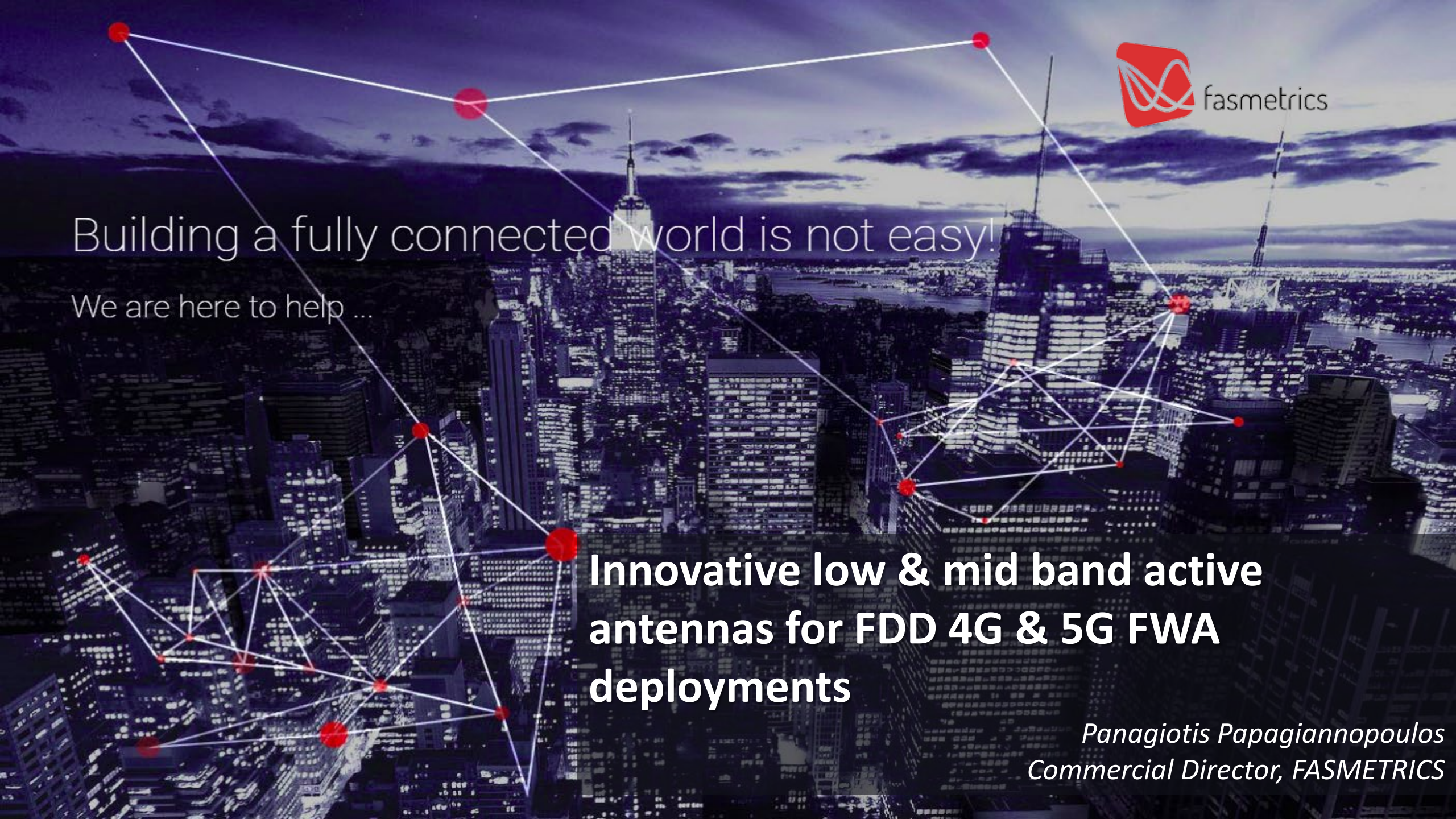
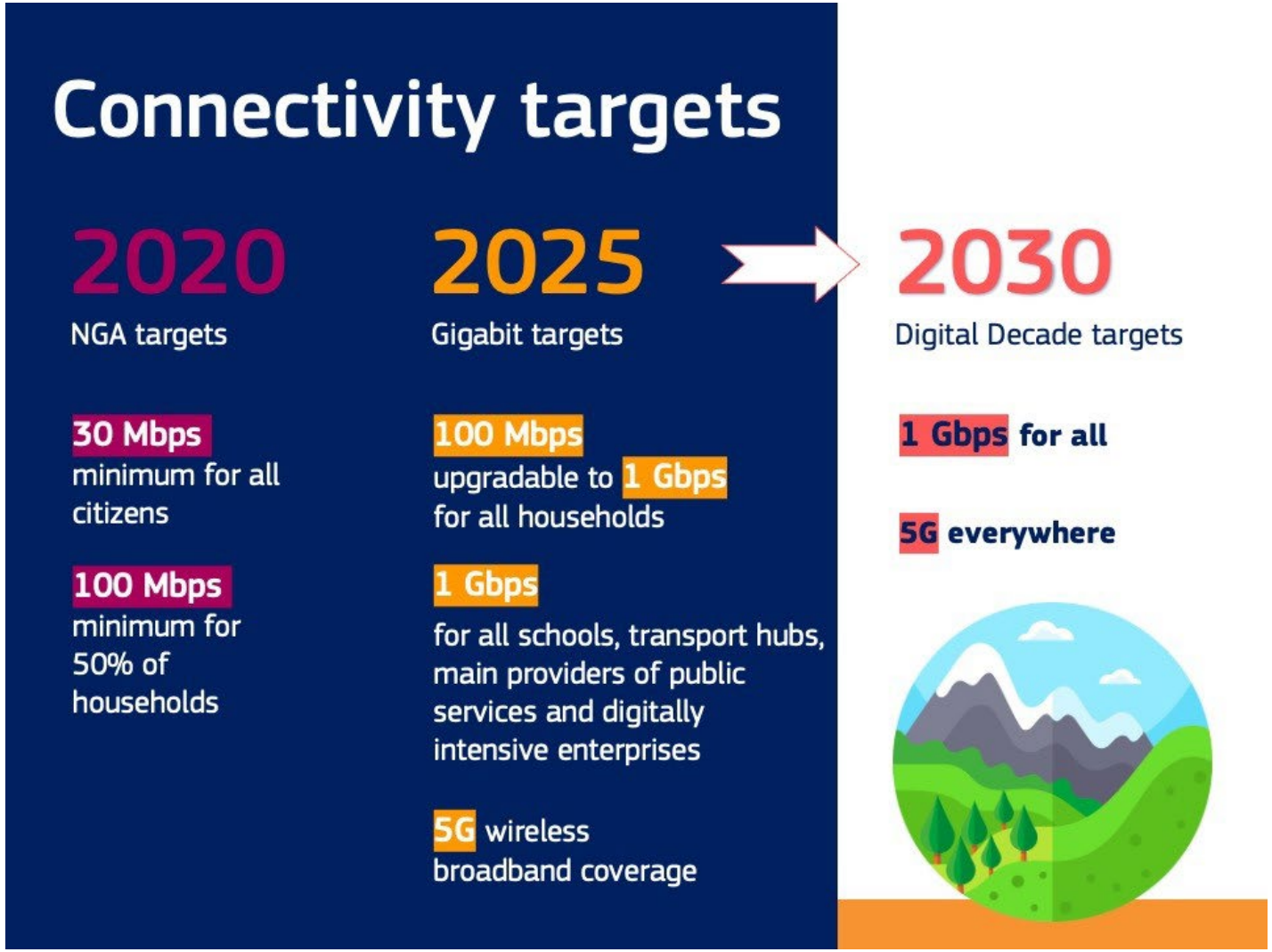


