

Television and Radio Desk-Based Report

Wilmslow Road

Watkin Jones Group

December, 2020

PLANNING SOLUTIONS FOR:

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EXECUTIVE SUMMARY

Overview

Pager Power has been commissioned to investigate the potential impact of a proposed building development upon terrestrial and satellite television services, as well as radio, in the surrounding area. The proposed development is located at 188 Wilmslow Road in Manchester, UK, and has a maximum altitude of 70.23m above means sea level (amsl) and 26.98m above ground level (agl). The assessment has been undertaken based on guidance produced by Ofcom.

The aim of this study is to determine the impact of the proposed development upon terrestrial and satellite television reception in key interference areas, as well as radio services. The report has determined the potential for effects by identifying the relevant transmitters and satellites, and modelling appropriate diffraction and reflection zones, as appropriate.

Terrestrial Television Assessment Conclusions

The overall conclusions for terrestrial television transmissions are:

- The proposed development is within the coverage area for the Winter Hill television transmitter which is expected to be the main transmitter serving the area;
- Any interference would be due to diffraction (shadowing) effects i.e. the weakening of the transmitted signal due to the physical presence of the proposed development;
- Considering the desk-based modelling results and Pager Power's assessment experience, any interference effects would be limited to approximately 1km of the proposed development and within its shadow (to the south east of the proposed development on a bearing of approximately 135.62);
- In practice, small/moderate losses may be tolerable to the current terrestrial television signal without affecting the quality of the reception in the area. It is possible that no noticeable effects would occur in practice.

Satellite Television Assessment Conclusions

The overall conclusions for satellite television transmissions are:

- The modelled shadow zone for satellite television services is limited to 75m north west of the proposed development's location;
- A review of the available imagery has revealed no satellite dishes within this zone as it covers woodland and green spaces;
- No impact upon satellite television services is expected.

Radio Assessment Conclusions

The results of the analysis for radio transmissions are:

- Radio services will be provided by a range of transmitters in the area. Digital and analogue service are broadcast;
- Weakening of the signal in the immediate shadow of the building is possible. The potential for significant impacts is limited due to:
 - The variable signal strength of radio transmissions in an urban environment;
 - The robust nature of radio services.
- Interference to radio service is less likely than those to terrestrial television services. This is evident as internal radio aerials are more likely to be successful decoding radio signals than internal television aerials are at decoding television signals;
- In many cases, significant interference caused by building developments never materialises internally or externally;
- It is therefore unlikely that noticeable impacts upon radio signals will occur in practice. An investigation of any reported interference can be undertaken, with the approach similar to that of investigating reported terrestrial television interference.

Recommendations

A terrestrial television and a radio baseline reception survey could be undertaken to measure current signal strength and quality. This can assist with determining the likelihood of interference occurring and provide a comparison result if interference is subsequently reported.

Any reported terrestrial television or radio interference should be investigated by means of a post-construction reception measurement. The modelling can then be compared alongside the baseline survey results (if completed) to determine whether the effect is attributable to the development. No pre-emptive mitigation is required.

Mitigation

Technical mitigation solutions have been identified and could be implemented in the event that a significant impact occurs. These are outlined in Section 9 of this report. No pre-emptive mitigation is required.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 48 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 BACKGROUND

1.1 Introduction

Pager Power has been commissioned to investigate the potential impact of a proposed building development upon terrestrial and satellite television services, as well as radio, in the surrounding area. The proposed development is located at 188 Wilmslow Road in Manchester, UK, and has a maximum altitude of 70.23m above means sea level (amsl) and 26.98m above ground level¹ (agl). The assessment has been undertaken based on guidance produced by Ofcom.

The aim of this study is to determine the impact of the proposed development upon television (terrestrial and satellite) and radio reception in key interference areas. The report has determined the potential for effects upon both by identifying the relevant transmitters (television) and modelling appropriate diffraction and reflection zones, as appropriate.

1.2 Assessment Requirement

The proposed development will introduce a new tall structure into the urban environment which could interact with wireless television signals and cause interference in the surrounding area. This report has been completed to investigate potential issues arising from its development.

¹ Considering a ground level of 43.25m as per 1093-TGA-XX-ZZ-DR-A-05001.

2 DEVELOPMENT PLANS

2.1 Proposed Development Boundary

The red line boundary for the proposed development overlaid on aerial imagery is shown in Figure 1² below.

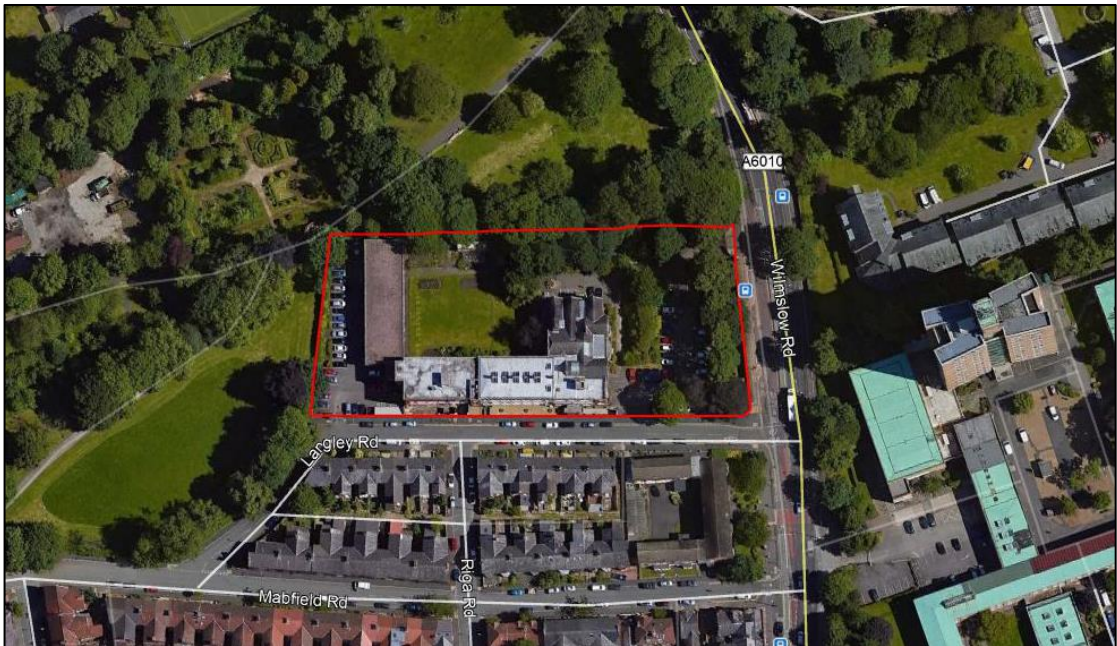


Figure 1 Proposed development red line boundary overlaid on aerial imagery

2.2 Proposed Development Ground Floor Plan and Elevation

The ground floor plan for the proposed development is shown in Figure 2³ on the following page.

