 192.168.0.0
   - IP mask: 255.255.255.0
   Valid IP address range: 192.168.0.0 – 192.168.0.254

   Choose a different IP Net ID for TNA, for example:
   - IP net ID: 192.168.10.0
   - IP mask: 255.255.255.0
   Valid IP address range: 192.168.10.0 – 192.168.10.254
   Assign a valid, static IP address to the PC Network Interface, for example 192.168.10.11

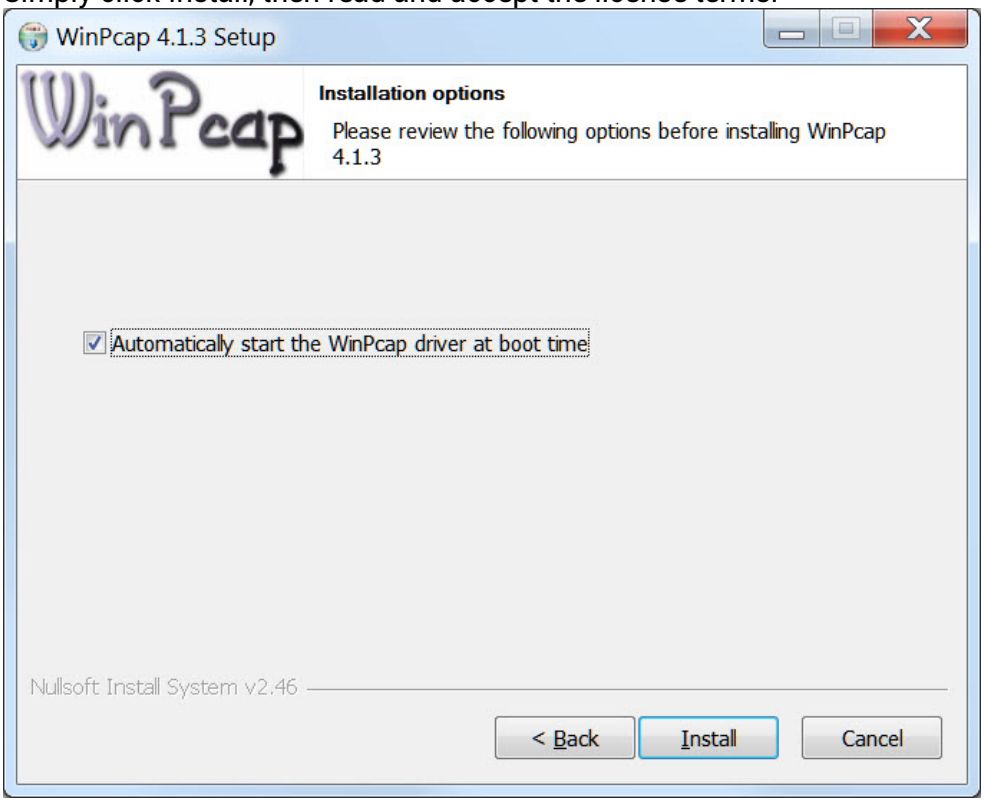
To begin, first download the TNA zip file from www.triax.com and extract all contents to a folder of your choice. Note that it is not possible to run TNA directly from the zip folder!

After successful extraction, follow the steps on the next pages.

2. Setup and preparations

Step 1: Install WinPcap

To install WinPcap go the WinPcap folder and run “WinPcap_4_1_3.exe”.
Do not change any settings.
Simply click Install, then read and accept the license terms.



Step 2: Configure the Network Interface Card

Prior to starting TNA for the first time you must assign a valid, static IP address to the Network Interface connected to the EoC Controller.

Assuming the address range 192.168.10.0 – 192.168.10.254 is not already in use, you might for example use this range, with the following settings:

IP address: 192.168.10.11
IP mask: 255.255.255.0
IP DNS: 192.168.10.1

In Step 5: Assign IP addresses to all EoC nodes, TNA will use these settings to automatically assign IP addresses to all G.hn nodes.

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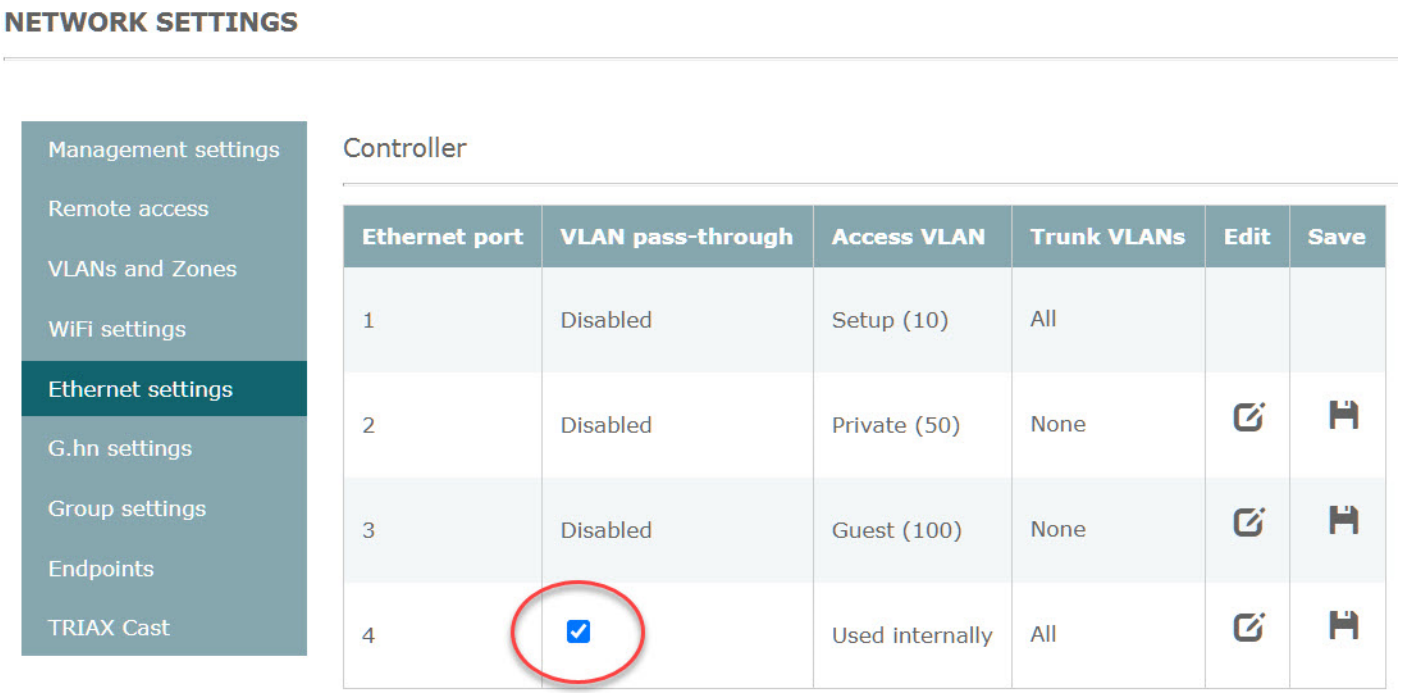
Step 3: Enabling VLAN pass-through

Before starting TNA for the first time, you must enable VLAN pass-through on the EoC Controller Ethernet port connected to the PC.

1) Connect the PC to the Controller GUI and browse to “setup.eoc”.

