EUSTON TOWER

Telecommunications Report

December 2023

British Land

Contents Page

Issue	Date	Details of Changes
0.0	15/08/2023	Working draft
0.1	31/10/2023	First draft issue
1.0	15/11/2023	First issue - minor editing
2.0	05/12/2023	Second issue - editing to address legal review comments. Chapter 6 updated. Other minor editing
Author: G Phillips		Reviewer: O Lloyd

GTech Surveys Limited

GTech Surveys Limited is a Midlands based broadcast and telecommunications consultancy conducting projects throughout the entire UK. We undertake mobile phone network, television and radio reception surveys (pre- and post-construction signal surveys), conduct broadcast interference and reception investigations, and support telecommunications planning work for wind energy developers, construction companies, architects, broadcasters and Local Planning Authorities.

In addition to radio interference modelling services and television reception surveys, we produce EIA and ES Telecommunications Chapters (also known as an 'Electronic Interference Chapter'); satisfying the requirements of Part 5, Regulation 18 (Parts 5a and 5b) of The Town and Country Planning EIA Regulations 2017. We peer review ES and EIA work, liaising with telecommunications providers (Arqiva, BT etc.) and advise developers with respect to associated Section 106 (Town and Country Planning Act 1990) and Section 75 (Town and Country Planning (Scotland) Act 1997) agreements.

GTech Surveys Limited is a consultant member of the Trade Association for Content Delivery - (Confederation of Aerial Industries Ltd - CAI) and the RDI - the digital sector's professional body and trade organisation. We are listed on Constructionline and verified as a Safety Schemes in Procurement (SSIP) member by Safety Management Advisory Services (SMAS), making us compliant with the industry standard PAS 91:2013 + A1:2017.

Professional broadcast trained project engineers deliver, and supply QBE insured technical products to support planning applications, discharge planning conditions (including S106 Agreements) and for due diligence. For more information about GTech Surveys Limited please visit our website - www.gtechsurveys.com

GTech Surveys Ltd.
Accountancy House,
4 Priory Road,
Kenilworth,
Warwickshire,
CV8 1LL.

T: +44(0) 1926 744771

Executive Summary

A baseline (pre-construction) signal survey and reception impact assessment has been undertaken to determine the potential effects on the local reception of television services from the proposed redevelopment of Euston Tower. This assessment has been produced to investigate the possibility of television interference and to provide the baseline reception data to assist with any further studies if required. Accordingly, impacts to the reception of digital terrestrial television (also known as Freeview) and digital satellite television services (such as Freesat and Sky) have been assessed.

Interference to the reception of digital terrestrial television (DTT) services reception is not expected (DTT is commercially known as *'Freeview'*). The existing structure (Euston Tower) which occupies the application Site, already dominates local reception conditions, yet coverage is still robust. The Proposed Development is unlikely to cause any new or different interference effects. As no interference is expected, no mitigation measures are required to restore reception.

Whilst the Proposed Development is unlikely to cause any disruption to the reception of digital satellite television (such as Freesat and Sky), the use of tower cranes used during the construction phase may cause interference to the reception of digital satellite television services in areas to the immediate northwest of the Site, in particular, Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets. In these locations, the use of tower cranes could obscure satellite dish views of the southern skies, resulting in sporadic interference occurring during crane lifting operations. If any interference does occur, the repositioning of the affected satellite dish to a new or different location with a clear line-of-sight view to the serving satellites should restore optimal reception. If satellite dish relocation is not possible, the use of DTT receiving equipment or TV via fibre / broadband could offer any affected satellite television viewer an alternative source of some digital television broadcasts.

Overall, the use of tower cranes is likely to cause disruption to the reception of digital satellite television services in areas to the immediate northwest of the Site. In this identified area, clear line-of-sight views of the southeastern skies could be obscured, resulting in interference. If interference does occur, the repositioning of satellite dishes to new locations without an obscured line-of-sight view to the serving satellites should restore reception. If satellite dish relocations are not possible, the use of DTT receiving equipment or TV over broadband / fibre is likely to offer any affected satellite television viewer an alternative source of some digital television broadcasts. These are acceptable, standard and easy to adopt mitigation solutions in situations where construction work has degraded local television reception. Any sporadic interference arising from tower crane use is expected to be limited in duration (only occurring during working hours) and will cease completely when the cranes are removed.

This report provides the existing level and quality television signal reception within the survey area and can be used for reference. This assessment has been produced to support the planning application submission.

1 - Introduction

This Pre-Construction Television Signal Survey and Reception Impact Assessment has been prepared by GTech Surveys Limited in support of a full planning application submitted to the London Borough of Camden (LBC) by British Land Property Management Limited (thereafter British Land and referred to as 'the Applicant') for the redevelopment of Euston Tower, 286 Euston Road, London, NW1 3DP (hereafter referred to as 'the Site').

This Pre-Construction Television Signal Survey and Reception Impact Assessment should be read in conjunction with other supporting documents submitted with the planning application, including the Planning Statement and the Design and Access Statement, which explain the Proposed Development in more detail and relate it to the surrounding context and planning policy framework for the Site.

Overall, this report summates the findings of a comprehensive study and pre-construction signal reception survey to determine the viewing preference of receptors located around the Site and identifies what impacts and effects the Proposed Development may have on the reception of television broadcast services.

The Proposed Development

Full planning permission is sought for the redevelopment of Euston Tower, including the partial retention (retention of existing core, foundations and basement), disassembly, reuse and extension of the existing building, to provide a 32-storey building for use as offices and research and development floorspace (Class E(g)) and office, retail, café and restaurant space (Class E) and learning and community space (Class F) at ground, first and second floors, and associated external terraces. Provision of public realm enhancements, including new landscaping, and provision of new publicly accessible steps and ramp. Provision of short and long stay cycle storage, servicing, refuse storage, plant and other ancillary and associated works.

British Land's vision is to create a world leading science, technology and innovation building and public realm for Camden and the Knowledge Quarter that inspires, connects and creates opportunities for local people and businesses. This will be achieved by:

- Transforming the disused Euston Tower ensuring it is fit for the future by adopting cutting-edge sustainability targets and reusing, recycling, and offsetting where necessary, to reach net zero at completion and in operation.

- Putting social impact at the heart of the project from the start and ensure that communities play a key role in shaping new spaces which meet local needs.

- Creating pioneering workspaces in the Knowledge Quarter for businesses of all sizes to prosper, including flexible incubator and accelerator spaces, to support start-ups and knowledge sharing.

- Ensuring that the future use of Euston Tower is built upon identified needs and contributes to a thriving local, regional and national economy for our ever-changing world.

- Reimagining the public spaces of Regent's Place, creating safe, inclusive, connected and sustainable spaces for Camden's communities.

- Contributing to meeting Camden's housing needs.

The Site and Surrounding Areas

Euston Tower is situated within the London Borough of Camden ('LBC'), and the ward of Regent's Park. The Site is bounded by Euston Road (south), Hampstead Road (east), Brock Street (north) and Regent's Place (west). The Site covers an area of 7,250sqm, comprised of a single, ground plus an existing 36-storey tower. The tower has been largely vacant for several years, predominantly comprising office uses on the upper floors, however there are still retail uses currently in operation at ground floor level. The Site does not fall within a conservation area; however, Fitzroy Square CA and Bloomsbury CA are both located in close proximity (south). There are no elements of the Site that are statutory or locally listed. A Certificate of Immunity from listing has been submitted and at the time of submission is still pending in respect of the existing tower. There are several buildings located within a close radius of the Site that are Grade I, Grade II and Grade II* listed. The Site has a PTAL rating of 6b indicating 'excellent' transport connectivity. The Site is mainly served by Warren Street Underground Station (south), Euston Square Underground Station (east) and Great Portland Street Underground Station (west). There are also several bus routes that serve the site along Euston Road (south) and Hampstead Road (east).

The land surrounding the Site consists of a range of uses. The Site is designated within the Knowledge Quarter Innovation District ('KQID'), home to world-class clusters of scientific and knowledge-based institutions and companies specialising in life-sciences, data and technology and creative industries. The neighbouring Regent's Place comprises commercial, office and cultural land uses, as well as pedestrianised streets and public realm incorporated into the space. The closest residential properties are located along Drummond Street (north) and Hampstead Road (east). Figure 1 shows the location of the Site.

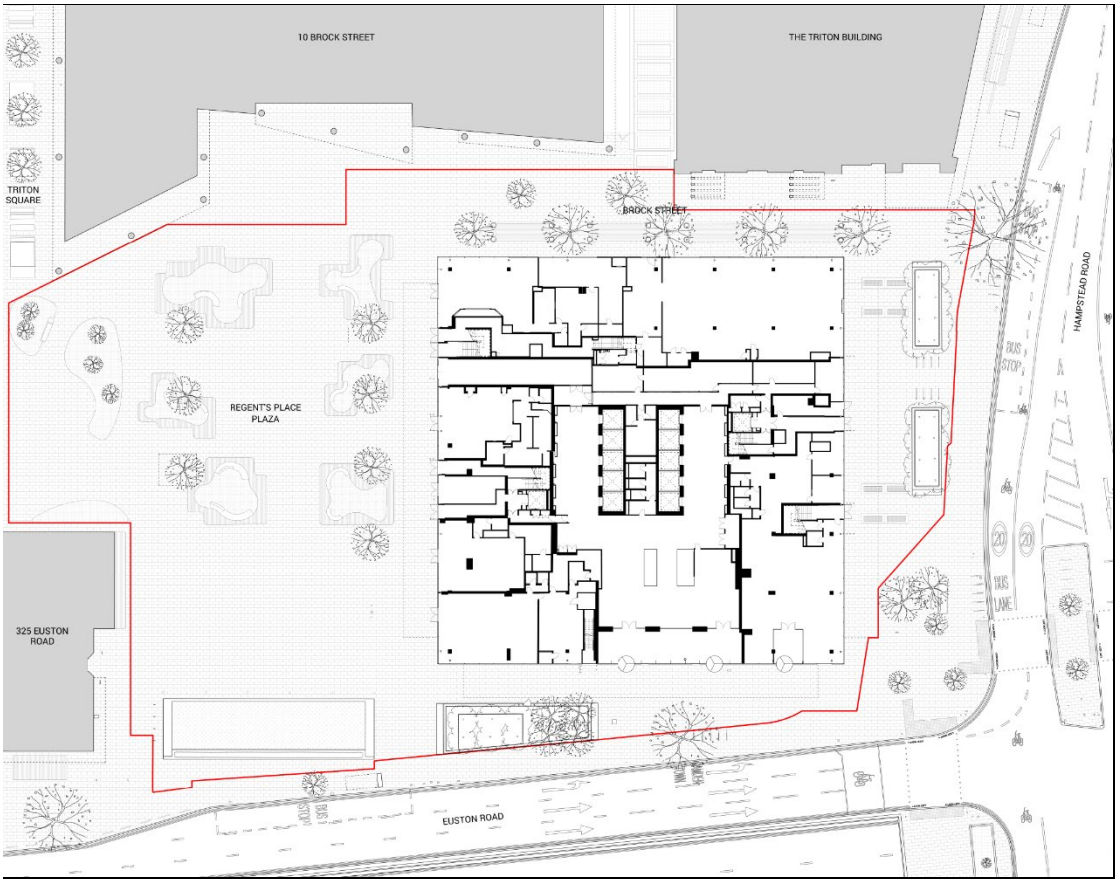


Figure 1 - The Location of the Site and Existing Footprint of Structure

The Existing Structure on the Site

Euston Tower is a 36-storey tall building standing on the northern edge of central London, situated in the south-west of the London Borough of Camden.

Located on the corner of Euston and Hampstead Road, at the top of Tottenham Court Road the tower shares a busy intersection with The UCL Hospital campus and is directly opposite Warren Street Station. The current tower has a prominent presence, given its status as the tallest building in the borough aside from the nearby BT Tower, and as such acts as a physical landmark for London Euston, Euston Square and Warren Street stations as well as wayfinding for the wider neighbourhood.

Completed in 1970, Euston Tower is designed in the 'International Style'. Above a two-storey extruded glazed podium, the tower has a pinwheel plan clad in aluminium curtain walling with green reflective tinted glazing. It was designed as an office building to provide cellular office accommodation typical of the period and formed part of a wider masterplan known as The Euston Centre. It now stands on the eastern edge of the pedestrianised Regent's Place Estate.

Since its completion, it has undergone a small refurbishment to but beyond this its external form and façade remain as originally constructed. These elements

of the building are in a generally poor condition, due to a combination of wear in use and the quality of the original detailing. Gradually it has been vacated, and since 2021, with the exception of the retail at grade level, the building is entirely disused.

Planning Policy Context

This study has been prepared to provide an assessment of television broadcast reception considerations relevant to the Proposed Development having regard to the national, regional and local planning policy framework as follows:

National requirements under The National Planning Policy Framework (NPPF), September 2023 (Department for Levelling Up, Housing and Communities) states under Chapter 10 'Supporting high quality communications', that:

> *116. Local planning authorities should not impose a ban on new electronic communications development in certain areas, impose blanket Article 4 directions over a wide area or a wide range of electronic communications development, or insist on minimum distances between new electronic communications development and existing development. They should ensure that:*
>
> *b) they have considered the possibility of the construction of new buildings or other structures interfering with broadcast and electronic communications services*

Additionally, The London Plan, March 2021 requires that development proposals should address the possible impacts on broadcast and telecommunications reception and investigate possible electronic interference (refer to Appendix IX - *Planning Policies - National Planning Policies and Regional Planning Requirements*). In addition, the London Plan places significant importance on new development being designed and built with consideration to robust and future-proof digital connectivity, as specified in Policy SI 6 - Digital connectivity infrastructure.

Locally, (whilst not related to electronic interference issues) the Camden Local Plan 2017 (London Borough of Camden, 2017), Policy E1 Economic development, requires that the council will;

> *h. expect the provision of high speed digital infrastructure in all employment developments*

Impacts to Wireless and Telecommunications Systems and Networks

The following paragraphs outline the potential impacts to each technology initially considered as part of this assessment and the justification for their subsequent omission.

Microwave Links

The impacts to fixed point-to-point microwave links near to or across the Site have been investigated. A fixed point-to-point microwave link is a wireless / radio link (a radio communication system which normally forms part of a more extensive telecommunication network), which can be explained as follows:

Microwave is a line-of-sight wireless communication technology that uses high frequency beams of radio waves to provide high speed wireless connections that can send and receive voice, video, and data information. Microwave links are widely used for point-to-point communications because their small wavelength allows conveniently-sized antennas to direct them in narrow beams, which can be pointed directly at the receiving antenna. This allows nearby microwave equipment to use the same frequencies without interfering with each other, as lower frequency radio waves do. Another advantage is that the high frequency of microwaves gives the microwave band a very large information-carrying capacity; the microwave band has a bandwidth 30 times that of all the rest of the radio spectrum below it. Microwave links carry vital data for all modern communications systems including military and national infrastructure needs for communications, emergency services and government.

