GTech Surveys Limited

Planning Condition 37
Television Signal Reception Assessment

Downley Drive

CHANGE HISTORY

Issue	Date	Details of Changes	
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Author: G Phillips			Reviewer: O Lloyd

Issue: 0.1

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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 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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Executive Summary

A post-construction television signal survey and reception impact assessment has been undertaken to determine the effects on local television reception arising from the practical completion of the Downley Drive development. The work has been conducted to discharge planning condition 37:

> *Notwithstanding the TV reception survey prepared by GTech, stamped as received by the City Council, as Local Planning Authority, on the 22 August 2023, 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, a study shall identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified in the survey carried out above. The measures identified must be carried out either before the building is first occupied or within one month of the study being submitted to the City Council as local planning authority, whichever is the earlier.*
>
> *Reason - To provide an indication of the area of television signal reception likely to be affected by the development to provide a basis on which to assess the extent to which the development during construction and once built, will affect television reception and to ensure that the development at least maintains the existing level and quality of television signal reception - In the interest of residential amenity, as specified in policy DM1 of Core Strategy.*

During August 2023, a pre-construction signal survey and television reception impact assessment was undertaken to assess the possible reception impacts within the study area. Overall, coverage was found to be acceptable throughout the study area.

During September 2026, the survey area was visited again to assess the post-construction reception conditions and to determine if the development had caused any signal interference or television reception degradation. It has been concluded that through the assessment of available signal levels and signal qualities, while come changes to signal levels have been noted, signal decoding is still possible. It should be noted that no interference reports were received during the construction phase of the development and no mitigation has been requested so far. Consequently, it is unlikely that any interference has occurred. The post-construction survey and television reception assessment has been undertaken to fully discharge planning condition 37.

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1 - Introduction

This report details the findings of a desk-based study and post-construction signal survey to determine what impacts and effects the Downley Drive development has had on local television reception to satisfy the requirements of an associated planning condition. Planning condition 37 states;

> *Notwithstanding the TV reception survey prepared by GTech, stamped as received by the City Council, as Local Planning Authority, on the 22 August 2023, 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, a study shall identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified in the survey carried out above. The measures identified must be carried out either before the building is first occupied or within one month of the study being submitted to the City Council as local planning authority, whichever is the earlier.*
>
> *Reason - To provide an indication of the area of television signal reception likely to be affected by the development to provide a basis on which to assess the extent to which the development during construction and once built, will affect television reception and to ensure that the development at least maintains the existing level and quality of television signal reception - In the interest of residential amenity, as specified in policy DM1 of Core Strategy.*

A signal reception survey has been conducted to assess the existing reception conditions around the Site.

During August 2023, a pre-construction signal survey and television reception impact assessment was undertaken to assess the possible reception impacts within the study area.

During September 2026, the study area was visited again to assess the post-construction reception conditions and to determine if the development had caused any signal interference or reception degradation. During the survey, signal measurements were undertaken to record the existing reception conditions and signal levels. Analysis has been undertaken to assess the differences between the pre-construction and post-construction survey data to determine what impacts the development has had on local television reception conditions. The effects on digital terrestrial television and digital satellite television reception have been assessed. This report concludes by summating the what overall effects the development has had on television reception for local residents.

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This report follows the following structure:

Chapter 1 introduces the work and the associated planning condition requirement

Chapter 2 describes the pre-construction and post-construction television services in the survey area; the locations of local transmitters, the situation regarding the ongoing digital television upgrade project, the orientation of incoming signals etc.

Chapter 3 describes the pre-construction and post-construction television reception conditions around the development and within the survey area from the results of the pre-construction survey and March 2026 post-construction survey and assessment

Chapter 4 identifies any differences between the pre-construction and post-construction survey data

Chapter 5 identifies any suitable mitigation circumstances and measures for any potentially affected television user

Chapter 6 presents the conclusion

This study was undertaken during September 2026. The report details the existing reception conditions for future reference and can be used to discharge the associated planning condition (37).

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2 - Pre-Construction and Post-Construction Television Services

Pre-Construction Television Services

Analogue Terrestrial Television Services

The area around the Site was not served by analogue television transmissions due to the completed Digital Television Switchover. All analogue services were switched off in Manchester and the Granada television region during 2009.

