

Television Baseline Survey Report

Faithful+Gould

Silk Street

May, 2019

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Issue	Date	Detail of Changes
1	May, 2019	Initial issue

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EXECUTIVE SUMMARY

Overview

Faithful+Gould is the lead consultant for a proposed housing development project at Silk Street in Manchester, UK. The proposals will cause new tall structures to be introduced into the area – which could interact with wireless terrestrial television signals with the potential to 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.

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 22 May 2019 to confirm the relevant transmitter and record the signal quality.
- Terrestrial coverage is generally good in the proposed development shadow zone. The locations nearest the proposed development show very good signal strength and quality.
- 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 noticeable effects would likely be immediately southeast of the development (within a few hundred metres).

Recommendation

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

Mitigation

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. The most likely options, if 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.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 46 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

Faithful+Gould is the lead consultant for a proposed housing development project located at Silk Street in Manchester, UK. The proposals will cause new tall structures to be introduced into the area – which could interact with wireless terrestrial television signals with the potential to cause interference.

1.2 Development Description

The project comprises a new build of 75 modular homes, mixed between apartments and houses. Specifically:

- 21 houses (terraces).
- 54 apartments (mix between 1 and 2 beds).

The available plans show the apartment blocks will reach four storeys. Figure 1 below¹ shows the development site.



Figure 1 Proposed development site

¹ Provided to Pager Power by Faithful+Gould.

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

2.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 26 km northwest of the proposed development (published coordinates SD66051446). The main digital services provided are shown in Table 1 below.

	Public (PSB)			Commercial (COM)		
Service	BBC A	Digital 3&4	BBC B	SDN	Arqiva A	Arqiva B
Channel	50	59	54-	58	49	55
Power	100 kilo-Watts (kW)					

Table 1 Winter Hill main transmissions

Additional Winter Hill transmissions are shown in Table 2 below.

	Local Multiplexes			
Service	COM 7	COM8	LM/LL/LPR	GIM
Channel	31	37	56	57
Power	25.7 kW	22.6kW	2 kW	1 kW

Table 2 Winter Hill additional transmissions

2.3 Television Transmitter Location

Figure 2 below³ shows the relative location of the transmitter and the proposed development.

² Source: Ofcom

³ Copyright 2019 © Google, Landsat / Copernicus.



Figure 2 *Television transmitter and proposed development relative location*

3 BUILDINGS AND TELEVISION INTERFERENCE

3.1 Technical Overview

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

The quality of the image and sound on a television set is dependent on both the strength of the signal received directly from the transmitter (carrier signal) and the strength of any interference signals from other sources.

To achieve good quality reception an aerial must receive a strong carrier signal but weak interference signals.

There are two ways that buildings can cause interference to television reception, these are described below.

3.2 Obstruction of the Signal

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

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

The Ofcom document states that:

"In general, there will be three 'zones' behind the structure:

Zone A - close behind the structure (typically a few tens of metres) there may be a large reduction in signal level with a possible complete loss of reception

Zone B - further away (typically a few hundred metres) the signal reduction is less severe and the shadow will be smaller as diffraction effects partially fill in the shadow. Depending on the size of the structure, some locations could still lose reception completely

Zone C - some distance away (1-5km) the shadow will effectively have disappeared."

The zones mentioned are illustrated in Figure 3 below⁴, taken from Section 3.2 of an Ofcom paper⁵ regarding the impact of buildings on broadcast signals.

⁴ Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.

⁵ Reference as above.

