

Television Desk-Based Report

Artal Ltd

Cornbrook

January 2023

PLANNING SOLUTIONS FOR:

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Issue	Date	Detail of Changes
1	December 2023	Initial issue
2	January 2024	Updated Red Line Boundary

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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 in its surrounding area. The proposed development is located at 10 Cornbrook Road, Manchester, UK, and has a maximum altitude of 106m above mean sea level (amsl) / 77.75m above ground level¹ (agl). The assessment has been undertaken based on guidance produced by Ofcom².

The report has determined the potential for effects upon terrestrial and satellite television reception by identifying the relevant transmitters and satellites, and modelling appropriate diffraction and reflection zones, and diffraction loss calculations as appropriate.

Terrestrial Television Assessment Conclusions

The overall conclusions for terrestrial television transmissions are:

- The proposed development is within the coverage area of the Winter Hill television transmitter which is the main transmitter serving the area;
- Any interference would be due to diffraction (shadowing) effects behind the building relative to the transmitter 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 industry experience, any interference effects would be limited to approximately 1km of the proposed development and within its shadow (to the southeast of the proposed development on a bearing of approximately 137 degrees);
- 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 178m north-west of the proposed development's location;
- No dwellings have been identified within the satellite shadow zone;

¹ Considering a ground level of 28.25m as per 8353-LRW-XX-XX-PP-A-00-013_P01_Latest Plans and Elevations Package (Figure 3 in this report).

² See section 3 of this report for further details on guidance produced by Ofcom.

- Some tolerance is built into the receiving equipment, and it is possible that a satellite signal may still be maintained even if line of sight is blocked. Therefore, it is possible that no noticeable effects would occur in practice.

Mitigation

No pre-emptive mitigation is required.

Technical mitigation solutions (outlined in Section 6) could be implemented in the event that interference is experienced within the shadow zone and 1km from the proposed development.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 58 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 in its surrounding area. The proposed development is located at 10 Cornbrook Road, Manchester, UK, and has a maximum altitude of 106m above mean sea level (amsl) / 77.75m above ground level³ (agl). The assessment has been undertaken based on guidance produced by Ofcom⁴.

The report has determined the potential for effects upon terrestrial and satellite television reception by identifying the relevant transmitters and satellites, and modelling appropriate diffraction and reflection zones, and diffraction loss calculations 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.

1.3 Proposed Development Boundary

The red line boundary for the proposed development is shown in Figure 1 below.

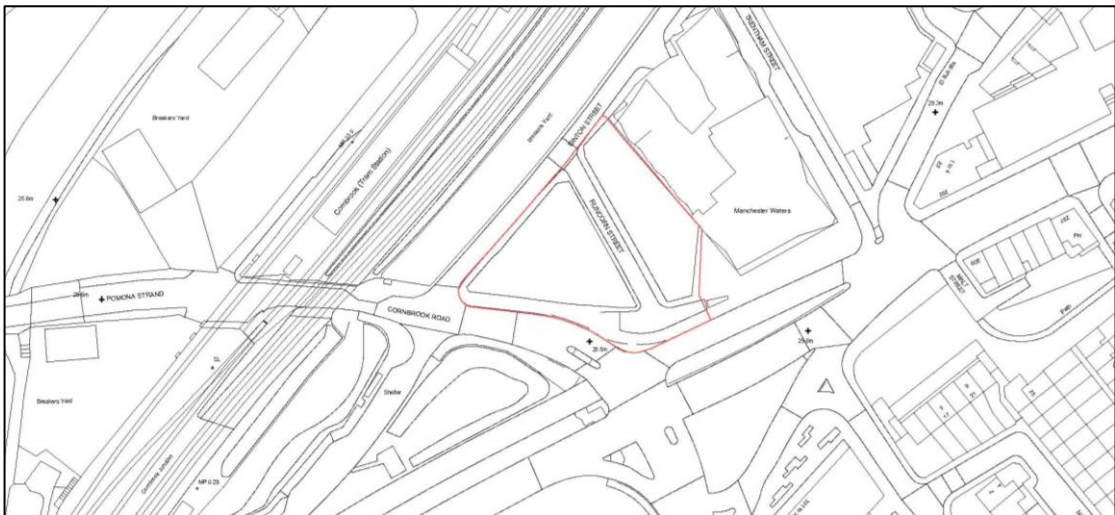


Figure 1 Proposed development red line boundary

³ Considering a ground level of 28.25m as per 8353-LRW-XX-XX-PP-A-00-013_P01_Latest Plans and Elevations Package (Figure 3 in this report).

⁴ See section 3 of this report for further details on guidance produced by Ofcom.

1.4 Proposed Development Elevation

The elevation of the proposed development is shown in Figure 2⁵ below.

