

GTech Surveys Limited

Television Reception Impact Assessment

121-131 Bell Lane, Bury

CHANGE HISTORY

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GTech Surveys Limited

GTech Surveys Limited is a Midlands based broadcast and telecommunications consultancy conducting projects throughout the entire UK. We undertake mobile phone network, television and radio reception surveys (pre- and post-construction signal surveys), conduct broadcast interference and reception investigations, and support telecommunications planning work for wind energy developers, construction companies, architects, broadcasters and Local Planning Authorities.

In addition to radio interference modelling services and television reception surveys, we produce EIA and ES Telecommunications Chapters (also known as an 'Electronic Interference Chapter'); satisfying the requirements of Part 5, Regulation 18 (Parts 5a and 5b) of The Town and Country Planning EIA Regulations 2017. We peer review ES and EIA work, liaising with telecommunications providers (Arqiva, BT etc.) and advise developers with respect to associated Section 106 (Town and Country Planning Act 1990) and Section 75 (Town and Country Planning (Scotland) Act 1997) agreements.

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Professional broadcast trained project engineers deliver, and supply QBE insured technical products to support planning applications, discharge planning conditions (including S106 Agreements) and for due diligence. For more information about GTech Surveys Limited please visit our website - www.gtechsurveys.com



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Executive Summary

A baseline (pre-construction) signal survey and reception impact assessment has been undertaken to determine the potential effects on the local reception of television broadcast services from the proposed 121-131 Bell Lane, Bury development. This report has been produced to assess the possibility of television interference and to provide the baseline reception data to assist with any further studies. Accordingly, impacts to the reception of digital terrestrial television (also known as Freeview) and digital satellite television services (such as Freesat and Sky), have been assessed. Impacts to the reception of analogue television services have not been assessed in this study because analogue terrestrial television services were switched off in Bury during 2009.

Due to the existing excellent coverage and the robust nature of reception conditions in any theoretical signal shadow zone, the Proposed Development is not expected to impact the reception of digital terrestrial television (Freeview) services.

The Proposed Development may cause minor disruption to the reception of digital satellite television services in areas to the immediate north and northwest of the application site, up to 41m from the base of the proposed building. In the identified area (Villiers Street in particular), the Proposed Development could obscure satellite dishes' views of the southern skies (where the satellites are located), resulting in interference. If this does occur, the repositioning of the dish to a location without an obscured line of sight view to the serving satellites would restore all services. If this is not possible the use of DTT receiving equipment would offer any affected viewer an alternative source of digital television broadcasts.

Overall, the Proposed Development may cause minor short-term interference to digital satellite television reception in localised areas around the application site, but mitigation solutions exist that will quickly restore the reception of affected television services, leaving no long-term adverse effects for any viewer. This report provides the existing level and quality television signal reception in the survey area and can be used to support planning matters.

1 - Introduction

This report outlines the findings of a comprehensive study and pre-construction signal reception survey to determine the viewing preference of residents located around the proposed 121-131 Bell Lane development in Bury and identifies what effects the Proposed Development may have on the local reception of television broadcast services. The Proposed Development comprises of the demolition of the existing building and erection of 24 no. apartments and 1 no. retail unit with 18 no. car parking spaces.

Local council requirements (Bury Council Checklist Criteria, 15 March 2020) request that a television reception impact assessment is undertaken for new buildings of four or more storeys in height. Requirement 25 states;

25. TV Impact Assessment - To assess the impact of proposals on adjoining properties in respect of TV reception.

Threshold:

All applications involving new buildings of four or more storeys in height, where adjoining other developed residential land,

And other developments if specified in pre-application advice.

A desktop study was first undertaken, based on broadcast transmission information, plans of the Proposed Development and maps of the area. The relevant TV signal survey area for the Proposed Development was identified and a site visit was then subsequently conducted to establish the baseline television reception conditions. Modelling techniques and field assessments of viewers' choice of television transmitter were then used to predict the potential effects upon television broadcast reception in the area. The impacts from the Proposed Development are consequently analysed, and together with various mitigation options, conclusions are drawn on the overall effects of the Proposed Development on television broadcast service reception for local residents. Figure 1 shows the location of the application site.

