

Television Baseline Survey Report

Jersey Wharf

Manchester Life Development Company 3 Limited

December 2021

PLANNING SOLUTIONS FOR:

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ADMINISTRATION PAGE

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2	December 2021	Minor amendments

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been commissioned to investigate the potential impact of a proposed building development upon terrestrial television reception in the surrounding area. The proposed development will comprise two tall building plots and is located at Jersey Street, Manchester, UK.

Results

- The proposed development is within the coverage area for the Winter Hill television transmitter. The baseline survey confirmed it was the main transmitter serving the area.
- Any interference would be due to shadowing effects i.e. the weakening of the transmitted signal due to the physical presence of the buildings.
- A site survey was undertaken on the 20th of October 2021 to confirm the relevant transmitter and record the signal quality.
- Terrestrial signal strength is very good in the proposed development shadow zone for the main multiplexes and overall good to very good on average when including the results for the local (lower power) multiplexes¹.
- Negative effects upon signal strength are most likely at locations close to the proposed development i.e. within 1km of the proposed development and within its shadow zone. This area contains a mixture of dwellings and apartment blocks. The signal strength within this range was recorded as very good for the main multiplexes¹. Interference effects are possible; however, this could depend on the relative height of the building development and any receiving aerials. Based on the current signal quality, significant effects are unlikely to be noticeable.

Recommendation

Any reported television interference after construction has begun should be investigated by means of a reception measurement.

Mitigation

Mitigation measures should be installed if reported effects are found to be attributable to the proposed development. Solutions are likely to be readily available if required, the most common options are presented in Section 6.

¹ Local multiplexes had an average of good to moderate signal strength; however, with all channels surveyed resulting in fine picture and audio quality.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 51 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 television reception in the surrounding area. The proposed development will introduce new tall structures into the urban environment, which could interact with broadcast signals, causing interference. The interference zones have been modelled in accordance with Ofcom guidance (Section 3) and a baseline reception survey has been undertaken within potentially affected areas (Sections 4 and 5).

1.2 Proposed Development Boundary

The proposed development is located at Jersey Street, Manchester, UK. The development boundary for the proposed development is shown in Figure 1² below.

