



# **Positron GAM – Basic Troubleshooting**

**Version 1.1**

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## 1 Summary

Positron Access designs and manufactures the G.hn Access Multiplexer (GAM), the leading G.hn (ITU-T G.9960) based solution in North America for delivering Gigabit services to every tenant/guest by repurposing the existing wiring in the building (coax or twisted pair). The GAM is the most effective way to serve customers in brownfield buildings that were not able to be reached historically. The GAM is a fiber (xPON / Active Ethernet) or fixed wireless access (FWA) solution that extends Gigabit services to places without disruption to the brownfield property.

The GAM is the ideal distribution backbone for WiFi Access Points in brownfield hospitality and MDU buildings, saving up to 75% in installation and equipment costs compared to a rewiring with Fiber to the Door. It dramatically accelerates the time to operation and eliminates disruption to guests and tenants.

With the GAM backbone connected to main distribution switches and feeding APs in the rooms, hospitality guests and MDU tenants can be assured of a secure, always-on, full property connectivity experience with support for advanced smart-building IoT devices and features.

As a carrier-grade Ethernet Switch, the GAM supports multiple VLANs with strict Quality of Service (QOS) over the existing wiring infrastructure to provide Ethernet services to end users.

## 2 G.hn Introduction

The ITU-T G.9960 G.hn Wave-2 standard is designed to leverage the existing telephone, UTP, CAT-3 or CAT-5/5e/6 wiring, or RG-6/RG-11/RG-59 coaxial cable to deliver a Gigabit Internet service to each subscriber. Reuse of the existing wiring eliminates the complexity and delays associated with in-building fiber installation.

G.hn is used as an access technology by Broadband Service Providers (including telcos, cable companies, ISPs, and WISPs) looking to extend Gigabit services serving properties via Fiber or FWA over the in-building wiring. G.hn is a highly scalable Ethernet technology that greatly simplifies the access network and backend infrastructure. With G.hn, operators deliver advanced Gigabit internet and managed Wi-Fi without the high capital and operational expenses associated with a fiber retrofit.

A G.hn Access Multiplexer (GAM) operates as a Domain Master (DM) while the G.hn to Gigabit Ethernet bridge that connects to the AP operates as an Endpoint (EP).

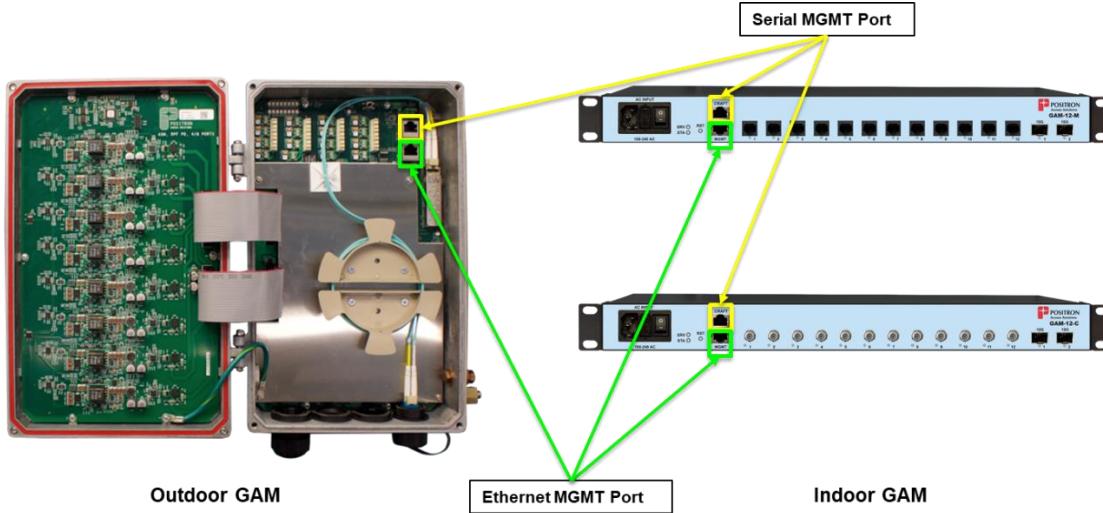
Each G.hn subscriber port of an EP supports up to 1.7 Gbps of dynamically allocated bandwidth for near symmetric Gigabit services. Each G.hn link is encrypted with 128-bit keys for additional security. The GAM operates in point-to-point mode over telephone wiring and supports point-to-multipoint operation over coaxial cabling by leveraging the existing CATV splitters and taps. The Positron GAM solution is ideally suited to deliver reliable Ethernet services in MDU, MTU, and Hospitality deployments.