The proposed development will have a maximum elevation of 70.23m above mean seal level or 26.98m above ground level.

² Source: Copyright © 2020 Google.

³ Source: Tim Groom Architect (cropped).

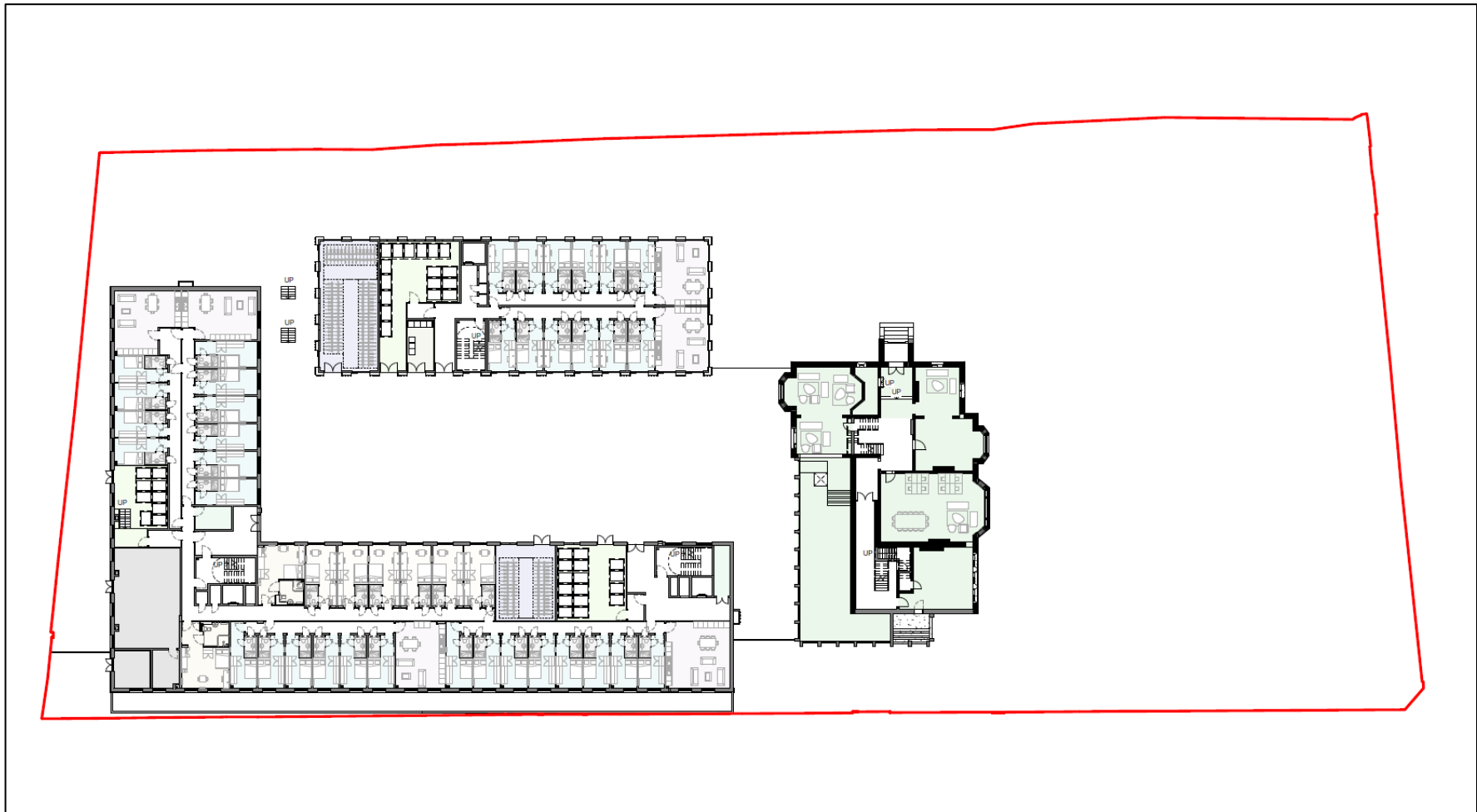


Figure 2 Proposed development's ground floor plan

3 TELEVISION AND RADIO TRANSMITTER DETAILS

3.1 Relevant Transmitter

A comprehensive search of transmitter and coverage maps revealed that the Winter Hill transmitter is the main transmitter most likely to be serving the area around the proposed development.

Digital television services are broadcast via Ultra High Frequency (UHF) signals; no analogue television signals are broadcast. The transmitter information is presented below⁴.

3.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 27.99km northwest of the development (published coordinates SD66051446). The main digital services provided are shown in the sub-sections below. Digital television services are broadcast, details are presented in Table 1 and Table 2.

	Public (PSB)			Commercial (COM)		
Service	BBC A	Digital 3&4	BBC B	SDN	Arqiva A	Arqiva B
Channel	32	34	35	29	31	37
Power	100 kilo-Watts (kW)					

Table 1 Winter Hill main transmissions

	Local Multiplexes/Other				
Service	COM 7	LM/LL/LPR	GIM	-	-
Channel	55	56	57	24	27
Power	25.7 kW	1kW	1 kW	-	-

Table 2 Winter Hill additional transmissions

⁴ Source: [Ofcom](#), UK digital television transmitter details – DSO multiplexes, UKFreeTV and previous reception surveys.

3.3 Winter Hill Transmitter Location

Figure 3⁵ below shows the location of the proposed development relative to the Winter Hill transmitter.