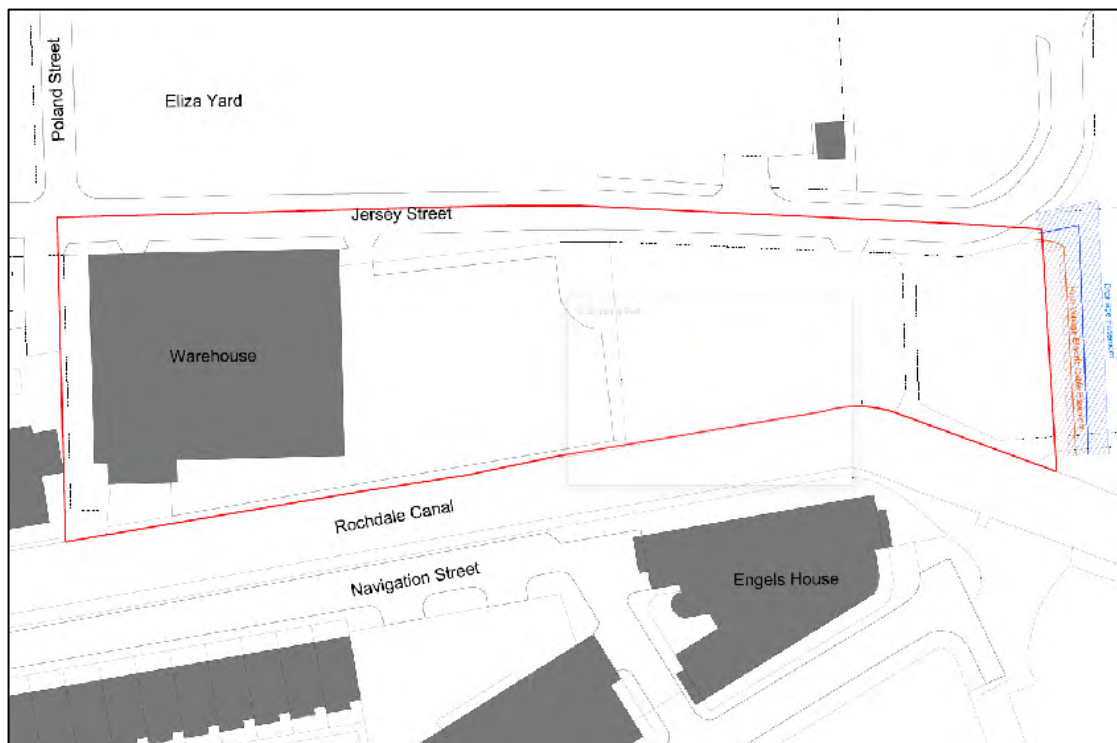


Figure 1 Proposed development boundary

² Source: BA9225_1140_Site Boundary.pdf (cropped).

1.3 Proposed Development Boundary – Aerial image

The development boundary (red line) for the proposed development overlaid on aerial imagery is shown in Figure 2³ below.



Figure 2 Proposed development boundary overlaid on aerial imagery

³ Copyright © 2021 Google.

2 TELEVISION TRANSMITTER DETAILS

2.1 Relevant Transmitter

The Winter Hill transmitter predominantly serves the area around the development⁴. Digital television services are broadcast via Ultra High Frequency (UHF) signals.

2.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 24.8km northwest of the development.

Digital television services are broadcast, details are presented in Tables 1 and 2 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 (main multiplexes)

Service	LTVmux (Manchester)	Glmux	COM 7
Channel	24	27	55
Power	2 kW	1 kW	25.7 kW

Table 2 Winter Hill transmissions (local multiplexes)

⁴ Based on coverage maps and Digital UK information.

3 BUILDINGS AND TELEVISION INTERFERENCE

3.1 Technical Overview

Terrestrial television services are provided by means of UHF radio waves which propagate from transmitters to receiving aerials which then relay the signal to a television set.

The quality of the image and sound on a television 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 below.

3.2 Obstruction of the Signal

This is caused by the building physically blocking the transmitted television signal, reducing the strength of the carrier signal in the shadow of the building. In the case of Winter Hill transmissions, this would affect residences to the southeast of the proposed development. Specifically:

- The highest losses (greatest interference) will be located immediately behind the building.
- Losses near the edge of the shadow zone will be less significant due to diffraction effects (bending of the signal).

The Ofcom document states that:

"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."

The zones mentioned are illustrated in Figure 3 on the following page⁵, taken from Section 3.2 of an Ofcom paper⁶ regarding the impact of buildings on broadcast signals.

⁵ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

⁶ Reference as above.

