

Television Baseline Survey Report

Mobility Hub, Ancoats, Manchester

May 2021

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ADMINISTRATION PAGE

Job Reference:	10444A
Date:	March 2021
Author:	Waqar Qureshi
Telephone:	01787 319001
Email:	waqar@pagerpower.com

First Reviewer:	Andrea Mariano
Second Reviewer:	Kai Frolic
Date:	March 2021
Telephone:	01787 319001
Email:	andrea@pagerpower.com; kai@pagerpower.com

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Stour Valley Business Centre, Brundon Lane, Sudbury, CO10 7GB

T:+44 (0)1787 319001 **E:**info@pagerpower.com **W:**www.pagerpower.com

EXECUTIVE SUMMARY

Overview

This report pertains to the proposed Ancoats Mobility Hub development located in Back of Ancoats, Manchester. The proposed development will cause tall structures to be introduced into the area – which could interact with wireless terrestrial television signals and cause interference.

Report Purpose

This report presents the results of the television baseline reception survey undertaken to investigate the potential impact of the proposed development upon television signals in the surrounding area.

Results

- 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.
- A site survey was undertaken on 5th March 2021 to confirm the relevant transmitter and record the signal quality.
- Terrestrial coverage is generally good in the surrounding area.
- It is possible that there will be no impact on television signals due to the proposed development because small/moderate losses may not result in noticeable interference in the context of the surrounding area. Any impacts would most likely be in the shadow zone within one kilometre of the proposed development.

Recommendation

Any reported television interference should be investigated by means of a reception measurement.

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.

Mitigation measures should only be installed if reported effects are found to be attributable to the proposed development. There is no reason to install pre-emptive mitigation due to the distinct possibility that no noticeable effects will occur.

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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

A television baseline reception survey has been completed for the proposed Ancoats Mobility Hub development located in Back of Ancoats, Manchester, which will provide parking and logistics services for the neighbourhood.

The proposed development will introduce tall structures into the area – these 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 a prediction of the expected impact.

1.2 Proposed Development

The existing site plan is shown in Figure 1¹ below.

