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Terrestrial Television Baseline Survey Report

Plot 9B, First Street

Vita Meadow Ltd

October 2024

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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	October 2024	Initial issue
2	December 2024	Consideration of development height changes

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EXECUTIVE SUMMARY

Report Purpose

A television baseline reception survey has been completed for a proposed building development, located on the corner of Medlock Street, Hulme Street and Newcastle Street in Manchester city centre. The proposed development comprises one building with a maximum height of 131.950m above ground.

The proposed redevelopment will introduce a tall structure into the area which could interact with wireless terrestrial television signals and cause interference in the surrounding area.

Results

- Residences in the area surrounding the proposed development receive television services predominantly from the Winter Hill main transmitter.
- A site survey was undertaken on 14th October 2024 to confirm the relevant transmitter and record the signal quality.
- The strength and quality of the signal in the shadow zone was generally moderate close to the proposed development, to good further from the proposed development. This might be due to the presence of Plot 11 First Street, which is located immediately to southeast of the proposed development and will share the same shadow zone.
- Any interference would be due to shadowing effects, i.e. the weakening of the transmitted signal due to the physical presence of the proposed development.
- Negative effects upon signal strength are typically limited to within 1km of the development and within its shadow zone based on Pager Power's assessment experience.
- A reduction in signal strength at low-rise residential properties within approximately 200-400m of the proposed development may result in interference due to the current signal strength in the area.
- Other low-rise residential properties at greater distances are unlikely to experience interference due to the baseline signal strength.

Recommendation

It is recommended that reports of interference in the shadow zone are investigated following construction of the proposed development, to determine whether they are attributable to the proposed development. If this is found to be the case through comparison to the readings taken as part of this assessment, mitigation can be applied.

Mitigation

In the event a mitigation requirement transpires, the most common forms of mitigation are a replacement of receiving aerial with a more directional or higher gain aerial or the replacement of terrestrial reception equipment with satellite reception equipment or cable.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 59 countries internationally.

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

A television baseline reception survey has been completed for a proposed building development, located on the corner of Medlock Street, Hulme Street and Newcastle Street in Manchester city centre. The proposed development comprises one building with a maximum height of 131.950m above ground.

The proposed redevelopment will introduce a tall structure into the area which could interact with wireless terrestrial television signals and cause interference in the surrounding area. This report produces the results of the baseline survey along with the predicted impact.

1.2 Proposed Development Location

The proposed development location is indicated by the yellow pin in Figure 1 below.



Figure 1 *Proposed development location*

1.3 Proposed Development General Arrangement Plan

The development general arrangement plan is shown in Figure 2 below[1]. The proposed development is outlined in red.