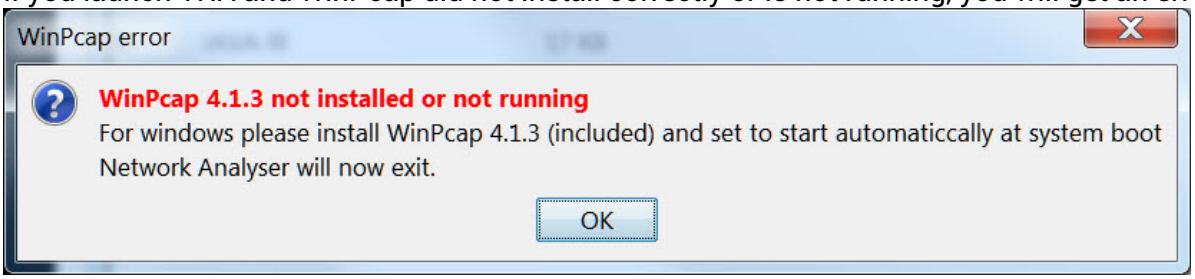
2) Go to NETWORK SETTINGS/Ethernet settings

3) Set the checkmark for VLAN pass-through of the desired Ethernet port
   - Click “Edit”
   - Click checkbox
   - Click “Save”
   - Click “Save & Apply”



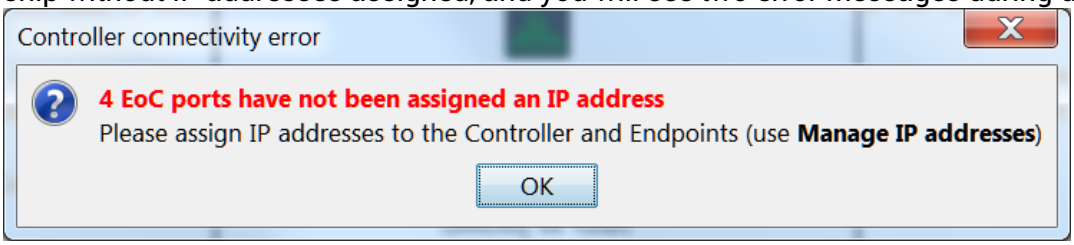
Step 4: Launch TNA for the first time

If you launch TNA and WinPcap did not install correctly or is not running, you will get an error message:



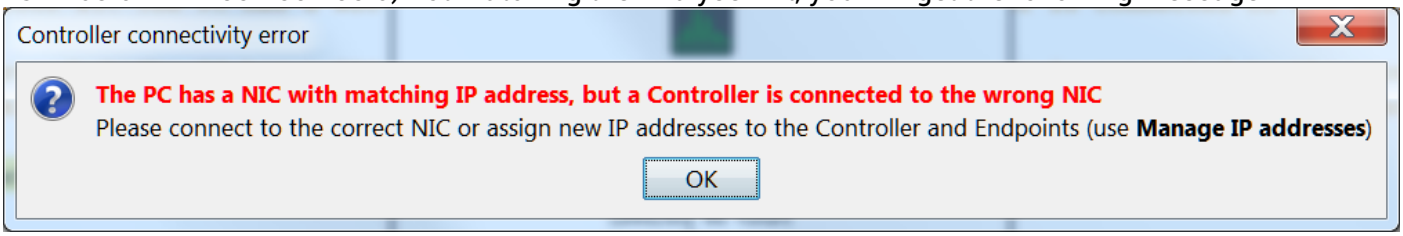
Should this happen try reinstalling WinPcap.

TNA requires that IP addresses have been assigned to all EoC nodes.
However, as it cannot be known at manufacturing time which IP Net ID is used on sites, all EoC products ship without IP addresses assigned, and you will see two error messages during discovery:



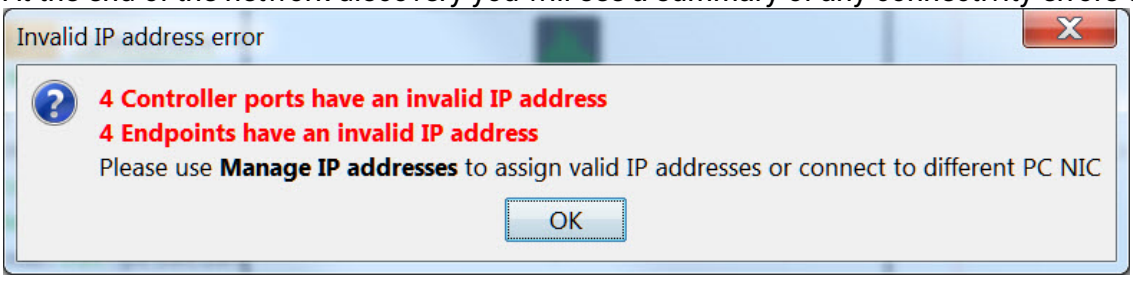
The exception is the Analyser Kit, which ships with default IP addresses 192.168.10.240 & 192.168.10.241.

If the Analyser Kit is connected to a PC network interface card (NIC) with an IP configuration (for example 192.168.0.11 / 255.255.255.0) not matching the Analyser Kit, you will get the following message:



This may also happen if you connect to an EoC Controller, which has IP addresses not matching the currently connected PC NIC.

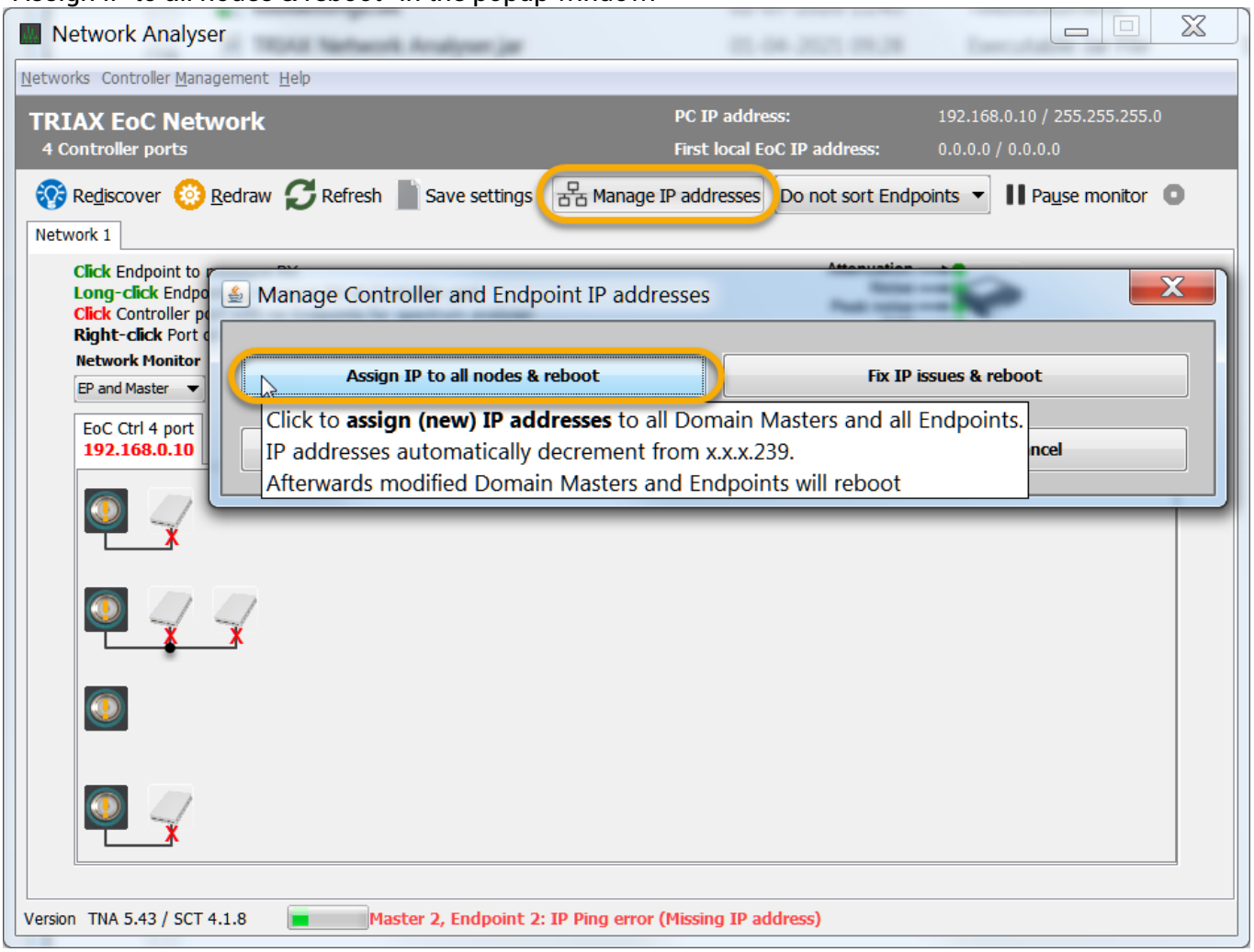
At the end of the network discovery you will see a summary of any connectivity errors detected:



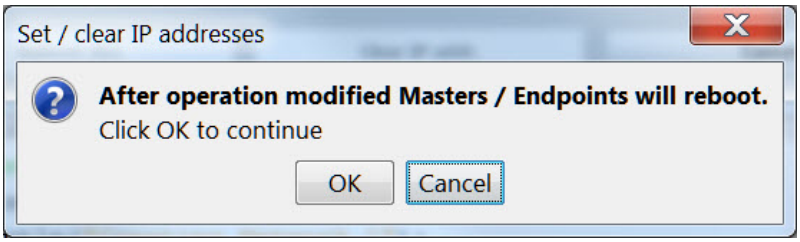
Step 5: Assign IP addresses to all EoC nodes

The first time you connect to an EoC Controller (without IP addresses assigned) you must assign IP addresses before TNA can make measurements on the coaxial network.

