Response to the Ofcom Call for Information on their Review of the use of fixed wireless links and spectrum implications

The European Utilities Telecoms Council (EUTC), representing European electricity and gas generation, transmission and distribution companies welcomes the opportunity to respond to Ofcom's Call for Inputs.

Summary

Wireless fixed links constitute a vital element of the telecommunications networks serving critical industries. This specifically holds true for utilities. Although the majority of telecommunications backhaul capacity in commercial telecommunication networks is and will continue to be provided by fibreoptic networks, the growth of critical communications networks and an increasing focus on resilience will require greater deployment of radio-based fixed links in networks for critical infrastructure. The main reason is that fibre is not available in remote locations where the critical infrastructure of utilities is needed. Laying out fibre to these locations is commercially often not attractive. In many of these cases radio links are the most viable option left. Because these scenarios generally require long distances between radio sites, and with increasing weather related incidents due to climate change, utilities require the lower frequencies bands where propagation characteristics are more amenable to these requirements.

Question 1: Please provide a description of your current use of fixed links.

The use of fixed links to which this response is addressed is described in the category 'Utilities' in Table3.1 of the CFI: "Provision of communications links for substation monitoring, network backup and security for energy, electricity, water and offshore windfarm companies." Figure 1 below illustrates how the telecommunications layer of a power grid maps onto the physical electrical grid network.

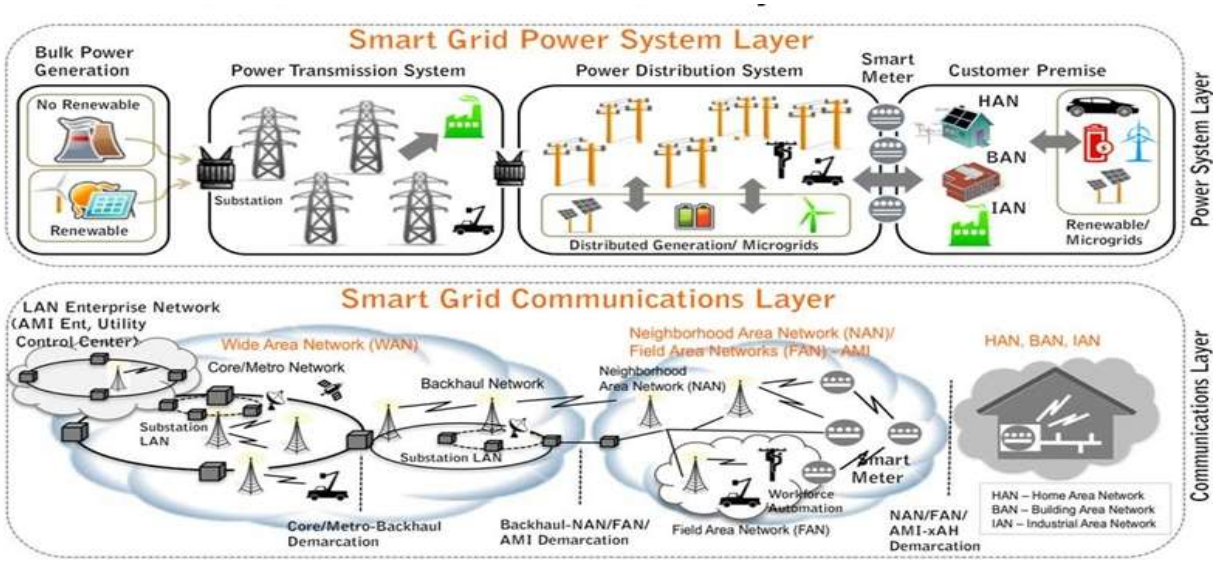

Fig.: 1 Smart grid communications physical architecture

Radio fixed links play a role in both transmission and distribution grids. Although fibre is the preferred option for most primary telecommunications paths, radio links have a role, where for example:

- Resilience to provide diverse redundant routing in case of an interruption to the fibre communication path, e.g. an excavator cutting a duct, a tree root pulling up a fibre, a pylon falling and breaking the fibre, water flooding destroying fibre cable ducts etc.
- A new renewable source of generation requiring connection to the network and where there is no commercial 4G service available and the installation of a fibre connection would delay the connection excessively.
- The cost of a fibre installation to connect a new energy source is disproportionate to the cost of the electrical connection and would otherwise make the connection non viable.
- Additional electricity infrastructure has to be installed and fibre is not available for the entire route.
- A backhaul link to a radio base station required for a critical operational telecommunications network.
- Adding fibre connectivity to a power line route would cause excessive disruption to third parties, eg digging a highway.

An incident may disrupt an electricity network and break a telecommunications fibre whilst power is still flowing, creating a potentially hazardous situation. Radio links controlling the electricity network are able to continue monitoring and controlling the incident.
(Picture courtesy ENWL)

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?

It must be stressed that radio fixed links form part of a highly available, diverse and resilient telecommunications network. The reasons for choosing fixed links in any particular location include:

- Speed of deployment
- Flexibility
- Diversity
- Cost
- Resilience
- Environmental considerations
- Lack of disruption which would be caused by installing a fibre or copper link.

The need for enhanced management of utility networks, new operational communications networks and the energy policy imperatives to connect more renewable generation together with demand management will most likely increase the demand for scalable communication services (radio fixed links) in utility networks. The approach to this challenge in other countries such as Scandinavia, Netherland, Poland or Germany is to build a cellular mobile radio network dedicated solely to critical infrastructure users with the focus on utilities. The design of these networks in Germany for example is using existing dark fibre at main locations to form the backbone of the network and use radio links to redundantly connect base stations to the core. This approach leads together with a proper design to highly resilient communication services for utilities but also keeps costs down due to the usage of radio links to (often remote) base stations. In this respect radio links have a strategic future oriented role in utility communications.

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 loss of lower frequency fixed links bands as illustrated by Figure 2 from the CFI is of great concern when installing long haul fixed links requiring high availability, especially in severe weather when the utility networks are under the greatest strain. The potential loss of the 6 GHz bands will only accentuate this problem.