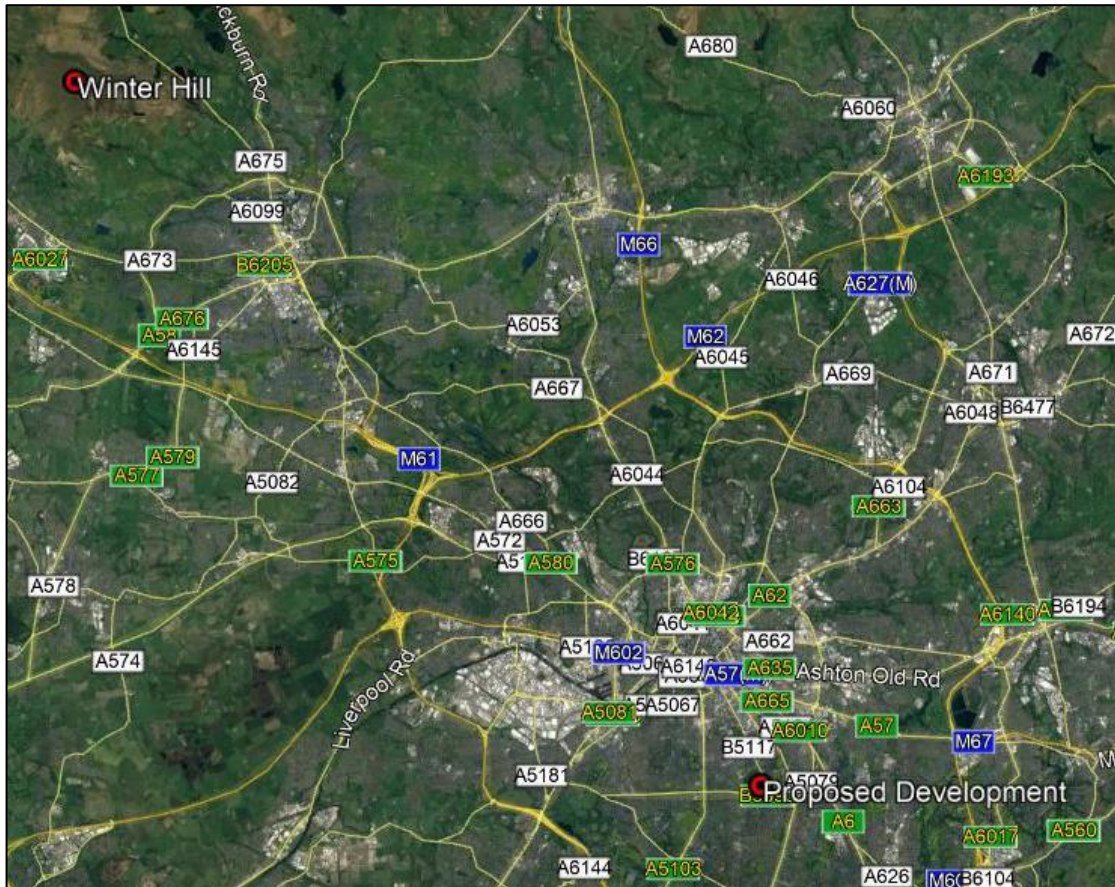


Figure 3 Proposed development and assessed transmitter relative locations

3.4 Radio Transmissions

Radio services in the UK are broadcast from a variety of main and local transmitters. Services are currently broadcast as both analogue and digital transmissions and in many cases are broadcast from television transmitter towers. In the case of the proposed development, Winter Hill and several other transmitters are expected to be broadcasting the radio services in the surveyed area. Both digital and analogue radio services are broadcast in the UK.

Receivers are typically mobile or portable devices with omnidirectional aerials. The relevant transmitter is dependent on the receiver's exact position and the radio channel that is being received. Because of this radio signals tend to be more robust compared to television signals.

⁵ Source: Copyright © 2020 Google.

4 BUILDINGS AND INTERFERENCE MECHANISMS

4.1 Technical Overview

Terrestrial television services are provided by means of electromagnetic waves in the Ultra High Frequency (UHF) range which propagate from land-based transmitters to receiving aerials. Typical radio transmissions are transmitted at a variety of frequencies, from Medium Frequency (MF) to Very High Frequency (VHF) range.

The quality of the image and sound on a set is dependent on both the strength of the signal received directly from the transmitter (carrier signal) and the strength of any interference signals from other sources. To achieve good quality reception an aerial must receive a strong carrier signal but weak interference signals.

There are two ways that buildings can cause interference to television reception, these are described in the following sections.

4.2 Obstruction of the Signal – Television Services

This is caused by the building physically blocking the transmitted signal, reducing the strength of the carrier signal in the shadow of the building. In the case of Winter Hill's terrestrial television transmissions, this would affect residences to the south east of the proposed development. For satellite television reception, all interference areas are north of an obstruction in the northern hemisphere. The following is true for both terrestrial and satellite television signals:

- The highest losses (greatest interference) will be located immediately behind the building relative to the transmitter or satellite i.e. in the shadow zone;
- Losses near the edge of the shadow zone will be less significant due to diffraction effects (bending of the signal).

Ofcom has produced a document⁶ offering guidance on this issue for terrestrial television. See Section 3.4 for extracts relating to satellite television. Relevant extracts from the documents relating to terrestrial television are presented below.

"In general, there will be three 'zones' behind the structure:

Zone A - close behind the structure (typically a few tens of metres) there may be a large reduction in signal level with a possible complete loss of reception

Zone B - further away (typically a few hundred metres) the signal reduction is less severe and the shadow will be smaller as diffraction effects partially fill in the shadow. Depending on the size of the structure, some locations could still lose reception completely

⁶ Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services

Zone C - some distance away (1-5km) the shadow will effectively have disappeared.”

The zones mentioned are illustrated in Figure 4⁷ below, taken from Section 3.2 of the Ofcom guidance regarding the impact of buildings on broadcast signals.

