

GTech Surveys Limited

Television Reception Survey and Impact Assessment

Old Granada Studios (OGS)

CHANGE HISTORY

Issue	Date	Details of Changes
0.0	29/12/2021	Working draft
0.1	25/01/2022	First draft issue
Author: G Phillips		Reviewer: O Lloyd

Contents	Page
GTech Surveys Limited	
Executive Summary	
1 - Introduction	4
2 - The Mechanisms of Interference to Television Broadcast Services	7
3 - Available Television Broadcast Services	11
4 - Survey Methodology & Description of Baseline	12
5 - Predicted Impacts and Effects	14
6 - Mitigation Measures	16
7 - Conclusions	17
Appendix	18
Television Transmission Frequencies	
Signal Measurements	
An Overview of Signal Measurements	
Survey Equipment	
Calculation of Received Field Strength	
References	
Mapping Data	

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.

GTech Surveys Limited is a consultant member of the Trade Association for Content Delivery - (Confederation of Aerial Industries Ltd - CAI) and the RDI - the digital sector's professional body and trade organisation. We are listed on Constructionline and verified as a Safety Schemes in Procurement (SSIP) member by Safety Management Advisory Services (SMAS), making us compliant with the industry standard PAS 91:2013 + A1:2017.

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



GTech Surveys Ltd.
Accountancy House,
4 Priory Road,
Kenilworth,
Warwickshire,
CV8 1LL.

T: +44(0) 1926 744771



Executive Summary

A signal survey and reception impact assessment has been undertaken to determine the potential effects on the local reception of television broadcast services from the Old Granada Studios (OGS) development in Manchester.

A planning condition associated with the scheme states;

Studies with regard to television reception in the area containing the site shall be submitted to and approved in writing by the City Council as local planning authority to assess the impact of the development on television signal reception within the potential impact area identified in the approved TV and Reception Survey prepared by SCS Technologies within one month of the practical completion of the development and at any other time during the construction of the development if requested in writing by the City Council as local planning authority in response to identified television signal reception problems within the potential impact area. The study shall identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified TV and Reception Survey prepared by SCS Technologies as approved by the Local Planning Authority.

In addition to the development, the adjacent plots have been considered in this assessment. During March 2017, SCS Technologies undertook a signal survey in an area identified as being at risk of interference. This report has been produced to discharge the planning condition 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 Manchester (Granada TV region) during 2009 and throughout the rest of the UK by 2012.

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

Due to lack of viewers and satellite dishes in any theoretical signal shadow zone, the development will not cause any interference to local digital satellite television reception, such as Freesat and Sky.

Overall, the development is unlikely to cause any interference to the reception of any television broadcast platform. As no interference is expected or has occurred, no mitigation measures are required to restore the reception of any broadcast service.

1 - Introduction

This report outlines the findings of a reception impact assessment and signal reception survey to determine the viewing preference of residents located around the Old Granada Studios (OGS) development and identifies what effects the OGS development may have on the reception of television broadcast services. A planning condition associated with the scheme states;

Studies with regard to television reception in the area containing the site shall be submitted to and approved in writing by the City Council as local planning authority to assess the impact of the development on television signal reception within the potential impact area identified in the approved TV and Reception Survey prepared by SCS Technologies within one month of the practical completion of the development and at any other time during the construction of the development if requested in writing by the City Council as local planning authority in response to identified television signal reception problems within the potential impact area. The study shall identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified TV and Reception Survey prepared by SCS Technologies as approved by the Local Planning Authority.

In addition to the development, the adjacent plots have been considered in this assessment. The development is shown in Figure 1. The profiles of Zone 5 and Zone 6 are shown in Figure 2. During March 2017, SCS Technologies undertook a signal survey in an area identified as being at risk of interference. The SCS Technologies study area was well considered and as presented in Figure 3.

A desktop study was first undertaken, based on broadcast transmission information, plans of the development and maps of the area. The relevant TV and signal survey area for the 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 development are consequently analysed, and together with various mitigation options, conclusions are drawn on the overall effects of the development on television broadcast service reception for local residents.

This study was undertaken during December 2021 and January 2022 to investigate whether the development could cause interference to local television broadcast reception. 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 has been prepared by GTech Surveys Limited for the applicant.