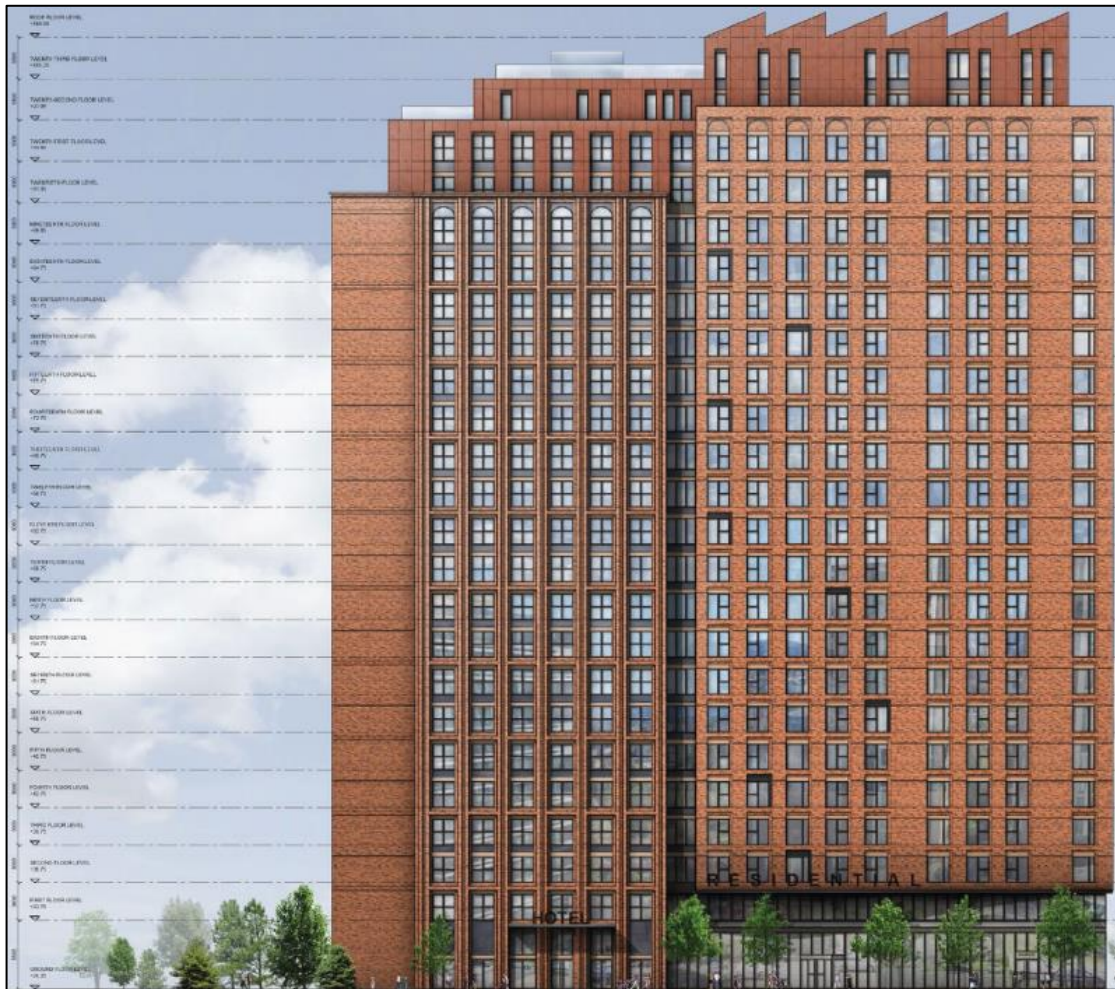


Figure 2 Elevation of the proposed development

⁵ Source: 8353-LRW-XX-XX-PP-A-00-013_P01_Latest Plans and Elevations Package (cropped).

2 TERRESTRIAL TELEVISION, SATELLITE AND RADIO DETAILS

2.1 Relevant Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 23.9km northwest of the development. The Winter Hill transmitter serves the area around the development.

Digital television services are broadcast via Ultra High Frequency (UHF) signals; no analogue television signals are broadcast. The transmitter information is presented below⁶.

2.2 Winter Hill Main Transmitter

The main Winter Hill transmissions are shown in Table 1 below.

	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

Additional Winter Hill transmissions are shown in Table 2 below.

	Local Multiplexes	
Service	LTVmux	Glmux
Channel	24	27
Power	2 kW	1 kW

Table 2 Winter Hill additional transmissions

2.3 Satellite Television

It is understood that satellite television services in the UK are predominantly provided by Astra satellites, which is a group of geostationary satellites at longitudes between 19.2 degrees and 31.5 degrees.

Satellite dishes are typically mounted externally with a vertical elevation angle that varies based on latitude. In the UK, elevation angles are typically around 25 degrees. The height at which a dish is mounted can vary substantially, initial modelling is based on a height of five metres above ground level.

⁶ Source: Ofcom

3 BUILDINGS AND INTERFERENCE MECHANISMS

3.1 Technical Overview

Terrestrial television services are provided by means of electromagnetic waves in UHF range which propagate from land-based transmitters to receiving aerials.

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 a building can cause interference to television reception; obstruction of the signal and reflection of the signal. These are described in the following sections.