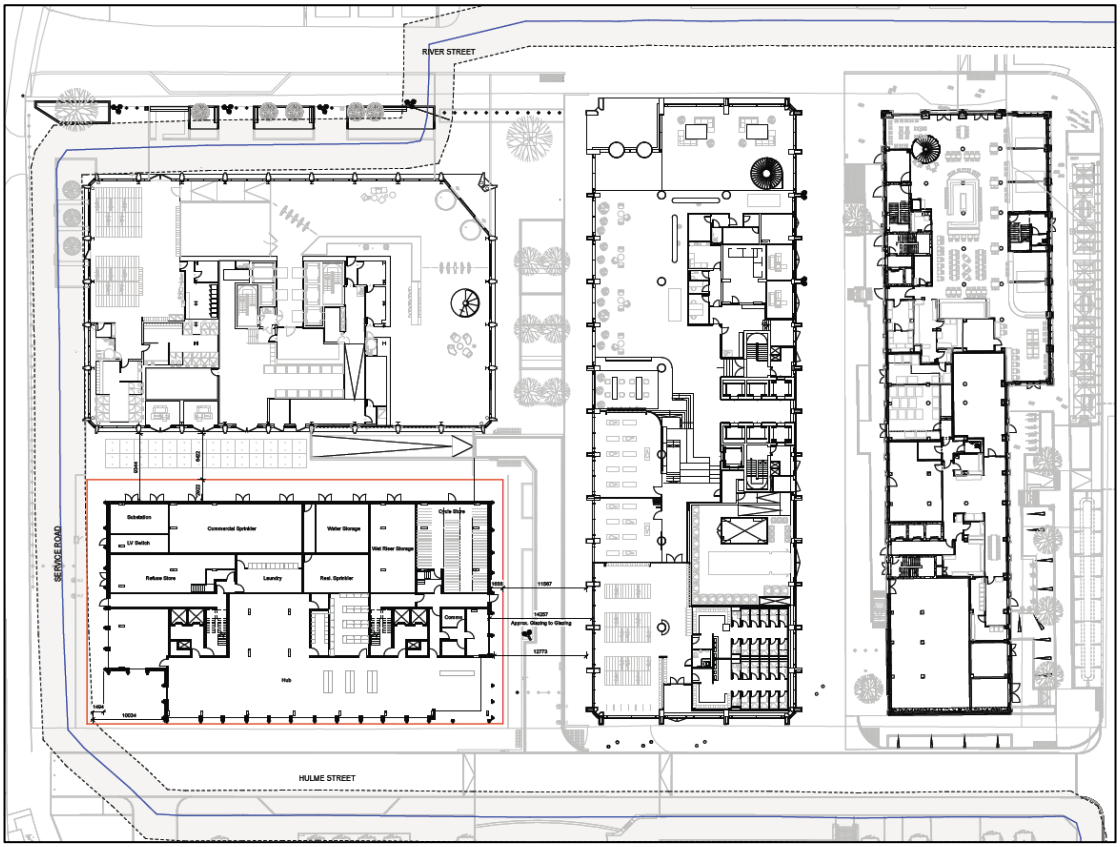


Figure 2 *Proposed development general arrangement plan*

[1] 1207-TGA-XX-00-DR-A-10200-P04 General Arrangement - Site Plan (cropped).

2 TELEVISION TRANSMITTER DETAILS

2.1 Relevant Transmitter

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

Digital television services are broadcast via Ultra High Frequency (UHF) signals; no analogue television signals are broadcast. The transmitter information is presented below[2].

2.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 24.6km northwest of the Proposed Development (published coordinates SD66051446). The transmitter broadcasts digital television, digital radio, and FM radio.

The details of the main television transmissions from 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 transmissions (main multiplexes)*

The details of the local television transmissions available in Manchester are presented in Table 2 below.

Service	L-MAN	G-MAN
Channel	24	27
Power	2 kW	1 kW

Table 2 *Winter Hill transmissions (local multiplexes)*

[2] Source: https://www.freeview.co.uk/help/coverage-checker/detailed-view?postcode=M156TT

3 BUILDINGS AND INTERFERENCE MECHANISMS

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 south-east 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[3] on the following page, taken from Section 3.2 of an Ofcom paper[4] regarding the impact of buildings on broadcast signals.

[3] Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.
[4] Reference as above.