Microwave links can be adversely affected by physical obstructions on and near to their transmission path such as construction cranes, wind turbines, tall buildings and trees. In general, the directional nature of microwave links means that interference can be avoided by defining clearance zones beyond which any degradation will be insignificant, or by moving the link to avoid the obstruction. Disruption or interference caused to a microwave link's operation will cause degradation to the voice, video or data carried over the link. This would result in the overall functionality (efficiency and reliability) of the microwave link to be reduced and could impact the operations of the wider telecommunications network the microwave link is part of. As microwave links form parts of national infrastructure sectors, microwave link owners will be required to ensure link performance remains optimal. An adverse impact on the operation and reliability of a wireless link may exist only if a link is situated directly over the Site / Proposed Development or passing in close proximity to it. Potential impacts arise from a complex link length and frequency dependent factor and is further defined in the published Ofcom report[1]. A review of publicly held information on 16th August 2023[2] and again verified 28th November 2023, indicate that whilst no existing fixed point-to-point microwave links pass directly

1 - Office of Communications (Ofcom) (2002) Fixed-link wind-turbine exclusion zone method, D F Bacon

2 - https://www.ofcom.org.uk/spectrum/information/spectrum-information-system-sis/spectrum-information-portal

over the existing Euston Tower structure, one link passes close enough to the Site to determine if any interference effects could occur during the construction phase of the Proposed Development.

The overall situation is shown in Figure 2 (a screenshot of Ofcom's link database output). Any radio link start and termination points are displayed as small circles and any fixed links are displayed as straight lines, connecting the link termination points (the small circles) together. A significant number of links emanate from BT Tower (NGR TQ292819), which is located due south of the Site.

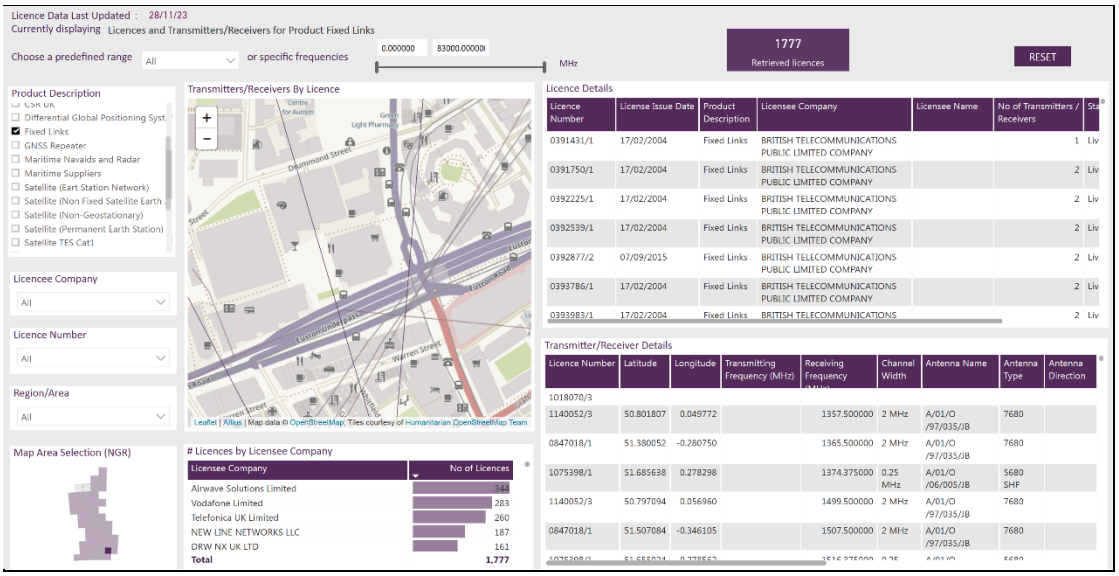


Figure 2 - A plot (Ofcom SIS screen grab) showing links passing near to the Site. This is provided to show the location of any existing fixed link with respect to the existing structure on the Site

Figure 3 provides more detail of the fixed microwave link that passes to the west of the existing Euston Tower structure. Link 0951188/1 passes to the immediate west of the site and is operated by Vodafone. It should be noted that the existing Euston Tower structure has no adverse impact or effect upon the operation of this existing fixed point-to-point microwave link because of the separation distances between the existing structure and the link's path.

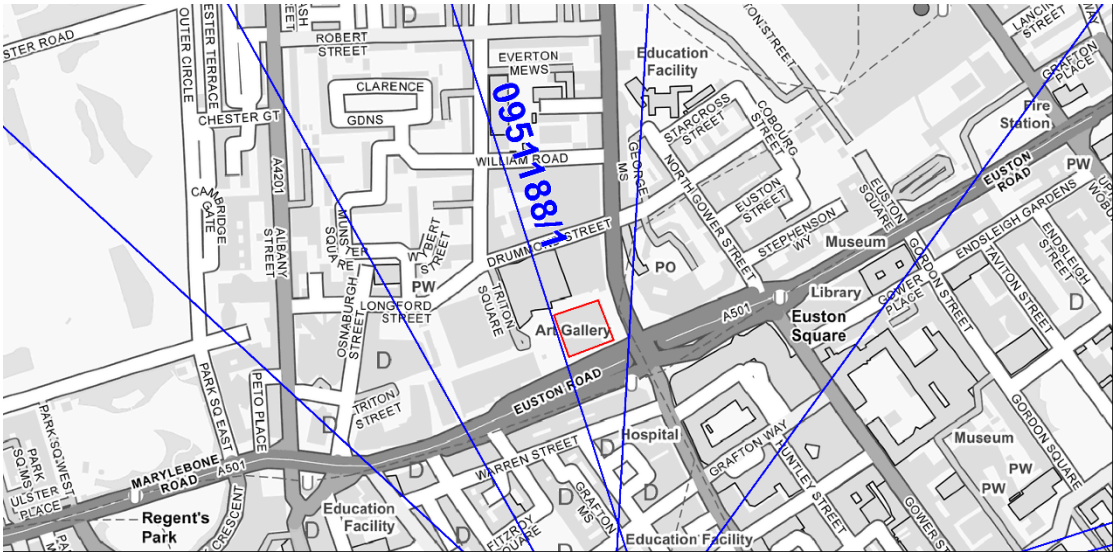


Figure 3 - The path of the Vodafone fixed point-to-point microwave link (Ofcom link ID 0951188/1) passing to the immediate west of the existing Euston Tower structure (delineated in red). Microwave links are shown as blue lines

Whilst the operation of the Proposed Development will not cause any adverse impact to the operation of link 0951188/1 (because the existing structure does not cause any adverse operational impact to the link), if tower cranes used for any construction activities relating to the Proposed Development are located to the west of the structure (in close proximity to where the link passes), interference could occur.

Based on the proposed locations of the three required tower cranes (which will only be erected and used during the construction phase - their base locations are shown in Figure 4), it is considered that interference to the Vodafone link (0951188/1) is unlikely because the link passes to the furthest point west of any tower crane base locations.

For completeness, Vodafone was contacted 18 August 2023 to determine the following relating to link 0951188/1;

a) If the link is active
b) If this link is due for decommission or obsolete
c) If the link is still active, what possible impacts are likely to occur to link operations from tower crane use
d) If adverse impacts are expected, what mitigation solutions exist in order to maintain link operations

Whilst every effort was made to liaise with the identified link owner (Vodafone), a detailed and comprehensive reply was not received within the standard 28 day time period from initial contact. The 28 day timeframe is line with standard

ES / EIA consultation time periods[3]. This assessment will be updated if any correspondence is received at a later date.

N.B. Vodafone were contacted because only radio link operators can undertake any impact assessment due to the complex technical nature of radio networks, radio link planning and need for accurate and up-to-date technical information regarding the operational characteristics of radio links. It should also be noted that the assessment needs to be conducted in a three-dimensional domain because links pass through the air, not at ground level. The height of the link above any one location is determined by the antenna heights and ground levels at both terminating points, and the physical separation of the link path at the area in question with respect to local ground level datums.

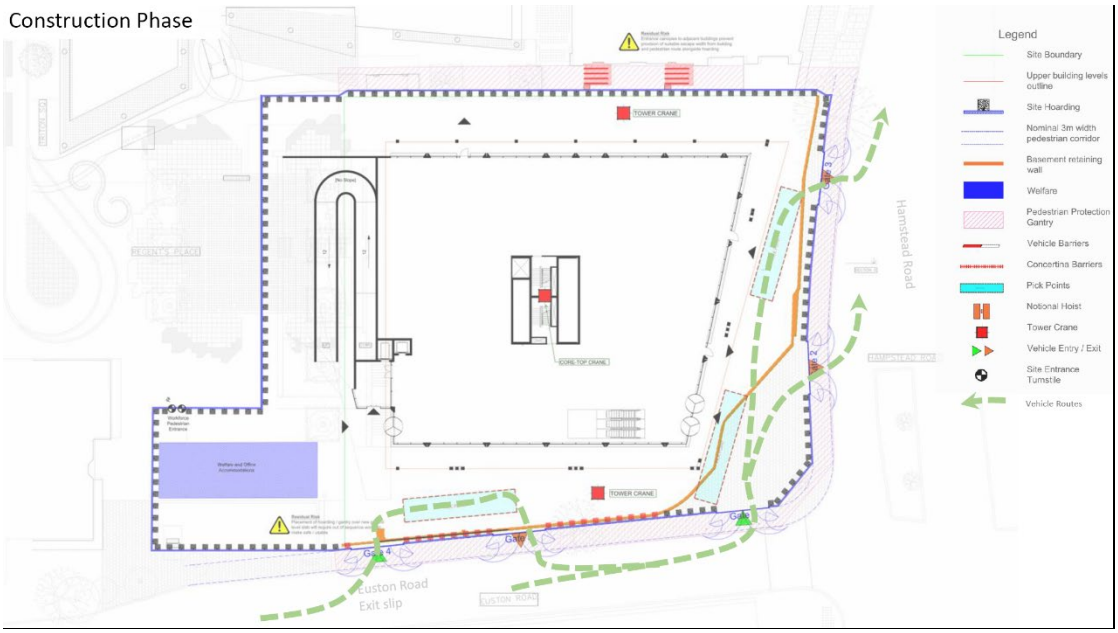


Figure 4 - The location of the proposed 3 cranes used for the construction phase (the three tower cranes base locations are indicated as red squares). The existing Vodafone link passes to the western side of the existing Euston Tower structure

Wi-Fi Networks

With respect to impacts on Wi-Fi network functionality, impacts from both the demolition and construction stage and the completed development stage are considered highly unlikely.

Wi-Fi is a family of wireless network protocols based on a set of defined standards, which are commonly used for local area networking of devices and Internet access, allowing nearby digital devices to exchange data by radio

3 - https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-seven-environmental-impact-assessment-process-preliminary-environmental-information-and-environmental-statements/

waves. Private (domestic use) Wi-Fi networks are designed to offer wireless coverage within a limited range of a Wi-Fi enabled broadband router (normally placed somewhere inside a domestic dwelling) and the service area of the router falls away as distance is increased between the router and the wirelessly connected device. In addition to the limited operational area provided by Wi-Fi routers and associated devices, the frequencies most commonly used, 2.4 gigahertz and 5 gigahertz, are channelized, enabling robust coverage when other wireless networks (Wi-Fi systems) are also in operation in close proximity. This is due to the dynamic nature of the radio technology to adjust the operational Wi-Fi channel in use to assist unwanted interference effects. Furthermore, Wi-Fi operational radio bands (2.4 gigahertz and 5 gigahertz) have relatively high material absorption (their inability to propagate well through substances) and work best for line-of-sight use. Many common obstructions such as walls, pillars, home appliances, thermally efficient double glazing etc., will greatly reduce operational range, but this also assists to minimise interference between different Wi-Fi networks in crowded environments such as residential flats and residential housing estates. There is nothing that is commonly and lawfully used during any construction activity that could cause unwanted interference on regulated and licensed Wi-Fi operational bands. With respect to the completed development, internal Wi-Fi systems may be installed and used and these too would be limited in range due to the mechanisms of signal propagation, as previously discussed. Consequently, interference to Wi-Fi networks has not been considered in the assessment.

Digital Audio Broadcasting

With respect to impacts on digital radio broadcast services such as Digital Audio Broadcasting (DAB), structures and buildings rarely cause reception disruption. This is due to the lower frequencies used for the transmission of radio services (with respect to television) and the digital technologies and methods used for encoding, reception and signal decoding. Based on professional judgement and experience, DAB radio reception is considered robust in urban environments and the Proposed Development is unlikely to alter coverage significantly. Consequently, DAB radio reception has not be considered in the assessment.

VHF (FM) Radio

With respect to impacts on VHF (FM) analogue radio broadcast services such as BBC Radio 1, BBC Radio 2, BBC Radio 3 etc. broadcast between 88 MHz and 108 MHz, structures and buildings rarely cause reception disruption. This is due to the lower frequencies used for the transmission of radio services (with respect to television) and the various technologies and methods used for encoding, reception and signal decoding. Based on professional judgement and experience, VHF (FM) radio reception is considered robust in urban environments and the Proposed Development is unlikely to alter coverage significantly. Furthermore, as the reliance on VHF (FM) radio reception

decreases due to the uptake of DAB receivers in cars[4], and online streaming in properties and mobile phone handsets, any possible impact effects are further reduced. Consequently, VHF (FM) radio reception has not be considered in the assessment.

Mobile Phone Networks

With respect to impacts on mobile phone networks, there are currently four mobile phone generations in use; 2G, 3G, 4G and the recently introduced 5G platform. All mobile platforms rely on numerous base stations (mobile phone transmitters) spread over an area to provide reliable coverage. This ensures that as the phone user moves from one location to another, a base station is available to continue seamless connectivity. In a busy urban and densely populated area, the density of base stations will be high enough to provide good coverage, especially if one particular base station is at capacity or offline. The telecoms and broadcast study area (1km radius from the Site boundary; the area considered for interference investigations) surrounding the Site is well served by multiple mobile phone networks and, due to handsets' ability to continually utilise the best serving mobile network base station, the Proposed Development would not have any effect upon the operation of a mobile phone network. Coverage maps provided by the operators (Three, Everything Everywhere, O2 and Vodafone) and Ofcom[5] are shown in Appendix I - Mobile Network Coverage Maps. Coverage is shown to be robust in the areas surrounding the Site. Therefore, an assessment on the effects to mobile phone networks has not been included in the assessment.

Telecommunication Service Providers

With respect to telecommunication service providers and due to the evolving nature of telecommunications networks and systems (mobile phone networks in particular), significant changes will be occurring to all mobile phone networks as a result of the planned closure of third generation services (3G), the continued enhancement of fourth generation services (4G) and the rollout of new high data capacity fifth generation technologies (5G). The overall effect of these changes will ensure that coverage within urban areas is enhanced, optimised and robust. In addition, mobile network operators (MNOs) will wish to offer coverage to locations around new development, to attract new customers and retain existing users. Consequently, possible impacts to telecommunication services providers have not been considered because it is considered that the Proposed Development would have no adverse impacts on telecommunication service providers.

4 - The Road Vehicles (Approval) Regulations 2020 came into force on 1 September 2020 and has implemented the provisions of the EU Directive covering the compulsory fitment of digital radio in passenger cars and buses that come fitted with a radio.

5 - https://checker.ofcom.org.uk/en-gb/mobile-coverage

Analogue Terrestrial Television Services

Impacts on the reception of analogue terrestrial television services have not been considered in this assessment because analogue terrestrial television services were switched off in London during 2012.

Cabled Telecommunication Services

Cabled services such as broadband television, broadband internet and telephone landline services are transmitted and delivered via underground copper and fibre optic cables. By not using air-borne electromagnetic waves (radio / wireless networks etc.), such services cannot be adversely affected by the layout and massing of the completed Proposed Development. Whilst the construction works for the Proposed Development may include utility diversion works, these works would be coordinated to ensure services to the Site and surrounding facilities are maintained during the works and may require a phased approach for the removal of items in line with the agreements with the relevant statutory authorities. Works would be undertaken by a network operator who would operate under statutory controls to be coordinated with the Applicant. This information can then be used to avoid any potential disruption that would be caused by the accidental severing of cables by avoiding those areas or taking due care when excavating. If due care is taken then there will be no effect. Therefore, an assessment on the effects to cabled communication systems has not been included in the assessment.