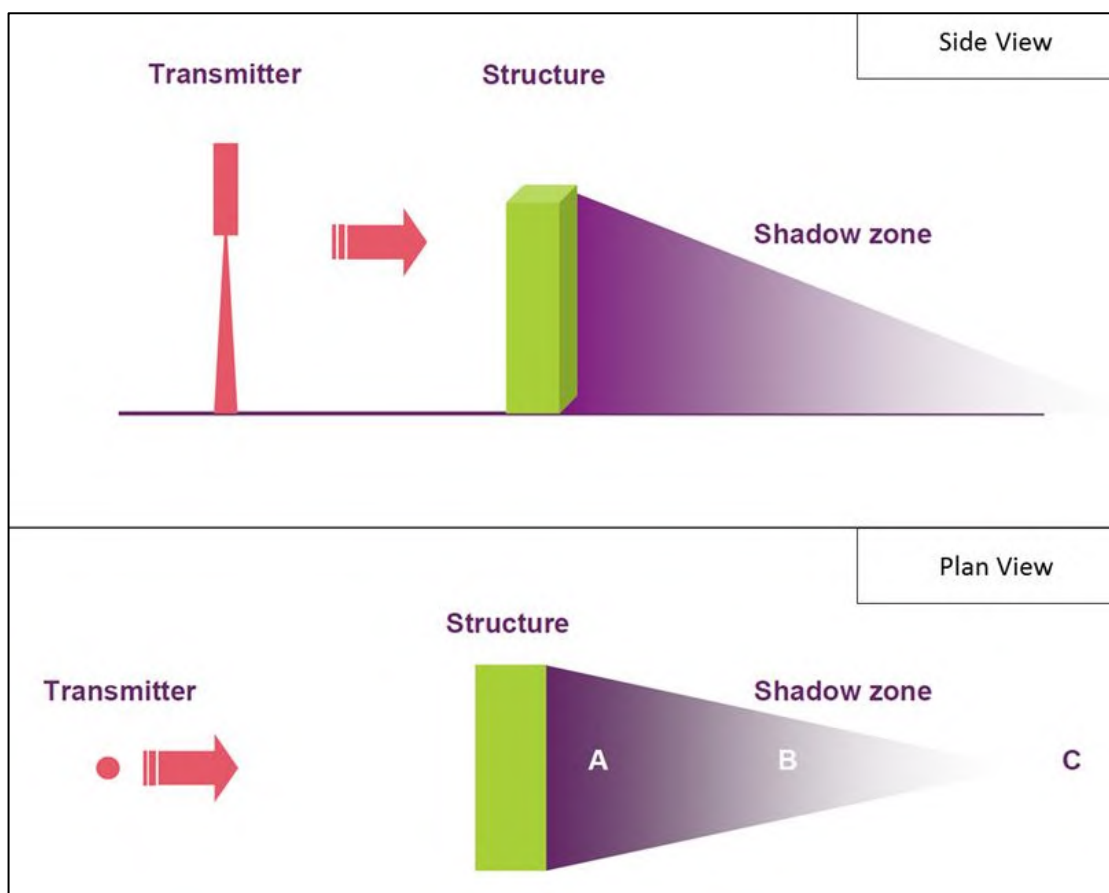


Figure 3 Diffraction loss zones

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 4 on the following page (taken from Section 3.3 of the Ofcom document referenced above) illustrates this effect.