Innovative low & mid band active antennas for FDD 4G & 5G FWA deployments

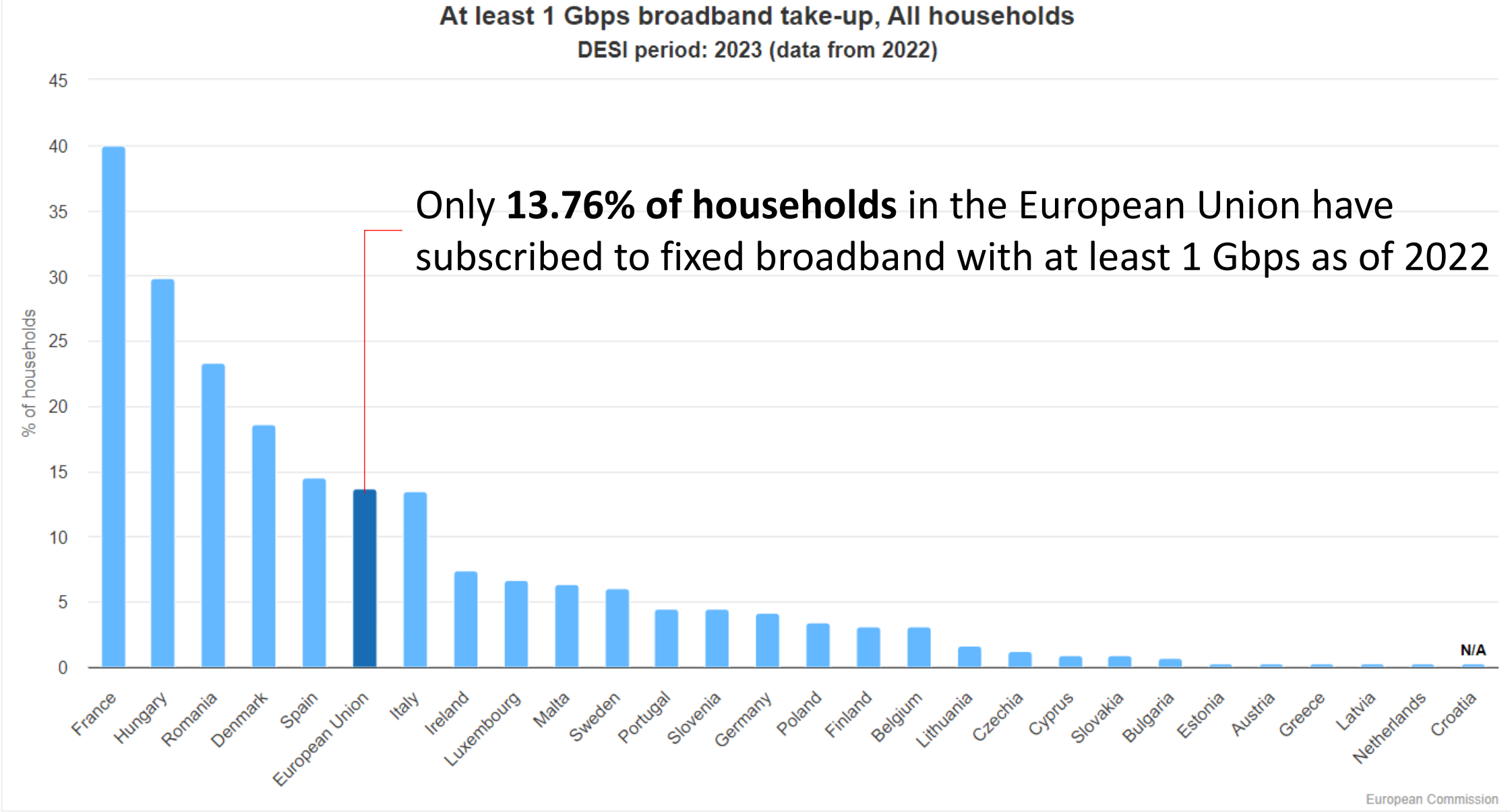
Panagiotis Papagiannopoulos
Commercial Director, FASMETRICS