To automatically assign IP addresses, click the “Manage IP addresses” button, followed by “Assign IP to all nodes & reboot” in the popup window:

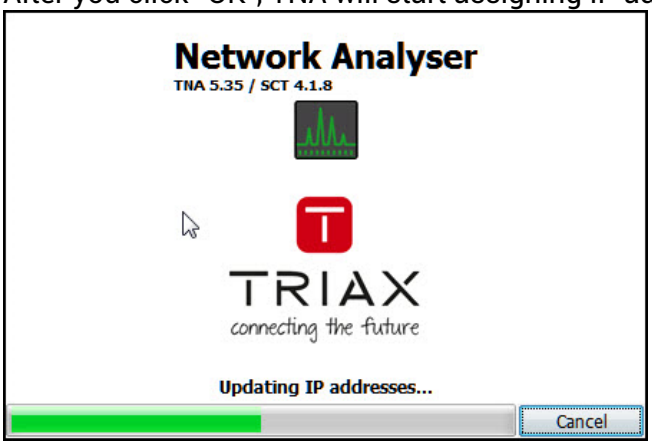


The red IP address in the tab displays the Net ID of the PC NIC; the red “x” under the nodes indicates a connectivity issue, in this case missing IP addresses.

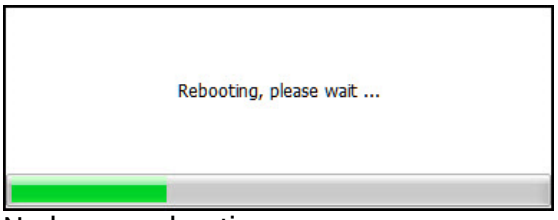


You will get a warning that all nodes will reboot, disconnecting the nodes for a few seconds.

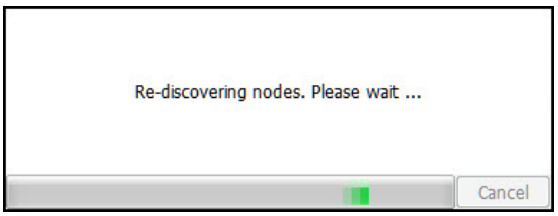
After you click "OK", TNA will start assigning IP addresses, starting from the top and counting downwards:



IP addresses are being assigned.



Nodes are rebooting.



TNA is re-discovering the EoC network.

Assigning IP addresses is a one-time thing; the assigned IP addresses are stored in persistent memory and will remain in effect after a node has been power-cycled.

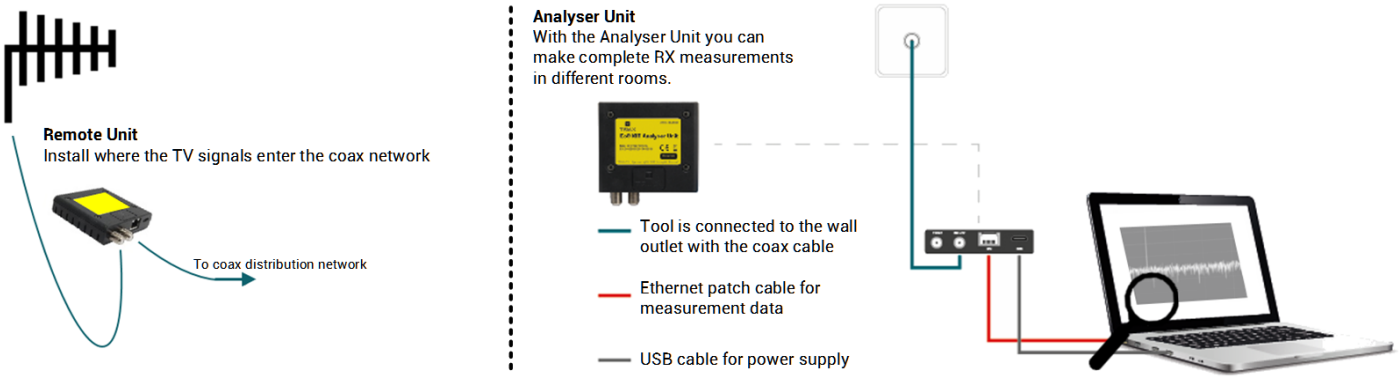
That's it.
Once the re-discovery has completed, you may start making measurements, generating reports, …

3. Pre-qualification using the EoC Kit

The EoC Kit consists of two compact units, each the size of an EoC Media Converter:

The **Remote Unit** must be installed at the central distribution point of the coaxial cabling (at the point of TV signal injection).

The **Analyser Unit** connects to a Windows laptop PC and is carried from test point to test point.

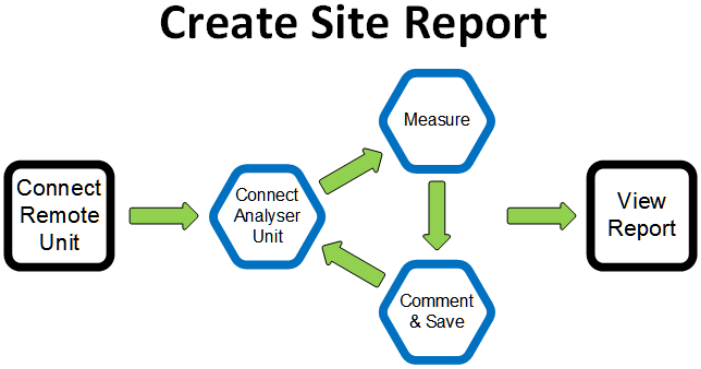


How to create a Survey Report

To create a pre-qualification report, follow these simple steps (see next page for screenshots):

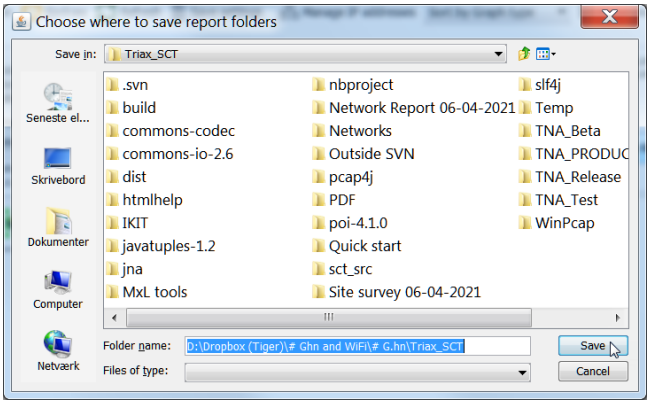
1) Install the Remote Unit where the TV signal enters the coax network (where the controller will eventually be situated).
2) Go to the first room, connect the Analyser Unit and launch TNA.
   In case the Analyser Unit could not connect to the Remote Unit, TNA will show only the Analyser Unit. Click the Analyser Unit to use TNA in **G.hn Spectrum Analyser** mode.
3) On the main page, click "Survey Report" (only available when connected to the Remote Unit).
4) a. Choose where to save report folders (or accept the default by simply clicking "Save").
   b. Choose a report folder name (or accept the default by simply clicking "Save folder name").
5) Make and log RX measurements.
   a. TNA will show the "**Live RX Measurements - Combined View**" window, allowing you to verify connectivity, noise levels, …
   b. When satisfied click anywhere in the black graph area to enter a comment and save the current measurements.
      - TNA will now pause, allowing you to move to the next room.
   c. Once the Analyser Unit is connected in the next room, again click anywhere in the black graph area to resume making RX measurements.

   Repeat a) to c) until all planed rooms have been surveyed, or close the survey window to generate the Survey Report as an Excel Sheet.
6) If MS Excel is installed, the report will automatically be opened after it has been generated.