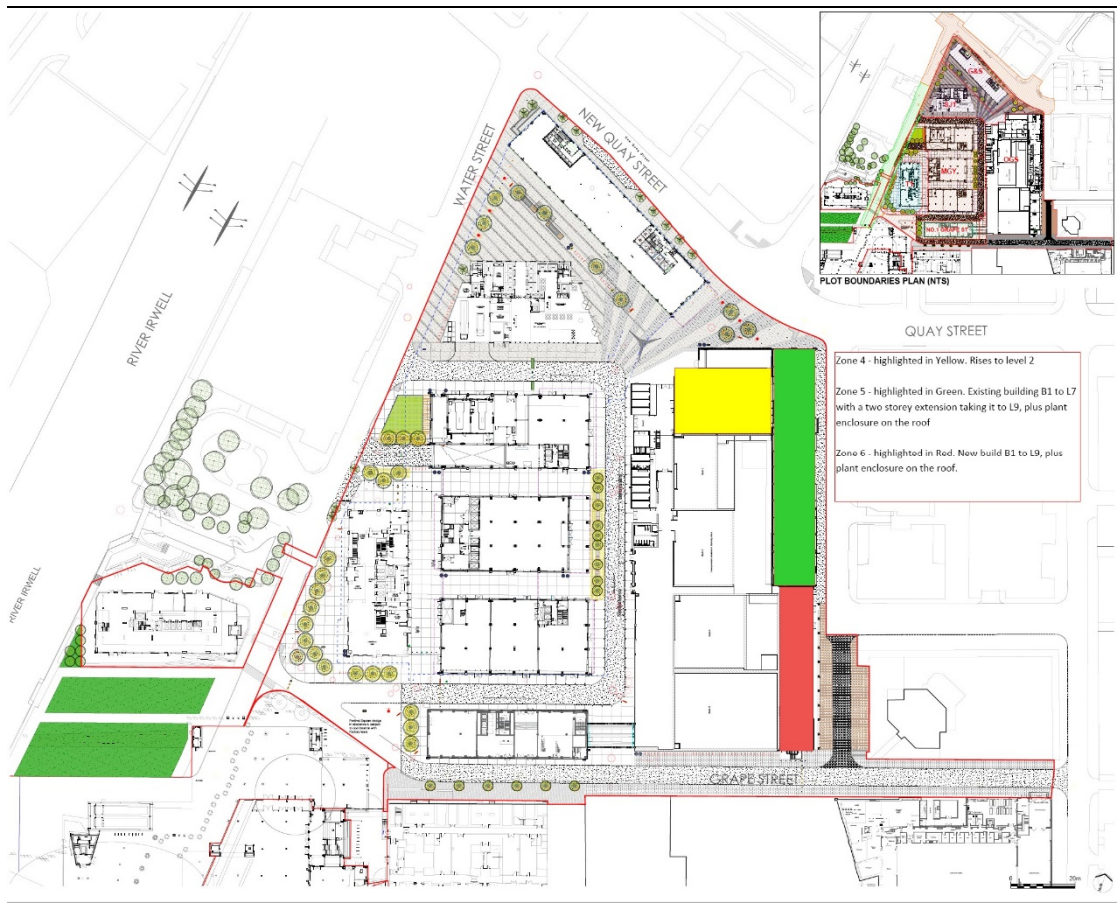


Figure 1 - Location of the OGS Development Plots indicated in Yellow (Zone 4), Green (Zone 5) and Red (Zone 6)