Digital Terrestrial Television (DTT) - Freeview

The survey area was served by DTT services (Granada TV region) from the Winter Hill DTT transmitter (grid reference SD 66053 14463), on a bearing of 309° (with respect to true north) and 25 km away from the Site. The transmitter is shown relative to the Site in Figure 1.

Technical transmission information for each service at the aforementioned transmitter site is detailed in Table A, found in the Appendix - *Television Transmission Frequencies*.

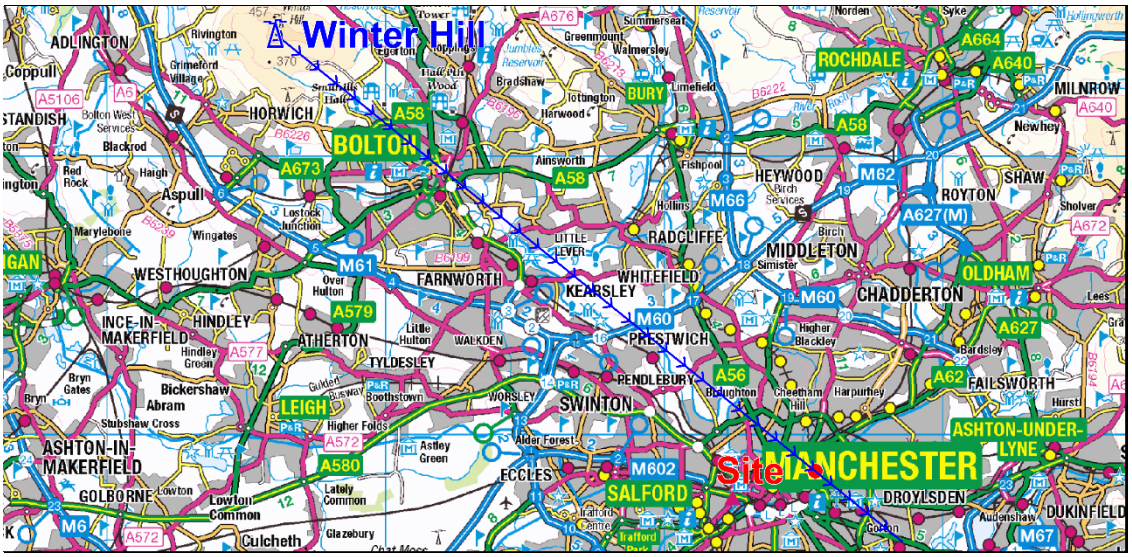


Figure 1 - The Location of the Winter Hill DTT transmitter, the location of the Site and the direction of the incoming DTT signals at the Site (shown by the blue arrow)

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.

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Post-Construction Television Services

Analogue Terrestrial Television Services

The areas around the Site are not served by analogue television transmissions.

Digital Terrestrial Television (DTT) - Freeview

The area is still served by DTT services from the Winter Hill transmitter. Since the pre-construction survey (2023), no significant technical changes have occurred to DTT transmissions emanating from the Winter Hill DTT transmitter.

Technical transmission information for each service at the Winter Hill DTT transmitter site is detailed in Table A, found in the Appendix - *Television Transmission Frequencies.*

Non-Terrestrial Television Services (Digital Satellite Television)

For the reception of the 28.2 degrees east ASTRA satellite cluster, dish elevations of 22.8 degrees are still required at this latitude. Optimal receive dish azimuths are still 143.8 degrees with respect to true north.

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3 - Pre-Construction and Post-Construction Signal Surveys

Pre-Construction Survey Overview

The pre-construction survey was undertaken during summer 2023. 10 locations were visited within the possible signal shadow areas. In this study, measurements were undertaken up to two kilometres from the Site, however, the study mainly focused around the Site and areas to the immediate northwest and southeast, the areas where predicted (modelled) interference was considered. These locations are identified in Figure 2, and the measurements are detailed in Table B, 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*.

