

Television Desk-Based Report

Crown Street, Phase 3

Renaker Build Ltd

March, 2023

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ADMINISTRATION PAGE

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been commissioned to investigate the potential impact of a proposed building development (Phase 3) located on Crown Street, Manchester city centre upon terrestrial television services.

Findings

The desk-based analysis shows that the proposed development's shadow zone partially overlaps with the shadow zone generated by the existing Trinity Island and Crown Street – Zone 1 – C2 developments, increasing its width and length marginally.

It is expected that any additional impact caused by Phase 3 will not significantly change the current baseline scenario for dwellings located beyond 1km. However, further signal losses are possible for locations closer to Phase 3 based on previous complaints from residents in the area.

Therefore, further degradation to terrestrial television signal is deemed possible, however, any impacts can be suitably managed due to overall good signal quality.

No pre-emptive mitigation is required.

High-Level Cumulative – Phase 3

Phase 3 is located directly north of Plot D. The development will consist of four towers measuring up to 151.8m agl. There is the potential for cumulative effects due to Phase 3 and Plot D existing on the same shadow path. The main contributor to any impact will depend on which development is built first. Typically, the obstruction closest to an affected dwelling (Plot D) is most likely to be the primary cause of interference where the dimensions of the developments are similar.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 56 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 INTRODUCTION

1.1 Overview

Pager Power has been commissioned to investigate the potential impact of a proposed building development (Phase 3) located on Crown Street, Manchester city centre upon terrestrial television services. The associated interference areas for Phase 3 will be modelled. The report includes:

- Executive summary, contents and introduction;
- Proposed development details;
- Overview of interference mechanisms;
- Discussion of actual interference compared to predicted interference;
- Modelling of interference areas for Phase 3, including:
 - Diffraction zone; and
 - Reflection zone.
- Summary of pre-construction investigations/survey;
- Summary of post-construction investigations/surveys;
- Summary of mitigation actions taken;
- Overall risk and key issues;
- Conclusions and recommendations.

Following the technical analysis, the overall conclusions and recommendations are presented.

2 DEVELOPMENT DETAILS

2.1 Description of Development

The description of the development is as follows¹:

The Proposed Development includes four residential towers. These sit on top of a podium providing ground floor flexible commercial uses. A central area of significant public realm is provided spanning Great Jackson Street, with traffic calming measures proposed to Great Jackson Street. Basement car parking is also proposed.

2.2 Proposed Development General Arrangement

The general arrangement plan for the proposed development is shown in Figure 1² below.

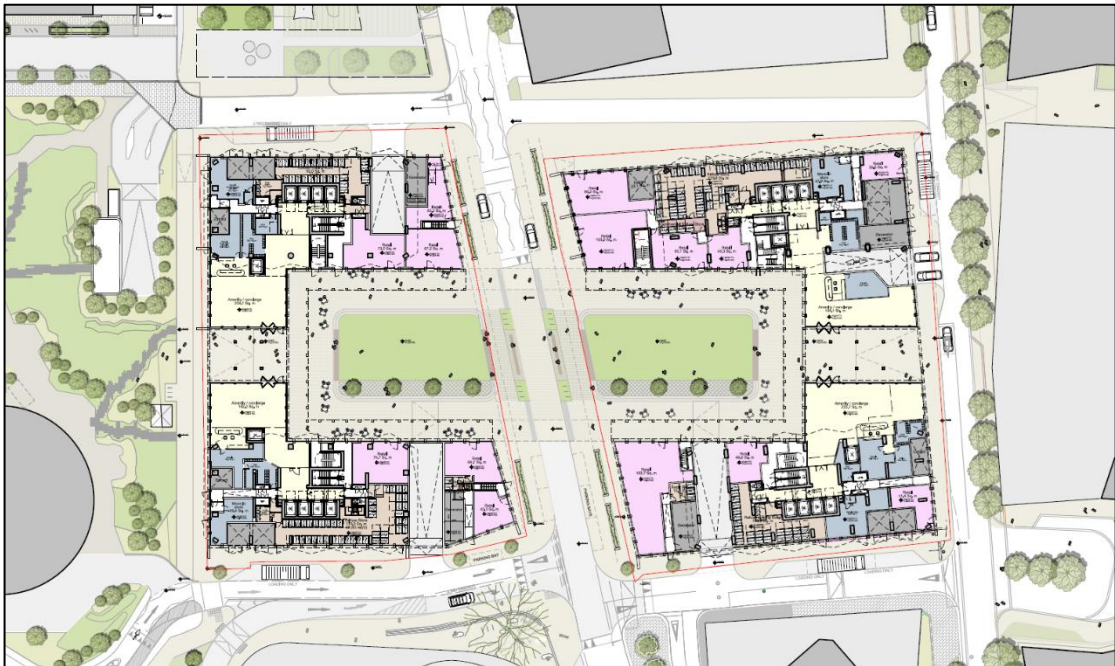


Figure 1 – Proposed development general arrangement plan

¹ CS Phase 3 and Plot D - Key Information Table.

² Plot D - General Arrangement [cropped]. The landscaping and floorplan shown are indicative only.

2.3 3D Building Representation

A representative 3D aerial image of the proposed development is shown in Figure 2 below.



Figure 2 – 3D building representation

3 TELEVISION TRANSMITTER DETAILS

3.1 Relevant Transmitter

The Winter Hill transmitter serves the area around the development.

Digital television services are broadcast via Ultra High Frequency (UHF) signals; no analogue television signals are broadcast. The transmitter information is presented below³.

3.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 24.3km northwest of the development (published coordinates SD66051446). The main digital services provided at the time of the last survey⁴ are shown in Table 1 below.

	Public (PSB)			Commercial (COM)		
Service	BBC A	Digital 3&4	BBC B	SDN	Arqiva A	Arqiva B
Channel	32	34	35-	29	31	37
Power	100 kilo-Watts (kW)					

Table 1 – Winter Hill main transmissions

Additional Winter Hill transmissions provided at the time of the last survey are shown in Table 2 below.

	Local Multiplexes			
Service	COM 7	COM8	LM/LL/LPR	GIM
Channel	55	37	56	57
Power	25.7 kW	22.6kW	1-2 kW	1 kW

Table 2 – Winter Hill additional transmissions

³ Source: Ofcom

⁴ Transmissions at the time of writing are provided on different channels following spectrum clearing. This has no significant bearing on the results presented within this report.