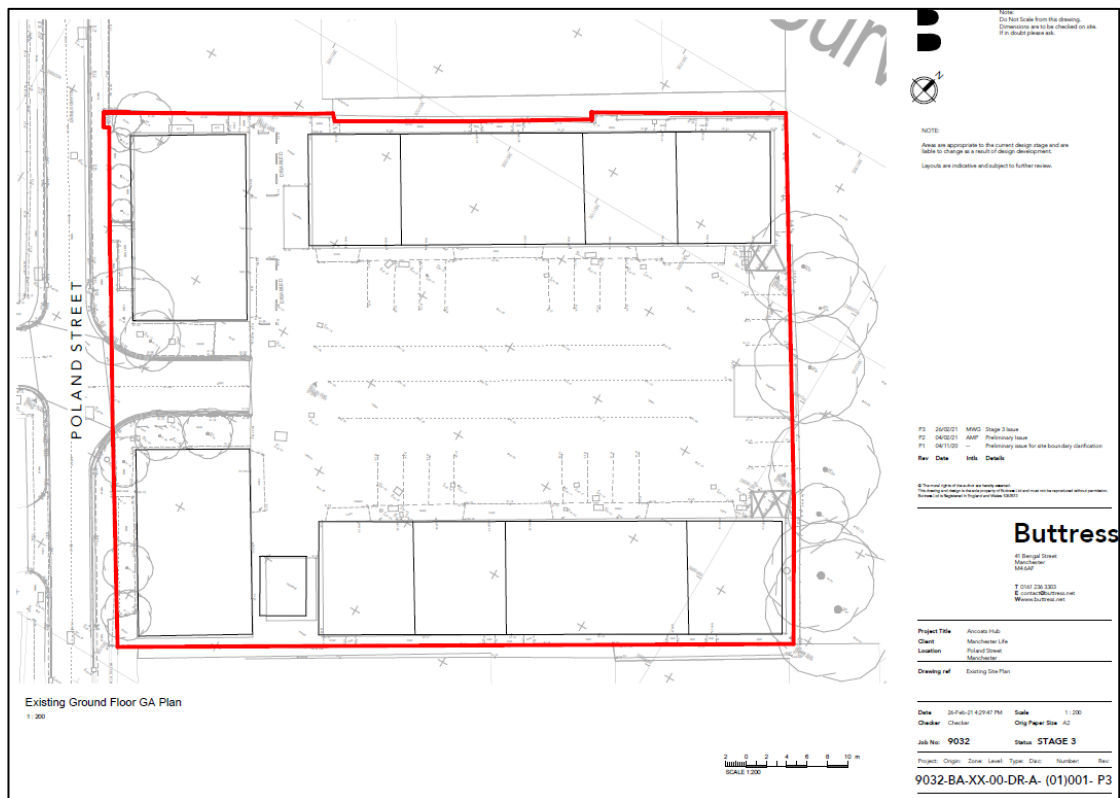


Figure 1 Proposed development red line boundary

¹ Source: 9032-BA-XX-00-DR-A-(01)001-Existing Site Plan.pdf (cropped)

2 TELEVISION TRANSMITTER DETAILS

2.1 Relevant Transmitter

A comprehensive search of transmitter and coverage maps revealed that the Winter Hill transmitter serves the area around the proposed development.

Digital television services are broadcast via Ultra High Frequency (UHF) signals; no analogue television signals are broadcast. The transmitter information is presented below².

2.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 25 km northwest of the proposed development (published coordinates SD66051446). The digital services provided are shown in Table 1 below.

Multiplex	Services shown at time of survey
21	Tiny Pop
24	Tiny Pop / That's TV
27	Clubland / Sony + 1 / TV Warehouse
29	CCXTV / 5 Star / 5 USA / Create and Craft
31	4Music / Sky News / Pick / Sky Arts / Challenge
32	BBC 2 / BBC 1 NW
34	ITV 3 / ITV 4 / ITV
35	BBC 1 HD / BBC 2 HD / ITV HD
37	Ideal World / Yesterday
55	BBC News HD / CBeebies HD / QVC HD

² Frequencies have been adjusted relatively recently due to spectrum clearing, the available channels were determined using a spectrum analyser and the service shown on the screen was noted.

Table 1 *Winter Hill transmissions*

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 2³ on the following page, taken from Section 3.2 of an Ofcom paper⁴ regarding the impact of buildings on broadcast signals.