3.2 Obstruction of the Signal – Television Services

Obstruction of the signal 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 document⁷ offering guidance on this issue for terrestrial television. Section 3.4 of the guidance relates to satellite television. Relevant extracts from the guidance relating to terrestrial television are set out 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

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

⁷ Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.
Television Desk-Based Report

The zones mentioned are illustrated in Figure 3⁸ below, taken from Section 3.2 of the Ofcom guidance regarding the impact of buildings on broadcast signals.

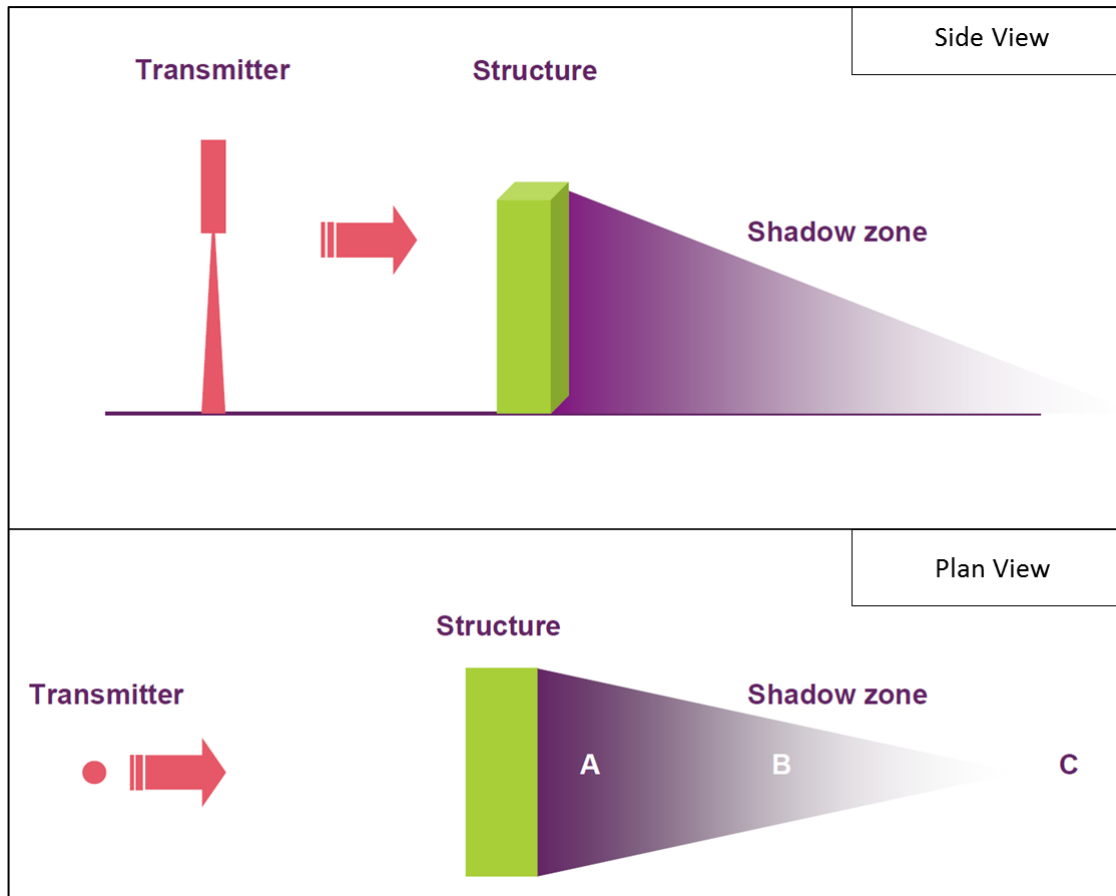


Figure 3 Diffraction loss zones

⁸ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.
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3.3 Reflection of the Signal

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 4⁹ below (taken from Section 3.3 of the Ofcom guidance referenced above) illustrates this effect.