BT Openreach already has extensive fibre in the wider study area and to the Site. Due to the nature of delivery (underground), the Proposed Development will not have any impacts upon existing BT Openreach fibre networks. In addition, due to the presence of existing fibre around the application Site and to the Site, it is envisaged that the Site will be optimally digitally connected, if a BT fibre connection is utilised. The location of existing BT fibre (as of 28th November 2023) is shown in Figure 5.

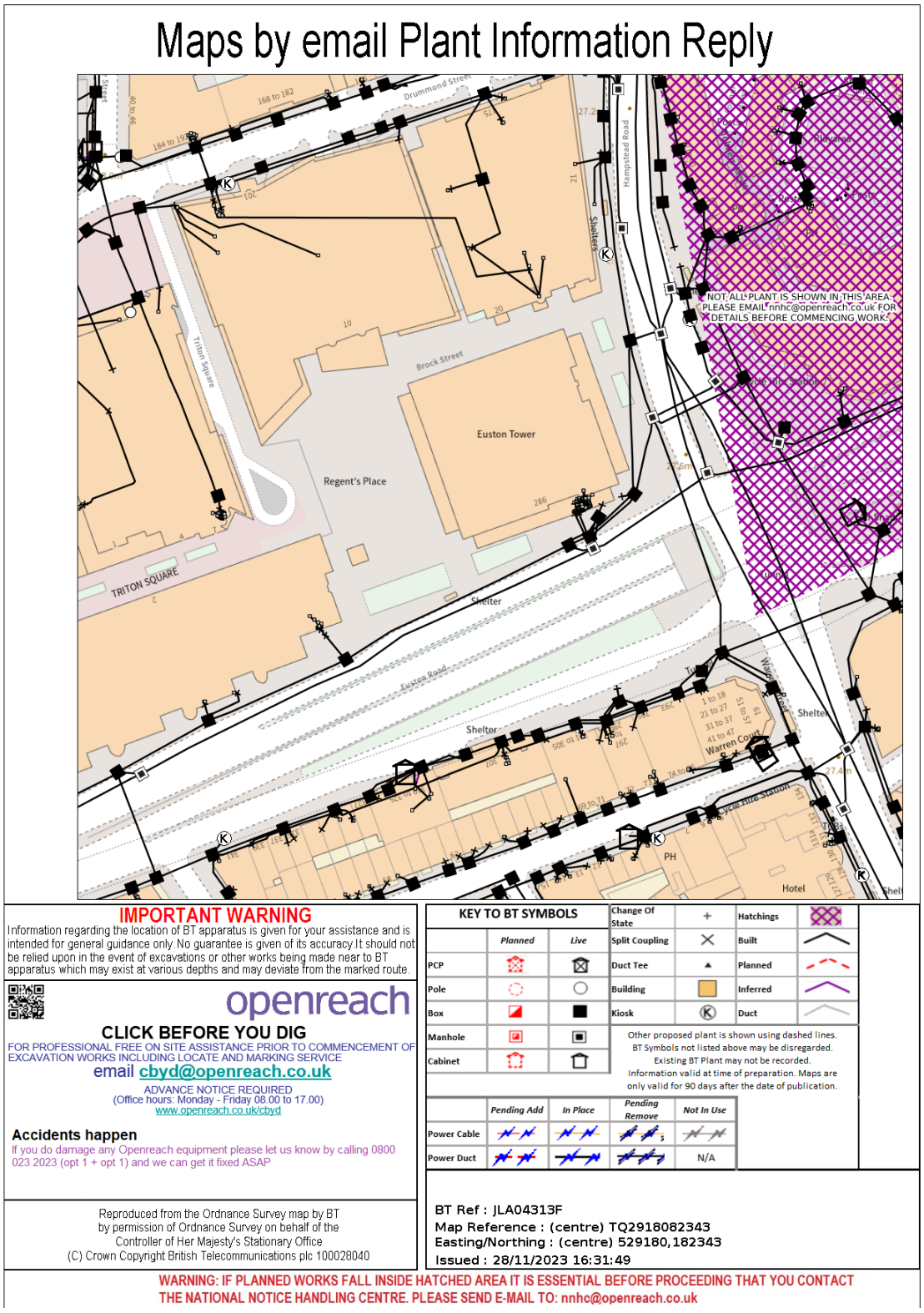


Figure 5 - Existing BT openreach Fibre installed around the application Site and to the existing Euston Tower structure

Internal Telecommunications Systems and Networks

No detailed telecommunication design has been undertaken at this stage, as is typical for development projects of this size. The telecoms systems would likely consist of telephony (voice), broadband, Wi-Fi calling and possibly a mobile / cellular distributed antenna system (DAS). It is anticipated that the infrastructure works up to and including the connection point would be provided by network operator (BT or others). From this point the internal network / communications and networking infrastructure would be developed by a specialist installer to be distributed to all final users and recipients within the Proposed Development.

Impact Assessment Methodology

The assessment has been refined to focus on the possible impacts and effects on local television reception for receptors.

> **N.B.** Receptors are considered to be domestic dwellings where TV is watched as an amenity. Places where TV is part of a commercial offering, such as hotels, offices and shops, are not considered to be receptors. This differentiation has been consistently used by relevant UK government agencies (currently Ofcom) since the inception of television services in England. The sensitivity of the receptors will vary with their use of TV services but experience shows that many high-use receptors will be highly sensitive.

A desktop study was first undertaken, based on broadcast transmission information, plans of the Proposed Development and maps of the area. The relevant signal survey area for the Proposed Development was identified and a site visit was then subsequently conducted to establish the baseline television reception conditions. Modelling techniques and field assessments of viewers' choice of television transmitter were then used to predict the potential effects upon television broadcast reception in the area.

The impacts from the Proposed Development are consequently analysed, and together with various mitigation options, conclusions are drawn on the overall effects of the Proposed Development on television reception for local residents.

This study was undertaken during September – November 2023 to investigate whether the Proposed Development could cause any unwanted electrical interference. Overall, the effects on digital terrestrial television and digital satellite television service reception are discussed. The report details the baseline reception conditions for future reference and can be used to support the planning application submission. This report follows the following structure:

Chapter 1 - introduces the Proposed Development, the Site, the reasoning why certain wireless and telecommunications systems have not been considered in this assessment and the overall format of the assessment

Chapter 2 - discusses the different forms of structure (building) generated television interference and how these can impact the reception of different television broadcast platforms

Chapter 3 - describes the available television services in the survey / study area

Chapter 4 - describes the pre-construction television reception conditions around the Site

Chapter 5 - describes the predicted impacts of the Proposed Development upon television reception before any mitigation measures are applied

Chapter 6 - describes any suitable mitigation measures for any affected receptor (TV viewer)

Chapter 7 - presents the conclusion

2 - The Mechanisms of Interference to Television Broadcast Services

Terrestrial Television Services

Any structure will produce two zones of potential disruption to television reception. One zone is where the development creates a ‘shadow’ (affects all television broadcast platforms) and the other where it gives rise to a ‘reflection’. At the frequencies used for broadcasting, the processes of creating a ‘shadow’ or a ‘reflection’ are somewhat more complicated than with visible light but thinking of the problem in these terms is still a helpful way of approaching the matter.

Signal ‘Shadowing’ Effects

In the area behind the structure, the television transmitter is effectively screened from the viewer and the strength of the signal is reduced - Figures 6 and 7.

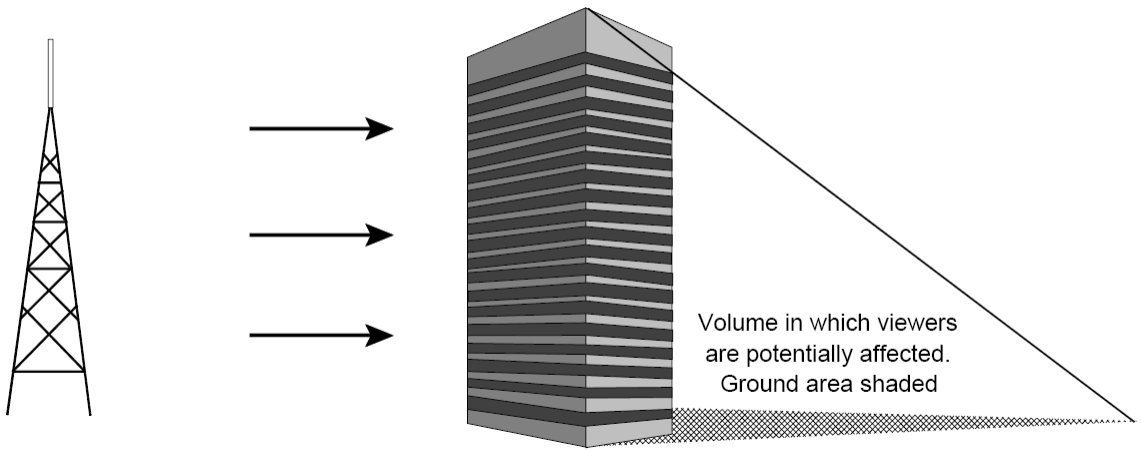


Figure 6 - Affected area in the ‘shadow’ zone behind the structure

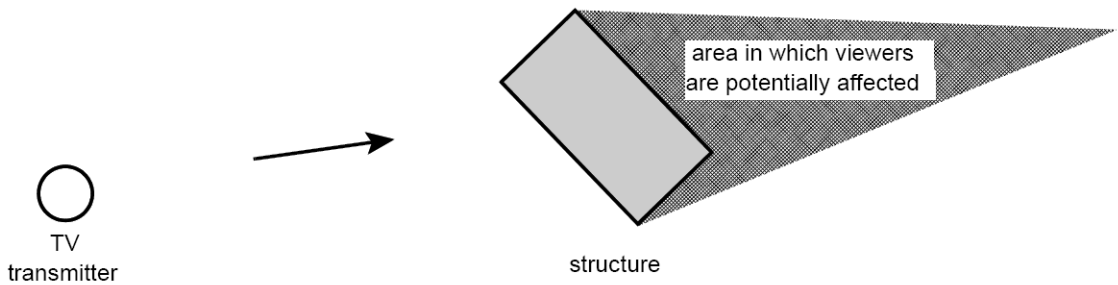


Figure 7 - Plan view of the ‘shadow’ zone

Television signals do not create such a ‘hard’ shadow as visible light, and for the purposes of explanation, a ‘shadow’ zone must be considered which is divided into three sub-zones.

i. Within a few tens of metres from a solid structure, over the region where optical view of the transmitter is lost, the reduction in signal strength is critically dependent on the specific design and composition of the structure. For most brick and concrete buildings, the reduction can be severe and, in some cases, almost total if existing reception conditions are poor.

ii. Further away from the structure (e.g. beyond 25 to 50 metres, but this varies depending on its size) the limit of the ‘shadow’ zone and signal reduction are determined by diffraction at the edges of the structure and reflection off surrounding structures. The simple condition of whether or not a location has an optical view of the transmitter is not enough to classify the potential interference zone adequately. In general, the effect is that the signal appears to bend around the sides of the structure; the shadow zone reduces in size and the signal strength is reduced by much less than simple ray optics would suggest.

iii. Even further away from the structure (e.g. 250m) complex multiple reflections and diffraction, caused by structures in the locality, may result in the ‘shadow’ zone becoming almost non-existent, against interfering signals that arrive on significantly different bearings. This can result in an increase in the ratio of wanted to unwanted signal as presented to the television receiver.

Signal ‘Reflection’ Effects

The second zone of potential interference is produced by ‘reflection’ or ‘scattering’ of the incident signal, see Figure 8.

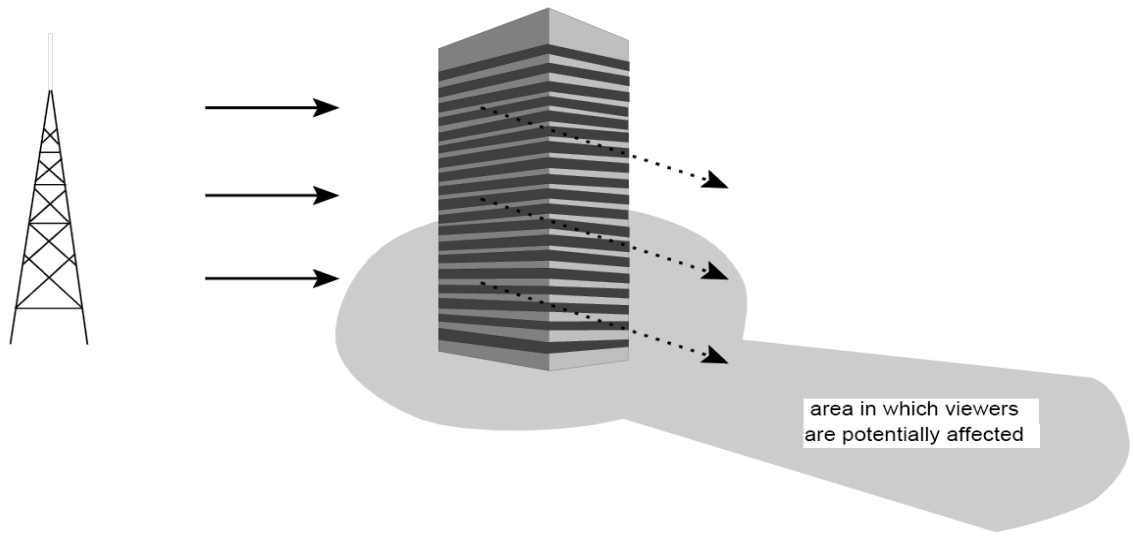


Figure 8 - Affected areas in the ‘reflected’ zone of the structure

Consider Figure 9, the direct signal travels a distance P1 to the viewer, whilst the signal reflected from the structure travels slightly further, distance (P2 + P3). Although travelling at the speed of light, the different path lengths can mean that one signal arrives with a significant delay relative to the other. This results in a degradation in signal quality.

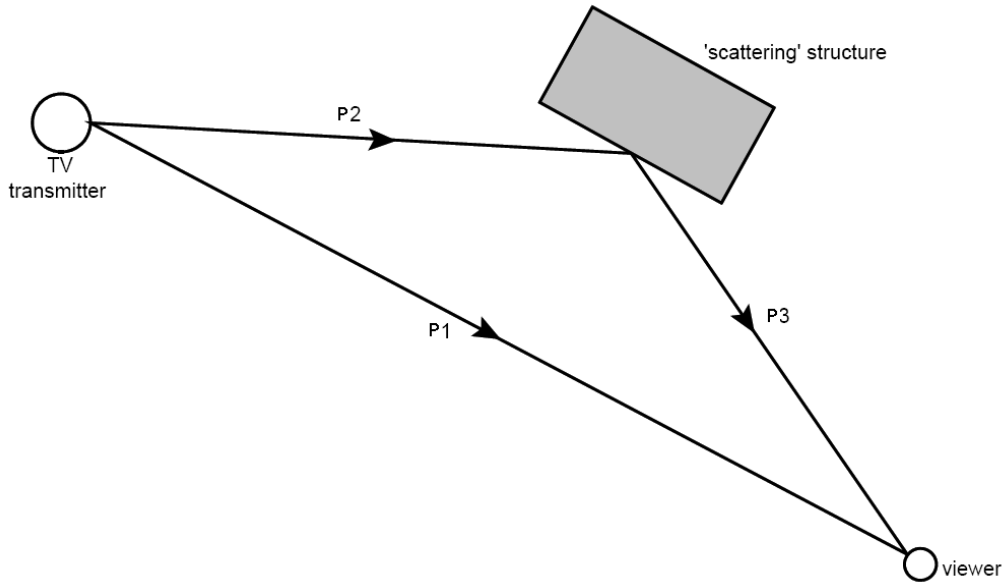


Figure 9 - Direct and Indirect Signal Paths

To avoid interference, it is necessary to ensure that the ratio of wanted signal along the direct path (P1) to the unwanted signal along indirect paths (P2+P3) is sufficiently high. Domestic TV receiving antennas generally have a significant directional response to incoming signals, which means that the antenna may discriminate against interfering signals that arrive on significantly different bearings. This can result in an increase in the ratio of wanted to unwanted signal, as presented to the television receiver.