3.3 Television Transmitter Location

Figure 3 below shows the relative location of the transmitter and the development.

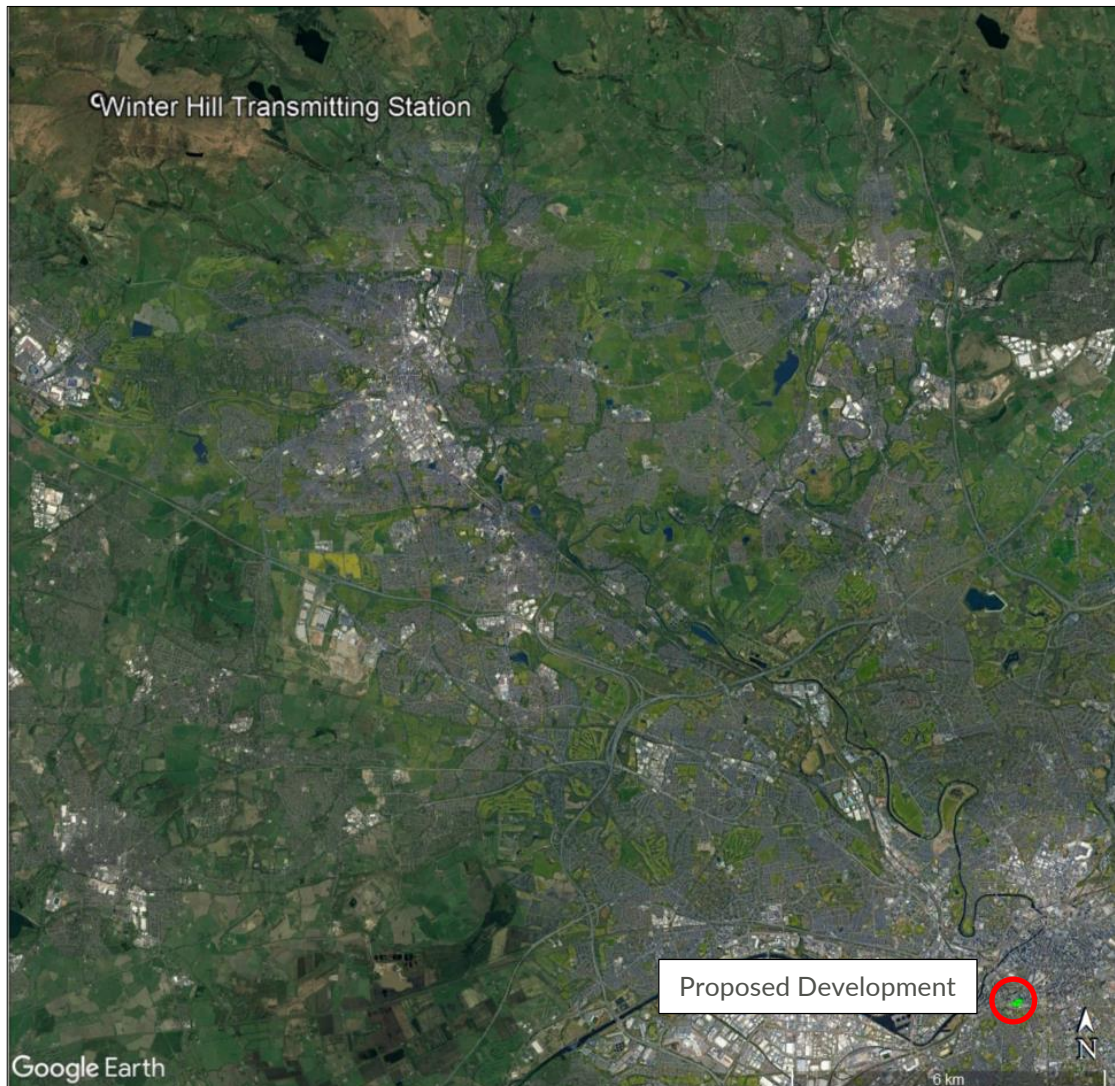


Figure 3 – Television transmitter and development location

4 BUILDINGS AND INTERFERENCE MECHANISMS

4.1 Technical Overview

Terrestrial television services are provided by means of electromagnetic waves in the Ultra High Frequency (UHF) range which propagate from land-based transmitters to receiving aerials.

The quality of the image and sound on a 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 in the subsection below.

4.2 Obstruction of the signal

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 south-southeast of the development. The following is true for television signals:

- 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).

Ofcom has produced a document⁵ offering guidance on this issue. Relevant extracts from the documents 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 4⁶ below, taken from Section 3.2 of the Ofcom guidance regarding the impact of buildings on broadcast signals.

