

Television Desk-Based Report and Baseline Reception Survey

Trinity Islands

Renaker Build Limited

October 2021

PLANNING SOLUTIONS FOR:

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ADMINISTRATION PAGE

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1	August 2021	Initial issue (10385C)
1	October 2021	Added baseline survey and minor amendments (10385C)

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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 the surrounding area. The proposed Trinity Islands development is located at Water Street, Manchester, and consists of four towers with a maximum altitude of 210.40m above mean sea level (amsl) and 183m 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 terrestrial and satellite television reception in key interference areas. The report has determined the potential for effects by identifying the relevant transmitters and satellites, and modelling appropriate diffraction and reflection zones, as appropriate. A terrestrial television baseline reception survey has also been completed within the key interference areas.

Terrestrial Television Assessment Conclusions

The overall conclusions for terrestrial television transmissions are:

- A site survey was undertaken on 20 October 2021 to confirm the relevant transmitter and record the signal quality.
- The baseline survey confirmed that the Winter Hill television transmitter was the main transmitter serving the area;
- Any interference would most likely be due to diffraction (shadowing) effects i.e. the weakening of the transmitted signal due to the physical presence of the proposed development. This is where the baseline signal readings were taken;
- Received terrestrial signals from the main multiplexes were generally moderate to good strength and quality in the surrounding area. Local multiplexes were generally low to moderate strength and quality however these are broadcast at a much lower power. Existing tall buildings likely already attenuate signals from Winter Hill, particularly at ground and lower levels;
- Considering the desk-based and survey results, as well as 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 between a bearing of approximately 134.31-134.86 degrees);

¹ Considering a ground level of 27.4m as per drawing 10364-Z1-SHP-G200-SE-0001.

- It is possible that there will be no significant impact on terrestrial television signals due to the Proposed Development because small/moderate losses may not result in noticeable interference in the context of the surrounding area.

Satellite Television Assessment Conclusions

The overall conclusions for satellite television transmissions are:

- The potential impacts created by the proposed development upon satellite television signals extends to circa 600m north west of the proposed development;
- 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 partially blocked;
- Therefore, it is possible that no noticeable effects would occur in practice;
- If interference is reported, it should be investigated.

Recommendations and Mitigation

Technical mitigation solutions have been identified for implementation if an impact occurs. The most likely options, in the event a mitigation requirement transpires, would be:

- Replacement of receiving aerial with a more directional or higher gain aerial.
- Replacement of terrestrial reception equipment with satellite reception equipment or cable.

No pre-emptive action is recommended however, and any reported television interference should be investigated by means of a post-construction reception measurement. The survey can then be compared alongside the baseline survey results and modelling results to determine whether the effect is attributable to the development.

Mitigation

Technical mitigation solutions have been identified and could be implemented in the event that a significant impact occurs. 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 50 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 the surrounding area. The proposed Trinity Islands development is located at Water Street, Manchester, and consists of four towers with a maximum altitude of 210.40m above mean sea level (amsl) and 183.00m above ground level² (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) reception in key interference areas. The report has determined the potential for effects upon both by identifying the relevant transmitters and modelling appropriate diffraction and reflection zones, as appropriate. A terrestrial television baseline reception survey has also been completed.

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 Coordinate System

Unless otherwise stated all coordinates used within this report are in British National Grid (OSGB36 datum) or WGS84 latitude and longitude.

² Considering a ground level of 27.4m as per drawing 10364-Z1-SHP-G200-SE-0001.

2 DEVELOPMENT PLANS

2.1 Development Description

The Site comprises two distinct plots of land, 'Site C' (0.89 hectares) to the north and 'Site D' (0.89 hectares) to the south, divided by the A6042. The Site, until recently, was used as a compound for the Ordsall chord development, however it is currently being used as a surface level car park.

Site C comprises two residential towers of 39 and 48 storeys, providing 935 residential units. Site D comprises two residential towers of approximately 55 and 60 storeys, providing circa 1015 residential units. Each tower sits above a two-deck podium with associated two-storey underground resident parking.

2.2 Proposed Development Elevations

The tower maximum elevation above ordnance datum (AOD) and above ground level (agl) are presented below:

- C1: Maximum elevation AOD = 146.875m. Maximum elevation agl = 119.575m.
- C2: Maximum elevation AOD = 173.350m. Maximum elevation agl = 145.950m.
- D1: Maximum elevation AOD = 210.400m. Maximum elevation agl = 183.000m.
- D2: Maximum elevation AOD = 196.150m. Maximum elevation agl = 168.750m.

2.3 Proposed Development Boundary

The red line boundary for the proposed development is shown in Figure 1³ below. The two boundaries are defined as Site C and Site D.

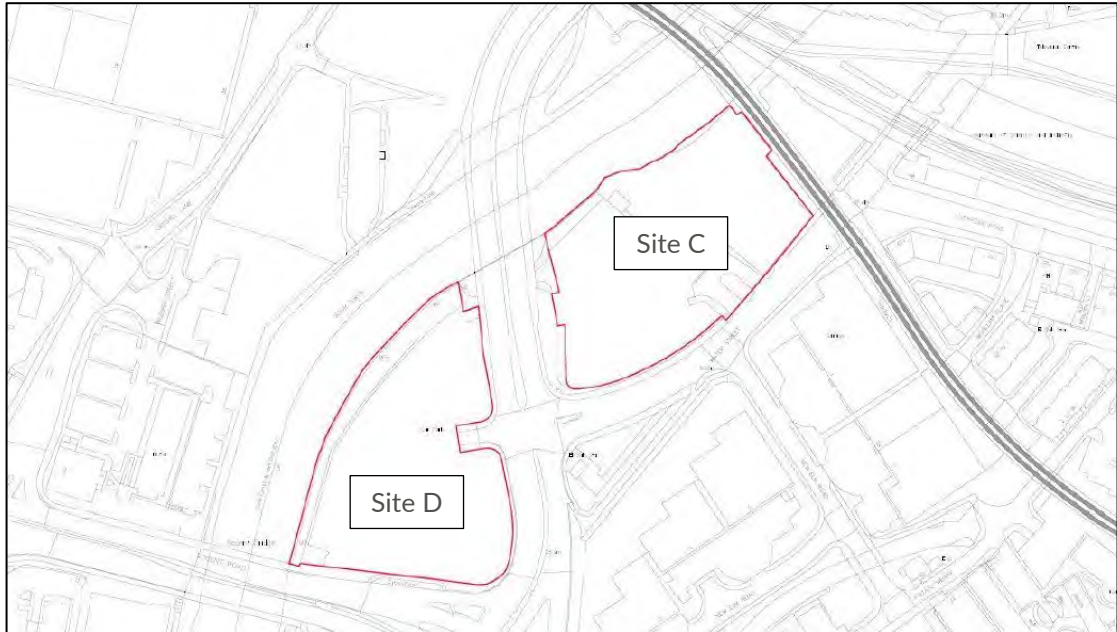


Figure 1 Proposed development red line boundary

³ Source: Simpsonhaugh (cropped).

2.4 Proposed Development Boundary

The red line boundary for the proposed development overlaid on aerial imagery is shown in Figure 2⁴ below.



Figure 2 Proposed development red line boundary overlaid on aerial imagery

⁴ Source: Copyright © 2021 Google.

2.5 Proposed Development Ground Floor Plan and Elevation

The ground floor plan for the proposed development is shown in Figure 3⁵ below.



Figure 3 Proposed development ground floor plan

⁵ Source: Simpsonhaugh (cropped).

2.6 Proposed Development Footprint and Elevations

Figures⁶ 4 and 5 below and on the following page show the proposed footprints of each tower with co-ordinates. The maximum elevation of the towers AOD are also shown.