Digital Terrestrial Television (DTT) - Freeview

The digital television broadcast platform offers many advantages over older analogue broadcast technologies. Due to the way picture signals are encoded and broadcast, digital television offers a much more resilient platform against interference. The construction of digital signals ensures that they are much more impervious to the effects of interference from indirect secondary reflections, which consequently ensures good quality and coherent data stream integrity at the receiver, resulting in an interference free picture. Disruption to DTT services is normally caused by a poor-quality receiving antenna system or locally generated wideband electrical noise. Signal blocking caused by buildings can also degrade received signal quality.

Digital Satellite Television Services - Freesat and Sky

Digital satellite television services are provided by geo-stationary earth orbiting satellites positioned above the equator. To ensure good reception of digital satellite television services, satellite receive antennas (satellite dishes) are normally positioned away from trees and other clutter and are orientated to face the southern (south-southeast) skies.

Disruption to digital satellite television services is normally caused by an obstruction on the line-of-sight from the satellite to the receive antenna e.g. a tall building or tall trees. Adverse weather can also influence reception. In the United Kingdom, Freesat and Sky services come from the 28.2 degrees east ASTRA satellite cluster.

Figure 10 below shows typical clearance distances and obstruction heights for interference free satellite television reception.

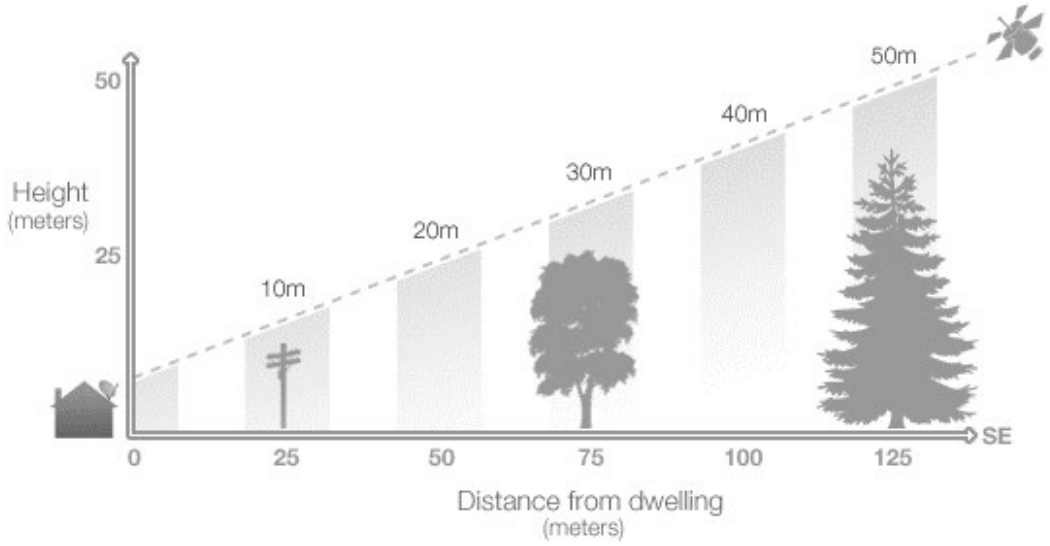


Figure 10 - Typical Clearance Distances and Obstruction Heights for Interference Free Satellite Television Reception

3 - Available Television Services

Digital Terrestrial Television (DTT) - Freeview

The area around the Site is only served by DTT services from the Crystal Palace transmitter (NGR TQ 33940 71220), 12km away on a bearing of 156 degrees with respect to true north of the Site.

The transmitter is shown with respect to the Site in Figure 11. Technical transmission information for each DTT service emanating from The Crystal Palace transmitter site is detailed in Table A, found in the Appendix II - *Television Transmission Frequencies*.

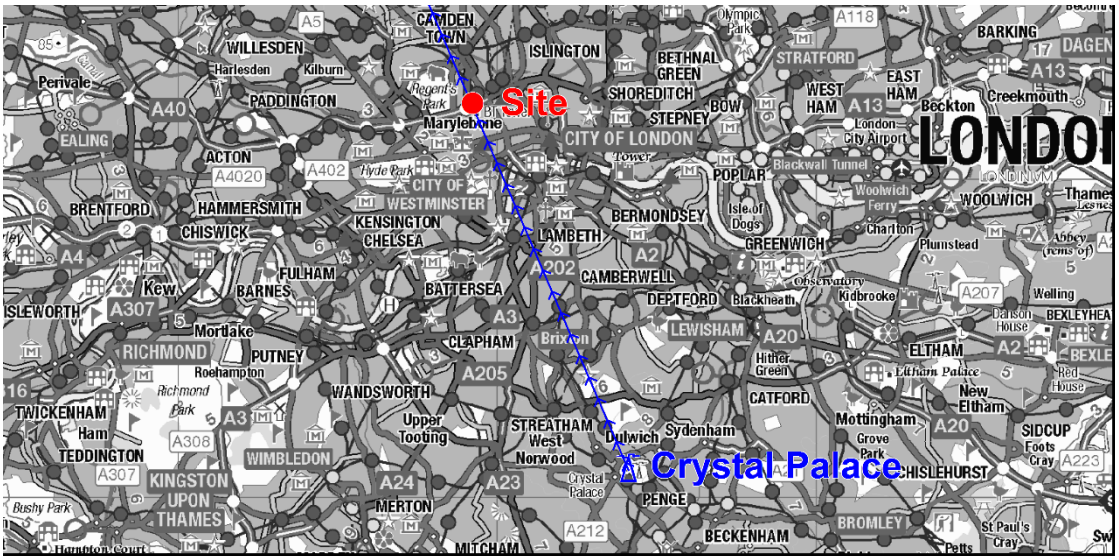


Figure 11 - Locations of the Crystal Palace DTT transmitter and the Site. The blue arrow indicates the direction of the incoming DTT signals from the Crystal Palace Transmitter at the Site

Non-Terrestrial Television Services (Digital Satellite Television)

Digital satellite television services are provided by geo-stationary earth orbiting satellites positioned above the equator. For the optimum reception of all satellite services, all receiving dishes must be positioned on the highest part of a rooftop as possible to ensure views to the sky's southeast horizon are free from other local skyline building clutter.

For the reception of the 28.2 degrees east ASTRA satellite cluster (Freesat and Sky services), dish elevations of 25.3 degrees are required at this latitude. Optimal receive dish azimuths are 145.4 degrees with respect to true north.

4 - Survey Methodology and Description of Baseline

Due to the complex nature of television interference in cluttered urban environments, field investigations must be undertaken in the general area around a site to fully evaluate any potential effects. During August 2023, signal measurements were undertaken up to one kilometre away from the Site. The study mainly focused around the Site and areas to the immediate northwest, in all areas where predicted (modelled) interference may occur (as the incoming terrestrial and satellite television signals originate from the southeast).

These are identified in Figure 12, and the measurements are detailed in Table B, found in the Appendix III - *Signal Measurements*. In particular, the following data was recorded:

- Field strength and technical signal measurements of DTT transmissions from the main serving transmitter

- Viewing preference (choice of television transmitter) of residents in all areas visited

Television signal measurements were carried out using a UHF log-periodic receive antenna, mounted on GTech Surveys's broadcast survey vehicle, at a receive height of 10 metres above ground level (AGL), industry standard height for such work. During the survey, no assessment was made of reception conditions within viewers' homes. Equipment details are detailed in the Appendix VI - *Survey Equipment*.

Survey Results and Observations

In general, building uses around the Site is predominately for commercial use. There are a number of significantly tall and wide buildings around the Site, including the existing Euston Tower. There are no typical two-storey detached residential dwellings in the study area (the typical receptors considered for this assessment), however there are areas of residential use to the north and northwest of the Site.

Digital Terrestrial Television (DTT) - Freeview

DTT services were available at all surveyed locations from the Crystal Palace transmitter. At all locations, received signal levels were in excess of recommended minimum amounts and the technical quality of received signals was found to be good[6]. DTT services currently provide good coverage and service throughout the study area.

6 - Signal levels as specified by the *CAI - Association for Audio Visual Professionals Code of Practice (COP) For the Installation of Aerials/Antennas & Receiving Equipment in the Single Dwelling Unit CAI COP 2: September 2022*

Additional technical information regarding the Freeview signal can be found in the Appendix - *An Overview of Signal Measurements*

When visible during the survey, all signal receive antenna systems are mounted on rooftops, ensuring optimal reception conditions. All terrestrial television antennas are directed towards the Crystal Palace transmitter, which is expected because the Crystal Palace transmitter is the main regional transmitter for the area.

The existing tall and wide buildings in the study area are likely to dominate reception conditions.

Digital Satellite Television - Freesat and Sky

Due to the commercial building use in parts of the study area, few satellite dishes were noted. In residential use areas, a high number of satellite dishes were noted on building sides. Additional satellite dishes may be mounted on rooftops or at the rear of buildings, not visible from street level or public roads.

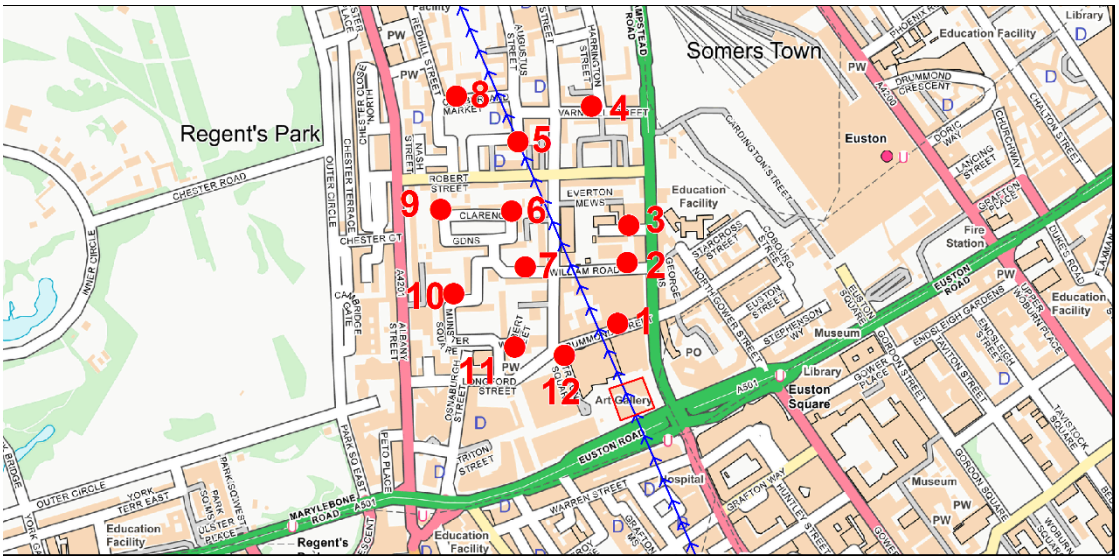


Figure 12 - Surveyed Locations. The blue arrows indicate the direction of the incoming DTT signals from Crystal Palace transmitter. The existing structure is delineated in red

5 - Predicted Impacts and Effects

Methodology

To assess the effects of the Proposed Development upon television broadcast service reception, the structures were considered to create interference to services in the immediate areas around the Site, in signal reflection areas and in the signal shadow zones. These methods, used in conjunction with broadcast transmission information, development plans, maps of the study area and modelling techniques, contribute towards predicting the potential effects upon television broadcast reception in the study area.

The field survey then investigated the areas identified as being at risk of interference and assessed all available services and the transmitter viewing preferences of residents in order to determine if the computed risk is practically valid. The collected data was finally used to determine what actual risks exist and what viable solutions are available to minimise any adverse effects. The predicted effects are discussed below and summarised in Tables 1 and 2.

Digital Terrestrial Television (DTT) - Freeview

Widespread interference is not expected to occur due to the existing good coverage in the study area and the lack of receptors adjacent to the Site. Importantly, the existing form, size and shape of the structure on the Site already dominates local reception conditions, which are still robust. The Proposed Development will alter the local reception environment; however, good reception is likely to be still be possible.

Overall, it is considered that the Proposed Development will not impact the reception of Freeview services.

Digital Satellite Television - Freesat and Sky

Tall and wide structures, tower cranes and tall buildings can all disrupt digital satellite television reception by causing unwanted obstructions on the line-of-sight to the satellite dish from the serving satellite, as discussed in Chapter 2.

Using trigonometry, the approximate maximum height of the existing and proposed building[7] and the angle and orientation of the incoming satellite signals, theoretical signal shadow zones for the 28.2E ASTRA satellite cluster are as indicated;

7 - The highest point of Euston Tower rises 36 storeys above ground to a height of approximately 153.300m AOD.

Element	Max. Signal Shadow Length (m)
Existing Structure	246
Proposed Structure	246

These areas extend in a north-northwesterly direction from the structure's base. As no changes in building height are proposed, no new or different interference effects will occur to those that already exist.

Whilst widespread interference is not expected, the use of cranes during the construction phase could cause temporary and sporadic signal disruption to satellite television reception for receptors in the following locations; Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets. In these areas, tower crane operations may cause intermittent signal disruption, resulting in interference for viewers.

Broadcast platform	Area(s) of predicted interference	Risk of interference & reasoning	Mitigation
DTT (Freeview)	None identified because the Proposed Development is similar in form to the existing structure on the Site	N/A	N/A
Digital Satellite TV (Freesat and Sky)	None identified because the Proposed Development is to be the same height as the existing structure on the Site	N/A	N/A

Table 1 - Summary of Predicted Interference from the Proposed Development

Broadcast platform	Area(s) of predicted interference	Risk of interference & reasoning	Mitigation
DTT (Freeview)	None identified because coverage is robust in the study area	N/A	N/A
Digital Satellite TV (Freesat and Sky)	Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets	The use of tower cranes is likely to cause disruption to digital satellite television reception in areas to the northwest of tower crane bases	Moving dishes to new locations where interference does not occur. Alternatively, the use of DTT receiving equipment or television broadcasts via broadband or cable

Table 2 - Summary of Predicted Interference during the Construction Period

Predicted Effects - Conclusions

Interference to the reception of DTT services is not expected. No mitigation measures are required.