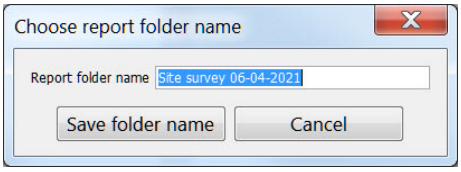


Create Survey Report screenshots

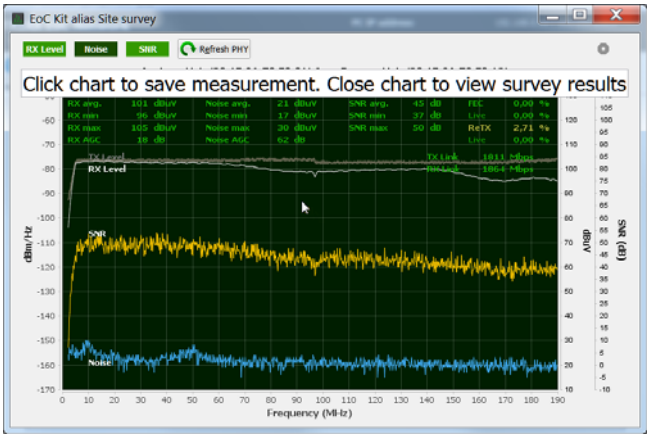
4.1 Choose where to save report folders



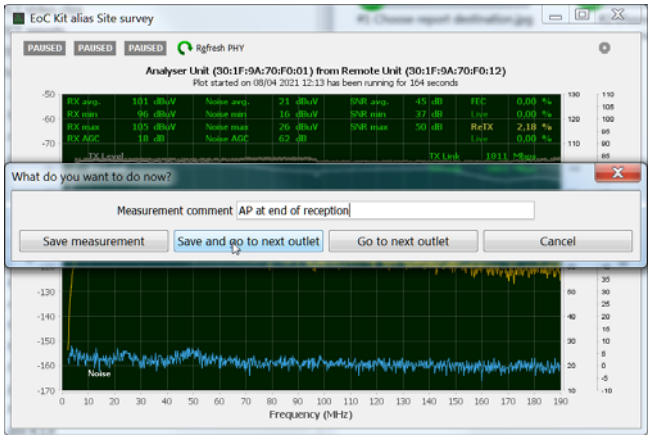
4.2 Choose report folder name



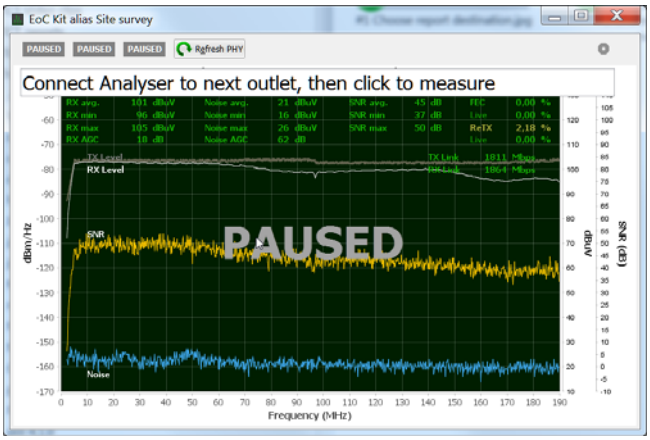
5.a Make RX measurements



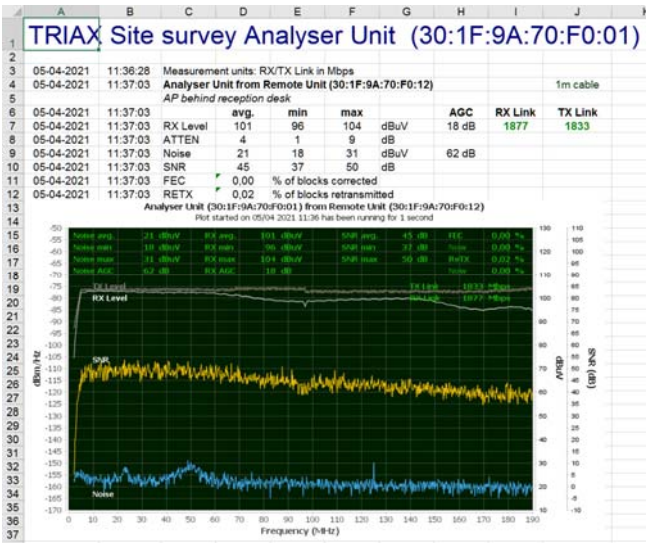
5.b Enter comment and save measurements



5.c Next room



6. The report has been generated



4. TRIAX Network Analyser Main Window

RX Measurements

1 Make RX Measurements
Click to measure RX at Endpoint.
Long-click to measure at Controller port

2 Controller Port with Endpoints
Long-click Endpoint to measure RX from Endpoint at Controller port.

2.1 Controller Port with no Endpoints
Click to use the G.hn Spectrum Analyser.

3 Measurement Sweep rate
Set Sweep rate of Spectrum Analyser.

4 Network Endpoint order
Choose in which order endpoints are displayed on network map.

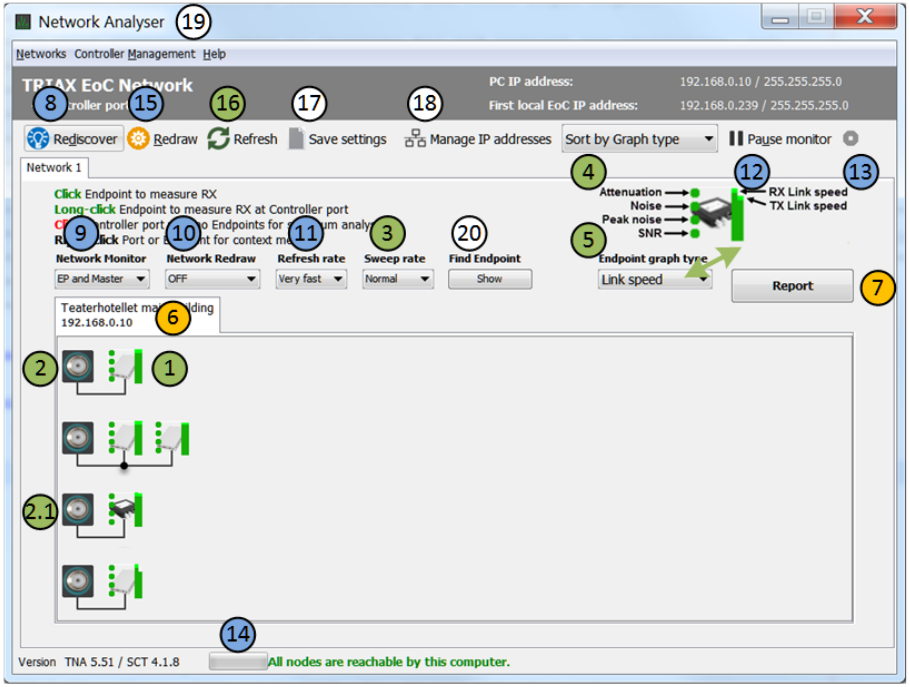
5 Endpoint graphics overlay type
Choose information overlayed on the Endpoint graphics

16 Refresh
Click to refresh Endpoint graphics

17 Save settings
Save current settings of 3, 4, 5, 9, 10 and 11.

6 Controller name
Double-click to change the Controller name used in Network and Survey Reports.

7 Network Report generation
Click to generate an Excel sheet report of the network



G.hn Network

8 Rediscover Network
Click to re-discover all Endpoints and Controllers of the network

9 Network Monitoring scope
Choose what to monitor

10 Network Redraw mode
Turn on or off automatic redraw Endpoints when network changes
Note that the network is always updated if new Endpoints are added.