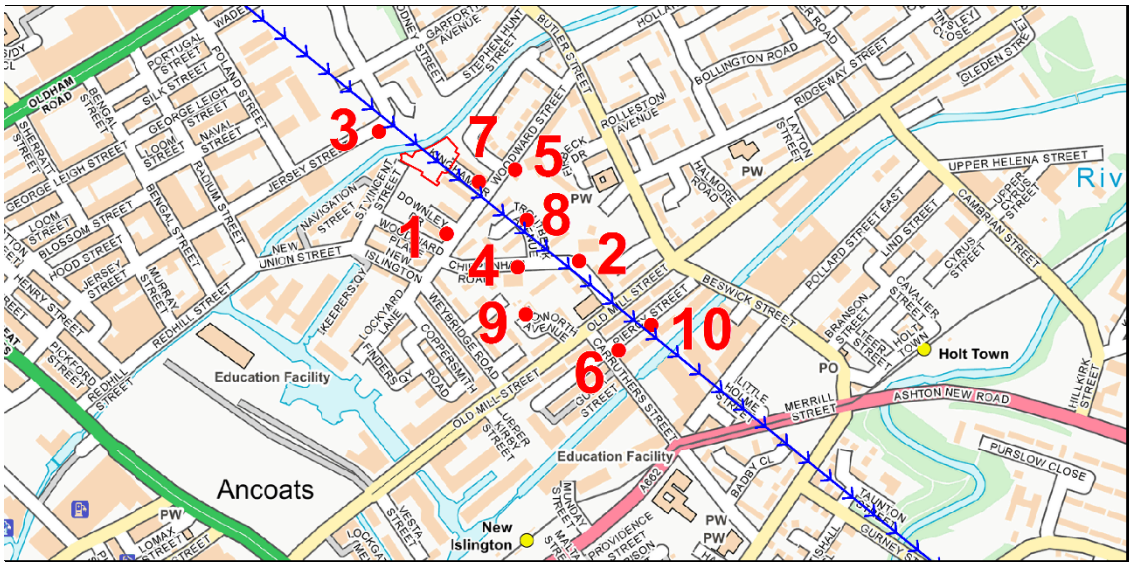


Figure 2 - Surveyed Locations. The Site is delineated in red. The blue arrow indicates the direction of the incoming DTT signals from Winter Hill transmitter in the study area

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Survey Results and Observations

In general, building use around the Site was mainly residential with some commercial use. There was a significant amount of construction work being undertaken in the wider study area. When visible during the survey, all signal receive antenna systems were mounted on rooftops, ensuring optimal reception conditions. However, nearer to the Site, antennas were mounted in lower positions due to the type of housing stock; Kingham Drive, Woodward Street and Downley Drive in particular. Additionally, in this location, antennas were noted to be of poorer quality.

Analogue Terrestrial Television

Due to the completed Digital Television Switchover, analogue television signals were no longer available in the study area.

Digital Terrestrial Television - Freeview

DTT services were available at all surveyed locations from the Winter Hill transmitter. All terrestrial television antennas are directed towards the Winter Hill transmitter.

In most locations, received signal levels were in excess of recommended minimum amounts and the technical quality of received signals was found to be good[1]. DTT services currently provide very good coverage and service throughout the majority of the study area. Nearer the Site on Kingham Drive, Woodward Street and Downley Drive, received signal levels were noted to be slightly reduced.

Digital Satellite Television - Freesat & Sky

Satellite dishes were mounted on existing properties near the Site, especially in residential areas off Woodward Place, Downley Drive and St. Vincent Street. More dishes may be mounted on rooftops of developments such as Avro House and Engel's House however, these would not be visible from street level.

1 - Signal levels as specified by the CAI - Association for Audio Visual Professionals Code of Practice (COP) For the Installation of Aerials/Antennas & Receiving Equipment in the Single Dwelling Unit CAI COP 2: September 2022

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

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Post-Construction Survey Overview

The assessment was undertaken during September 2026. 10 locations were visited in similar areas as identified in Figure 2 and signal measurements were undertaken to assess the quality and availability of DTT services. the measurements are detailed in Appendix - *Signal Measurements.* The following data was recorded:

Field strength and technical signal measurements of DTT transmissions from the Winter Hill transmitter

Viewing preference (choice of television transmitter) of residents in all areas visited

All television measurements were carried out using a log-periodic receive antenna. During the survey, no assessment was made of reception conditions within viewers' homes. Survey procedures, signal measurements and the survey equipment used are detailed in the Appendix - *Survey Equipment*.