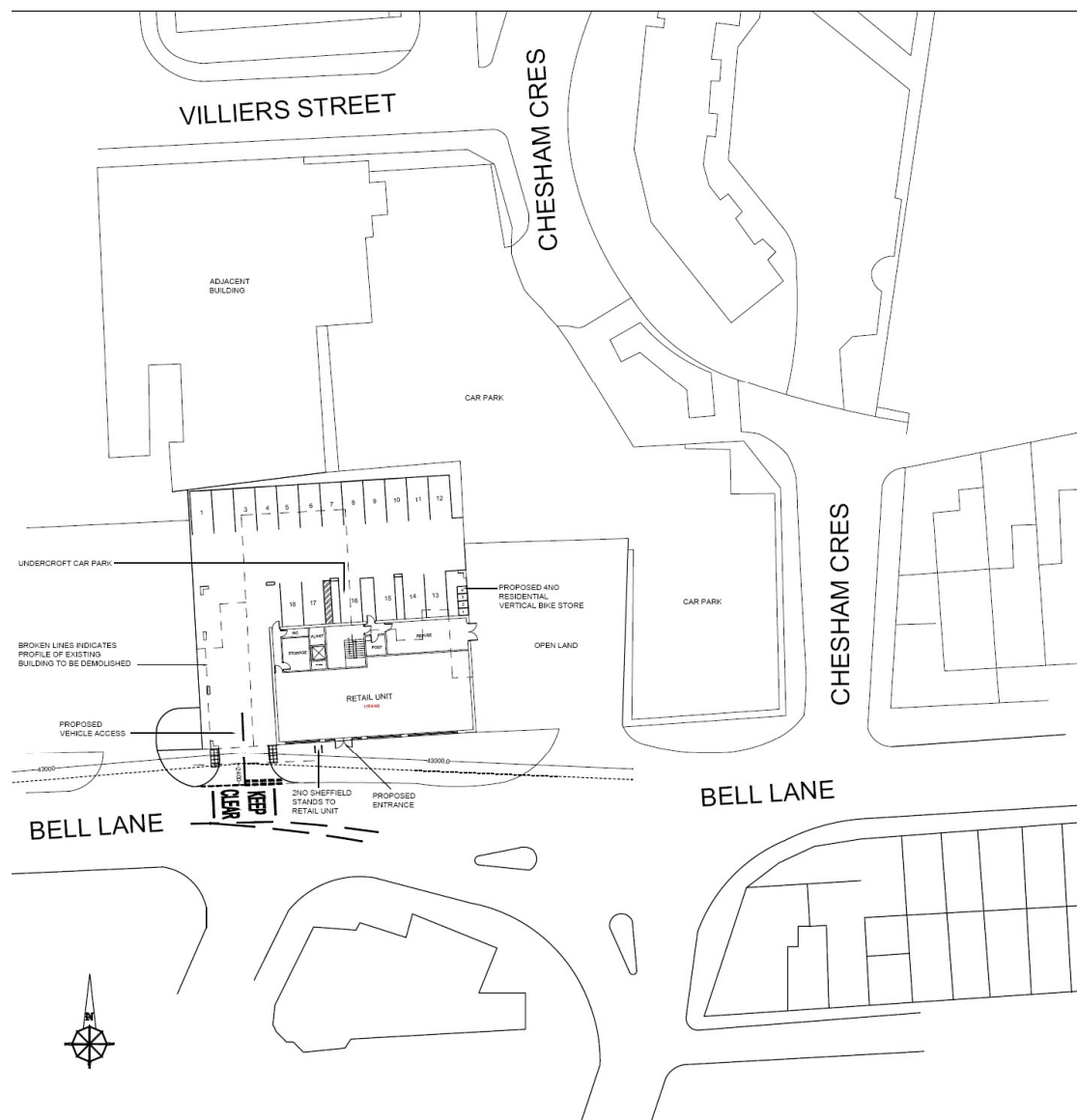


Figure 1 - The Location of the Site

This study was undertaken in December 2021 and January 2022 to investigate whether the Proposed Development could cause interference to local television broadcast reception. Subsequently, the effects on digital terrestrial television and digital satellite television service reception are discussed. The report also details the baseline reception conditions for future reference.

This report follows the following structure:

Chapter 1 introduces the work

Chapter 2 discusses the different forms of structure generated television interference and how these can impact the reception of different television broadcast platforms

Chapter 3 describes the available television services in the survey area

Chapter 4 describes the pre-construction television reception conditions around the application site

Chapter 5 describes the predicted impacts of the Proposed Development upon television broadcast reception before any mitigation measures are applied

Chapter 6 describes any suitable mitigation measures for any affected TV viewer

Chapter 7 presents the conclusion

2 - The Mechanisms of Interference to Television Broadcast Services

Terrestrial Television Services

Any structure will produce two zones of potential disruption to television reception. One zone is where the development creates a 'shadow' (affects all television broadcast platforms) and the other where it gives rise to a 'reflection'. At the frequencies used for broadcasting, the processes of creating a 'shadow' or a 'reflection' are somewhat more complicated than with visible light but thinking of the problem in these terms is still a helpful way of approaching the matter.

Signal 'Shadowing' Effects

In the area behind the structure, the television transmitter is effectively screened from the viewer and the strength of the signal is reduced - Figures 2 and 3.

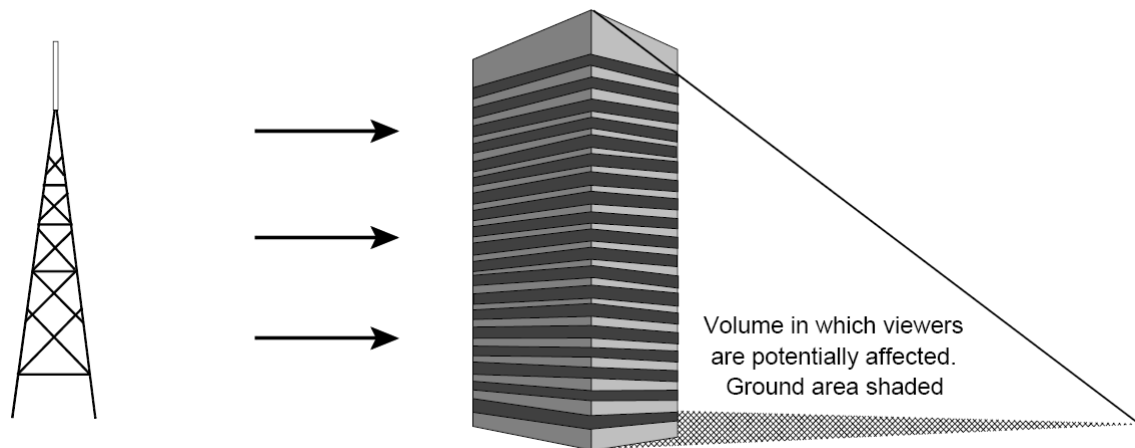


Figure 2 - Affected area in the 'shadow' zone behind the structure

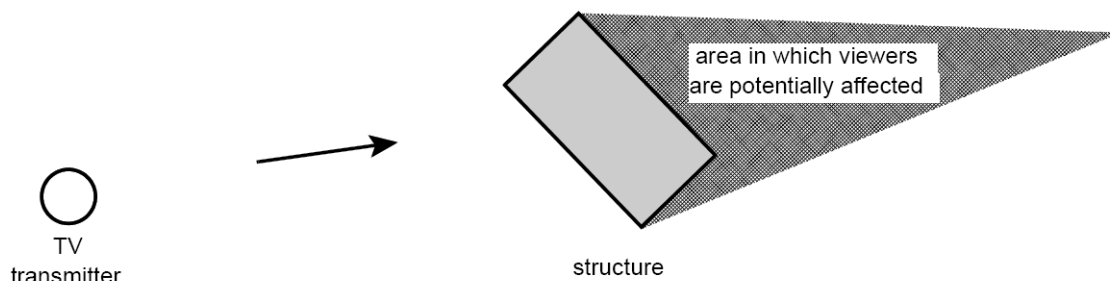


Figure 3 - Plan view of the 'shadow' zone

Television signals do not create such a 'hard' shadow as visible light, and for the purposes of explanation, a 'shadow' zone must be considered which is divided into three sub-zones.

