Electricity North West is the power operator for the North West. We are one of 14 distribution network operators in the UK regulated by Ofgem and the majority of electricity enters our network from National Grid. We are responsible for maintaining and upgrading 13,000 km of overhead power lines and more than 44,000 km of underground electricity cables and much more. This covers the diverse communities between the beautiful Lake District landscapes to the bustling city of Manchester and all the wonderful towns and villages located in-between.

Our network in the North West is one of the most reliable in the country and we are investing £1.7bn between 2023-28 to ensure we continue to deliver an excellent, safe and affordable service to all our customers.

Electricity North West welcomes the opportunity to respond to the OFCOM publication *"call for input: Review of the use of fixed wireless links and spectrum implications"*.

ENW realises the importance of Wireless link availability in providing digitalisation of the energy sector as critical to reaching net zero by 2050 and supporting a smart, flexible energy system.

In response to this CFI the following key points are referenced throughout.

- Availability of the right spectrum must be provided immediately as timescales are short to meet the climate targets of 2030,2035 and 2050.
- The significance of Fixed Links in Utility Telecoms infrastructure planning and network
- The importance of availability, resilience, latency and scalability on the use of fixed links
- Review of frequency bands suitability and suggestions on the availability of additional spectrum for backhaul requirements

Question 1: Please provide a description of your current use of fixed links (or indicate which of the use types in Table 3.1 best describe your use type)

In the high level presentation of user types in Table 3.1, Electricity North West would fit into the category of Utilities, specifically that of electricity distribution.

In a geographically based electricity distribution business such as ours, the choice of location for the communications infrastructure is crucial to supporting the critical network it provides. Therefore, the choice and placement of the fixed links needs to meet the reliability requirements of our operational needs. ENW uses Point to Point Microwave ranging from 6GHz to 80GHz and Point to Multipoint at 10.5GHz.

The operation of these links is designed for high availability and resilience because the electricity supply underpins the operation of critical infrastructure and essential functions—including hospitals, water and wastewater systems, transportation, and telecommunication networks.

Weather-related events have historically been the biggest threat to the electricity supply industry (ESI). Energy distribution systems are designed to respond to weather variability such as daily changes in temperature that affect the load or rapid changes in renewable resource availability that affect the supply. These short-term fluctuations are managed by designing redundancy into the energy systems and using tools to predict, evaluate, and optimize response strategies in the near term. However, infrastructure is vulnerable to direct impacts from severe weather events.

The reliable operation of Electricity North West's Telecommunication infrastructure is so critical that a disruption or loss of energy function can directly affect the security and resilience of other critical infrastructure sectors. Critical in the planning of our networks is the objective to reduce the social

consequences as expressed in terms of impact to quality of life, economic activity, and national security, beyond the impact to the energy system performance itself.

To minimise these social consequences, we use tools to give an improved situational awareness. These tools include synchrophasors and frequency disturbance recorders for monitoring conditions of power delivery networks, new energy management systems, optimisation tools for restoration prioritisation, automation, Protection equipment, SCADA, corporate data and voice services.

ENWL, in response to the '*Call for Input: Potential spectrum bands to support utilities sector transformation.'*[1], highlighted the importance of fixed wireless links for backhaul in the implementation of an LTE network[2], particularly, the importance of sub 10GHz bands. In addition, the ENWL response highlighted the areas where increased monitoring could be required and the substantial increase in the exchanging of data that means availability is required in places where it is not readily available today.

The International Energy Agency (IEA) report on '*electricity grids and secure energy transitions*' states that digitalisation is an essential part of the transformation of the energy network.

…the significance of investing in digital technologies cannot be overlooked, showing a progressive increase from about 12% of total grid investment in 2016 to about 20% in 2022. The need to manage a growing number of distributed energy resources (e.g. EVs, small-scale renewable energy plants and electric heat pumps) as well as new active players (e.g. aggregators and prosumers) is requiring system operators to implement new digital solutions…

The industry has a reliance on access to managed bands, but it's clear that even using these bands is a challenging issue to the electricity utilities with the recent notification received from OFCOM to revoke the 1.4GHz band. The threat to the 6 and 7GHz bands, and overcrowding in some areas of the 6, 7 and 13GHz bands, emphasises the industry's requirement for dedicated spectrum which it can deploy into without the threat of future removal.

[1] https://www.OFCOM.org.uk/__data/assets/pdf_file/0029/263567/utilities-cfi-June-2023.pdf

[2] Electricity North West (OFCOM.org.uk)

Question 2: What are the factors driving your choice of fixed links over alternative connectivity solutions, and which factors have the biggest impact on your decisions? Is this likely to change in the next 5 years? If so, what do you expect will change?