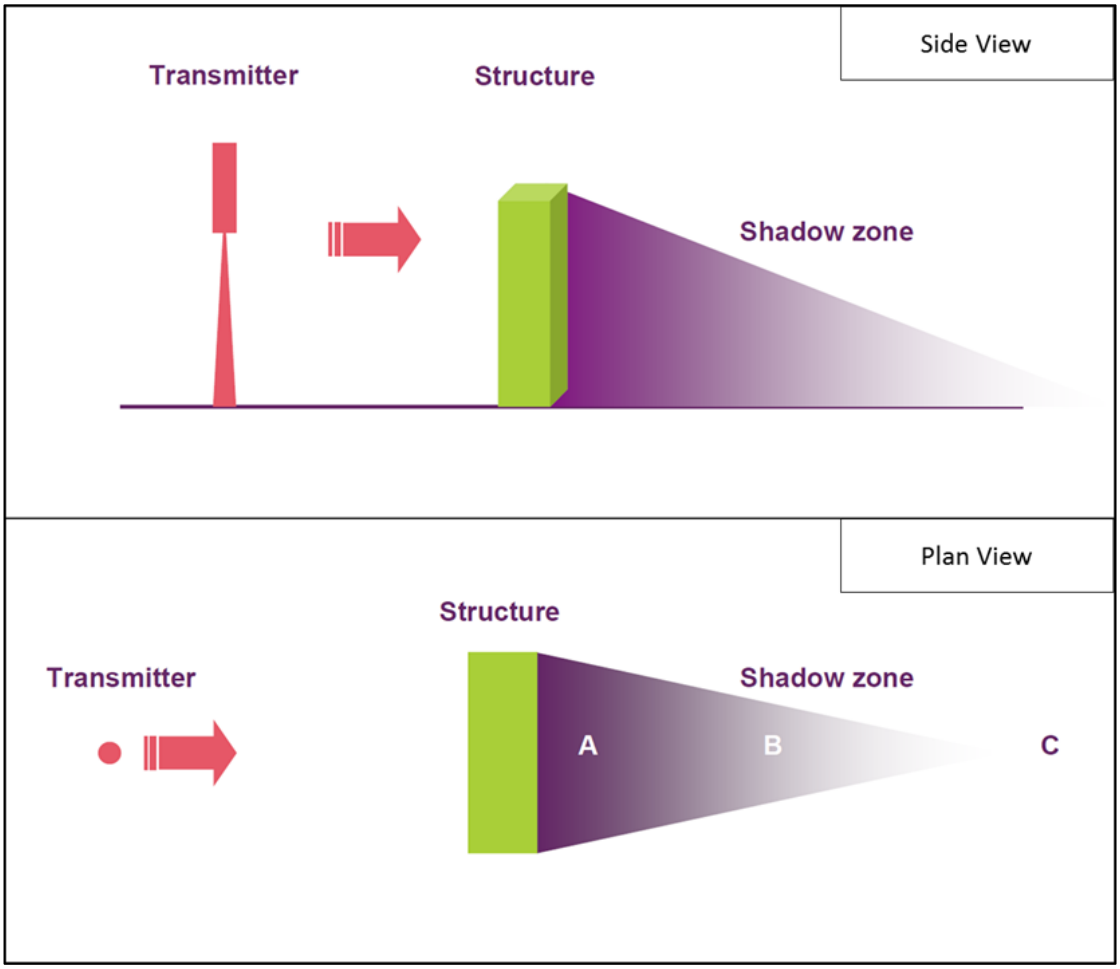


Figure 3 *Diffraction Loss Zones*

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 on the previous page) illustrates this effect.