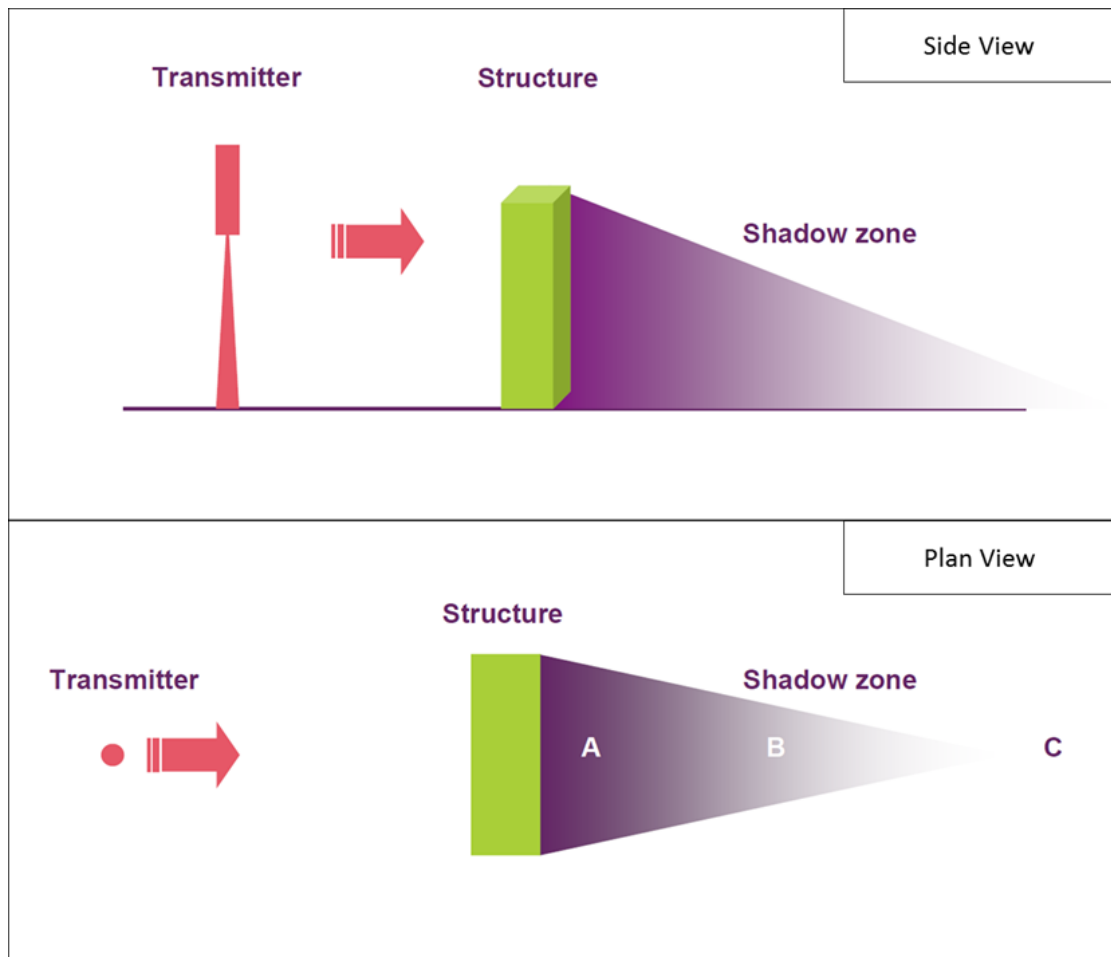


Figure 2 Diffraction Loss Zones

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

³ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

⁴ Reference as above.

