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Terrestrial Television Baseline Survey and Report

Renaker Build Limited

Great Jackson Street - Plot F

July 2023







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ADMINISTRATION PAGE

Job Reference:	10603E
Author:	Abdul Wadud
Telephone:	01787 319001
Email:	abdul@pagerpower.com

Reviewers:	Jacob Cunningham; Hannah McNaul
Emails:	jacob@pagerpower.com; hannahm@pagerpower.com

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1	July 2023	Initial issue

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

T:*01787 319001* E:*info@pagerpower.com* W:*www.pagerpower.com*

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been commissioned to investigate the potential impact upon terrestrial television reception in the surrounding area of the proposed building development located at Great Jackson Street, Manchester. This report serves as a baseline to establish current terrestrial television signal strength and reception quality.

Results

- A baseline site survey was undertaken on 18th July 2023 to record the terrestrial television signal strength and quality. The site survey also confirmed that the Winter Hill transmitter is the main transmitter serving the surrounding area of the proposed development;
- Any interference would be due to shadowing effects i.e. the weakening of the transmitted signal due to the physical presence of the buildings;
- The average terrestrial signal strength is moderate in the shadow zone of the proposed development for the main multiplexes, and low on average for the local (lower power) multiplexes;
- 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. Buildings in the surrounding environment within 1km of the proposed development were mainly commercial and high-rise residential properties;
- At locations beyond 1km and within the shadow zone, no significant impacts are predicted and interference is predicted to be unlikely.

Recommendations and Mitigation

No requirement for pre-emptive mitigation has been identified.

It is recommended any reports of interference are investigated to determine whether these are attributable to the proposed development. Comparisons between a post-construction survey and this baseline survey should be made if undertaken.

If interference is found to be attributable to the proposed development, mitigation measures should be installed. Solutions are likely to be readily available if required, the most common options are presented in Section 6.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 58 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects;
- Building developments;
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 BACKGROUND

1.1 Introduction

Pager Power has been commissioned to investigate the potential impact upon terrestrial television reception in the surrounding area of the proposed building development located at Great Jackson Street, Manchester. This report serves as a baseline to establish current terrestrial television signal strength and reception quality.

This survey is to satisfy Part A of the following planning condition:

> *Prior to the commencement of development within Phase 1, studies containing the following with regard to television reception in the area containing the site shall be submitted to and approved in writing by the City Council as local planning Authority.*
>
> *a) Measure the existing television signal reception within the potential impact areas identified in the Television Desk-Based Report by Pager Power dated October 2021 before development commences. The work shall be undertaken by an aerial installer registered with the Confederation of Aerial Industries or by a body approved by the Office of Communications, and shall include an assessment of the survey results obtained.*
>
> *…*
>
> *To provide an indication of the area of television signal reception likely to be affected by the development to provide a basis on which to assess the extent to which the development during construction and once built, will affect television reception and to ensure that the development at least maintains the existing level and quality of television signal reception, pursuant to Policy DM1 of the Core Strategy for the City of Manchester and Section 5 of the National Planning Policy Framework.*

1.2 Proposed Development

The proposed development consists of two 51-storey towers (F1 and F2), including the provision of two- and three-tiered basement car parking and associated works, at land at Plot F of the Great Jackson Street framework.

The redline boundary[1] of the proposed development and 3D illustration of the buildings pertaining to the proposed development is shown in Figures 1 and 2 respectively on the following page.