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

⁶ Source: Ofcom publication

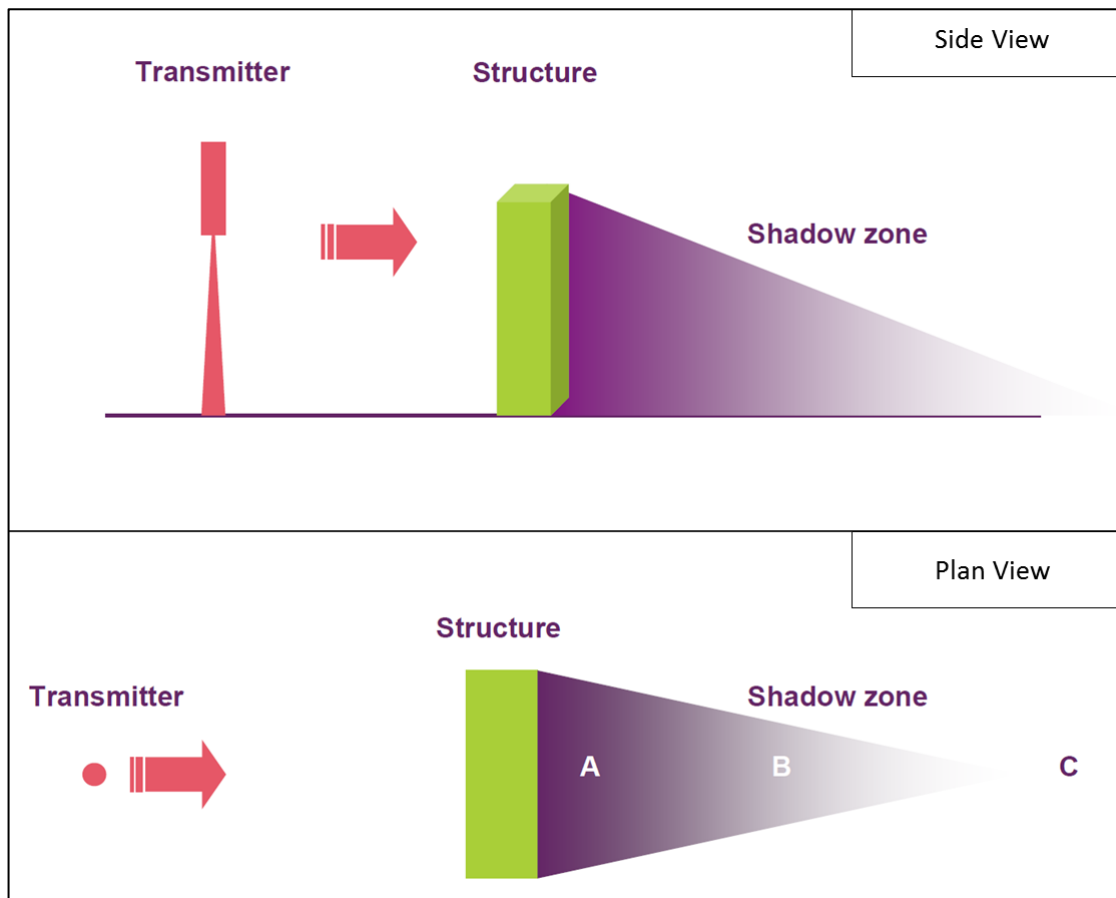


Figure 4 – Diffraction Loss Zones

4.3 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 5⁷ below (taken from Section 3.3 of the Ofcom guidance referenced above) illustrates this effect.

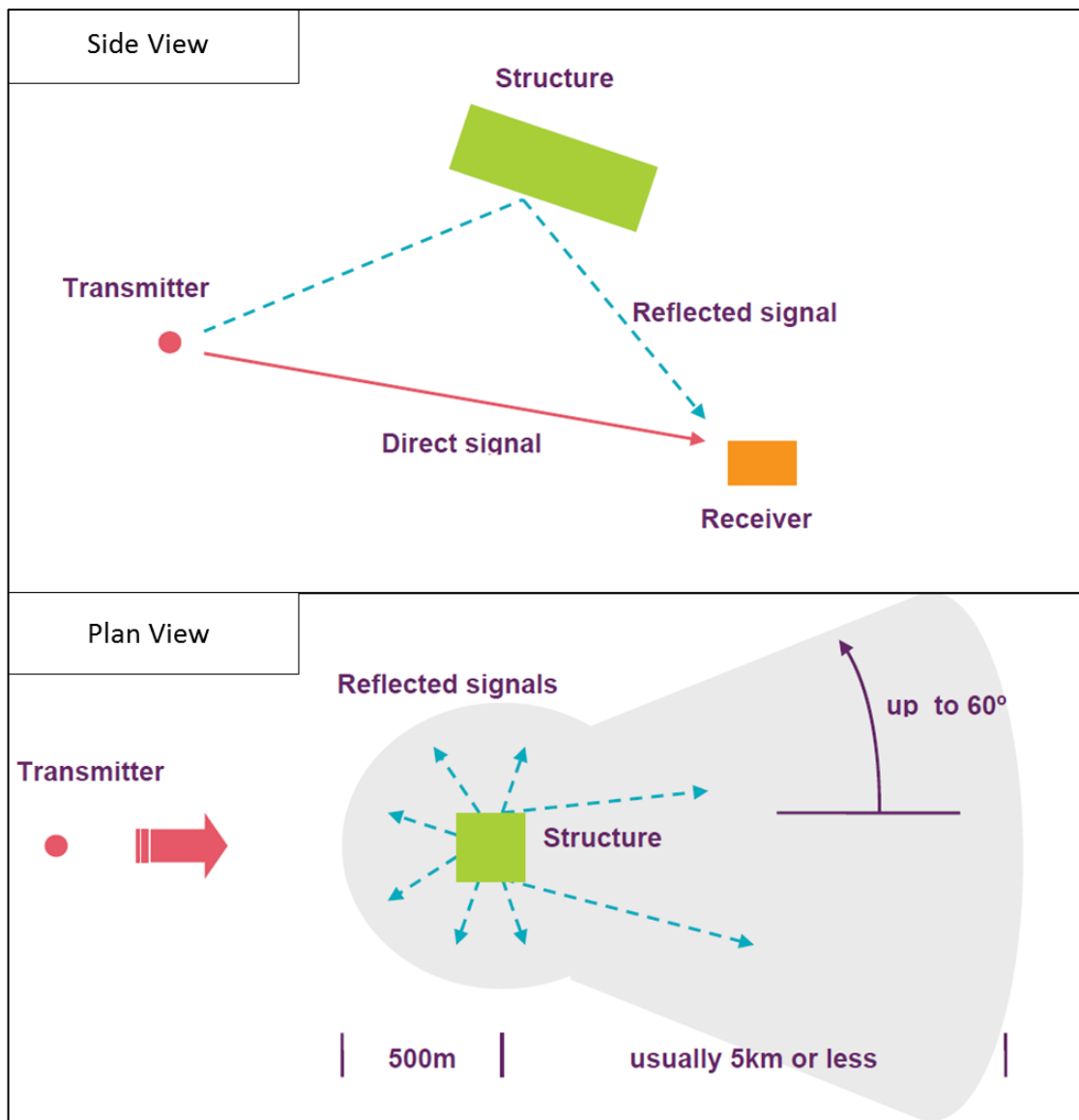


Figure 5 – Reflection Zones

⁷ Source: Ofcom publication

In practice, it is considered highly unlikely that reflections will have an effect for receivers in front of the building or on either side when viewed from the location of the transmitter. For digital transmissions in particular, it is unlikely that issues will occur if the angle between the direct signal and the reflected signal is more than 30 degrees.

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.

5 ASSESSMENT PROCESS

5.1 Defining Potential Interference Areas

Figure 6 below shows the potential interference areas that were modelled for the development.

These were 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 building 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 4 in the previous section.