EU's broadband connectivity targets



Source: [European Commission]

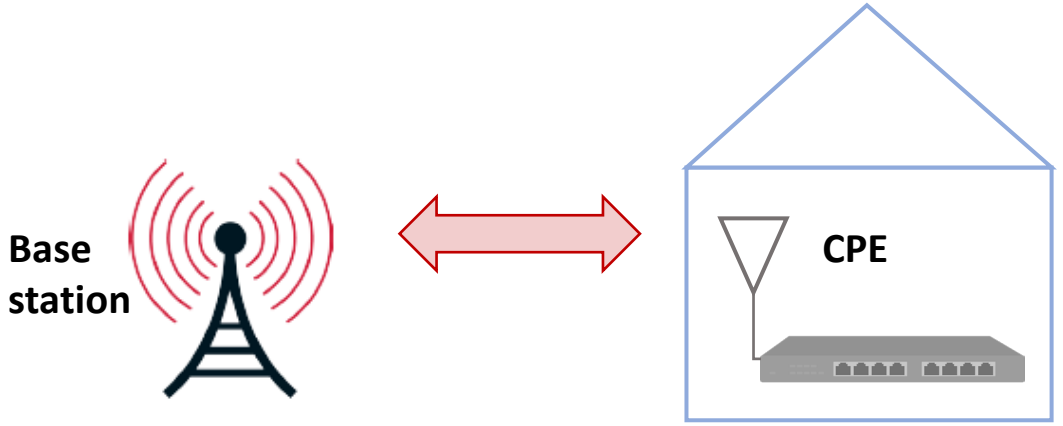
Still a lot to be done…



Source: [European Commission/DESI 2023 Indicators]

NOKIA : "FWA broadband technology is an essential tool in bridging the digital divide"

*"Fixed Wireless Access (FWA) is an innovative use case that **uses 4G and 5G radio spectrum** (the same as used for mobile phone services) to provide wireless broadband connectivity between two fixed points, a mobile network cell tower and a FWA device in a customer's home".*



2 key elements: BS and CPE

"…Deploying fiber can come at considerable cost and complexity in some circumstances, for example remote homesteads, rural communities, or centuries-old apartment buildings. In these cases, network operators need alternative technologies that can deliver broadband speeds without needing a physical fiber connection all the way into the home or building.