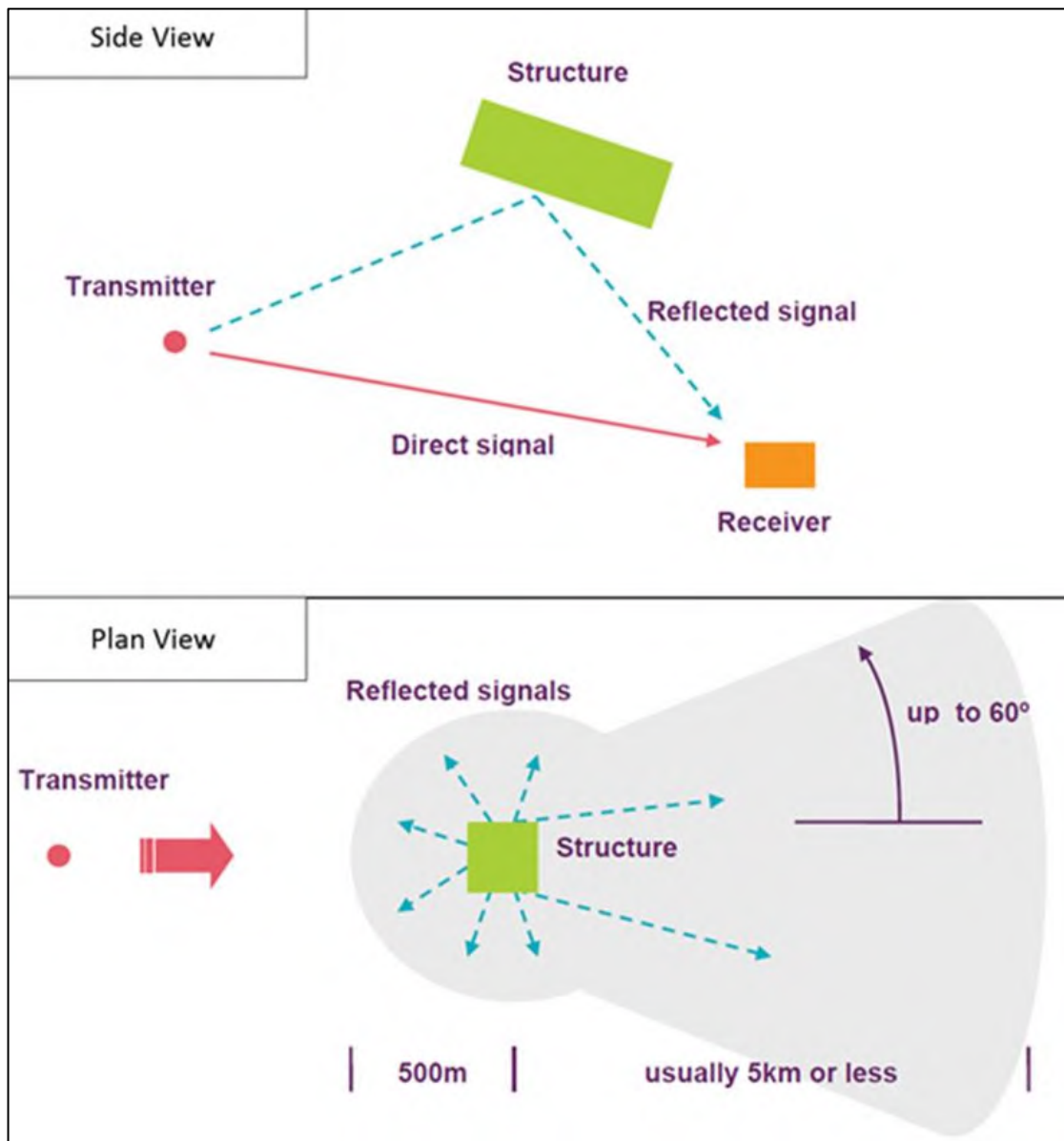


Figure 4 Reflection zones

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 degrees⁷.

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.

⁷ 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.

4 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 3 in the previous section. Figure 5 below shows the potential interference areas associated with the proposed development⁸.