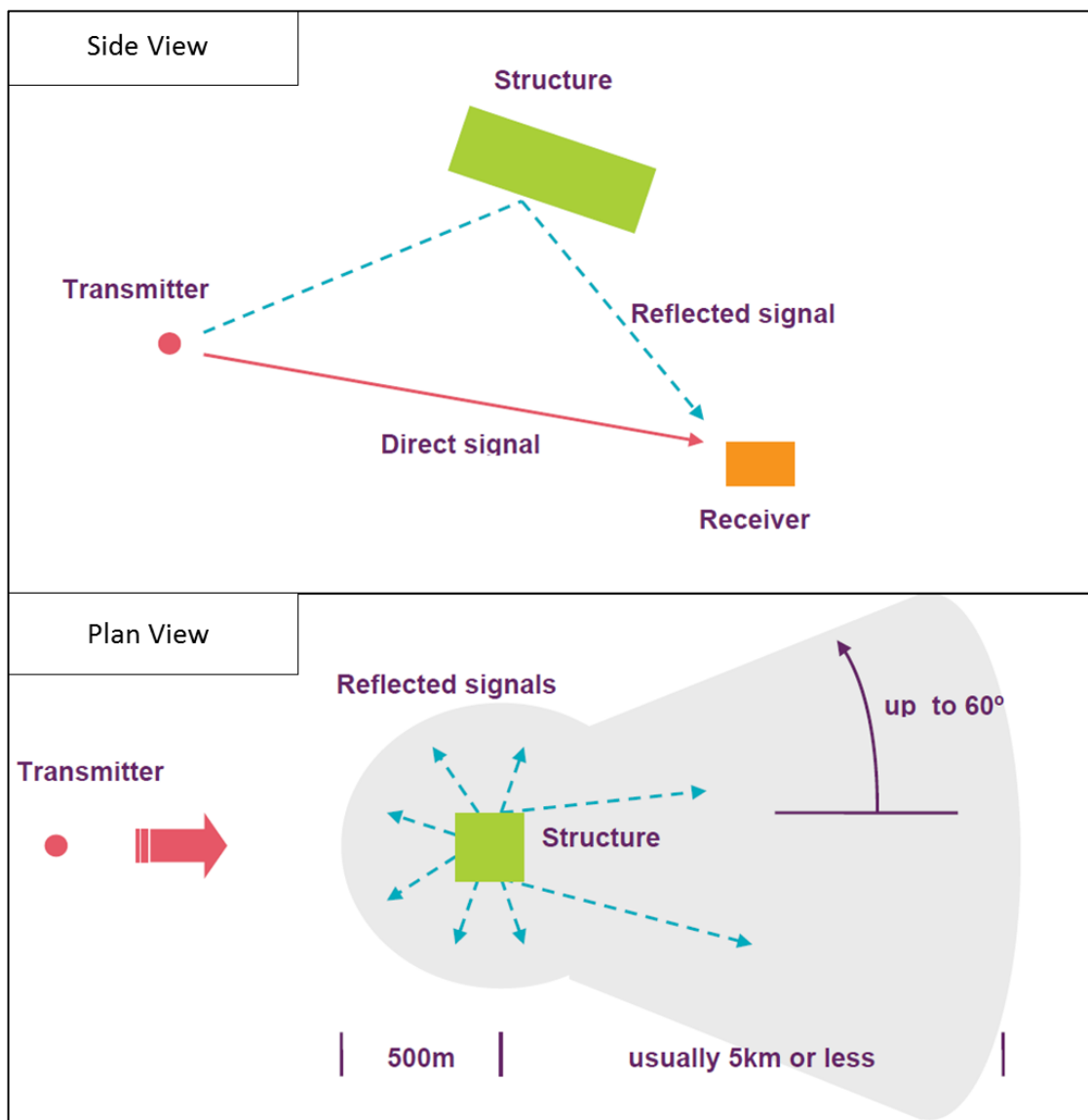


Figure 4 Reflection zones

⁹ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

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 degrees¹⁰.

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.

3.4 Satellite Television Interference

The principle of shadowing (discussed in Section 3.2 of this report) 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 guidance¹¹ 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 5 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.

¹⁰ 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.

¹¹ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

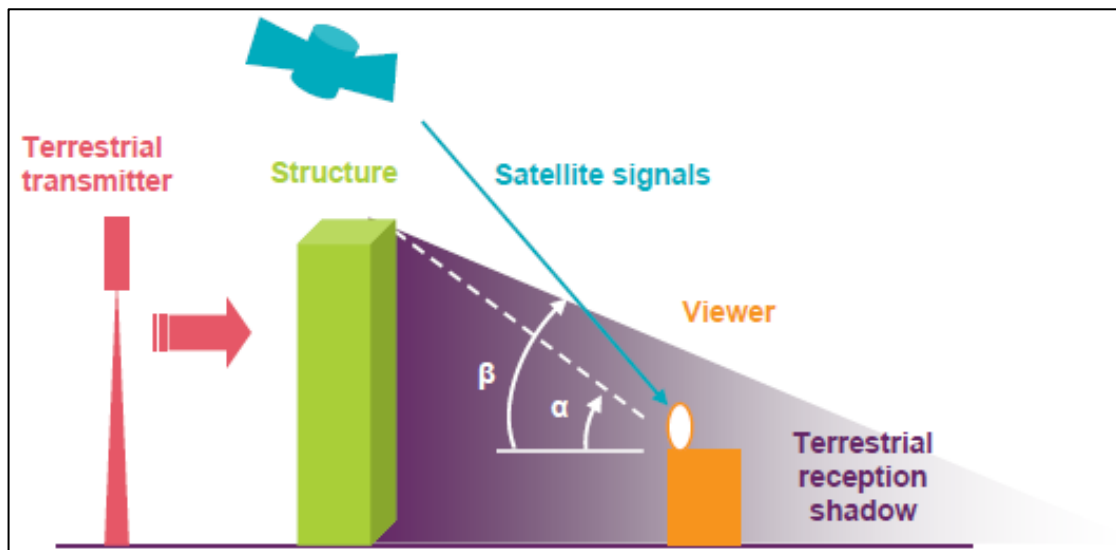


Figure 5 Satellite reception not affected by a new structure

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 – this is assumed to be 25 degrees.

