W&D Band – An Operator Perspective
UK Spectrum Policy Forum THz Spectrum Workshop

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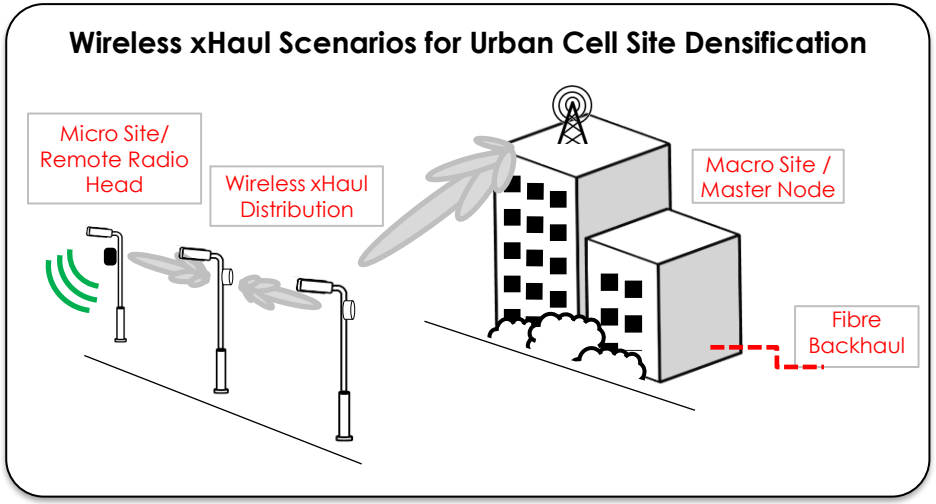
View of Extremely High Frequency (EHF) Use Cases

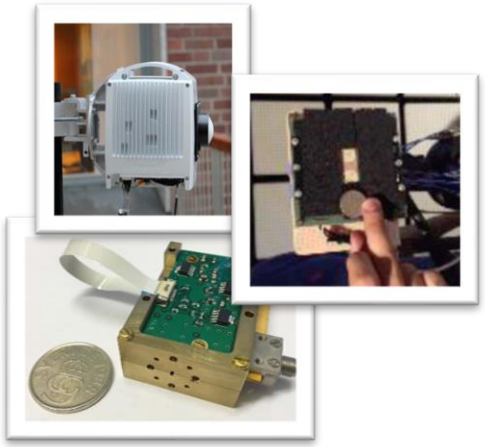
- In the short term BT is primarily focused on research activities below 175GHz – specifically wireless transport/backhaul use cases.
- It is perhaps too early to conclude clear requirements for low power access/sensing applications of spectrum above 100GHz e.g. spectrum available across bands: 116-122 GHz,174.8 – 182 GHz and185-190 GHz.
- Fixed service use cases present the most mature application of EHF bands – namely short range wireless transport solutions in the 'W-band' 92-114.25GHz and 'D-band' spectrum 130-174.8GHz.
- W/D band present opportunities to realise dense mobile network architectures with fibre like short range wireless links.



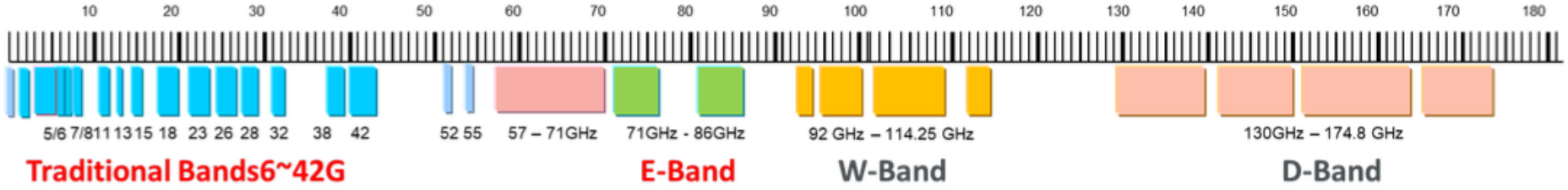
Performance Considerations

- Bands >100GHz have the potential to compliment fibre connectivity solutions in urban environments. Bandwidth and duplexing schemes should facilitate performance parity with fibre optics interfaces.
- Multiples of 10Gbps in E/W band and multiples of 25Gbps in D-band (achievable with 5GHz bandwidth with realistic link budget and availability targets).
- Anticipated performance could enable future deployment architecture models such as centralised or cloud RAN requiring high capacity, low latency 'fronthaul' based transport solutions.