Whilst the Proposed Development itself will not cause any disruption to the reception of digital satellite television services, the use of tower cranes during the construction phase may cause disruption for digital satellite television viewers to the immediate north west of the Site, including Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets. In these locations, tower crane operations may cause sporadic interference effects to the reception of satellite television services. Should satellite dishes be located in this area (especially located on residential properties), repositioning satellite dishes to new locations where views of the south-eastern skies are no longer obscured should restore reception for any affected receptor. If satellite dishes cannot be relocated out of any signal shadow zone, the use of DTT receiving equipment or TV over fibre / broadband services could also offer viewers alternative sources of broadcasts. If any satellite dish relocating is required, it is advised that a professional registered antenna installer conducts all required work, as further detailed in Chapter 6.

6 - Mitigation Measures

For any affected digital satellite television user located to the northwest of the Site (in particular on Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets), relocating satellite dishes to new locations where views to the southeast horizon are no longer obscured should restore the reception of services. Affected digital satellite television viewers could also use DTT reception equipment to restore services. Additionally, some satellite television broadcasts may now be available via broadband or cable.

These are common and simple mitigation solutions for similar situations where local digital satellite television reception conditions have been affected by adjacent construction work. A registered installer should be able to advise on the most effective mitigation measures once the existing installed satellite dish system has been inspected and construction-generated interference has been identified.

It is recommended that all antenna work (dish moving, relocating etc.) is undertaken by a registered installer (CAI accredited) and any system components used must be CAI benchmarked. More information regarding the Confederation of Aerial Industries can be found on the following website[8].

The CAI's benchmarking scheme ensures that the cables and antennas have passed minimum requirements for the use of DTT and digital satellite television reception. The use on non-benchmarked products in an antenna system would degrade overall performance and effectiveness of the system, increasing the risk from interference. More information on CAI benchmarked products can be found on the CAI's website[9].

Complaints Procedure and Investigation of Television Interference

To enable the interference reporting process, contact details / phone numbers will be displayed on the hoarding surrounding the Site, should any local resident wish to discuss television interference (or any other construction matter) with the developer.

If reports of television interference are received, a procedure is required to enable the developer to determine the validity of a claim and to understand the extent of the potential interference problem. It is recommended that the following information is recorded for any reports of interference. If clusters or patterns of interference form, such data would quickly enable an investigation to take place and will greatly decrease the time taken to resolve the matter.

8 - http://www.cai.org.uk/index.php

9 - https://www.cai.org.uk/index.php/services/product-certification-scheme

Based on information received from the developer, an initial investigation would be carried out to validate the claim. For an expert to undertake this, the developer is required to log any complaints and the operational times and dates of any tower crane use. In addition, the complainant could complete the TV Interference Questionnaire, or a similar form (as presented in the Appendix X - *Television Signal Survey Questionnaire*).

The log should contain the following as a minimum;

- *full contact details of the complainant (name, address, contact number etc.)*
- *a physical description of the interference (sporadic, constant, digital interference effects (loss of sound, green blocking on received images etc.) and identifying which TV sets are affected*
- *if satellite television reception has been affected (this would include FreeSat and Sky)*
- *the dates and the times of day when interference is noticed*
- *the channels the interference affects (particularly important for DTT services)*
- *when the interference was first noticed (time and date)*

This information would then be assessed through the findings of this report to validate any claim or claims. Previous experience has shown that most reports of interference have been down to either; user error with equipment; damaged or incorrectly set up receiving equipment; or confusion regarding domestic technical appliances. Most reception problems can be resolved with simple technical advice. However, if a pattern of interference emerges that corresponds with any theoretical or predicted impacts, or if clusters of interference have formed within the study area, further field investigations may be required.

If the complaints are found to be valid, the developer will employ the services of a local, registered aerial installer (for example, a Confederation of Aerial Industries member) who will remedy the identified impairment. A registered antenna installer should be able to advise on the most effective mitigation measures once the existing installed antenna system has been inspected and development or construction-generated interference has been identified.

It should be noted that because tower cranes are normally taller than the structure being built and tower cranes operate over a wide area, moving dishes to different locations may not resolve all reception issues. To reduce tower crane interference, it is advised that the crane jibs / arms are positioned in a northwesterly to southeasterly facing orientation at the end of crane lifting operations, hence reducing the overall cross-sectional area presented to the incoming satellite signals. This action reduces disruption because the satellite

signals come in at a bearing of 145 degrees with respect to true north (for Freesat and Sky digital satellite television services), and so encounter less of the crane's structure if parallel to the direction of the incoming signals.

7 - Conclusions

A desktop-based study and baseline reception survey have been performed to assess the possible effects and impacts on the reception of telecommunication services that may arise from the proposed Euston Tower redevelopment in Camden, London. The study has focused on the reception of the two television broadcast platforms that could be impacted by the Proposed Development and the Proposed Development's construction; DTT and digital satellite television services.

Digital Terrestrial Television (DTT) - Freeview

The Proposed Development is unlikely to impact the reception of DTT services. As no interference is likely to occur, no mitigation measures to restore optimal reception are required.

Digital Satellite Television - Freesat and Sky

The use of tower cranes during the construction phase is likely to cause disruption to the reception of digital satellite television services in areas to the immediate northwest of the Site; on Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets. If interference does occur, the repositioning of satellite dishes to locations without an obscured line-of-sight view to the serving satellites should restore reception. If this is not possible, the use of DTT receiving equipment would also offer any affected viewer an alternative source of digital television broadcasts. Any sporadic interference arising from tower crane use is expected to be limited in duration (only occurring during periods when the cranes are erected) and will cease completely when the cranes are taken down.

Overall, the use of tower cranes is likely to cause temporary disruption to the reception of digital satellite television services in areas to the immediate northwest of the Site's boundary (Longford Street, Drummond Street, Stanhope Street, William Road, and other closes and roads off these streets). In these areas, clear views of the southeastern skies could be sporadically obscured, resulting in interference. If interference does occur, the repositioning of satellite dishes to new locations without an obscured line-of-sight view to the serving satellites should restore reception. If satellite dish relocations are not possible, the use of DTT receiving equipment would also offer any affected viewer an alternative source of digital television broadcasts. These are standard and easy to adopt mitigation solutions in situations where construction work has degraded local television reception conditions.

If the complaints are found to be valid, the developer will employ the services of a local, registered aerial installer (for example, a Confederation of Aerial Industries member) who will remedy the identified impairment. A registered antenna installer should be able to advise on the most effective mitigation measures once the existing installed antenna system has been inspected and development or construction-generated interference has been identified.

This assessment has been prepared to support the planning application submission.

APPENCICES

Appendix I - Mobile Network Coverage Maps

Appendix II - Television Transmission Frequencies

Appendix III - Signal Measurements

Appendix IV - An Overview of Signal Measurements

Appendix V - Calculation of Received Field Strength

Appendix VI - Survey Equipment

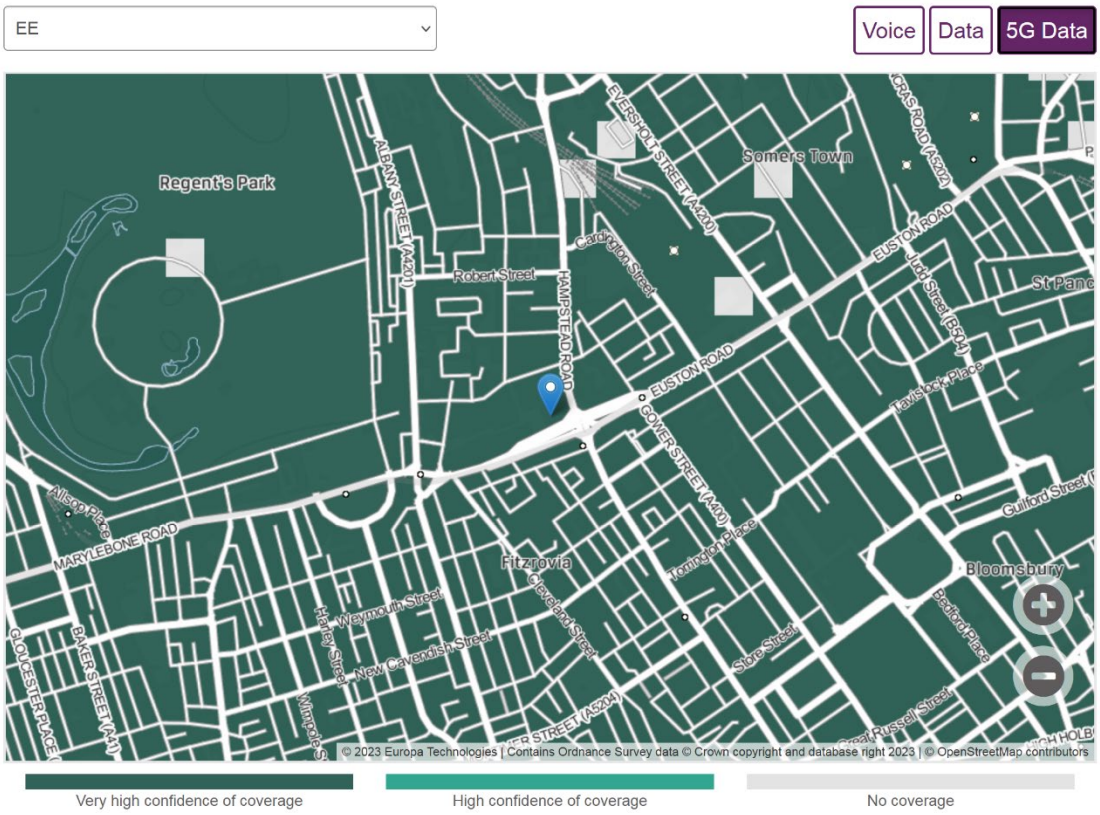
Appendix VII - References

Appendix VIII - Mapping Data

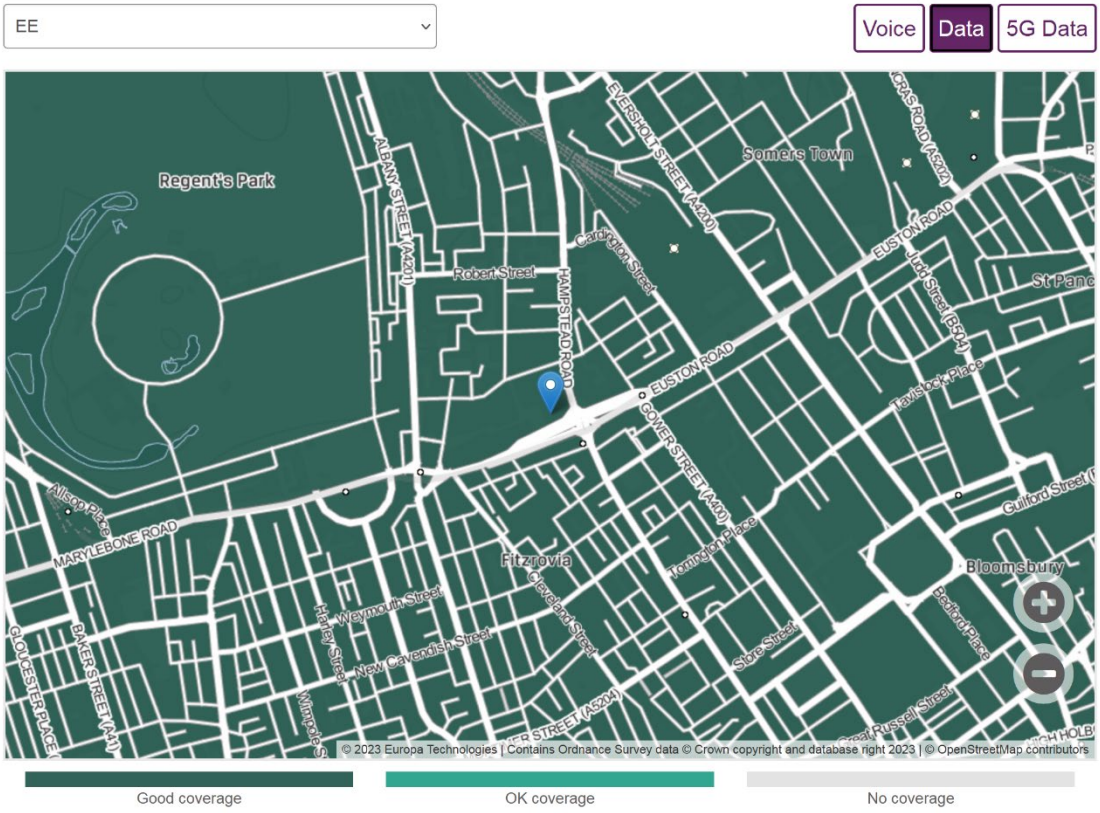
Appendix IX - Planning Policies - National Planning Policies and Regional Planning Requirements

Appendix X - Television Signal Survey Questionnaire

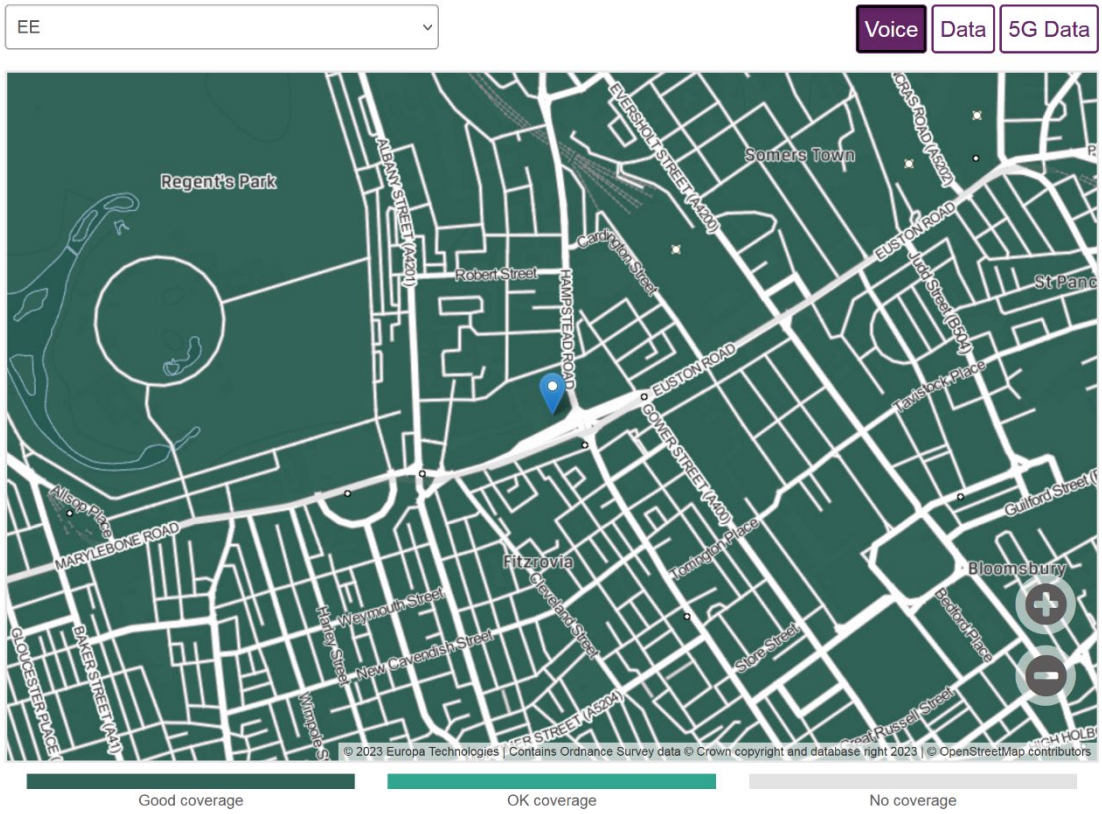
Appendix I - Mobile Network Coverage Maps