Electricity North West, within its telecommunications infrastructure, uses several different mediums to communicate with its assets including Fibre, Radio including Point to Point Microwave ranging from 6GHz to 80GHz, Point to Multipoint at 10.5GHz, UHF in the 450MHz band and a Digital Mobile Radio (DMR) system in the 139-148 MHz bands. We have an extensive aging copper network which uses DSL services, but these have become redundant in our plans for any future connection due to the ceasing of the manufacture of SHDSL chips. The impact of loss of DSL services, means we need an alternative solution to the use of our incumbent copper pilots. There are 2 options available to mitigate this 1) Fibre 2) Radio, the latter increases the need for further suitable spectrum.

It is expected that additional spectrum will be required to backhaul LTE base station sites to existing network connection points.

ENWL uses a wide range of spectrum specifically in the 6GHz-80GHz bands, this gives us several options which are dependent on the path length and bandwidth requirements. The extension of our telecommunications network using microwave radio provides coverage in areas which lack alternative infrastructure e.g., Fibre. In remote and difficult to address areas, the use of microwave radio links provides a more cost effective solution than fibre cable deployment – and may be the only viable alternative in challenging terrain.

Design requirements for utility radio networks will differ from the usual wireless carrier networks; therefore, design and deployment of private radio networks will use a different approach than carrier wireless networks. One of the main differences is the pre-defined location of existing sites that must be covered with the radio signal or connected to with a microwave link. Therefore, there is very little flexibility in finding the ideal location, which makes radio design even more challenging.

There are several factors that are considered in the choice of fixed links over alternative connectivity solutions:

- Availability and Resilience

In network design, high availability, reliability and maintainability is put into effect in all components involved, with the basic requirements of 99.999% availability and a 72 hour battery/power backup under all weather conditions taken into account. The Mobile Network Operators (MNO's) and Satellite providers will not provide a suitable Service Level Agreement (SLA) that meets our normal standards and as a result they are eliminated as an option to carry critical traffic.

The EU produced a study in 2014 [3], *'Is a commercial cellular suitable for mission critical broadband',* in which they looked at the major reservations of Utilities on whether commercial operators are willing and able to provide long-term reliable and resilient services. It is also noted that OFCOM, in its publications December 2023[4] , 9 years after this report, has started to address the resilience of the MNO's networks, however, no such requirement has been made of Satellite providers.

[3] Is commercial cellular suitable for mission critical broadband? - Publications Office of the EU (europa.eu)

[4] Resilience guidance consultation and mobile RAN power back up

Report ITU-RM.2533-0 (09/23) issued by the ITU radio communication sector clearly summarises the issues with commercial carriers.

Firstly, the utility networks need to provide full coverage of their asset base with 99.999% availability, something that has proven to be commercially unviable for public mobile. Current utility networks are built to cover the entire geographic area with overlap redundancy, power redundancy, strict maintenance schedules and emergency group talk functions. Despite the poor financial case, a commercial provider would have to provide a network that fulfilled all of these criteria. Secondly, another issue is reliability and resiliency during adverse conditions. Maintaining and re-establishing communications during crises has always been fundamental in recovery plans for utility providers. Thirdly, concerns surround the level of cyber security of some commercial providers, given some commercial telecommunications providers may not be subject to rigorous requirements in national regulation.

- Latency

Data travels over microwave links at the speed of light resulting in minimal latency, the quality of protection system must work fast enough that the occurrence of the error in one part does not affect the rest of the healthy parts. The end to end delays cannot be controlled in a commercial carrier network.

- Scalability

Modern microwave links can easily scale to the demands of increasing bandwidth, often by enabling through a software license. This makes network upgrades more cost effective than laying physical cables.

Question 3: Is the current spectrum available for fixed links in the UK suitable and sufficient for your needs? If not, what would you change and why? If you believe changes are required, please give specific examples and reasons along with supporting evidence if available

The constant uncertainty on available spectrum makes planning difficult, a long-term perspective is crucial, especially when making major capital expenditures that support our Networks' operational integrity. The withdrawal of the 1.4GHz band at relative short notice involved major financial investment and some of the replacement frequency bands used in that are now under consideration of reallocation for other use.The mitigation for the implementation of an alternative frequency band cost the North West Public in the region of £8 million excluding increased on going operational costs.

OFCOM has acknowledged in the CFI that the lower frequency bands (below 10GHz) *are not rain-fade dominated and therefore support longer distance high availability links, which are important for connecting areas that are more difficult to reach using other technologies.* We would ask that OFCOM work with the sector on ensuring that an adequate provision of suitable Spectrum (10GHz and below) is secured for our industry's future needs.