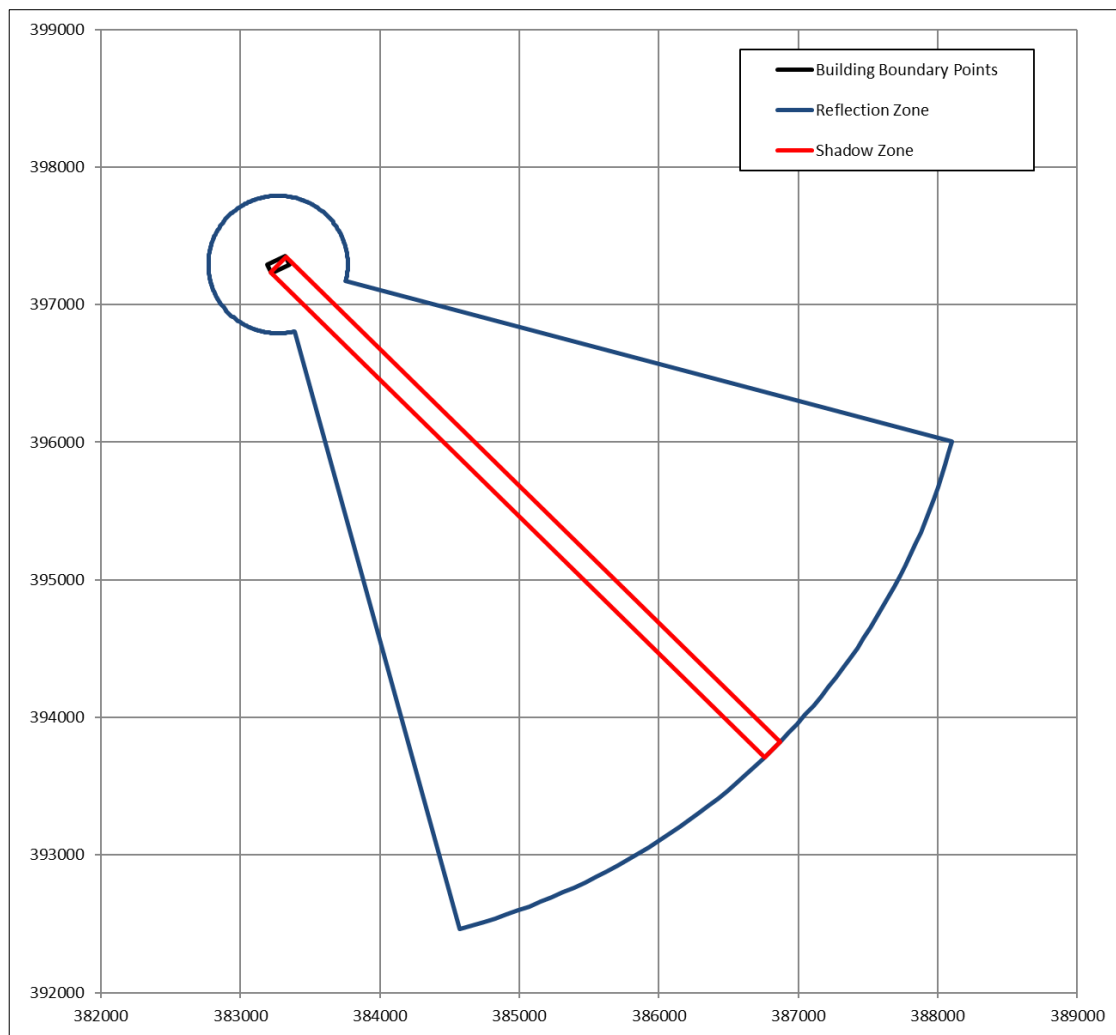


Figure 6 – Interference areas

Figure 7 below shows the interference zones overlaid onto aerial photography of the area.



Figure 7 – Interference zones – aerial image

5.2 Potential Diffraction Issues – Terrestrial Television

The shadow zone passes over both urban and industrial buildings as well as high and low-rise residential developments. Areas closest to the development are generally⁸ at the highest risk of experiencing television interference.

5.3 Potential Reflection Issues – Terrestrial Television

Reflection effects are most likely if the transmitter does not have direct radio line of sight to the receiving aerial.

⁸ Under some circumstances, this is not the case e.g. if the pre-existing signal quality was exceptional at close range but borderline at longer range.

Based on bare-earth terrain, the Winter Hill transmitter has coverage below ten metres for the populated areas within the reflection zone. This means that any 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 not be already obstructed by a building or other existing obstacle;
- The reflected signal path via the development would have to be relatively unobstructed;
- The angle between the reflected signal via the 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 not predicted.

5.4 Survey Results

The results of the baseline surveys considered for this report and carried out between 2019 and 2021 confirmed that the Winter Hill transmitter served the surveyed area within the shadow zone.

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 television 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

6 RECEPTION SURVEYS – TRINITY ISLAND

6.1 Overview

Pager Power has previously carried out a pre-construction television surveys for a development (Trinity Island) circa 800m northwest of Phase 3.

6.2 Trinity Island Development

The Trinity Island development is composed of four towers located to the northwest of the proposed development. Figure 8 below Trinity Island's site boundary (yellow polygons) and its location relative to the proposed development Phase 3 (green polygon).