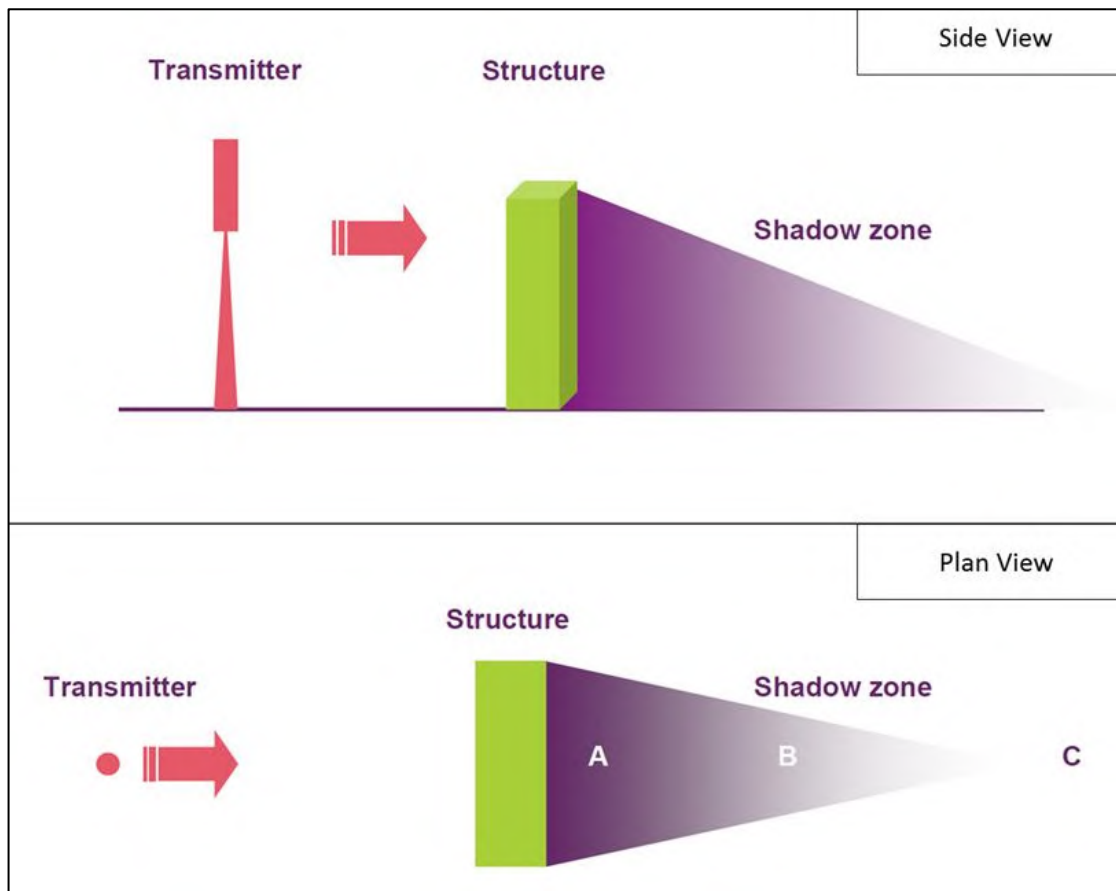


Figure 3 Diffraction Loss Zones

3.3 Reflection of the Signal

For large developments with straight edges, the transmitted signal can be reflected by the building itself. This causes an effect known as ‘multipath interference’ whereby the signal is received twice by an aerial at different times. The direct signal arrives first because it has a shorter distance to travel.