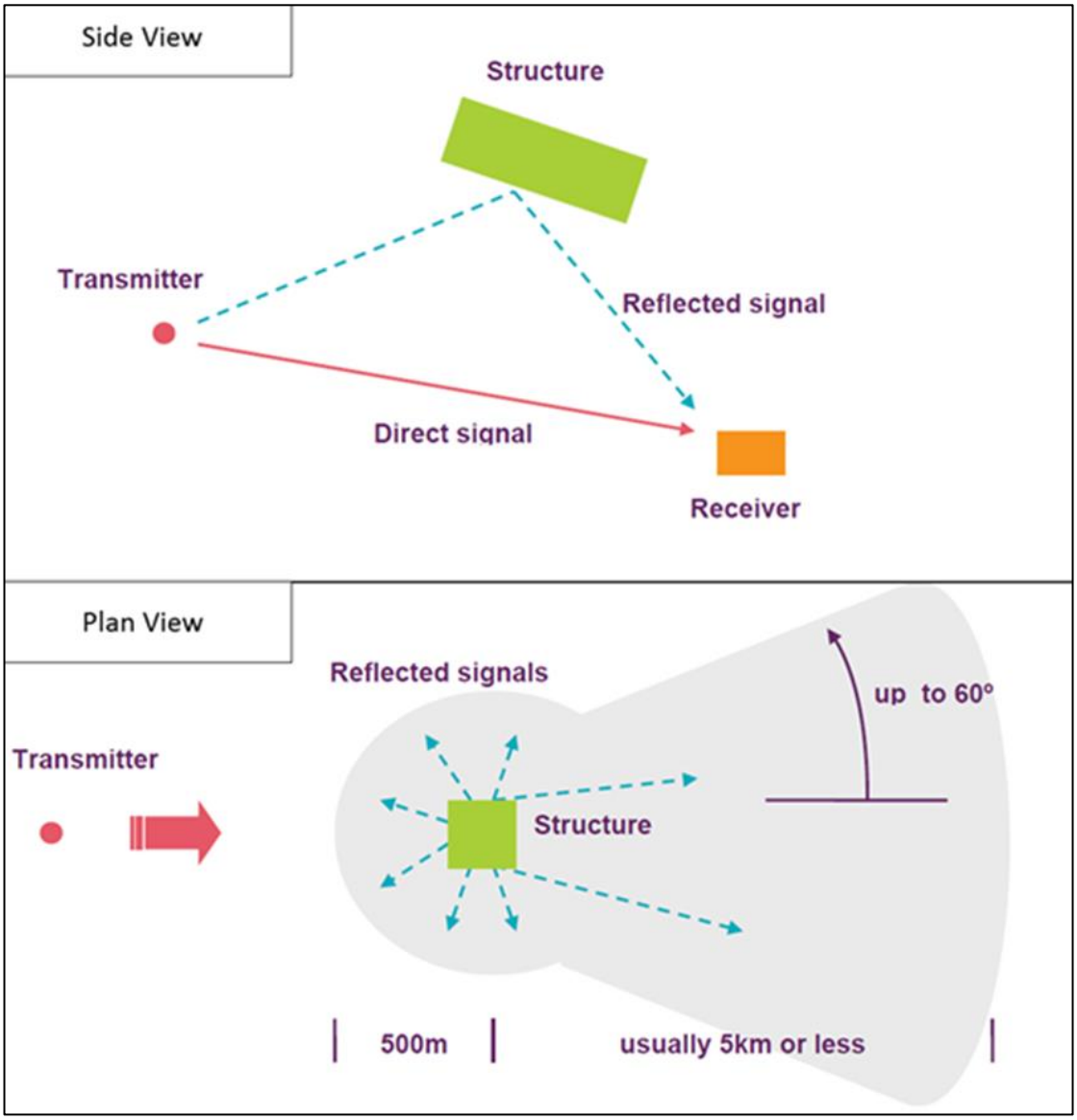


Figure 4 *Diffraction Loss Zones*

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 degrees[5].

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.

[5] 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.

No location can be affected by both diffraction (shadowing) and direct reflections.

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 TECHNICAL ASSESSMENT

4.1 Potential Interference Areas

Figure 5 below shows the potential interference areas associated with the proposed development with respect to the Winter Hill main Transmitter overlaid onto aerial imagery. These have been defined based on the geometry of the potential interference zones 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.