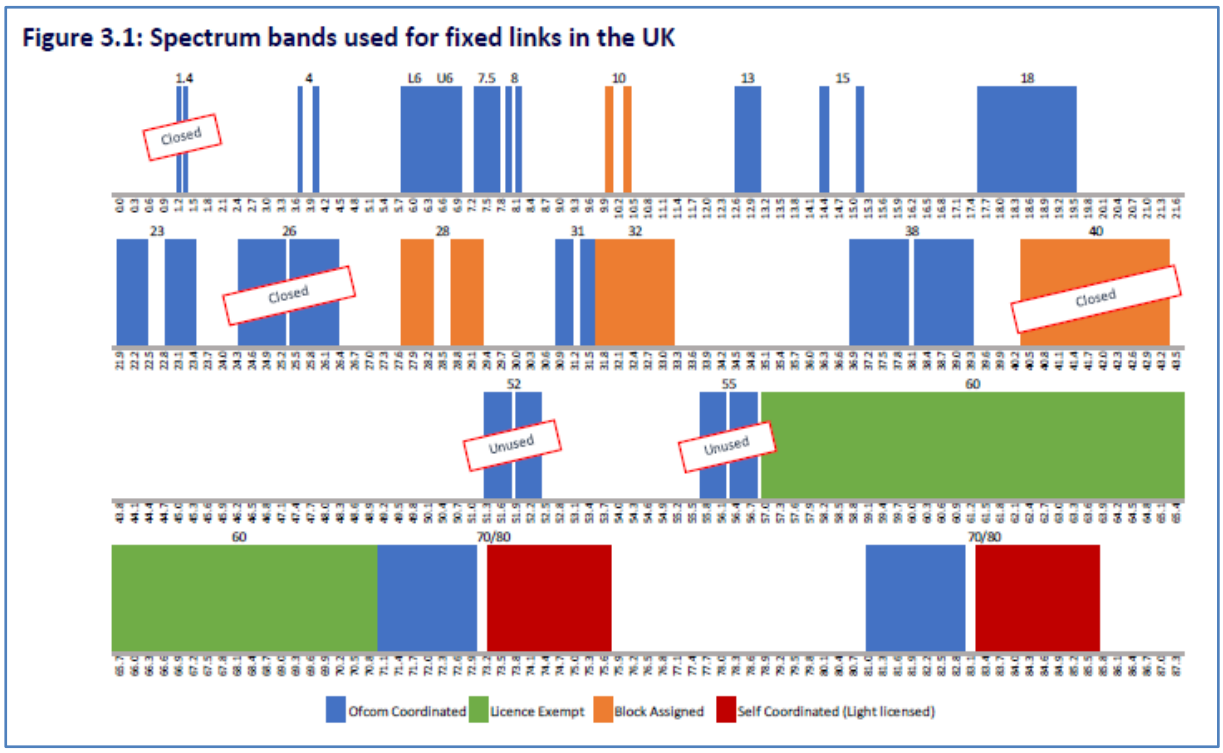

Fig. 2: Spectrum bands used for fixed links in the UK (CFI)

As climate change leads to more frequent and severe weather events, spectrum bands below the rain fade peak around 24 GHz become increasingly important.

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

By international comparisons, Ofcom's authorization processes are perceived to be flexible, efficient and responsive to customer requirements in most cases. The only area EUTC would highlight is the need for a rapid assignment process in cases of emergency. Where a power line of a critical fibre route is disrupted by an incident, a utility will normally seek to by-pass the damaged section with a temporary fibre/power cable laid on the ground. However, where there is a significant obstacle such as a river, motorway or railway line, this may not be possible. In these rare cases an emergency assignment process in order to install a temporary bypass link using microwave measured in hours rather than days would improve the situation significantly.

This situation becomes more critical with increasing numbers of severe flooding events involving the destruction of bridges over waterways and rivers. In some cases, utility and telecom services are conveyed through the bridge infrastructure, and its destruction interrupts both main and back-up telecoms pathways, leaving radio as the only alternative.

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.***

Ofcom will already have volume data for fixed links in their own licence records where utility links can be readily identified. The reason for the increase in the number of fixed links in the energy sector is driven by increasing deployment of renewable energy sources creating a two-way electricity network requiring greater monitoring and control than historically necessary.

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.D***

EUTC does not possess this information on the UK fixed link market. However, in EUTC's opinion, growth is likely to be driven in the UK by:

- Resilient connectivity requirements for an operational utility telecoms network if such a network proceeds in GB and/or NI. Redundant radio links would be used to connect (remote) base stations to the network core in a redundant and cost effective way. The backbone core would use existing dark fibre links.

- The need to install teleprotection services, 'loss of mains detection' services and critical demand management services in the distribution networks in areas where alternative fixed telecommunications services are not available, or will incur adverse cost or delay to install.

These changes are driven as much by national energy policy decisions as normal commercial pressures. Thus, the 8% growth in utility fixed links over the period 2016-2023 may be the best indicator of future growth based on current market conditions.

The growth is likely to be in terms of numbers of links rather than massive increases in bandwidth.

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.

These new links will generally be outside the main conurbations as connectivity around major towns and cities by fibre will normally be sufficient to meet these needs.

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

It is not currently perceived that NGSO satellites will have a major impact on critical operational utility telecommunications. At present, their resilience, availability, longevity and performance in adverse weather have yet to be established.

Once these parameters have been proven, the outstanding key performance metric will be end-to-end latency and continuation of connectivity during hand-over from one satellite to the next. As illustrated below in table 1 of performance requirements specified in IEC 61850, the global standard for substation automation, some of the classes of latency requirement will still not be achievable through satellite services.