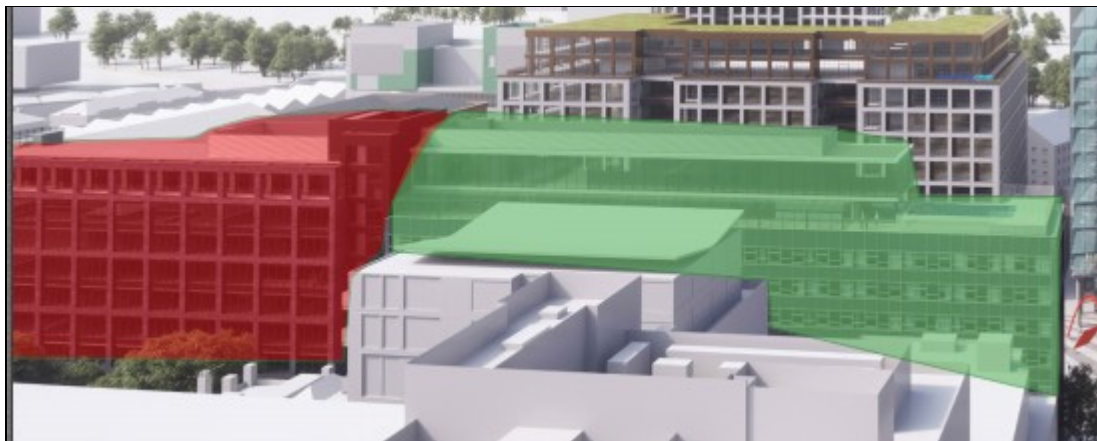


Figure 2 - Profiles of Zone 5 and Zone 6

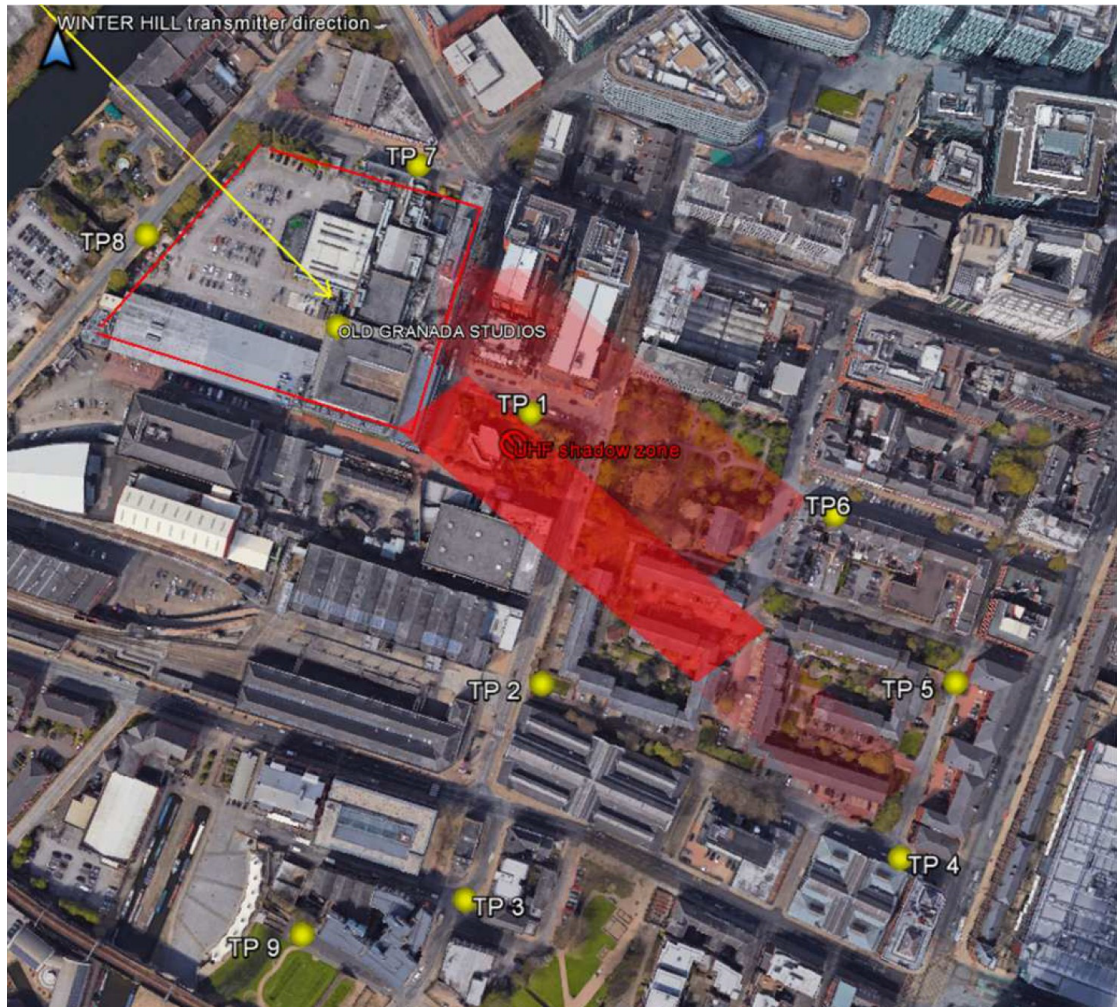


Figure 3 - The SCS Technologies Interference Area (defined in red). The yellow arrow indicates the direction of incoming signals from the main regional television transmitter at Winter Hill