[Further information about G.hn Technology can be found here on the Positron website.](#)

### 3 Connecting to the GAM

The management of the GAM can be done through the Web UI of the GAM using a Web browser.

- a. Connect an RJ-45 UTP patch cord between your PC and the MGMT port of the GAM. The location of MGMT port of the GAM is shown in **Figure 1** with green lines.



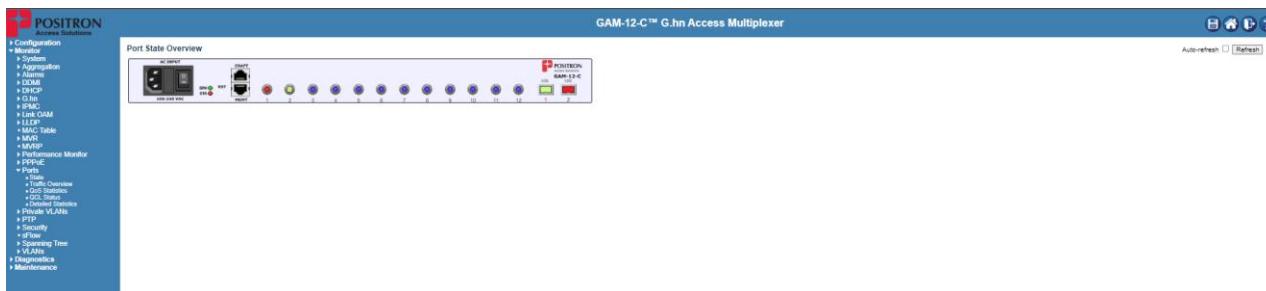
**Figure 1** Location of IP MGMT port on the GAM

- b. Set your PC with **IP address** 192.168.10.2 **Mask** 255.255.255.0
  - c. Open a Web browser and type 192.168.10.1 in the address bar. This is the default IP address of the GAM.
  - d. Once the Log On window is displayed, use the following credentials:

**Username:** admin

**Password:** Blank (no password set by default)

- e. The main page of the GAM will be displayed as shown below.



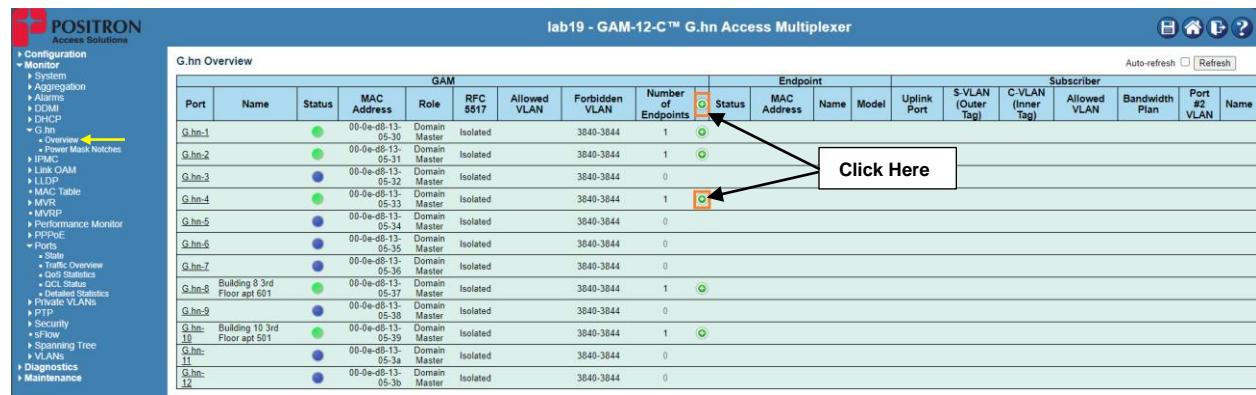
**Figure 2** Main Page of the GAM-12-C

## 4 Troubleshooting

In this section we provide a few basic troubleshooting procedures that can be applied on a GAM solution.

