TRIAX

connecting the future

Ethernet over Coax
Fast, reliable **IP** networks

IP & Wi-Fi
No new cables

Create an enterprise grade Gigabit IP network over existing coax cable infrastructure

Reliable and secure IP and Wi-Fi network access around a hotel or deliver fibre speeds to residents in MDUs

The perfect choice for listed buildings

Low costs: no need for new cabling

No disruption: quick, discreet installation

TRIAX EoC

Fast network connection
None of the costs of new cables

Future Ready High Quality Network

High bandwidth, low latency and the most reliable IP over coax performance.
Perfect for a wide range of networking possibilities.

Goodbye Buffering

Gigabit network delivered over coax cables: the fastest, most reliable in its class.

Ready to stream demanding content: 4K UHD, HDR & 60FPS.

No Disruption

No drilling, no dust, no mess, no new cabling, install in minutes.

Take the work out of Networking.

Ideal for listed buildings.

Home From Home Streaming

Serve guests their own streaming services directly onto hotel TVs.

Fastest network in its class, for reliable OTT streaming and low-latency gaming.

Low Cost Environmentally Friendly

Uses your existing coax cables: no need for expensive re-cabling projects.

Reduces need for costly traditional TV subscriptions.

Adding Value On Demand

Open up a huge range of connected services that add value for hotel guests (for example, Video on Demand, guest Wi-Fi or in-house promotional channels).

The commercial TRIAX EoC family

Unleash the power of your existing cables

Our full suite of EoC products deliver fast, reliable networking over coax, with no drilling, no new cabling, and no rooms out of service.

EoC Controller

The EoC backbone sends Data & TV signals throughout the building.

EoC Media Converter

Separates IP network services and DVB TV signals; competitively priced.

EoC Wi-Fi Endpoint

Fast, reliable guest Wi-Fi to every corner of a hotel, and in-room DVB TV signals.

Ethernet Wi-Fi Endpoint

Connectivity throughout a hotel including locations with no coax cables (eg, reception, restaurant).

TRIAX EoC uses the coax cables already installed to provide IP network access around a hotel or deliver fibre speeds to residents in MDUs. That's a fast, reliable gigabit IP network ready for all the IP services a hotel or ISP wishes to offer – without the cost and disruption of new cables.

The TRIAX EoC MediaConverter fits snugly onto the back of each TV, providing IP network access while maintaining the standard DVB TV signals. Installed quickly and efficiently, TRIAX EoC opens up a huge new range of viewing possibilities that satisfies the streaming demands of today and the future.

Connected Clients are Contented Clients

Our best-in-class G.hn Wave 2 technology makes all the benefits of IPTV services and Gigabit connectivity possible for a fraction of the price of running in new CAT or Fibre cables with none of the installation disruption, inconvenience or mess for your clients.

Bridge the Gigabit gap to achieve fibre speeds from the pavement to the resident in MDUs or listed buildings, or replace the poor reach of corridor Wi-Fi in hotels with full in room coverage.
All the benefits of Gigabit connectivity without the hassle; that's TRIAX EoC.

Quick, secure, discreet

Installed in a matter of minutes.
Tucks in neatly behind the TV out of sight, no mass of cabling.
Tamper-proof, secure fixing.

TV out

The standard DVB TV service, delivered as normal.

EoC + TV in

The combined data and TV signals, straight from the EoC controller via the existing coax cables already installed in the building.

Ethernet out

A fast, reliable 1 Gbps IP network connection. Use for IPTV, OTT or any other connected service, like Wi-Fi.

Power-saving flexibility

Can be powered directly from the TVs USB
Comparable devices use up to 100% more power.

Product shown actual size

Images are for illustration purposes only

Once fibre has arrived at or in a building, many network operators and home owners are faced with the question of how to bridge the last few metres to the Apartments in MDU, or the rest of the Home in a SDU. If the existing building is not easy to re-cable (or it is a listed building), then the use of the existing coaxial cable network presents an ideal, cost effective and environmentally friendly solution.

Ethernet over Coax or "EoC", utilises G.hn Wave 2 Technology and is often able to provide a solution to this conundrum by providing that missing link from the fibre termination point to the rest of the home or building.

Most consumers, if they have full fibre broadband, assume the speed at their front door will be the speed available throughout their property. This can be difficult to achieve with alternative technologies such as Mesh, Wi-Fi or Powerline. In MDU's, the use of existing legacy telephone cabling is also not ideal and prone to incurring service level issues resulting in frustrated clients.

EoC provides for a seamless transition from the fibre optic network, usually GPON, to the in-house coaxial cable network, delivering the **full benefit** of **full fibre** to places other technologies cannot reach. EoC utilises a more robust transmission path of screened coax cable, ensuring the same level of full fibre performance, as is delivered to the door, is received anywhere a coax outlet is installed.