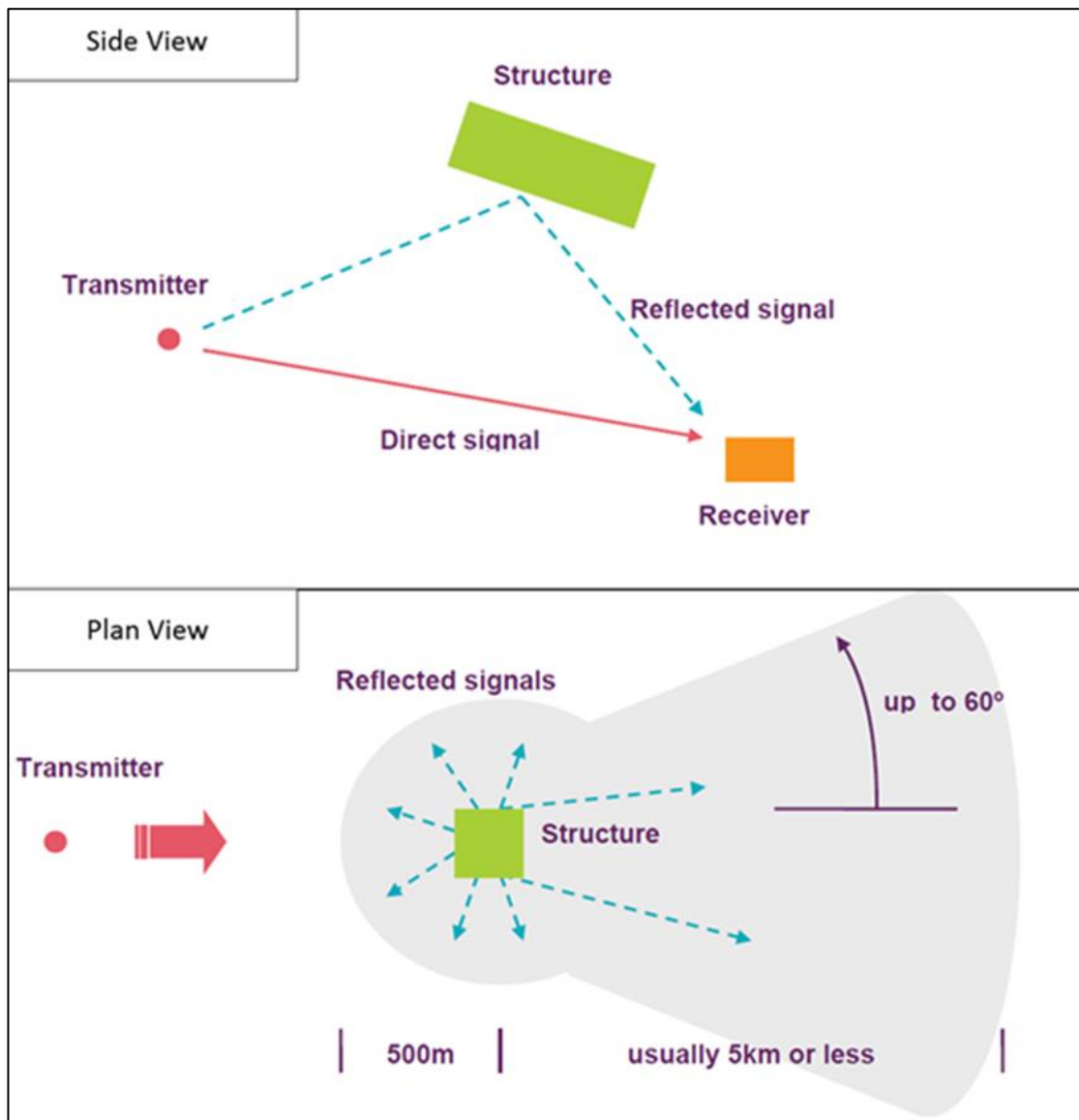


Figure 3 *Diffraction Loss Zones*

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 degrees⁵.

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.

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.

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 4 below shows the potential interference areas associated with the proposed development.

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 2 in the previous section.

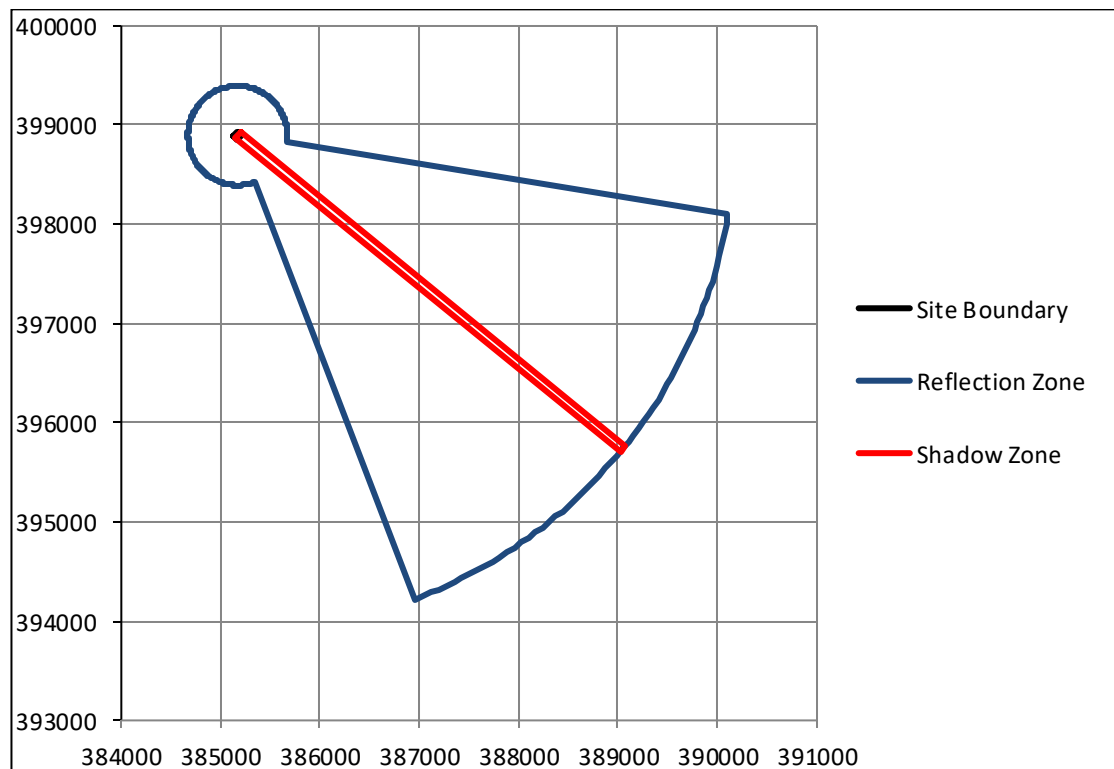


Figure 4 Interference areas

Figure 5⁶ below shows the interference areas overlaid onto aerial imagery.