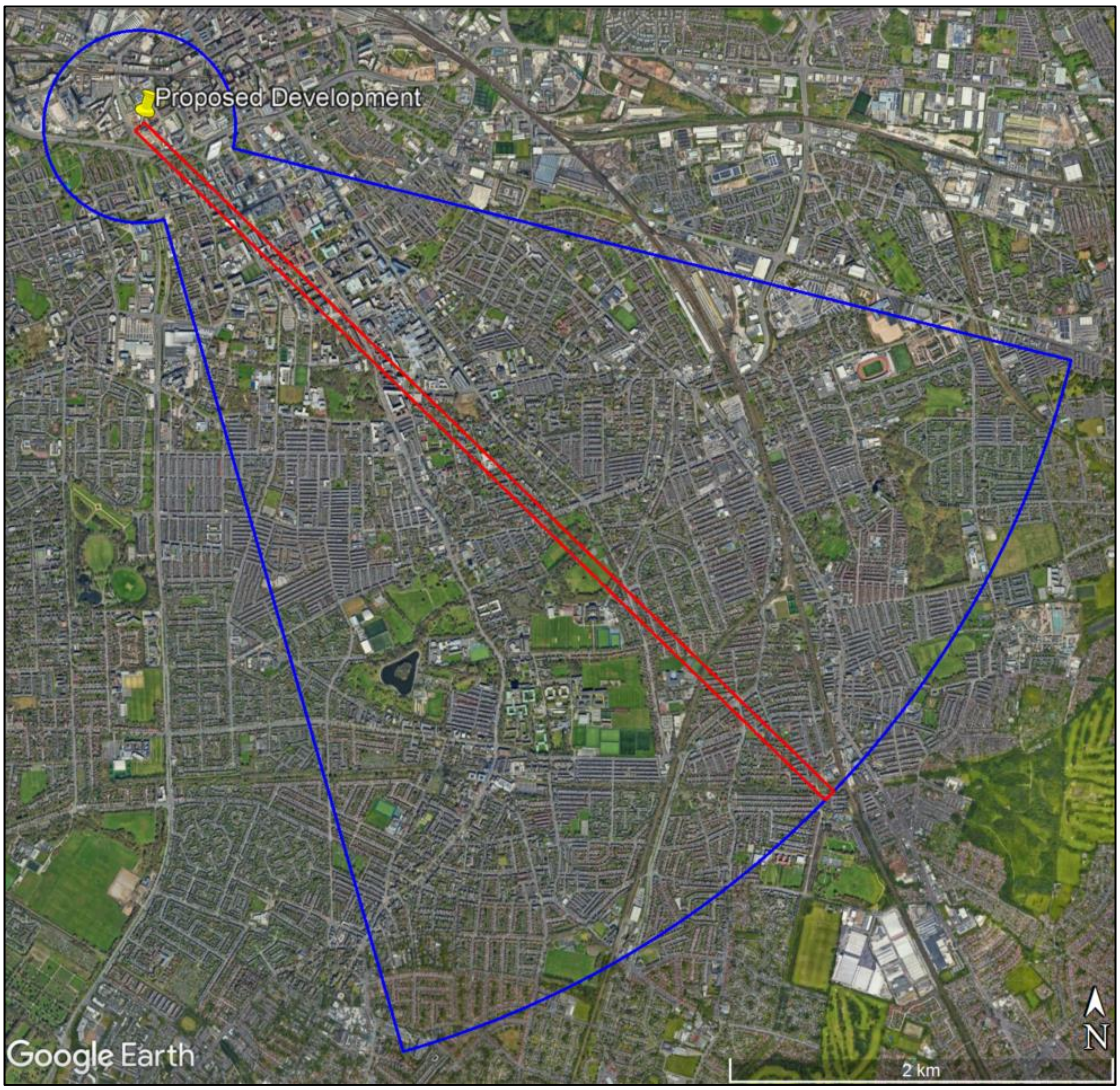


Figure 5 *Interference zones - aerial image*

The interference zones have been constructed in accordance with Ofcom guidance presented in Section 3, which gives fixed dimensions that do not vary with building size. The survey results and previous experience have informed the overall judgement of where effects are predicted.

4.2 Potential Diffraction Issues

The shadow zone (red outlined area in Figure 5) passes over high- and low-rise residential areas, the University of Manchester, and commercial buildings. Areas closest to the built development are at the highest risk of experiencing television interference.

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.

For interference to occur due to reflections, the following criteria would need to be met:

- The receiving aerial would not be already obstructed by a building or other existing obstacle.
- The reflected signal path via the built development would have to be relatively unobstructed.
- The angle between the reflected signal via the built development and the direct signal would have to be small.

In practice it is unlikely that all of the above criteria would be met. Impacts due to reflections are considered unlikely.

5 TELEVISION SURVEY RESULTS

5.1 Overview

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.
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 on the 14th October 2024.

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 a 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 6 below shows the planned survey locations overlaid onto aerial photography. The interference zones are also shown. Locations were selected considering residential areas within the building's shadow zone.



Figure 6 *Survey locations*

The locations are deliberately spaced close together nearest the proposed development, as this is the area where effects would generally be the most likely. Survey locations were chosen pre-survey (within the shadow zone); however safe and available access influenced the specific position on the day.

The cyan icon shows a planned survey location that was inaccessible on the day of the survey.

5.3 Survey Results

An overview of the survey results is presented in Table 4 on the following pages.

The following abbreviations are used where appropriate:

- Multiplex (MUX) – a group of television channels.
- Horizontally Polarised (HP) – suggests that the aerial is orientated towards and receiving services from a main transmitter.

The average signal strength is given separately for the main television multiplexes and the local television multiplexes. This is because the difference in power for these transmissions is significant, such that a single average figure would not be meaningful.

Detailed survey results are shown in Appendix A. Photos taken at the individual survey locations are shown in Appendix B.

Location	Measured Signal Strength (dB)	Remarks	High Level Conclusion
1	Main TV MUX: 44.0 (Moderate) Local TV MUX: 30.9 (Low)	No aerials or satellite dishes observed in the area, any aerials are likely to be on the nearby university accommodation building and will be much taller than 10m. It was noticed that a tall building had recently been constructed (Plot 11 First Street) that would share the same shadow zone as the proposed development. Two main multiplexes displayed fine picture and audio quality and two main multiplexes struggled to decode. Two main and two local multiplexes did not decode.	The survey location is within 116 metres of the proposed development, at the closest accessible location within the shadow zone. A reduction in signal strength is possible based on the distance to the proposed development; however, effects may not be noticeable in practice considering the lack of low-rise residential buildings and aerials in the area.
2	Main TV MUX: 44.9 (Moderate) Local TV MUX: 28.3 (Low)	Multiple HP aerials orientated towards Winter Hill and satellite dishes observed in the area. All main multiplexes displayed fine picture and audio quality with no signs of interference. Both local multiplexes did not decode.	The survey location is within 275 metres of the proposed development. A reduction in signal strength is possible based on the proximity to the proposed development. Considering the presence of low-rise residential dwellings in the area and the current signal strength, a reduction in signal may result in interference.