	6-42GHz (Traditional microwave)	71-86 + 92-114GHz (E-band + W-band)	130-175GHz (D band)
Link Capacity	Good ~500Mbps	Excellent n x 10Gbps	Excellent n x 25Gbps
Link Length	Excellent 10(s)km	Good <3km	Fair <0.5km
Frequency Re-Use	Good	Good (narrow beam widths)	Excellent (narrow beam widths + smart antennas)

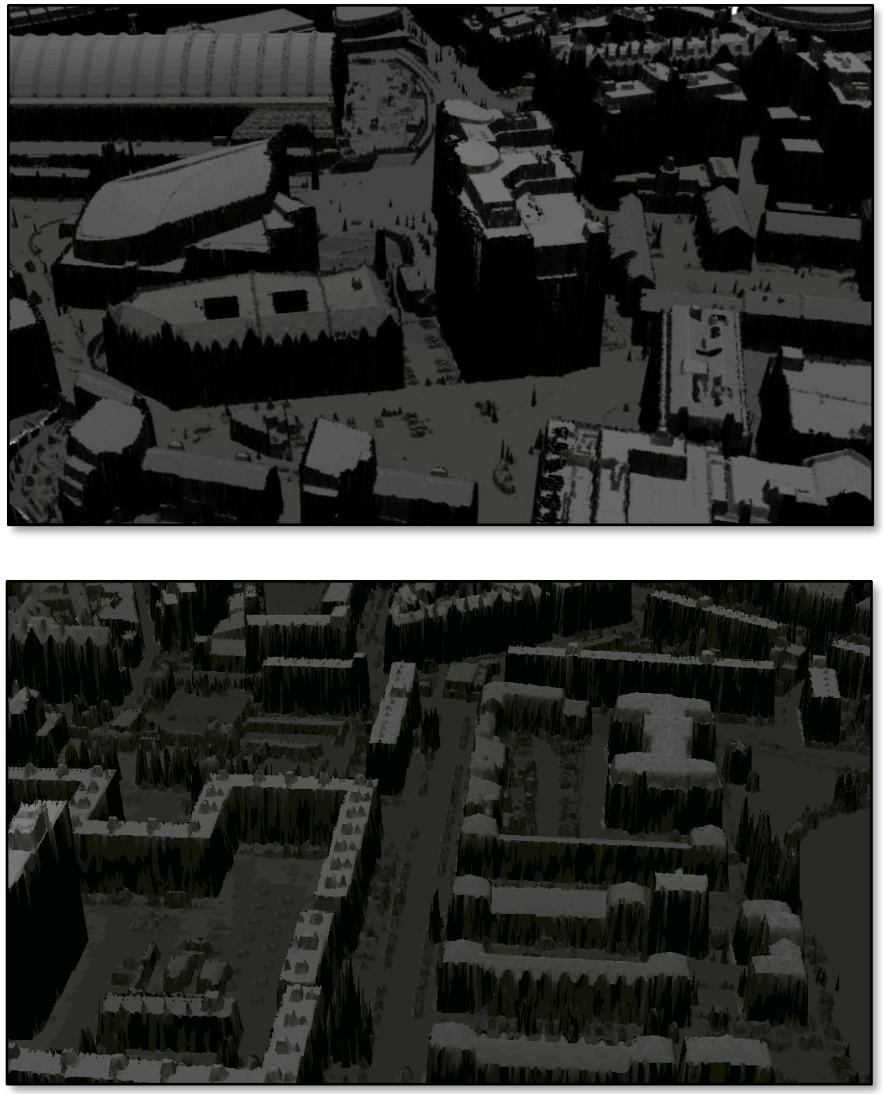


Source: ETSI mWT ISG - *etsi.org/committee/1426-mwt*



Planning Considerations

- BT are actively researching deployment scenarios for W/D band transport solutions to support national mobile network densification.
- EHF spectrum presents challenging propagation characteristics, a high susceptibility to blockage (building/foliage etc) and antenna misalignment – i.e. predominantly line-of-sight (LOS) .
- Deployment generalisations and low resolution environmental approximations have proven adequate for radio planning microwave bands. Environmental resolution relative to wavelengths is often the limiting factor for accurate EHF radio planning particularly in urban street level scenarios.
- The substantial bandwidth available at EHF facilitate multiple licensing regimes including shared access and block allocation for self-managed interference and rapid deployment.