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

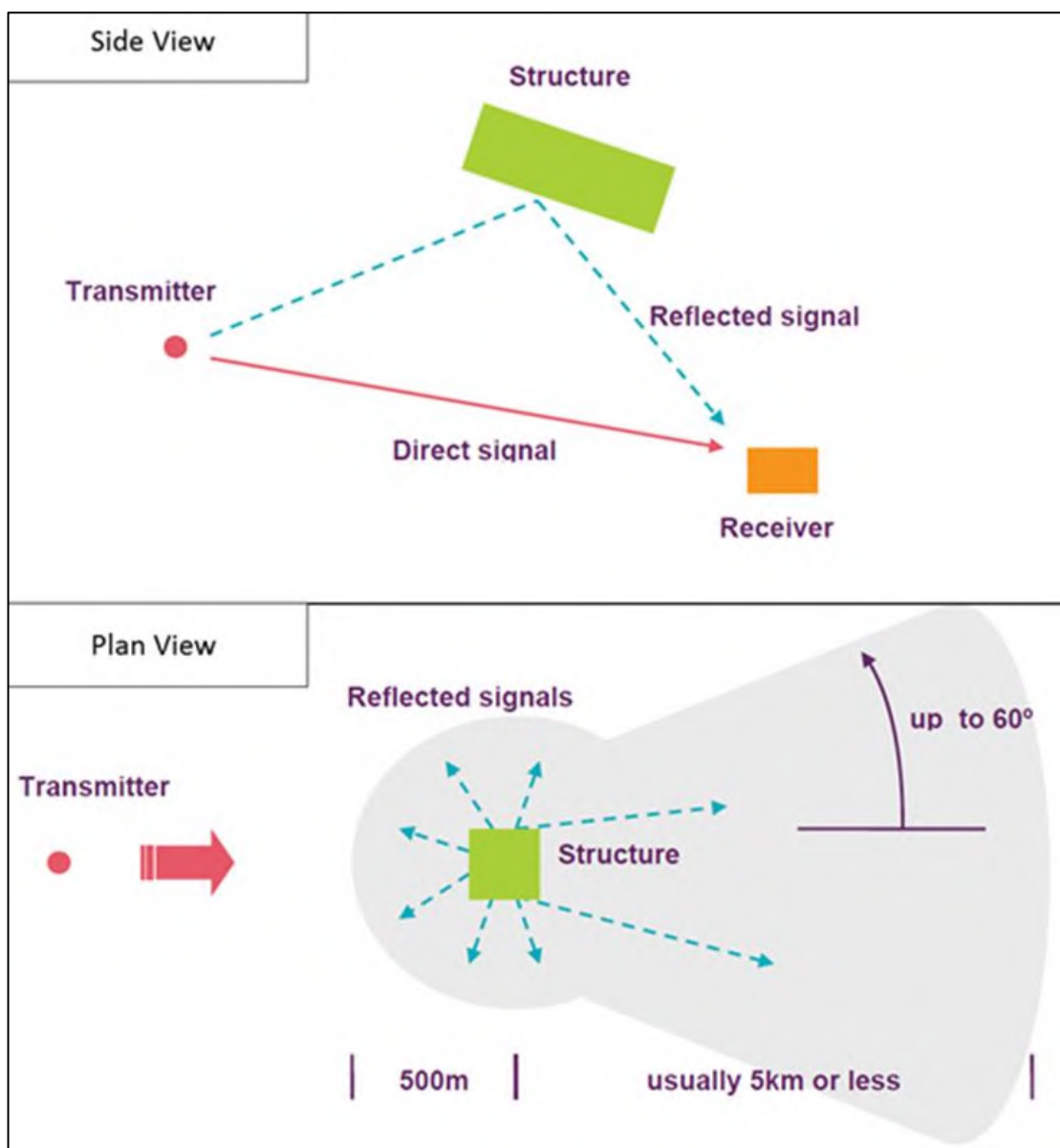


Figure 4 Diffraction Loss Zones

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 degrees⁶.

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 building is strong (e.g. clear radio line of sight from the transmitter to the building and the building to the receiver).

The worst case scenario is for both of the above conditions to be satisfied. The best case scenario is for neither of the above conditions to be satisfied.

4 TECHNICAL ASSESSMENT

4.1 Potential Interference Areas

Figure 5 below shows the potential interference areas associated with the proposed development. The 'shadow boundary' includes all development areas where a building may be present after all three phases are complete.