[1] Source: Z1-SHP-G100-PL-Grd-001

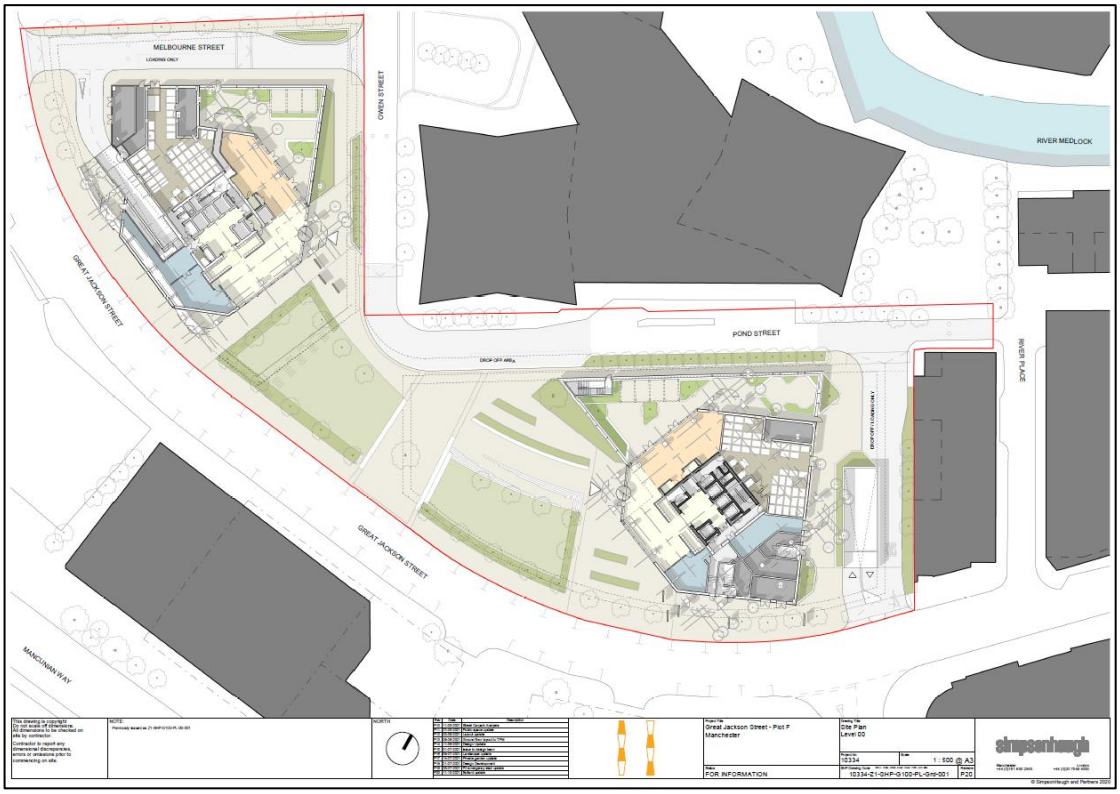


Figure 1 *Redline boundary*



Figure 2 *Buildings F1 and F2*

2 TELEVISION TRANSMITTER DETAILS

2.1 Relevant Transmitter

The Winter Hill transmitter predominantly serves the area around the development[2]. 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 24km 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)	GImux	COM 7
Channel	24	27	55
Power	2 kW	1 kW	25.7 kW

Table 2 *Winter Hill transmissions (local multiplexes)*

[2] Based on coverage maps and Digital UK information.

3 BUILDINGS AND TELEVISION INTERFERENCE

3.1 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 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.

3.2 Interference Mechanisms

Buildings can cause interference to terrestrial television reception by way of obstruction and reflection, outlined in the following subsections.

3.2.1 Obstruction

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 transmissions, this would affect residences to the southeast of the development. Specifically:

- The highest losses (greatest interference) will be located immediately behind the building relative to the transmitter 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).

Relevant extracts from OFCOM relating to guidance[3] on this issue 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."

The zones mentioned are illustrated in Figure 3[4] on the following page, taken from Section 3.2 of the OFCOM guidance regarding the impact of buildings on broadcast signals.

[3] OFCOM (2009): Tall Structures and their impact on broadcast and other wireless services
[4] Source: OFCOM publication