ENWL would encourage OFCOM to continue work which it started on the Public Sector Spectrum Release Programme (publishing.service.gov.uk) with the Ministry of Defence (MOD) looking at enabling more effective sharing of spectrum usage.

ENWL would welcome OFCOM'S release of 25MHz of additional spectrum available in the 10.161 GHz to 10.637GHz range for the use of Point to Point and Point to Multipoint radio to be managed and controlled by JRC. The release of this spectrum could meet multiple requirements (except in the areas of an operational license restriction).

Spectrum falls within international allocations for fixed links in 10.5GHz and there are ITU-R and CEPT recommendations on frequency plans – this helps availability of technology which would not necessarily apply for proprietary UK allocations.

Technology currently exists in both Point-to-Point and Point-to-Multipoint architectures from multiple suppliers.

Technology available currently supports high-level modulation schemes and Adaptive Coding and Modulation (ACM) providing significant throughputs for relatively small sized antennas.

Control of spectrum by JRC would permit efficiencies on link packing density compared to OFCOM controlled bands, as the performance and interference modelling can be based upon 'real-life' equipment characteristics as opposed to the nominal theoretical receiver model adopted by OFCOM.

10.5 GHz link performance and fade margins are calculated based on multipath fading as opposed to higher frequency bands where rain attenuation is the dominant fading mechanism – this makes 10.5 GHz a good alternative to the OFCOM 7.5 and 13 GHz bands which are historically congested in several areas in the UK. Links where performance is not dominated by fade margin are important to the Utility industry as storm conditions with associated heavy rain attenuation are the conditions where mission critical links are most required to be available.

In a self-managed band, users can shield links from one another in areas of high demand to enhance capacity and collaborate across utility regulated areas to accommodate extra demands. The OFCOM process does not facilitate this process and in most case does not allow such co-operation.

At present, OFCOM applies a strict first come - first served approach, even when urgent requests are submitted where infrastructure has failed and might reasonably justify a same day response (which used to be possible from the Radio Agency but is no longer permissible). More responsive timescales for processing applications are therefore available in a self-managed band, this is particularly important for rapidly deploying fixed links to replace other links where infrastructure has failed.

There is greater certainty of retaining a band associated with block spectrum allocations from OFCOM yielding longer term security of access; and security is enhanced compared to third party circuits because the fixed links are within your own secure environment and subject to industry specific design criteria.

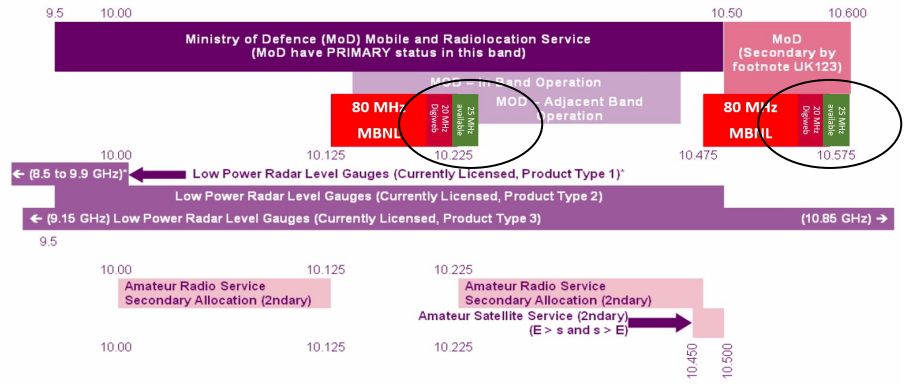
As a direct radio link, it is useful for teleprotection which requires low latency and high availability.

The new generation of electricity Active Network Management (ANM) systems will require highly available internet protocol (IP) communications to be supplied to all primary substations with at least 2 megabits per second (Mb/s) bandwidth, possibly 4 Mb/s.

The 10GHz frequency is suitable to use for our high availability requirements up to 20km. Links greater than 20km would be applied for within the 6 to 7 GHz bands; however, the availability from OFCOM is unknown.

The plans below (in green) illustrate the potential spectrum available, and we would encourage OFCOM to open negotiations with the MOD on releasing this spectrum to support the needs of Utilities in meeting government set Net Zero targets.