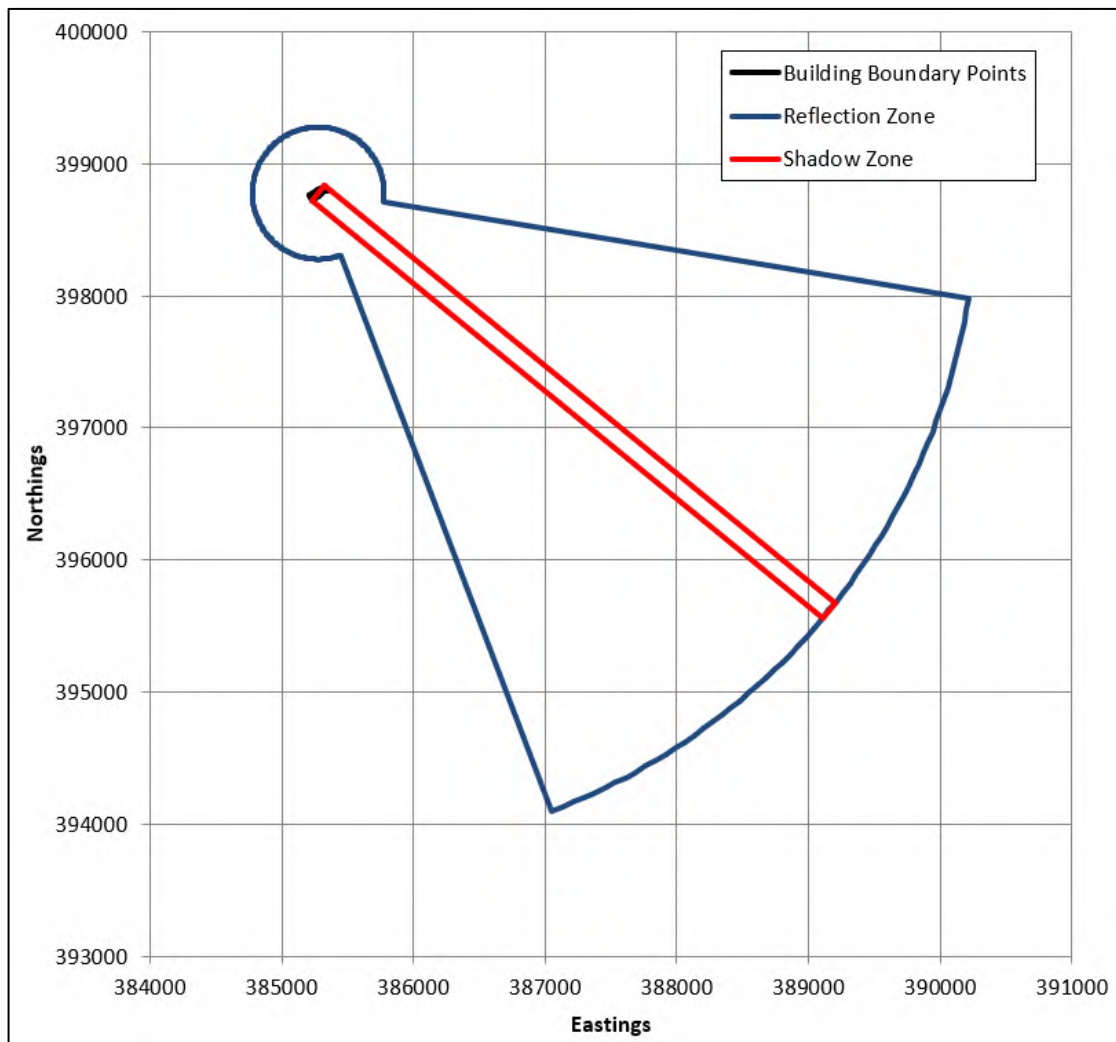


Figure 5 Interference areas

⁸ The cumulative footprint (site boundary) of the proposed development has been considered.

Figure 6³ below shows the interference zones overlaid onto an aerial image of the area.



Figure 6 *Interference zones map*

4.2 Potential Diffraction Issues – Terrestrial Television

The shadow zone passes over urban and commercial buildings. 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. Dwellings and apartment blocks are located within 1km of the proposed development shadow zone.

4.3 Potential Reflection Issues

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 TELEVISION BASELINE SURVEY

5.1 Overview – Television Services

The purpose of a 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 (for television).
2. 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.
3. 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 the 20th of October 2021.

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 with Table 3 below.

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

Table 3 Television signal strength categories

5.2 Survey Locations

Figure 7³ below shows the survey locations overlaid onto aerial photography. The proposed development location and the shadow zone are also shown. 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. Survey locations are more closely grouped nearer the proposed development because interference is generally more likely the closer the location is to the obstruction. Radial white icons represent television survey locations.