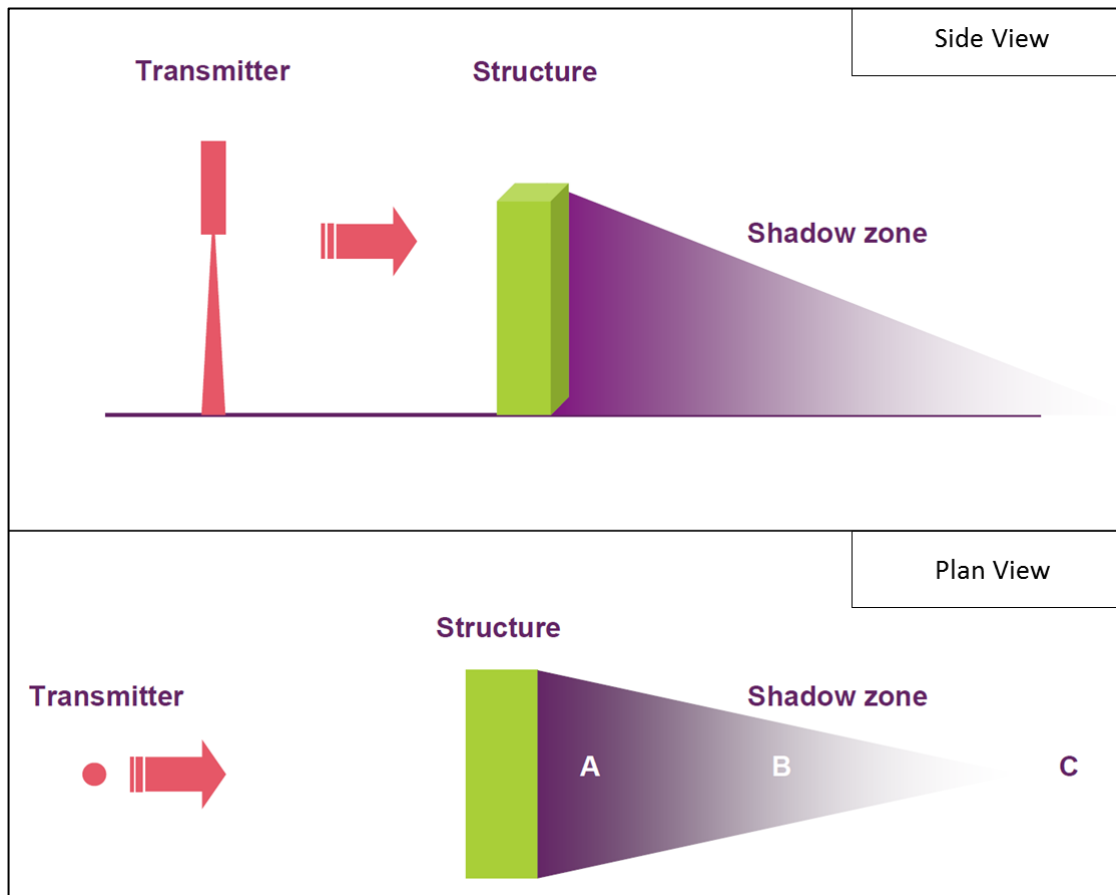


Figure 4 Diffraction loss zones

⁷ Source: Ofcom publication.

4.3 Reflection of the Signal

The following is generally true for terrestrial television signals only.

For large developments with straight edges, the transmitted signal can be reflected by the building itself. This causes an effect known as 'multipath interference' whereby the signal is received twice by an aerial at different times. The direct signal arrives first because it has a shorter distance to travel. Figure 5⁸ below (taken from Section 3.3 of the Ofcom guidance referenced above) illustrates this effect.

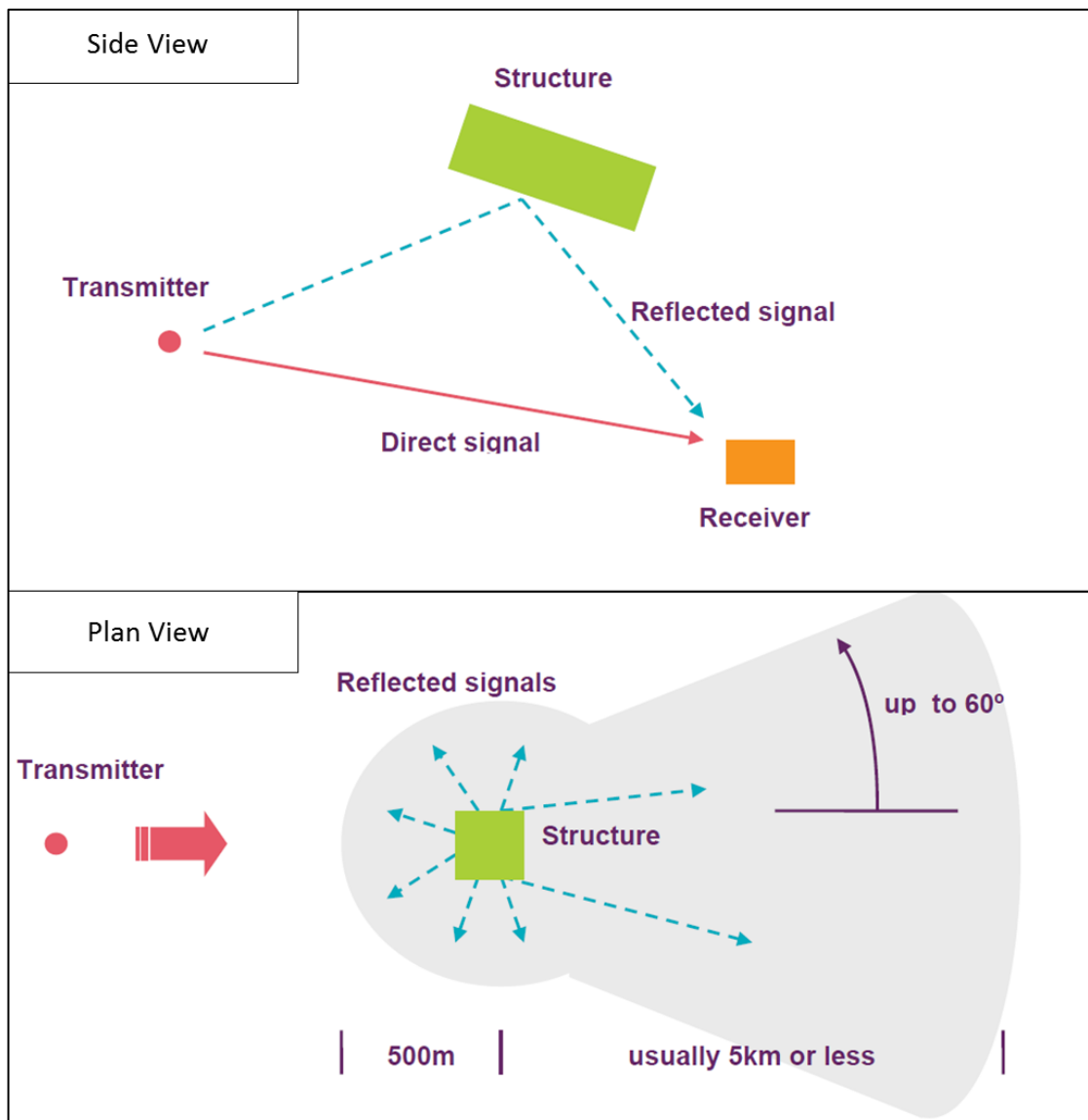


Figure 5 Reflection zones

⁸ Source: Ofcom publication

In practice, it is considered highly unlikely that reflections will have an effect for receivers in front of the building or on either side when viewed from the location of the transmitter. For digital transmissions in particular, it is unlikely that issues will occur if the angle between the direct signal and the reflected signal is more than 30 degrees⁹.