Survey Results and Observations

In general, building use around the Site was still mainly for commercial and residential use. The development's form and massing now dominate the area. All terrestrial television antennas are still directed towards the Winter Hill DTT transmitter.

Analogue Terrestrial Television Services

Analogue television services are still unavailable in the study area.

Digital Terrestrial Television (DTT) - Freeview

DTT services were available at all surveyed locations from the Winter Hill DTT transmitter. In general, received signal levels were in excess of recommended minimum amounts and the technical quality of received signals was found to be good[2]. However, nearer the Site on Kingham Drive, Woodward Street and Downley Drive, received signal levels were noted to be reduced, as previously expected. It is considered that the massing of the development has caused signal attenuation. Poorer quality antenna installations will be more prone to the effects of TV interference.

2 - Signal levels as specified by the *CAI - Association for Audio Visual Professionals*

Code of Practice (COP) For the Installation of Aerials/Antennas & Receiving Equipment in the Single Dwelling Unit CAI COP 2: September 2022

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

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Digital Satellite Television - Freesat and Sky

As before, satellite dishes are mounted on existing properties near the Site, especially in residential areas off Woodward Place, Downley Drive and St. Vincent Street. More dishes may be mounted on rooftops of developments such as Avro House and Engel's House however, these would not be visible from street level.

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4 - Analysis between Pre-Construction and Post-Construction Survey Reception Data

An assessment of the survey data analysis is presented below and summated in Table 1.

Digital Terrestrial Television (DTT) - Freeview

DTT transmissions emanating from the Winter Hill DTT transmitter employ a guard interval[3] in the digital video broadcasting - terrestrial (DVB-T) data stream, which ensures resilience against the interference caused by signal multipath in cluttered urban areas. In addition to the embedded protection in DVB-T data stream offered by forward error correction (FEC) techniques, the guard interval enables the DTT receiver to make advantageous use of constructive multipath interference created in typical urban environments. In addition to the use of FEC, DTT transmissions now utilise eight thousand (8K) sub-carriers per digital multiplex. The use of 8K helps overcome the problems associated with impulse interference, which is more common in large towns and cities where many electrical items and electrical systems are in use[4].

Based on existing signal and technical measurements, signal levels are above recommended minimum amounts (as specified in Code of Practice (COP) For the Installation of Aerials / Antennas & Receiving Equipment in the Single Dwelling Unit CAI COP 2: September 2022)[5].

However, nearer the Site, signal levels were noted to be lower, which was to be expected. In some cases, the effects of a lower signal level may present as interference, especially if poor quality antenna systems are in use. Conversely, if antenna systems are of good quality, even though signal levels may have been reduced, full decoding may still be possible.

If signal levels have been reduced, suitable mitigation as discussed in Chapter 5, should restore the error free reception of DTT services.

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3 - In the UK's DTT network, guard intervals are used to ensure that distinct transmissions do not interfere with one another, or otherwise cause overlapping transmissions. The purpose of the guard interval is to introduce immunity to propagation delays, echoes and reflections, to which digital data is normally very sensitive. In a cluttered city environment, existing structures (buildings etc.) can cause numerous signal echoes and reflections.

4 - At the launch of DTT, the DTT signal was split into 2000 (2k) sub-carriers, because receivers were not technically advanced. The standard now is to use 8000 sub-carriers (8k), which allows the data to be sent 4 times slower. This is advantageous because slower data is more resilient against impulse interference. This is likely to particularly benefit reception using indoor aerials and antennas located in city environments, as they are closer to sources of impulse interference (unwanted interference).

5 - Signal levels as specified by the *CAI - Association for Audio Visual Professionals*

Code of Practice (COP) For the Installation of Aerials/Antennas & Receiving Equipment in the Single Dwelling Unit CAI COP 2: September 2022

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

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Digital Satellite Television - Freesat and Sky

Unless interference has been reported, it is unlikely that the development has adversely impacted the reception of digital satellite television services such as Sky and Freesat.