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

It can be seen that the shadow zone passes over areas that are mostly urban containing high and low-rise residential developments. Areas closest to the proposed development are at the highest risk of experiencing television interference.

⁶ Copyright © 2021 Google.

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.

Receivers that have a low signal strength are likely to be affected by existing obstructions. For interference to occur due to reflections, the following criteria would need to be met:

- The receiving aerial would be already obstructed by a building or other existing obstacle;
- The reflected signal path via the Proposed Development would have to be relatively unobstructed;
- The angle between the reflected signal via the Proposed 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 BASELINE SURVEY

5.1 Overview

The purpose of a baseline survey is to establish current television 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; and
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 5th March 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 a television analyser to record the signal strength and stability.

The strength of the recorded signals is categorised in accordance with Table 2 below.

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

Table 2 *Television signal strength categories*

5.2 Survey Locations

Figure 6⁶ below shows the survey locations overlaid onto aerial photography. The interference zones 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.

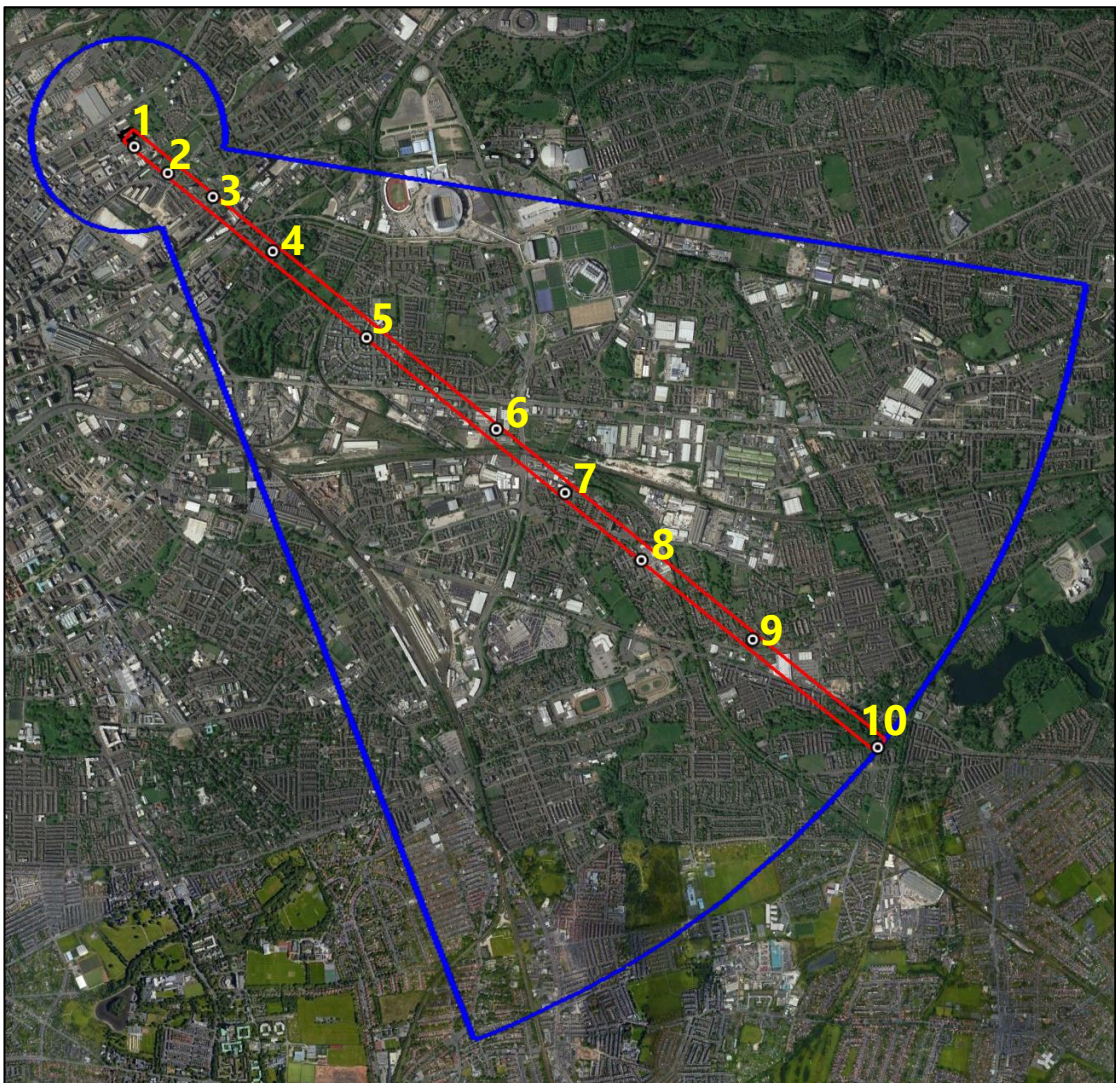


Figure 6 *Survey locations*

5.3 Survey Results

An overview of the survey results is presented in Table 3 below, whilst the full survey results are shown in Appendix A. Survey photographs are shown in Appendix B.

Location	Measured Signal Strength (dB)	Remarks	High-Level Conclusion
1	31 – 63 The majority of multiplexes overall were of very good strength.	Aerials directed towards Winter Hill were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is immediately adjacent to the proposed development location. A moderate impact upon signals at this location is possible based on the proximity to the proposed development (within 500m). The most significant effects are possible for the weaker local channels, but the majority of channels should retain good quality transmission. This could depend on the relative height of the building development and any receiving aerials.

Location	Measured Signal Strength (dB)	Remarks	High-Level Conclusion
2	32 – 67 The majority of multiplexes overall were of good or very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is within 300m of the proposed development. A moderate impact upon signals at this location is possible based on the proximity to the proposed development (within 500m). The most significant effects are possible for the weaker local channels, but the majority of channels should retain good quality transmission. This could depend on the relative height of the building development and any receiving aerials.