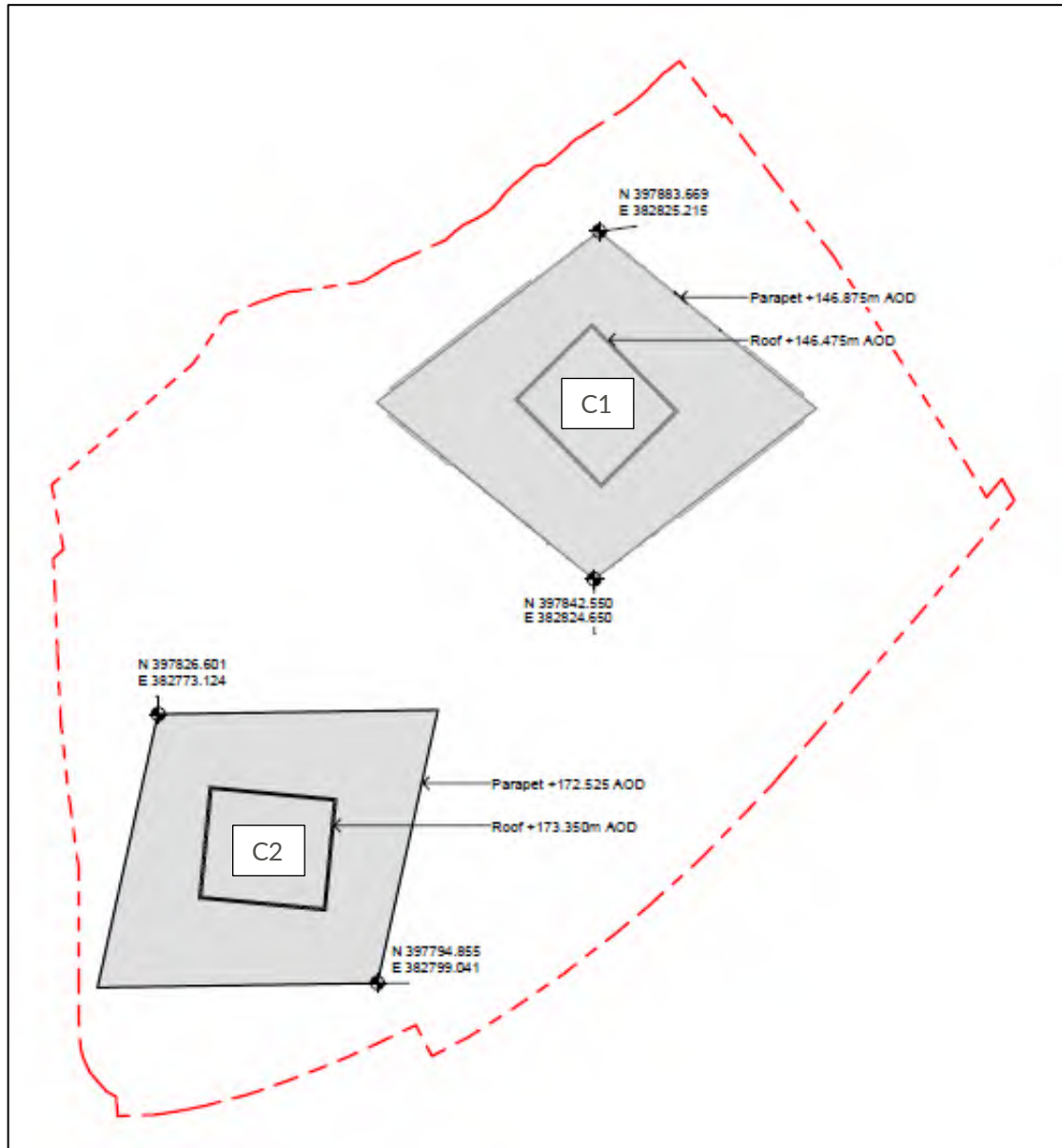


Figure 4 Proposed development footprint – Towers C1 and C2

⁶ Source: Simpsonhaugh (cropped).

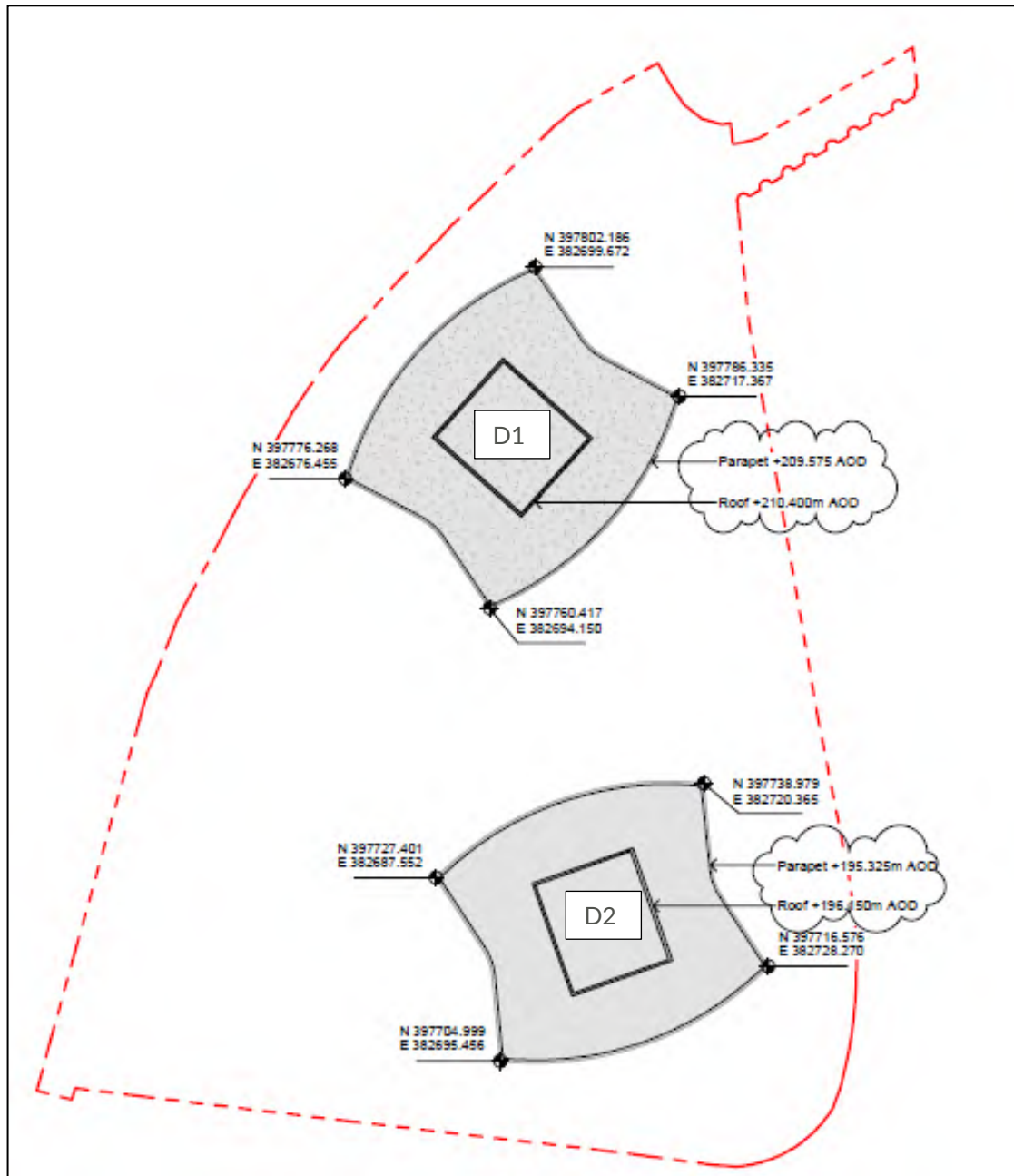


Figure 5 Proposed development footprint – Towers D1 and D2

2.7 Proposed Development 3D Representation

Figure 6⁷ below shows the 3D representation of the proposed developments. The image is aligned approximately west.



Figure 6 Proposed development 3D representation

⁷ Source: Simpsonhaugh (cropped).

3 TELEVISION TRANSMITTER DETAILS

3.1 Relevant Transmitter

A comprehensive search of transmitter and coverage maps, as well the baseline reception survey confirmed, that 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 below⁸.