EoC achieves this by employing G.hn wave 2 technology, which uses the lower frequency range of 2 to 200 MHz on the coaxial cable. Using this lower frequency range allows far greater distances to be achieved than traditional structured cable such as Cat6, whilst maintaining the Gigabit Network performance right to the end of the coax cable where it is required.

If they are required, use of this lower frequency band also allows for the continued use of DVB-C, DVB-T and DVB-S services down the same coax cable. DVB-S requires a multiswitch with a passive terrestrial path or alternatively, can be combined on to the coax cable after the multiswitch and separated before the end point with a TV/SAT Diplexer.

EoC enables a data rate of up to 1.6 Gbit/s on the coaxial cable between an EoC controller and any end points. It doesn't matter whether the end points are connected via a star-shaped coaxial distribution or via a tree and branch structure, they will still connect to the EoC controller. The G.hn signal becomes available in all connected rooms/flats at any end point position to reproduce the incoming speed at the RJ45 Ethernet Port of the end point whilst maintaining any TV signal on its TV Out Port.

If VHF radio channels below 200 MHz are still required, these frequency ranges can be masked out by in-built electronic notch filtering in the EoC controller. These frequencies will then not be used for data transmission (but it should be noted that the achievable data rate will decrease as a result).

However, test measurements have shown, that even if only a frequency range of around 85 MHz of the normal 198 MHz is available, a symmetrical net data throughput of 550 Mbit/s is still possible. Latency too is minimal at ~ 1 ms.

To maximise the performance of any EoC system it is recommended to "clear" the frequency band between 2 to 200 MHz and wherever possible only use outlet plates that do not have built-in filtering (to ensure this frequency range passes to the end point unhindered), ensuring maximum bandwidth and throughput is

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What is G.hn Wave 2 Technology?

G.hn is a protocol and ITU Standard, which when employed as EoC basically converts data packets from an ethernet connection into a signal of QAM modulated OFDM sub-carriers that is transmitted over a coax cable and converted back to data packets via an ethernet connection again. In effect it replicates a direct ethernet connection but with some added, distinct advantages

ITU G.hn is a next-generation, unified coaxial, phone line and power line home networking standard. Even if the main target for this standard is in-home networks, the same technology can also be used in access networks when the access features are implemented on top of the standard-based solution.

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Compared to all other Coax technologies, G.hn wave 2 has more bandwidth, lower latency, fewer errors and uses a more manageable frequency. It also compares well to fibre solutions.

It can be used with most existing TV solutions without channel reallocation and the G.hn wave 2 technology offers a data rate of 1.6 gigabit per second (1.6 Gbps). The G.hn link between the EoC controller and the end points can be limited by other factors such as noise and attenuation but generally will maintain a link speed of up to 1.6 Gbps.

The ethernet interface will normally have a limit of 1 gigabit per second (1 Gbps). As a consequence, the max throughput of an EoC system is 1 Gbps duplex.

Normally an Internet connection will have a download (DL) and an upload (UL) speed. i.e: 50 / 10 Mbps. G.hn wave 2 bandwidth is 1,600 Mbps total (simplex), and this will be dynamically distributed between download and upload.

This means that G.hn throughput can be anywhere between:

800 / 800 Mbps

1,000 / 600 Mbps

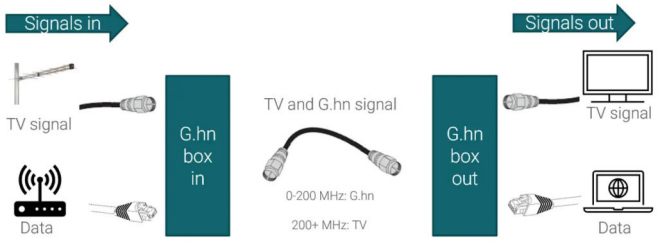
600 / 1,000 Mbps

It is often possible to isolate or notch out specific frequencies i.e. the FM band from 88 – 108 MHz .

This would result in a 10% bandwidth loss (200 MHz – 20 MHz) resulting in a combined bandwidth for up/downstream of 1,440 Mbps.

Or it is possible to limit the frequency used to 0-100 MHz resulting in 50% bandwidth loss leaving 800 Mbps of bandwidth.

Commonly, tap and splitter frequencies start at 5 MHz – resulting in around a 2.5% loss of G.hn bandwidth but tests have shown that it is still possible to maintain link speeds in excess of 1,500 Mbps.



EoC in SDU

FTTH is revolutionizing Broadband delivery to Home Owners and many households manage their needs quite comfortably from a single router positioned near, where traditionally, their main landline telephone socket is located. This may be in the hallway or lounge, or if a newer build property, perhaps under the stairs or utility cupboard in the kitchen. The location of the router has a huge impact on its performance.