i. Within a few tens of metres from a solid structure, over the region where optical view of the transmitter is lost, the reduction in signal strength is critically dependent on the specific design and composition of the structure. For most brick and concrete buildings, the reduction can be severe and, in some cases, almost total if existing reception conditions are poor.

ii. Further away from the structure (e.g. beyond 25 to 50 metres, but this varies depending on its size) the limit of the 'shadow' zone and signal reduction are determined by diffraction at the edges of the structure and reflection off surrounding structures. The simple condition of whether or not a location has an optical view of the transmitter is not enough to classify the potential interference zone adequately. In general, the effect is that the signal appears to bend around the sides of the structure; the shadow zone reduces in size and the signal strength is reduced by much less than simple ray optics would suggest.

iii. Even further away from the structure (e.g. 250m) complex multiple reflections and diffraction, caused by structures in the locality, may result in the 'shadow' zone becoming almost non-existent, against interfering signals that arrive on significantly different bearings. This can result in an increase in the ratio of wanted to unwanted signal as presented to the television receiver.

Signal 'Reflection' Effects

The second zone of potential interference is produced by 'reflection' or 'scattering' of the incident signal, see Figure 4.

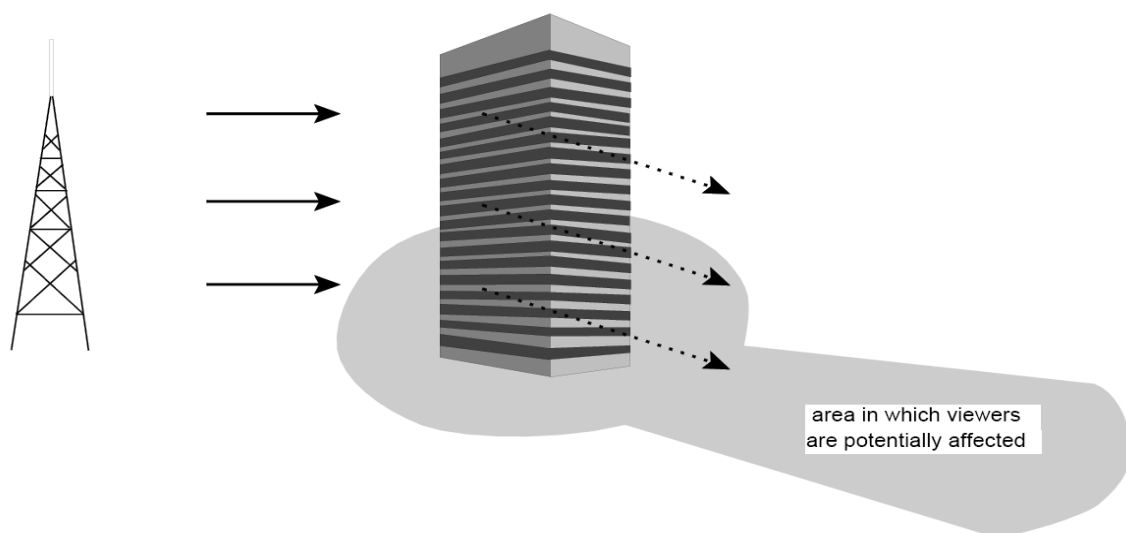


Figure 4 - Affected areas in the 'reflected' zone of the structure

Consider Figure 5, the direct signal travels a distance P1 to the viewer, whilst the signal reflected from the structure travels slightly further, distance (P2 + P3). Although travelling at the speed of light, the different path lengths can mean that one signal arrives with a significant delay relative to the other. This results in a degradation in signal quality.

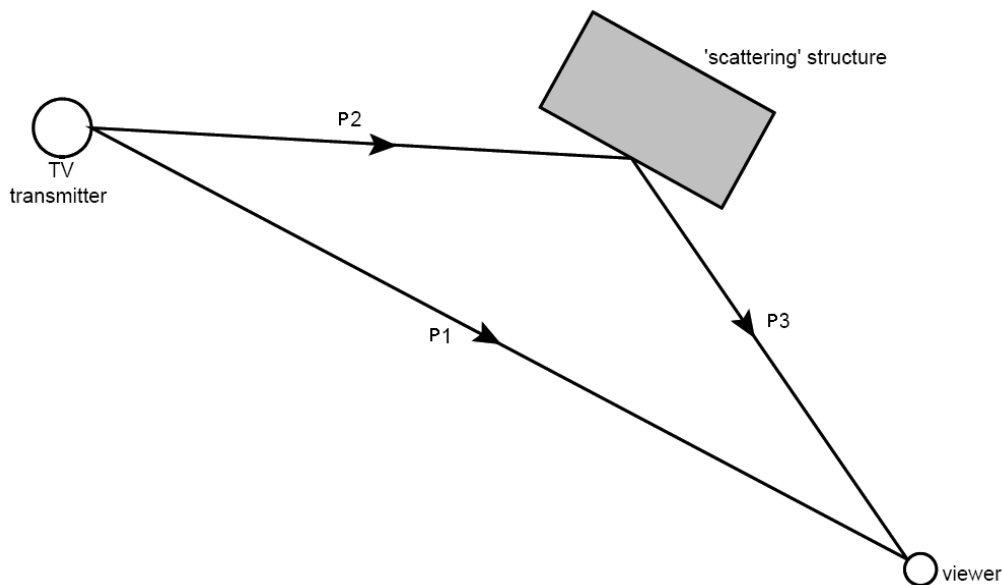


Figure 5 - Direct and Indirect Signal Paths

To avoid interference, it is necessary to ensure that the ratio of wanted signal along the direct path (P1) to the unwanted signal along indirect paths (P2+P3) is sufficiently high. Domestic TV receiving antennas generally have a significant directional response to incoming signals, which means that the antenna may discriminate against interfering signals that arrive on significantly different bearings. This can result in an increase in the ratio of wanted to unwanted signal, as presented to the television receiver.