### 4.1 Checking Endpoints

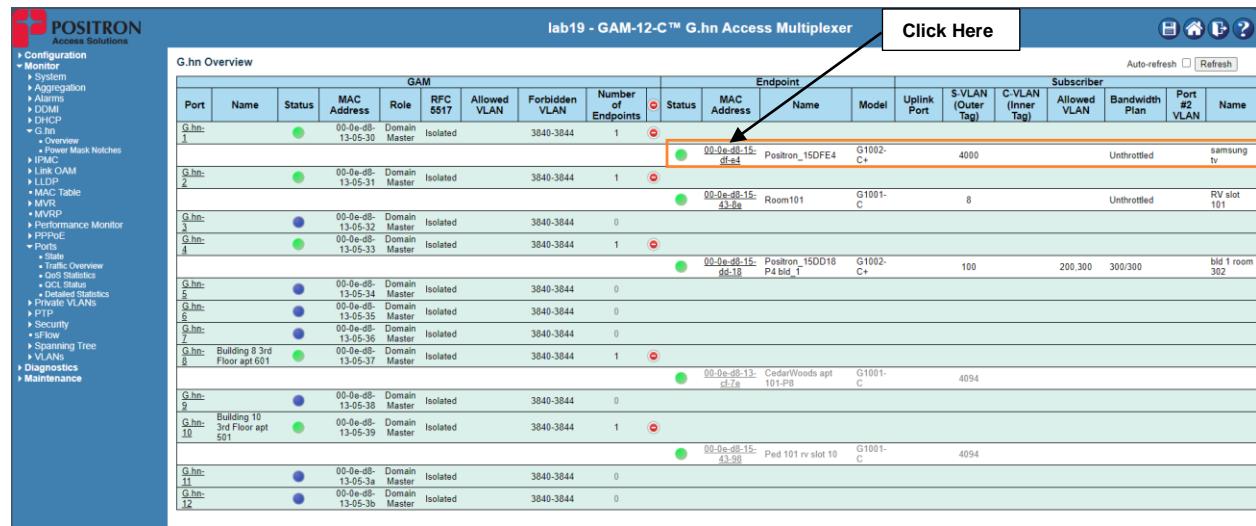
To verify the status of Endpoints we need to be connected to the GAM Web UI first. Once there, we go to **Monitor→G.hn→Overview**. For GAM solution over coax, it is necessary to click on the  symbol to expand the list of Endpoints in the GAM as shown in **Figure 3**. For the GAM solution over Copper Twisted Pairs, the MACs of Endpoints will be displayed immediately on the **G.hn Overview** page as shown in **Figure 5**.



lab19 - GAM-12-C™ G.hn Access Multiplexer																			
G.hn Overview																			
Port	Name	Status	MAC Address	Role	RFC 5517	Allowed VLAN	Forbidden VLAN	Number of Endpoints	Endpoint	Subscriber									
									Status	MAC Address	Name	Model	Uplink Port	S-VLAN (Outer Tag)	C-VLAN (Inner Tag)	Allowed VLAN	Bandwidth Plan	Port #2 VLAN	Name
G.hn-1			00-0e-0b-13-05-30	Domain Master	Isolated	3840-3844		1											
G.hn-2			00-0e-0b-13-05-31	Domain Master	Isolated	3840-3844		1											
G.hn-3			00-0e-0b-13-05-32	Domain Master	Isolated	3840-3844		0											
G.hn-4			00-0e-0b-13-05-33	Domain Master	Isolated	3840-3844		1											
G.hn-5			00-0e-0b-13-05-34	Domain Master	Isolated	3840-3844		0											
G.hn-6			00-0e-0b-13-05-35	Domain Master	Isolated	3840-3844		0											
G.hn-7			00-0e-0b-13-05-36	Domain Master	Isolated	3840-3844		0											
G.hn-8	Building 8 3rd Floor apt 601		00-0e-0b-13-05-37	Domain Master	Isolated	3840-3844		1											
G.hn-9			00-0e-0b-13-05-38	Domain Master	Isolated	3840-3844		0											
G.hn-10	Building 10 3rd Floor apt 501		00-0e-0b-13-05-39	Domain Master	Isolated	3840-3844		1											
G.hn-11			00-0e-0b-13-05-3a	Domain Master	Isolated	3840-3844		0											
G.hn-12			00-0e-0b-13-05-3b	Domain Master	Isolated	3840-3844		0											