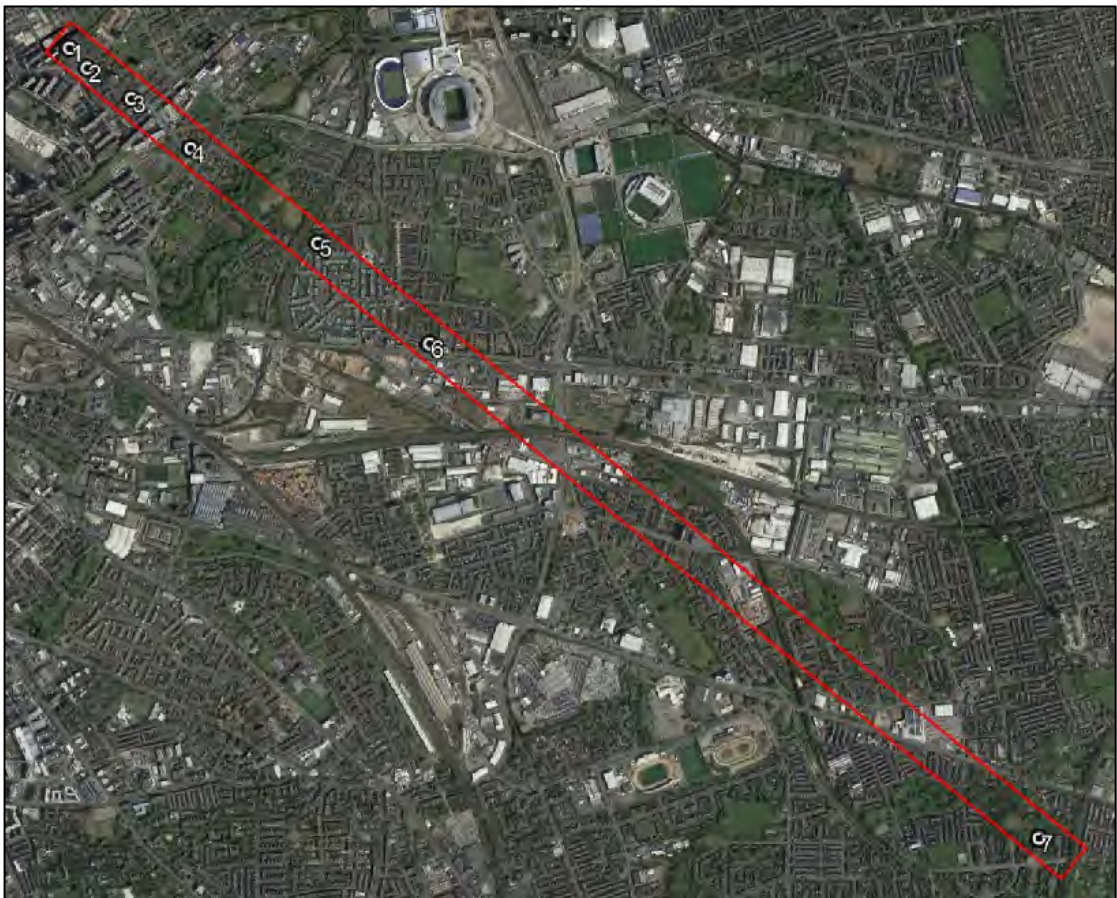


Figure 7 Survey locations

5.3 Survey Results

A summary of the survey results is presented in Table 4 on the following page. 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	Average: 53.5 (Good) Main TV MUX: 59.4 (Very good) Local TV MUX: 41.6 (Moderate)	Multiple HP⁹ UHF¹⁰ aerial directed towards the Winter Hill transmitter was observed. Satellite dishes observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.2dB. All local multiplexes displayed fine picture and audio quality, an average of moderate signal strength and signal fluctuations of less than or equal to 0.1dB.	This location is approximately 40 metres from the proposed development boundary. Circa four to five storey apartments are located to the immediate north of location 1. Effects are possible based on the proximity to the proposed development. This could depend on the relative height of the building development and any receiving aerials; however, based on the current signal quality, significant effects are unlikely to be noticeable. Interference is possible.