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 television reception conditions around the Site

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

Chapter 6 describes any suitable mitigation measures for any affected TV viewer and a methodology to report and identify the cause of any interference

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 4 and 5.

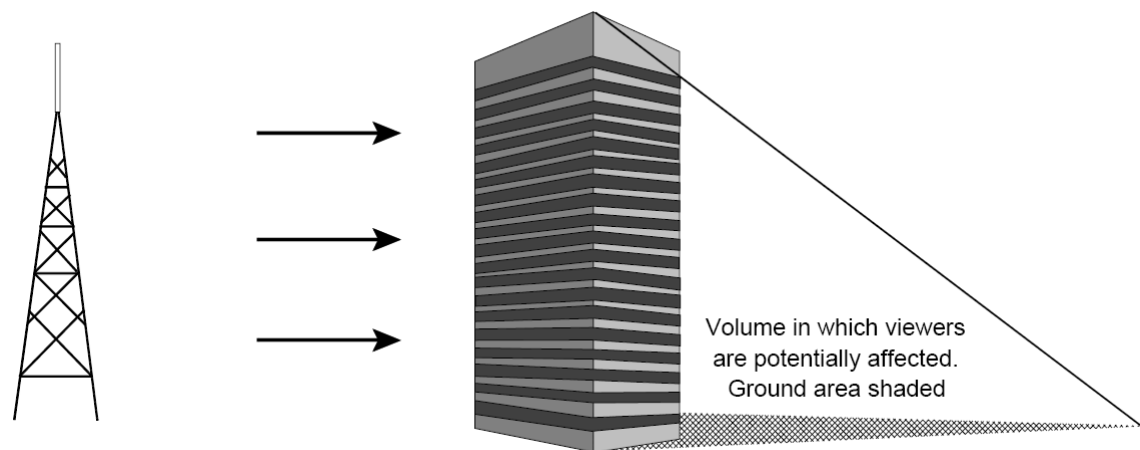


Figure 4 - Affected area in the 'shadow' zone behind the structure

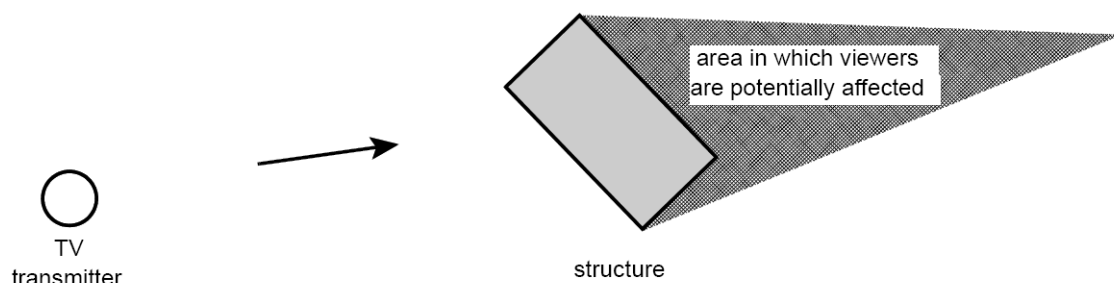


Figure 5 - Plan view of the 'shadow' zone

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 6.