4 TERRESTRIAL TELEVISION TECHNICAL ASSESSMENT

4.1 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 6 below shows the potential interference areas associated with the proposed development¹².

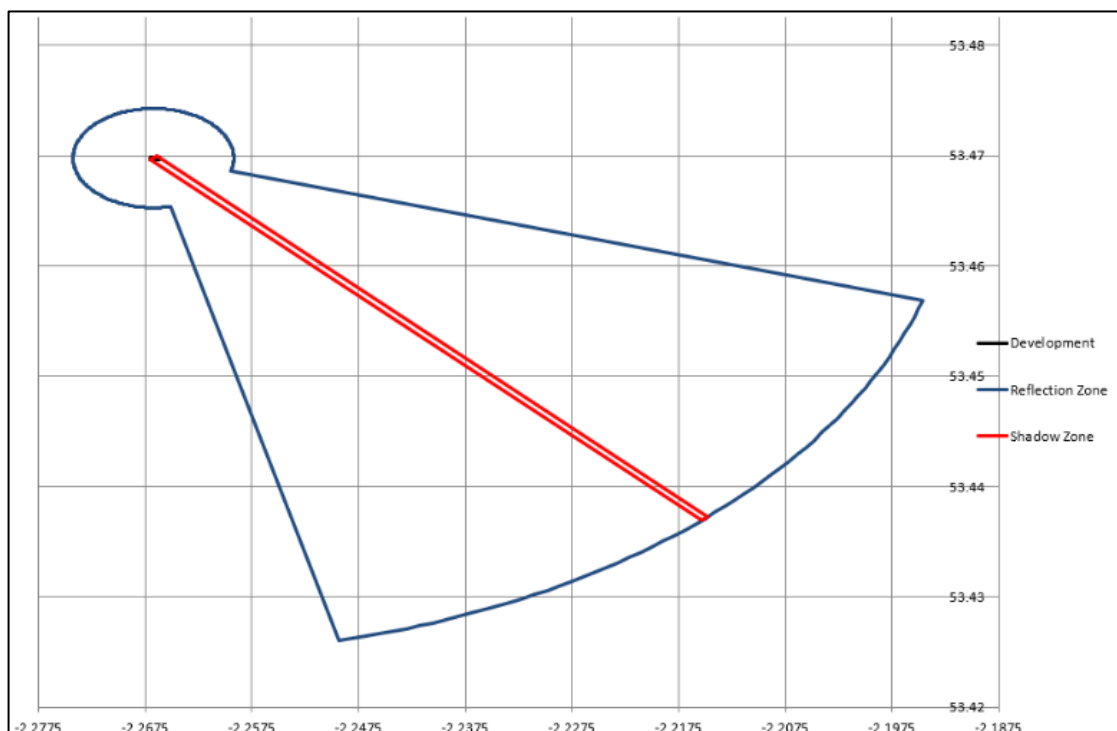


Figure 6 Television diffraction and reflection Interference areas (in Lat/Long) (Not To Scale)

¹² The extrapolated building footprint within the site redline has been considered.

Figure 7 below shows the interference zones overlaid onto an aerial image of the area.