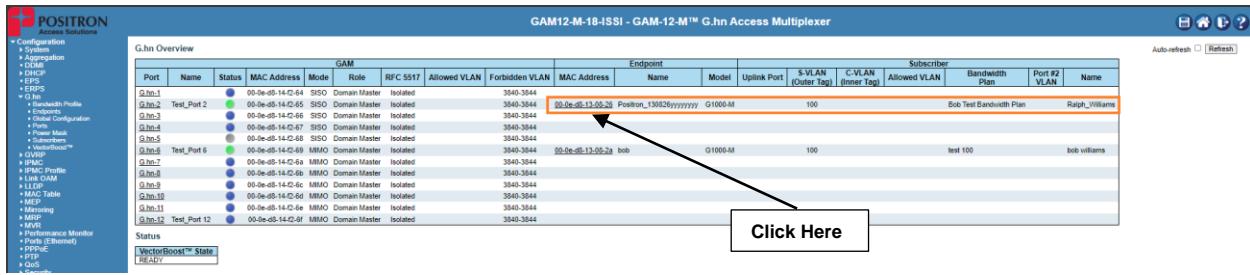
Figure 3 Monitoring Endpoints in Coax GAM

Green Status  means that the Endpoint is physically connected to the GAM and the G.hn link is Up. The Endpoint Model will also be displayed.



lab19 - GAM-12-C™ G.hn Access Multiplexer																			
G.hn Overview																			
Port	Name	Status	MAC Address	Role	RFC 5517	Allowed VLAN	Forbidden VLAN	Number of Endpoints	Endpoint	Subscriber									
									Status	MAC Address	Name	Model	Uplink Port	S-VLAN (Outer Tag)	C-VLAN (Inner Tag)	Allowed VLAN	Bandwidth Plan	Port #2 VLAN	Name
G.hn-1			00-0e-0b-13-05-30	Domain Master	Isolated	3840-3844		1		00-0e-0b-15-0f-44	Positron_15DFE4	G1002-C+	4000	Unthrottled	samsung tv				
G.hn-2			00-0e-0b-13-05-31	Domain Master	Isolated	3840-3844		1		00-0e-0b-15-43-8a	Room101	G1001-C	8	Unthrottled	RV slot 101				
G.hn-3			00-0e-0b-13-05-32	Domain Master	Isolated	3840-3844		0											
G.hn-4			00-0e-0b-13-05-33	Domain Master	Isolated	3840-3844		1		00-0e-0b-15-0d-18	Positron_15DD18	G1002-C+	100	200,300	300/300	bld 1 room 302			
G.hn-5			00-0e-0b-13-05-34	Domain Master	Isolated	3840-3844		0											
G.hn-6			00-0e-0b-13-05-35	Domain Master	Isolated	3840-3844		0											
G.hn-7			00-0e-0b-13-05-36	Domain Master	Isolated	3840-3844		0											
G.hn-8	Building 8 3rd Floor apt 601		00-0e-0b-13-05-37	Domain Master	Isolated	3840-3844		1		00-0e-0b-15-0d-18	Ped 101 rv slot 10	G1001-C	4094						
G.hn-9			00-0e-0b-13-05-38	Domain Master	Isolated	3840-3844		0											
G.hn-10	Building 10 3rd Floor apt 501		00-0e-0b-13-05-39	Domain Master	Isolated	3840-3844		1		00-0e-0b-15-43-99	CedarWoods apt 101-P8	G1001-C	4094						
G.hn-11			00-0e-0b-13-05-3a	Domain Master	Isolated	3840-3844		0											
G.hn-12			00-0e-0b-13-05-3b	Domain Master	Isolated	3840-3844		0											