3.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 23.6km northwest of the development (published coordinates SD66051446). The main digital services provided are shown in the sub-sections below. Note that the channels broadcast by Winter Hill have changed in recent years.

The channels broadcast by Winter Hill are presented 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	COM 7	LM/LL/LPR (LTVmux)	GIM (GImux)
Channel	55	24	27
Power	25.7kW	1/2kW	1kW

Table 2 Winter Hill additional transmissions

⁸ Source: Ofcom

3.3 Television Transmitter Location

Figure 7 below shows the relative location of the Winter Hill transmitter and the proposed development.

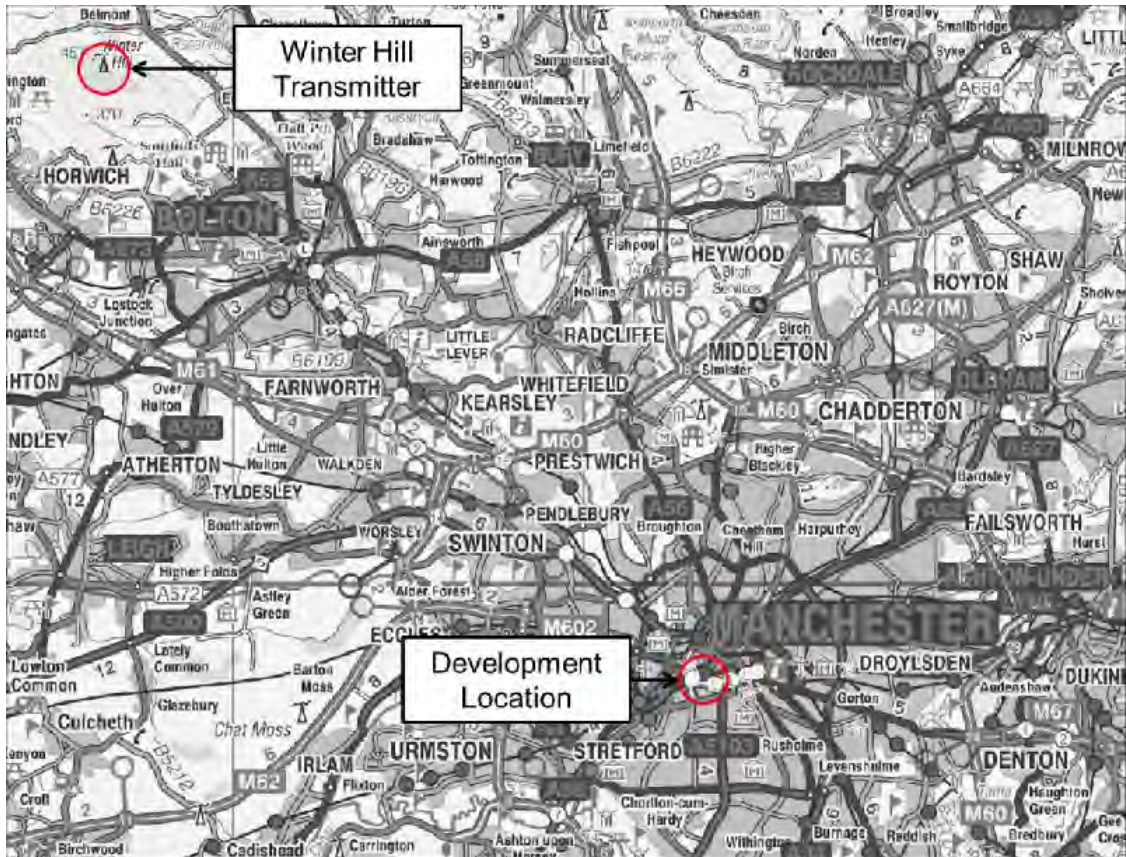


Figure 7 Television transmitter and development location

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.

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 west 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 document⁹ offering guidance on this issue for terrestrial television. See Section 4.4 of this report 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

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

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

The zones mentioned are illustrated in Figure 8¹⁰ below, taken from Section 3.2 of the Ofcom guidance regarding the impact of buildings on broadcast signals.