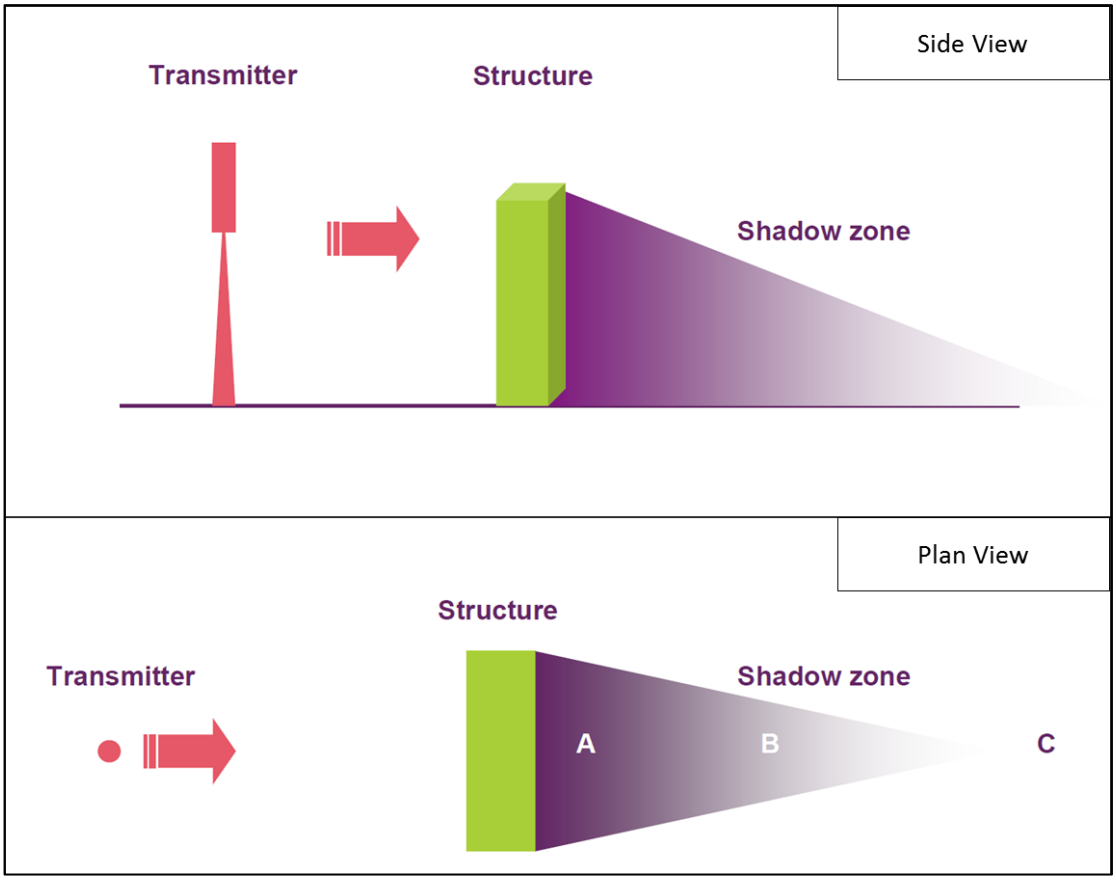


Figure 3 *Diffraction Loss Zones*

3.2.2 Reflection

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[5] on the following page (taken from Section 3.3 of the OFCOM guidance referenced previously) illustrates this effect.

[5] Source: OFCOM publication

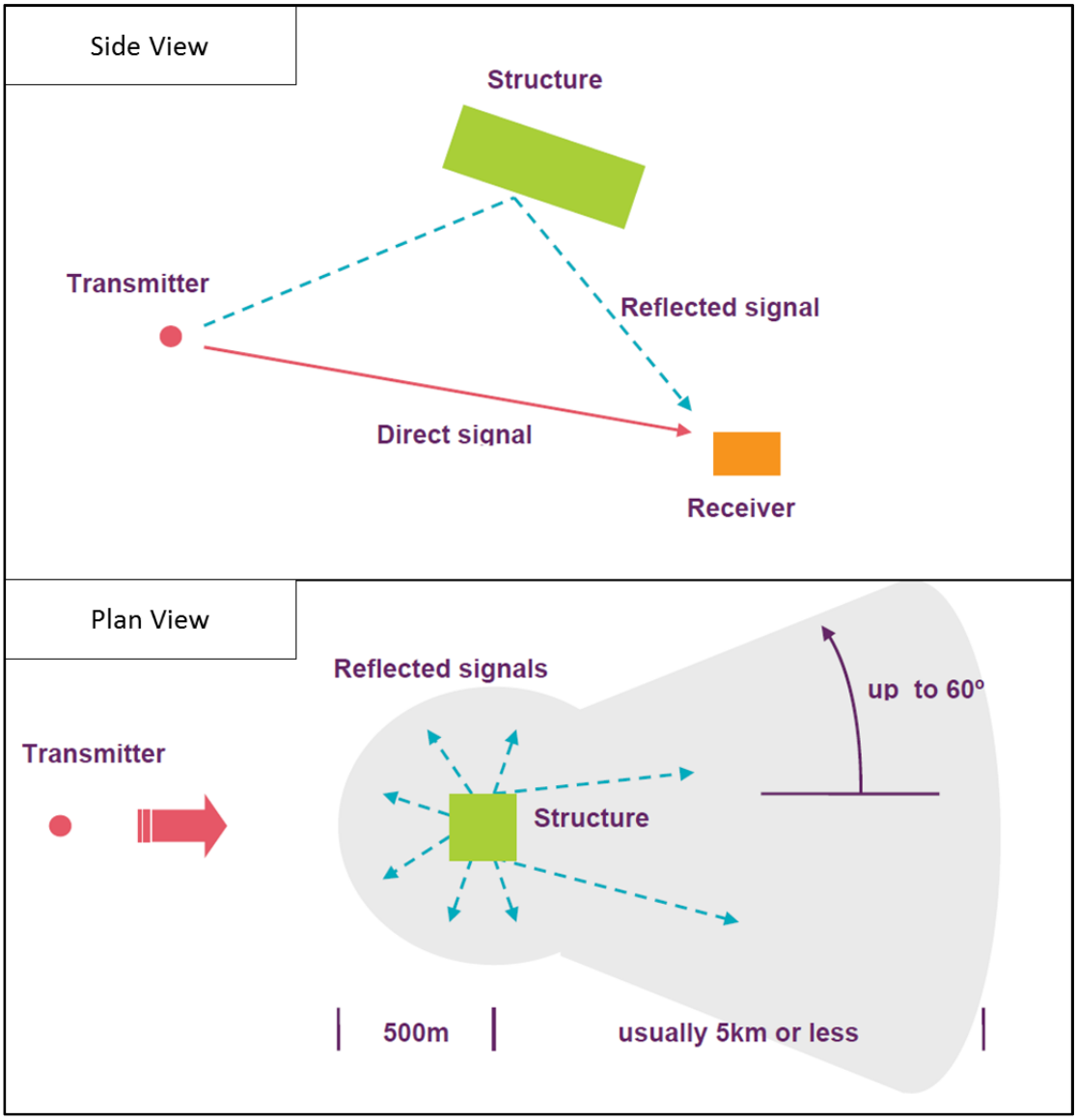


Figure 4 *Reflection Zones*

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 degrees[6] .