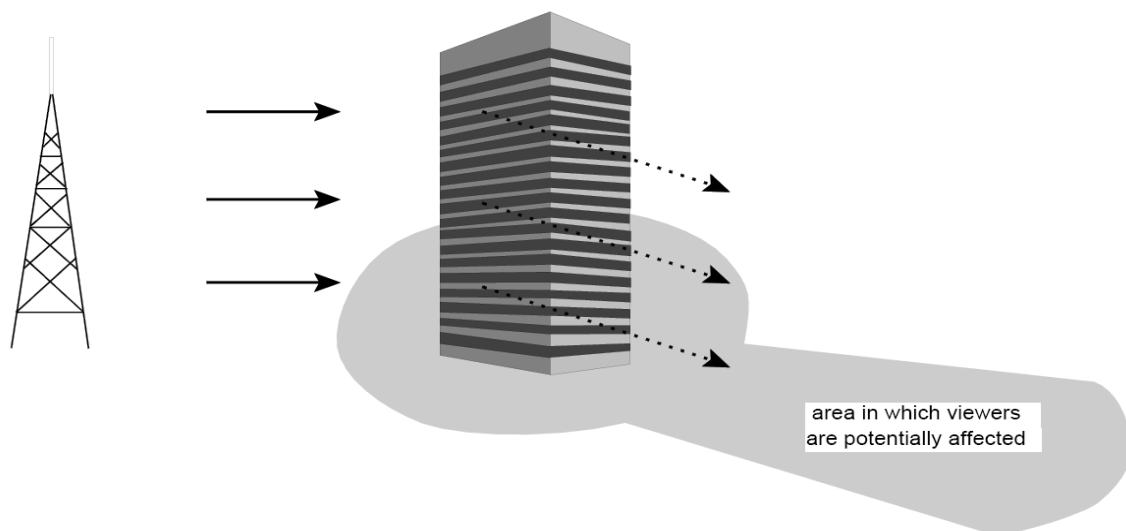


Figure 6 - Affected areas in the 'reflected' zone of the structure

Consider Figure 7, 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.