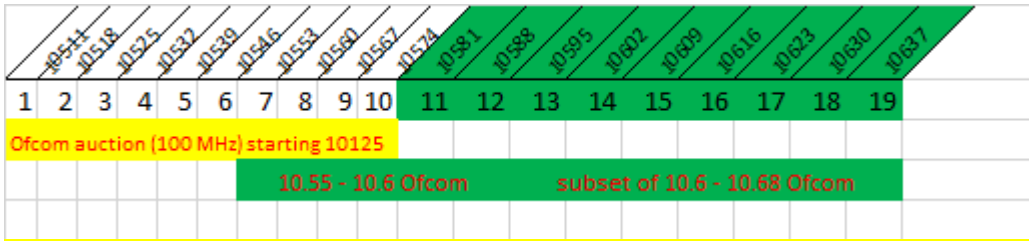
Figure 1 Band Plan 10 GHz (Frequencies in GHz)



350MHz T/R spacing ETSI

Potential 7MHz Channels	i0161	i0168	i0175	i0182	i0189	i0196	i0203	i0210	i0217	i0224	i0231	i0238	i0245	i0252	i0259	i0266	i0273	i0280	i0287
Channel Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Ofcom auction (100 MHz) starting 10125																		
										subset of 10.225 - 10.4 GHz, MOD									

350MHz T/R spacing ETSI



Question 4: Is there anything about OFCOM's current framework for authorising fixed links which you consider could be improved?

The challenging requirements of the government's policy on Net Zero and climate change should trigger a change in how OFCOM views utilities telecom infrastructure. Extension of the rights of Electricity Utilities implementing telecoms infrastructure, which supports the critical networks of the United Kingdom, is necessary to facilitate the rollout of future network changes. This should include rights to share third-party duct infrastructure, code power rights on telecom leases, planning and wayleave rights to facilitate the rapid rollout of these networks, like that which is available to mobile network operators.

ENWL has had several problems when trying to exercise a technical variation on an existing license when submitting an OFW85.

A. Application purpose

A.1 Please tick the relevant box:

- ☐ Fixed link new application - now complete sections B to F
- ☑ Fixed link licence variation - now answer B1, and sections C to E (as appropriate) and F
- ☐ Surrender a fixed link licence - now answer B1, C2 and complete section F

A.2 If you require a licence for less than 12 months, then indicate both the start and end dates

Start date:

End date:

In the simplest form the easiest change is keeping same frequency band and channel plan but required change of the ETSI spectral class, fixed modulation and dedicated capacity (MBits/s in MHz) as per TFAC.

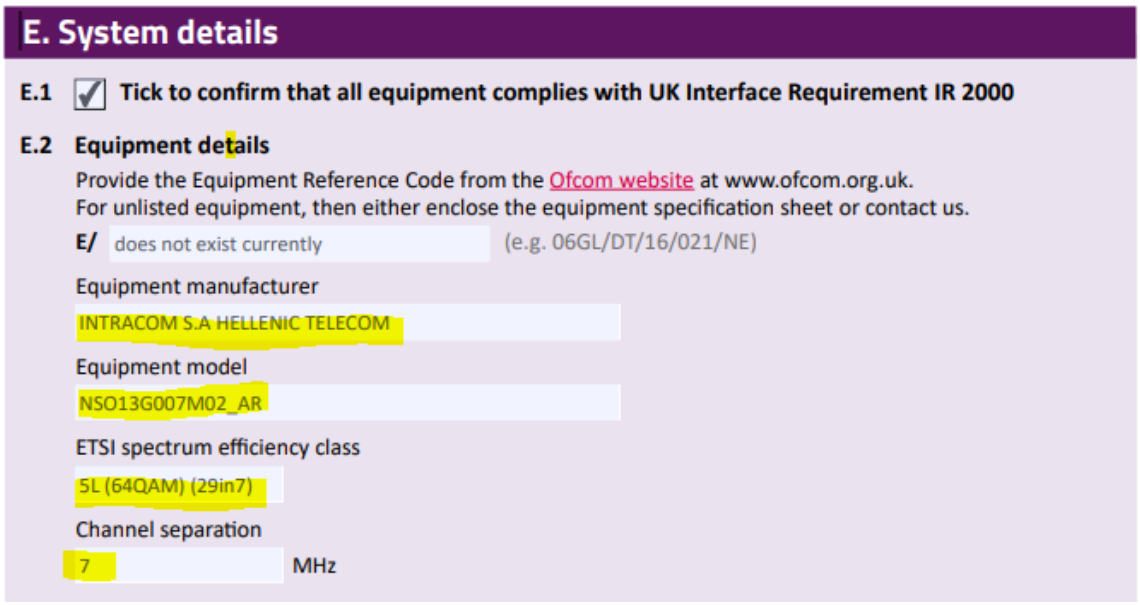
We cannot fill out equipment reference code as no equipment reference has ever been issued by OFCOM for this variant (with any customer).