[6] 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.

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 development site 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

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 reflection and shadow areas, or interference zones, associated with the proposed development.

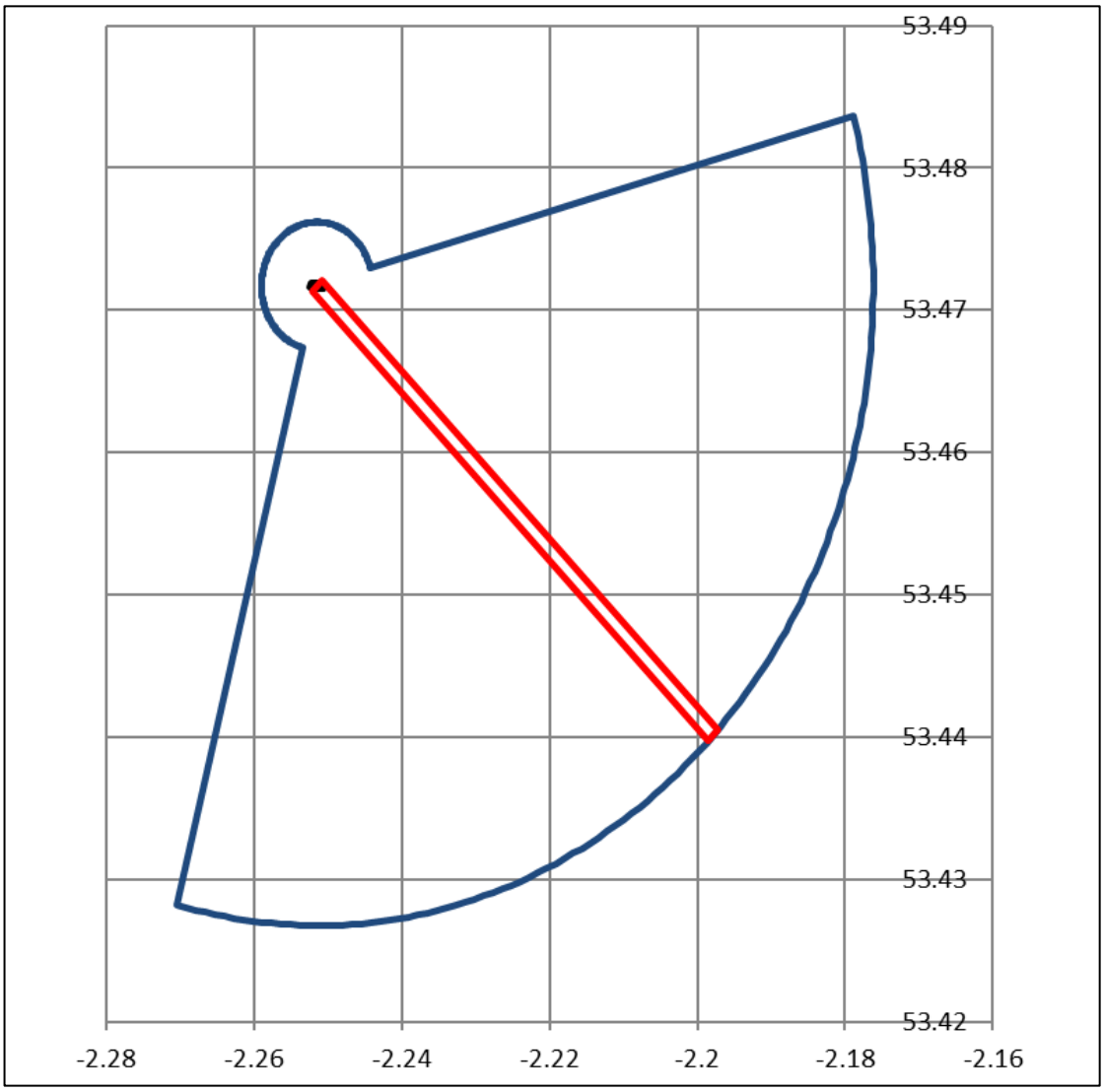


Figure 5 *Reflection and Shadow Zones*

Figure 6 below shows the interference zones overlaid onto an aerial image.