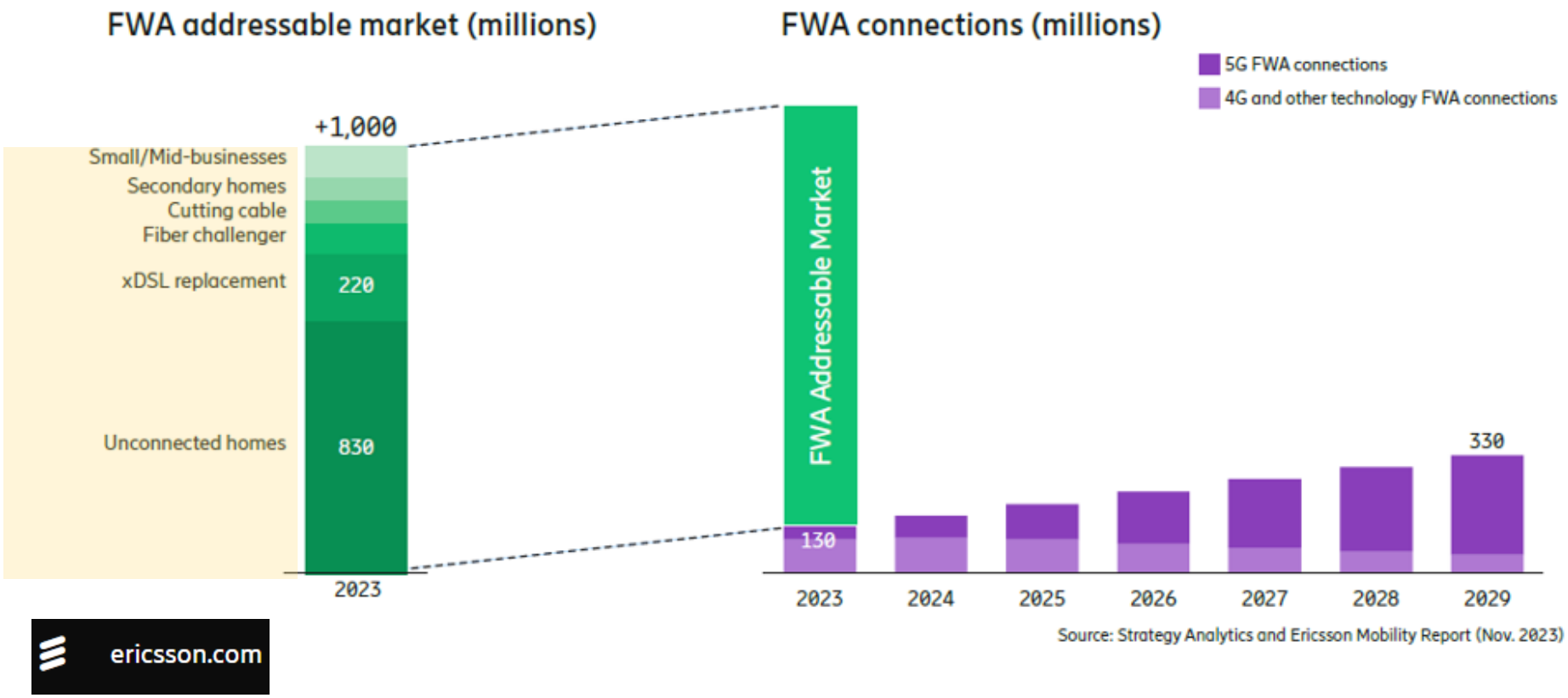
***As FWA does not need a physical connection into a building, new geographies can be covered, and new customers can be connected, much more quickly and cheaply than with fiber**".*

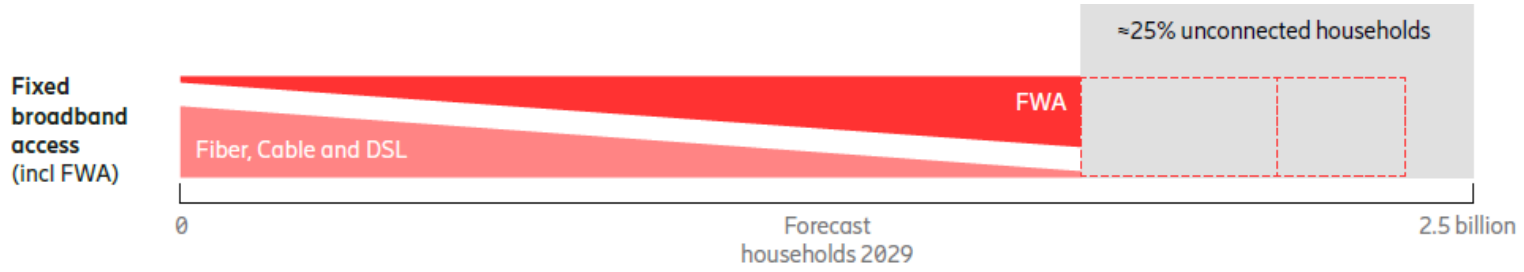
Source: https://www.nokia.com/about-us/newsroom/articles/fixed-wireless-access-explained/

ERICSSON : FWA potential (mainly on remote areas)

6 opportunities to close the +1billion premises digital divide:

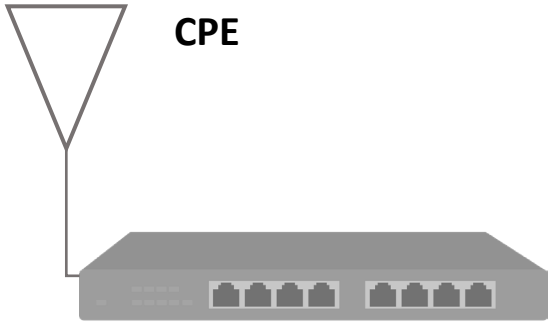
***Mainly on remote areas where FO is not an option**.*





Source: [Ericsson FWA Handbook]