Digital Terrestrial Television (DTT) - Freeview

The digital television broadcast platform offers many advantages over older analogue broadcast technologies. Due to the way picture signals are encoded and broadcast, digital television offers a much more resilient platform against interference. The construction of digital signals ensures that they are much more impervious to the effects of interference from indirect secondary reflections, which consequently ensures good quality and coherent data stream integrity at the receiver, resulting in an interference free picture. Disruption to DTT services is normally caused by a poor-quality receiving antenna system or locally generated wideband electrical noise. Signal blocking caused by buildings can also degrade received signal quality.

Digital Satellite Television Services - Freesat & Sky

Digital satellite television services are provided by geo-stationary earth orbiting satellites positioned above the equator. To ensure good reception of digital satellite television services, satellite receive antennas (satellite dishes) are normally positioned away from trees and other clutter and are orientated to face the southern (south-southeast) skies.

Disruption to digital satellite television services is normally caused by an obstruction on the line of sight from the satellite to the receive antenna e.g. a tall building or tall trees. Adverse weather can also influence reception. In the United Kingdom, Freesat and Sky services come from the 28.2 degrees east ASTRA satellite cluster.

Figure 6 below shows typical clearance distances and obstruction heights for interference free satellite television reception.

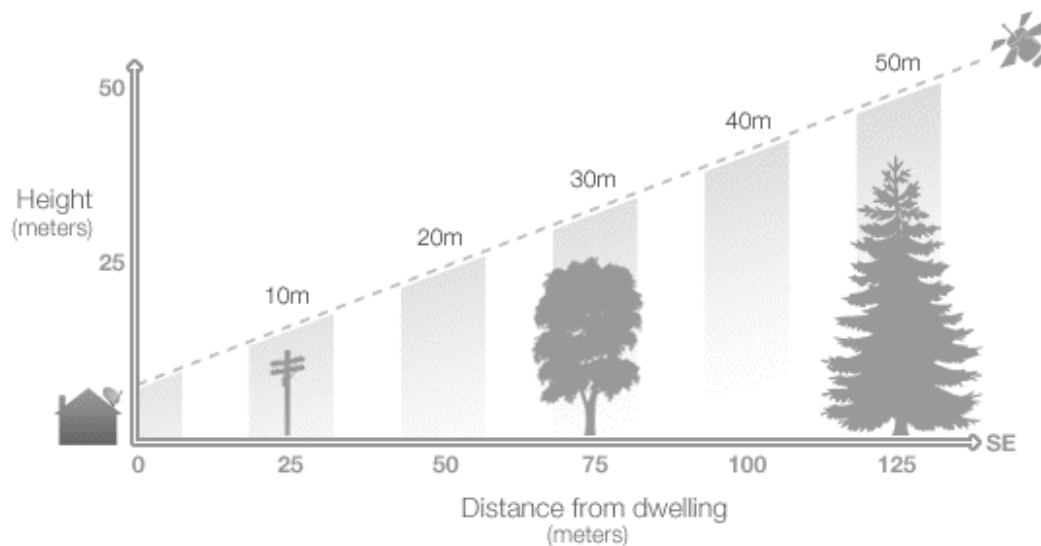


Figure 6 - Typical Clearance Distances and Obstruction Heights for Interference Free Satellite Television Reception

3 - Available Television Broadcast Services

Terrestrial Television Services

The area around the Site is no longer served by analogue television transmissions due to the completed Digital Television Switchover. All analogue services were switched off in the Granada television region during 2009.

Digital Terrestrial Television (DTT) - Freeview

The survey area is served by DTT services (Granada TV region) from the Winter Hill transmitter (grid reference SD 66053 14463), on a bearing of 281° (with respect to true north) and 16km away. The Winter Hill transmitter is shown with respect to the Site in Figure 7. Technical transmission information for each digital television service broadcast from the Winter Hill transmitter site is detailed in Table A, found in the Appendix - *Television Transmission Frequencies*.

Up to date technical information regarding the Granada TV region and Winter Hill transmitter group can be found on the Digital UK website - <http://www.digitaluk.co.uk>

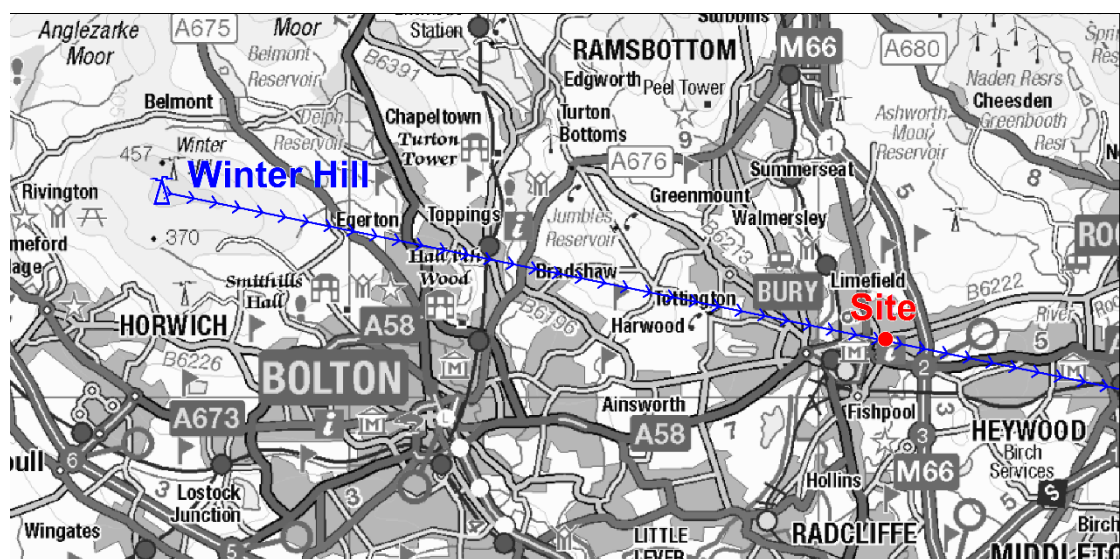


Figure 7 - The Locations of the Winter Hill Transmitter, the Site and the direction of the incoming DTT signals at the Site (indicated by the blue arrowed line)

Non-Terrestrial Television Services (Digital Satellite Television)

For the reception of the 28.2 degrees east ASTRA satellite cluster (Freesat and Sky services), dish elevations of 22.8 degrees are required at this latitude. Optimal receive dish azimuths are 143.8 degrees with respect to true north (approximately southeast).