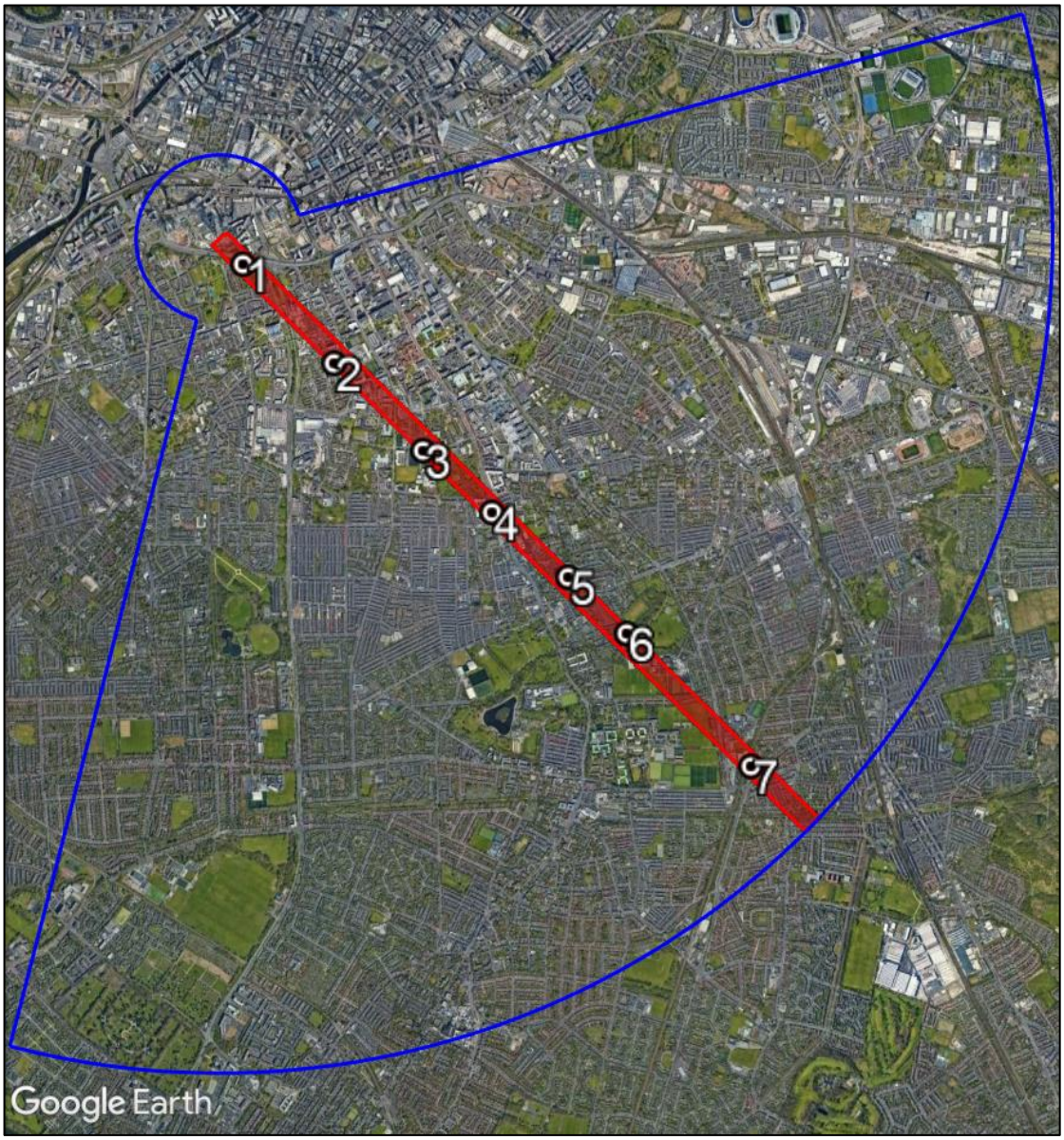


Figure 6 *Interference zones onto aerial imagery*

4.2 Potential Diffraction Issues – Terrestrial Television

The shadow zone passes over urban areas that contain commercial and residential 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.

The 1km assessment area predominantly features commercial and high-rise residential properties, therefore, interference is unlikely due to the lack of aerials present or their heights. Beyond 1km, commercial and low-rise properties exist. Interference is unlikely to be experienced at this range.

4.3 Potential Reflection Issues

Reflection effects are most likely if the transmitter does not have direct 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 is small.

Interference is most likely if all of the above criteria are met. Interference is least likely if none of the above criteria are met.

In practice it is unlikely that all of the above criteria would be met for the proposed development. In particular, locations that are below radio line of sight from the transmitter are unlikely to have an unobstructed path to the proposed development, due to their relative heights. Impacts due to reflections are considered unlikely.

5 TERRESTRIAL TELEVISION BASELINE SURVEY

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 (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.

5.2 Survey Locations

A baseline television reception survey was undertaken for the proposed development on 18th July 2023. Figure 7 on the following page shows the survey locations overlaid onto aerial photography. 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.