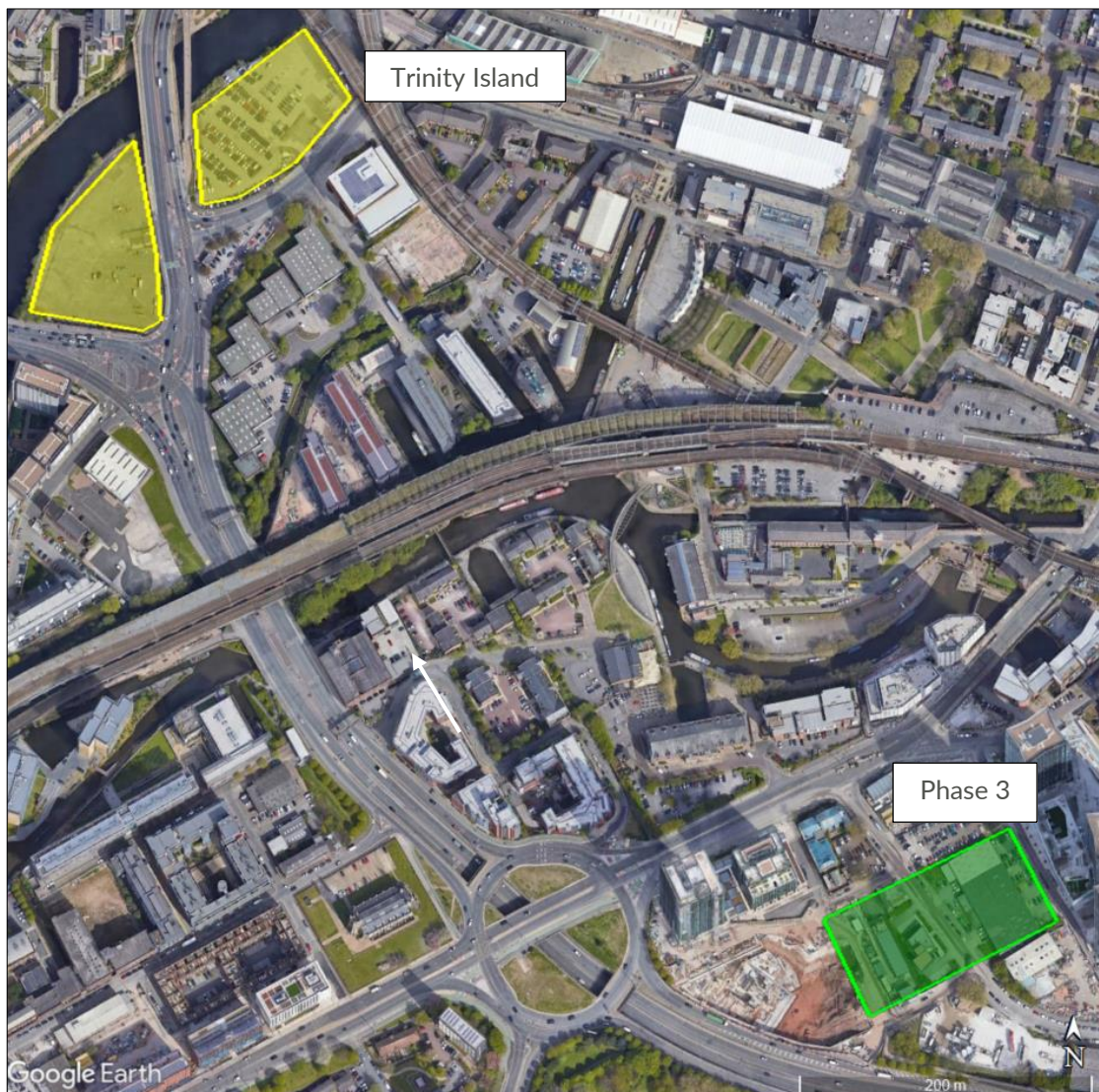


Figure 8 – Location of Trinity Island development (yellow) relative to the Phase 3 (green)

6.3 Trinity Island's Potential Interference Areas

Figure 9 below shows the potential interference areas that were modelled for the development Trinity Island (orange line) and the Phase 3 (red line). Since both developments are on the same bearing with Winter Hill and are close to each other both shadow areas almost fully overlap.



Figure 9 – Interference zones (Trinity Island and Phase 3) – aerial image

6.4 Surveys Undertaken

The pre-construction survey was undertaken by Pager Power for the Trinity Island development. The pre-construction survey for Trinity Island was undertaken in October 2021, prior to the construction of the development.

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.
3. It allows a 'before and after' comparison to be made in the event that a complaint is received.

6.5 Survey Locations

Figure 10 on the following page shows the survey locations (October 2021) overlaid onto aerial photography with the icons showing where television measurements were taken. The Trinity Island site outline is shown in the top left. The survey locations were chosen pre-survey as close to the previous survey locations as possible⁹.

⁹ Safe and available access influenced the specific position on the day.