Figure 4 Checking Endpoint Status in Coax GAM

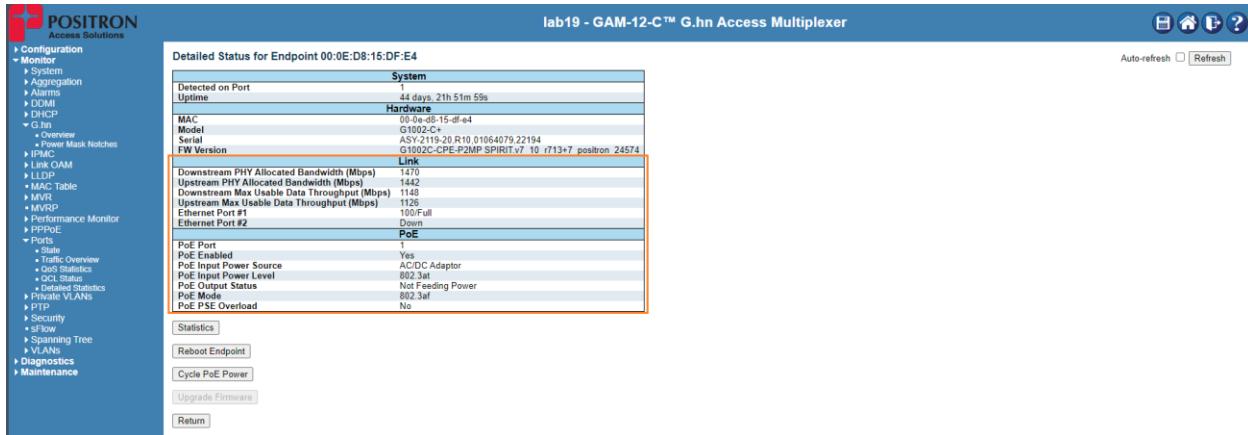


Port	Name	Status	MAC Address	Mode	GAM	RFC 5517	Allowed VLAN	Forbidden VLAN	MAC Address	Endpoint	Name	Model	Uplink Port	S-VLAN (Outer Tag)	C-VLAN (Inner Tag)	Subscriber	Bandwidth Plan	Port #2 VLAN	Name
G.hn.1		Up	00:0e:0b:13:00:26	SISO	Domain Master	Isolated	3540-3544		3540-3544	00:0e:0b:13:00:26	Positron_150826/*****	G1005-M	100			Bob Test Bandwidth Plan	Ralph_Williams		
G.hn.2	Test_Port_2	Up	00:0e:0b:13:00:26	SISO	Domain Master	Isolated	3540-3544		3540-3544	00:0e:0b:13:00:26	bob	G1005-M	100			test 100	bob williams		
G.hn.3		Up	00:0e:0b:13:00:26	SISO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.4		Up	00:0e:0b:13:00:26	SISO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.5		Up	00:0e:0b:13:00:26	SISO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.6		Up	00:0e:0b:13:00:26	SISO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.7	Test_Port_6	Up	00:0e:0b:13:00:26	MIMO	Domain Master	Isolated	3540-3544		3540-3544	00:0e:0b:13:00:26	bob	G1005-M	100			test 100	bob williams		
G.hn.8		Up	00:0e:0b:13:00:26	MIMO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.9		Up	00:0e:0b:13:00:26	MIMO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.10		Up	00:0e:0b:13:00:26	MIMO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.11		Up	00:0e:0b:13:00:26	MIMO	Domain Master	Isolated	3540-3544		3540-3544										
G.hn.12	Test_Port_12	Up	00:0e:0b:13:00:26	MIMO	Domain Master	Isolated	3540-3544		3540-3544										

Figure 5 Checking Endpoint Status in Copper Twisted Pairs GAM

We can get detailed information of the Endpoint by clicking on the Endpoint MAC address as shown in **Figure 4** and **Figure 5**.