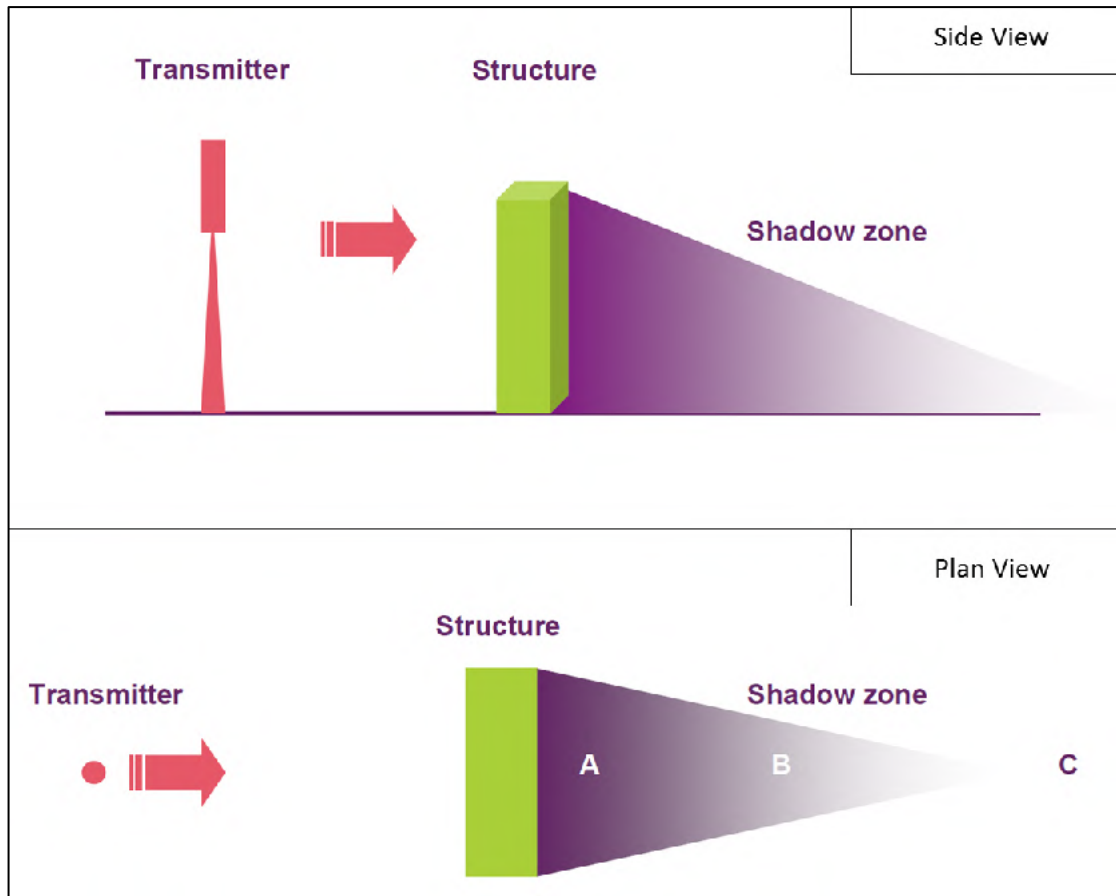


Figure 8 Diffraction loss zones

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

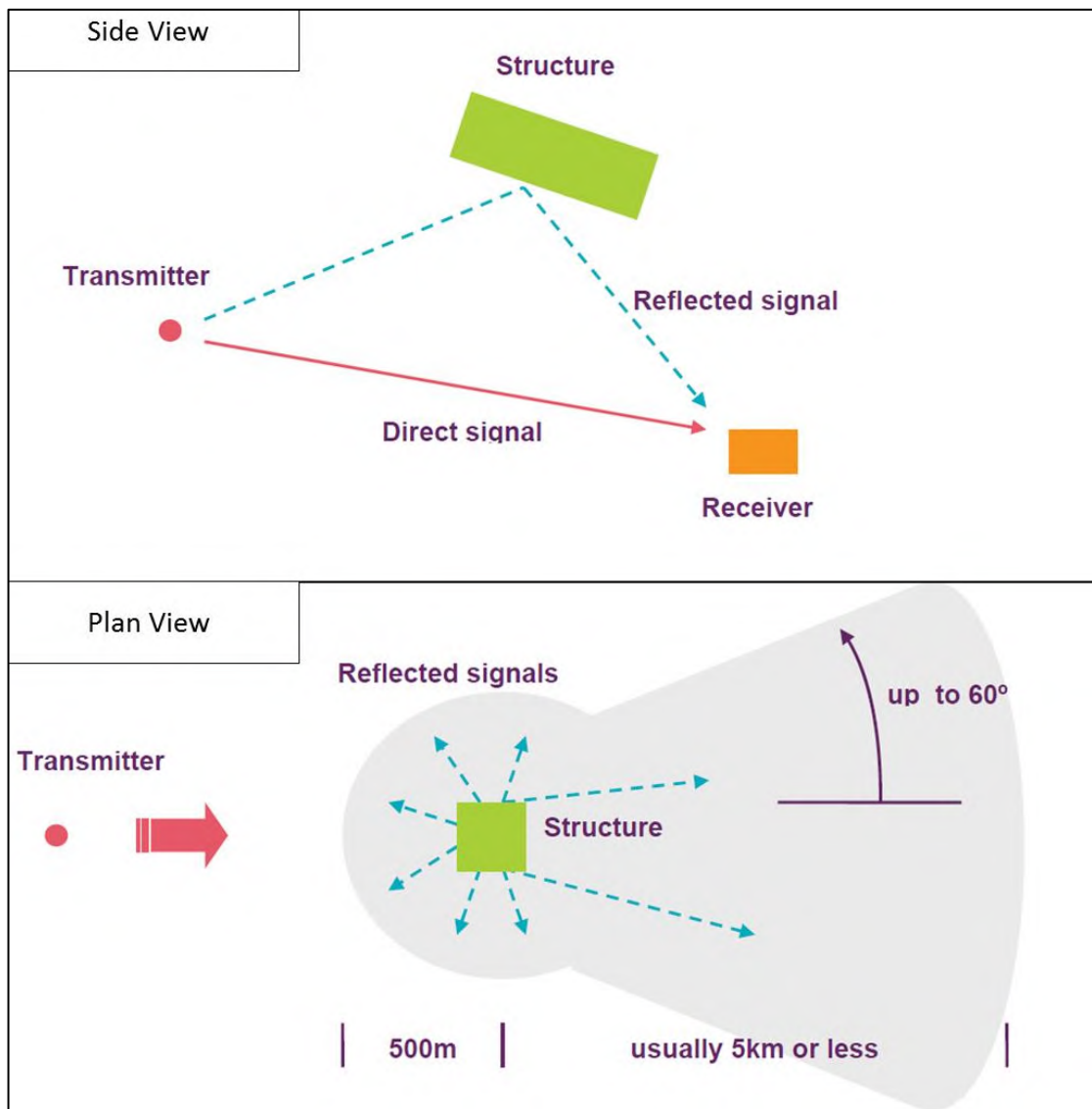


Figure 9 Reflection zones

¹¹ 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 degrees¹².

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 guidance¹³ 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 10 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.

¹² 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.

¹³ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

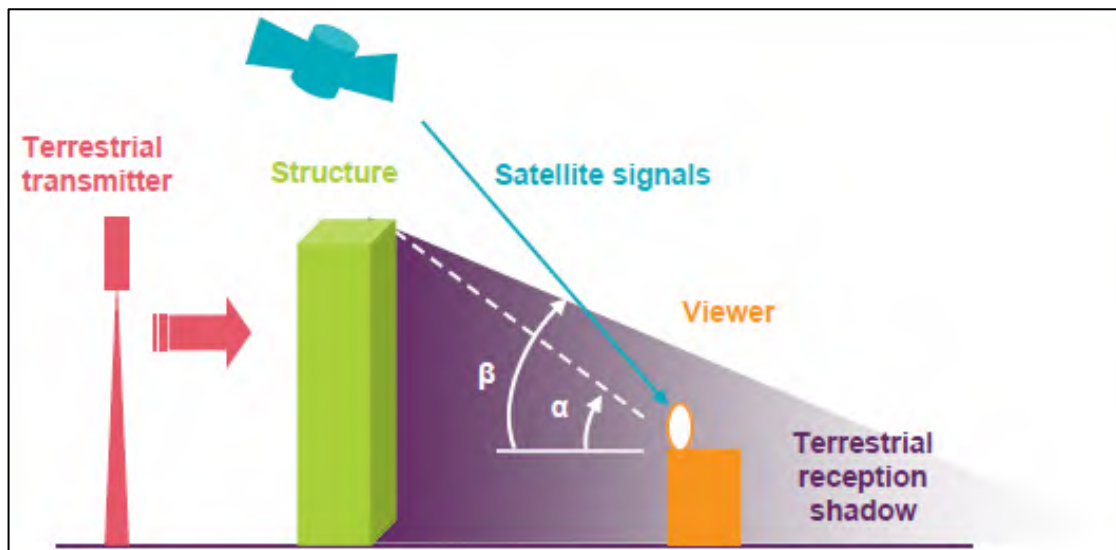


Figure 10 Satellite reception not affected by a new structure

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.

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 8 in the previous section.

Figure 11 on the following page shows the potential interference areas associated with the proposed development¹⁴.

¹⁴ The extrapolated building footprint within the site redline has been considered.