11 Network Monitor Refresh rate
Set Monitor refresh rate

12 Pause/run Network Monitor
Click to Pause/run the Monitor

13 Network Monitor
Flashes to show Monitor heartbea

14 Network Monitor progress
Indicates the relative progress of the Network Monitor

15 Network Redraw
Click to update Endpoint information (no re-discovery).

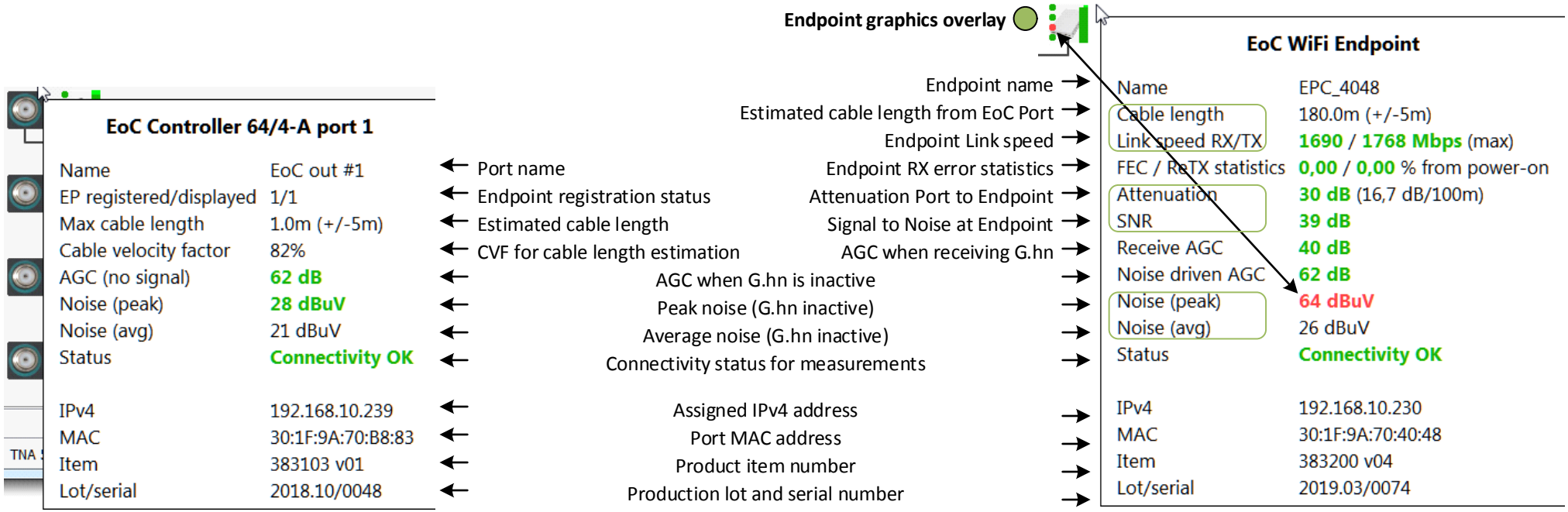
18 Manage IP addresses
Click to *Assign IP adresses* to Masters and Endpoints, *Fix IP address* issues, clear IP addresses, or to *Reboot all* G.hn nodes.

19 Controller Management menu
Functions to manage Controllers which cannot be automatically discovered.

20 Find Endpoint
Click to bring the "Find Endpoint" window and searc by full or partial name / MAC address.

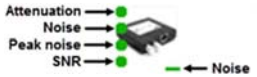
5. Pop-up node status

Hovering the mouse over an EoC Port or and Endpoint will bring up a node status summary:



Endpoint Graphics Overlay

The graphics overlay provides a traffic light type status of each Endpoints (See Appendix A – Value Colouring).
Depending on the setting of "**Endpoint graph type**" in the Main Window, the following can be displayed (indicated with ▭ above):

Cable length	Link speed	Attenuation	Signal to Noise	Noise (avg)	Noise (peak)
					
Relative distance to EoC Port	Max = 1860 Mbps	Max = 82 dB	Max = 45 dB	Max = 70 dBuV	Max = 70 dBuV

6. Making RX Measurements

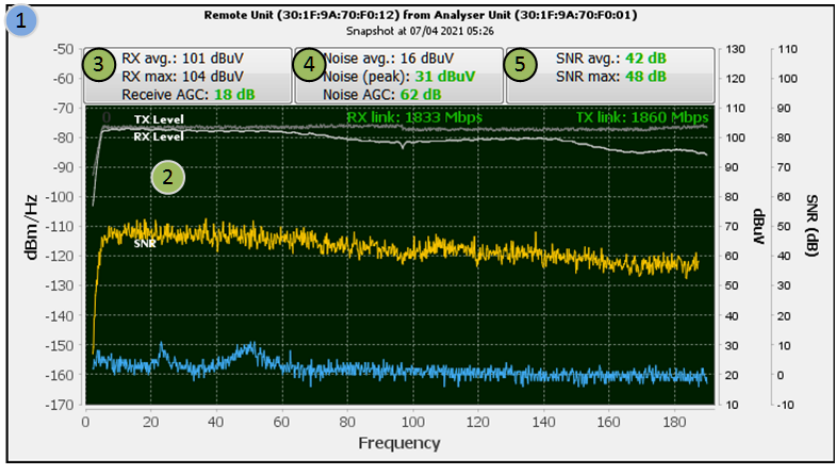
Clicking an Endpoint displays the latest snapshot of captured RX metrics.
The snapshots are periodically updated as per 9, 10 & 11 in the Main Window.

For live analysis with more details: click 2, 3, 4 or 5.

1 Pop-up Measurement Options
1) Click endpoint to display Endpoint RX measurements, or long-click to show Controller Port measurements.
2) Click 2, 3, 4 or 5 to display live measurement data.

2 Show combined view of all RX data
The combined view is the one most often used as it provides an overview of all relevant measurements.
From here, additional views may be opened by clicking 3, 4 or 5.

6 Graph area
Click to pause/run measurements



3 Measure only RX Level

4 Measure only Noise Floor

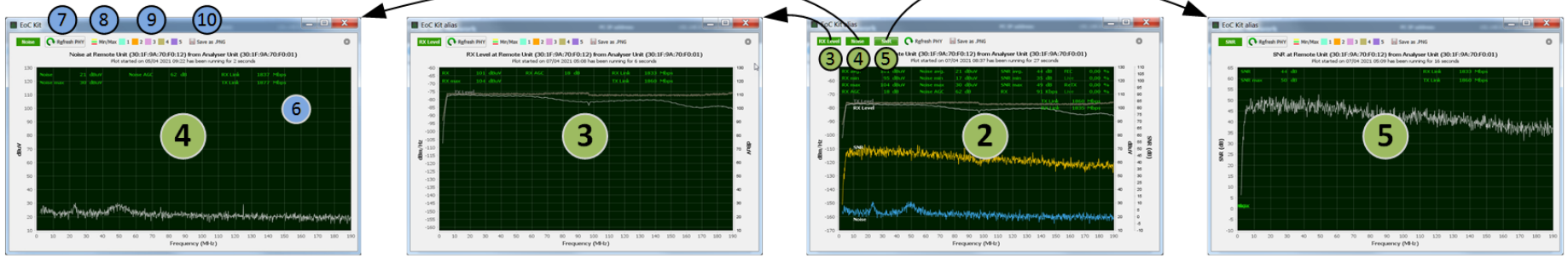
5 Measure only SNR

8 Hold min/max values
In the single measurement views (3, 4 & 5) it is possible to use high refresh rate min/max hold to capture periodic events which may disrupt the G.hn connection.

7 Attempt to update PHY rates

9 Hold the current values

10 Save a PNG file of the graph area



7. Live RX Measurements - Combined View

The Combined View aggregates all RX Measurements in a single view.

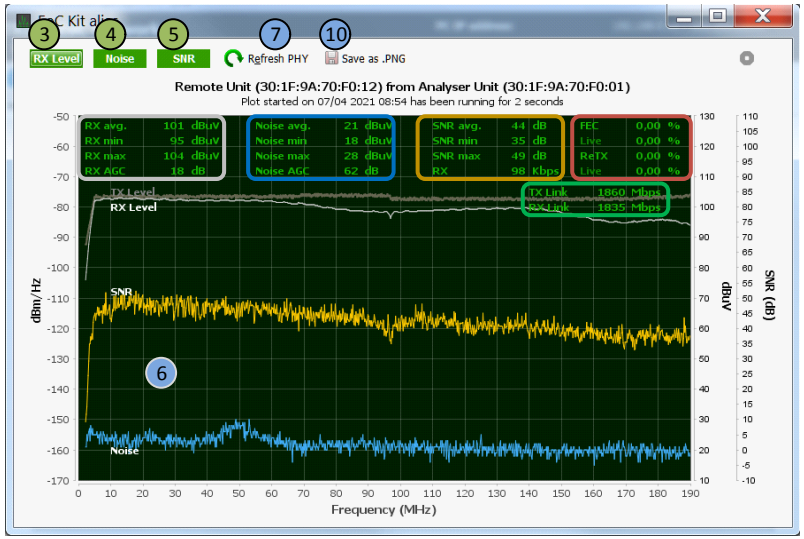
Measurements are updated “Live” at a rate set by “Sweep Rate (9)” in the Main Window.