As displayed in **Figure 6**, we get detailed status of the Endpoint.



Detailed Status for Endpoint 00:0E:D8:15:DF:E4	
<b>System</b>	
Detected on Port	1
Uptime	44 days, 21h 51m 59s
<b>Hardware</b>	
MAC	00:0e:d8:15:df:e4
Model	G1002-C+
Serial	ASY-2119-20 R10.01064079.22194
FW Version	G1002C-CPE-P2MP SPIRIT v7.10 /713+7_positron 24574
<b>Link</b>	
Downstream PHY Allocated Bandwidth (Mbps)	1470
Upstream PHY Allocated Bandwidth (Mbps)	1442
Downstream Max Usable Data Throughput (Mbps)	1148
Upstream Max Usable Data Throughput (Mbps)	1026
Ethernet Port #1	100/full
Ethernet Port #2	Down
<b>PoE</b>	
PoE Port	1
PoE Enabled	Yes
PoE Input Power Source	AC/DC Adaptor
PoE Input Power Level	802.3af
PoE Output Status	Not Feeding Power
PoE Mode	802.3af
PoE PSE Overload	No
<b>Statistics</b>	
Reboot Endpoint	
Cycle PoE Power	
Upgrade Firmware	
Return	

Figure 6 Endpoint Detailed Status

Under the **Link** section we can see the BW that an Endpoint can provide and the status of GigE ports.

- **Downstream PHY Allocated Bandwidth (Mbps):** Maximum Downstream BW (GAM to Endpoint) reached on G.hn link.
- **Upstream PHY Allocated Bandwidth (Mbps):** Maximum Upstream BW (Endpoint to GAM) reached on G.hn link.
- **Downstream Max Usable Data Throughput (Mbps):** Maximum Downstream L2 Capacity (GAM to Endpoint).
- **Upstream Max Usable Data Throughput (Mbps):** Maximum Upstream L2 Capacity (Endpoint to GAM).

It is very important to confirm that Downstream and Upstream BW values are symmetrical. If numbers are asymmetrical, it could be an indication of wiring issues, (bad connector, defective splitter/tap, etc.).

The **PoE Section** applies only to G1002-C+/ G1002-M+/G2002-M+ Endpoints models. We can check if the PoE feature is enabled on GigE port #1 of the Endpoint and which of the two PoE standards is being provided (802.3af – 15W or 802.3at – 30W).

## 4.2 Checking G.hn SNR and Noise

Signal levels must be reviewed during installation of the GAM solution to understand the quality of the G.hn link, and during troubleshooting to understand if physical connections between GAM and the Endpoints are performing well.

To check signal levels, go to **Diagnostics→G.hn→SNR PSD & Noise**. Once there it is necessary to select G.hn port of the GAM and the MAC address of Endpoint that we are going to inspect. Select **Direction** of the signal **Downstream** (GAM to Endpoint) and **Upstream** (Endpoint to GAM), select **Type** of signal to monitor and click on **Start** button as shown in 2. **SNR Probe** and **Noise** are the most important signals to check.

As shown in the following figures, maximum SNR value is displayed in the graph in yellow. The GAM is constantly measuring the SNR value between the G.hn port and the Endpoint to keep it above 40dB by adjusting AGC RX gain value displayed in white. AGC RX ranges from 18 to 62 dB.

When a GAM shows 42 dB or more of attenuation between the G.hn port and the Endpoint, we are going to see the AGC value reaching a maximum of 62 dB and SNR will start to show values under 40 dB.