4 - Survey Methodology & Description of Baseline

Due to the complex nature of television interference in cluttered urban environments, field investigations must be undertaken in the general area around a site to fully evaluate any potential effects. In this study, field measurements were undertaken up to one kilometre away from the Site, however, the study mainly focused around the application site and areas to the immediate east and northwest. Additionally, investigations are carried out in all areas where predicted (modelled) interference may occur. These are identified in Figure 8, and the measurements are detailed in Tables C and D, found in the Appendix - *Signal Measurements*. In particular, the following data was recorded:

- Field strength and technical signal measurements of DTT transmissions from the main serving transmitter
- Viewing preference (choice of television transmitter) of residents in all areas visited

All television measurements were carried out using a UHF log-periodic receive antenna, mounted on GTech Surveys's broadcast survey vehicle, at a receive height of 10 metres AGL (above ground level), industry standard height for such work.

During the survey, no assessment was made of reception conditions within viewers' homes. Equipment details are detailed in the Appendix - *Survey Equipment*.

Survey Results and Observations

In general, building use around the application site is mainly for commercial and residential use. When visible during the survey, all signal receive antenna systems are mounted on rooftops, ensuring optimal reception conditions. All terrestrial television antennas are directed towards the Winter Hill transmitter.

Digital Terrestrial Television - Freeview

DTT services were available at all surveyed locations from the Winter Hill transmitter. At all locations, received signal levels were in excess of recommended minimum amounts and the technical quality of received signals was found to be good¹. DTT services currently provide good coverage and service throughout the study area.

Digital Satellite Television - Freesat & Sky

During the survey a high number of satellite dishes were seen mounted on properties, particularly in residential areas and especially on Villiers Street. Dishes may have also been mounted on rooftops and at the rear of properties; however, these would not be visible from the street. No existing interference has been identified for any satellite television platform.

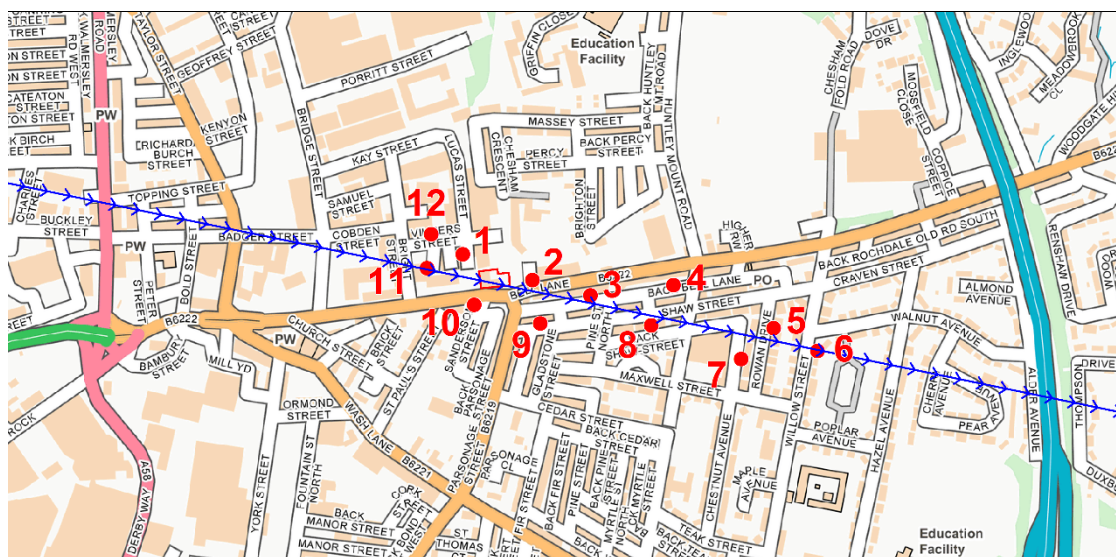


Figure 8 - Surveyed Locations. The blue arrows indicate the direction of the incoming DTT signals from Winter Hill transmitter. The Application Site is delineated in red

¹ - Signal levels as specified by the Code of Practice Confederation of Aerial Industries (CAI) COP 01 - Installation of Terrestrial and Satellite TV Reception Systems (MDU & Commercial), CAI, January 2021

Additional technical information regarding the Freeview signal can be found in the Appendix - An Overview of Signal Measurements

5 - Predicted Impacts and Effects

Methodology

To assess the effects of the Proposed Development upon television broadcast service reception, the structures were considered to create interference to services in the immediate areas around the Site, in signal reflection areas and in the signal shadow zones. These methods, used in conjunction with broadcast transmission information, development plans, maps of the study area and modelling techniques, contribute towards predicting the potential effects upon television broadcast reception in the study area.

The field survey then investigated the areas identified as being at risk of interference and assessed all available services and the transmitter viewing preferences of residents in order to determine if the computed risk is practically valid. The collected data was finally used to determine what actual risks exist and what viable solutions are available to minimise any adverse effects. The predicted effects are discussed below and summarised in Table 1.

Digital Terrestrial Television - Freeview

Digital television services are much less affected by signal reflections². Due to the existing excellent coverage in the survey area (arising from the proximity of the main regional transmitter) and the lack of antennas positioned in any signal shadow zones, the Proposed Development is not expected to have any adverse effect upon the reception of Freeview television services. No mitigation measures are required because no interference effects are thought to exist.

Digital Satellite Television - Freesat and Sky

Tall structures, trees and buildings can disrupt digital satellite television reception by causing obstructions on the line of sight to the signal receive dish from the serving satellite. This is discussed further in Chapter 2.