As an example, we are looking to go from 8in7 (current licence) to 29in7 (technical variation):

13 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
13 GHz band limits: 12.75 - 13.25 GHz	CEPT/ERC Recommendation 12-02 E	15	ETSI SEC 2	4 state	2 in 1.75	-123.0	26
					4 in 3.5	-120.0	26
					8 in 7	-117.0	26
					16 in 14	-114.0	26
			ETSI SEC 5L	64 QAM	29 in 7	-104.0	37
					58 in 14	-101.0	37

Here we are looking at completing this section of the OFW85 form with manufacturer detail as required and make the submission. E.2



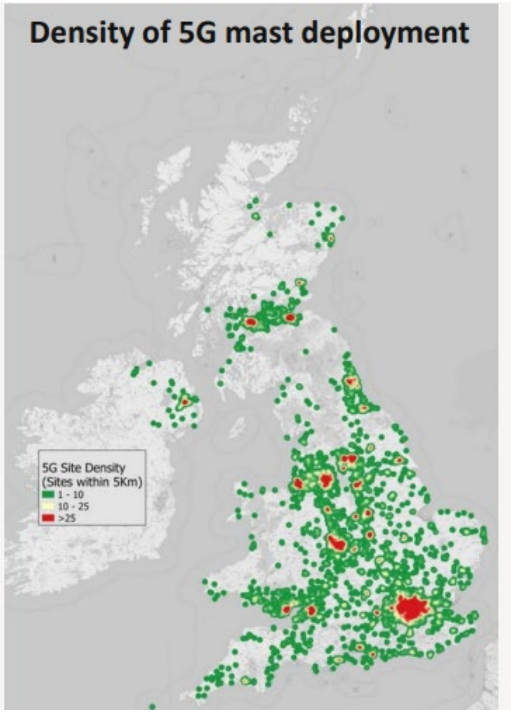
Repeatedly licenses are returned with a different revision number, but the technical variation has not been applied. This is leading to a loss of confidence in OFCOM's ability to administer spectrum allocation.

Previously, OFCOM had a Fixed Link Working Group (FLWG) in which it worked with representatives from different industries on their use of microwave radio, reintroducing a group of this kind may benefit all parties who are users of fixed links.

The MNO's need to be challenged on their requirement for spectrum. Their constant cry for more spectrums appears to other users as a 'land grab' and has the effect of sterilising spectrum bands from other users. An example of this is the allocation by OFCOM of the 26GHz band for 5G services. The removing of links from areas which have been designated high density areas and neighbouring areas (circa 53% of the population) so that spectrum can be awarded to mobile operators through an award mechanism, while the low density areas which compromise 47.5% of the population and 93.6% of the landmass have effectively sterilised the band to new fixed link deployment because OFCOM has accepted there is no excess demand for mobile 5G. See link to statement here.

CEPA has published an interesting document on spectrum auctions for 5G Mobile link here. This report indicates that many lots allocated for auction could remain unsold, again demonstrating how the implementation of 5G is sterilising spectrum bands.

The Cristina Data OFCOM presentation at the 5G conference of March 2023 shows the level of 5G service as of November 2022 and as can be seen large portions of the nation lack 5G Service. The latest Connected Nations Report published by OFCOM Summer 23 seen in the table below shows premises covered by 5G **outdoors**.



5G coverage

Premises (outdoor) covered by at least one operator	May 2022	September 2022	January 2023	April 2023
UK	54-69%	67-78%	73-82%	76-85%
England	56-72%	70-81%	76-85%	79-88%
Northern Ireland	26-34%	37-44%	48-55%	54-60%
Scotland	48-61%	57-68%	62-73%	66-76%
Wales	35-48%	46-58%	49-61%	53-65%

Premises (outdoor) covered by all operators	May 2022	September 2022	January 2023	April 2023
UK	5-13%	11-20%	12-22%	12-22%
England	5-14%	12-22%	13-23%	14-24%
Northern Ireland	2-7%	4-8%	5-12%	5-12%
Scotland	3-10%	6-15%	7-17%	8-19%
Wales	2-6%	4-7%	5-8%	4-8%

The 1900MHz band has remained unused for 23 years by the MNO's, to make sure that a similar issue does not develop out of any future or ongoing allocations, OFCOM needs to investigate why this situation occurred when mobile carriers are still looking for additional spectrum.

Question 5: How has your use of fixed links changed between 2016 and now? Please provide information on: - Reasons for increase or decrease in the number of your links since 2016; - Changes in the capacity of your links since 2016, including how you have; delivered this capacity change, e.g., different channel bandwidths, different link technology (please specify), etc.