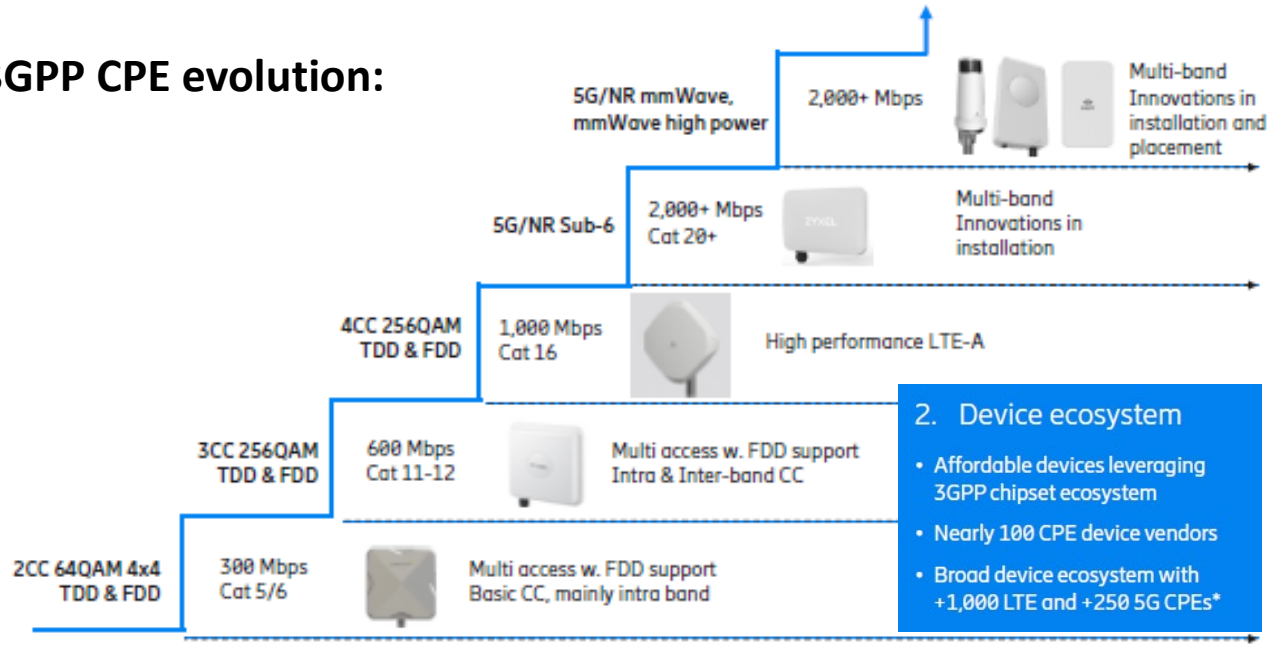
What is a FWA CPE?



Customer Premises Equipment (CPE) is a vital part of an FWA solution, as it terminates the 4G LTE and 5G NR air interfaces and provides Ethernet/WiFi service to the end user.

It has a direct impact on end-user service and quality, as well as the operator cost (CPE cost & network cost) for providing FWA services.

3GPP CPE evolution:



The device capabilities are described in the 'UE Category'. Ultimately, device capabilities such as bandwidth (CA) and MIMO layers should correspond with those the FWA network is built for.