Using the mathematical tangent function and based on the maximum height of the Proposed Development, the angle and orientation of the incoming satellite signals, theoretical signal shadow zones for the 28.2E ASTRA satellite cluster are up to 41m from the base of the proposed building. This area extends in a northwesterly direction from the building's base and falls over Villiers Street, where a number of satellite dishes are located.

² - Whilst less prone to signal reflection generated interference, modelling parameters assume that all installed antenna systems are mounted at least 10m AGL and installed to a modern standard, with all components meeting CAI quality standards. Antennas mounted at lower heights and substandard installations will be more prone to the effects of interference from external sources.

Broadcast platform	Area(s) of predicted interference	Risk of interference & reasoning	Mitigation
DTT (Freeview)	Non-identified	No because coverage is robust and there are no viewers located in any at risk areas	Not required
Digital Satellite TV (Freesat & Sky)	Up to 41m in a northwesterly direction from the base of the proposed structure	Possible because there are satellite television dishes located in the theoretical signal impact area (Villiers Street)	Required if interference occurs

Table 1 - Summary of Predicted Interference

Predicted Effects - Conclusions

No interference to the reception of digital terrestrial television (Freeview) services is expected.

The Proposed Development may cause reception issues for the reception of digital satellite television services in areas to the immediate north and northwest of the application site within 41m from the base of the proposed building. Should satellite dishes be located in this area (especially on the walls of existing residential properties on Villiers Street), repositioning satellite dishes to new locations where views of the south-eastern skies are no longer obscured would restore services for any affected service. If this is required, it is advised that a registered antenna installer undertakes all required work. This is detailed further in Chapter 6. Additionally, the use of DTT receiving equipment would also offer viewers alternative sources of broadcasts, however this is unlikely to be required due to the ease of relocating satellite dishes to higher locations.

6 - Mitigation Measures

For any affected digital satellite television user to the north-northwest of the site (up to 41m and 325.4 degrees with respect to north from the base of the proposed building), relocating satellite dishes to new locations where views to the southeast horizon are no longer obscured would restore the reception of services. Affected digital satellite television viewers could also use DTT reception equipment to restore services.

It is recommended that all antenna work (antenna betterment, dish moving, relocating etc.) is undertaken by a registered installer (CAI accredited) and any system components used must be CAI benchmarked. More information regarding the Confederation of Aerial Industries & Registered Digital Installers can be found on the following websites -

The CAI's Website - <http://www.cai.org.uk/index.php>

The CAI's benchmarking scheme ensures that the cables and antennas have passed minimum requirements for the use of DTT and digital satellite television reception. The use on non-benchmarked products in an antenna system would degrade overall performance and effectiveness of the system, increasing the risk from interference. More information on CAI benchmarked products can be found on the CAI's website -

<https://www.cai.org.uk/index.php/services/product-certification-scheme>

7 - Conclusions

A desktop-based study and baseline reception survey have been performed to assess the possible effects and impacts on the reception of television broadcast services from the proposed 121-131 Bell Lane, Bury development. The study has focused on the reception of the two television broadcast platforms that could possibly be impacted by the Proposed Development; digital terrestrial television and digital satellite television services.

Digital Terrestrial Television (DTT) - Freeview

Due to existing excellent coverage and robust nature of the DTT signal in the surveys area, the Proposed Development is not expected to have any adverse effect upon the reception of Freeview television services.

Digital Satellite Television - Freesat & Sky

The Proposed Development may cause disruption to the reception of digital satellite television services in areas to the immediate north and northwest of the application site, up to 41m from the base of the proposed building. In this area the Proposed Development could obscure clear views of the southeastern skies, resulting in interference to received signals. If interference does occur, the repositioning of satellite dishes to new locations without an obscured line-of-sight view to the serving satellites would restore all services. If this is not possible (which is an unlikely outcome) the use of DTT receiving equipment would also offer any affected viewer an alternative source of digital television broadcasts.

Overall, the Proposed Development may cause some highly localised disruption to the reception of digital satellite television services to the immediate north and northwest of the site, particularly to residential buildings along Villiers Street. Should interference occur, moving satellite dishes to new locations out of any signal shadows should restore optimal reception conditions. This report provides the existing level and quality of television signal reception in the survey area.

APPENDIX

Television Transmission Frequencies

Signal Measurements

An Overview of Signal Measurements

Calculation of Received Field Strength

Survey Equipment

References

Mapping Data

Planning Policies – National Planning Policies

Television Transmission Frequencies

Digital TV Multiplex	Multiplex Operator	UHF Channel Number *	Channel Frequency Fc (MHz) **	Transmitter Power (kW)
BBC A	BBC	32	562.000	100.0
D3&4	Digital 3 & 4	34	578.000	100.0
BBC B - HD	BBC	35	586.000	100.0
SDN	SDN	29	538.000	100.0
Arqiva A	Arqiva	49	698.000	100.0
Arqiva B	Arqiva	37	602.000	100.0
COM7 - HD	Arqiva	55	746.000	22.9

Table A - Winter Hill Digital Terrestrial Television Services

Public Service Broadcaster (PSB) Digital Multiplexes
Commercial (COM) Digital Multiplexes

* - Digital multiplexes with a "+" or "-" sign operate with a frequency offset making the channel frequency + or - 167 kHz

** - The nominal channel frequency, Fc (in Megahertz) of the multiplex can be calculated using $F_c = 8n + 306$, where 'n' is the UHF channel number

Information correct at time of writing. Information provided by DigitalUK and Arqiva