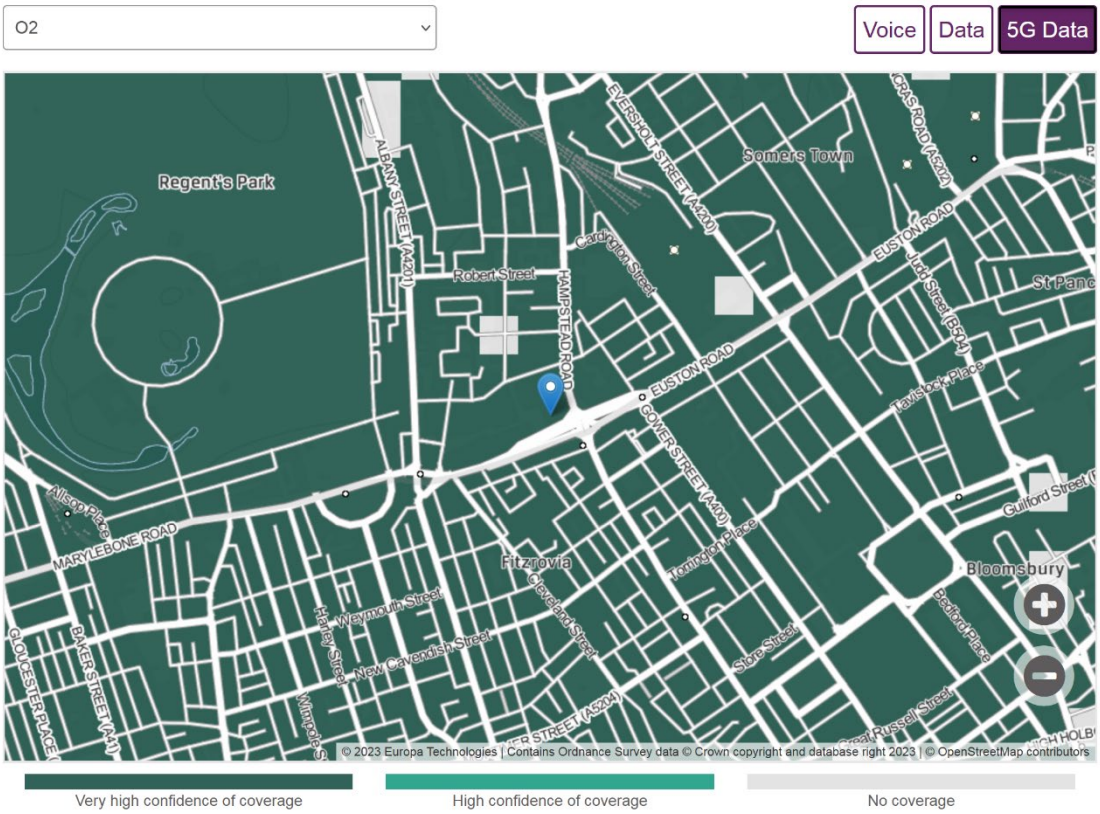
EE- 5G Coverage



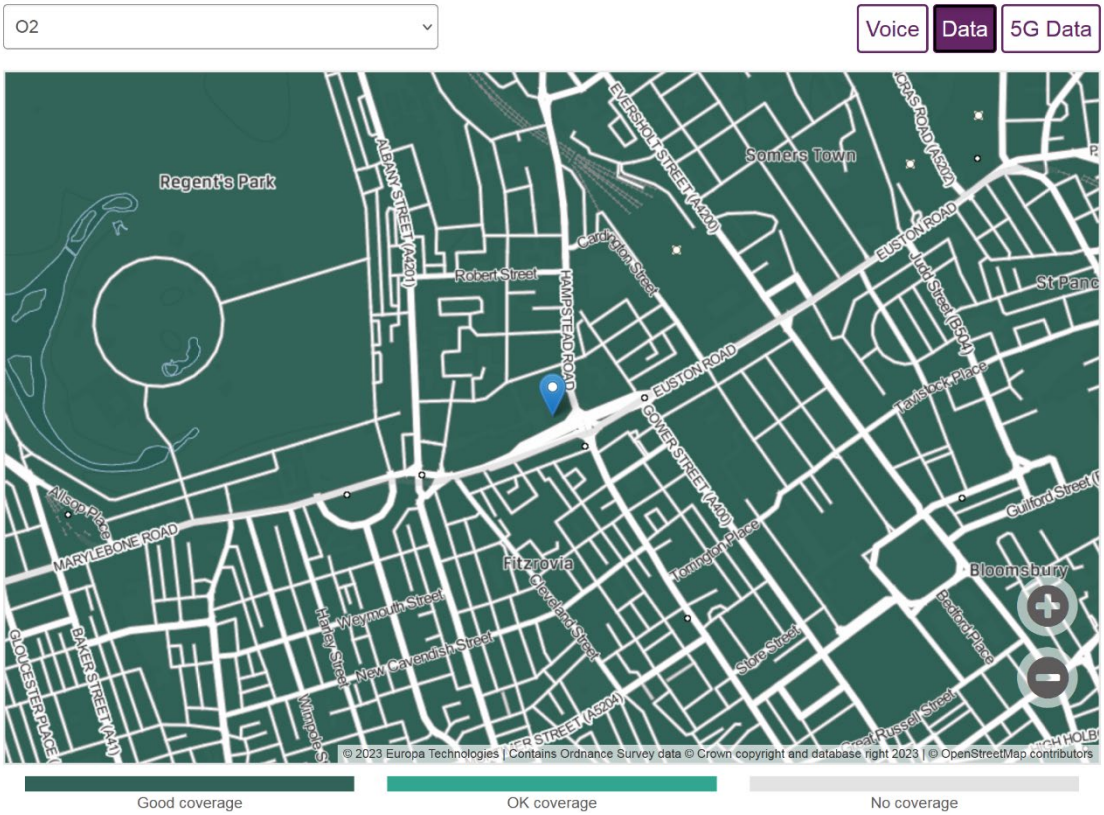
EE - Data Coverage



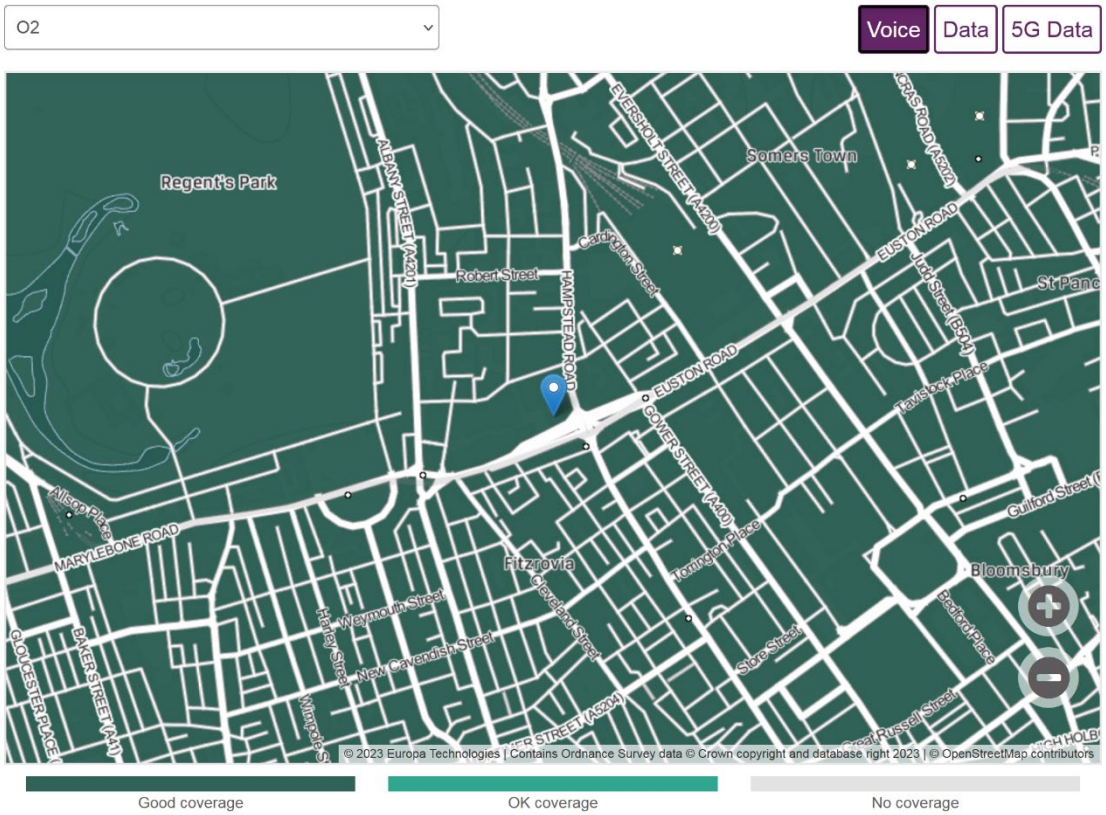
EE - Voice Coverage



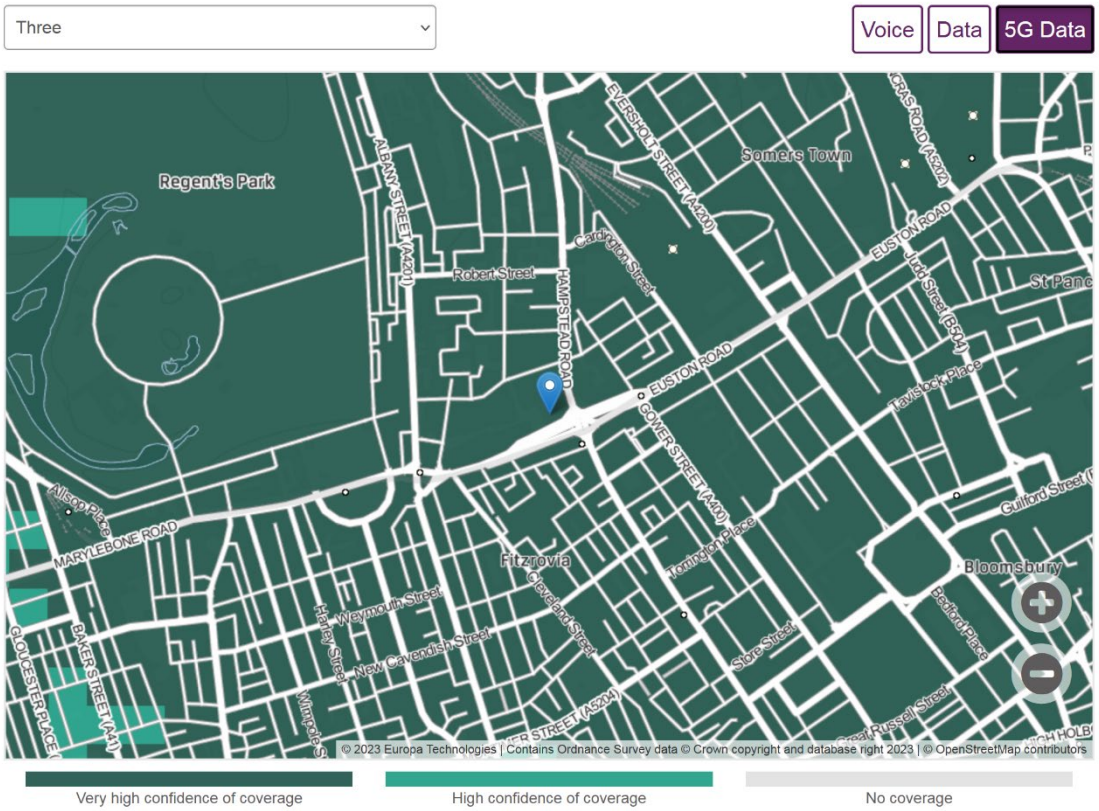
O2 - 5G Coverage



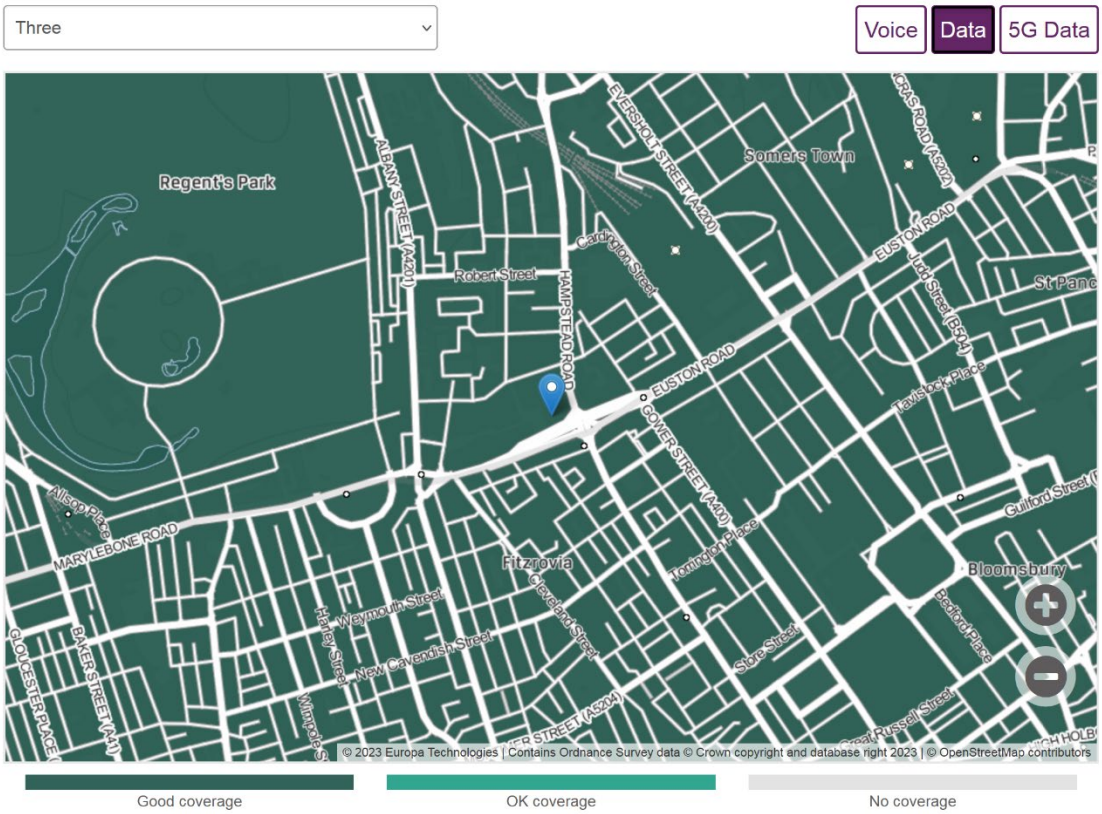
O2 - Data Coverage



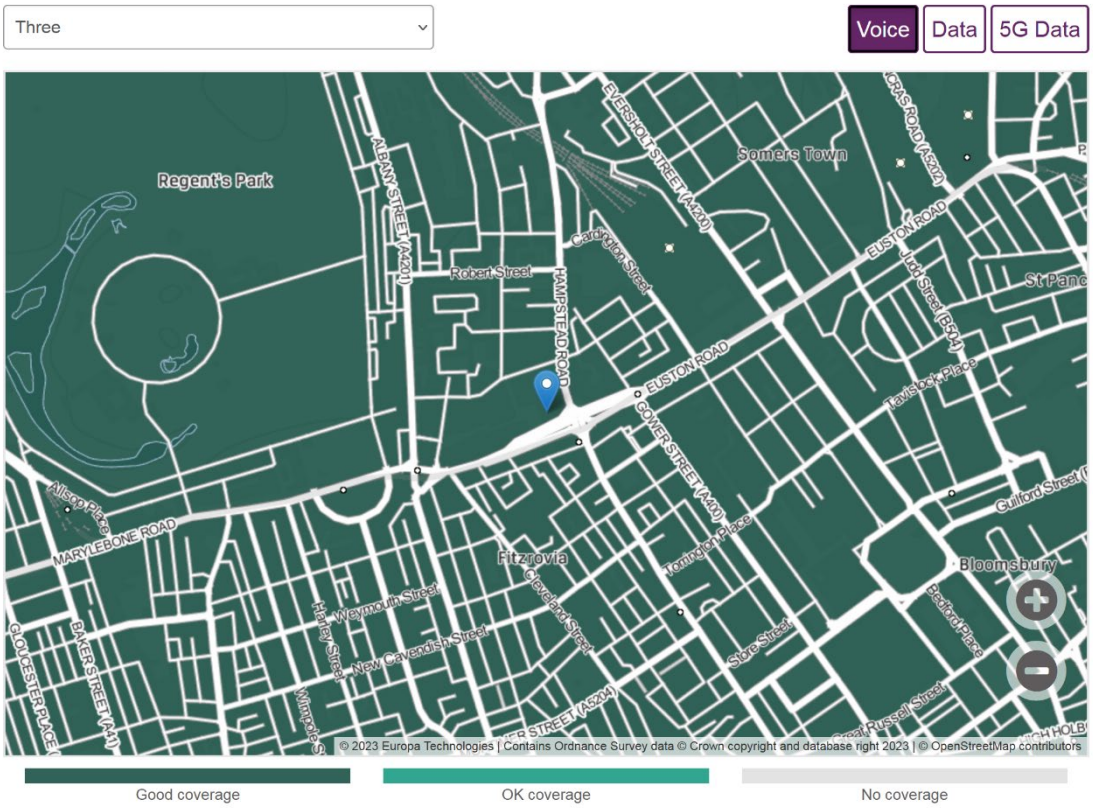
O2 - Voice Coverage



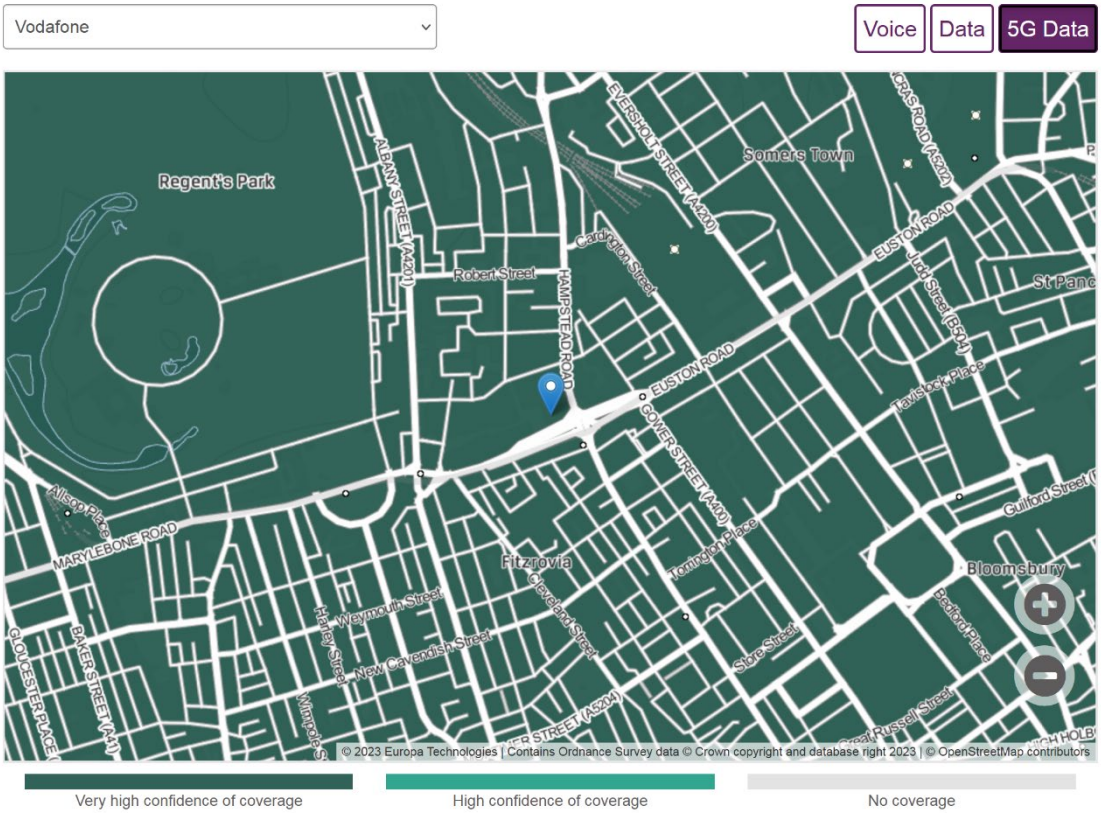
Three - 5G Coverage



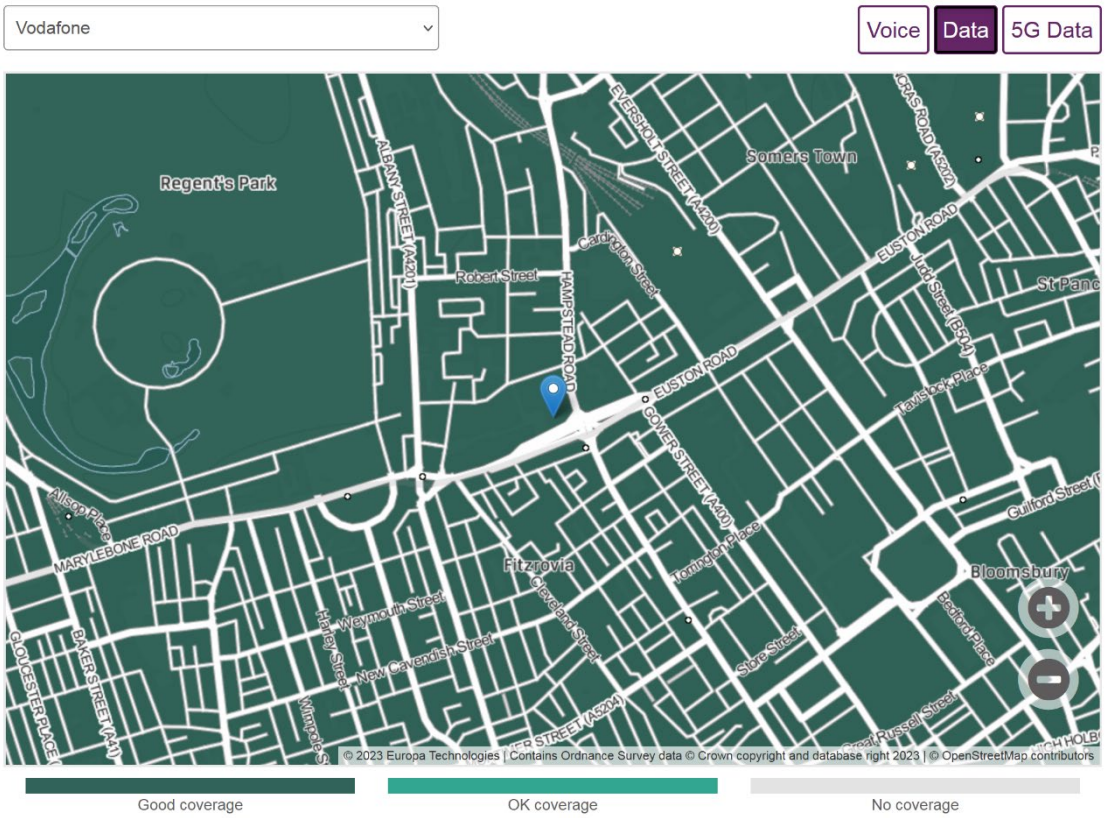
Three - Data Coverage



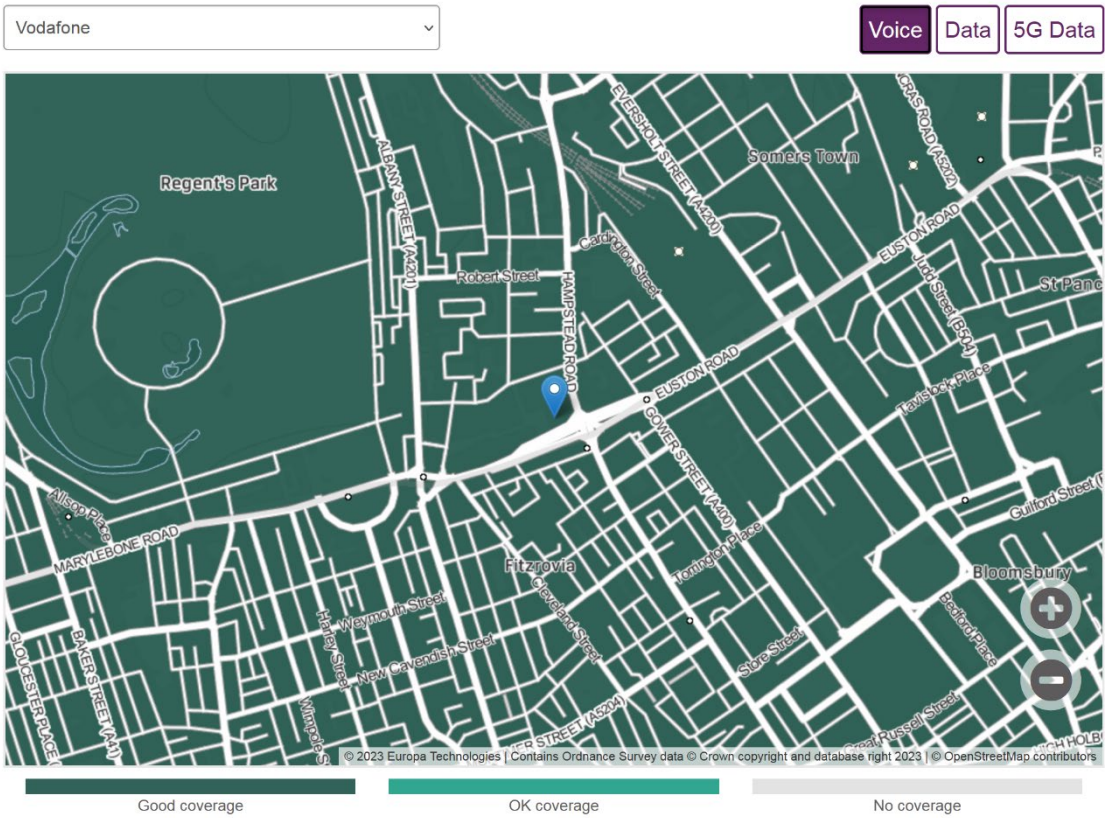
Three - Voice Coverage



Vodafone - 5G coverage



Vodafone - Data Coverage



Vodafone - Voice Coverage

Appendix II - Television Transmission Frequencies[10]

Digital TV Multiplex	Multiplex Operator	UHF Channel Number[11]	Channel Frequency Fc (MHz)[12]	Transmitter Power (kW)
BBC A	BBC	23	490.000	200
D3&4	Digital 3 & 4	26	514.000	200
BBC B - HD	BBC	30-	545.833	200
SDN	SDN	25	506.000	200
Arqiva A	Arqiva	22	482.000	200
Arqiva B	Arqiva	28-	529.833	200

Table A - Crystal Palace DTT Services

Public Service Broadcaster (PSB) Digital Multiplexes
Commercial (COM) Digital Multiplexes

10 - Information correct at time of writing. Information provided by DigitalUK and Arqiva

11 - Digital multiplexes with a "+" or "-" sign operate with a frequency offset making the channel frequency + or - 167 kHz

12 - The nominal channel frequency, Fc (in Megahertz) of the multiplex can be calculated using Fc = 8n+306, where 'n' is the UHF channel number

Appendix III - Signal Measurements

Measurement Point Number	Channel	23	26	30	25	22	28
	Frequency	490.00	514.00	546.00	506.00	482.00	530.00
	Service	BBC A	D3&4	BBC B -	SDN	Arqiva A	Arqiva B -