IP communications to primary substations were required as a key enabler for the new Network Management System (NMS) which was being implemented.

The Schneider Electric Network Management System (NMS) implementation is dependent on an IP based telecommunications network to communicate with telemetry equipment.

The new NMS system will not communicate using serial protocols previously used by the decommissioned Control Room Management System (CRMS), so it was a fundamental requirement that all RTU communications were moved to IP protocols.

There was a further requirement to provide enhanced data communications to field staff. In many parts of the distribution area, there are cellular communications 'blackspots' which reduce or remove the ability of field staff to access IT systems and data. As part of the solution to this, substation Wi-Fi connectivity has been provided:

IP connectivity to all primary substations was therefore needed to ensure that (a) telemetry can be operated using the new NMS solution and (b) access to IT systems from the field can be enhanced through delivering Wi-Fi access at selected substation sites. To deliver on these requirements, connectivity across substations has been reviewed and the following findings have been identified:

Of the solutions considered to meet the stated requirements, two viable technical options were identified to replace UHF and VHF radio communications at the 53 primary substation sites identified:

- Microwave (Point to Point PTP) radio (using licensed radio spectrum) – Existing solution
- Microwave (Point to Multi-point-PtMP) radio (using the 10.5 GHz licensed spectrum) – New solution

Based on comparison of the costs and benefits of PtMP and PTP options, the proposed solution was to provide the majority of the UHF and VHF sites with IP communications using PtMP (43 sites). 10 sites are planned to be served by Point to Point radio due to the geographical location. We decided as a design principle to limit PtMP to 20km and PTP up to 40km. Additional costs on third party sites for PtMP due to 2 antennae working per 90 degree sector rather than a PTP single antenna was also taken into consideration.

In addition, a benefit comparison was carried out between PtMP and PtP Microwave. Unlike Point-to-Point, PtMP microwave uses a single hub to create a sector of coverage that can backhaul multiple sites. PtMP microwave uses area licenced spectrum, rather than on a link by link basis, allowing bandwidth to be shared across all sites in the sector. By reducing the spectrum needed to deliver an equivalent service to its PTP counterpart, PtMP microwave saves on spectrum rental expenditure and becomes more efficient as networks get denser. As network demand increases, or new locations are identified, more sites can be deployed within a PtMP sector without a re-visit to the hub or need for additional spectrum. PtMP is 50% quicker to deploy than PTP for the second and subsequent links in a sector making it one of the simplest and fastest backhaul technologies to deploy. PtMP microwave needs as little as two links to become more cost effective than microwave PTP, providing a flexible infrastructure which can be quickly, easily and cost effectively expanded as the network grows.

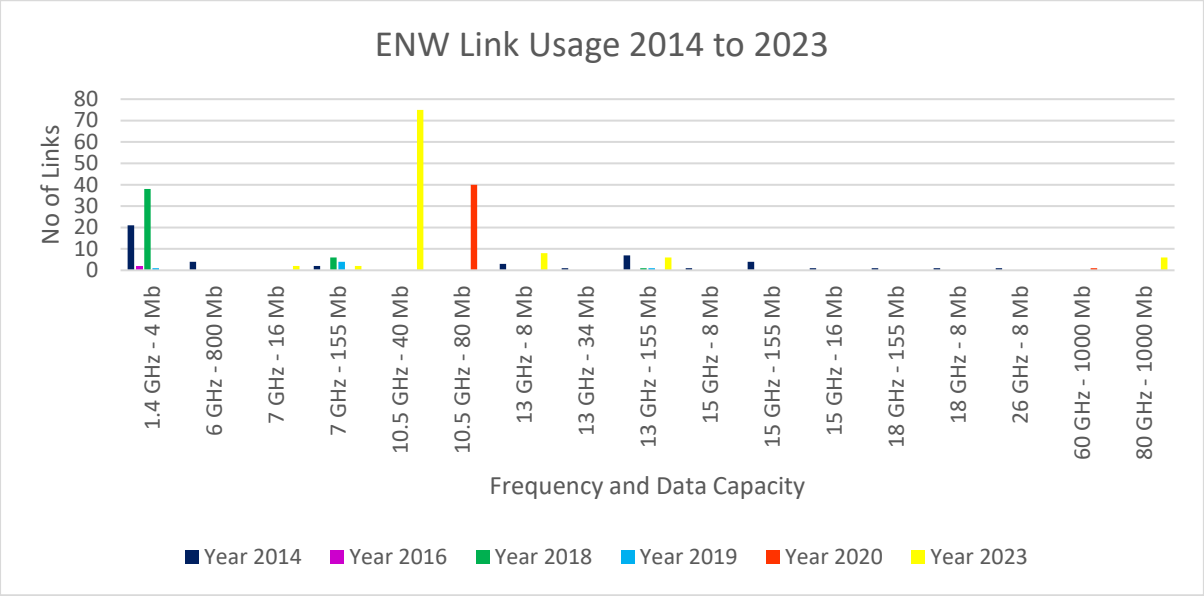
PtMP has some limits on the implementation of teleprotection services which are not found on PtP.