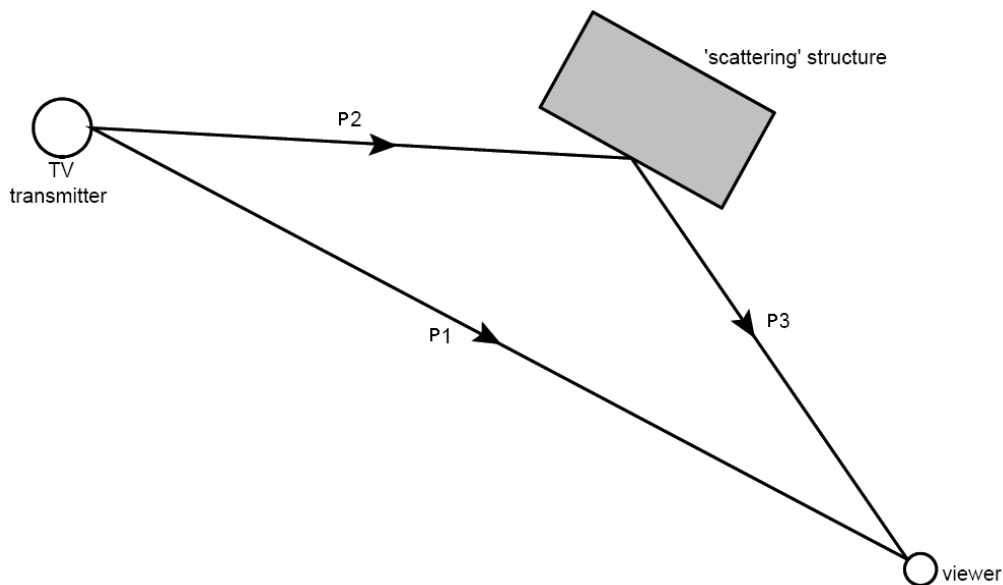


Figure 7 - Direct and Indirect Signal Paths

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

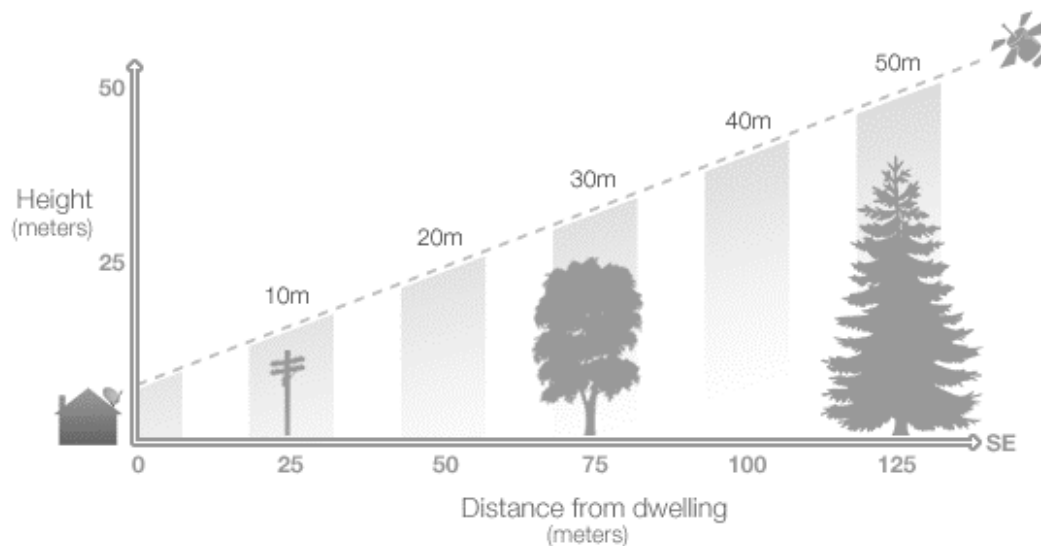


Figure 8 - Typical Clearance Distances and Obstruction Heights for Interference Free Satellite Television Reception

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 314° (with respect to true north) and 24km away.

The transmitter is shown with respect to the Site in Figure 9. Technical transmission information for each service at the aforementioned 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>

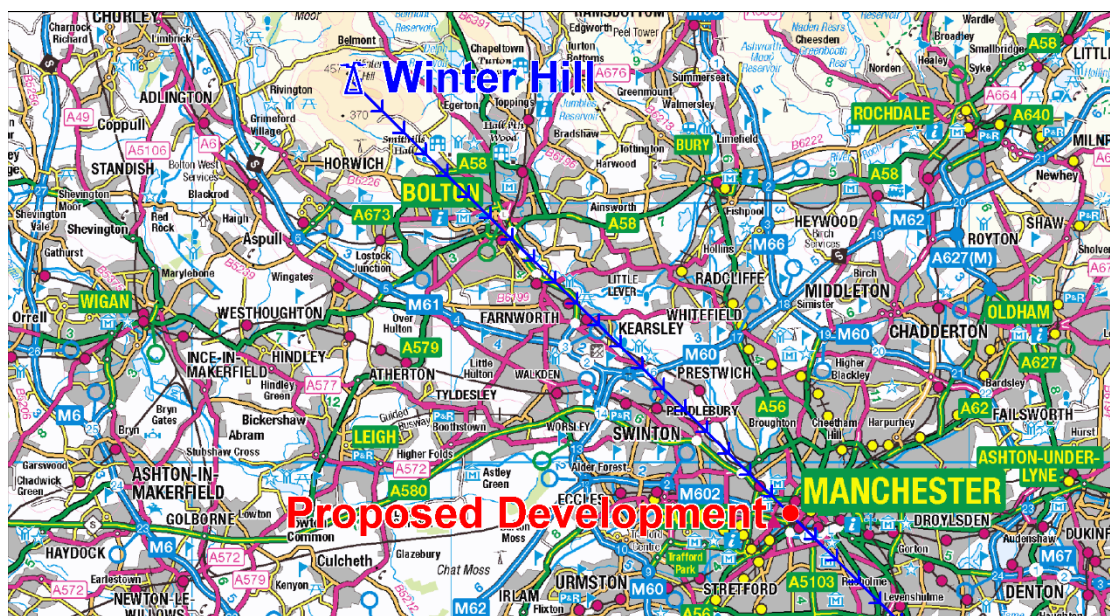


Figure 9 - The Location of the Winter Hill Transmitter, the Site's location and the direction of the incoming DTT signals at the Site

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 two kilometres away from the Site, however, the study mainly focused around the Site and areas to the immediate northwest and southeast. Additionally, investigations are carried out in all areas where predicted (modelled) interference may occur. These are identified in Figure 10, and the measurements are detailed in Table B, found in the Appendix - *Signal Measurements*. 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 above ground level (AGL), 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*.