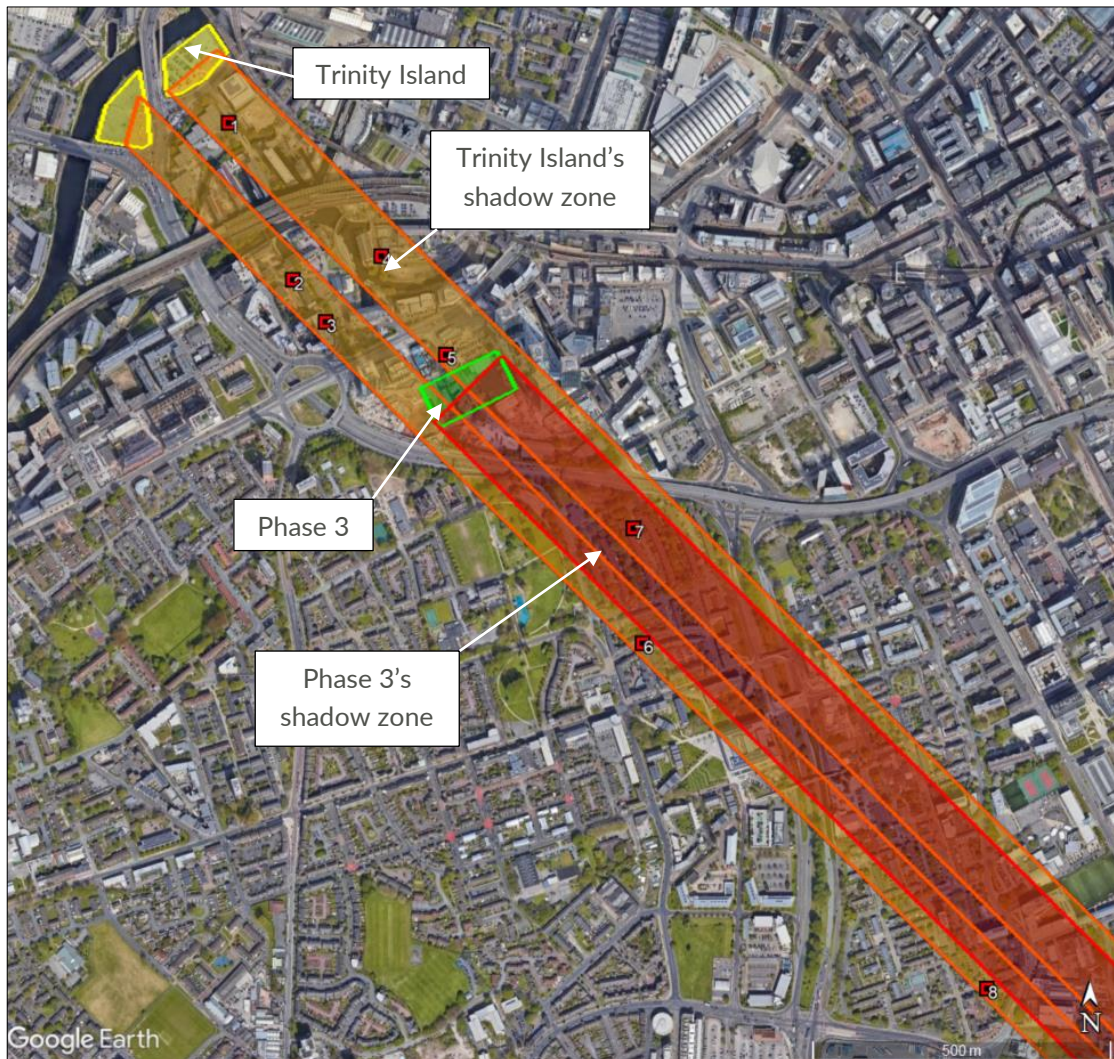


Figure 10 – Trinity Island survey locations

6.6 Pre-Construction Results – Entire Shadow Zone

Table 4 on the following page summarises the results and the comments of the pre-construction reception surveys for the whole shadow zone¹⁰. The term 'MUX' refers to multiplex which is a group of television channels.

The average signal strength is given for the pre-construction baseline¹¹. A number of factors, including variable weather and foliage conditions, can lead to minor fluctuations of signal strength. It can be assumed that the findings of the survey are also valid for Phase 3.

¹⁰ The full report completed by Pager Power is 10930A – Television Baseline and Post-Construction Survey Report Issue 1 dated October 2021.

¹¹ The baseline survey was carried out in October 2021 and the values are from the report 10930A.

Location	Average Measured Signal Strength (dB)	Comment
1	Main TV MUX: 47 (Good) Local TV MUX: 33 (Low)	Aerials and satellite dishes were not observed at this survey location. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplex was not decoded at this location.
2	Main TV MUX: 44 (Moderate) Local TV MUX: 31 (Low)	One horizontally polarised aerial directed towards the Winter Hill transmitter and multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.
3	Main TV MUX: 47 (Good) Local TV MUX: 31 (Low)	Aerials dishes were not observed at this survey location. One satellite dish was observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.
4	Main TV MUX: 51 (Good) Local TV MUX: 37 (Low)	Aerials and satellite dishes were not observed at this survey location. All main and local multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.
5	Main TV MUX: 49 (Good) Local TV MUX: 35 (Moderate)	Two horizontally polarised aerials directed towards the Winter Hill transmitter. No satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.

Location	Average Measured Signal Strength (dB)	Comment
6	Main TV MUX: 44 (Moderate) Local TV MUX: 32 (Low)	Multiple horizontally polarised aerials directed towards the Winter Hill transmitter and multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.
7	Main TV MUX: 49 (Good) Local TV MUX: 34 (Low)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.
8	Main T V MUX: 47 (Good) Local TV MUX: 31 (Low)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplex was not decoded at this location.

Table 4 – Trinity Island pre-construction survey result

6.7 Trinity Island Results – Specific to Phase 3

The locations at greatest risk are those in the shadow zone which are also 1km from the Phase 3 (6 and 7). Signal reflections towards locations 1 to 5 could occur; however, are highly unlikely to be noticeable in practice. Overall, for all these locations, the signal strength for multiplexes is of moderate-good quality and any impact might not be perceived in practice. Impact is not expected to be significant and any reduction in signal strength is not expected to be perceived in practice for other locations beyond the 1km distance (location 8). Whilst some degradation of the signal due to the presence of Phase 3 is possible at all locations, noticeable effects are not predicted to be experienced in practice due to the overall signal strength (based on the signal strength recorded during the survey carried out in October 2021). The addition of a new tower block will result in an increase in the Trinity Island's shadow area width.

7 RECEPTION SURVEYS – CROWN STREET – ZONE 1 – C2

7.1 Overview

Pager Power has previously carried out a pre- and post-construction television surveys for a development (Crown Street – Zone 1 – C2) circa 120m northwest of Phase 3.

7.2 Crown Street – Zone 1 – C2 Development

The Crown Street – Zone 1 – C2 development is composed of two towers located to the northwest of the proposed development. Figure 11 below Crown Street – Zone 1 – C2's site boundary (yellow polygons) and its location relative to the proposed development Phase 3 (green polygon).

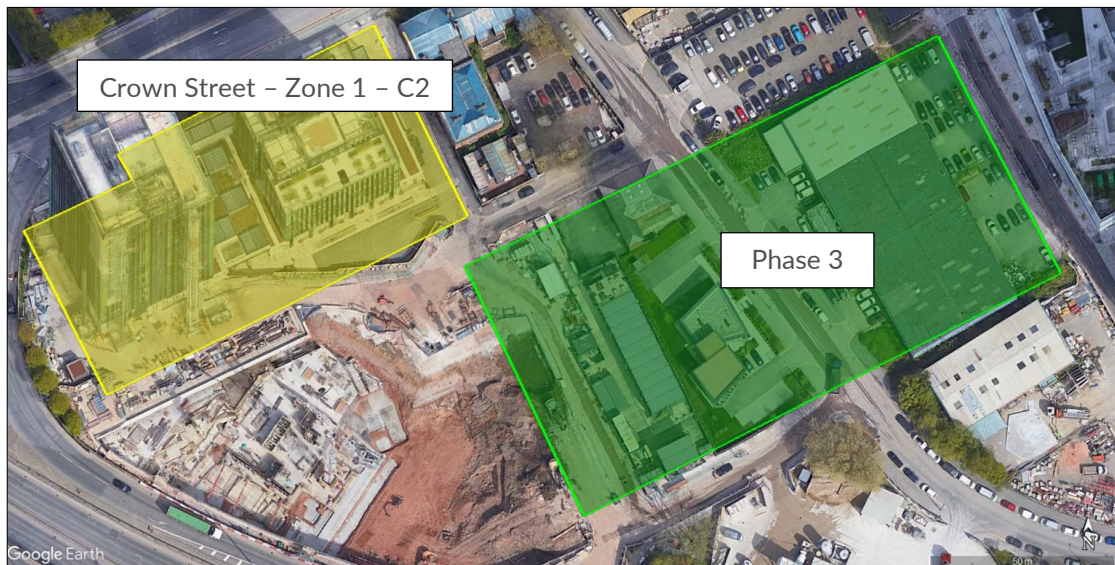


Figure 11 – Location of Crown Street – Zone 1 – C2 development (yellow) relative to the Phase 3 (green)

7.3 Crown Street – Zone 1 – C2's Potential Interference Areas

Figure 12 below shows the potential interference areas that were modelled for the development Crown Street – Zone 1 – C2 (orange line) and the Phase 3 (red line). Since both developments are on a similar bearing with Winter Hill and are close to each other both shadow areas partially overlap.