Other factors which have influenced our role out of additional links is OFCOM gave notice to revoke our point to point fixed link licences in the 1492 – 1517 MHz band ("1.4 GHz licences") on 31 December 2022 for the purpose of securing compliance with an international obligation of the United Kingdom ("May 2019 Notice").[5]

This was extended to April 2024 for the purpose of giving us reasonable time to install new and to replace the existing network.

[5] The international obligation we refer to is European Commission Implementing Decision 2015/750 of 8 May 2015 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union, as amended by European Commission Implementing Decision 2018/661 of 26 April 2018 harmonising the 1492 – 1517 MHz band for downlink-only wireless broadband electronic communications services on an EU wide basis (the "EC Decision").

Below we present a chart which illustrates ENW's use of spectrum and data use from 2014 to 2023:



Bandwidth demands are increasing due to greater demands for security / encryption in line with OFGEM Cyber Assessment Framework (CAF) objectives.

Some of our rural challenges also include sites that would be part of our black start (or ESR as its now called) restoration plans and we need resilient communication to 72 hours.

Question 6: How do you expect your usage to change over the next 5-10 years? Please provide information on: - any increase/decrease in the number of links (by band) and bandwidth expected. - likely changes in geographic distribution of links. - likely changes in distribution of links by frequency band. - likely changes in capacity of links and how you expect to deliver this capacity. - other changes not covered above.

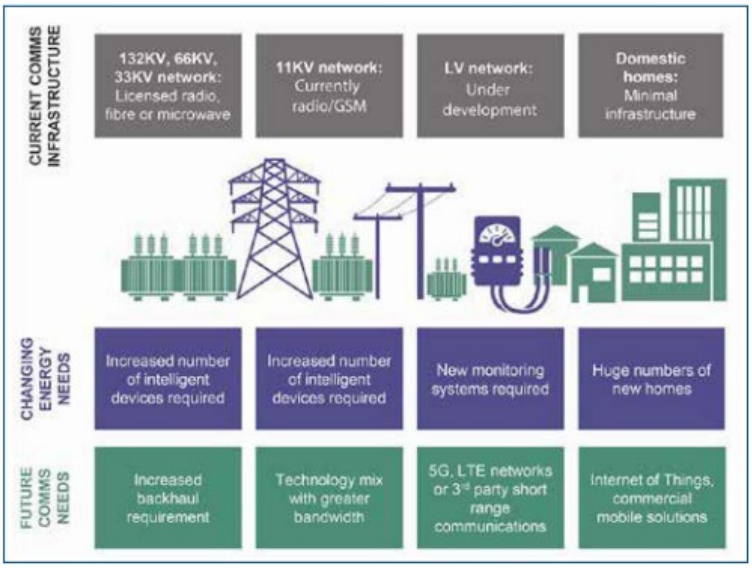
"Our future net zero energy system will comprise millions of assets – including solar panels, electric vehicles, heat pumps and batteries. These will need to be optimised, primarily through open and transparent markets, across our transmission and distribution networks, and coordinated with other sectors such as transport. We also need to unleash innovation across the sector, including in the low carbon services offered to consumers. This will only be possible by harnessing the power of data across a digitalised energy system."[5]

[5]Transitioning to a net zero energy system: Smart Systems and Flexibility Plan 2021 (publishing.service.gov.uk)

To facilitate the shift to Net Zero, the industry needs a communications system that is durable, scalable, and dependable due to the exponential development in connected devices. Only if spectrum access is granted for a private LTE-based system can this projected rise in consumption be supported or enabled. To ensure that we achieve decarbonisation and digitalization, connection must be extended to remote and difficult-to-reach places on our networks. This inexorably necessitates building the required telecom infrastructure, which uses frequencies lower than 15 GHz. Additionally, higher modulation levels will be needed to accommodate the anticipated rise in data-intensive applications, which will demand more bandwidth.

The JRC and ENA in their publication *Need for Increased Spectrum Allocation and Investment in Operational Telecommunications (OT) to enable the Electricity Networks to facilitate the 'Net Zero' transition*[6] clearly layout the reasons for bandwidth growth.