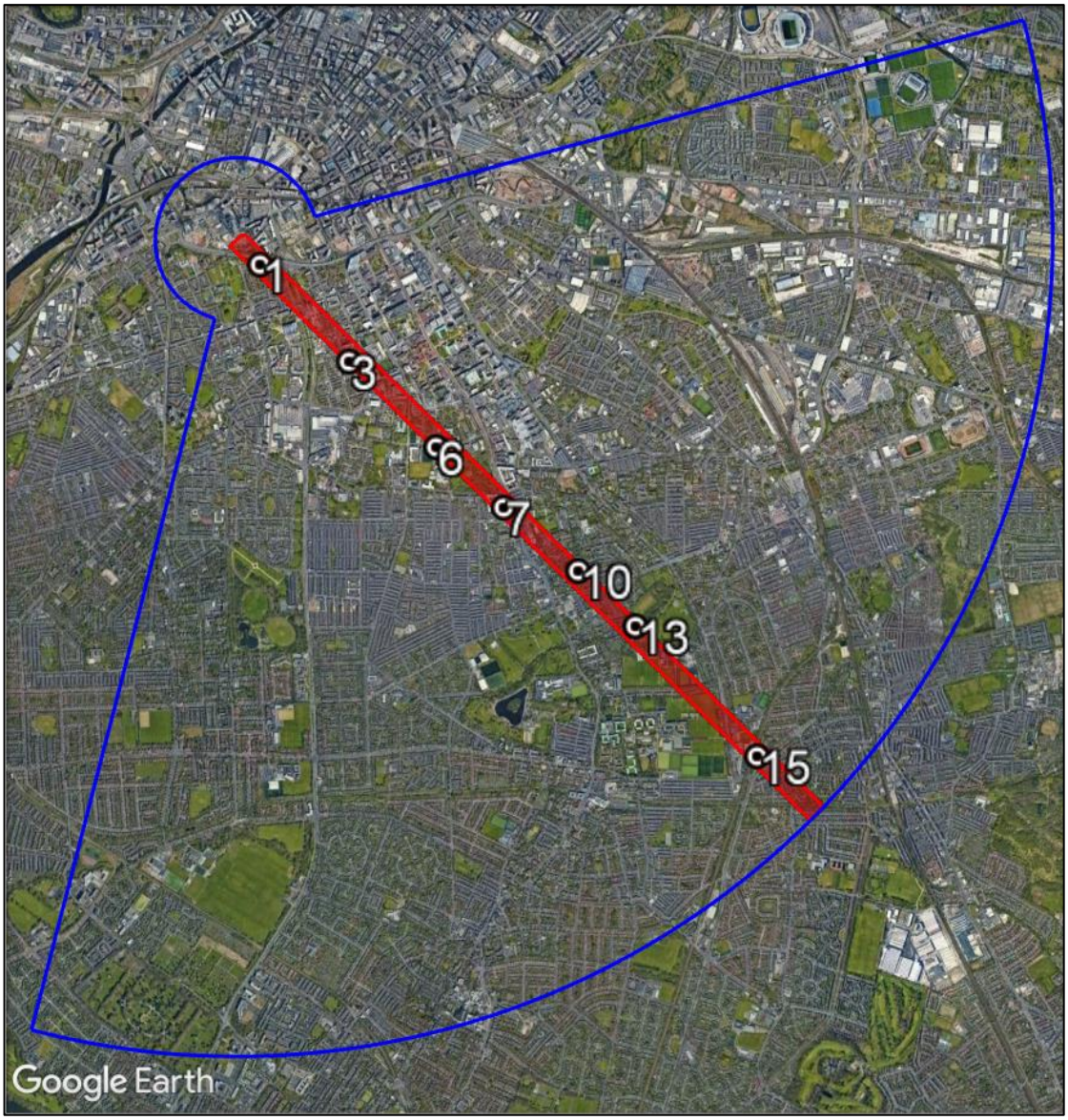


Figure 7 *Television reception survey locations*

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*

5.3 Survey Results

A summary of the survey results for television reception 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: 37.2 (Moderate) Main TV MUX: 42.9 (Moderate) Local TV MUX: 25.7 (Low)	Few HP[7] UHF[8] aerials and satellite dishes were observed. All main multiplexes decoded with fine picture and audio quality. An average of moderate signal strength and signal fluctuations of less than or equal to 1dB. All three local multiplexes did not decode. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	The survey location was within 210m of the proposed development and within its shadow zone. Signal losses at this range are likely to be small, considering the attenuation from existing buildings. Noticeable effects are not predicted in practice due to the existing signal strength.