3 **Click to measure only RX Level**

4 **Click to measure only Noise Floor**

5 **Click to measure only SNR**

RX Level & RX AGC
The average/min/max values of the RX Level measurement are displayed.
The **RX AGC** shows the current gain setting of the receiver input Automatic Gain Control under the current signal conditions.
A decrease in RX Level beyond the point where the RX AGC reaches its maximum (62 dB) will reduce the maximum achievable Link speed.



FEC & Retransmission statistics
The **FEC %** shows the percent of packets which have had bit errors corrected by the Forward Error Correction circuit since power-on/reboot, with the current ”Live” statistics underneath it.
The **ReTX %** shows the percent of packets which have been automatically retransmitted at the G.hn MAC layer since power-on/reboot, with the current ”Live” statistics underneath it.
To **Clear RX counters** right-click an Endpoint or Controller Port and follow the **RX Statistics** menu item.

TX & RX Link speed
Displays the current, estimated maximum PHY rates under the current signal conditions.
Sometimes, if the signal conditions changes, the TX & RX PHY rates need to be updated by clicking **Refresh PHY**.
Note that this is an estimated rate – not a guaranteed rate.

Noise floor & Noise AGC
The average/min/max values of the Noise floor measurement are displayed.
The **Noise AGC** shows the maximum gain setting of the receiver input Automatic Gain Control under the current noise conditions.
The optimal value is maximum gain (62 dB); this indicates that there is no significant amount of interfering noise at the input of the G.hn receiver.
Note that the presence of interfering signals at the input May reduce the maximum Link speed.

SNR & current RX throughput

6 **Graph area**
Click to pause/run measurements

7 **Attempt to update RX & RX Link speeds**

10 **Save a PNG file of the graph area**

8. Create a Network Report

Once site installation has been completed, TNA can generate a Network Report that may serve as documentation of network performance, or as reference in case of future troubleshooting.

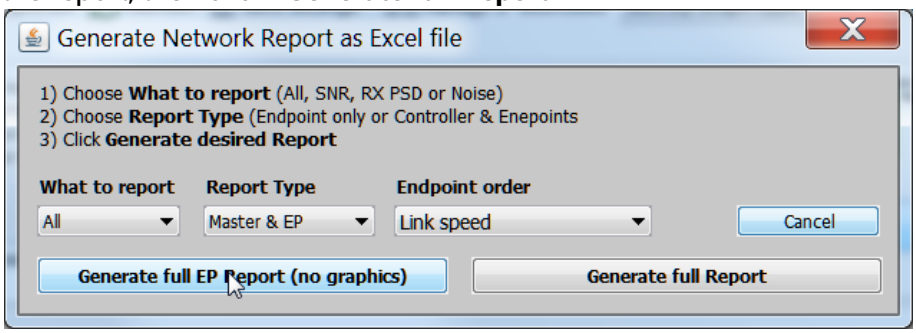
How to create a Network Report

To create a Network Report report, follow these simple steps (most screenshots are identical to those on the previous page):

1) Connect to the EoC Controller(s) through an Ethernet port with VLAN pass-through and launch TNA. Note that if you connect to multiple controllers through a switch, the switch ports connected to the controllers **must** have Port Isolation enabled.

2) On the main page, click "Report".

3) Choose what to report and the type of report you want.
   a. For a text only report of all Endpoints simply click "**Generate full EP Report (no graphics)**".
   b. For a full report with **Snapshots of the Live RX measurements**, first decide what to include in the report, then click "**Generate full Report**".



   c. **What to report**: Choose All (All RX measurements), SNR, RX Level or Noise
      Report type: Choose **Master & EP** or **EP only**
      Endpoint order: Endpoints may be sorted by Link speed, attenuation, EP name, …

4) a. Choose where to save report folders (or accept the default by simply clicking "Save").
   b. Choose a report folder name (or accept the default by simply clicking "Save folder name").

5) TNA will now create the Network Report as an Excel Sheet.

6) If MS Excel is installed, the report will automatically be opened after it has been generated.

Appendix A – Value Colouring

The colours below are used in Graphs plots, popup tables and reports.

	Very good	Good	OK	Poor	Very poor	Units
Attenuation	< 41	>= 41	>= 56	>= 66	>= 73	dB
Signal to Noise (SNR)	> 40	< 40	< 25	< 15	< 8	dB
Noise Level	-	>= 30	>= 45	>= 55	>= 62	dBuV
AGC no transmission	> 58	< 58	< 48	< 40	-	dB
AGC during receive	8	>= 8	>= 54	>= 62	-	dB
Retransmitted blocks (ReTX)	0	>0	>=1	>= 10	>= 75	%
Error corrected blocks (FEC)	0	>0	>=1	>= 10	>= 75	%
Link Speed*	> 1600	< 1600	< 1000	< 500	< 200	Mbps
Estimated cable length	< 300	>= 300	>= 600	>= 900	>= 1500	m

* Link Speed “Very Good” is only indicated on node bar graphs.

Appendix B - Troubleshooting

If, for some reason, performance in a certain room is not as expected, **Live RX Measurements** may help you identify why.

Typically, a lower than expected performance may be caused by:

1) High attenuation
2) High RF tilt caused by very long cables
3) Poor connectivity in outlet / F-connector (shield not connected)
4) Poor connectivity in outlet / F-connector (center wire not connected)
5) Poor connectivity in outlet / F-connector (not connected at all)
6) Poor connectivity in outlet / F-connector (corrosion)
7) Poor connectivity in outlet / F-connector (cable shield / center wire shorted)
8) Cables bent at very small radius
9) In-band noise (for example CATV channels below 190 MHz)
   Note that TV channels below 300 MHz may also reduce performance by driving the G.hn receiver amplifier Automatic Gain Control.
10) In-band noise (for example DOCSIS return channels)
11) Endpoint connected to outlet Radio instead of outlet TV

Note that some of these issues may not be detectable examining RX & TX Link speeds only. Therefore, it is highly recommended to always create a Network Report when a new installation has been finished. Only in this way can you be sure most potential problems have been identified.

The main factor impacting the link speed is the Channel Frequency Response (CFR) as expressed by RX level by frequency and the resulting SNR.

In a problem free installation, the CFR is typically characterized by:

1) A mostly linear decrease of RX level with increasing frequency.
   Very long cable (1000m RG 11 Plus)
   Long cable + high attenuation
2) A mostly flat Noise floor.

Conversely, installation issues may typically be identified by:

1) A non-linear CFR.
   Cable shielding not connected
   Neither shielding nor center wire connected in outlet