⁹ Horizontally Polarised

¹⁰ Ultra-High Frequency

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
2	Average: 53.7 (Good) Main TV MUX: 60.2 (Very good) Local TV MUX: 40.7 (Moderate)	Multiple HP UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.1dB. All local multiplexes displayed fine picture and audio quality, an average of moderate signal strength and signal fluctuations of less than or equal to 0.1dB.	This location is approximately 145 metres from the proposed development boundary. Predominately two storey dwellings are located adjacent to location 2. Effects are possible based on the proximity to the proposed development. This could depend on the relative height of the building development and any receiving aerials; however, based on the current signal quality, significant effects are unlikely to be noticeable. Interference is possible.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
3	Average: 62.4 (Very good) Main TV MUX: 68.0 (Very good) Local TV MUX: 51.1 (Good)	Multiple HP UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.1dB. All local multiplexes displayed fine picture and audio quality, an average of good signal strength and signal fluctuations of less than or equal to 0.1dB.	This location is approximately 350 metres from the proposed development boundary. Predominately two storey dwellings are located adjacent to location 3. Effects are possible based on the proximity to the proposed development. This could depend on the relative height of the building development and any receiving aerials; however, based on the current signal quality, significant effects are unlikely to be noticeable. Interference is possible.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
4	Average: 49.1 (Good) Main TV MUX: 55.8 (Very good) Local TV MUX: 35.9 (Moderate)	Multiple HP UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.1dB. All local multiplexes displayed fine picture and audio quality, an average of moderate signal strength and signal fluctuations of less than or equal to 0.1dB.	This location is approximately 645 metres from the proposed development boundary. Predominately two storey dwellings are located adjacent to location 4. Effects are possible based on the proximity to the proposed development. This could depend on the relative height of the building development and any receiving aerials; however, based on the current signal quality, significant effects are unlikely to be noticeable. Interference is possible.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
5	Average: 57.9 (Very good) Main TV MUX: 63.6 (Very good) Local TV MUX: 46.5 (Good)	Multiple HP UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.1dB. All local multiplexes displayed fine picture and audio quality, an average of good signal strength and signal fluctuations of less than or equal to 0.1dB.	This location is approximately 1.25km from the proposed development boundary. Effects at this range are likely to be relatively small based on previous experience. Based on the current signal quality, effects are unlikely to be noticeable. Interference is unlikely.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
6	Average: 63.2 (Very good) Main TV MUX: 69.0 (Very good) Local TV MUX: 51.4 (Good)	Multiple HP UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.1dB. All local multiplexes displayed fine picture and audio quality, an average of good signal strength and signal fluctuations of less than or equal to 0.2dB.	This location is approximately 1.83km from the proposed development. Effects at this range are likely to be relatively small based on previous experience. Based on the current signal quality, effects are unlikely to be noticeable. Interference is unlikely.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
7	Average: 56.2 (Very good) Main TV MUX: 62.4 (Very good) Local TV MUX: 43.6 (Moderate)	Multiple HP UHF aerial directed towards the Winter Hill transmitter was observed. Multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, an average of very good signal strength and signal fluctuations of less than or equal to 0.1dB. All local multiplexes displayed fine picture and audio quality, an average of moderate signal strength and signal fluctuations of less than or equal to 0.1dB.	This location is approximately 4.82km from the proposed development boundary. Effects at this range are likely to be relatively small based on previous experience. Based on the current signal quality, effects are unlikely to be noticeable. Interference is unlikely.

Table 4 Television baseline survey results

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

Mitigation options for television include:

- 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 or cable.

6.2 Recommended Options

If interference 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, the best option may be to upgrade and/or elevate the existing aerial.

It is also possible that the television services could be supplied by an alternate transmitter in the surrounding area.

6.3 Recommended Process

It is possible that no adverse effects will occur due to the current reception quality in the surrounding area and the scarcity of residential receptors at a low height in the immediate shadow zone.

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.

7 CONCLUSIONS

7.1 Findings

The proposed development is within the coverage area for the Winter Hill television transmitter. Any interference would be due to shadowing effects i.e. the weakening of the transmitted signal due to the physical presence of the buildings.

Terrestrial signal strength is very good in the proposed development shadow zone for the main multiplexes and overall good to very good on average when including the results for the local (lower power) multiplexes¹¹.

Negative effects upon signal strength are most likely at locations close to the proposed development i.e. within 1km of the proposed development and within its shadow zone. This area contains a mixture of dwellings and apartment blocks. The signal strength within this range was recorded as very good for the main multiplexes¹. Interference effects are possible; however, this could depend on the relative height of the building development and any receiving aerials. Based on the current signal quality, significant effects are unlikely to be noticeable.

Any reported television interference after construction has begun should be investigated by means of a reception measurement. Any impacts that do occur would most likely be constrained to areas immediately behind the proposed development.

¹¹ Local multiplexes had an average of good to moderate signal strength; however, with all channels surveyed resulting in fine picture and audio quality.

APPENDIX A – DETAILED SURVEY RESULTS

Location 1

Coordinates: Lon: -2.22263, Lat: 53.48517					
Channel	Service	Signal Strength ¹² (dBμV)	BER ¹³	Picture	Audio
24	LTVmux	38.6 +/- 0.1	1*10 ⁻⁸	Fine	Fine
27	Glmax	37.5 +/- 0.1	3*10 ⁻⁷	Fine	Fine
29	SDN	58.6 +/- 0.2	1*10 ⁻⁸	Fine	Fine
31	Arq A	59.0 +/- 0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	60.8 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	60.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35	BBC B	58.5 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	58.8 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	48.8 +/- 0.1	1*10 ⁻⁸	Fine	Fine

Notes: Multiple HP¹⁴ UHF¹⁵ aerial directed towards the Winter Hill transmitter was observed.
Satellite dishes observed.