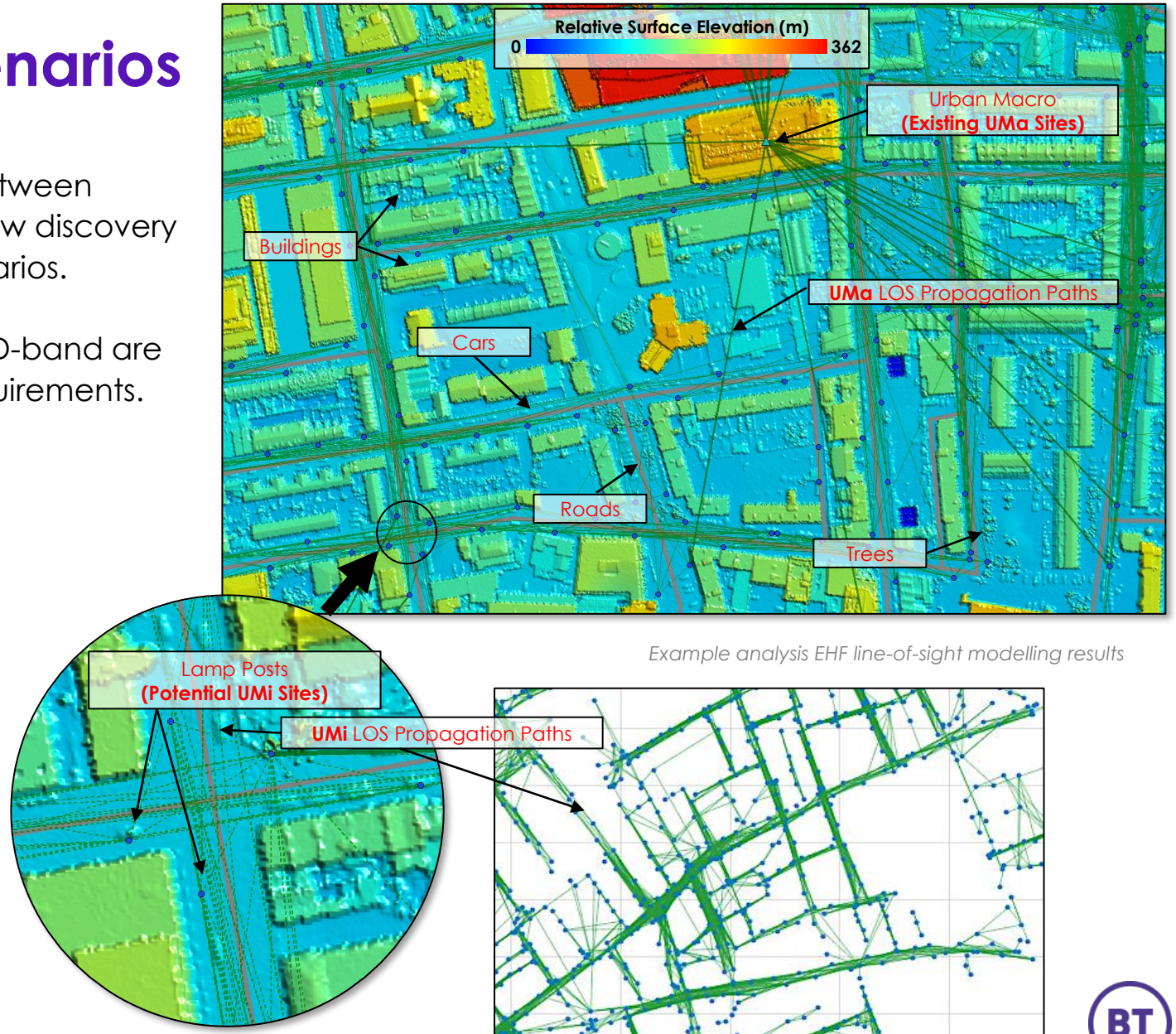


LIDAR based digital surface model 3D render (urban London/Manchester)

Example Fixed Service Scenarios

- Detailed studies of line-of-sight propagation paths between potential infrastructure sites in UK towns and cities allow discovery of the ideal EHF link properties and deployment scenarios.