The reflection zone has been constructed in accordance with the Ofcom approach, however the angle considered is 30 degrees rather than 60 degrees. This is in order to represent a more realistic scenario for digital transmissions.

Reflection issues are most likely to cause a noticeable impact if:

- The direct signal from transmitter to receiver is weak (e.g. obstructed by terrain or buildings);
- The reflected signal from the building is strong (e.g. clear radio line of sight from the transmitter to the building and the building to the receiver).

The worst-case scenario is for both of the above conditions to be satisfied. The best-case scenario is for neither of the above conditions to be satisfied.

4.4 Satellite Television Interference

The principle of shadowing (discussed in Section 4.2) is also applicable to satellite transmissions. Signals from a satellite tend to come from a much steeper angle than those from a terrestrial transmitter, however receivers that are located in close proximity to an obstruction could still be affected. The Ofcom guidance¹⁰ states:

'Satellite TV reception is not generally affected by new structures unless the development blocks the 'line-of-sight' between a dish antenna and the satellite in the sky. While terrestrial TV aerials are generally mounted to receive signals in line with the horizon, and are therefore liable to be blocked by taller structures, satellite signals are received from a much higher elevation. This means that disruption to satellite reception is usually limited only to cases where a tall building is erected very close to an existing building.'

Figure 6 on the following page – taken from the Ofcom guidance – illustrates an example of a receptor that is in the shadow zone for a terrestrial transmitter but outside the shadow zone for a satellite.

⁹ This is known to be the angle that Arqiva considers when safeguarding its Television Re-Broadcast Links with regard to reflections from wind turbines – whilst wind turbines cause issues that are different to buildings this particular issue is similar for the two.

¹⁰ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

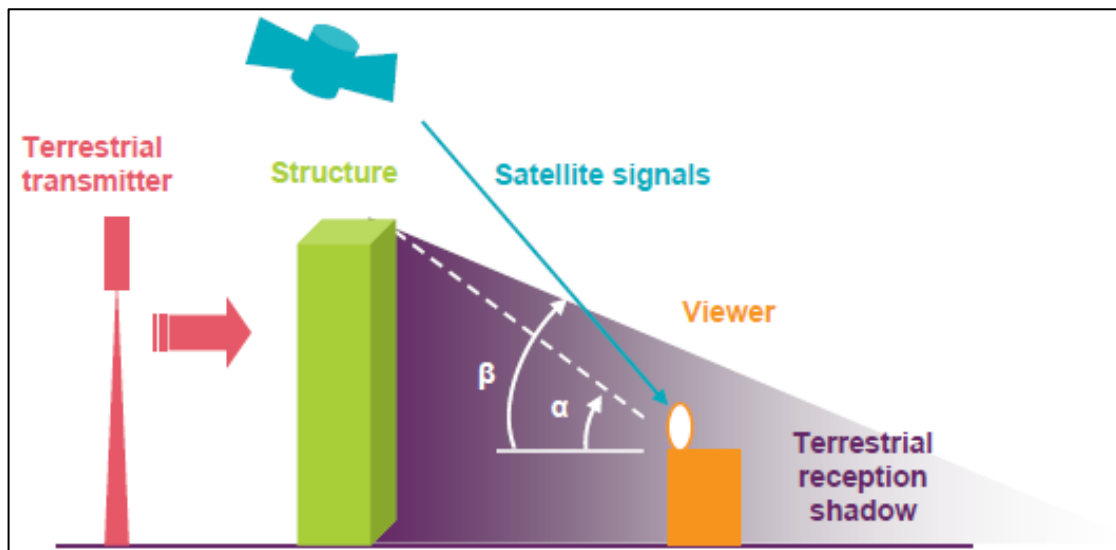


Figure 6 Satellite reception not affected by a new structure

The dimensions of the shadow zone for a satellite are dependent on:

- The relative height of the satellite dish and the building.
- The vertical angle from the satellite dish to the satellite itself – in Manchester this is approximately 26 degrees.

4.5 Radio Interference

There is less specific guidance for radio interference within the Ofcom guidance. The following information is given:

Although reports of new structures causing problems to radio reception are rare, the possibility of difficulties cannot be ruled out entirely. Broadcast radio (FM, AM and DAB digital radio) are transmitted on lower frequencies than those used by terrestrial TV signals. Lower frequency signals tend to pass through obstructions more easily than the higher frequency TV signals, and diffraction effects also become more significant at lower frequencies. Both these factors will tend to lessen the impact of new structures on radio reception.

Strong signal reflections will reduce the quality of FM reception leading to fluttering noises or sound distortion. In contrast, the signal format used for DAB digital radio is designed to offer high levels of robustness in difficult conditions and it is not materially affected by reflections. FM and DAB reception can be affected where a structure blocks signals and both may cease to function if signals are reduced below a certain threshold.

It is Pager Power's experience that reported interference to radio services is significantly less common than reported interference to television services. Potential impacts on radio have nevertheless been considered at a high-level within the analysis for completeness – see Section 7.

5 TERRESTRIAL TELEVISION TECHNICAL ASSESSMENT

5.1 Potential Interference Areas

The shadow and reflection zones have been defined based on the geometry as set out in the previous section. Both zones extend to a distance of 5km beyond the proposed development location in accordance with the Ofcom guidance.

In the case of the shadow zone, this has been modelled as having straight sides in order to be conservative. In actuality due to diffraction effects the zone would have a more triangular shape as shown in Figure 4 in the previous section.

Figure 7 on the following page shows the potential interference areas associated with the proposed development¹¹.

¹¹ The extrapolated building footprint within the site redline has been considered.