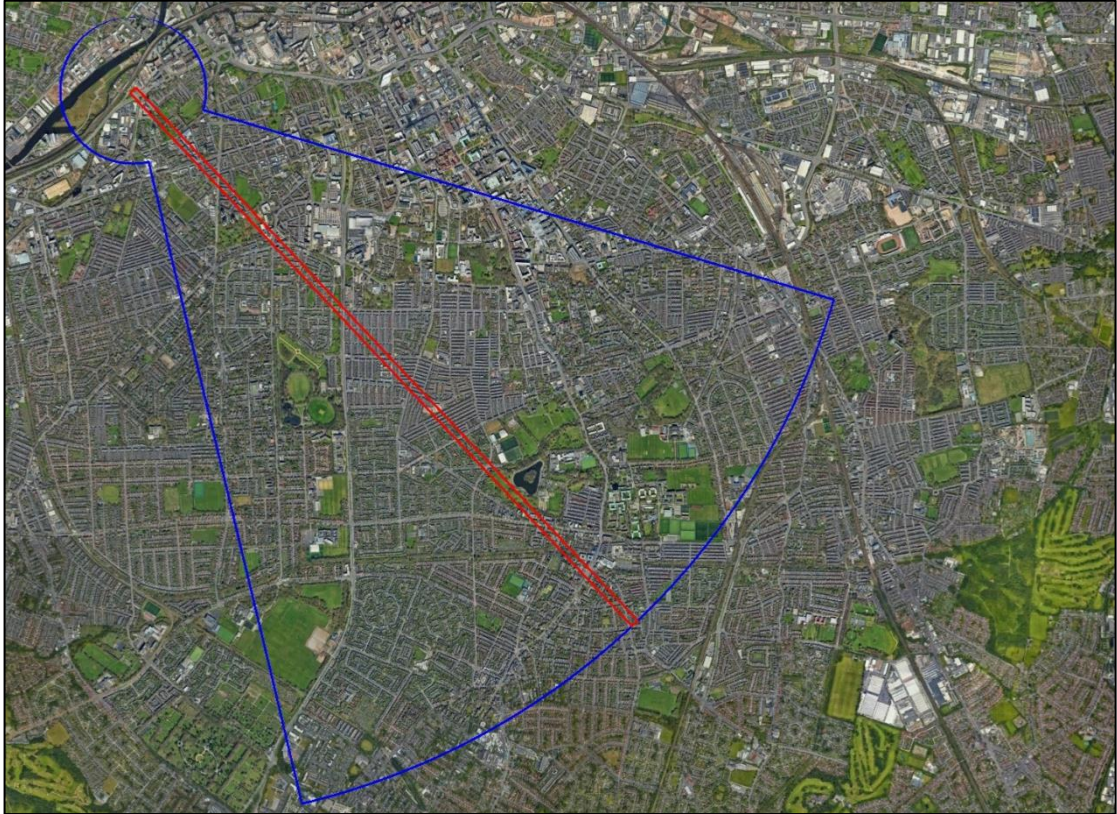


Figure 7 Interference zones map

4.2 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 industry experience.

4.2.1 Diffraction Calculations – Terrestrial Television

The level of attenuation at a receptor location will, in practice, vary based on many factors including:

- Receiving aerial height above ground level;
- Location of the receiving aerial relative to the proposed development;
- Existing obstructions between the receiving aerial and the transmitter.

Diffraction loss calculations¹³ have been undertaken at particular distances beyond the proposed development. The calculation is designed to determine the signal losses due to the presence of the obstruction. The calculation considers relative ground heights, the proposed development's dimensions (maximum height = 77.75m (agl), maximum width = width of development relative

¹³ Based on a modified Bullington method as recommended within ITU-P526-13.

to the Winter Hill transmitter) and a terrestrial television aerial located at 10m above ground level at each calculation location. Table 3 below shows the results.

Location Distance	Diffraction loss at 10m above ground (considering proposed development only) (dB)
0.05km	32.1
0.1 km	29.0
0.2 km	25.8
0.5 km	21.4
1 km	18.0
1.5 km	13.2
2 km	8.1
3 km	0.2
4 km	0
4.99km ¹⁴	0

Table 3 Reference diffraction calculations

The signal losses in practice will almost certainly be lower than those presented in Table 3 however the results do show that the most significant signal power losses are within 1km of the proposed development. The losses then drop off at much smaller increments beyond this.

Figure 8 on the following page shows the calculation sheet for a point 50m behind the proposed development relative to the Cystal Palace transmitter.

¹⁴ 5km beyond centre of proposed development red line boundary.

Diffraction Loss Calculation			
Location	3		
Frequency (GHz)	0.57		
Wavelength (m)	0.525952		
	1	2	3
Distance from Antenna 1 to blocking point (m)	23900	23900	23900
Distance from Antenna 2 to blocking point (m)	3000	3000	3000
Height of blocking point (m)	-19.4	55	55
	v	-0.73281	2.077406
	J dB	0.31534	19.35109
	jv (Loss Factor)	1.036972	9.280143
Shielding Loss	Jmin(v)	-1.43661	
	Jav(v)	0.20822	

Figure 8 Diffraction loss calculation at 50m from the proposed development

All calculation sheets can be provided upon request.

4.3 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.

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 is 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.

4.4 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 137 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 the shadow zone and 1kmn from the proposed development, they should be investigated.

5 SATELLITE TELEVISION TECHNICAL ASSESSMENT

5.1 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 77.75 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 conservative review of the buildings in the developments immediate shadow (within 100-200m).