Location	Measured Signal Strength (dB)	Remarks	High Level Conclusion
3	Main TV MUX: 49.1 (Good) Local TV MUX: 32.7 (Low)	Multiple HP aerials orientated towards Winter Hill and satellite dishes observed in the area. All main multiplexes displayed fine picture and audio quality with no signs of interference. One local multiplex decoded with fine picture and audio and one did not.	The survey location is within 369 metres of the proposed development. A reduction in signal strength is possible based on the proximity to the proposed development. Considering the presence of low-rise residential dwellings in the area and the current signal strength, a reduction in signal may results in interference.
4	Main TV MUX: 45.3 (Good) Local TV MUX: 32.8 (Low)	No aerials or satellite dishes observed despite being on the street of university accommodation. They may be located on the rooves or on the other sides of the buildings. Five main multiplexes displayed fine picture and audio quality with no signs of interference. One multiplex had glitchy picture and audio. One local multiplex decoded with fine picture and audio and one did not.	This location is approximately 577 metres from the proposed development. A reduction in signal strength is possible based on the distance to the proposed development. Based on the current main multiplex signal quality, interference may not materialise in practice.

Location	Measured Signal Strength (dB)	Remarks	High Level Conclusion
5	Main TV MUX: 41.5 (Moderate) Local TV MUX: 27.3 (Low)	No aerials or satellite dishes observed, which is to be expected based on the location on the university campus. All main multiplexes decoded, with two displaying fine picture and audio, and two being very glitchy. Both local multiplexes displayed fine picture and audio quality.	This location is approximately 845 metres from the proposed development. A reduction in signal strength is possible based on the distance to the proposed development; however, effects may not be noticeable in practice considering the lack of low-rise residential buildings and aerials in the area.
6	Main TV MUX: 43.0 (Moderate) Local TV MUX: 26.3 (Low)	A few HP aerials orientated towards Winter Hill and satellite dishes observed in the near distance. Four main multiplexes displayed fine picture and audio quality, two multiplexes displayed fine picture and audio after some time, and one did not decode. Both local multiplexes did not decode.	This location is approximately 2.18km from the proposed development. Effects at this range are likely to be relatively small based on previous experience; however, interference cannot be entirely ruled out based on the current signal strength.

Location	Measured Signal Strength (dB)	Remarks	High Level Conclusion
7	Main TV MUX: 53.7 (Good) Local TV MUX: 35.2 (Moderate)	Multiple HP aerials orientated towards Winter Hill and satellite dishes observed in the area. All main multiplexes displayed fine picture and audio quality with no signs of interference. One local multiplex decoded with fine picture and audio and one did not.	This location is approximately 2.91km from the proposed development. Effects at this range are likely to be relatively small based on previous experience. Based on the current signal quality, interference is unlikely to materialise.
8	Main TV MUX: 62.4 (Very Good) Local TV MUX: 40.6 (Moderate)	Multiple HP aerials orientated towards Winter Hill and satellite dishes observed in the area. All main and local multiplexes displayed fine picture and audio quality with no signs of interference.	This location is approximately 3.80km from the proposed development. Effects at this range are likely to be relatively small based on previous experience. Based on the current signal quality, interference is unlikely to materialise.
9	Main TV MUX: 68.7 (Very Good) Local TV MUX: 47.1 (Good)	Multiple HP aerials orientated towards Winter Hill and satellite dishes observed in the area. All main and local multiplexes displayed fine picture and audio quality with no signs of interference.	This location is approximately 4.83km from the proposed development. Effects at this range are likely to be relatively small based on previous experience. Based on the current signal quality, interference is unlikely to materialise.

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 will be required.

There is no reason to install pre-emptive mitigation as interference may not materialise in practice.

6.2 Mitigation Options

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.
- Replacing terrestrial reception equipment with satellite reception equipment, cable or provision via the internet.

6.3 Recommended Process

It is recommended that reports of interference in the shadow zone are investigated following construction of the proposed development, to determine whether they are attributable to the proposed development. If this is found to be the case through comparison to the readings taken as part of this assessment, mitigation can be applied.

6.4 Recommended Options

If interference were to be attributable to the proposed development for a small number of homes, it is likely that installation of satellite television would be the most suitable option.

If interference were to be attributable to the proposed development for dwellings with poor quality or low receiving aerials, the best option may be to upgrade and/or elevate the existing aerial.