However, all too often, a single router within the property is not sufficient to serve all the needs of the home owner. In many cases, residents struggle to stream or game comfortably around the house. This can be down to many factors, for example, a low powered ISP router, distance from the router to the wireless client itself, wall construction type, airborne interference and Wi-Fi congestion – these can all play a part in slowing down the speed of their connection. This is most noticeable with FTTH, where speeds of 500 Mbps or more are not uncommon and can be enjoyed (with the right device) next to, or hardwired to their router. However, in their bedroom or conservatory at the rear of their house, they can end up with very poor connectivity and low speeds by comparison, which lead them to suffer buffering or loss of connectivity.

There are several options available to potentially overcome this, and other means of getting the data to where it is needed are often employed. Some are more effective than others and some are more robust and reliable too. Hardwiring however, is always the preferred choice as this provides the most reliable and robust connectivity without loss of speed or bandwidth. With CAT6 for example, a Gigabit can be maintained up to around 90m which is adequate for most domestic environments, but what if you need to get connectivity to an outbuilding over 90m away or you cannot run a new Ethernet Cable for some reason? Perhaps the customer does not want the mess or disruption to their property that would be involved in running in that new ethernet cable, or there is no discrete way to route it. This is where EoC is the perfect solution. No drilling, no mess and an instant, reliable and robust Gigabit network to their home in minutes and capable of delivering a Gigabit up to 500m. (Figure 3)

figure 3

Attenuation (dB)	0	20	40	60	70	80
Throughput (Mbps)	1429	1419	1367	638	315	51
Cable Length* (m)	N/A	250	500	750	850	1000

The figures in Figure 3 are based on attenuation levels when using good quality type 100 cable, and although 500m is not likely to be required in a domestic setting, the point to note is that the attenuation level at that distance is around 40 dB in the EoC G.hn frequency range of 2-200 MHz.

This demonstrates that even when using older existing cables in a property, which may be poor quality, with high attenuation levels, EoC will still perform as intended over what are generally shorter distances. It should also be noted that TV services are unlikely to travel the same 500m and above. EoC functionality at these distances is really intended for Data only applications and as you can see from the table, you can still achieve around 50 Mbps after 1 km of coax.

As the reception of TV in the Home moves ever closer towards a streaming future, EoC is an ideal means of providing robust and reliable Gigabit connectivity to any TV or room that is connected to a legacy terrestrial TV system.

EoC in MDU

In a typical block of apartments with an existing IRS system in place, the G.hn signal can be fed into a coaxial network via the passive terrestrial antenna input on a multi-switch (must be passive and capable of passing 2-200 MHz) and the EoC signal would then be available in all connected flats

Where an existing Coax Network has an amplifier or other component that will not pass 2-200 MHz then a bypass filter can be used to separate the TV and EoC signal to allow the EoC signal to bypass the Amplifier unhindered and re-combine the G.hn signal with the TV signal again into the coax network again on the other side of the filter. (Figure 5)

Figure 5

1-200 MHz

Return path filter

The return path filter is used to bypass amplifiers in a normal coax based TV network on the data frequency of EoC. This allows the data to have a return path and the TV signal to be amplified

EoC has for many years been successfully used in hotels, hospitals, camp sites and nursing homes – in fact anywhere there was an existing coax network in place. A typical EoC system will usually consist of a controller (Figure 6), which is often available with two or four G.hn coax output ports, and various types of end points that provide the transition back from G.hn to Gigabit Ethernet or WLAN. The example shown (Figure 6) is capable of up to 16 end points per G.hn coax port or a combined string of up to 64 end points from a single G.hn port.

For ISP or network operators, there are media converters which can work as "network blind", so they do not have to worry about how to manage or configure them and they can easily be installed by the end customer in their home. It is equipped with a Gigabit Ethernet interface for connecting to End-User CPE such as a modem or router or any network enabled device such as a smart TV, streaming device, games console, Wi-Fi Access point etc. There is also a coaxial F jack to enable connection to a local TV to ensure reception of any TV services is maintained.

When more G.hn EoC end points are used, sharing the same coax medium, the G.hn bandwidth will be distributed fairly between them. The bandwidth will be adjusted dynamically and on demand, ensuring that each end point gets its own fair share. When only a single end point needs to transmit or receive data over G.hn, it will utilize the entire bandwidth and as more end points need to transmit and receive, the bandwidth is then evenly distributed between all active end points. This compares well with traditional IP networks, where the bandwidth needs of individual clients are often asynchronous and spiky. In contrast to having a fixed fractional part of the bandwidth statically assigned for the individual MDUs this allows for a much better utilization of the bandwidth available.