Overall, it is unlikely that digital satellite television service reception has been disrupted by signal interference generated by the development.

Broadcast platform	**Has interference occurred?**	**Mitigation required?**
DTT - Freeview	In some locations, signal levels have changed due to the massing and form of the development	Depends upon the quality of the antenna system in use
Digital Satellite TV - Freesat and Sky	Not possible to verify, but unlikely	No

Table 1 - Summary of Post-Construction Survey Findings after Data Comparison and Reception Analysis

Effects on Television Reception - Conclusions

Widespread interference to DTT service reception is unlikely to have occurred, however some areas of lower signal level may be experienced nearer to the site

Interference to digital satellite television reception is unlikely to have occurred

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5 - Mitigation Measures

With respect to the requirement of mitigation, the associated planning condition (37) states:

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>
> *Reason - To provide an indication of the area of television signal reception likely to be affected by the development to provide a basis on which to assess the extent to which the development during construction and once built, will affect television reception and to ensure that the development at least maintains the existing level and quality of television signal reception - In the interest of residential amenity, as specified in policy DM1 of Core Strategy.*

If any DTT interference has been experienced, it is likely as a result of signal attenuation. For any affected Freeview viewer to the immediate south-east of the Site, the betterment of antennas is likely to restore good service reception. Betterment of antenna systems could include any of the following;

- Replacement of components not fit for purpose (damaged, water ingress in cables / antennas, electrically faulty, old brown type coaxial etc.)
- Replacement or installation of a mast head amplifier and new antenna
- Replacement of old coaxial cable to better signal throughput and to reduce unwanted external electrical pickup
- Installation of a higher gain antenna
- Good earthing on antenna systems and associated components to help reduce unwanted electrical system noise and unwanted electrical pickup
- Installation of a higher antenna (above ground level) in a location as far away from the Site as possible i.e. on another chimney stack etc.

These are common and simple mitigation solutions suggested for similar situations where local television reception conditions have been affected by

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adjacent construction work and new development. A registered installer should be able to advise on the most effective mitigation measures once the existing antenna system has been inspected and construction-generated interference has been identified. It is recommended that all antenna work (antenna improvement, satellite dish moving, antenna 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 can be found on the following website[6].

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 will 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[7].

The majority of television broadcasts are now available on smart TV applications (apps), such as Sky Go, BBC iPlayer, ITVX, Channel 4, 5 (including 5STAR, 5USA, 5ACTION and 5SELECT), Netflix and Amazon Prime. Such TV content via fibre, broadband or smart TV app cannot be impacted by new development due to the nature of content delivery and removes the need for externally mounted TV antennas altogether.

6 - http://www.cai.org.uk/index.php

7 - https://www.cai.org.uk/index.php/services/technical/product-certification-scheme

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6 - Conclusions

A post-construction signal survey has been performed to assess the possible effects and impacts on the reception of television broadcast services from the practically complete Downley Drive development. The work has been conducted to discharge the associated planning condition (37):

> *Notwithstanding the TV reception survey prepared by GTech, stamped as received by the City Council, as Local Planning Authority, on the 22 August 2023, 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, a study shall identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified in the survey carried out above. The measures identified must be carried out either before the building is first occupied or within one month of the study being submitted to the City Council as local planning authority, whichever is the earlier.*
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During August 2023, a pre-construction television reception impact assessment was undertaken to assess the baseline reception conditions and to determine the possible reception impacts within the study area. Reception conditions were deemed to be good throughout the survey area.

During September 2026, the study area was visited again to assess the post-construction reception conditions and to determine if the development had caused any signal interference or reception degradation. The study focused on the television broadcast platforms that could possibly be affected by the development; DTT and digital satellite television services. During the survey work, to assess the possible impacts to local television reception, twelve locations were visited which were located in and near to the theoretical signal shadow zones. The pre-construction and post-construction survey data has been compared and the impacts and effects on local television reception have been assessed.