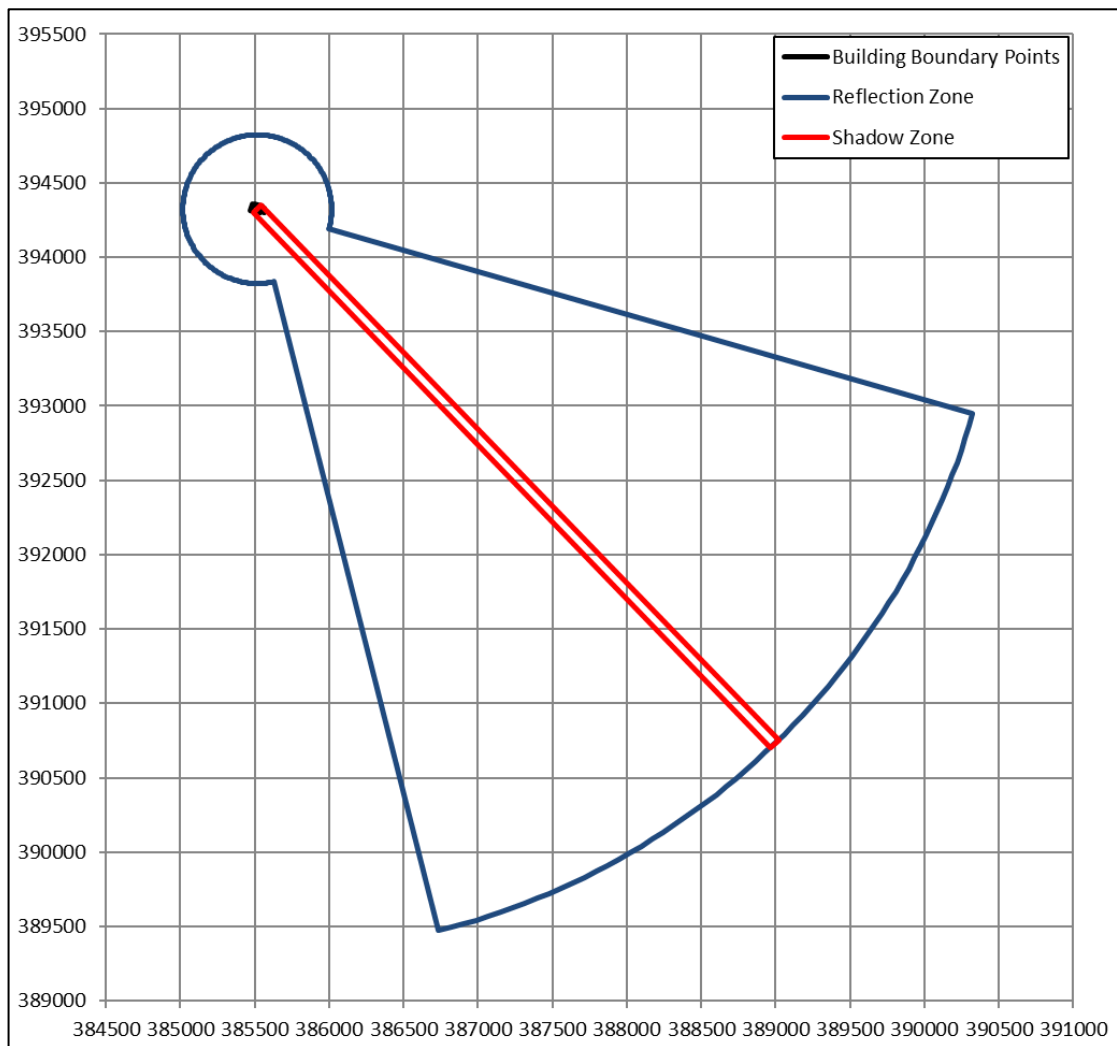


Figure 7 Television diffraction and reflection Interference areas

Figure 8 below¹² shows the interference zones overlaid onto an aerial image of the area.

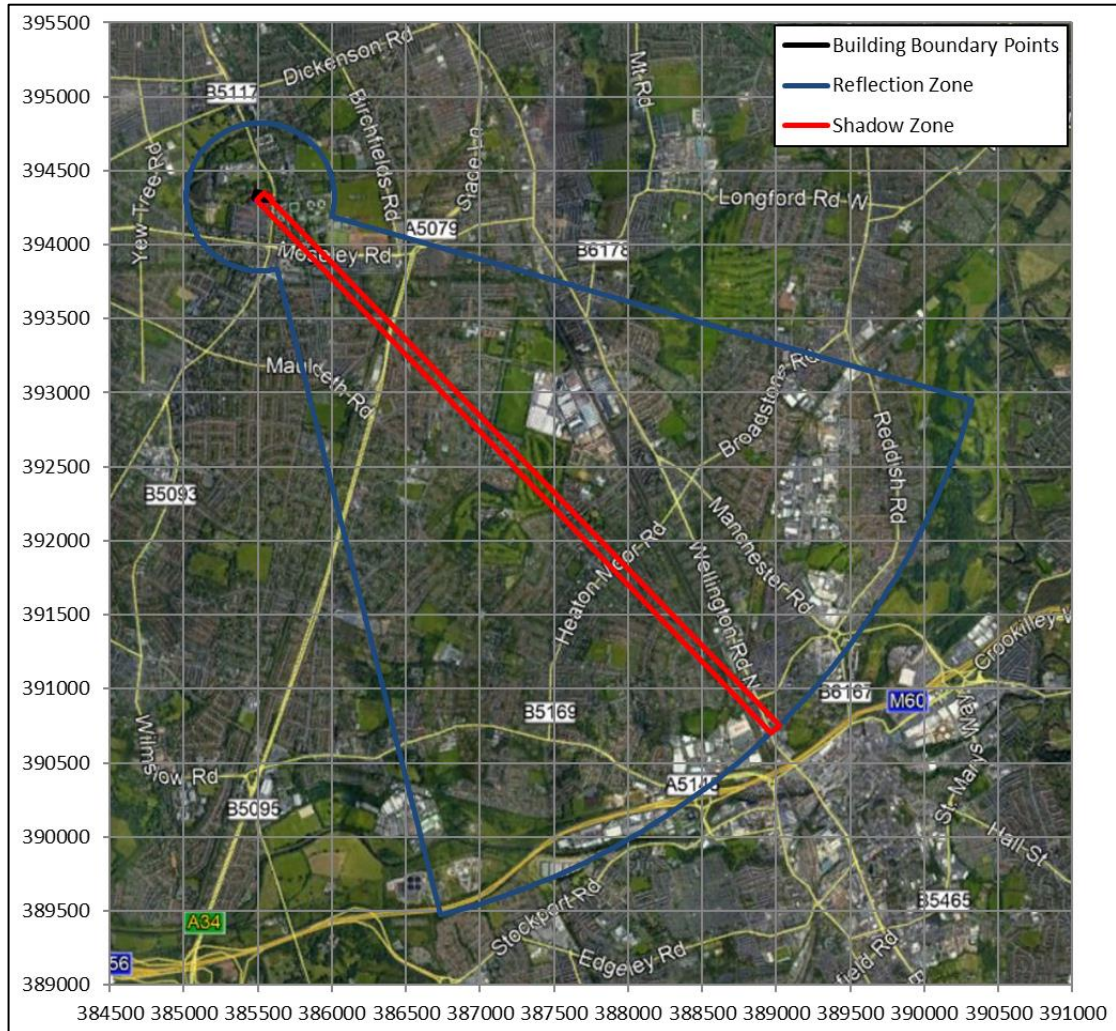


Figure 8 Interference zones – aerial image

5.2 Potential Diffraction Issues – Terrestrial Television

It can be seen that the shadow zone passes over urban areas. Areas closest to the proposed development are at the highest risk of experiencing television interference. This is typically limited to 1km based on Pager Power's assessment experience.