Signal Measurements

Measurement Point Number	Channel Frequency Service	32	34	35	29	49	37	55
		562.00	578.00	586.00	538.00	698.00	602.00	746.00
		BBC A	D3&4	BBC B	SDN	Arqiva A	Arqiva B	COM7
1	FS	91.1	87.6	86.4	92.2	90.0	89.9	82.1
	CSI	22.6	20.3	-	19.2	20.9	21.4	-
	MER	30.3	30.9	-	31.4	30.9	31.3	-
2	FS	89.7	89.3	93.0	86.9	91.1	86.4	83.7
	CSI	20.7	22.7	-	22.4	24.4	20.1	-
	MER	30.1	29.5	-	30.5	30.9	31.9	-
3	FS	89.0	84.6	89.6	89.4	86.6	90.9	83.5
	CSI	27.3	25.1	-	19.8	21.4	23.6	-
	MER	30.2	33.0	-	30.5	31.6	30.4	-
4	FS	89.1	86.1	90.1	91.3	96.2	89.9	88.4
	CSI	20.1	23.2	-	21.7	19.4	19.9	-
	MER	32.1	30.3	-	30.7	29.5	31.0	-
5	FS	90.8	88.0	93.6	93.2	93.6	85.7	79.0
	CSI	18.8	19.6	-	19.4	20.2	24.9	-
	MER	31.9	31.9	-	30.9	30.0	31.0	-
6	FS	86.5	91.0	90.0	89.4	86.5	89.4	84.3
	CSI	20.4	18.9	-	20.1	16.7	17.8	-
	MER	32.2	30.3	-	30.8	30.9	31.1	-
7	FS	87.2	93.2	86.8	91.3	88.7	89.6	78.3
	CSI	20.6	22.1	-	17.2	20.2	21.5	-
	MER	31.0	29.3	-	30.9	30.0	32.1	-
8	FS	89.7	89.9	91.6	91.4	92.6	89.0	79.4
	CSI	19.5	17.8	-	23.4	23.7	17.9	-
	MER	30.9	32.0	-	31.3	30.6	30.5	-
9	FS	89.7	92.5	91.0	93.6	90.5	93.8	85.5
	CSI	21.5	28.6	-	21.3	19.4	19.9	-
	MER	31.7	31.4	-	29.6	32.0	32.3	-
10	FS	86.7	85.2	89.3	89.5	94.3	84.0	90.2
	CSI	24.9	24.5	-	19.8	20.2	27.7	-
	MER	31.8	31.2	-	29.8	30.7	29.7	-
11	FS	89.1	85.7	91.6	86.0	89.8	94.5	84.4
	CSI	19.4	26.9	-	21.7	18.1	29.0	-
	MER	31.1	30.2	-	29.3	31.8	28.4	-
12	FS	90.3	85.8	88.9	92.4	90.6	91.0	81.2
	CSI	17.7	18.3	-	20.2	24.7	23.4	-
	MER	32.8	31.2	-	30.5	31.9	31.7	-

Table C - Field Strength Measurements of Winter Hill Digital Television Services

Frequencies listed are in MHz

Field strength (FS) values are indicated in dB μ V/m

CSI Channel Status Information (%)

MER Modulation Error Ratio (dB)

An Overview of Signal Measurements

The first and easiest parameter to check is signal level (also referred to as amplitude or terminated signal strength). In many cases this gives a good indication of the available decoding margin, or the extent of any shortfall.

At the receiver input, the terminated level of a DTT signal is measured in the usual units of dB μ V (a maximum signal level of 70 dB μ V and a minimum signal level of 50 dB μ V). It is helpful to understand that the level of a DTT signal represents the total power of all the carriers in the Coded Orthogonal Frequency Division Multiplexing (COFDM) signal and not the level of each individual COFDM carrier. For satisfactory reception of digital signals, it is important the signals applied to the receiver are within these ranges. These maximum and minimum levels define a so-called window of operation for the receiver.

Common practice dictates that in order to measure the quality of a received DTT signal we have to look at one or more of the following parameters: Bit-Error Rate (BER), Channel BER (CBER), Carrier-to-Noise Ratio (CNR) and Modulation Error Ratio (MER). The Channel State Information (CSI) feature available in DTT measurement equipment is a very valuable tool providing additional insight into the quality of reception in a typical domestic or professional DTT installation.

Using the BER alone is an ill-advised “hit-or-miss” strategy because of the 'cliff-edge effect' characteristic of any digital TV system. A BER reading below the reference quasi error free (QEF) value of 2×10^{-4} might wrongly lead us to conclude that the receiving conditions are satisfactory.

However, the BER provides a very narrow signal measurement range. Even for vanishingly small BER readings, a small drop in the level of received DTT signal can push the DTT receiver over the digital cliff edge beyond the point of system failure. The CBER is closely related to the BER providing a wider signal measurement range. Depending on the type(s) of unknown disturbance(s) affecting our DTT installation (noise, co-channel or adjacent PAL, co-channel DTT, etc.), the CBER corresponding to the reference QEF BER of 2×10^{-4} varies between 4 and 7 in 100 [1]. Unfortunately, the CBER is not a reliable indicator of how far the digital cliff edge is.

DTT engineers need a tool with a wide measurement range that solves the shortcomings of the BER and CBER. This measurement tool should provide some estimate of the noise margin of the DTT installation. A first candidate comes to mind: CNR or, alternatively, its sibling the MER.

The CNR is defined as the ratio of the average RF power of the DTT signal to the power of the noise present in the UHF channel. Similarly, the MER is defined as the ratio of the average power of the DTT signal to the average power of the constellation errors. It can therefore be used to give a more direct indication of decoding margin when, as is often the case, there is co-channel

interference as well as noise in the channel. The higher the MER value, the **better** the reception conditions. Our measurement equipment provides a maximum MER measurement value of up to 35 dB.

In situations where there is no multipath propagation so that the channel frequency response remains reasonably flat, CNR and MER are in principle the same thing. In practice, the accuracy of the measured CNR is limited by the noise floor of the measurement equipment and by the presence of other disturbances on adjacent UHF channels. Likewise, both the receiver's noise floor and other issues resulting from its practical implementation degrade the MER estimate.

Channel State Information (CSI)

Some flavour of CSI is used internally by all commercial DTT receivers to achieve the recommended target system performance³. The CSI counts the effect of both the noise present in the channel and the shape of the transmission channel itself. In other words, the CSI gives a measure of the reliability of the received DTT signal. We measure the average of the CSI across the UHF channel occupied by the DTT signal. The higher the percentage value of CSI, the **less** reliable DTT reception is.

As explained, the CSI can be used as a means to measure the noise margin in a DTT installation. Let us call CSI_{QEF} the percentage CSI measured at the point where the measurement equipment displays the reference QEF BER. The noise margin in dB is then approximately given by –

$$NM \text{ (dB)} = \frac{CSI_{QEF} - CSI}{2.6}$$

This empirical approximation represents a good estimate for NM below 8dB. The CSI alone, on the other hand, has a wider measurement range, providing meaningful results for NM of up to 15dB.