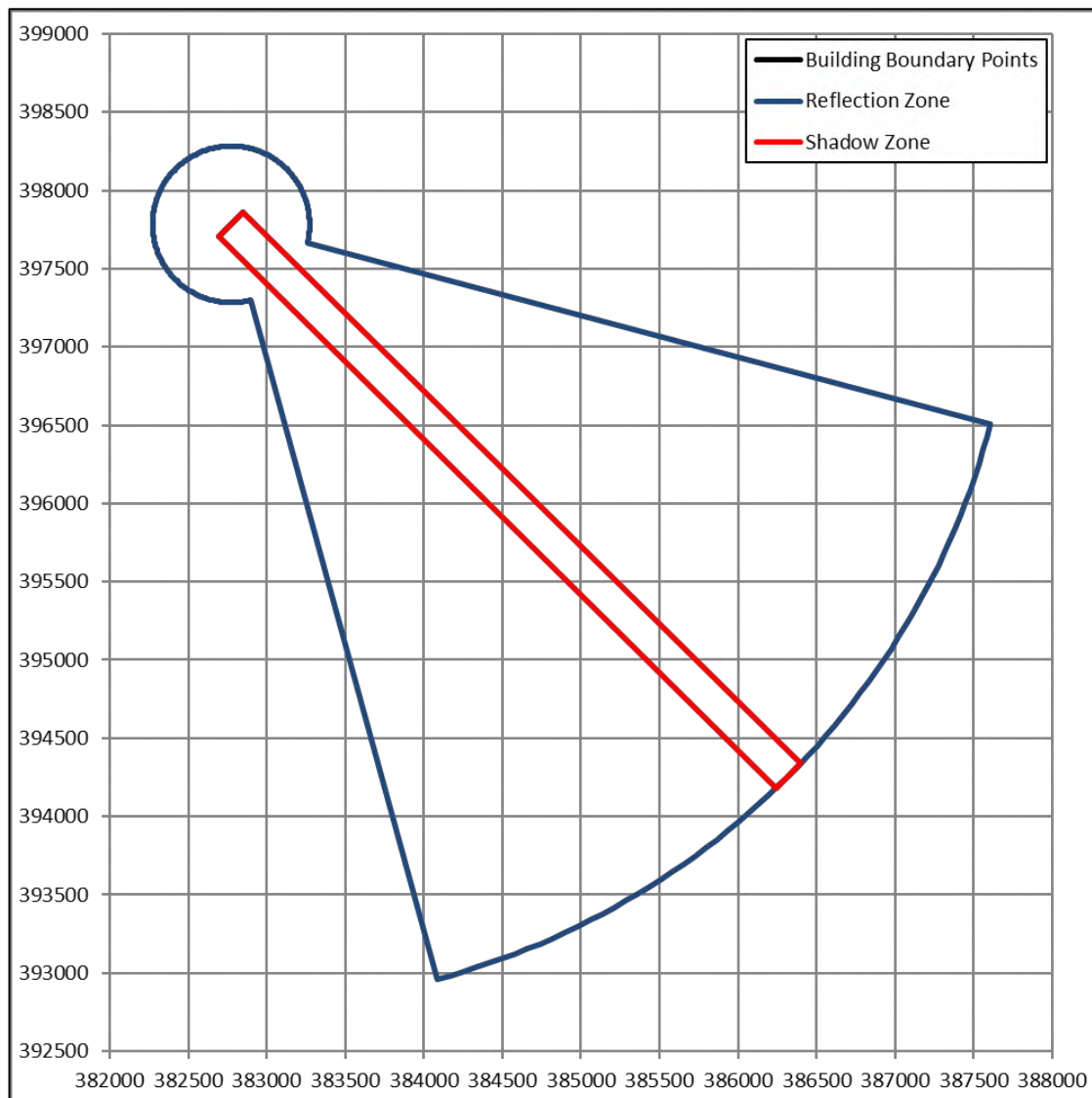


Figure 11 Television diffraction and reflection interference areas

Figure 12¹⁵ below shows the interference zones overlaid onto an aerial image of the area. The purple zone shows the combined shadow zone for D1 and D2. The turquoises zone shows the combined shadow zone for C1 and C2. The clearance between the two shadow zones is approximately 40m. There remains a small clearance between tower C1 and C2 relative to the Winter Hill transmitter however these towers have been assessed as a single obstruction to remain conservative. The combined reflection zone for all towers is defined by the blue line.

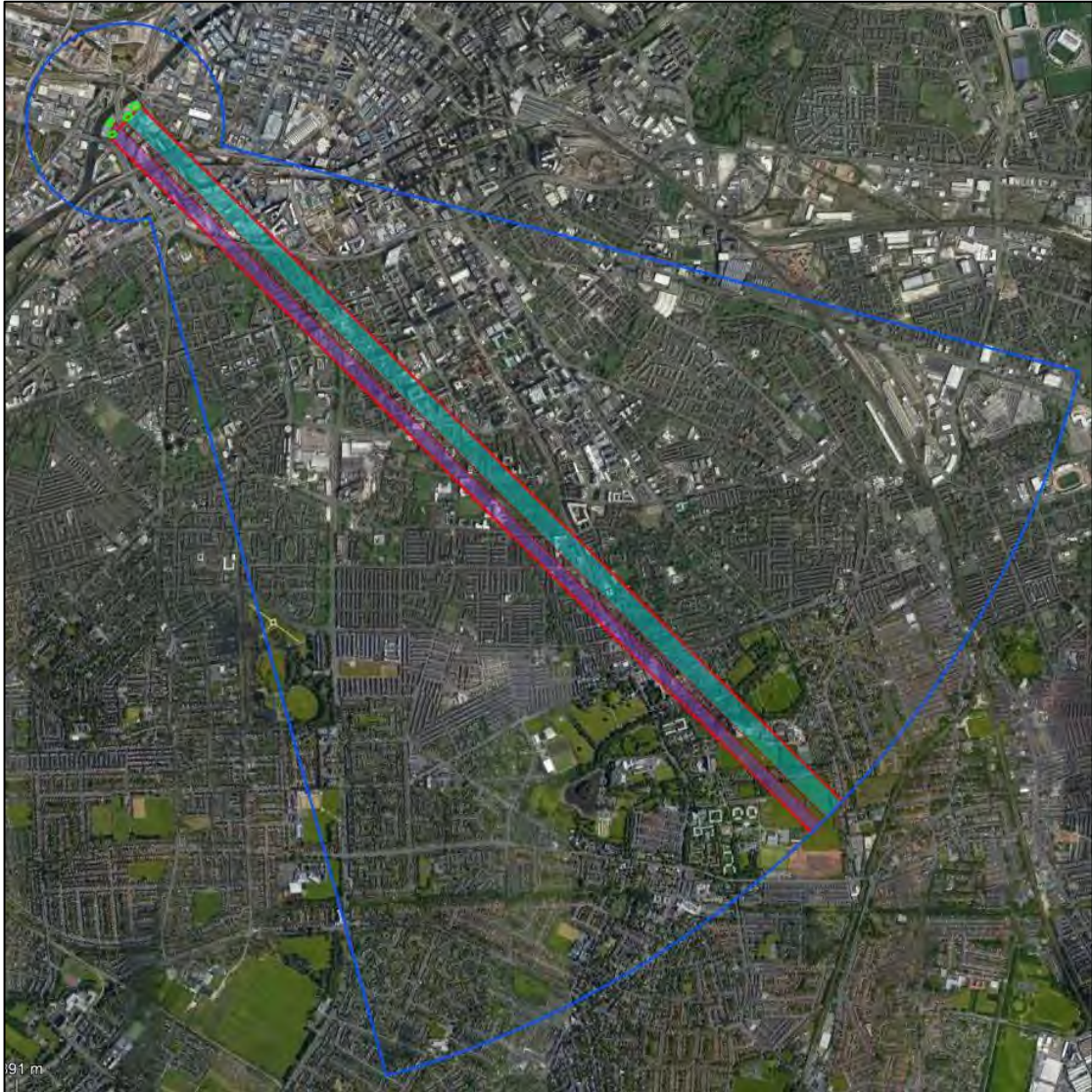


Figure 12 *Interference zones – aerial image*

¹⁵ Source: Copyright © 2021 Google.

Figure 13¹⁶ below shows the interference zones overlaid onto an aerial image of the area zoomed in on approximately the first 1.5km of the shadow zone for all towers. The footprints of the towers are shown, defined by the green lines.



Figure 13 Interference zones – aerial image (zoomed) – approx. first 1.5km

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 in practice based on Pager Power’s assessment experience.

¹⁶ Source: Copyright © 2021 Google.

5.2.1 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 calculations¹⁷ 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 = Tower C1, maximum width = width of all towers collectively relative 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)
0.05km	38.2 dB
0.1 km	35.2 dB
0.2 km	32.1 dB
0.5 km	28.1 dB
1 km	24.9 dB
1.5 km	23.0 dB
2 km	21.6 dB
3 km	19.1 dB
4 km	16.6 dB
4.99km ¹⁸	13.8 dB

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 14 on the following page shows the calculation sheet for a point 50m behind the proposed development relative to the Winter Hill transmitter.

¹⁷ Based on a modified Bullington method as recommended within ITU-P526-13.

¹⁸ 5km beyond centre of proposed development red line boundary.

Diffraction Loss Calculation			
Location	0.05		
Frequency (GHz)	0.508528		
Wavelength (m)	0.58953		
	1	2	3
Distance from Antenna 1 to blocking point (m)	25560	25560	25560
Distance from Antenna 2 to blocking point (m)	50	50	50
Height of blocking point (m)	178.2	110	110
	v	46.45989	28.681
	J dB	46.24446	42.04481
	jv (Loss Factor)	205.2215	126.5436
Shielding Loss	Jmin(v)	33.68999	
	Jav(v)	38.27863	

Figure 14 Diffraction loss calculation at 50m from the Proposed Development

All calculation sheets can be provided upon request.

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.

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 ranging from approximately 134.31-134.86 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 180.15 metres¹⁹ 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 will not extend as far as the model shows and are therefore conservative. An assumed dish height of 10 metres above ground level has been used considering a review of the buildings in its immediate shadow (with 100-200m).

Figure 15 on the following page shows the individual shadow zones for five commonly used satellites and their positions.

¹⁹ The new maximum tower height is 183.00m agl which will result in a minor increase to the shadow zone length. This increase does not significantly affect the overall results and recommendations of this report with respect to satellite television interference.



Figure 15 Satellite television interference zones

Figure 16²⁰ below shows the satellite shadow zones overlaid onto aerial imagery. The image is aligned north.