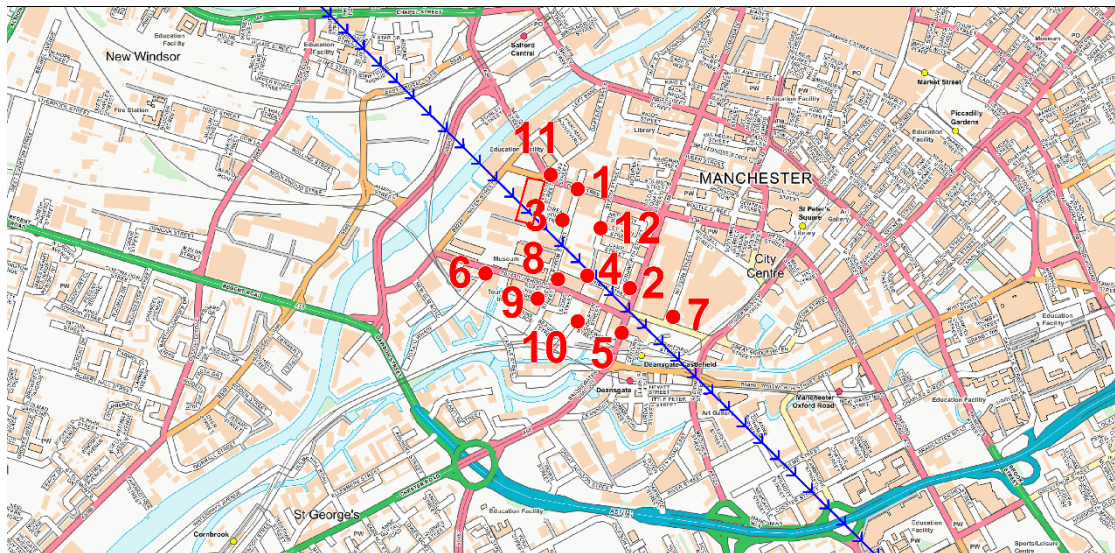


Figure 10 - Surveyed Locations. The blue arrows indicate the direction of the incoming DTT signals from Winter Hill transmitter. The Site is delineated in red

Survey Results and Observations

In general, building use around the Site is mainly for commercial and residential use. There are a number of tall and wide buildings located around the Site and construction work is being undertaken in the locality. When visible during the survey, all signal receive antenna systems are mounted on rooftops, ensuring optimal reception conditions. 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 very good coverage and service throughout the study area.

Digital Satellite Television - Freesat & Sky

Few satellite dishes were noted on the sides of buildings during the survey. Additional dishes may be mounted on rooftops and at the rear of properties; however, these would not be visible from any publicly accessible area. No existing interference has been identified for any satellite television platform.

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 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 on television broadcast reception 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 robust coverage in the survey area and lack of viewers in any theoretical signal shadow areas, the Development is not expected to cause widespread interference upon the reception of Freeview television services. No interference has occurred.

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.

As there are no satellite dishes located in any theoretical signal shadow areas, no interference will occur or has occurred.

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)	Non-identified	No because there are no satellite dishes / viewers located in any signal shadow areas	Not required

Table 1 - Summary of Interference

Predicted Effects - Conclusions

No interference to the reception of digital terrestrial television (Freeview) services is expected or has occurred

No interference to the reception of digital satellite television (Freesat and Sky) services is expected or has occurred

6 - Mitigation Measures

As no interference to the reception of any television broadcast platform has been identified or has occurred, no mitigation measures are required to restore broadcast service reception.

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 OGS development in Manchester. A planning condition associated with the scheme states;

Studies with regard to television reception in the area containing the site shall be submitted to and approved in writing by the City Council as local planning authority to assess the impact of the development on television signal reception within the potential impact area identified in the approved TV and Reception Survey prepared by SCS Technologies within one month of the practical completion of the development and at any other time during the construction of the development if requested in writing by the City Council as local planning authority in response to identified television signal reception problems within the potential impact area. The study shall identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified TV and Reception Survey prepared by SCS Technologies as approved by the Local Planning Authority.

During March 2017, SCS Technologies undertook a signal survey in an area identified as being at risk of interference. This study has focused on a similar area to assess the reception of the two television broadcast platforms that could possibly be impacted by the development - digital terrestrial television and digital satellite television services. In addition to the assessment of the development, the additional development zones have been assessed and conclusions have been drawn on the overall impacts and effects on local television reception.