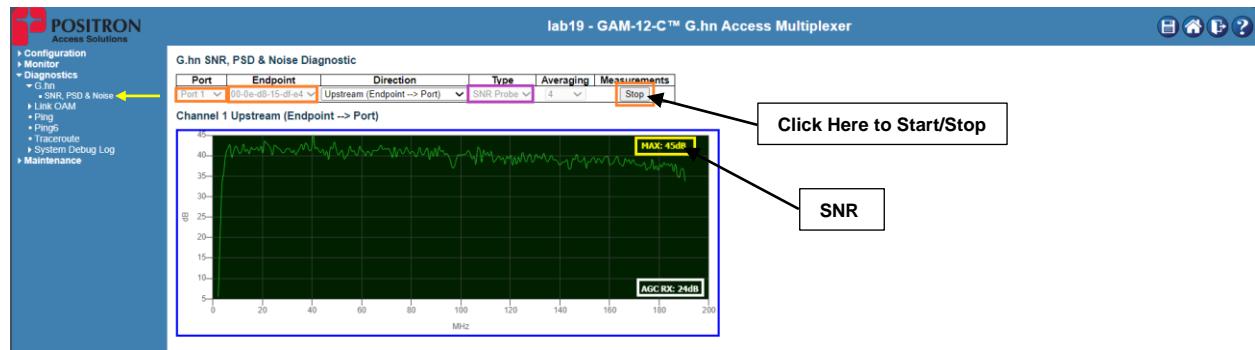


Figure 7 Checking Upstream SNR

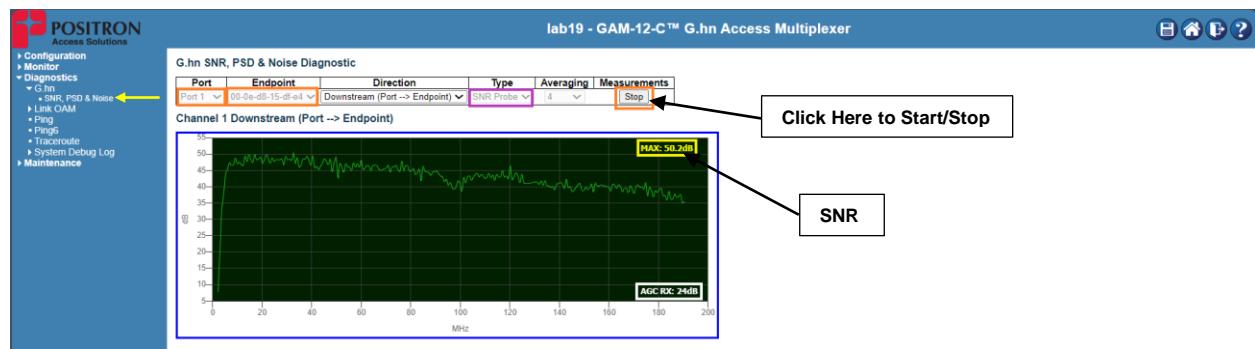


Figure 8 Checking Upstream SNR

Noise graphs also display max value with yellow numbers. It refers to the noise measured on the G.hn link between GAM port and an Endpoint. If noise levels are lower than -110 dB (-111, -112...-120) it will

not impact the quality G.hn link. On the other hand, if we see noise levels with values higher than -110 dB (-109, -108...-100), it could impact the quality of the G.hn link.