[6]Electricity Networks Brochure (LINKED) jan (energynetworks.org)



The communications infrastructure currently in use neither has the capability for the anticipated number of new connections required, nor the bandwidth to accommodate the amount of data expected from each new device [14].

In addition to this the loss of DSL services over our aging copper network will inevitably mean we look to replace this service with microwave radio being one of the main options considered.

Question 7: Which of the developments listed above are expected to have the biggest impact on your use of fixed links? Are there other developments to be aware of that have not been listed? Please explain the reasons for your answer.

The number of active fixed links run by the Energy Network Operators would be significantly impacted by the development of a Private LTE network. The loss of the DSL service on the aging copper network is expected to lead to a rapid deployment of fixed links as the network fails. The greater demands for security / encryption in line with OFGEM Cyber Assessment Framework (CAF) objectives.

Question 7a: Are you considering using NGSO satellites to provide backhaul for your network? If so, please provides details of the capacity requirements/expectations and the locations where delivery of this type of backhaul would be likely.

At present no, however once NGSO satellites are operational and in service, their potential for usage will be investigated, contingent upon factors such as availability, resilience, latency, security, etc. According to early indications, while NGSO technology might theoretically support some applications, their usefulness and relevance will be severely limited by their unique failure mechanisms and the assumed inability to obtain any meaningful Service Level Agreements with the providers. Under no circumstances would they be appropriate as a stand-alone replacement for terrestrial microwave communication.

Question 8: If you already use alternative transport options for delivering your services, please: - Provide an indication of the proportion of your services delivered over fixed links vs each alternative that you currently use. Is this proportion likely to change over the next 5-10 years? Is so please provide details; - Explain how your business rationale for use of fixed links vs alternative

connectivity solutions is changing over time; - If possible, provide examples of your decision-making process for recently deployed connections

Our alternative service, Fibre, is always considered on a cost budget analysis and with opportunity of replacement of existing infrastructure.

Question 9: Which of the listed technologies are you already using, or do you plan to use in the future? For each that you are using/plan to use, please explain: - the current extent of your use, whether you expect to expand or shrink your use over the next 5-10 years, and how availability of these capabilities might impact your choice to deploy fixed links vs an alternative. Estimates of numbers or percentage of links deployed with each capability now and in the future would be valuable. We are particularly interested in feedback on future use of BCA.

• Co-Channel Dual Polar (CCDP) technology

This technology we have been using in the business for over 12 years and is used to provide resilience and diverse routing for the fibre optic network. In locations which are hard to reach by fibre e.g., a remote radio site which is a hub for multiple links, XPIC provides the capacity we need. It is expected that more of these links will be implemented in the future.

• Dual-band operation (band and carrier aggregation or BCA)

Due to the high availability requirements of our network, we cannot envisage a use for BCA.

• Adaptive Coding and Modulation (ACM)

This is currently deployed on 100 links within our network and, with the use of QOS, enables us to prioritise critical services during weather events. At our next network refresh, all existing links without this ability will be replaced.

Question 9a: If you plan to use BCA, would you plan to use this primarily for new links, upgrades to existing links or a mix? What factors affect your decision to deploy (or not deploy) BCA today? Please provide whatever detail you can.

N/A

Question 10: Do you have a need for W and D bands for fixed links use (or alternative uses)? If so, in what timescale? Please provide further details, including any evidence you have to support your response.

N/A

Question 11: Do you expect to apply for new fixed links in the upper 6 GHz band in the future, and if so, in which geographical areas? What are the reasons for choosing this band over other available bands or alternative technologies? Is there a technical reason why you would choose the upper 6 GHz band?

We are expecting to apply for fixed links in the U6GHz band, anywhere within ENWL's geographical reach. It is OFCOM who have put us into this frequency band due to lack of availability in other frequency bands such as 7GHz or 13 GHz. Its operational characteristics of long range propagation are a good match to replace the 7GHz unavailability.

Question 12: Are there other international developments that you are aware of that could affect availability and utility of fixed links in the next 5-10 years?

The ITU radiocommunication sector has recently published an ITU-R Report ITU-RM.2533-0 (09/23) which looks at the future, growing worldwide communications requirements for the utility industry.

The OFCOM consultation on *Hybrid sharing: enabling both licensed mobile and Wi-Fi users to access the upper 6 GHz band*, has serious implications on the operation of fixed links in the 6GHz band. Detailed consideration should be given to the work carried out by UTC in America https://utc.org/6ghz who have demonstrated the interference caused by Hybrid networks.

There is also concern over 6G developments expressing an interest in the 7-24GHz fixed wireless bands.

As a 10GHz user we are aware of ITU discussions in Region 2 specific to International Mobile Telecommunications (IMT).