- The characteristics of bands above 100 GHz such as D-band are well aligned with future urban small cell transport requirements.

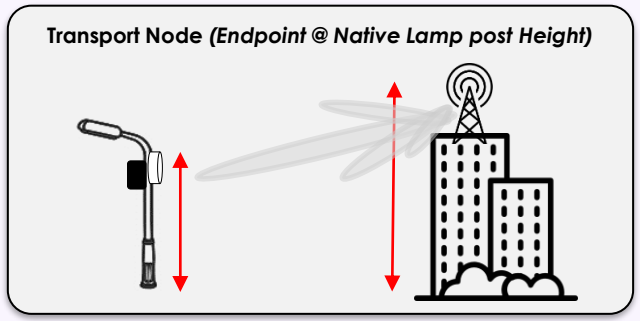
Modelling results exported and visualised with Google Earth

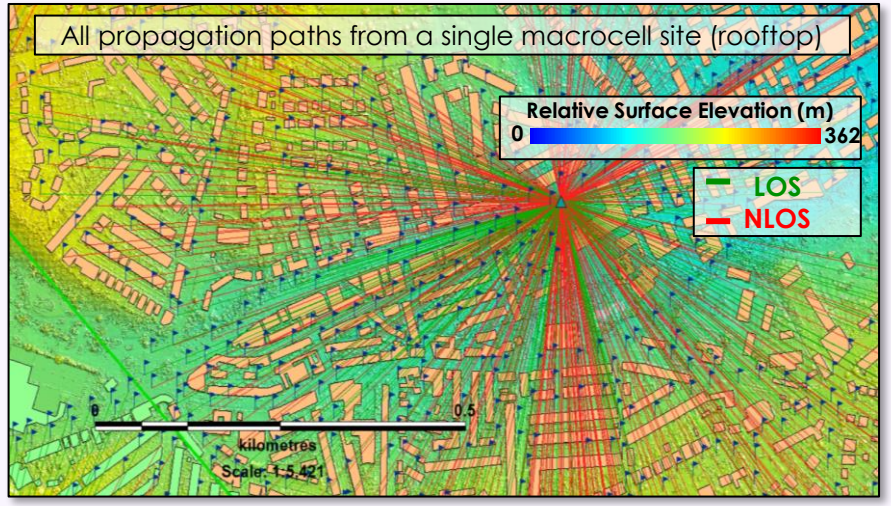


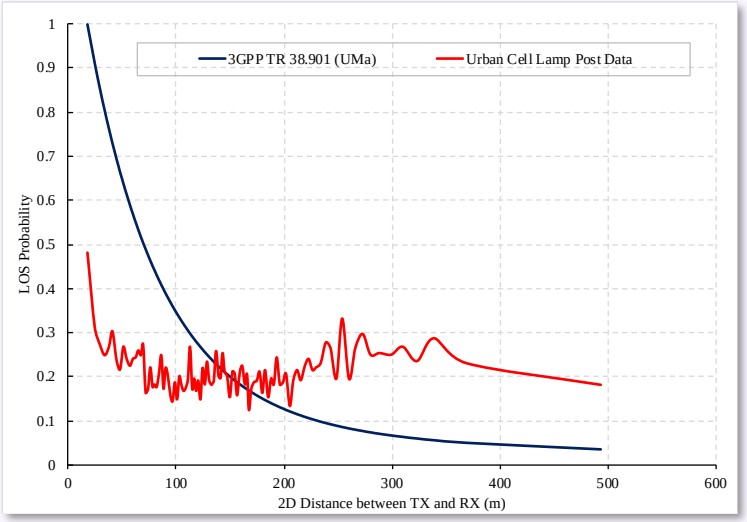
Example analysis EHF line-of-sight modelling results