7 CONCLUSIONS

7.1 Results

- Residences in the area surrounding the proposed development receive television services predominantly from the Winter Hill main transmitter.
- A site survey was undertaken on 14th October 2024 to confirm the relevant transmitter and record the signal quality.
- The strength and quality of the signal in the shadow zone was generally moderate within a few hundred metres of the proposed development, to good further from the proposed development. This might be due to the presence of Plot 11 First Street, which is located immediately to southeast of the proposed development and will share the same shadow zone.
- Any interference would be due to shadowing effects, i.e. the weakening of the transmitted signal due to the physical presence of the proposed development.
- Negative effects upon signal strength are typically limited to within 1km of the development and within its shadow zone based on Pager Power's assessment experience.
- A reduction in signal strength at low-rise residential properties within approximately 200-400m of the proposed development may result in interference due to the current signal strength in the area.
- Other low-rise residential properties at greater distances are unlikely to experience interference due to the baseline signal strength.

7.2 Recommendation

It is recommended that reports of interference in the shadow zone are investigated following construction of the proposed development, to determine whether they are attributable to the proposed development. If this is found to be the case through comparison to the readings taken as part of this assessment, mitigation can be applied.

7.3 Mitigation

In the event a mitigation requirement transpires, the most common forms of mitigation are a replacement of receiving aerial with a more directional or higher gain aerial or the replacement of terrestrial reception equipment with satellite reception equipment or cable.

APPENDIX A – BASELINE SURVEY RESULTS

Location 1

GPS Coordinates: -2.244805, 53.470768				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	31.3 ± 0.2	DND	-
27	G-MAN	30.4 ± 0.2	DND	-
29	SDN	45.5 ± 0.4	$2x10^{-2}$ Struggled to decode	Glitchy
31	Arqiva A	44.9 ± 0.2	Decoded briefly then dropped out	-
32	BBC A	44.9 ± 0.3	$4x10^{-3}$	Fine
34	D3&4	44.2 ± 0.2	$5x10^{-3}$	Fine
35-	BBC B	42.3 ± 0.2	DND	-
37	Arqiva B	42.3 ± 0.2	DND	-

Notes: Next to a tall university accommodation building, aerials likely to be on the roof and far taller than the 10m aerial height used for the survey

Location 2

GPS Coordinates: -2.243039, 53.469798				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	29.1 ± 0.2	DND	-
27	G-MAN	27.4 ± 0.3	DND	-
29	SDN	44.4 ± 0.2	$1x10^{-3}$	Fine
31	Arqiva A	44.6 ± 0.2	$6x10^{-5}$	Fine
32	BBC A	45.8 ± 0.2	$3x10^{-6}$	Fine
34	D3&4	45.4 ± 0.3	$3x10^{-6}$	Fine
35-	BBC B	45.9 ± 0.2	$1x10^{-8}$	Fine
37	Arqiva B	43.1 ± 0.4	$8x10^{-4}$	Fine

Notes: Multiple HP aerials orientated towards Winter Hill and satellite dishes observed

Location 3

GPS Coordinates: -2.242261, 53.469059				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	32.4 ± 0.2	$1x10^{-3}$	Fine
27	G-MAN	33.0 ± 0.1	DND	-
29	SDN	49.0 ± 0.2	$7x10^{-6}$	Fine
31	Arqiva A	50.3 ± 0.2	$1x10^{-6}$	Fine
32	BBC A	48.4 ± 0.2	$6x10^{-7}$	Fine
34	D3&4	50.2 ± 0.2	$1x10^{-8}$	Fine
35-	BBC B	48.6 ± 0.2	$1x10^{-8}$	Fine
37	Arqiva B	48.3 ± 0.2	$1x10^{-8}$	Fine

Notes: Multiple HP aerials orientated towards Winter Hill and satellite dishes observed

Location 4

GPS Coordinates: -2.239985, 53.467790				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	33.5 ± 0.3	$2x10^{-8}$	Fine
27	G-MAN	32.1 ± 0.1	DND	-
29	SDN	47.0 ± 0.4	$9x10^{-7}$	Fine
31	Arqiva A	41.3 ± 0.2	$9x10^{-3}$	Glitchy
32	BBC A	44.0 ± 0.4	$2x10^{-8}$	Fine
34	D3&4	46.9 ± 0.4	$2x10^{-8}$	Fine
35-	BBC B	44.5 ± 0.2	$1x10^{-8}$	Fine
37	Arqiva B	48.3 ± 0.2	$1x10^{-7}$	Fine

Notes: On the street of university accommodation; however, no aerials or satellite dishes observed, which could instead be located on the rooves.