[7] Horizontally Polarised.
[8] Ultra-High Frequency

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
2	Average: 48.1 (Good) Main TV MUX: 55.8 (Very good) Local TV MUX: 32.6 (Low)	Many HP UHF aerials and satellite dishes directed towards the Winter Hill transmitter were observed. All main multiplexes decoded with fine picture and audio quality. An average of good signal strength and signal fluctuations of less than or equal to 1dB. One out of three local multiplexes decoded with fine picture and audio quality. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	The survey location was within 1.00km of the proposed development and within its shadow zone. Signal losses at this range are likely to be small, considering the attenuation from existing buildings. Noticeable effects are not predicted in practice due to the existing signal strength.
3	Average: 42.9 (Moderate) Main TV MUX: 49.8 (Moderate) Local TV MUX: 29.1 (Low)	Few HP UHF aerials and satellite directed towards the Winter Hill transmitter were observed. All main multiplexes decoded with fine picture and audio quality. An average of moderate signal strength and signal fluctuations of less than or equal to 1dB. One out of three local multiplexes decoded with fine picture and audio quality. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	This location is approximately 1.76km from the proposed development. Effects at this range are likely to be relatively small based on industry experience, and effects are unlikely to be noticeable based on the current signal quality.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
4	Average: 37.5 (Moderate) Main TV MUX: 41.9 (Moderate) Local TV MUX: 28.7 (Low)	Few HP UHF aerials and satellite dishes directed towards the Winter Hill transmitter were observed. All main multiplexes decoded with fine picture and audio quality. An average of good signal strength and signal fluctuations of less than or equal to 1dB. One out of three local multiplexes decoded with fine picture and audio quality. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	This location is approximately 2.32km from the proposed development. Effects at this range are likely to be relatively small based on industry experience, and effects are unlikely to be noticeable based on the current signal quality.
5	Average: 40.0 (Moderate) Main TV MUX: 44.8 (Moderate) Local TV MUX: 30.3 (Low)	Few HP UHF aerials and satellite dishes directed towards the Winter Hill transmitter were observed. All main multiplexes decoded with fine picture and audio quality. An average of moderate signal strength and signal fluctuations of less than or equal to 1dB. Two out of three local multiplexes decoded with fine picture and audio quality. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	This location is approximately 2.92km from the proposed development. Effects at this range are likely to be relatively small based on industry experience, and effects are unlikely to be noticeable based on the current signal quality.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
6	Average: 41.1 (Moderate) Main TV MUX: 47.2 (Good) Local TV MUX: 28.7 (Low)	Few HP UHF aerials and satellite dishes directed towards the Winter Hill transmitter were observed. All main multiplexes decoded with fine picture and audio quality. An average of moderate signal strength and signal fluctuations of less than or equal to 1dB. One out of three local multiplexes decoded with fine picture and audio quality. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	This location is approximately 3.40km from the proposed development. Effects at this range are likely to be relatively small based on industry experience, and effects are unlikely to be noticeable based on the current signal quality.
7	Average: 50.8 (Good) Main TV MUX: 58.7 (Very good) Local TV MUX: 34.9 (Low)	Few HP UHF aerials and satellite dishes directed towards the Winter Hill transmitter were observed. All main multiplexes decoded with fine picture and audio quality. An average of good signal strength and signal fluctuations of less than or equal to 1dB. Two out of three local multiplexes decoded with fine picture and audio quality. An average of low signal strength and signal fluctuations of less than or equal to 1dB.	This location is approximately 4.49km from the proposed development. Effects at this range are likely to be relatively small based on industry experience, and effects are unlikely to be noticeable based on the current signal quality.

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

The result of the baseline survey suggests there is no reason to install pre-emptive mitigation. Mitigation and recommendations have only been included for completeness.

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.

7 CONCLUSIONS

7.1 Results

- A baseline site survey was undertaken on 18th July 2023 to record the terrestrial television signal strength and quality. The site survey also confirmed that the Winter Hill transmitter is the main transmitter serving the surrounding area of the proposed development;
- Any interference would be due to shadowing effects i.e. the weakening of the transmitted signal due to the physical presence of the buildings;
- The average terrestrial signal strength is moderate in the shadow zone of the proposed development for the main multiplexes, and low on average for the local (lower power) multiplexes;
- 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. Buildings in the surrounding environment within 1km of the proposed development were mainly commercial and high-rise residential properties;
- At locations beyond 1km and within the shadow zone, no significant impacts are predicted and interference is predicted to be unlikely.

7.2 Recommendations and Mitigation

No requirement for pre-emptive mitigation has been identified.

It is recommended any reports of interference are investigated to determine whether these are attributable to the proposed development. Comparisons between a post-construction survey and this baseline survey should be made, if undertaken.

If interference is found to be attributable to the proposed development, mitigation measures should be installed. Solutions are likely to be readily available if required, the most common options are presented in Section 6.

APPENDIX A – DETAILED SURVEY RESULTS

Location 1

Coordinates: Lon -2.249149°, Lat 53.470409°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	24.5 0.2	DND[9]		
29	SDN	43.6 0.1	1×10^{-8}	Fine	Fine
31	Arqiva A	43.2 0.1	1×10^{-8}	Fine	Fine
32	BBC A	43.0 0.3	1×10^{-8}	Fine	Fine
34	Digital 3&4	42.9 0.2	1×10^{-8}	Fine	Fine
35	BBC B	40.5 0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	44.0 0.3	1×10^{-8}	Fine	Fine
27	GImux	27.6 0.1	DND		
55	COM 7	25.1 0.1	DND		

Notes: HP[10] aerials and UHF[11] satellite dishes were observed.