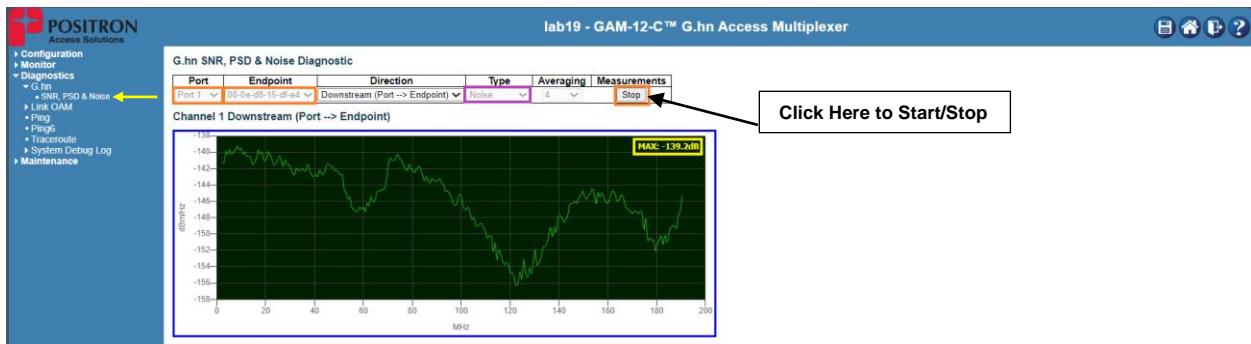


Figure 9 Checking Downstream Noise

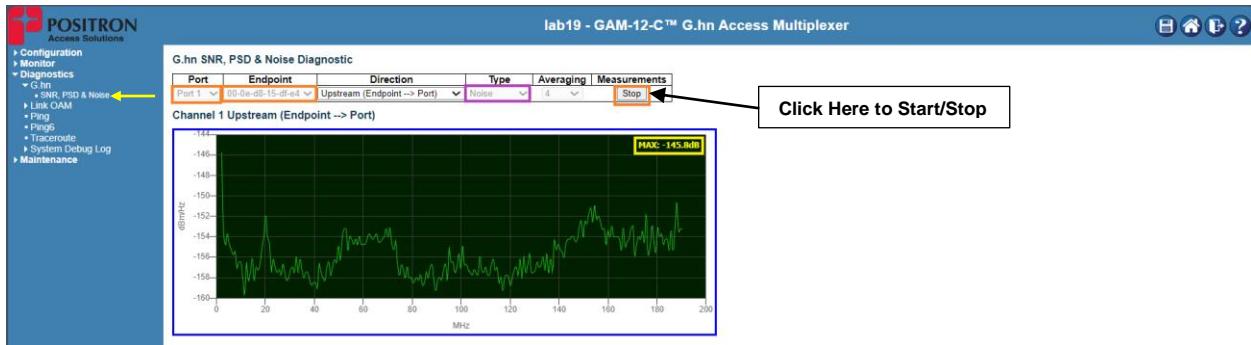


Figure 10 Checking Upstream Noise

#### 4.3 Endpoint Firmware Issues

We may see a warning icon  while checking Endpoint Status at **Monitor→G.hn→Overview**. This symbol means that the Endpoint is using an older FW version and needs to be updated from the GAM. See **Figure 11**, Detailed Status of an Endpoint requiring to be updated.

Detailed Status for Endpoint 00:0E:D8:13:26:04

System	
Detected on Port	7
Uptime	64 days, 3h 19m 38s
Hardware	
MAC	00-0e-d8-13-26-04
Model	G1001-M
Serial	99000031
FW Version	G1001M-GNT-GNOW SPIRIT.v7_8_r590+7+2b_positron_22511 
Link	
Downstream PHY Allocated Bandwidth (Mbps)	482
Upstream PHY Allocated Bandwidth (Mbps)	387
Downstream Max Usable Data Throughput (Mbps)	1217
Upstream Max Usable Data Throughput (Mbps)	1006
Downstream Current Usage (Mbps)	1
Upstream Current Usage (Mbps)	1
Downstream Number of Allocated Bands	1
Upstream Number of Allocated Bands	1
Estimated Wire Length (m)	6
Estimated Wire Length (ft)	20
Ethernet Port #1	Unavailable (must upgrade CPE firmware) 
PoE	
PoE Port	Unsupported

Figure 11 Endpoint showing FW inconsistency

To update Endpoint Firmware, we can do it from the GAM Web UI. First we go to **Configuration→G.hn→Global Configuration**, then we Enable **Endpoint Automatic Firmware Upgrade** feature as indicated in **Figure 12** and **Figure 13**. Once enabled, the GAM will start to upgrade all the Endpoints with the new FW. Upgrades take about two minutes, and the Endpoint will reboot a couple of times during the process.

**G.hn Global Configuration**

Subscriber Model	Endpoint-Aware
Double-Tagging Default NNI Port	10G-1
Endpoint Automatic Firmware Upgrade	Enable
Shelf Seed Index	1
Use Automatic Notch	Enabled

Click Here → Save Reset

**Figure 12** Enabling Automatic FW Upgrade of Endpoints in Copper Twisted Pair GAM

**G.hn Global Configuration**

Double-Tagging Default NNI Port	10G-1
Endpoint Automatic Firmware Upgrade	Enable

Click Here → Save Reset

**Figure 13** Enabling Automatic FW Upgrade of Endpoints in Coax GAM