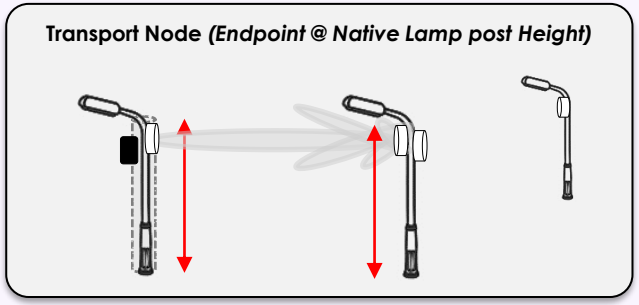
Appendix

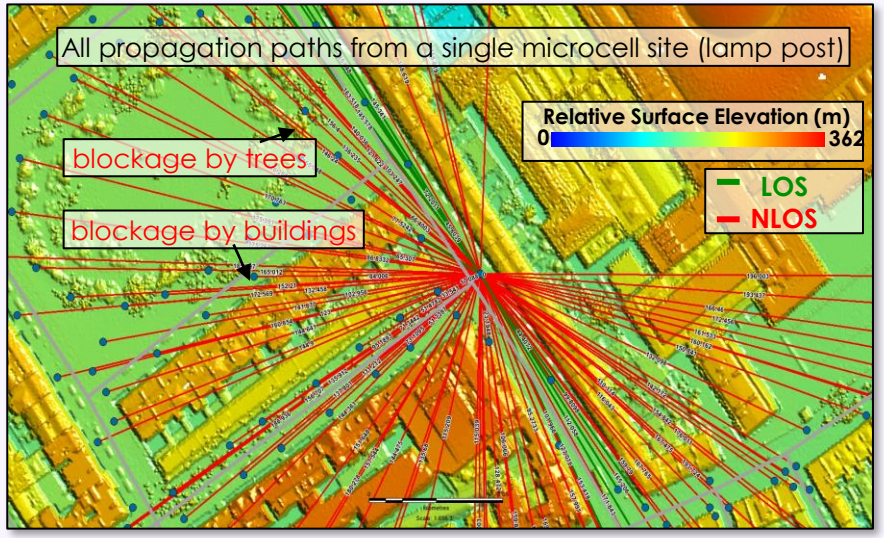
Line-of-Sight Properties – EHF Transport