5.3 Potential Reflection Issues – Terrestrial Television

Reflection effects are most likely if the transmitter does not have direct radio line of sight to the receiving aerial.

¹² Source: Copyright © 2020 Google.

The predicted coverage of the Winter Hill transmitter is generally good in the surrounding area. Interference due to reflections are most likely when:

- The receiving aerial is unobstructed by existing obstacles.
- The reflected signal path via the proposed development is unobstructed.
- The angle between the reflected signal via the proposed development and the direct signal would be small.

Interference is most likely if all of the above criteria are met. Interference is least likely if none of the above criteria are met.

In practice it is unlikely that all of the above criteria would be met for the proposed development. In particular, locations that are below radio line of sight from the transmitter are unlikely to have an unobstructed path to the proposed development, due to their relative heights. Impacts due to reflections are considered unlikely.

5.4 Results Discussion

Based on Pager Power's experience, television interference for building developments is typically limited to approximately 1km of its location and within its shadow zone. In this instance, this would be for dwellings to the south east of the proposed development on a bearing of approximately 135.62 degrees. It is possible that small / moderate losses to the current signals may be tolerable without noticeably affecting the quality of the terrestrial television reception in the area. If any report of interference is received from properties within or close to the shadow zone, they should be investigated.

6 SATELLITE TELEVISION TECHNICAL ASSESSMENT

6.1 Potential Diffraction Issues – Satellite Television

Shadow zones have been modelled for five satellite locations, based on the longitude of the main ASTRA satellites.

These zones have been constructed based on a maximum development height of 26.98 metres above ground level across the entire development area. Note that the tallest part of the development will not encompass the whole area, therefore the shadow zones may in practice not extend as far as the model shows and are therefore conservative. An assumed dish height of 3 metres above ground level has been used considering a review of the buildings in its immediate shadow (with 100-200m).

Figure 9 on the following page shows the individual shadow zones for five commonly used satellites and their positions.

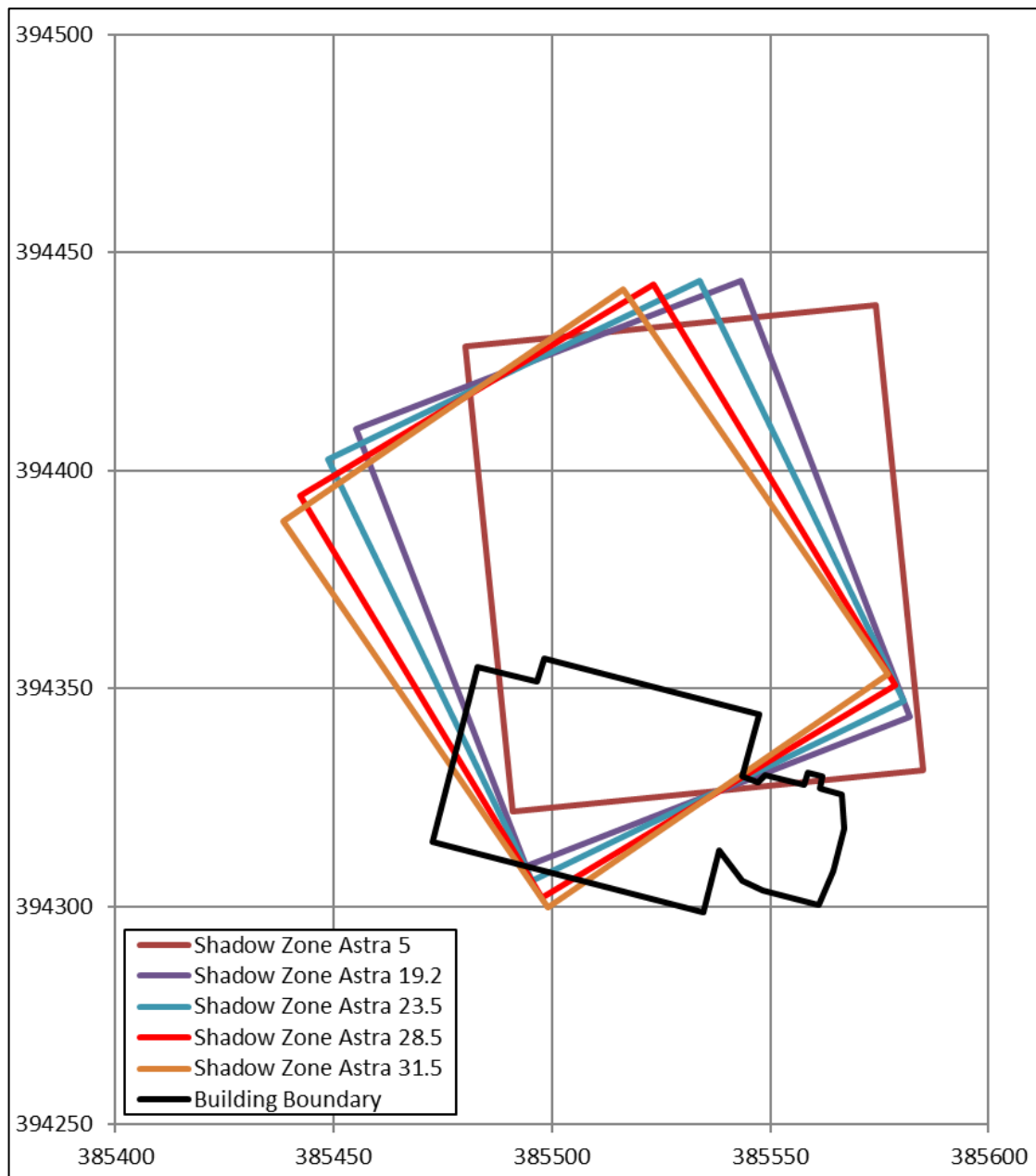


Figure 9 Satellite television interference zones

Figure 10¹³ below shows the combined satellite shadow zone overlaid onto aerial imagery.