3	42 – 72 The majority of multiplexes overall were of very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is within 600 metres of the proposed development. A low impact upon signals at this location is possible based on the proximity to the proposed development (within 1 km). The most significant effects are possible for the weaker local channels, but the majority of channels should retain good quality transmission. This could depend on the relative height of the building development and any receiving aerials.

Location	Measured Signal Strength (dB)	Remarks	High-Level Conclusion
4	27 – 50 The majority of multiplexes overall were of good or very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. The weakest local channel was not received at this location. All remaining multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is within 1 kilometre of the proposed development. A low impact upon signals at this location is possible based on the proximity to the proposed development (within 1 km). The most significant effects are possible for the weaker local channels, but the majority of channels should retain good quality transmission. This could depend on the relative height of the building development and any receiving aerials.
5	32 – 63 The majority of multiplexes overall were of very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is approximately 1.7 km from the proposed development. A minimal impact upon signals at this location is expected based on the distance to the proposed development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is therefore unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes that are currently receivable.

Location	Measured Signal Strength (dB)	Remarks	High-Level Conclusion
6	31 – 61 The majority of multiplexes overall were of very good strength.	No aerials or satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is approximately 2.5 km from the proposed development. A minimal impact upon signals at this location is expected based on the distance to the proposed development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is therefore unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes that are currently receivable.
7	38 – 71 The majority of multiplexes overall were of very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is approximately 3 km from the proposed development. A minimal impact upon signals at this location is expected based on the distance to the proposed development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is therefore unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes that are currently receivable.

Location	Measured Signal Strength (dB)	Remarks	High-Level Conclusion
8	40 – 73 The majority of multiplexes overall were of very good strength.	Satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is approximately 3.5 km from the proposed development. A minimal impact upon signals at this location is expected based on the distance to the proposed development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is therefore unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes that are currently receivable.
9	34 – 67 The majority of multiplexes overall were of very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is approximately 4.2 km from the proposed development. A minimal impact upon signals at this location is expected based on the distance to the proposed development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is therefore unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes that are currently receivable.