1	FS	88.1	85.3	84.9	81.1	95.5	90.7
	CSI	21.0	20.5	-	22.0	23.8	21.7
	MER	30.5	30.5	-	28.0	29.8	32.3
2	FS	87.9	84.9	96.8	95.1	86.8	88.5
	CSI	20.7	21.0	-	22.0	21.0	23.0
	MER	31.9	30.7	-	30.6	31.0	31.4
3	FS	88.3	82.2	90.7	94.0	95.6	98.2
	CSI	22.0	19.0	-	18.8	19.1	22.0
	MER	31.2	32.1	-	30.3	30.0	31.8
4	FS	94.6	93.9	90.4	88.1	89.6	97.3
	CSI	21.0	22.0	-	23.0	18.7	22.0
	MER	30.3	29.1	-	30.4	31.0	29.9
5	FS	93.0	93.4	85.1	82.3	91.6	73.0
	CSI	21.9	20.9	-	18.3	21.2	22.3
	MER	29.2	31.1	-	30.3	30.6	31.7
6	FS	90.6	87.7	91.1	94.6	90.6	84.4
	CSI	21.6	21.2	-	22.1	21.2	20.6
	MER	30.9	31.1	-	32.0	31.0	29.2
7	FS	83.1	91.8	89.2	87.8	89.2	87.0
	CSI	21.2	22.0	-	21.7	21.0	21.4
	MER	31.5	31.6	-	30.3	31.3	30.1
8	FS	89.6	85.2	81.8	87.1	85.8	87.3
	CSI	22.3	18.5	-	22.1	18.1	2.0
	MER	29.7	31.8	-	28.3	31.3	31.6
9	FS	89.2	88.5	89.8	87.5	92.2	84.3
	CSI	22.4	21.0	-	22.0	21.3	22.1
	MER	31.0	29.2	-	32.5	30.9	31.0
10	FS	91.6	79.4	88.4	89.5	74.1	87.7
	CSI	20.0	19.5	-	19.6	22.0	17.0
	MER	30.8	30.3	-	30.1	30.8	32.0
11	FS	96.5	85.9	76.4	86.2	87.8	85.9
	CSI	20.0	24.1	-	21.0	21.0	21.5
	MER	30.6	31.3	-	29.5	29.8	31.8
12	FS	88.5	85.8	80.8	91.8	88.4	93.8
	CSI	21.0	21.2	-	20.0	20.1	22.0
	MER	30.6	31.8	-	29.5	31.9	29.5

Table B - Technical Measurements of Crystal Palace DTT Services

Frequencies listed are in MHz
Field strength (FS) values are indicated in dBμV/m
CSI Channel Status Information (%)
MER Modulation Error Ratio (dB)

Appendix IV - An Overview of Signal Measurements

The first and easiest parameter to check is signal level (also referred to as amplitude or terminated signal strength). In many cases this gives a good indication of the available decoding margin, or the extent of any shortfall.