¹² +/- followed by a number represents the approximate signal fluctuation.

¹³ E = 1 x10 to the power of the following number e.g. -8.

¹⁴ Horizontally Polarised

¹⁵ Ultra-High Frequency

Location 2

Coordinates: Lon: -2.22159, Lat: 53.48448					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
24	LTVmux	40.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
27	Glmax	38.5 +/- 0.1	1*10 ⁻⁸	Fine	Fine
29	SDN	61.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
31	Arq A	60.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	60.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	59.1 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35-	BBC B	60.3 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	58.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	42.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine

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

Location 3

Coordinates: Lon: -2.21903, Lat: 53.48342					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
24	LTVmux	48.4 +/- 0.1	1*10 ⁻⁸	Fine	Fine
27	Glmax	45.1 +/- 0.1	1*10 ⁻⁷	Fine	Fine
29	SDN	68.1 +/- 0.1	1*10 ⁻⁸	Fine	Fine
31	Arq A	61.6 +/- 0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	69.5 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	69.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35-	BBC B	69.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	70.0 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	59.8 +/- 0.1	1*10 ⁻⁸	Fine	Fine

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

Location 4

Coordinates: Lon: -2.21561, Lat: 53.48172					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
24	LTVmux	33.8 +/- 0.1	1*10 ⁻⁸	Fine	Fine
27	Glmax	31.8 +/- 0.1	3*10 ⁻⁶	Fine	Fine
29	SDN	53.5 +/- 0.1	1*10 ⁻⁸	Fine	Fine
31	Arq A	54.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	55.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	57.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35-	BBC B	56.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	57.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	42.1 +/- 0.1	1*10 ⁻⁸	Fine	Fine

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

Location 5

Coordinates: Lon: -2.20826, Lat: 53.47847					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
24	LTVmux	46.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
27	Glmax	43.6 +/- 0.1	1*10 ⁻⁸	Fine	Fine
29	SDN	62.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
31	Arq A	64.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	65.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	64.1 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35-	BBC B	62.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	62.3 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	49.1 +/- 0.1	1*10 ⁻⁸	Fine	Fine

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

Location 6

Coordinates: Lon: -2.20182, Lat: 53.47501					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
24	LTVmux	50.1 +/- 0.2	1*10 ⁻⁸	Fine	Fine
27	Glmax	44.3 +/- 0.1	1*10 ⁻⁸	Fine	Fine
29	SDN	68.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
31	Arq A	69.3 +/- 0.1	1*10 ⁻⁸	Fine	Fine
32	BBC A	69.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	69.0 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35-	BBC B	68.0 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	69.7 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	59.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine

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

Location 7

Coordinates: Lon: -2.16673, Lat: 53.45809					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
24	LTVmux	42.3 +/- 0.1	1*10 ⁻⁷	Fine	Fine
27	Glmax	40.6 +/- 0.1	1*10 ⁻⁷	Fine	Fine
29	SDN	61.2 +/- 0.1	1*10 ⁻⁷	Fine	Fine
31	Arq A	62.5 +/- 0.1	1*10 ⁻⁷	Fine	Fine
32	BBC A	62.5 +/- 0.1	1*10 ⁻⁸	Fine	Fine
34	D3+4	63.3 +/- 0.1	1*10 ⁻⁸	Fine	Fine
35-	BBC B	62.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine
37	Arq B	62.2 +/- 0.1	1*10 ⁻⁸	Fine	Fine
55	COM7	47.9 +/- 0.1	1*10 ⁻⁸	Fine	Fine

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

APPENDIX B – SURVEY PHOTOGRAPHS

Location 1



Location 2



Location 3



Location 4



Location 5



Location 6



Location 7





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