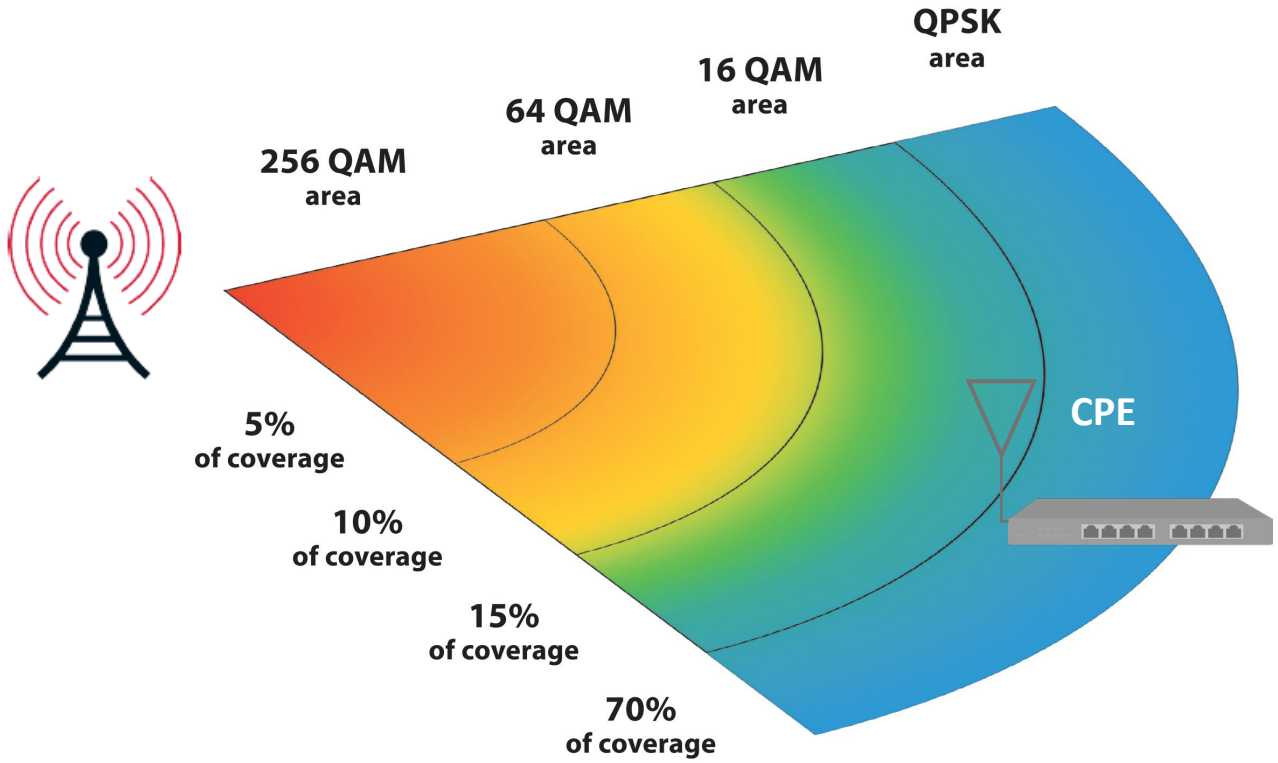
Source: Ericsson FWA Handbook

CPE connectivity performance (backhauling speed) depends on signal quality

Total BW (MHz)	MIMO Layers	MCS Index	Max DL (Mbps)
100	SISO	QPSK	125
		16QAM	250
		64QAM	375
		256QAM	490
	2x2	QPSK	250
		16QAM	500
		64QAM	750
		256QAM	980
	4x4	QPSK	500
		16QAM	1000
		64QAM	1500
		256QAM	1960

In order CPE to achieve acceptable speeds higher modulations should be deployed (such 64QAM and 256QAM).

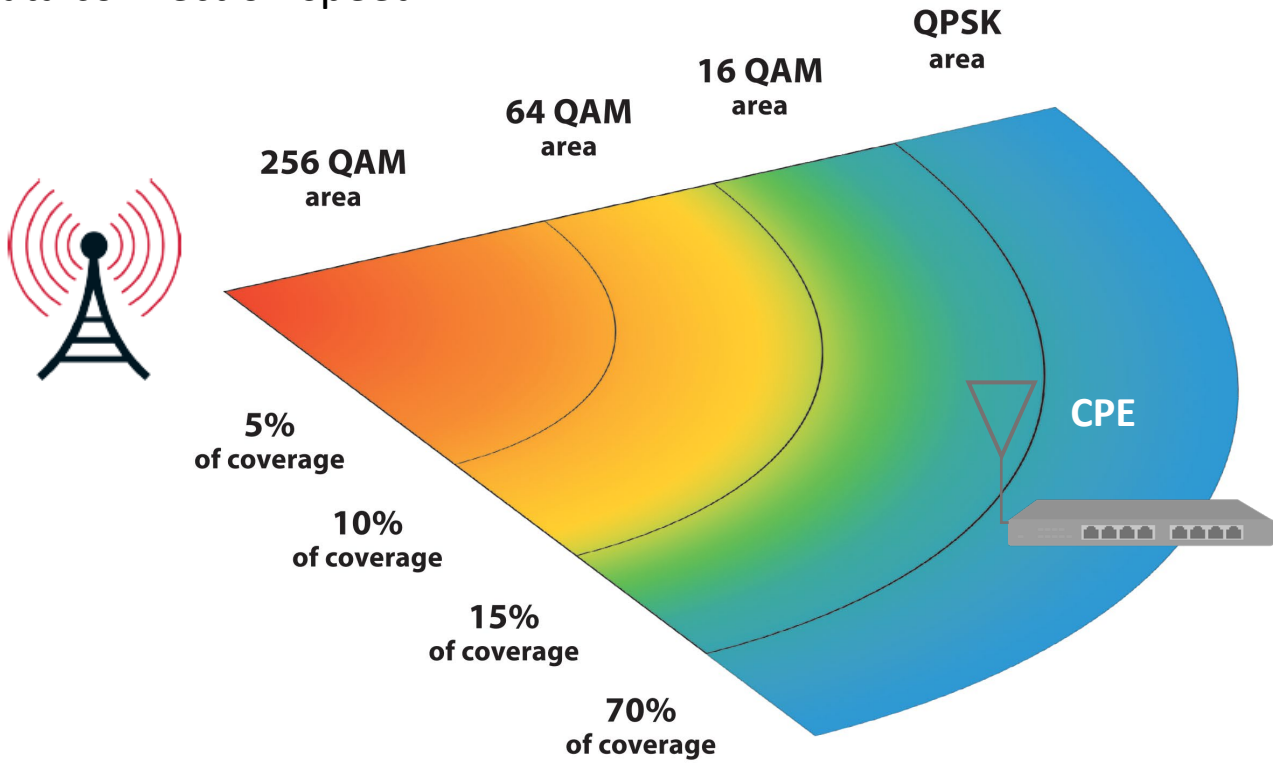
However, in most of the cases the CPE is located on remote areas where the LTE/5G network is less dense and signal quality is typically low (due to high propagation loss), especially if the CPE is located indoor (where the signal is further attenuated due to the building structure).
Hence, the connectivity degrades down up to 3G/2G levels (QPSK).



