Consultation Questions

Question 1:
Do you agree that we have identified the key drivers likely to have a significant impact on the spectrum demand for fixed wireless links? If not, please provide further detail and evidence to support your answer.
Do you have other comments to make/points to raise with us on these issues?

The challenging objectives of resilience and availability required of utility communications in keeping the lights on dictate a continued requirement for defined network (defined infrastructure, circuit routing and sites), which is best ensured on a self-provide / owned / operated basis.

Meeting these objectives is complicated by the continued low level of fibre penetration within rural UK and the challenging geography in which SSE operates, all of which indicate a continued reliance on radio links operating on spectrum which: affords favourable propagation characteristics; enables implementation of links over long paths; and provides redress in the event of interference from other users.

The application of millimetre wave (V&E) bands and potential of high capacity links appears of significant value in relation to rural broadband provision and mobile front-haul although susceptibility to fading places severe limits on path lengths for any acceptable level of path availability and this, in conjunction with the associated licencing regime render the bands inappropriate for critical traffic associated with the control and stability of the electrical network.

Access to the appropriate, protected spectrum, in conventional Ofcom-managed microwave bands will remain essential for the operation of utility networks and development of smart energy systems.

To be of use in meeting potential demand, it is important that availability of high bandwidth channels within the licenced microwave bands is given priority over assignment of low bandwidth channels both to enable deployment of high capacity links and link aggregation.

Question 2:
Do you agree with our conclusions on spectrum implications and our proposed strategy/next steps for each band?
Are there any other considerations of significance that you feel we should have included or do you have other comments to make/points to raise with us on these issues?
Please provide as much detail as possible to support your answer.

<u>1.4GHz</u>

Whilst historically, SSE has deployed very few links in the 1.4GHz band, this is partly due to the "depth" of microwave in the SSE network with subsequent aggregate capacity

prohibiting deployment of low capacity links. However, the propagation characteristics of this band – both in relation to resilience to rain fading and diffracted path working - are considered useful in resolving links to remote and obstructed locations. Given the predicted growth in connectivity requirements through "smart grid" enablement, this band would have been considered of significant value in resolving connection requirements for small sites in very remote locations at the very edge of the network. Latency constraints associated with tele-protection signalling are however likely to negate use of equipment configured as TDD due to degraded latency performance. The availability of duplex frequencies is therefore considered essential should this band be considered for smart grid application.

3.6 – 3.8GHz, 3.8 – 4.2GHz

The proposed consultation to allow further sharing in the band 3.8-4.2GHz is welcome due to the potential for provision of Fixed Wireless Broadband. This of course will be dependent on licencing constraints and cost and on the availability of hardware to operate within this band.

Lower and Upper 6GHz

These bands are considered essential for future deployment of high capacity links over very long (e.g. 30km – 60km) paths where link aggregation would be essential in realising capacity requirements for example for broadband back-haul. Spectrum congestion would rule out the use of the conventional 7.5GHz band.

It is important then that availability of high bandwidth channels within L & U6GHz are given priority over assignment of low bandwidth channels to enable deployment of high capacity links over contiguous sites.

Bands between 20GHz and 45GHz

The changes discussed in paragraph 4.24 would, if enacted, appear to leave 23GHz as the only Ofcom managed band within this range which is available on a non-block assigned basis. The use of the higher bands suggested as an alternative option to Ofcom managed bands would not be appropriate for utility communications both due to the "light licenced" / unprotected nature of spectrum assignment and due to the degraded latency performance of packet radio which prevails in the millimetre band environment.

Bands above 45GHz

The proposal to allow Multi Point and mesh technologies in the millimetre V Band may enable innovative solutions for combined wireless access and front-haul for Fixed Wireless Broadband and Centralised-RAN.

Performance demands of tele-protection signalling place heavy constraints on technology utilisation and on configuration parameters and currently dictates retention of TDM based radio equipment. The use of packet radio for tele-protection is a current research subject, although this is still unlikely to enable the use of capacity enhancing techniques. The potential of multiband systems to enable parallel use of conventional microwave bands in conjunction with higher capacity millimetre (E) band equipment could prove useful both from the point of increased capacity for smart grid and asset protection and for rural broadband back-haul. In such a configuration, millimetre (E) Band equipment would utilise capacity enhancing techniques and a ring topology would be used to

improve on path availability (enabling the microwave component to be operated at a conventional path length for that band).

Question 3:
Do you agree with the items we've identified for further consideration? Are there any other significant areas that you believe should be included? If so, please include all necessary evidence to support your view.

Please refer to our response to Question 2 in relation to the use of TDD for 1.4GHz radio links and in relation to the importance of availability of higher bandwidth channels for L/U6GHz radio links.

Developments proposed within the millimetre bands to facilitate high density fixed services should be considered complementary to fixed links deployed within the conventional microwave bands. Millimetre band spectrum cannot be considered as providing a direct replacement for microwave band spectrum for Utility applications due to a lack of spectrum protection and practical constraints of diminished availability and shorter path lengths.