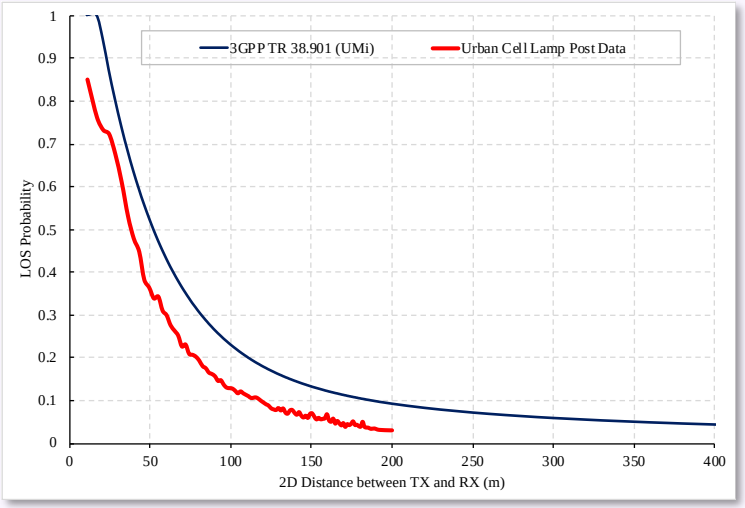






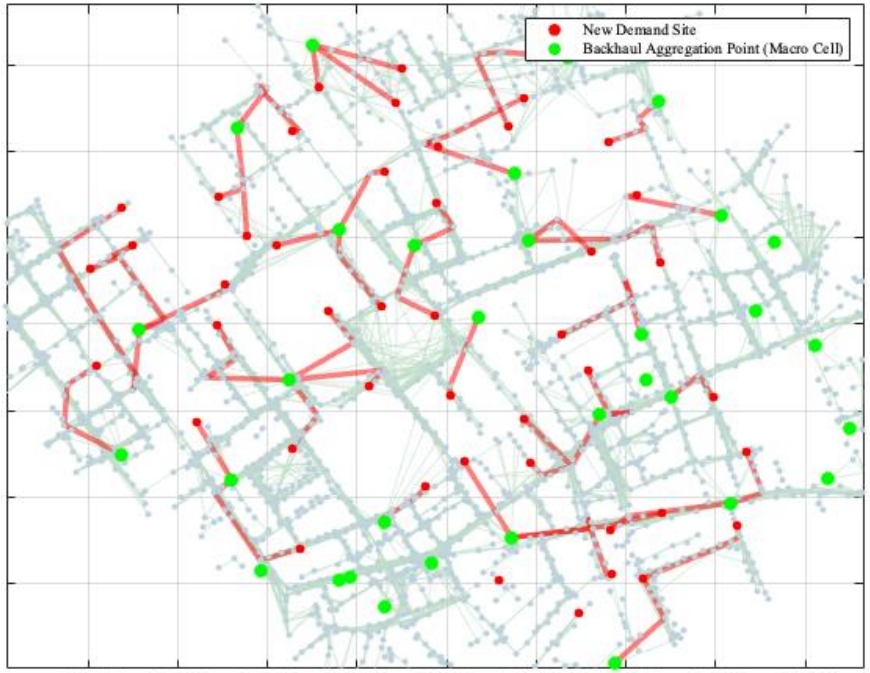


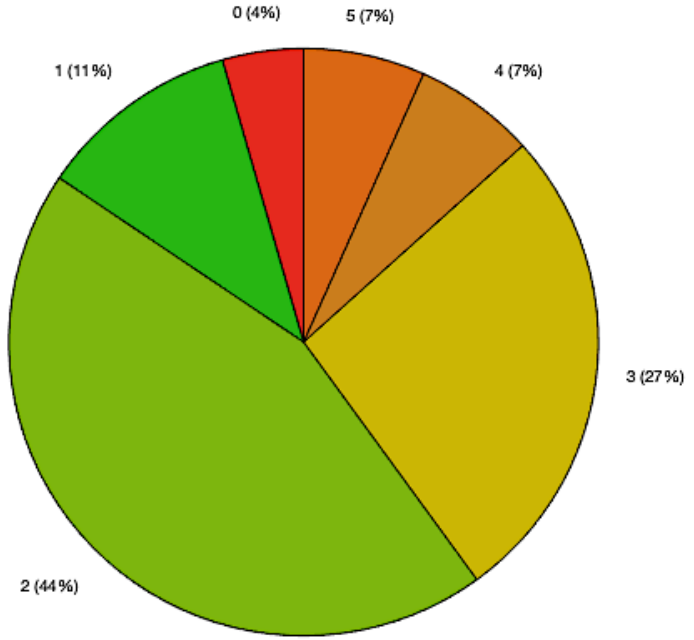




Multi-hop Properties - EHF Transport

- How many new lamp post based micro sites could be wirelessly aggregated (fronthauled) to an existing macro site if cell density was built to an inter-site distance of 200m?





Number of xHaul 'Hops' Required to Nearest Fibre Aggregation Point (Macrocell)

Target ISD	Number of new Sites Required	Number of new Hops Required	Maximum Hop Length Required	% of New Sites Successfully Backhauled
200 m	45	108 (63 are relay sites)	237 m	96% (82% within 3 hops)