This 15-25dB gap has a severe capacity impact (x2-3 times according to Ericsson) on the LTE/5G network

Due to low signal quality at remote areas, CPEs use radio network resources (PRBs) inefficiently.

According to Ericsson, if this 15-25dB gap could be eliminated, around two to three times as many households can be served with the same spectrum or equivalently, two to three times as many households can be served for the same data connection speed.



5G SIM Card/4R4T MU-MIMO/3600M

The problem is addressed by Ericsson, by proposing the CPEs be installed outdoor

Indoor CPE

"End-users may detect that they receive fairly good coverage and acceptable speed with an indoor device, but this can change very fast once a specific cell gets loaded with more users.

In an unloaded cell, any user can get many radio resources (PRBs) allocated and achieve acceptable speeds, regardless of the radio link quality and the fact that only QPSK modulation may be possible.

In a loaded busy hour scenario, significantly fewer resources are scheduled, and only the devices able to handle higher modulations (such as 64- and 256-QAM) can achieve acceptable speeds".

Source: [Ericsson FWA Handbook]

Outdoor CPE

"The most significant difference between outdoor and indoor CPE versions ***is the ability to achieve promised service levels, especially during busy hours****.*

An indoor CPE device is comparable to a smartphone device in terms of the required radio resources or slightly worse as it's always indoors. By contrast, ***an outdoor CPE device has the advantage of a 15–25 dB better signal quality, providing higher speeds, and better coverage".***

The innovation: An active antenna would address the problem more efficiently…

Turning the indoor CPE into outdoor, is not a solid solution as it generates other concerns. More specifically:

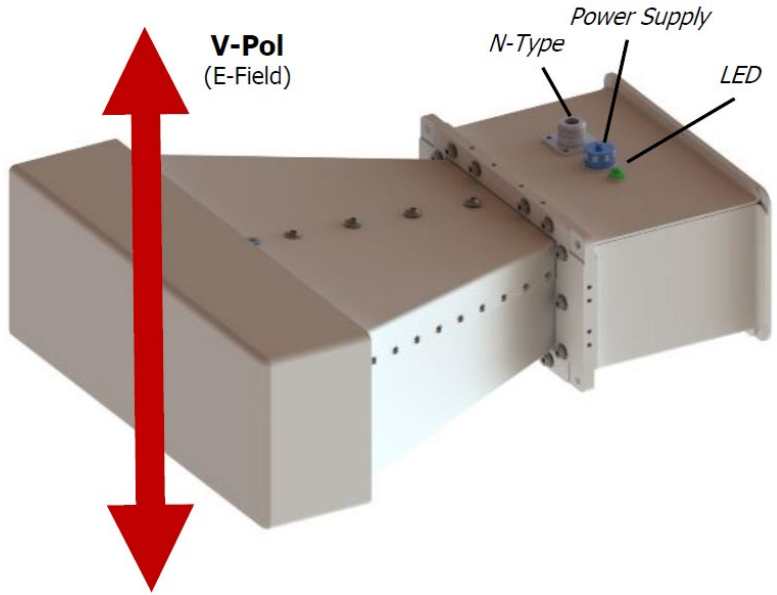
- **Generates additional cost**: Who is going to install it and who is going to take over that cost?...
- **Time-to-market**: When the installation will be done? The customer will be unconnected up to the installation…

In our perspective, the appropriate solution to this problem should be based on **the introduction of an active CPE antenna**[1] that could anticipate these missing 15-25dB in signal reception.