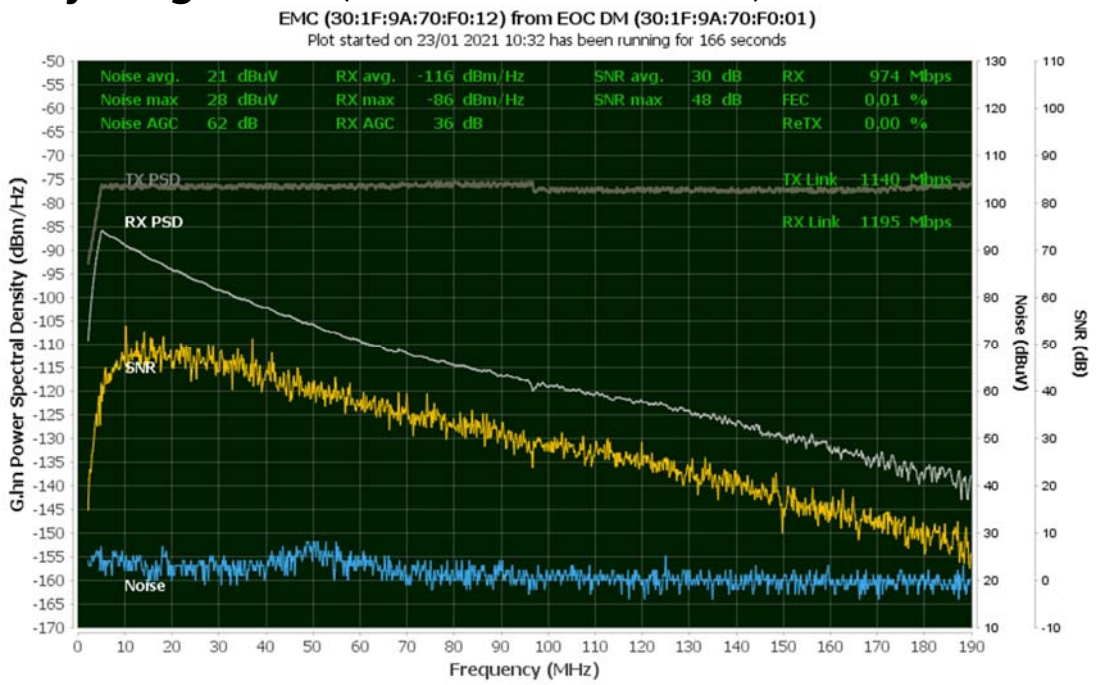
2) A reversed CFR, with attenuation decreasing with increasing frequency.
   Cable bent at very small radius

3) A “bumpy” CFR and Noise floor.
   Cable shielding not connected

Finally, performance may be impacted by in-band (0-200 MHz) or near-band (200-250 MHz) noise:

In-band FM signals
In-band QAM carrier at 122 MHz

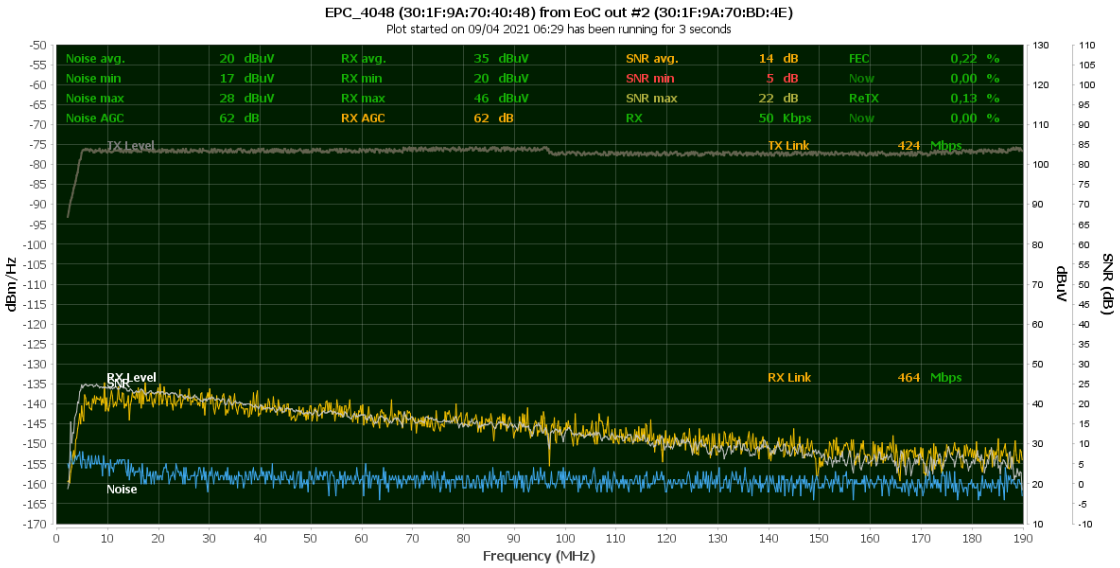
Very long cable (1000m RG 11 Plus)



Long cable + high attenuation

GUI indication

RX Measurements

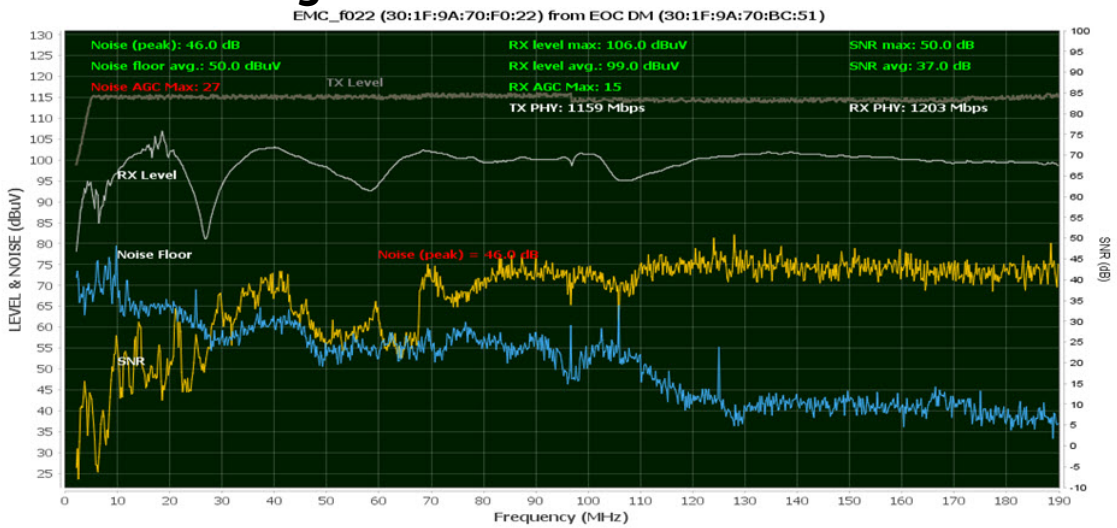


Notice that TNA highlights the following (see Appendix A – Value Colouring):

- RX AGC is at maximum (62 dB).
- Average SNR is very low, well below the point where the link speed starts decreasing (SNR ~45 dB).
- SNR minimum is **very** low, rendering part of the G.hn band not usable.
- Link speeds are very low.

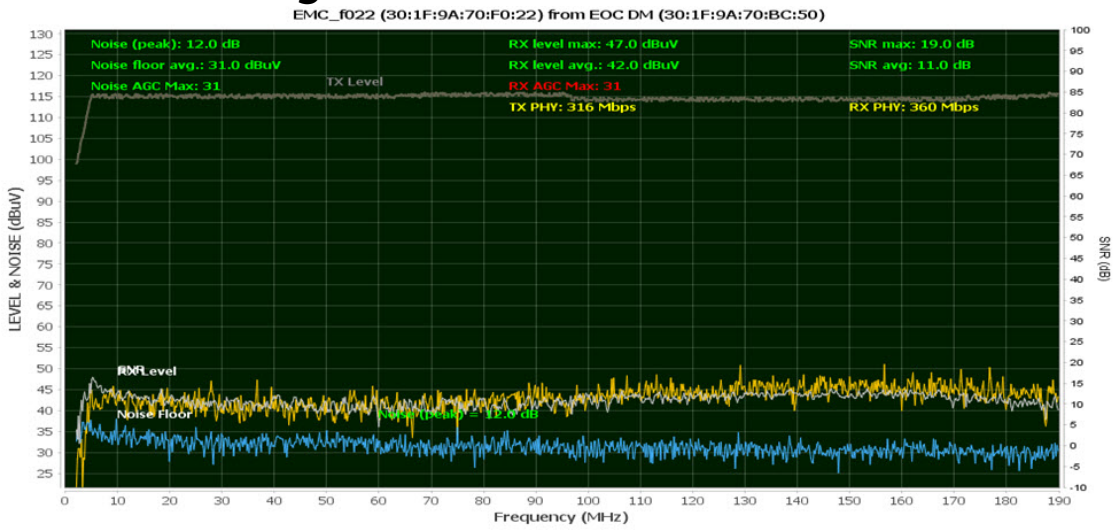
On the next pages you will find examples of how issues on page 18 may be identified when going through the Network Report or using Live RX Measurements.