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Digital Terrestrial Television (DTT) - Freeview

Based on existing signal and technical measurements, signal levels are still above recommended minimum amounts. However, nearer the Site, signal levels were noted to be lower, which was to be expected. In some cases, the effects of a lower signal level may present as interference, especially if poor quality antenna systems are in use. Conversely, if antenna systems are of good quality, even though signal levels may have been reduced, full signal decoding may still be possible. Antenna upgrades should resolve any interference issues. If any interference occurs, simple and cost-effective antenna betterment should restore the reception of all services. This is a standard and easy to adopt mitigation solution. If any antenna betterment is required, it is advised that a registered antenna installer undertakes the work. Alternatively, the majority of television broadcasts are now available on smart TV applications (apps), such as Sky Go, BBC iPlayer, ITVX, Channel 4, 5 (including 5STAR, 5USA, 5ACTION and 5SELECT), Netflix and Amazon Prime. Such TV content via fibre, broadband or smart TV app cannot be impacted by the Proposed Development due to the nature of content delivery and removes the need for externally mounted antennas altogether.

Digital Satellite Television - Freesat and Sky

The development is unlikely to have had any adverse effect upon the reception of digital satellite television services such as Freesat and Sky.

From the findings of a post-construction signal survey and this comparative assessment, it has been concluded that whilst some changes in signal level have been noticed (as was predicted), DTT services are still available in the study area. In addition, no interference reports have been received during the construction phase and no mitigation measures have been required so far. If any interference is reported and is due to the development, simple mitigation, as described in Chapter 5, will restore optimal reception of DTT services. This assessment can be used to fully discharge planning condition 37.

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Appendices

Television Transmitter Frequencies

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Television Transmitter Frequencies

Digital TV Multiplex	Multiplex Operator	UHF Channel Number[8]	Channel Frequency Fc (MHz)[9]	Transmitter Power (kW)
BBC A	BBC	32	562.00	100.0
D3&4	Digital 3 & 4	34	578.00	100.0
BBC B - HD	BBC	35	586.00	100.0
SDN	SDN	29	538.00	100.0
Arqiva A	Arqiva	31	554.00	100.0
Arqiva B	Arqiva	37	602.00	100.0

Table A - Winter Hill DTT Services

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

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

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

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Signal Measurements

Measurement Point Number	Channel	32	34	35	29	31	37
	Frequency	562.00	578.00	586.00	538.00	554.00	602.00
	Service	BBC A	D3&4	BBC B	SDN	Arqiva A	Arqiva B
1	FS	77.8	78.4	73.3	70.2	75.0	75.5
	CSI	21.6	19.6	-	23.3	29.5	23.5
	MER	28.5	29.8	-	28.7	29.5	29.0
2	FS	84.0	92.0	92.8	90.5	84.8	90.7
	CSI	20.7	19.9	-	15.6	20.3	22.9
	MER	31.2	33.2	-	30.5	30.6	30.5
3	FS	85.1	86.1	85.6	80.7	83.2	85.1
	CSI	19.5	16.7	-	23.4	25.2	17.6
	MER	29.1	31.7	-	30.3	30.2	31.9
4	FS	81.1	79.6	82.4	82.7	80.8	80.0
	CSI	24.5	27.7	-	23.0	20.5	19.3
	MER	31.1	32.0	-	30.1	30.8	30.5
5	FS	74.8	75.8	78.5	74.6	72.6	69.6
	CSI	22.4	21.3	-	23.2	23.8	24.8
	MER	29.9	28.9	-	28.0	28.7	28.5
6	FS	84.0	85.1	85.0	84.1	79.8	80.3
	CSI	22.6	20.8	-	19.7	22.2	24.0
	MER	29.6	31.7	-	32.8	31.5	30.2
7	FS	71.4	70.5	73.5	72.1	71.0	72.4
	CSI	22.8	21.5	-	23.1	23.2	24.4
	MER	29.9	28.5	-	28.5	28.7	28.7
8	FS	82.1	86.2	89.4	81.8	83.3	86.9
	CSI	25.1	28.1	-	24.4	22.0	20.0
	MER	32.1	29.6	-	29.1	27.5	30.3
9	FS	80.9	84.2	83.9	83.9	84.6	84.6
	CSI	26.2	25.1	-	18.9	22.3	29.0
	MER	31.5	29.9	-	29.0	32.2	31.7
10	FS	84.6	80.9	81.2	82.9	84.8	80.3
	CSI	23.6	27.1	-	23.2	21.0	30.9
	MER	29.9	28.3	-	31.1	30.9	32.3