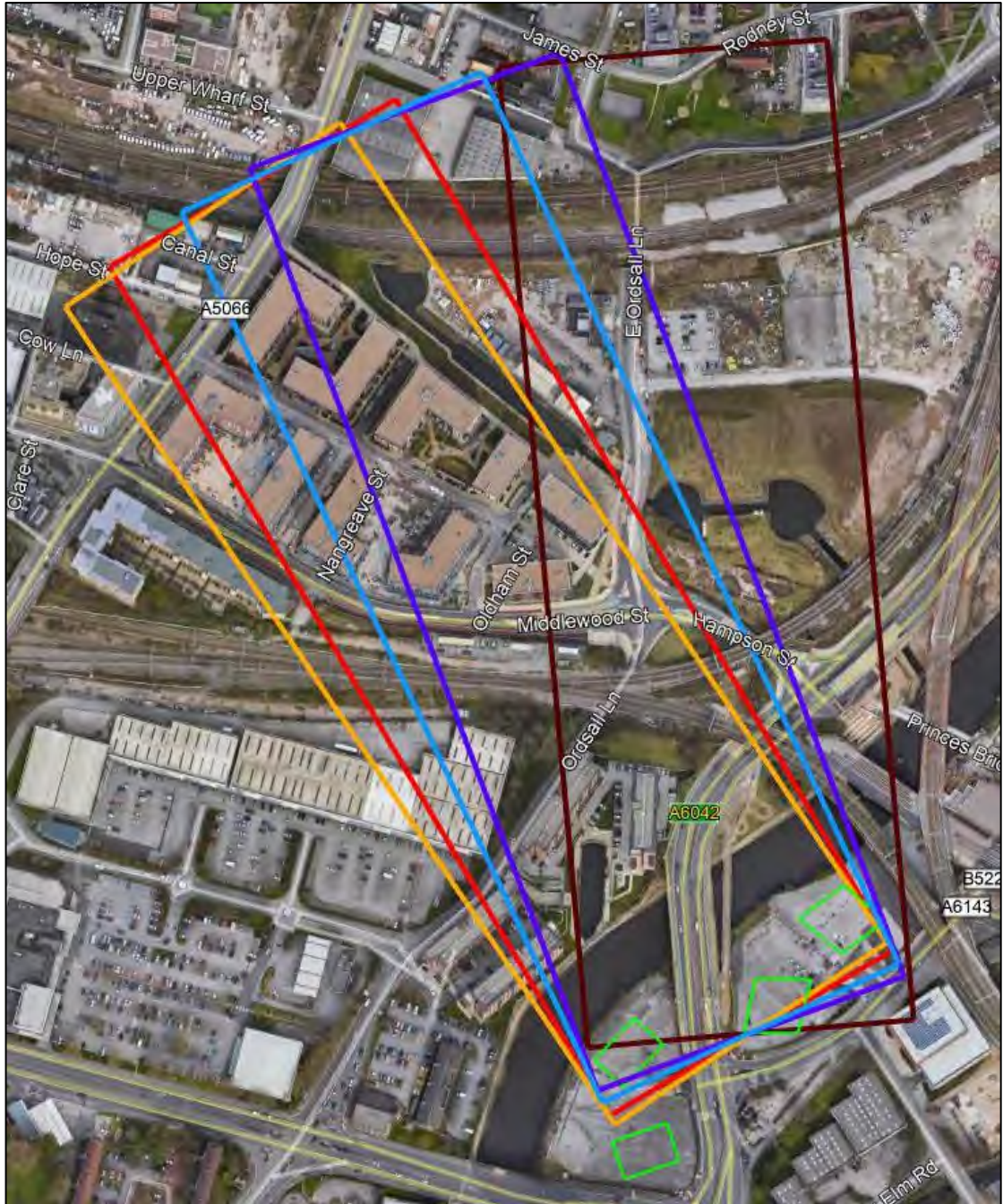


Figure 16 Satellite television interference zones (aerial image)

²⁰ Source: © 2021Google.

The shadow zones have a length of approximately 600m relative to the towers and extend north west. A review of street view imagery has that many of the buildings are multi-storey residential properties which will likely have satellite dishes on their roof. Figure 17²¹ below shows the satellite shadow zones overlaid onto 3D aerial imagery. The image is aligned north northeast.

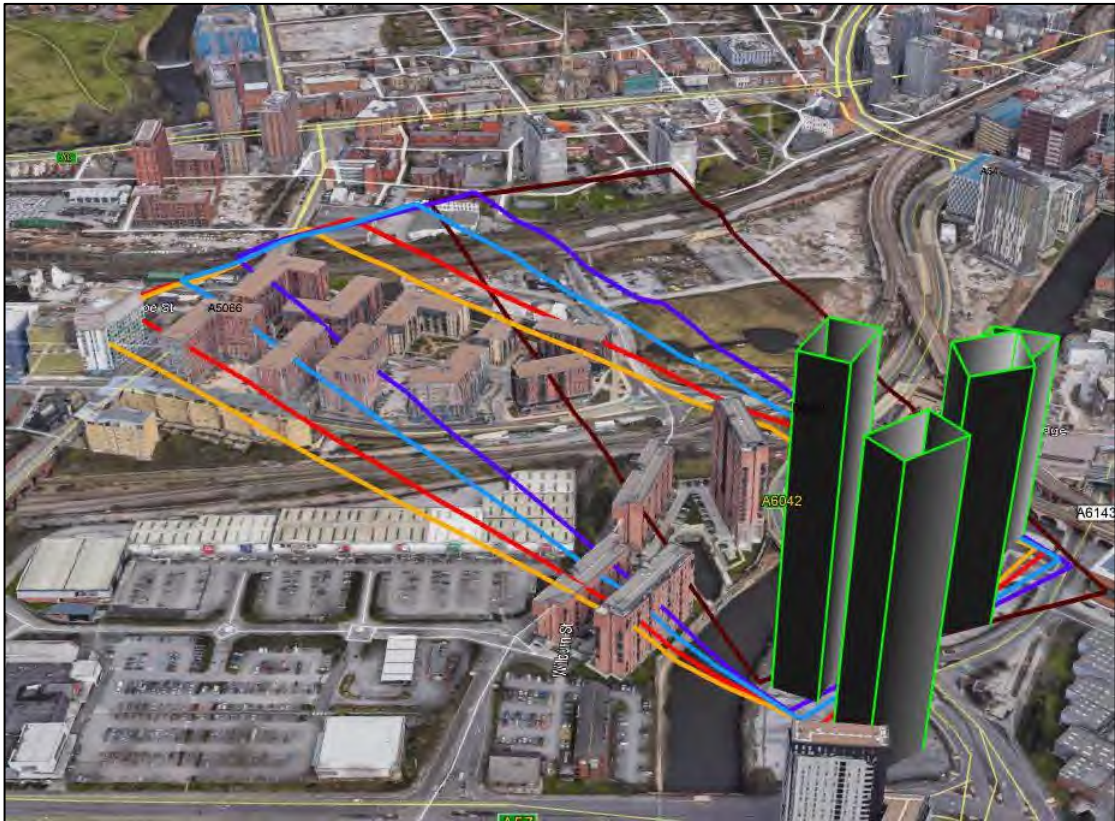


Figure 17 Satellite television interference zones (3D aerial image)

6.2 Results Discussion

Potential satellite television interference is limited to approximately 600m north west of the proposed development's location. Effects beyond this would not be anticipated.

Building developments are generally not designed around their potential impact upon television services. It is still however best practice to identify the potential impact of any tall building at the planning stage so that interference areas can be identified and the potential risk estimated. This can assist with investigating and verifying any complaint that is received.

It is not standard practice to implement pre-emptive mitigation due to the variable nature of the surrounding environment (including signal pathways), the receiving equipment and the robust nature of digital signals. There are many examples where impacts have been deemed possible

²¹ Source: © 2021Google.

but have not materialised in practice. Therefore, mitigation is only implemented in the event that impacts occur and are attributable to the proposed development. Any mitigation will be at the cost of the developer and will need to be implemented in a timely manner.