Question 4:
Do you agree with our proposal to change the authorisation regime in the 64 – 66 GHz band to licence exempt to create a common authorisation approach across the 57 – 66 GHz band for fixed outdoor installation use and that this would be a benefit to UK citizens and consumers?
Yes. Also, the availability of alternative (mesh / PtMP) topologies is considered essential to stimulate take up of this band.

Question 5:
a) Do you agree with the proposed new technical conditions in Table 6 to facilitate equipment intended for fixed outdoor installation in the 57 – 66 GHz band? Please provide evidenced views /alternatives if you disagree with our proposal. Do you consider any additional conditions should be mandated as part of a licence exemption to manage the interference environment?
We agree with this. The conditions should include the requirement for Class 4 antennas, particularly for higher eirp operation.

b) Do you agree with our assessment that the proposed changes in technical conditions will have minimal impact on existing use and are appropriate to manage the future outdoor interference environment?
c) Are there likely to be any fixed outdoor installation use cases that will require operation at eirp levels above 55 dBm? If so, please provide evidence of how the coexistence with the different outdoor users could be ensured?
We are not aware of any at this time and believe there is insufficient evidence to consider whether or not increased eirp would provide a proportional benefit (as opposed to just leading to an increase in multipath interference). A potential application of higher eirp may be to enable longer links in deep rural / remote locations, in which case coexistence would be less of a problem.

Question 6:
a) What are the use cases and technical parameters envisaged for the 66 - 71 GHz band? Are they likely to be similar to those in the 57 – 66 GHz band? If so, what are your views on extending the same or similar technical conditions as described above for the 57 - 66 GHz band

(both existing wideband data transmission (SRD) and new fixed outdoor technical conditions) to the 66 – 71 GHz band to facilitate both fixed and mobile use cases.
Broadband access and C-RAN dependent on enabling alternative to Point to Point topologies.
b) Please provide your view on whether the technical parameters of wideband data transmission (SRD) as shown in Figure 4 are suitable to facilitate mobile/portable equipment including use outdoor? If you do not consider they are suitable, what alternative technical parameters do you think should be considered?
Please provide as much detail to your answer as possible and your considerations on the co-existence aspects.

Question 7:
Do you agree that there is a continued need for future low capacity fixed link applications? If so, please provide information to support your view and what alternatives you would consider appropriate should the upper 1.4 GHz band no longer be available.
Please provide clear evidence to support the reasons for your views.
Please refer to responses to Questions 1 & 2 which should be considered in conjunction with the response below.

The extent of the geography which our utility communications network covers means that we remain reliant both on high capacity radio links in the core network and on low capacity radio links at the edge of the network. As the penetration of fibre increases over time – for example with transmission line re-conductorisation including fibre provision – it is envisaged that fixed radio links will become less prevalent within the core network, but more so to the edge of the network given the anticipated growth in connectivity requirements.

At this point in time, requirements could be met by low capacity links although the capacity required per-site is likely to rise with implementation of new services.

As requirements for connectivity penetrates deeper into the electrical network, this is likely to bring significant challenge in establishing Line of Sight paths to very remote sites, which is where the propagation characteristics of lower frequency bands (e.g. 1.4GHz) may enable links which otherwise would not be viable. The critical aspect of this is the ability to provide connectivity (as opposed to capacity), which may entail implementation of links over diffracted paths and with a low modulation scheme to maximise system gain and availability.

TDD operation within the 1.4GHz band is unlikely to meet latency objectives and therefore a band with comparable propagation characteristics would be required. L/U6GHz is unlikely to fulfil these requirements and is likely to result in larger form factor antennas and the requirement for more rigid mounting structures and for taller structures to enable higher antenna elevation.

Question 8:
Do you consider there is merit in considering making the bands 52 GHz and 55 GHz available under alternative authorisation approach(es)such as block assignment? If so, what would you consider to be the best approach(es)? Please provide detailed views to support your response.
Question 9:
Do you think we should review our authorisation approach to any other band used for fixed wireless links?
Question 10:

a) How do you envisage W band and D band will be used for mobile backhaul provision and the likely timescales? Please provide as much detail as possible on deployment scenarios and whether this would include indoor use. Are there any other types of applications (other than mobile backhaul) that could be suited for these bands?
b) What are your views on the most appropriate authorisation approach for the W and D bands? Please provide as much detail and technical evidence as possible in your answer.

Question 11:
Which capacity enhancing technique(s) are you using or planning to use? Please provide detail / evidence and clearly explain why and how each technique is planned to be used and if you consider there are any other aspects that should be considered.

Within the microwave bands and in relation to Utility use, most capacity enhancing techniques (e.g. Adaptive Modulation or improved system gain through advanced Forward Error Correction) are complicated due to degradation in latency performance and variation.

Availability of multiband systems appear of interest with the potential to enable a microwave Point to Point link transporting latency-critical traffic, in conjunction with a higher capacity millimetre band Point to Point link to meet capacity demands. Link path lengths would however be dictated by the microwave component and in such case, a ring topology is probably more appropriate to improve on the degraded availability of the millimetre link component.