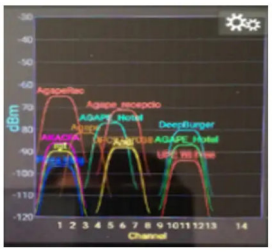
It is however still possible to control how much bandwidth that can maximally be consumed by the individual end points. This may be desired by MDU operators, allowing them to limit or upsell more bandwidth to the individual MDU residents.

EoC, it really is, that simple!

G.hn Wi-Fi end points can also be used, or standard Wi-Fi access points added to a media converter, to ensure robust in-room Wi-Fi to maximise speed and throughput in any environment.

This is particularly beneficial in MDU settings where congested wireless spectrum, due to large numbers of wireless routers all fighting for bandwidth, can lead to poor speeds and connectivity within Apartment Buildings (Figure 8).

Figure 8



Typical congested Wi-Fi Spectrum

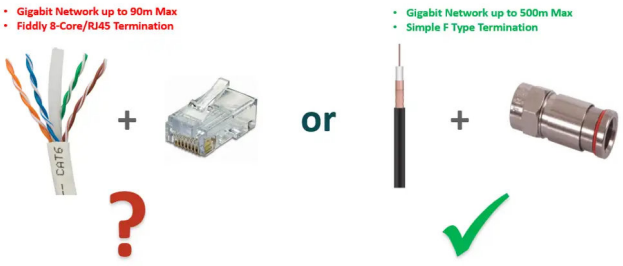
Important to note is the additional advantage to Building Owners where good Internet connectivity and Wi-Fi can be achieved in every apartment without changes to the building's structure which would otherwise involve consideration of matters such as fire protection etc, and without any significant service disruption or inconvenience to them or their residents.

Summary

"Convergence" is a term that was first used many years ago now, but as an Industry we are fast approaching the apex of the converging paths of traditional broadcasting and internet based TV.

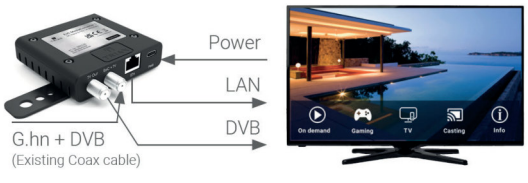
As Installers adapt and learn new skills to ensure their futures within the Industry, G.hn EoC can play a major part in the upskilling and re-skilling of the Installer base. It is the perfect stepping stone from a past of coax distribution networks across to the world of IP distribution networks.

With EoC, you do not need to be an IT expert to create IP Networks. It also allows any Installer to continue to use the more familiar, and so much easier to fit, F type connectors.



Type:	Controller for 32 / 64 Endpoints	EoC MediaConverter Endpoint	EoC Coax WiFi Endpoint	EoC Ethernet WiFi Endpoint
Art. No.	383104 / 383105	383235	383200	383230
Standards	G.hn wave 2, 1 GbE IEEE 802.3 Support ITU-T G.9960, ITU-T G.9963 (G.hn PHY), ITU-T G.9961 and G.9962 (MAC and DLL) specifications			1 GbE IEEE 802.3 Support PoE-in 802.3 af/at, PoE-out 802.3 af
Management & Monitoring	Web GUI, REST API, SNMPv2 and SNMPv3, SSH, RADIUS authentication for management access	n/a		
System throughput	Up to 1.6 Gbps			
G.hn frequency	2-200 MHz (option to omit sub-bands using built-in configurable notch filters)			n/a
TRAFFIC MANAGEMENT				
VLAN	Tag-based 802.1Q, access/trunk/hybrid			
Client isolation (guestmode)	Configurable per SSID/VLAN or option for full endpoint (resident) isolation			
Multicast	IGMPv1 and IGMPv2			
Quality of Service (QoS)	VLAN CoS and IP DSCP (ToS)			
NETWORKING INTERFACE				
Ethernet port	4 x 10/100/1000 Mbps (3 for switching,1 for management)	1x 10/100/1000 Mbps		2x 10/100/1000 Mbps
G.hn port	2 or 4 x 1.6 Gbps (option to combine allowing up to 64 end points on same coax cable)	1 x 1.6 Gbps		n/a
CONNECTORS				
Type - TV	1 F-connector TV-in	1 F-connector TV-out		n/a
Type - G.hn	2 or 4 F-connector	1x F-connector		n/a
Type - Ethernet	4x RJ45	1x RJ45		2 x RJ45 (PoE In/Out)
WI-FI DETAILS				
Antennas	n/a		2.4 GHz and 5 GHz, Dual Band Internal	
2.4 GHz	n/a		802.11 g/n, 2x2 MIMO, 20/40 MHz channel width, 300 Mbps	
5 GHz	n/a		802.11 n/ac, 2x2 MU-MIMO, 20/40/80 MHz channel width, 867 Mbps	
Wireless security	n/a		WPA/WPA2 personal and enterprise AES, TKIP, EAP	

Application examples
IPTV services and DVB to the room



Network Operator Service and DVB to the resident