There may be interference effects during construction of the proposed development, but any reported interference should be investigated as soon as construction has begun – as per the proposed planning condition presented in the following sub-section. The process for investigation of any interference should also be agreed with the local planning authority.

7 TELEVISION BASELINE SURVEY

7.1 Overview

The purpose of a terrestrial television 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;
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.

A baseline television reception survey was undertaken for the Proposed Development on 20 October 2020.

Survey measurements were taken using Pager Power's custom survey vehicle with a wideband UHF aerial extended to a height of 10 metres above ground level. This was connected to television analyser to record the signal strength and stability.

The strength of the recorded signals is categorised in accordance within Table 4 below.

Average Signal Strength (dB)	Subjective Signal Strength Definition
<35	Low
35-45	Moderate
45-55	Good
55+	Very Good

Table 4 Television signal strength categories

7.2 Survey Locations

Figure 18 below²² shows the survey locations overlaid onto aerial photography. The Proposed Development's location and the shadow zone are also shown. Locations were selected considering residential areas within the building's shadow zone. The locations are deliberately spaced close together nearest the proposed development, as this is the area where effects would generally be the most likely and multiple measurements within a relatively short distance could be the most relevant. Survey locations were chosen pre-survey (within the shadow zone) however safe and available access influenced the specific position on the day. The locations below show the actual survey locations.

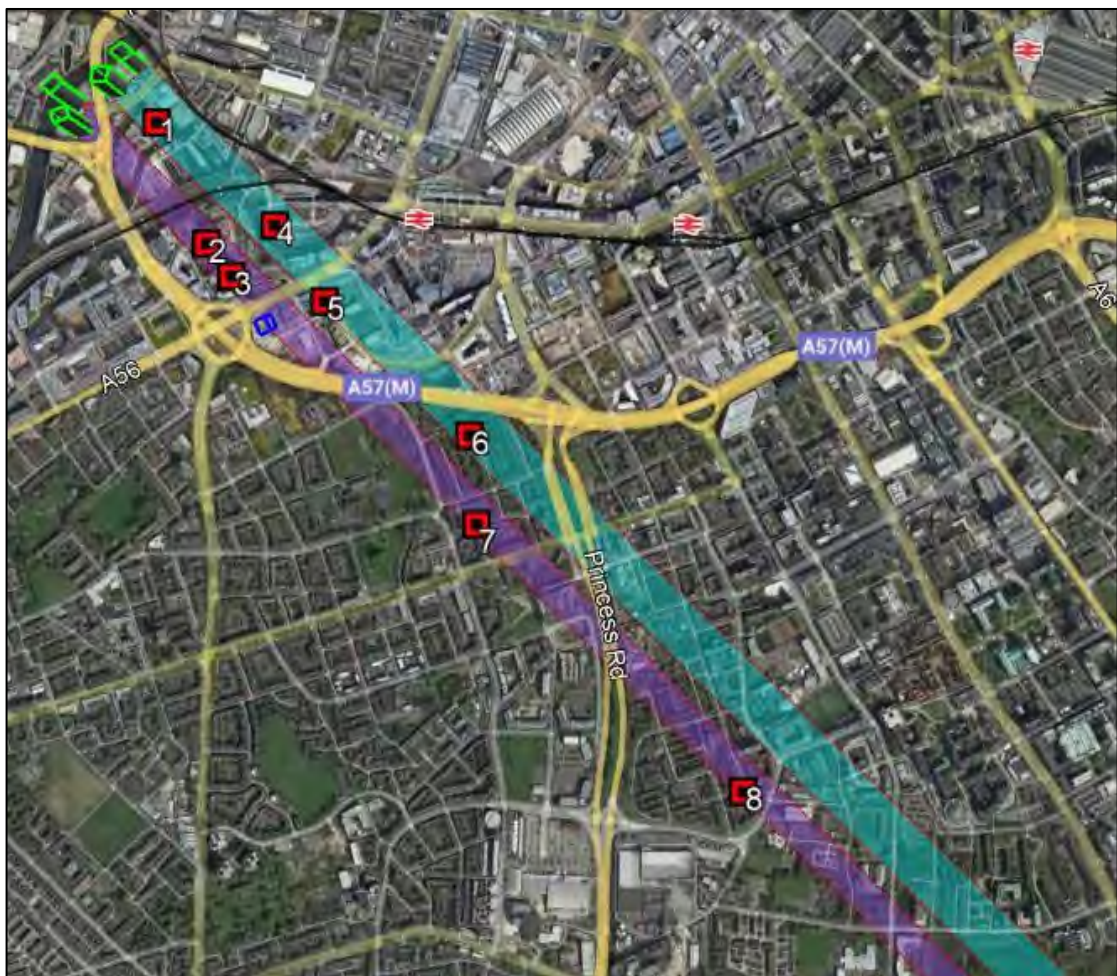


Figure 18 Survey locations

²² Source: Copyright © 2021 Google.

7.3 Survey Results

An overview of the survey results is presented in Table 6 below whilst the full survey results are shown in Appendix A. Survey photographs are shown in Appendix B.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
1	Main TV MUX: 47 (Good) Local TV MUX: 33 (Low)	Aerials and satellite dishes were not observed at this survey location. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplex was not decoded at this location.	The survey location is within 90m of the closest of the Proposed Development. Effects are possible based on the proximity to the Proposed Development. This could depend on the relative height receiving aerials and quality of the receiving equipment.
2	Main TV MUX: 44 (Moderate) Local TV MUX: 31 (Low)	One horizontally polarised aerial directed towards the Winter Hill transmitter and multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is within 350m of the closest of the Proposed Development. Effects are possible based on the proximity to the Proposed Development. This could depend on the relative height receiving aerials and quality of the receiving equipment

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
3	Main TV MUX: 47 (Good) Local TV MUX: 31 (Low)	Aerials dishes were not observed at this survey location. One satellite dish was observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is approximately 450m of the closest of the Proposed Development. It is possible that the signals are affected at this range, however significant effects are unlikely to be noticeable.
4	Main TV MUX: 51 (Good) Local TV MUX: 37 (Low)	Aerials and satellite dishes were not observed at this survey location. All main and local multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is more than 430m from the Proposed Development. It is possible that the signals are affected at this range, however existing good signal strength makes this less likely.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
5	Main TV MUX: 49 (Good) Local TV MUX: 35 (Moderate)	Two horizontally polarised aerials directed towards the Winter Hill transmitter. No satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	The survey location is more than 630m from the Proposed Development It is possible that the signals are affected at this range, however existing good signal strength makes this less likely.
6	Main TV MUX: 44 (Moderate) Local TV MUX: 32 (Low)	Multiple horizontally polarised aerials directed towards the Winter Hill transmitter and multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	The survey location is more than 1.05km from the Proposed Development It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. There are however existing tall buildings (Crown Street, Deansgate Square etc.) between the survey location and the Proposed Development. This means that cumulative effects are possible. Significant interference is unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
7	Main TV MUX: 49 (Good) Local TV MUX: 34 (Low)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	The survey location is more than 1.20km from the Proposed Development It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. There are however existing tall buildings (Crown Street, Deansgate Square etc.) between the survey location and the Proposed Development. This means that cumulative effects are possible. Significant interference is unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes.
8	Main T V MUX: 47 (Good) Local TV MUX: 31 (Low)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplex was not decoded at this location.	It is unlikely that noticeable losses would occur at 2.01km from the Proposed Development based on previous assessment experience even considering potential cumulative effects. Significant interference is unlikely.

Table 5 Baseline survey results

8 CONCLUSIONS

8.1 Terrestrial Television Assessment Conclusions

The overall conclusions for terrestrial television transmissions are:

- A site survey was undertaken on 20 October 2021 to confirm the relevant transmitter and record the signal quality.
- The baseline survey confirmed that the Winter Hill television transmitter was the main transmitter serving the area;
- Any interference would most likely be due to diffraction (shadowing) effects i.e. the weakening of the transmitted signal due to the physical presence of the proposed development. This is where the baseline signal readings were taken;
- Received terrestrial signals from the main multiplexes were generally moderate to good strength and quality in the surrounding area. Local multiplexes were generally low to moderate strength and quality however these are broadcast at a much lower power. Existing tall buildings likely already attenuate signals from Winter Hill, particularly at ground and lower levels;
- Considering the desk-based and survey results, as well as 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 between a bearing of approximately 134.31-134.86 degrees);
- It is possible that there will be no significant impact on terrestrial television signals due to the Proposed Development because small/moderate losses may not result in noticeable interference in the context of the surrounding area.