Digital Terrestrial Television (DTT) - Freeview

Due to existing excellent coverage and robust nature of the DTT signal in the surveys area, the development is not expected to have any adverse effect upon the reception of Freeview television services. No interference has occurred.

Digital Satellite Television - Freesat & Sky

Due to lack of viewers and satellite dishes in any theoretical signal shadow zone, the development will not cause any interference to local digital satellite television reception. No interference has occurred.

Overall, the development is unlikely to have caused or will cause any interference to the reception of any television broadcast platform. As no interference is expected, no mitigation measures are required to restore the reception of any broadcast platform. 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

Survey Equipment

Calculation of Received Field Strength

References

Mapping Data

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	87.6	86.4	83.1	89.6	89.1	89.2	81.6
	CSI	20.9	19.2	-	18.5	19.8	20.3	-
	MER	29.6	30.8	-	31.4	30.9	31.4	-
2	FS	86.6	88.0	90.7	85.3	90.2	85.1	80.2
	CSI	19.7	20.9	-	21.2	23.5	19.3	-
	MER	30.5	29.4	-	30.2	30.3	32.0	-
3	FS	85.9	82.4	89.4	88.5	84.7	87.6	81.0
	CSI	26.3	24.0	-	18.3	20.6	22.4	-
	MER	30.0	33.0	-	30.1	31.8	31.0	-
4	FS	86.2	85.2	87.3	90.0	94.1	88.5	85.8
	CSI	19.1	23.1	-	20.4	17.9	18.4	-
	MER	32.3	30.2	-	30.9	29.9	30.9	-
5	FS	89.0	85.0	92.4	90.0	90.5	83.6	77.5
	CSI	17.6	18.2	-	18.9	19.4	24.5	-
	MER	32.6	32.0	-	31.0	30.6	30.7	-
6	FS	84.3	89.6	88.5	85.8	84.2	87.5	81.9
	CSI	19.7	17.2	-	19.0	15.8	17.3	-
	MER	31.9	30.3	-	30.2	30.7	31.3	-
7	FS	86.3	89.7	83.9	87.7	86.9	88.2	78.0
	CSI	20.1	20.8	-	17.1	19.8	20.7	-
	MER	31.1	29.7	-	31.0	30.1	32.4	-
8	FS	88.2	86.5	88.7	90.9	90.5	87.7	78.8
	CSI	19.4	16.8	-	21.9	22.1	16.5	-
	MER	30.6	32.1	-	30.9	30.8	30.3	-
9	FS	87.7	90.5	89.7	91.7	87.6	91.1	84.9
	CSI	20.6	27.2	-	20.5	18.4	18.7	-
	MER	31.6	31.3	-	29.4	31.3	32.8	-
10	FS	83.4	82.2	86.9	87.6	93.7	80.3	88.4
	CSI	23.4	23.8	-	18.6	19.6	26.8	-
	MER	31.7	31.5	-	29.9	31.0	28.8	-
11	FS	86.0	84.8	89.4	84.9	89.4	90.7	83.1
	CSI	19.0	26.0	-	21.1	16.8	27.8	-
	MER	31.6	30.4	-	29.9	31.6	29.0	-
12	FS	87.4	85.1	87.5	90.8	88.9	88.6	78.7
	CSI	17.1	17.6	-	18.7	23.5	22.2	-
	MER	32.4	31.5	-	30.8	32.1	31.6	-

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).

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.

GTech Surveys Limited accepts no responsibility to any parties whatsoever, following the issue of the Report, for any matters arising outside the agreed scope of the works. This work was conducted under GTech Surveys Limited's standard terms and conditions which can be found on our website.

This Report is issued in confidence to the Client and GTech Surveys Limited have no responsibility to any third parties to whom this Report may be circulated, in part or in full, and any such parties rely on the contents of the report solely at their own risk.

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.

Unless specifically assigned or transferred within the terms of the agreement, the consultant asserts and retains all Copyright, and other Intellectual Property Rights, in and over the Report and its contents.

Any questions or matters arising from this Report should be addressed in the first instance to the Project Manager.