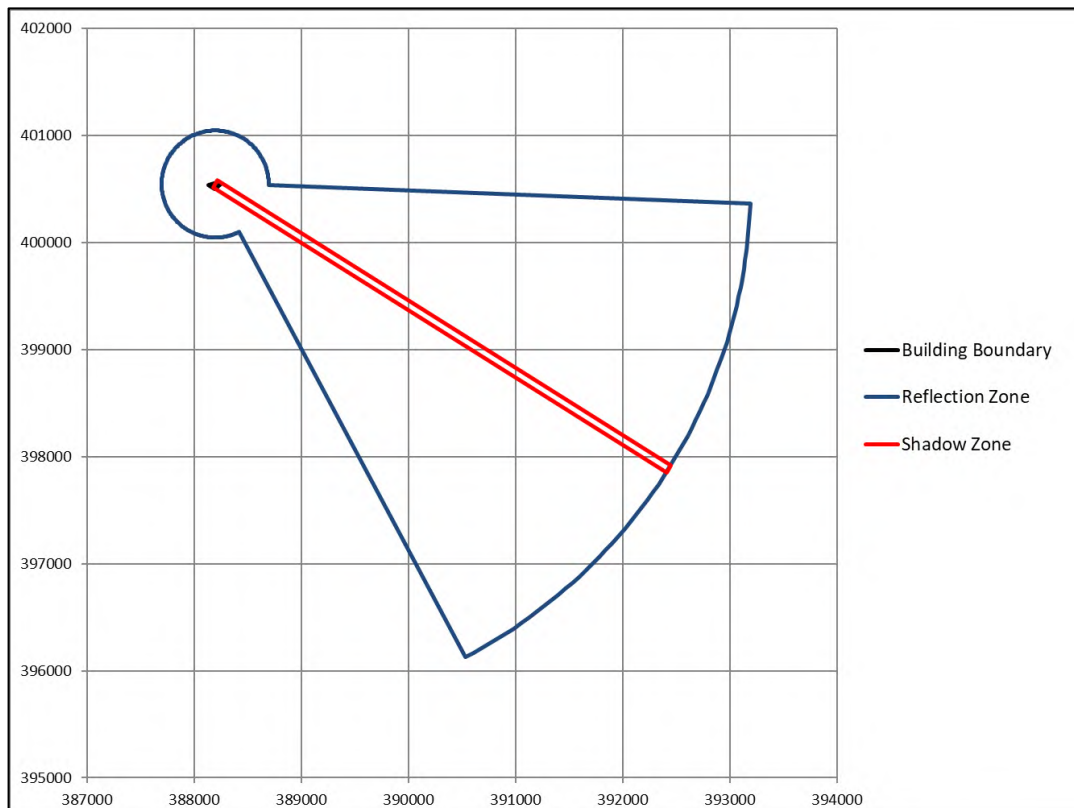


Figure 5 Interference areas

These have been defined based on the geometry of the potential interference zones as set out in the previous section. Both zones extend to a distance of 5km beyond the proposed development location in accordance with the Ofcom guidance.

In the case of the shadow zone, this has been modelled as having straight sides in order to be conservative. In actuality due to diffraction effects the zone would have a more triangular shape as shown in Figure 3 in the previous section.

Figure 6 below⁷ shows the interference zones overlaid onto an aerial image of the area.

⁷ Copyright 2019 © Google, Landsat / Copernicus.



Figure 6 Interference zones map

4.2 Potential Diffraction Issues

It can be seen that the shadow zone passes over urban areas that containing dwellings. Areas closest to the proposed development at the highest risk of experiencing television interference.

4.3 Potential Reflection Issues

Reflection effects are most likely if the transmitter does not have direct radio line of sight to the receiving aerial. Based on bare-earth terrain, the Winter Hill transmitter has coverage below ten metres for the vast majority of the reflection zone.

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 22 May 2019.

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 within Table 3 below.

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

Table 3 Television signal strength categories

5.2 Survey Locations

Figure 7 below⁸ shows the survey locations overlaid onto aerial photography. The proposed development location and the shadow zone are also shown. Survey locations were chosen pre-survey (within the shadow zone) however safe and available access influenced the specific position on the day. The locations below show the actual survey locations. The locations are deliberately closer together in the proposed development's immediate vicinity. This is because interference is generally more likely the closer the location is to the obstruction.



Figure 7 Survey locations

⁸ Copyright 2019 © Google, Landsat / Copernicus.

5.3 Survey Results

A summary of the survey results is presented in Table 4 below. 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	Main TV MUX: 61 (Very Good) Local TV MUX: 52 (Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with many satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	This location is within 150 metres of the proposed development. It is likely that the signal will be partially weakened by the proposed development. It is possible that the losses would not be noticeable in practice due to the current signal strength, however interference at this range cannot be ruled out. Interference is possible.
2	Main TV MUX: 67 (Very Good) Local TV MUX: 59 (Very Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with many satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	This location is approximately 300 metres from the proposed development. It is probable that the signal will be partially weakened by the proposed development. It is possible that the losses would not be noticeable in practice due to the current signal strength, however interference at this range cannot be ruled out. Interference is possible.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
3	Main TV MUX: 63 (Very Good) Local TV MUX: 57 (Very Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with some satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	This location is approximately 500 metres from the proposed development. Based on the scale of the proposed development and the quality of the existing signal, noticeable impacts are unlikely in practice. Interference is unlikely.
4	Main TV MUX: 57 (Very Good) Local TV MUX: 49 (Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with many satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	This location is approximately 1 km from the proposed development. Based on the scale of the proposed development and the quality of the existing signal, noticeable impacts are unlikely in practice. Interference is unlikely.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
5	Main TV MUX: 65 (Very Good) Local TV MUX: 59 (Very Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with some satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	It is highly unlikely that noticeable losses would occur at this range. No interference is predicted.
6	Main TV MUX: 66 (Very Good) Local TV MUX: 59 (Very Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with some satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	It is highly unlikely that noticeable losses would occur at this range. No interference is predicted.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
7	Main TV MUX: 59 (Very Good) Local TV MUX: 53 (Good)	Aerials directed towards the Winter Hill transmitter were observed at this location, along with many satellite dishes. All multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 0.5dB and no signs of interference.	It is highly unlikely that noticeable losses would occur at this range. No interference is predicted.