Location	Measured Signal Strength (dB)	Remarks	High-Level Conclusion
10	32 – 65 The majority of multiplexes overall were of very good strength.	Aerials directed towards Winter Hill and satellite dishes were observed. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.	The survey location is approximately 5 km from the proposed development. A minimal impact upon signals at this location is expected based on the distance to the proposed development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is therefore unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes that are currently receivable.

Table 3 *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.

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 Options

If interference were to occur for a small number of homes, it is likely that installation of satellite television 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.

6.4 Recommended Process

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

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

- Residences in the area surrounding the proposed development receive television services from the Winter Hill transmitter. The strength and quality of the signal is variable, in part due to existing developments in the city centre, but generally good or very good.
- The proposed development will introduce tall structures that will have a shadowing effect to the southeast.
- Receiving aerials in the proposed development's shadow, within approximately one kilometre, may experience degradation of terrestrial television reception quality.
- Receptors at greater distances are unlikely to experience noticeable impacts in practice.
- In the event that effects are reported, it is recommended that a reception measurement is undertaken (post-construction) to investigate the likely cause of the interference.
- If mitigation is required, provision of alternative receiving equipment such as a satellite dish or cable television is likely to be the most appropriate solution.
- No requirement for pre-emptive mitigation has been identified.

APPENDIX A – DETAILED SURVEY RESULTS

Location 1

GPS Coordinates: -2.22444 53.48607				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	31.5 ± 0.2	1e-6	Fine	Fine
24	43.0 ± 0.2	1e-7	Fine	Fine
27	41.6 ± 0.1	1e-7	Fine	Fine
29	60.9 ± 0.2	1e-8	Fine	Fine
31	62.6 ± 0.2	1e-8	Fine	Fine
32	62.1 ± 0.1	1e-8	Fine	Fine
34	60.5 ± 0.2	1e-8	Fine	Fine
35	59.4 ± 0.1	1e-8	Fine	Fine
37	60.6 ± 0.1	1e-8	Fine	Fine
55	49.2 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter were observed.

Location 2

GPS Coordinates: -2.22183 53.48485				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	32.1 ± 0.1	5e-7	Fine	Fine
24	45.6 ± 0.1	1e-7	Fine	Fine
27	35.1 ± 0.1	1e-4	Fine	Fine
29	53.5 ± 0.1	2.4e-8	Fine	Fine
31	66.6 ± 0.1	1e-8	Fine	Fine
32	65.0 ± 0.1	1e-8	Fine	Fine
34	58.9 ± 0.1	1e-8	Fine	Fine
35	54.1 ± 0.1	1e-8	Fine	Fine
37	66.9 ± 0.1	1e-8	Fine	Fine
55	56.0 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 3

GPS Coordinates: -2.21831 53.48374				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	42.2 ± 0.1	1e-8	Fine	Fine
24	54.4 ± 0.1	1e-7	Fine	Fine
27	52.3 ± 0.1	1e-8	Fine	Fine
29	68.9 ± 0.1	1e-8	Fine	Fine
31	71.1 ± 0.1	1e-8	Fine	Fine
32	70.7 ± 0.1	1e-8	Fine	Fine
34	68.9 ± 0.1	1e-8	Fine	Fine
35	69.7 ± 0.1	1e-8	Fine	Fine
37	70.8 ± 0.1	1e-8	Fine	Fine
55	58.1 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 4

GPS Coordinates: -2.21366 53.48123				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	27.5 ± 0.5	DND	DND	DND
24	29.0 ± 0.1	7E-4	Fine	Fine
27	31.7 ± 0.1	5E-6	Fine	Fine
29	47.5 ± 0.1	1e-8	Fine	Fine
31	49.3 ± 0.1	1e-8	Fine	Fine
32	48.5 ± 0.1	1e-8	Fine	Fine
34	49.3 ± 0.1	1e-7	Fine	Fine
35	49.9 ± 0.1	1e-8	Fine	Fine
37	48.3 ± 0.1	1e-8	Fine	Fine
55	44.7 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 5