Where longer transfer times are acceptable e.g. Performance Class P6, existing geostationary satellites established their dependability over a number years before being entrusted with critical utility telecommunications traffic.

TABLE 1: MESSAGE TYPE AND PERFORMANCE CLASS FROM IEC 61850 [5]

Performance class	Requirement description	Transfer time		Application
		Class	ms	
P1	The total transmission time shall be below the order of a quarter of a cycle (5ms for 50Hz, 4ms for 60Hz).	TT6	≤ 3	Trips, blockings
P2	The total transmission time shall be in the order of half a cycle (10ms for 50Hz, 8ms for 60Hz).	TT5	≤ 10	Releases, status changes
P3	The total transmission time shall be of the order of one cycle (20ms for 50Hz, 17ms for 60Hz).	TT4	≤ 20	Fast automatic interactions
P4	The transfer time for automation functions is less demanding than protection type messages (trip, block, release, critical status change) but more demanding than operator actions	TT3	≤ 100	Slow automatic interactions
P5	The total transmission time shall be half the operator response time of ≥ 1s regarding event and response (bidirectional)	TT2	≤ 500	Operator commands
P6	The total transmission time shall be in line with the operator response time of ≥ 1s regarding unidirectional events	TT1	≤ 1000	Events, alarms

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.***

As explained above in answer to previous questions, fibre is the preferred medium for critical utility telecommunications, and will continue to be so in the future.

Where sub 100ms end-to-end latency is essential, satellite is unlikely to be a solution, and also especially in the case of NGSO satellites when there is a sovereignty requirement for traffic to be contained within the UK jurisdiction.

This implies a continuing and growing requirement for fixed links as the number of points of connectivity in utility networks grows by several orders of magnitude. However, it should be noted that whereas the number of points of connectivity will grow, the data volumes delivered by each device are unlikely to grow by the same orders of magnitude as in other markets, and the traffic will be upload centric as opposed to general consumer networks where the traffic is download centric.

Remote base station sites are most cost effectively and resiliently connected into the backhaul network by microwave fixed links.

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.***

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.

Capacity is not as major an issue for utility backhaul networks as for commercial operators. Increasing the number of connectivity points to be backhauled together with an increase in video traffic is increasing data volumes, as is the demand for increased security, but not to the same extent as consumer based networks. On the other hand the base station connectivity to the core network in a mission critical cellular network would require a substantial amount of bandwidth due to the aggregation of end devices in the connected radio cells.

Since availability and resilience are major drivers, the technology of greatest importance in the list in paragraph 5.9 of the CFI is 'Adaptive Coding and Modulation (ACM)'. This enables a core set of applications requiring at least 99.999% availability to be carried on links which might not otherwise be able to deliver this grade of performance.

Question 10: Do you have a need for W and D bands for fixed links use (or alternative uses)? If so, in what timescale?

It is difficult to see a role for W and D bands in utility applications because of the short distances covered by these links and their vulnerability to adverse weather events.

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?

Because utilities expect a life-time for their communication infrastructure of 10-25 years, they are shunning the upper 6 GHz band because of the uncertainty regarding its continuation as a high performance fixed link band. As explained, the critical nature of the utility use cases requires reliable radio links in all weather conditions which leads to frequencies below 8 GHz. Where possible, the 7.5 GHz band is much preferred and required.

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 international developments affecting utility use of fixed links over the next period up to 2050 are likely to be environmental goals to reduce carbon dioxide emissions to net zero which on current trends will mean a growth in electricity demand by up to five times its current capacity[1] together with a shift from fossil fuel generation towards renewable energy sources. This is likely to drive the deployment of increasing numbers fixed links in the UK (although not necessarily a significant increase in capacity of each link) to support the electricity infrastructure.