³ - J. Lago-Fernández, "Using Channel State Information (CSI) to Characterize DVB-T Reception", IBC, Amsterdam, 12-17 September 2002

Survey Equipment

1 x Promax Prolink 4C Premium – Serial Number PK4COPAB11B /
060419030005 Running firmware version 2.47

1 x Sony Wide screen CRT Reference Receiver KV-16TIU – Serial Number
4014480

1 x Professional Broadcast Wideband Log Periodic 8 element antenna –
Amphenol Jaybeam (details below)

**Amphenol JAYBEAM**

468-860 MHz

A Log Periodic antenna designed for UHF Broadcast, TETRA and Cellular communications applications. This antenna is often used in a stacked array to form a rugged, high power, extended range antenna. Produced to the highest quality standards, these robust antenna designs will insure reliable operation in harsh environmental conditions.

Replace "x" with desired model number option.

LPU/Rx
V-Pol or H-Pol | Log Periodic | 70° | 7.9 dBd

Electrical Characteristics		
Frequency band	468-860 MHz	
Model number options (x)	Model Number LPU/R-N LPU/R-7/16	Connector type N-Female 7/16-DIN Female
Polarization	Vertical or Horizontal	
Horizontal beamwidth	70°	
Gain	7.9 dBd	
Impedance	50Ω	
VSWR	<1.3:1	
Maximum power	250 W	
Connector type	see model number options above	
Lightning protection	DC grounded	
Mechanical Characteristics		
Materials	Aluminium Alloy	
Dimensions (Length x Width)	1210 x 320 mm	47.6 x 12.6 in
Weight without bracket	3.5 kg	7.7 lbs
Mounting Options		
Mounting	Mounting bracket included to fit 38-50 mm dia. pipe.	



Technical Specification for an Amphenol Jaybeam Professional Broadcast Wideband Log Periodic 8-Element Antenna

All RF cables, interconnects and systems of professional quality and calibrated to determine feeder losses and antenna gains. These are factored into the results, providing accurate descriptions of actual field strength values at 10m AGL for each surveyed location – see *Calculation of Received Field Strength*

Calculation of Received Field Strength

The Field Strength (dBμV/m) is derived from the Terminated Level (dBμV) as measured at the input of the Promax measurement receiver in the survey vehicle.

Field Strength (dBμV/m) = Terminated Level (dBμV) – Aerial Gain (a) + Dipole Factor (b) + Feeder Loss (c)

where -

Dipole Factor (to matched load)	(b)	$20\text{Log}\left(\frac{2\pi}{\lambda}\right)$ <i>Where λ = Transmission Wavelength (m)</i>
Feeder Loss	(c)	3 dB
Aerial Gain (dB _{dipole})	(a)	10 dB

References

The building information found in Chapter 2 was sourced from the following Ofcom document –

http://licensing.ofcom.org.uk/binaries/spectrum/fixed-terrestrial-links/wind-farms/tall_structures.pdf

Mapping Data

This report includes mapping and mapping data provided by Ordnance Survey (OS), under the terms of the Open Government Licence, OS data Crown copyright and database copyright (2021).

Planning Policies - National Planning Policies

National Planning Policy Framework (NPPF), Ministry of Housing,
Communities & Local Government, July 2021

10. Supporting high quality communications

116. Local planning authorities should not impose a ban on new electronic communications development in certain areas, impose blanket Article 4 directions over a wide area or a wide range of electronic communications development, or insist on minimum distances between new electronic communications development and existing development. They should ensure that:

- a) they have evidence to demonstrate that electronic communications infrastructure is not expected to cause significant and irremediable interference with other electrical equipment, air traffic services or instrumentation operated in the national interest; and
- b) they have considered the possibility of the construction of new buildings or other structures interfering with broadcast and electronic communications services

DISCLAIMER

This Report was completed by GTech Surveys Limited on the basis of a defined programme of work and terms and conditions agreed with the Client. We confirm that in preparing this Report we have exercised all reasonable skill and care taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project.

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The UK's terrestrial television and radio networks are highly complex engineering systems and are constantly being modified, re-designed, upgraded and maintained. The reception conditions detailed in this report were those prevailing at the time of the survey in the study area. Engineering work at transmitter sites, weather conditions and the time of the year will influence the quality and coverage of terrestrial services and their susceptibility to interference. Whilst every effort was made to accurately measure and assess the available television and radio transmissions and services at the time of the survey, GTech Surveys Limited cannot assume that any part of the television or radio broadcast network or transmission from any transmitter was operating in required specification or correctly to any design criteria. The signal measurements undertaken during the survey work were used to define the possible impacts to television and radio reception for this project. Although best practice has been applied in understanding the potential impacts, due to the complex nature of the subject, GTech Surveys Limited is not accountable in anyway whatsoever if unpredicted impacts occur at any location anywhere in the study area.

Modelling parameters assume that all installed UHF antenna systems are mounted at least 10m AGL and installed to a modern standard, with all components meeting CAI quality standards. Antennas mounted at lower heights and poor-quality installations will be more prone to the effects of interference from external sources and as such, reception conditions to installations with the aforementioned characteristics have not been accounted for in any impact modelling. Consequently, properties with such installations may be prone to interference effects that have not been identified. Such installations are commonly found in camping and caravan parks, on bungalows and properties where it is not possible to attach an antenna to the exterior roof. Antennas mounted in lofts are also more prone to interference effects arising from the signal attenuation caused by roofing materials. Again, reception conditions to properties with the aforementioned antenna installation characteristics have not been accounted for in any impact modelling and as such, properties with these installations may be prone to interference effects that have not been identified.

Digital terrestrial television (Freeview) coverage may vary as a result of engineering works or any frequency changes authorised by Ofcom. We advise that consumers always check future reception predictions (<http://www.digitaluk.co.uk/coveragechecker/>) before buying TV equipment. GTech Surveys Limited, Ofcom and Digital UK are not responsible for household TV reception arrangements.

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