Table 4 Baseline survey results

6 MITIGATION

6.1 Mitigation Requirement

If an adverse effect on television services occurs and is attributable to the 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.

- 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 internet television.

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 due to the low risk of interference.

7 CONCLUSIONS

7.1 Findings

- Residences in the area surrounding the proposed development receive television services from the Winter Hill transmitter. The coverage quality is generally good in the surrounding area, including the immediate shadow zone.
- The proposed development will introduce a new structure that will have a shadowing effect to the south-southeast.
- Receiving aerials in the development's shadow, within a few hundred metres, may experience degradation of terrestrial television reception quality. The losses may not be noticeable in practice due to the scale of the proposed development (circa four storeys) and the current signal 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 most appropriate solution.
- No requirement for pre-emptive mitigation has been identified.

APPENDIX A – DETAILED SURVEY RESULTS

Location 1

Location 1 (GPS Coordinates: SD 88345 00467 +/- 18ft)					
Television					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	56.5 +/- 0.4	1*10-8	Fine	Fine
37	COM8	63.5 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	64.3 +/- 0.2	1*10-8	Fine	Fine
50	BBC A	65.3 +/- 0.3	1*10-8	Fine	Fine
54-	BBC B	64.0 +/- 0.2	1*10-8	Fine	Fine
55	Arqiva B	54.2 +/- 0.2	1*10-8	Fine	Fine
56	LM/LL/LPR	49.8 +/- 0.2	1*10-8	Fine	Fine
57	GIM	38.8 +/- 0.2	1*10-8	Fine	Fine
58	SDN	60.8 +/- 0.2	1*10-8	Fine	Fine
59	Digital 3&4	59.1 +/- 0.3	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. Horizontally polarised (HP) aerials orientated towards Winter Hill were observed. Many satellite dishes observed.

Location 2

Location 2 (GPS Coordinates: SD 88478 00376 +/- 31ft)					
Television					
Channel	Service	Signal Strength (dB μ V)	BER	Picture	Audio
31	COM7	64.0 +/- 0.2	1*10-8	Fine	Fine
37	COM8	73.2 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	71.0 +/- 0.2	1*10-8	Fine	Fine
50	BBC A	71.3 +/- 0.1	1*10-8	Fine	Fine
54-	BBC B	70.2 +/- 0.3	1*10-8	Fine	Fine
55	Arqiva B	61.2 +/- 0.2	1*10-8	Fine	Fine
56	LM/LL/LPR	56.8 +/- 0.2	1*10-8	Fine	Fine
57	GIM	43.8 +/- 0.2	1*10-8	Fine	Fine
58	SDN	65.3 +/- 0.2	1*10-8	Fine	Fine
59	Digital 3&4	63.8 +/- 0.2	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. HP aerials orientated towards Winter Hill were observed. Many satellite dishes were observed.

Location 3

Location 3 (GPS Coordinates: SD 88699 00219 +/- 34ft)					
Television					
Channel	Service	Signal Strength (dB μ V)	BER	Picture	Audio
31	COM7	65.6 +/- 0.1	1*10-8	Fine	Fine
37	COM8	70.2 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	66.2 +/- 0.2	1*10-8	Fine	Fine
50	BBC A	66.5 +/- 0.3	1*10-8	Fine	Fine
54-	BBC B	65.9 +/- 0.4	1*10-8	Fine	Fine
55	Arqiva B	57.0 +/- 0.3	1*10-8	Fine	Fine
56	LM/LL/LPR	53.0 +/- 0.3	1*10-8	Fine	Fine
57	GIM	40.1 +/- 0.3	1*10-8	Fine	Fine
58	SDN	61.6 +/- 0.3	1*10-8	Fine	Fine
59	Digital 3&4	61.0 +/- 0.2	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. HP aerials orientated towards Winter Hill were observed. Satellite dishes were observed.