8.2 Satellite Television Assessment Conclusions

The overall conclusions for satellite television transmissions are:

- The potential impacts created by the proposed development upon satellite television signals extends to circa 600m north west of the proposed development;
- 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 partially blocked;
- Therefore, it is possible that no noticeable effects would occur in practice;
- If interference is reported, it should be investigated.

8.3 Recommendations and Mitigation

Technical mitigation solutions have been identified for implementation if an impact occurs. The most likely options, in the event a mitigation requirement transpires, would be:

- Replacement of receiving aerial with a more directional or higher gain aerial.

- Replacement of terrestrial reception equipment with satellite reception equipment or cable.

No pre-emptive action is recommended however, and any reported television interference should be investigated by means of a post-construction reception measurement. The survey can then be compared alongside the baseline survey results and modelling results to determine whether the effect is attributable to the development.

APPENDIX A – DETAILED SURVEY RESULTS

Location 1

Location 1 (GPS Coordinates: 53 28 34.09320 -2 15 34.34399)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	32.9	0.1	1.6×10^{-7}	Fine	Fine
27	Unknown	29	0.1	-	DND ²³	DND
29	SDN	46.8	0.1	4.5×10^{-7}	Fine	Fine
31	Arqiva A	46.9	0.1	6.3×10^{-8}	Fine	Fine
32	BBC A	47.9	0.1	4.2×10^{-8}	Fine	Fine
34	Digital 3&4	46	0.1	1×10^{-8}	Fine	Fine
35	BBC B	46	0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	46.5	0.1	1×10^{-8}	Fine	Fine
55	COM7	37.6	0.1	-	DND	DND

Notes: No UHF aerials or satellite dishes were observed at this location.

²³ Did not decode.

Location 2

Location 2 (GPS Coordinates: 53 28 25.30559 -2 15 27.94680)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	29.5	0.1	7×10^{-4}	Fine	Fine
27	Unknown	28.5	0.1	-	DND	DND
29	SDN	47	0.1	2.7×10^{-7}	Fine	Fine
31	Arqiva A	44.6	0.1	1.2×10^{-7}	Fine	Fine
32	BBC A	45.5	0.2	1×10^{-8}	Fine	Fine
34	Digital 3&4	42.9	0.1	1×10^{-8}	Fine	Fine
35	BBC B	41.9	0.2	1×10^{-8}	Fine	Fine
37	Arqiva B	42.1	0.1	5×10^{-6}	Fine	Fine
55	COM7	33.5	0.1	-	DND	DND

Notes: One UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes observed.

Location 3

Location 3 (GPS Coordinates: 53 28 23.10599 -2 15 25.44840)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	33	0.1	3×10^{-7}	Fine	Fine
27	Unknown	29.8	0.1	-	DND	DND
29	SDN	45.8	0.1	4×10^{-6}	Fine	Fine
31	Arqiva A	47.7	0.1	8×10^{-7}	Fine	Fine
32	BBC A	47.6	0.1	1×10^{-8}	Fine	Fine
34	Digital 3&4	47.1	0.1	1×10^{-8}	Fine	Fine
35	BBC B	45.8	0.1	1×10^{-7}	Fine	Fine
37	Arqiva B	45.6	0.1	3.4×10^{-7}	Fine	Fine
55	COM7	30.7	0.1	-	DND	DND

Notes: No UHF aerials were observed at this location. One satellite dish was observed. Survey aerial looked east at this location because stronger signal in that direction were received.

Location 4

Location 4 (GPS Coordinates: 53 28 26.82120 -2 15 20.47320)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	36.2	0.1	1×10^{-7}	Fine	Fine
27	Unknown	34.1	0.1	8×10^{-4}	Fine	Fine
29	SDN	53.7	0.1	1×10^{-8}	Fine	Fine
31	Arqiva A	52.1	0.1	1×10^{-8}	Fine	Fine
32	BBC A	52.5	0.2	1×10^{-8}	Fine	Fine
34	Digital 3&4	50	0.1	1×10^{-8}	Fine	Fine
35	BBC B	50	0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	50	0.1	1×10^{-8}	Fine	Fine
55	COM7	40.3	0.1	1×10^{-8}	Fine	Fine

Notes: No UHF aerials or satellite dishes were observed at this location.

Location 5

Location 5 (GPS Coordinates: 53 28 21.50039 -2 15 15.07319)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	35.3	0.1	1*10 ⁻⁸	Fine	Fine
27	Unknown	29.7	0.1	-	DND	DND
29	SDN	50.4	0.1	1*10 ⁻⁸	Fine	Fine
31	Arqiva A	48.6	0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	47.8	0.1	1*10 ⁻⁸	Fine	Fine
34	Digital 3&4	48.9	0.1	1*10 ⁻⁸	Fine	Fine
35	BBC B	48.8	0.1	1*10 ⁻⁸	Fine	Fine
37	Arqiva B	51.2	0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	38.9	0.1	1*10 ⁻⁸	Fine	Fine

Notes: Two UHF aerials directed towards the Winter Hill transmitter were observed. No satellite dishes were observed.

Location 6

Location 7 (GPS Coordinates: 53 28 5.77199 -2 14 56.64840)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	31.2	0.1	2×10^{-6}	Fine	Fine
27	Unknown	29.1	0.1	-	DND	DND
29	SDN	44.2	0.2	7.5×10^{-8}	Fine	Fine
31	Arqiva A	45.7	0.1	1×10^{-8}	Fine	Fine
32	BBC A	44.8	0.2	1×10^{-8}	Fine	Fine
34	Digital 3&4	42.9	0.2	6.7×10^{-8}	Fine	Fine
35	BBC B	41.2	0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	43.4	0.1	4.3×10^{-7}	Fine	Fine
55	COM7	36.5	0.1	1×10^{-8}	Fine	Fine

Notes: Multiple UHF aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 7

Location 6 (GPS Coordinates: 53 28 12.08640 -2 15 57.38999)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	32	0.1	2.4×10^{-7}	Fine	Fine
27	Unknown	30.1	0.1	-	DND	DND
29	SDN	41.5	0.2	1×10^{-4}	Fine	Fine
31	Arqiva A	52.9	0.1	1×10^{-8}	Fine	Fine
32	BBC A	51.3	0.1	1×10^{-8}	Fine	Fine
34	Digital 3&4	50.9	0.1	1×10^{-8}	Fine	Fine
35	BBC B	49.9	0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	49.2	0.1	1×10^{-8}	Fine	Fine
55	COM7	40	0.1	1×10^{-8}	Fine	Fine

Notes: Multiple UHF aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 8

Location 8 (GPS Coordinates: 53 27 47.22839 -2 14 25.46879)						
Channel	Service	Signal Strength (dBμV)	Variance	BER	Picture	Audio
24	Unknown	30.9	0.1	4×10^{-5}	Fine	Fine
27	Unknown	27.6	0.1	-	DND	DND
29	SDN	45.3	0.1	4×10^{-5}	Fine	Fine
31	Arqiva A	47.1	0.1	7×10^{-8}	Fine	Fine
32	BBC A	49.4	0.1	1×10^{-8}	Fine	Fine
34	Digital 3&4	47	0.1	1×10^{-8}	Fine	Fine
35	BBC B	45.6	0.1	1×10^{-7}	Fine	Fine
37	Arqiva B	48.4	0.1	1×10^{-7}	Fine	Fine
55	COM7	34.1	0.1	-	DND	DND

Notes: Multiple UHF aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

APPENDIX B – SURVEY PHOTOGRAPHS

Location 1



Location 2



Location 3



Location 4



Location 5



Location 6



Location 7



Location 8





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