GPS Coordinates: -2.20633 53.47722				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	32.9 ± 0.1	1e-7	Fine	Fine
24	43.4 ± 0.1	1e-7	Fine	Fine
27	39.5 ± 0.1	1e-8	Fine	Fine
29	59.3 ± 0.1	1e-8	Fine	Fine
31	62.0 ± 0.1	1e-8	Fine	Fine
32	61.7 ± 0.1	1e-8	Fine	Fine
34	60.6 ± 0.1	1e-8	Fine	Fine
35	61.1 ± 0.1	1e-8	Fine	Fine
37	62.5 ± 0.1	1e-8	Fine	Fine
55	49.5 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 6

GPS Coordinates: -2.19621 53.47297				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	31.7 ± 0.1	5e-6	Fine	Fine
24	43.5 ± 0.2	1e-7	Fine	Fine
27	40.6 ± 0.1	1e-8	Fine	Fine
29	60.2 ± 0.1	1e-8	Fine	Fine
31	61.0 ± 0.1	1e-8	Fine	Fine
32	60.3 ± 0.1	1e-8	Fine	Fine
34	57.6 ± 0.1	1e-8	Fine	Fine
35	57.9 ± 0.1	1e-8	Fine	Fine
37	59.9 ± 0.2	1e-8	Fine	Fine
55	50.8 ± 0.2	1e-8	Fine	Fine

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

Location 7

GPS Coordinates: -2.19086 53.47002				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	38.5 ± 0.1	1e-8	Fine	Fine
24	51.9 ± 0.1	1e-7	Fine	Fine
27	47.6 ± 0.1	1e-8	Fine	Fine
29	69.4 ± 0.1	1e-8	Fine	Fine
31	71.0 ± 0.1	1e-8	Fine	Fine
32	70.5 ± 0.1	1e-8	Fine	Fine
34	69.3 ± 0.1	1e-8	Fine	Fine
35	69.7 ± 0.1	1e-8	Fine	Fine
37	70.9 ± 0.1	1e-8	Fine	Fine
55	57.3 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 8

GPS Coordinates: -2.18493 53.4669				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	40.7 ± 0.1	1e-7	Fine	Fine
24	54.4 ± 0.1	1e-7	Fine	Fine
27	50.4 ± 0.1	1e-8	Fine	Fine
29	69.4 ± 0.1	1e-8	Fine	Fine
31	71.7 ± 0.1	1e-8	Fine	Fine
32	71.3 ± 0.1	1e-8	Fine	Fine
34	70.4 ± 0.1	1e-8	Fine	Fine
35	71.4 ± 0.1	1e-8	Fine	Fine
37	72.3 ± 0.1	1e-8	Fine	Fine
55	60.0 ± 0.1	1e-8	Fine	Fine

Notes: Satellite dishes were observed.

Location 9

GPS Coordinates: -2.17628 53.46322				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	34.8 ± 0.1	1e-7	Fine	Fine
24	51.6 ± 0.1	1e-7	Fine	Fine
27	47.3 ± 0.1	1e-8	Fine	Fine
29	66.0 ± 0.1	1e-8	Fine	Fine
31	66.6 ± 0.1	1e-8	Fine	Fine
32	66.4 ± 0.1	1e-8	Fine	Fine
34	64.4 ± 0.1	1e-8	Fine	Fine
35	64.7 ± 0.1	1e-8	Fine	Fine
37	65.6 ± 0.1	1e-8	Fine	Fine
55	49.8 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (UHF) aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 10

GPS Coordinates: -2.16657 53.45823				
Channel	Signal Strength (dBμV)	BER	Picture Quality	Audio Quality
21	32.1 ± 0.1	1e-7	Fine	Fine
24	45.9 ± 0.1	1e-7	Fine	Fine
27	42.1 ± 0.1	1e-8	Fine	Fine
29	63.0 ± 0.1	1e-8	Fine	Fine
31	63.6 ± 0.1	1e-8	Fine	Fine
32	64.1 ± 0.2	1e-8	Fine	Fine
34	61.2 ± 0.1	1e-8	Fine	Fine
35	61.1 ± 0.1	1e-8	Fine	Fine
37	62.3 ± 0.1	1e-8	Fine	Fine
55	51.1 ± 0.1	1e-8	Fine	Fine

Notes: Elevated Horizontally Polarised (HP) Ultra High Frequency (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



Location 9



Location 10





Pager Power Limited
Stour Valley Business Centre
Sudbury
Suffolk
CO10 7GB

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com