At the receiver input, the terminated level of a DTT signal is measured in the usual units of dBμV (a maximum signal level of 70 dBμV and a minimum signal level of 50 dBμV). It is helpful to understand that the level of a DTT signal represents the total power of all the carriers in the Coded Orthogonal Frequency Division Multiplexing (COFDM) signal and not the level of each individual COFDM carrier. For satisfactory reception of digital signals, it is important the signals applied to the receiver are within these ranges. These maximum and minimum levels define a so-called window of operation for the receiver.

Common practice dictates that in order to measure the quality of a received DTT signal we have to look at one or more of the following parameters: Bit-Error Rate (BER), Channel BER (CBER), Carrier-to-Noise Ratio (CNR) and Modulation Error Ratio (MER). The Channel State Information (CSI) feature available in DTT measurement equipment is a very valuable tool providing additional insight into the quality of reception in a typical domestic or professional DTT installation.

Using the BER alone is an ill-advised “hit-or-miss” strategy because of the 'cliff-edge effect' characteristic of any digital TV system. A BER reading below the reference quasi error free (QEF) value of 2×10-4 might wrongly lead us to conclude that the receiving conditions are satisfactory.

However, the BER provides a very narrow signal measurement range. Even for vanishingly small BER readings, a small drop in the level of received DTT signal can push the DTT receiver over the digital cliff edge beyond the point of system failure. The CBER is closely related to the BER providing a wider signal measurement range. Depending on the type(s) of unknown disturbance(s) affecting our DTT installation (noise, co-channel or adjacent PAL, co-channel DTT, etc.), the CBER corresponding to the reference QEF BER of 2×10-4 varies between 4 and 7 in 100 [1]. Unfortunately, the CBER is not a reliable indicator of how far the digital cliff edge is.

DTT engineers need a tool with a wide measurement range that solves the shortcomings of the BER and CBER. This measurement tool should provide some estimate of the noise margin of the DTT installation. A first candidate comes to mind: CNR or, alternatively, its sibling the MER.

The CNR is defined as the ratio of the average RF power of the DTT signal to the power of the noise present in the UHF channel. Similarly, the MER is defined as the ratio of the average power of the DTT signal to the average power of the constellation errors. It can therefore be used to give a more direct indication of decoding margin when, as is often the case, there is co-channel

interference as well as noise in the channel. The higher the MER value, the **better** the reception conditions.

In situations where there is no multipath propagation so that the channel frequency response remains reasonably flat, CNR and MER are in principle the same thing. In practice, the accuracy of the measured CNR is limited by the noise floor of the measurement equipment and by the presence of other disturbances on adjacent UHF channels. Likewise, both the receiver's noise floor and other issues resulting from its practical implementation degrade the MER estimate.

Channel State Information (CSI)

Some flavour of CSI is used internally by all commercial DTT receivers to achieve the recommended target system performance[13]. The CSI counts the effect of both the noise present in the channel and the shape of the transmission channel itself. In other words, the CSI gives a measure of the reliability of the received DTT signal. We measure the average of the CSI across the UHF channel occupied by the DTT signal. The higher the percentage value of CSI, the **less** reliable DTT reception is.

As explained, the CSI can be used as a means to measure the noise margin in a DTT installation. Let us call CSI_{QEF} the percentage CSI measured at the point where the measurement equipment displays the reference QEF BER. The noise margin in dB is then approximately given by –

$$NM\ (dB) = \frac{CSI_{QEF} - CSI}{2.6}$$

This empirical approximation represents a good estimate for NM below 8dB. The CSI alone, on the other hand, has a wider measurement range, providing meaningful results for NM of up to 15dB.

13 - *J. Lago-Fernández, "Using Channel State Information (CSI) to Characterize DVB-T Reception", IBC, Amsterdam, 12-17 September 2002*

Appendix V - Survey Equipment

1 x Promax Prolink 4C Premium – Serial Number PK4COPAB11B / 060419030005 Running firmware version 2.47

1 x Sony Wide screen CRT Reference Receiver KV–16TIU – Serial Number 4014480

1 x Professional Broadcast Wideband Log Periodic 8 element antenna – Amphenol Jaybeam (details below)

Amphenol JAYBEAM

468-860 MHz

A Log Periodic antenna designed for UHF Broadcast, TETRA and Cellular communications applications. This antenna is often used in a stacked array to form a rugged, high power, extended range antenna. Produced to the highest quality standards, these robust antenna designs will insure reliable operation in harsh environmental conditions.

LPU/Rx

V-Pol or H-Pol | Log Periodic | 70° | 7.9 dBd

Replace "x" with desired model number option.

Electrical Characteristics		
Frequency band	468-860 MHz	
Model number options (x)	Model Number LPU/R-N LPU/R-7/16	Connector type N-Female 7/16-DIN Female
Polarization	Vertical or Horizontal	
Horizontal beamwidth	70°	
Gain	7.9 dBd	
Impedance	50Ω	
VSWR	<1.3:1	
Maximum power	250 W	
Connector type	see model number options above	
Lightning protection	DC grounded	
Mechanical Characteristics		
Materials	Aluminium Alloy	
Dimensions (Length x Width)	1210 x 320 mm	47.6 x 12.6 in
Weight without bracket	3.5 kg	7.7 lbs
Mounting Options		
Mounting	Mounting bracket included to fit 38-50 mm dia. pipe.	

Technical Specification for an Amphenol Jaybeam Professional Broadcast Wideband Log Periodic 8-Element Antenna

All RF cables, interconnects and systems of professional quality and calibrated to determine feeder losses and antenna gains. These are factored into the results, providing accurate descriptions of actual field strength values at 10m AGL for each surveyed location – see *Calculation of Received Field Strength*

Appendix VI - Calculation of Received Field Strength

The Field Strength (dBµV/m) is derived from the Terminated Level (dBµV) as measured at the input of the Promax measurement receiver in the survey vehicle.

Field Strength (dBµV/m) = Terminated Level (dBµV) – Aerial Gain (a) + Dipole Factor (b) + Feeder Loss (c)

where -

Dipole Factor (to matched load)	(b)	$20Log(\frac{2\pi}{\lambda})$ *Where λ = Transmission Wavelength (m)*
Feeder Loss	(c)	3 dB
Aerial Gain (dB_{dipole})	(a)	10 dB

Appendix VII - References

The building information found in Chapter 2 was sourced from the following Ofcom document –

http://licensing.ofcom.org.uk/binaries/spectrum/fixed-terrestrial-links/wind-farms/tall_structures.pdf

Appendix VIII - Mapping Data

This report includes mapping and mapping data provided by Ordnance Survey (OS), under the terms of the Open Government Licence, OS data Crown copyright and database copyright (2023).

Appendix IX - Planning Policies - National Planning Policies and Regional Planning Policies

National Planning Policy Framework (NPPF), Department for Levelling Up, Housing and Communities, September 2023

10. Supporting high quality communications

116. Local planning authorities should not impose a ban on new electronic communications development in certain areas, impose blanket Article 4 directions over a wide area or a wide range of electronic communications development, or insist on minimum distances between new electronic communications development and existing development. They should ensure that:

a) they have evidence to demonstrate that electronic communications infrastructure is not expected to cause significant and irremediable interference with other electrical equipment, air traffic services or instrumentation operated in the national interest; and

b) they have considered the possibility of the construction of new buildings or other structures interfering with broadcast and electronic communications services

Planning Policies - Regional Planning Policies

London - The London Plan - The Spatial Development Strategy for Greater London, March 2021, The Greater London Authority (GLA)

The London Plan 2021 (March 2021) - Spatial Development Strategy for Greater London, discusses at length the need for robust digital connectivity and that new development must not cause interference to telecommunications networks and local connectivity. Two policies and associated text relating to telecommunications, broadcast reception and digital connectivity are presented below;

Policy SI 6 Digital connectivity infrastructure

A) To ensure London's global competitiveness now and in the future, development proposals should:

1) ensure that sufficient ducting space for full fibre connectivity infrastructure is provided to all end users within new developments, unless an affordable alternative 1GB/s-capable connection is made available to all end users

2) meet expected demand for mobile connectivity generated by the development

3) take appropriate measures to avoid reducing mobile connectivity in surrounding areas; where that is not possible, any potential reduction would require mitigation

4) support the effective use of rooftops and the public realm (such as street furniture and bins) to accommodate well-designed and suitably located mobile digital infrastructure.

B) Development Plans should support the delivery of full-fibre or equivalent digital infrastructure, with particular focus on areas with gaps in connectivity and barriers to digital access.

9.6.3 Better digital connectivity with a focus on capability, affordability, security, resilience and the provision of appropriate electrical power supply should be promoted across the capital. The specific requirements of business clusters, such as a symmetrical-capable service with the same upload and download speeds, should also be met.

9.6.4 Given the fast pace at which digital technology is changing, a flexible approach to development is needed that supports innovation and choice. Part R1 of the Building Regulations 2010 requires buildings to be equipped with at least 30 MB/s ready in-building physical infrastructure, however new developments using full fibre to the property or other higher-grade infrastructure can achieve connectivity speeds of 1GB/s. Developers should engage early with a range of network operators, to ensure that development proposals are

designed to be capable of providing this level of connectivity to all end users. Mechanisms should also be put in place to enable further future infrastructure upgrades. Innovation is driving reductions in the size of infrastructure, with marginal additional unit costs, but greater digital connectivity is needed in more locations.

9.6.5 Development proposals should also demonstrate that mobile connectivity will be available throughout the development and should not have detrimental impacts on the digital connectivity of neighbouring buildings. Early consultation with network operators will help to identify any adverse impact on mobile or wireless connectivity and appropriate measures to avoid/mitigate them.

9.6.6 Access for network operators to rooftops of new developments should be supported where an improvement to the mobile connectivity of the area can be identified. Where possible, other opportunities to secure mobile connectivity improvements should also be sought through new developments, including for example the creative use of the public realm.

9.6.8 The Mayor will work with network operators, developers, councils and Government to develop guidance and share good practice to increase awareness and capability amongst boroughs and developers of the effective provision of digital connectivity and to support the delivery of policy requirements. The Mayor will also help to identify spatial gaps in connectivity and overcome barriers to delivery to address this form of digital exclusion, in particular through his Connected London work. Boroughs should encourage the delivery of high-quality / world-class digital infrastructure as part of their Development Plans.

9.6.9 Digital connectivity supports smart technologies in terms of the collection, analysis and sharing of data on the performance of the built and natural environment, including for example, water and energy consumption, waste, air quality, noise and congestion. Development should be fitted with smart infrastructure, such as sensors, to enable better collection and monitoring of such data. As digital connectivity and the capability of these sensors improves, and their cost falls, more and better data will become available to improve monitoring of planning agreements and impact assessments, for example related to urban design. Further guidance will be developed to make London a smarter city.

Policy D9 Tall buildings

Definition

A) Based on local context, Development Plans should define what is considered a tall building for specific localities, the height of which will vary between and within different parts of London but should not be less than 6 storeys or 18 metres measured from ground to the floor level of the uppermost storey.

2) functional impact

f) buildings, including their construction, should not interfere with aviation, navigation or telecommunication, and should avoid a significant detrimental effect on solar energy generation on adjoining buildings

Appendix X - Television Signal Survey Questionnaire

Television Signal Survey Questionnaire

Contact details *please highlight (in bold or circle) your required method of contact*

Name:

Address (inc. postcode):

Telephone: Mobile:

Email:

About your TV Signal

What provides the signal to the television set(s) in your home?

- ☐ Digital Satellite (Sky/Freesat)
- ☐ Digital Terrestrial (Freeview)
- ☐ Cable/Broadband (BT/Virgin Media)

Which of these rooms do you have a television set in?

- ☐ Lounge
- ☐ Dining room
- ☐ Kitchen
- ☐ Bedroom 1
- ☐ Bedroom 2
- ☐ Bedroom 3
- ☐ Bedroom 4
- ☐ Bedroom 5
- ☐ Other
  *Please specify*_____
  _____

Which of these television sets have been affected by interference since (or during) the building's construction?

- ☐ Lounge
- ☐ Dining room
- ☐ Kitchen
- ☐ Bedroom 1
- ☐ Bedroom 2
- ☐ Bedroom 3
- ☐ Bedroom 4
- ☐ Bedroom 5
- ☐ Other
  *Please specify*_____
  _____

What interference have you been experiencing?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

When does this happen?

- ☐ Daytime
- ☐ Night time

How often does this happen?

- ☐ Daily
- ☐ Weekly
- ☐ Monthly
- ☐ Yearly

What channels are affected?

_____
_____
_____
_____

When did you first notice the interference?

_____
_____
_____
_____

Please feel free to add any additional comments

Signature:..... Date:.....

DISCLAIMER

This Report was completed by GTech Surveys Limited on the basis of a defined programme of work and terms and conditions agreed with the Client. We confirm that in preparing this Report we have exercised all reasonable skill and care taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project.

GTech Surveys Limited accepts no responsibility to any parties whatsoever, following the issue of the Report, for any matters arising outside the agreed scope of the works. This work was conducted under GTech Surveys Limited's standard terms and conditions which can be found on our website.

This Report is issued in confidence to the Client and GTech Surveys Limited have no responsibility to any third parties to whom this Report may be circulated, in part or in full, and any such parties rely on the contents of the report solely at their own risk.

The UK's terrestrial television and radio networks are highly complex engineering systems and are constantly being modified, re-designed, upgraded and maintained. The reception conditions detailed in this report were those prevailing at the time of the survey in the study area. Engineering work at transmitter sites, weather conditions and the time of the year will influence the quality and coverage of terrestrial services and their susceptibility to interference. Whilst every effort was made to accurately measure and assess the available television and radio transmissions and services at the time of the survey, GTech Surveys Limited cannot assume that any part of the television or radio broadcast network or transmission from any transmitter was operating in required specification or correctly to any design criteria. The signal measurements undertaken during the survey work were used to define the possible impacts to television and radio reception for this project. Although best practice has been applied in understanding the potential impacts, due to the complex nature of the subject, GTech Surveys Limited is not accountable in anyway whatsoever if unpredicted impacts occur at any location anywhere in the study area.

Modelling parameters assume that all installed UHF antenna systems are mounted at least 10m AGL and installed to a modern standard, with all components meeting CAI quality standards. Antennas mounted at lower heights and poor-quality installations will be more prone to the effects of interference from external sources and as such, reception conditions to installations with the aforementioned characteristics have not been accounted for in any impact modelling. Consequently, properties with such installations may be prone to interference effects that have not been identified. Such installations are commonly found in camping and caravan parks, on bungalows and properties where it is not possible to attach an antenna to the exterior roof. Antennas mounted in lofts are also more prone to interference effects arising from the signal attenuation caused by roofing materials. Again, reception conditions to properties with the aforementioned antenna installation characteristics have not been accounted for in any impact modelling and as such, properties with these installations may be prone to interference effects that have not been identified.

Digital terrestrial television (Freeview) coverage may vary as a result of engineering works or any frequency changes authorised by Ofcom. We advise that consumers always check future reception predictions (http://www.digitaluk.co.uk/coveragechecker/) before buying TV equipment. GTech Surveys Limited, Ofcom and Digital UK are not responsible for household TV reception arrangements.

Unless specifically assigned or transferred within the terms of the agreement, the consultant asserts and retains all Copyright, and other Intellectual Property Rights, in and over the Report and its contents.

Any questions or matters arising from this Report should be addressed in the first instance to the Project Manager.