Figure 12 – Interference zones (Crown Street – Zone 1 – C2 and Phase 3) – aerial image

7.4 Surveys Undertaken

The pre- and post-construction survey was undertaken by Pager Power for the Trinity Island development. The pre-construction survey for Crown Street – Zone 1 – C2 was undertaken in November 2019, prior to the construction of the development. The most recent post-construction survey for Crown Street – Zone 1 – C2 was undertaken in October 2021, after the construction of the C2 tower.

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.
3. It allows a 'before and after' comparison to be made in the event that a complaint is received.

The purpose of a post-construction survey is as follows:

1. To establish the reception quality post-construction.
2. To determine the variation to television signal strength and quality from baseline to post-construction.
3. To determine whether significant interference (reported or otherwise) is occurring and to identify the specific development to which the interference is attributable.

7.5 Survey Locations

Figure 13 on the following page shows the pre-construction survey locations (circle icon) (November 2019) and the post-construction survey location (square icons) (October 2021) overlaid onto aerial photography with the icons showing where television measurements were taken. The Crown Street – Zone 1 – C2 site outline is shown in the top left. The survey locations were chosen pre-survey as close to the previous survey locations as possible¹².

The locations chosen for the pre- and post-construction surveys undertaken to assess the impact of Crown Street – Zone 1 – C2 impact upon television signals also lie within the proposed development's shadow area (Phase 3). Therefore, results from that survey provides a valid representation past baseline television signal¹³.

¹² Safe and available access influenced the specific position on the day.

¹³ This is correct provided that no new building has been built in the vicinity of the proposed development Plot D and on the same bearing with Winter Hill.

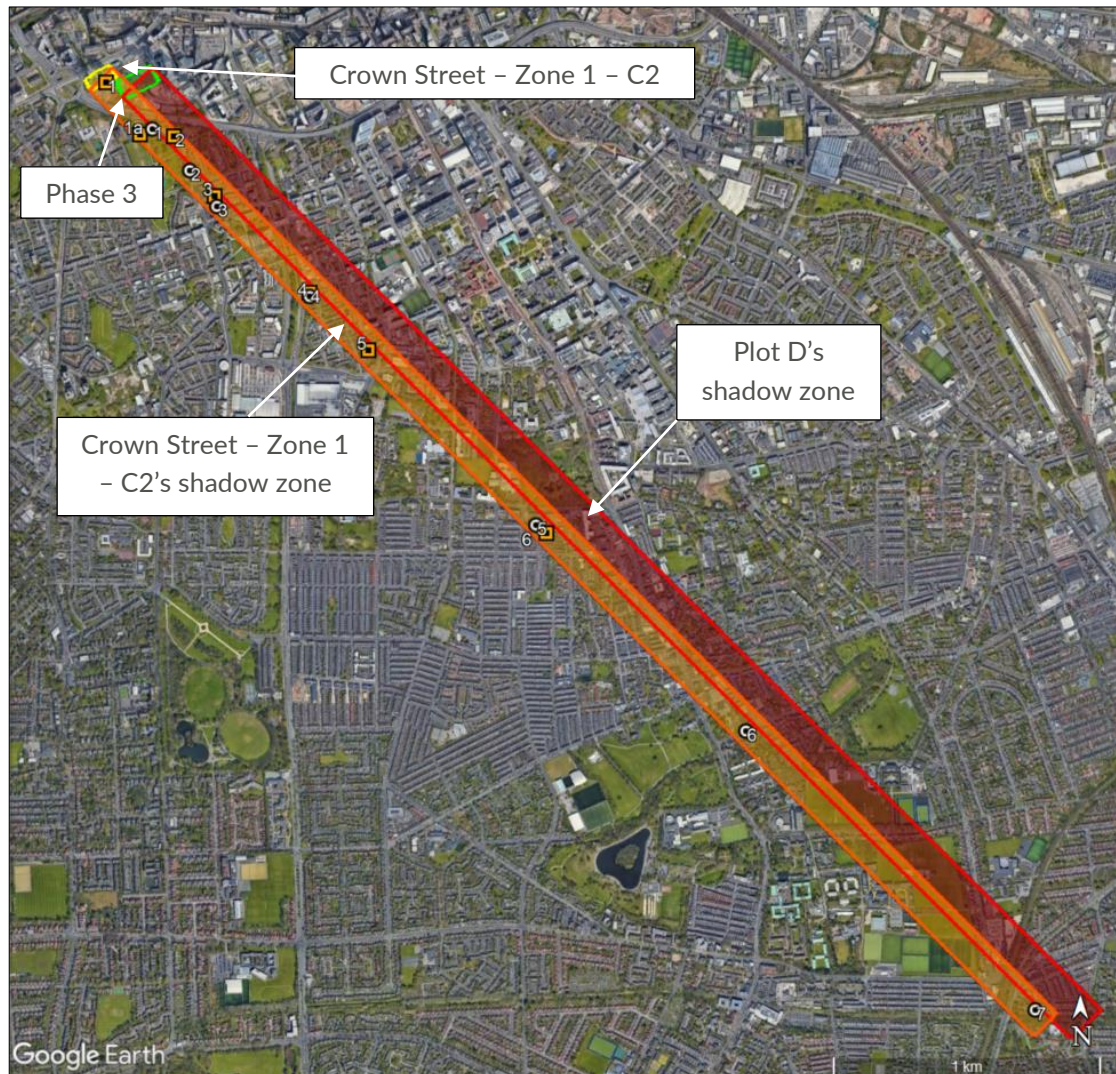


Figure 13 – Crown Street – Zone 1 – C2 survey locations

7.6 Survey Results – Entire Shadow Zone

Table 5 and Table 6 on the following pages summarise the results and the comments of the pre-¹⁴ and post-construction¹⁵ reception surveys for the whole shadow zone. The term 'MUX' refers to multiplex which is a group of television channels.