Cable shielding not connected



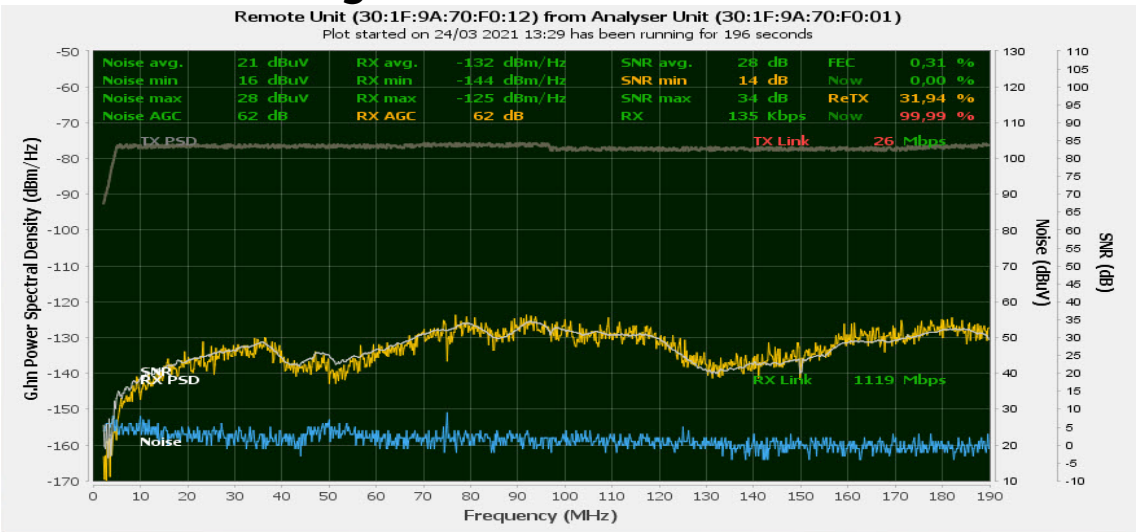
While the performance in this this case may look OK when examining the Link speed, there is a **very** high probability that the missing shielding will cause problems in the future.

Cable shielding and center wire shorted



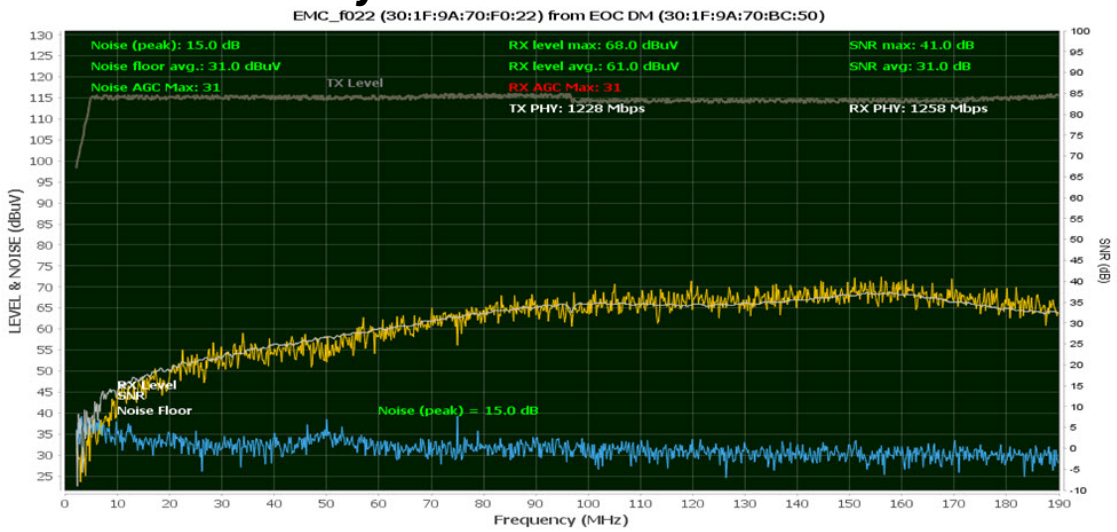
In this case the lack of RX tilt indicates a short rather than simply high attenuation due to long cables.

Neither shielding nor center wire connected in outlet

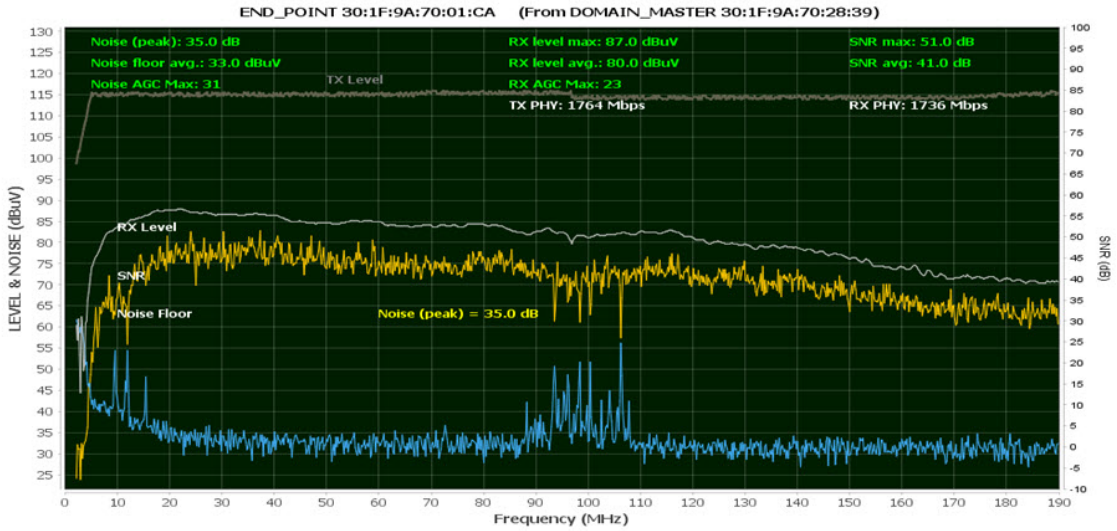


The only good indicator in this case is probably high rate of retransmissions (ReTX). Obviously, this must be corrected.

Cable bent at very small radius



In-band FM signals

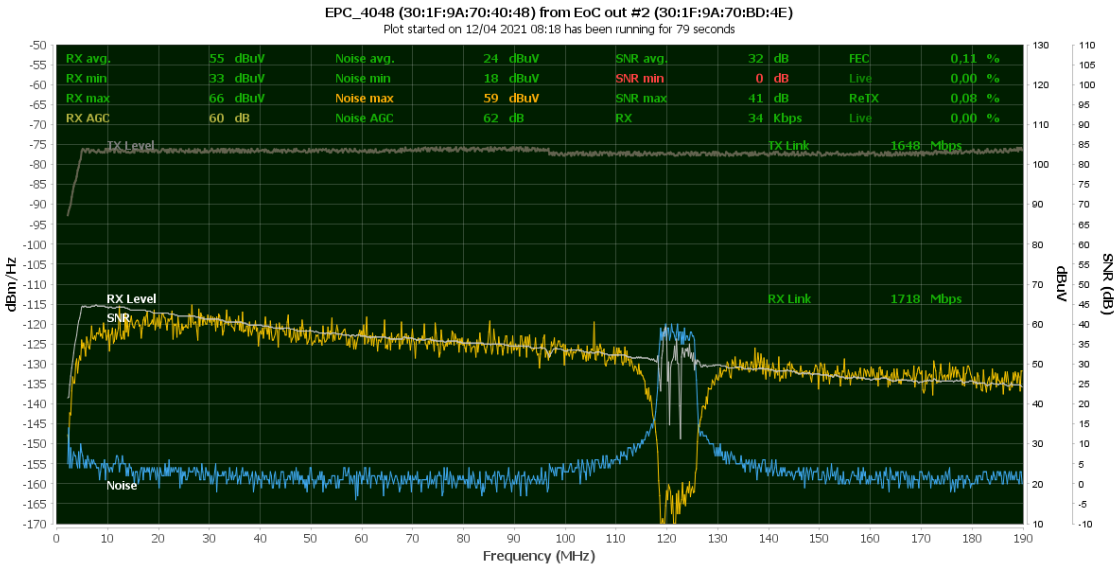


While the FM signals in this case is not a problem as such for EoC, the G.hn signal will likely render the FM signal not usable. The solution is to notch out the FM band on the EoC Controller.

In-band QAM carrier at 122 MHz

GUI indication

RX Measurements



An in-band QAM carrier is reducing performance / Link Speed.