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

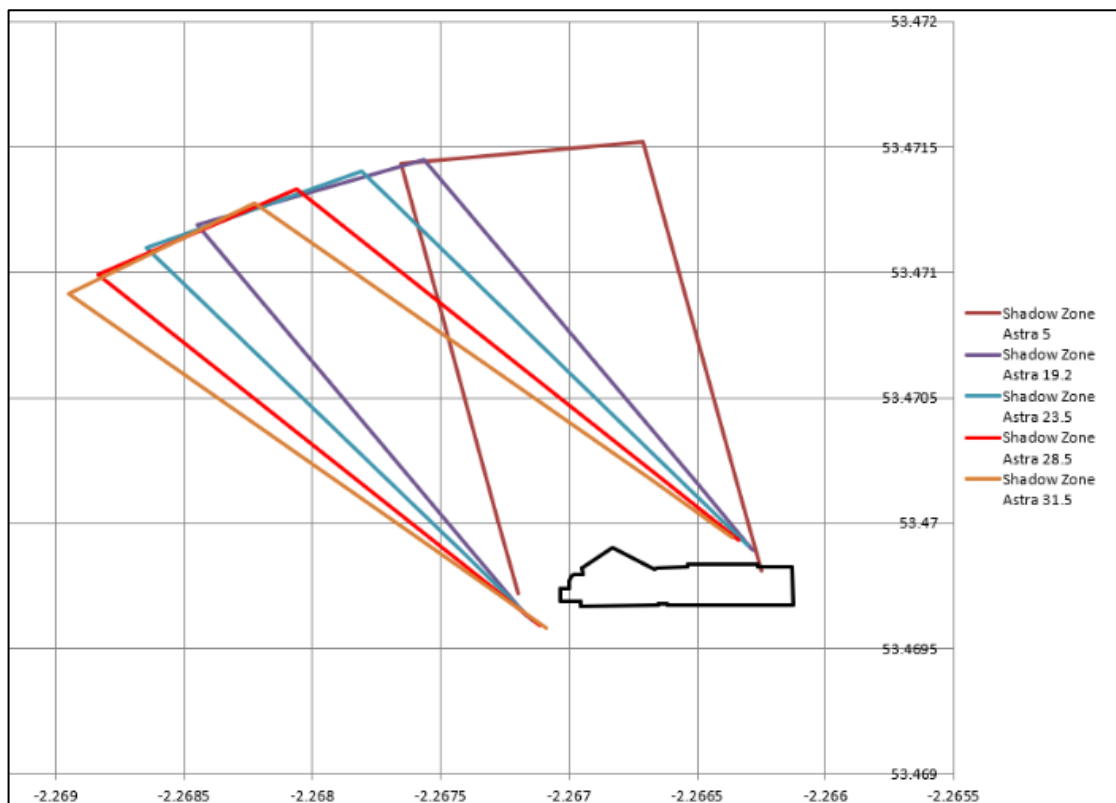


Figure 9 Satellite television interference zones (in Lat/Long) (Not To Scale)

Figure 10 below shows the combined satellite shadow zones overlaid onto aerial imagery.

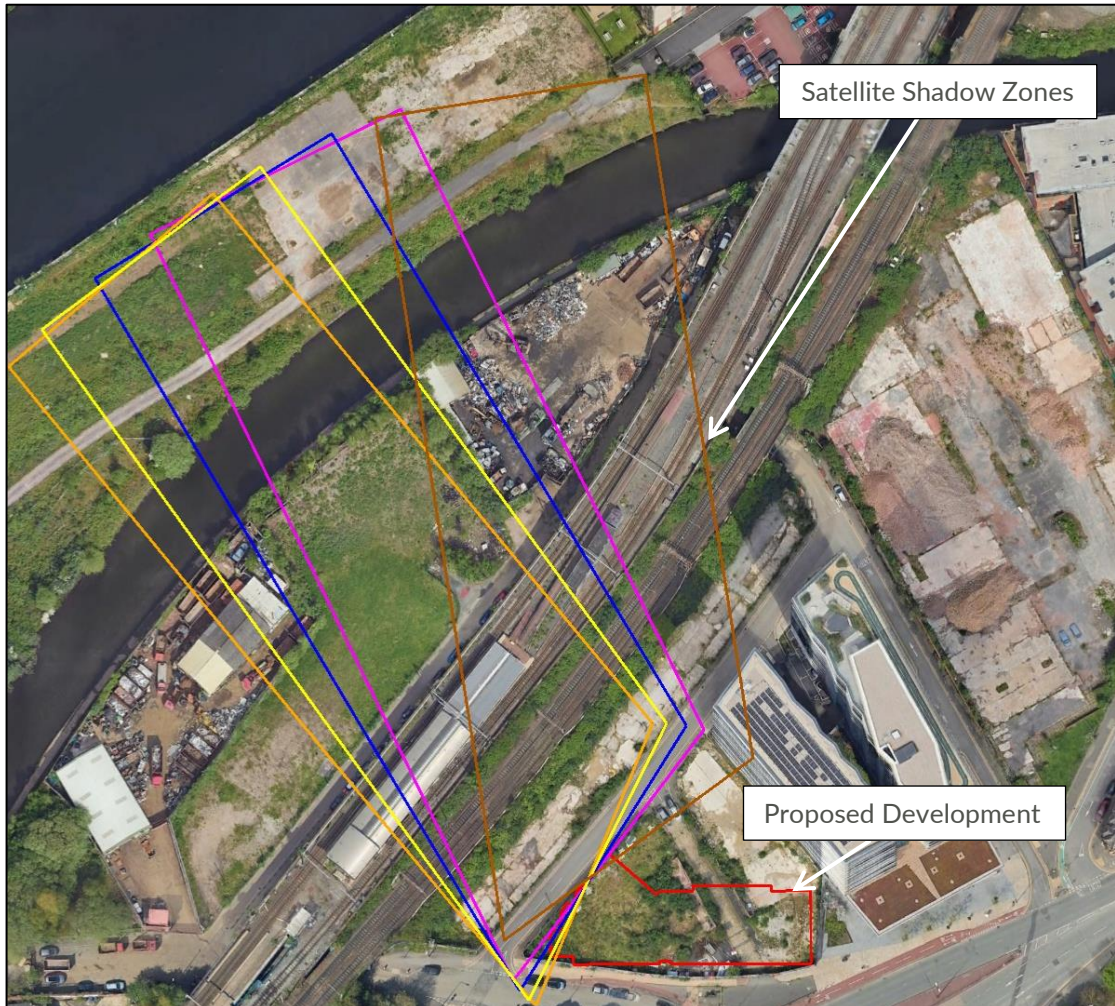


Figure 10 Satellite television interference zones (aerial image)

Figure 11 on the following page shows the combined satellite shadow zone overlaid onto a 3D aerial image.