Location 5

GPS Coordinates: -2.236837, 53.466255				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	27.9 ± 0.1	DND	-
27	G-MAN	26.7 ± 0.1	DND	-
29	SDN	42.2 ± 0.3	DND	-
31	Arqiva A	41.3 ± 0.2	DND	-
32	BBC A	42.5 ± 0.3	$9x10^{-3}$ Decoded intermittently	Very glitchy
34	D3&4	43.0 ± 0.2	$2x10^{-3}$ Struggled to decode	Very glitchy
35-	BBC B	38.5 ± 0.3	DND	-
37	Arqiva B	41.3 ± 0.2	DND	-

Notes: On the university campus, unlikely to be near accommodation. No aerials or satellite dishes observed

Location 6

GPS Coordinates: -2.222552, 53.457830				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture** **Audio**
24	L-MAN	27.8 ± 0.2	DND	-
27	G-MAN	24.8 ± 0.1	DND	-
29	SDN	41.5 ± 0.5	$1x10^{-3}$ Struggled to decode for a while	Started glitchy and eventually became fine
31	Arqiva A	44.7 ± 0.2	$8x10^{-6}$	Fine
32	BBC A	38.3 ± 0.2	$1x10^{-3}$ Struggled to decode for a while	Fine once decoded
34	D3&4	46.8 ± 0.2	$1x10^{-8}$	Fine
35-	BBC B	39.7 ± 0.2	DND	-
37	Arqiva B	47.2 ± 0.2	$5x10^{-8}$	Fine

Notes: A few HP aerials orientated towards Winter Hill and satellite dishes observed in the near distance

Location 7

GPS Coordinates: -2.214693, 53.453188				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	38.7 ± 0.2	$1x10^{-8}$	Fine
27	G-MAN	31.6 ± 0.1	DND	-
29	SDN	52.8 ± 0.2	$1x10^{-8}$	Fine
31	Arqiva A	57.0 ± 0.3	$1x10^{-8}$	Fine
32	BBC A	52.0 ± 0.3	$1x10^{-8}$	Fine
34	D3&4	49.6 ± 0.4	$1x10^{-8}$	Fine
35-	BBC B	52.6 ± 0.3	$1x10^{-8}$	Fine
37	Arqiva B	58.2 ± 0.2	$1x10^{-8}$	Fine

Notes: Multiple HP aerials orientated towards Winter Hill and satellite dishes observed

Location 8

GPS Coordinates: -2.205200, 53.447553				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	43.5 ± 0.1	$1x10^{-8}$	Fine
27	G-MAN	37.7 ± 0.3	$1x10^{-4}$	Fine
29	SDN	61.9 ± 0.2	$1x10^{-8}$	Fine
31	Arqiva A	62.2 ± 0.2	$1x10^{-8}$	Fine
32	BBC A	61.4 ± 0.2	$1x10^{-8}$	Fine
34	D3&4	63.8 ± 0.1	$1x10^{-8}$	Fine
35-	BBC B	63.4 ± 0.1	$1x10^{-8}$	Fine
37	Arqiva B	61.4 ± 0.1	$1x10^{-8}$	Fine

Notes: Multiple HP aerials orientated towards Winter Hill and satellite dishes observed

Location 9

GPS Coordinates: -2.193858, 53.441234				
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture and Audio**
24	L-MAN	51.6 ± 0.2	$1x10^{-8}$	Fine
27	G-MAN	42.6 ± 0.2	$1x10^{-8}$	Fine
29	SDN	68.7 ± 0.2	$1x10^{-8}$	Fine
31	Arqiva A	69.2 ± 0.2	$1x10^{-8}$	Fine
32	BBC A	69.0 ± 0.3	$1x10^{-8}$	Fine
34	D3&4	69.5 ± 0.2	$1x10^{-8}$	Fine
35-	BBC B	68.4 ± 0.2	$1x10^{-8}$	Fine
37	Arqiva B	67.1 ± 0.2	$1x10^{-8}$	Fine

Notes: Multiple HP aerials orientated towards Winter Hill and satellite dishes observed

APPENDIX B – SURVEY PHOTOGRAPHS

Location 1



Location 1

Location 2



Location 2

Location 3



Location 3

Location 4



Location 4

Location 5



Location 5

Location 6



Location 6

Location 7



Location 7

Location 8



Location 8

Location 9



Location 9

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