The average signal strength is given for the pre-construction baseline¹⁶. A number of factors, including variable weather and foliage conditions, can lead to minor fluctuations of signal strength. It can be assumed that the findings of the survey are also valid for Phase 3.

¹⁴ The full reported completed by Pager Power is 9669C – Television Baseline Survey Report Issue 1 dated December 2019.

¹⁵ The full reported completed by Pager Power is 10930A – Television Post-Construction Survey Report Issue 1 dated October 2021.

¹⁶ The baseline survey was carried out in 2021 and the values are from the report 10685C+F.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
1	Main TV MUX: 45 (Moderate) Local TV MUX: 37 (Moderate)	Aerials were not observed at this survey location. One main and two local multiplexes were not received at this location. Another local multiplex showed intermittent interference. The 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 200m of the closest of the Proposed Development. Effects are possible based on the proximity to the Proposed Development. This could depend on the relative height of the building development and any receiving aerials.
2	Main TV MUX: 60 (Very Good) Local TV MUX: 44 (Moderate)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. The survey aerial was not at its maximum height due to trees at the survey location. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	The survey location is within 400m of the closest of the Proposed Development. The existing signal strength is high, particularly for the main multiplexes, however effects are possible at this range.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
3	Main TV MUX: 51 (Good) Local TV MUX: 41 (Moderate)	Horizontally polarised aerials directed towards the Winter Hill transmitter and many satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is approximately 500 m of the closest of the Proposed Development. It is possible that the signal will be affected at this range, which could be noticeable for the channels of moderate strength.
4	Main TV MUX: 47 (Good) Local TV MUX: 39 (Moderate)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is more than 1 km from the Proposed Development. It is unusual for significant signal degradation to manifest itself at ranges of more than 1 km. Significant interference is unlikely, however the possibility cannot be ruled out, particularly for the weakest multiplexes.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
5	Main TV MUX: 58 (Very Good) Local TV MUX: 38 (Moderate)	Horizontally polarised aerials directed towards the Winter Hill transmitter and many satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	It is unlikely that significant losses would be experienced at this location (approximately 2.2km from the Proposed Development) considering the existing signal strength and distance. Impacts are unlikely.
6	Main TV MUX: 70 (Very Good) Local TV MUX: 52 (Good)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	It is unlikely that noticeable losses would occur at the outer extremities (3.3 km) of the shadow zone. No interference is predicted.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
7	Main TV MUX: 68 (Very Good) Local TV MUX: 50 (Good)	Horizontally polarised aerials directed towards the Winter Hill transmitter and some satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	It is unlikely that noticeable losses would occur at the outer extremities (4.8 km) of the shadow zone. No interference is predicted.

Table 5 – Crown Street – Zone 1 – C2 post-construction survey result

Location	Average Measured Signal Strength (dB)	Comment
1	Main TV MUX: 47 (Good) Local TV MUX: 33 (Low)	Aerials and satellite dishes were not observed at this survey location. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplex was not decoded at this location.
2	Main TV MUX: 44 (Moderate) Local TV MUX: 31 (Low)	One horizontally polarised aerial directed towards the Winter Hill transmitter and multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.

Location	Average Measured Signal Strength (dB)	Comment
3	Main TV MUX: 47 (Good) Local TV MUX: 31 (Low)	Aerials dishes were not observed at this survey location. One satellite dish was observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.
4	Main TV MUX: 51 (Good) Local TV MUX: 37 (Low)	Aerials and satellite dishes were not observed at this survey location. All main and local multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference.
5	Main TV MUX: 49 (Good) Local TV MUX: 35 (Moderate)	Two horizontally polarised aerials directed towards the Winter Hill transmitter. No satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.
6	Main TV MUX: 44 (Moderate) Local TV MUX: 32 (Low)	Multiple horizontally polarised aerials directed towards the Winter Hill transmitter and multiple satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.
7	Main TV MUX: 49 (Good) Local TV MUX: 34 (Low)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.

Location	Average Measured Signal Strength (dB)	Comment
8	Main T V MUX: 47 (Good) Local TV MUX: 31 (Low)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplex was not decoded at this location.

Table 6 – Crown Street – Zone 1 – C2 post-construction survey result

7.7 Crown Street – Zone 1 – C2 Results – Specific to Phase 3

The locations at greatest risk are those in the shadow zone which are also 1km from the Phase 3 (1¹⁷ to 5). However, locations 1 of the pre-construction report can still experience negative effects due to signal reflection.

Overall, the pre-construction survey shows that the recorded signal strength for multiplexes is of good and very-good quality and for the post-construction survey shows moderate and good quality and any impact might not be perceived in practice. However, it should be noted that a degradation of the signal has occurred.

Impact due to Phase 3 is not expected to be significant and any reduction in signal strength is not expected to be perceived in practice for other locations beyond the 1km distance.

Impacts upon terrestrial television services at all locations are likely due to the Phase 3 development, however not predicted to be experienced in practice due to the overall signal strength (based on the signal strength recorded during the survey carried out in October 2021). The addition of a new tower block will result in a small increase in the Crown Street – Zone 1 – C2's shadow area width.

¹⁷ Location 1 for the pre-construction is not within the Plot D shadow zone, however location 1 of the post construction is within the shadow zone.

8 CONCLUSIONS

8.1 Findings

The desk-based analysis shows that the proposed development's shadow zone partially overlaps with the shadow zone generated by the existing Trinity Island and Crown Street – Zone 1 – C2 developments, increasing its width and length marginally.

It is expected that any additional impact caused by Phase 3 will not significantly change the current baseline scenario for dwellings located beyond 1km. However, further signal losses are possible for locations closer to Phase 3 based on previous complaints from residents in the area.

Therefore, further degradation to terrestrial television signal is deemed possible, however, any impacts can be suitably managed due to overall good signal quality.

No pre-emptive mitigation is required.

8.2 High-Level Cumulative – Phase 3

Phase 3 is located directly north of Plot D. The development will consist of four towers measuring up to 151.8m agl. There is the potential for cumulative effects due to Phase 3 and Plot D existing on the same shadow path. The main contributor to any impact will depend on which development is built first. Typically, the obstruction closest to an affected dwelling (Plot D) is most likely to be the primary cause of interference where the dimensions of the developments are similar.



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