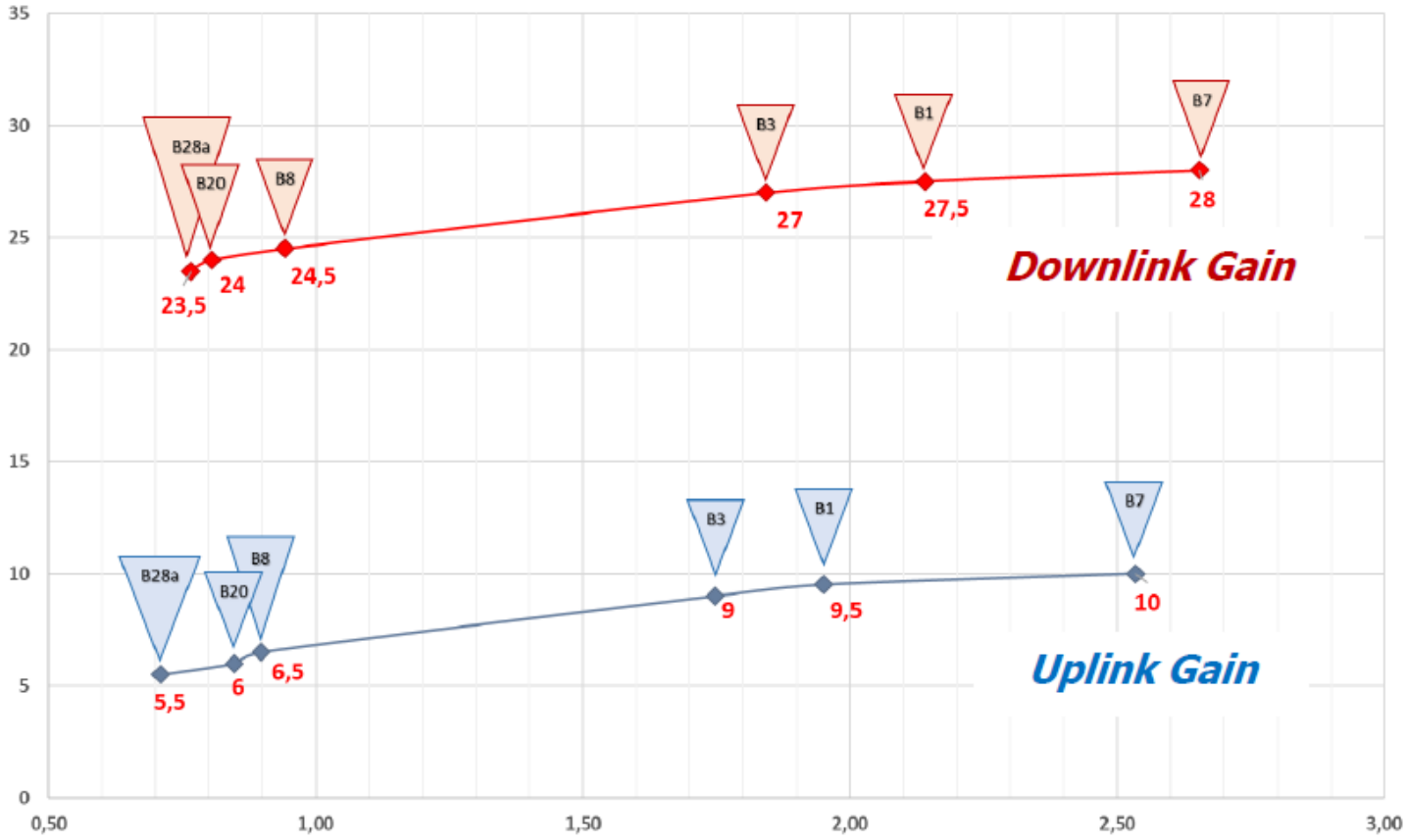
This solution improves the connectivity performance (DL speed) of FWA CPEs much more efficiently!

[1] *Patents pending*

FASMETRICS Ultra Broadband, exemplary Active CPE Antenna[1]



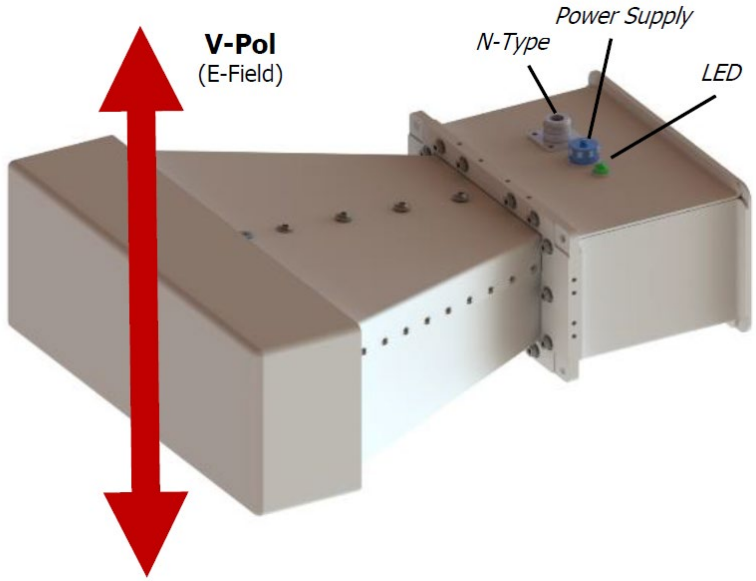
Directional Antennas	
Gain (Max) DL/UL	>25/ 6-10dBi
HBW (-3dB)	70°
VBW (-3dB)	70°
F/B	>30dB



Model 3SKL-100-A Typical DL & UL Gain for Bands 1, 3, 7, 8, 20, 28a

[1] *Patents pending*

FASMETRICS Ultra Broadband, exemplary Active CPE Antenna[1]



*This antenna **delivers an impressive 100x+ increase in LTE and 5G downlink signal strength across all operational frequency bands,** ensuring robust network connectivity for high capacity and optimal performance.*

*The unique **uplink "Net-0" gain feature** enables full power control capability during uplink transmissions, allowing connected devices to maintain balanced RF connections within the network's coverage area while actively restricting uplink interference to the serving radio base station.*

These antennas stand as a standout and reliable solution for high-performance antennas for various radio terminals, including Customer Premises Equipment (CPE) and Internet of Things (IoT) devices.

[1] *Patents pending*


fasmetrics
Building a fully connected world is not easy!
We are here to help ...
It’s more than just antennas.
It’s connectivity engineering.