Location 4

Location 4 (GPS Coordinates: SJ 89130 99943 +/- 33ft)					
Television					
Channel	Service	Signal Strength (dB μ V)	BER	Picture	Audio
31	COM7	57.7 +/- 0.3	1*10-8	Fine	Fine
37	COM8	62.7 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	60.8 +/- 0.2	1*10-8	Fine	Fine
50	BBC A	61.4 +/- 0.2	1*10-8	Fine	Fine
54-	BBC B	59.1 +/- 0.3	1*10-8	Fine	Fine
55	Arqiva B	49.2 +/- 0.2	1*10-8	Fine	Fine
56	LM/LL/LPR	45.2 +/- 0.2	1*10-8	Fine	Fine
57	GIM	32.0 +/- 0.2	1*10-7	Fine	Fine
58	SDN	55.6 +/- 0.2	1*10-8	Fine	Fine
59	Digital 3&4	54.0 +/- 0.2	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. HP aerials orientated towards Winter Hill were observed. Many satellite dishes were observed:

Location 5

Location 5 (GPS Coordinates: SJ 90019 99400 +/- 20ft)					
Television					
Channel	Service	Signal Strength (dB μ V)	BER	Picture	Audio
31	COM7	67.1 +/- 0.2	1*10-8	Fine	Fine
37	COM8	73.5 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	71.1 +/- 0.1	1*10-8	Fine	Fine
50	BBC A	71.8 +/- 0.2	1*10-8	Fine	Fine
54-	BBC B	70.0 +/- 0.2	1*10-8	Fine	Fine
55	Arqiva B	60.1 +/- 0.2	1*10-8	Fine	Fine
56	LM/LL/LPR	57.2 +/- 0.3	1*10-8	Fine	Fine
57	GIM	38.7 +/- 0.3	1*10-8	Fine	Fine
58	SDN	56.1 +/- 0.2	1*10-8	Fine	Fine
59	Digital 3&4	63.4 +/- 0.2	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. HP aerials orientated towards Winter Hill were observed. Satellite dishes were observed.

Location 6

Location 6 (GPS Coordinates: SJ 91062 98805 +/- 14ft)					
Television					
Channel	Service	Signal Strength (dB μ V)	BER	Picture	Audio
31	COM7	66.1 +/- 0.1	1*10-8	Fine	Fine
37	COM8	74.2 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	70.2 +/- 0.2	1*10-8	Fine	Fine
50	BBC A	71.0 +/- 0.2	1*10-8	Fine	Fine
54-	BBC B	67.9 +/- 0.3	1*10-8	Fine	Fine
55	Arqiva B	59.8 +/- 0.1	1*10-8	Fine	Fine
56	LM/LL/LPR	56.2 +/- 0.2	1*10-8	Fine	Fine
57	GIM	40.3 +/- 0.3	1*10-8	Fine	Fine
58	SDN	64.3 +/- 0.2	1*10-8	Fine	Fine
59	Digital 3&4	62.5 +/- 0.2	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. HP aerials orientated towards Winter Hill were observed. Satellite dishes were observed.

Location 7

Location 7 (GPS Coordinates: SJ 91749 98301 +/-34 ft)					
Television					
Channel	Service	Signal Strength (dB μ V)	BER	Picture	Audio
31	COM7	59.7 +/- 0.2	1*10-8	Fine	Fine
37	COM8	63.6 +/- 0.2	1*10-8	Fine	Fine
49	Arqiva A	63.1 +/- 0.2	1*10-8	Fine	Fine
50	BBC A	64.1 +/- 0.2	1*10-8	Fine	Fine
54-	BBC B	62.2 +/- 0.3	1*10-8	Fine	Fine
55	Arqiva B	53.1 +/- 0.3	1*10-8	Fine	Fine
56	LM/LL/LPR	47.5 +/- 0.3	1*10-8	Fine	Fine
57	GIM	40.7 +/- 0.2	1*10-8	Fine	Fine
58	SDN	55.9 +/- 0.3	1*10-8	Fine	Fine
59	Digital 3&4	55.6 +/- 0.3	1*10-8	Fine	Fine

Notes: Located in the outer city suburbs. HP aerials orientated towards Winter Hill were observed. Many satellite dishes were observed.

APPENDIX B – SURVEY PHOTOGRAPHS

Location 7



Location 6



Location 5



Location 4



Location 3



Location 2



Location 1





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