Table B - Winter Hill DTT Services

Frequencies listed are in MHz
Field strength (FS) values are indicated in dBμV/m
Channel Status Information (CSI) %
Modulation Error Ratio (MER) dB

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Measurement Point Number	Channel	32	34	35	29	31	37
	Frequency	562.00	578.00	586.00	538.00	554.00	602.00
	Service	BBC A	D3&4	BBC B	SDN	Arqiva A	Arqiva B
1	FS	76.0	74.8	69.9	69.1	73.6	73.7
	CSI	24.5	21.6	-	27.3	32.3	27.4
	MER	27.7	29.1	-	28.4	29.3	28.6
2	FS	82.1	87.0	84.0	89.3	83.6	89.6
	CSI	21.0	20.8	-	15.9	20.4	23.0
	MER	31.1	32.8	-	30.3	30.2	30.2
3	FS	84.0	84.6	84.4	78.9	82.0	83.8
	CSI	19.8	17.0	-	23.7	25.4	17.9
	MER	28.9	31.6	-	30.0	29.3	31.3
4	FS	80.0	77.7	80.7	81.2	79.5	78.0
	CSI	24.6	28.1	-	23.4	21.4	20.1
	MER	30.2	31.8	-	29.2	29.9	29.8
5	FS	70.4	74.1	76.2	72.6	68.1	68.2
	CSI	25.3	24.5	-	27.2	26.4	27.1
	MER	29.1	28.9	-	27.5	27.8	27.9
6	FS	82.9	83.2	83.7	82.3	78.5	78.7
	CSI	23.2	21.4	-	20.2	22.7	24.5
	MER	29.3	31.2	-	32.0	30.6	29.7
7	FS	71.3	67.4	73.4	71.6	69.0	68.6
	CSI	26.5	24.3	-	27.1	27.1	27.5
	MER	29.3	28.3	-	28.3	27.8	28.0
8	FS	80.3	84.6	87.5	80.4	81.6	85.0
	CSI	25.4	28.7	-	24.6	22.0	20.8
	MER	31.3	28.8	-	29.1	27.0	29.7
9	FS	78.9	82.4	82.6	82.1	82.7	82.7
	CSI	26.6	25.5	-	19.5	23.2	29.7
	MER	30.6	29.4	-	29.0	32.0	31.4
10	FS	83.4	79.7	79.9	81.1	83.0	79.0
	CSI	24.4	27.9	-	24.2	21.1	31.1
	MER	29.7	28.1	-	30.5	30.4	31.7

Table C - 2026 Measurements of Winter Hill DTT Services

Frequencies listed are in MHz
Field strength (FS) values are indicated in dBμV/m
Channel Status Information (CSI) %
Modulation Error Ratio (MER) dB

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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 dBμV (a maximum signal level of 70 dBμV and a minimum signal level of 50 dBμV). 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. 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

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well as noise in the channel. The higher the MER value, the **better** the reception conditions.

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 performance[10]. 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 –

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

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.

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

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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 Amphenol Jaybeam Professional Broadcast Wideband Log Periodic 8 element antenna (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.

LPU/Rx

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

Replace "x" with desired model number option.

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*

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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.

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

where -

Dipole Factor (to matched load)	(b)	$20Log(\frac{2\pi}{\lambda})$ *Where λ = Transmission Wavelength (m)*
Feeder Loss	(c)	3 dB
Aerial Gain (dB_{dipole})	(a)	10 dB

Impedance matching and consideration of losses over the feeder runs between 530 MHz and 610 MHz factored in to adjusted FS values.

Mapping Data

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The UK's terrestrial television 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 survey 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 transmissions and services at the time of the survey, GTech Surveys Limited cannot assume that any part of the television 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 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 survey 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.

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