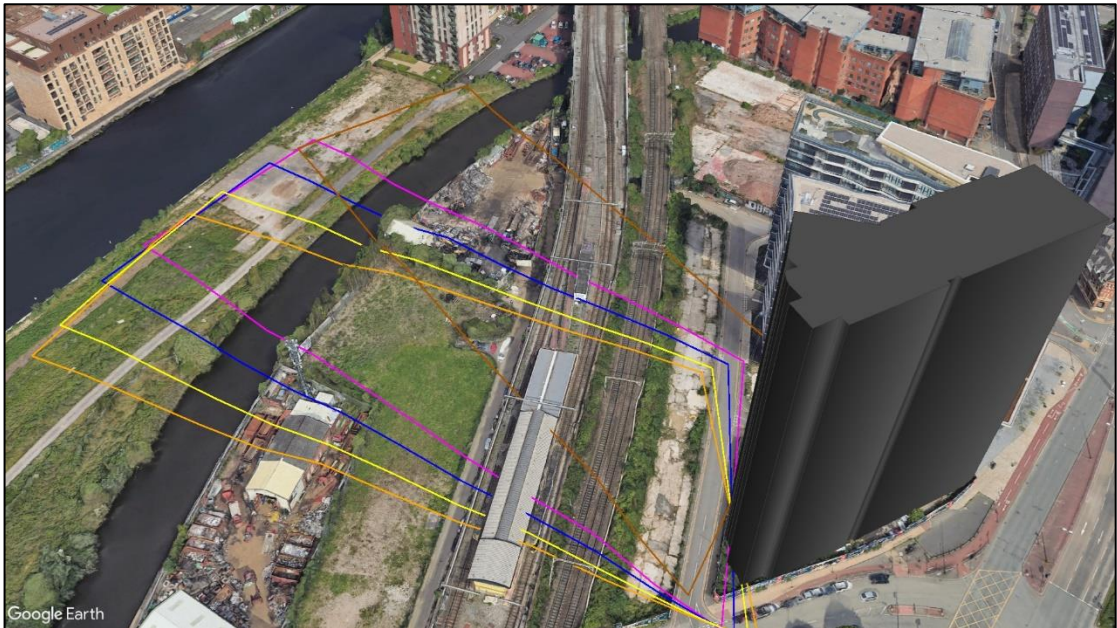


Figure 11 3D Satellite television interference zones (aerial image)

A mast carrying telecommunications infrastructure has been identified within the satellite shadow zones, however no satellite infrastructure has been identified and no impact from effects of shadowing is predicted.

No dwellings lie within the shadow zones. One commercial property has been identified, but is not believed to have a satellite dish, the property also extends outside of the shadow zone, as such a satellite dish can be implemented outside the shadow zone if required.

The interference zones for satellite television reception are very restricted and are defined by the shadow of the building relative to the satellites themselves. Cumulative effects are highly unlikely because interference areas from separate building developments are unlikely to overlap.

Any effects would be readily apparent as a building was constructed and require prompt mitigation. A scenario in which small impacts from multiple interference sources would contribute to a noticeable effect is unlikely in practice.

5.2 Results Discussion

Potential satellite television interference is limited to the north-west of the proposed development's location. If any report of interference is received from these properties, it should be investigated.

6 MITIGATION

6.1 Mitigation Requirement

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

6.2 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.

6.3 Satellite Television Mitigation Options

Below is a list of actions that can mitigate satellite television reception issues caused by building development:

- 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.

6.4 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.

6.5 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.

Pre-emptive mitigation requirement has not been identified.

7 CONCLUSIONS

7.1 Terrestrial Television Assessment Conclusions

The overall conclusions for terrestrial television transmissions are:

- The proposed development is within the coverage area of the Winter Hill television transmitter which is the main transmitter serving the area;
- Any interference would be due to diffraction (shadowing) effects behind the building relative to the transmitter 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 industry experience, any interference effects would be limited to approximately 1km of the proposed development and within its shadow (to the southeast of the proposed development on a bearing of approximately 137 degrees);
- 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.

7.2 Satellite Television Assessment Conclusions

The overall conclusions for satellite television transmissions are:

- The modelled shadow zone for satellite television services is limited to 178m north-west of the proposed development's location;
- No dwellings have been identified within the satellite shadow zone;
- Some tolerance is built into the receiving equipment, and it is possible that a satellite signal may still be maintained even if line of sight is blocked. Therefore, it is possible that no noticeable effects would occur in practice.



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