[9] Did not deceode
[10] Horizontally Polarised.
[11] Ultra-High Frequency

Location 2

Coordinates: Lon -2.240931°, Lat 53.465078°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	38.5 0.1	1×10^{-8}	Fine	Fine
29	SDN	55.0 0.2	1×10^{-8}	Fine	Fine
31	Arqiva A	55.6 0.1	1×10^{-8}	Fine	Fine
32	BBC A	53.5 0.2	1×10^{-8}	Fine	Fine
34	Digital 3&4	56.7 0.1	1×10^{-8}	Fine	Fine
35	BBC B	58.1 0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	56.0 0.2	1×10^{-8}	Fine	Fine
27	GImux	33.2 0.4	DND		
55	COM 7	26.0 0.1	DND		

Notes: HP aerials and UHF satellite dishes were observed.

Location 3

Coordinates: Lon -2.232862°, Lat 53.460369°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	34.8 0.3	1×10^{-8}	Fine	Fine
29	SDN	47.9 0.2	1×10^{-8}	Fine	Fine
31	Arqiva A	53.4 0.2	1×10^{-8}	Fine	Fine
32	BBC A	48.5 0.4	1×10^{-8}	Fine	Fine
34	Digital 3&4	50.0 0.2	1×10^{-8}	Fine	Fine
35	BBC B	49.0 0.1	1×10^{-8}	Fine	Fine
37	Arqiva B	50.0 0.5	1×10^{-8}	Fine	Fine
27	GImux	26.7 0.2	DND		
55	COM 7	25.8 0.1	DND		

Notes: HP aerials and UHF satellite dishes were observed.

Location 4

Coordinates: Lon -2.226620°, Lat 53.457049°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	32.3 0.1	1×10^{-8}	Fine	Fine
29	SDN	45.0 0.1	1×10^{-8}	Fine	Fine
31	Arqiva A	42.2 0.1	1×10^{-8}	Fine	Fine
32	BBC A	41.6 0.1	1×10^{-8}	Fine	Fine
34	Digital 3&4	41.2 0.1	1×10^{-8}	Fine	Fine
35	BBC B	40.7 0.2	1×10^{-8}	Fine	Fine
37	Arqiva B	40.9 0.1	1×10^{-8}	Fine	Fine
27	GImux	28.0 0.2	DND		
55	COM 7	25.9 0.1	DND		

Notes: HP aerials and UHF satellite dishes were observed.

Location 5

Coordinates: Lon -2.219749°, Lat 53.453568°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	32.7 0.2	1×10^{-8}	Fine	Fine
29	SDN	44.1 0.1	1×10^{-8}	Fine	Fine
31	Arqiva A	46.2 0.2	1×10^{-8}	Fine	Fine
32	BBC A	45.8 0.2	1×10^{-8}	Fine	Fine
34	Digital 3&4	44.4 0.1	1×10^{-8}	Fine	Fine
35	BBC B	43.0 1.0	1×10^{-8}	Fine	Fine
37	Arqiva B	45.5 0.3	1×10^{-8}	Fine	Fine
27	GImux	32.2 0.1	1×10^{-8}	Fine	Fine
55	COM 7	26.1 0.1	DND		

Notes: HP aerials and UHF satellite dishes were observed.

Location 6

Coordinates: Lon -2.214453°, Lat 53.450539°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	34.0 0.2	1×10^{-8}	Fine	Fine
29	SDN	42.5 0.3	1×10^{-8}	Fine	Fine
31	Arqiva A	48.0 0.3	1×10^{-8}	Fine	Fine
32	BBC A	51.3 0.3	1×10^{-8}	Fine	Fine
34	Digital 3&4	49.3 0.1	1×10^{-8}	Fine	Fine
35	BBC B	47.4 0.3	1×10^{-8}	Fine	Fine
37	Arqiva B	44.8 0.3	1×10^{-8}	Fine	Fine
27	GImux	26.2 0.1	DND		
55	COM 7	26.0 0.1	DND		

Notes: HP aerials and UHF satellite dishes were observed.

Location 7

Coordinates: Lon -2.203239°, Lat 53.443398°					
Channel	**Service**	**Signal Strength (dBμV)**	**BER**	**Picture**	**Audio**
24	LTVmux	40.8 0.3	1×10^{-8}	Fine	Fine
29	SDN	58.2 0.3	1×10^{-8}	Fine	Fine
31	Arqiva A	57.5 0.3	1×10^{-8}	Fine	Fine
32	BBC A	58.8 0.2	1×10^{-8}	Fine	Fine
34	Digital 3&4	59.6 0.1	1×10^{-8}	Fine	Fine
35	BBC B	59.7 0.2	1×10^{-8}	Fine	Fine
37	Arqiva B	58.9 0.2	1×10^{-8}	Fine	Fine
27	GImux	38.0 0.2	1×10^{-8}	Fine	Fine
55	COM 7	26.0 0.1	DND		

Notes: HP aerials and UHF satellite dishes were observed.

APPENDIX B – SURVEY PHOTOGRAPHS

Location 1



Location 2



Location 3



Location 4



Location 5



Location 6



Location 7



PAGERPOWER

Urban & Renewables

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

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