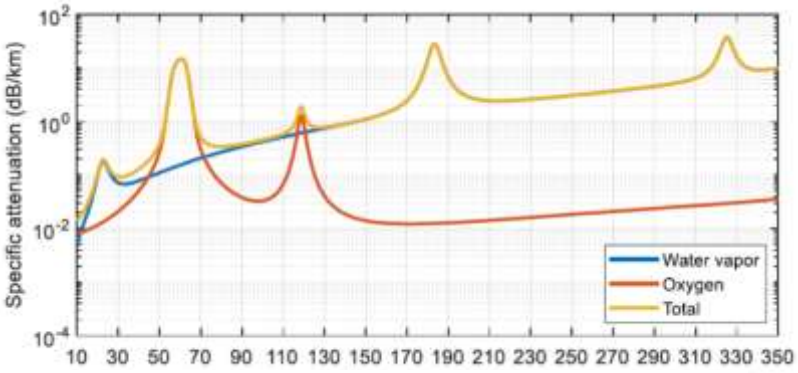

Fig. 3: Specific attenuation versus frequency

Ideally, these links will be in spectrum below the 24 GHz peak in atmospheric attenuation (as illustrated in Fig. 3 of the accompanying chart from ECC Report 282[2]) to offer long range and maximum immunity to increasingly severe weather events as highlighted by Figure 4 from the same report.

[1] Paragraph 61 of evidence by Tim Ambler to BEIS Parliamentary Select Committee on 9th January 2023 https://committees.parliament.uk/writtenevidence/115773/pdf/

[2] 1337 (cept.org)

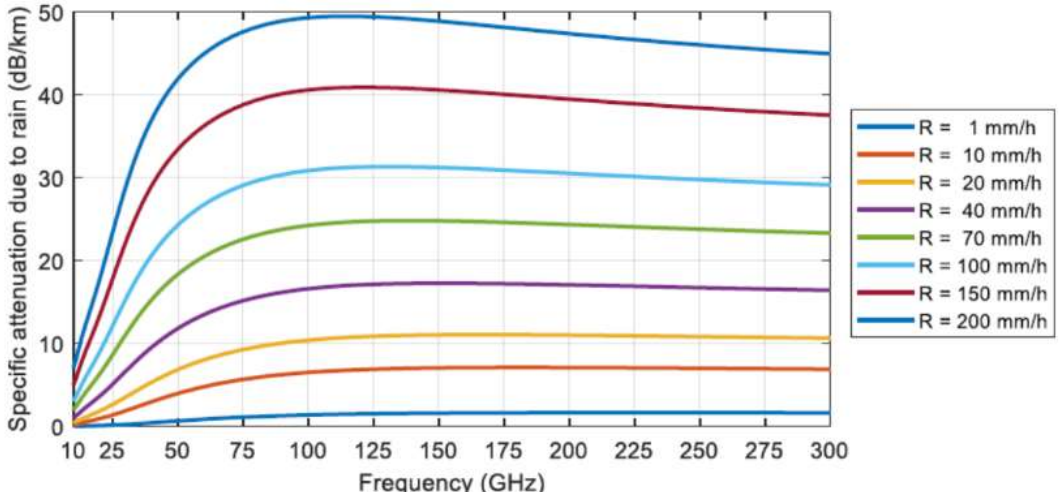

Fig. 4: Specific attenuation due to rain according to Recommendation ITU-R

The European Utilities Telecom Council (EUTC)

The European Utilities Telecom Council (EUTC) is the leading European Utilities trade association dedicated to informing its members and influencing policies on how telecommunication solutions and associated challenges can support the future smart infrastructures and the related policy objectives through the use of innovative technologies, processes, business insights and professional people.

This is combined with sharing best practices and learning from across the EUTC and the UTC global organization of telecommunication professionals within the field of utilities and other critical infrastructure environments and associated stakeholders.

In addition to continental Europe utilities EUTC includes a number of UK utilities and industrial partners operating in the UK.

Typical utility distribution control room

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