Figure 10 *Terrestrial television interference zones (aerial image)*

The shadow zones have a length of approximately 75m relative to the development. A review of street view imagery has revealed no satellite dishes present within any of the zones because the zones cover woodland and green spaces.

6.2 Results Discussion

Potential satellite television interference is limited to 75m north west of the proposed development's location however no satellite dishes have been observed within the shadow zone. No impact upon satellite television services is expected.

¹³ Source: © 2020 Google.

7 RADIO SERVICES DISCUSSION

7.1 Radio Services Impact Discussion and Conclusion

Radio signals are typically more robust than terrestrial television signals due to their lower frequency and less data being transmitted (only audio). This is evident as internal radio aerials are more likely to be successful decoding radio signals than internal television aerials are at decoding television signals. In many cases, significant interference caused by building developments never materialises internally or externally – see Section 4.5 for an extract from the Ofcom guidance.

Due to the number of potential transmitters and the nature of most radio receivers (mobile), the potential interference areas are less well defined than for television services. In general terms, interference is more likely at small distances from the building, similar to the distances defined for television services.

Overall, due to the overall low likelihood of interference occurring and the large number of potential transmitters, detailed technical modelling is not required or recommended. Whilst it is unlikely that impacts upon radio signals will occur, an investigation of any reported interference can be undertaken, with the approach similar to that of investigating reported terrestrial television interference.

8 TELEVISION AND RADIO BASELINE SURVEY

8.1 Overview

The purpose of a terrestrial television and radio baseline survey is to establish current signal strength and quality in the area. The baseline survey serves three purposes these are:

1. It confirms which transmitter is serving most homes in the areas surveyed (television);
2. It allows for confirmation of the receiving equipment in the interference zones;
3. It provides an indicator regarding the likelihood of interference. If current signals are of good quality, minor degradation is less likely to have a noticeable effect;
4. It allows a 'before and after' comparison to be made in the event that a complaint is received.

8.2 Baseline Survey Recommendations

A baseline reception survey could be undertaken if requested. This is typically undertaken at the pre-planning stage or as part of a planning condition.

If significant interference effects did occur, a post-construction survey could be completed to validate any interference reports and begin the mitigation process, if required.

Common mitigation options are presented in the following section.

9 MITIGATION

9.1 Mitigation Requirement

If an adverse effect on television or radio services occurs and is attributable to the proposed development, mitigation may be required.

9.2 Terrestrial Television Mitigation Options

The most effective form of mitigation is dependent on the specific impact. Common options are for terrestrial television are shown below:

- Replacement of receiving aerial with a more directional or higher gain aerial;
- Repositioning the receiving aerial so that the received signal is stronger;
- Directing the receiving aerial to an alternative transmitter that covers the area and retuning the television accordingly;
- Upgrading antenna cabling and connections;
- Installation of signal amplifiers;
- Development of a bespoke local solution using a receiving aerial some distance from the dwelling;
- A combination of the above;
- Replacing terrestrial reception equipment with satellite reception equipment, cable or internet television.

9.3 Satellite Television Mitigation Options

Whilst no satellite dishes in the shadow zone have been identified, for completeness, below is a list of actions that can mitigate satellite television reception issues caused by building developments:

- Increase the height of the receiving dish;
- Provision of cable television;
- Provision of a bespoke receiving solution e.g. a system to receive and re-distribute the satellite television signal.

9.4 Radio Mitigation Options

The most appropriate solution if radio services at residences are affected may be provision of a new radio or an external aerial.

9.5 Recommended Options

If interference to terrestrial television were to occur for a small number of dwellings, it is likely that installation of satellite television receiver would be the most suitable option.

If effects are experienced for dwellings with poor quality or low receiving aerials/dishes, the best option may be to upgrade and/or elevate the existing aerial/dish.

It may also be possible for television services to be supplied by an alternate transmitter in the surrounding area.

9.6 Recommended Process

It is possible that no adverse effects will occur due to the current reception quality in the surrounding area and the scale of the proposed development.

It is therefore recommended to investigate any reports of interference in order to determine whether these are attributable to the proposed development. If this is found to be the case, mitigation can be applied.

There is no reason to install pre-emptive mitigation.

10 CONCLUSIONS

10.1 Terrestrial Television Assessment Conclusions

The overall conclusions for terrestrial television transmissions are:

- The proposed development is within the coverage area for the Winter Hill television transmitter which is expected to be the main transmitter serving the area;
- Any interference would be due to diffraction (shadowing) effects i.e. the weakening of the transmitted signal due to the physical presence of the proposed development;
- Considering the desk-based modelling results and Pager Power's assessment experience, any interference effects would be limited to approximately 1km of the proposed development and within its shadow (to the south east of the proposed development on a bearing of approximately 135.62);
- In practice, small/moderate losses may be tolerable to the current terrestrial television signal without affecting the quality of the reception in the area. It is possible that no noticeable effects would occur in practice.

10.2 Satellite Television Assessment Conclusions

The overall conclusions for satellite television transmissions are:

- The modelled shadow zone for satellite television services is limited to 75m north west of the proposed development's location;
- A review of the available imagery has revealed no satellite dishes within this zone as it covers woodland and green spaces;
- No impact upon satellite television services is expected.

10.3 Radio Assessment Conclusions

The results of the analysis for radio transmissions are:

- Radio services will be provided by a range of transmitters in the area. Digital and analogue service are broadcast;
- Weakening of the signal in the immediate shadow of the building is possible. The potential for significant impacts is limited due to:
 - The variable signal strength of radio transmissions in an urban environment;
 - The robust nature of radio services.
- Interference to radio service is less likely than those to terrestrial television services. This is evident as internal radio aerials are more likely to be successful decoding radio signals than internal television aerials are at decoding television signals;
- In many cases, significant interference caused by building developments never materialises internally or externally;

- It is therefore unlikely that noticeable impacts upon radio signals will occur in practice. An investigation of any reported interference can be undertaken, with the approach similar to that of investigating reported terrestrial television interference.

10.4 Recommendations

A terrestrial television and a radio baseline reception survey could be undertaken to measure current signal strength and quality. This can assist with determining the likelihood of interference occurring and provide a comparison result if interference is subsequently reported.

Any reported terrestrial television or radio interference should be investigated by means of a post-construction reception measurement. The modelling can then be compared alongside the baseline survey results (if completed) to determine whether the effect is attributable to the development. No pre-emptive mitigation is required.



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