

GTech Surveys Limited

Television and Radio Reception Impact Assessment

Manchester Goods Yard

CHANGE HISTORY

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Contents	Page
GTech Surveys Limited	
Executive Summary	
1 - Introduction	4
2 - Available Television and Radio Broadcast Services	6
3 - Survey Methodology & Description of Baseline	8
4 - Survey Methodology & Description of Existing Reception Conditions	10
5 - Predicted Impacts and Effects	12
6 - Mitigation Measures	14
7 - Conclusions	15
Appendix	17
Television Transmission Frequencies	
VHF (FM) Radio Transmission Frequencies	
2018 Signal Measurements	
2021 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



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Executive Summary

A desktop-based study and a signal survey have been performed to assess the effects and impacts on the reception of television and radio broadcast services from the Manchester Goods Yard development in its current state. A planning condition associated with the scheme states;

Assess the impact of the development on television signal reception within the potential impact area identified in (a) above 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 in the survey carried out in (a) above unless otherwise agreed in writing with the City Council as local planning authority.

Accordingly, impacts to the reception of VHF (FM) radio, 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 the rest of the UK by 2012.

Due to the existing excellent coverage conditions in any theoretical signal shadow zone, the development has not impacted the reception of digital terrestrial television (DTT also known as 'Freeview') services.

The development caused disruption to the reception of digital satellite television services in well-defined areas to the immediate northwest of the site (up to 113m of the proposed building's base). Mitigation has been applied by the developer and the interference has ceased. No additional interference is expected and consequently, no further mitigation measures are required to restore optimal reception.

The development has not adversely impacted the reception of VHF(FM) radio broadcasts due to the existing good coverage in the survey area and the technology used to encode and decode radio signals.

Overall, the development caused some minor disruption to the reception of digital satellite television services to a small area to the immediate northwest of the site (up to 113m of the proposed building's base). Suitable mitigation was supplied, and the interference ceased. No further interference has been identified or caused and consequently, not additional mitigation measures are required to restore the optimal reception of any broadcast platform. This report provides the existing level and quality of radio and television signal reception in the survey area and can be used to discharge the associated planning condition.

1 - Introduction

This report is prepared to discharge a planning condition relating to the Manchester Goods Yard development. This report outlines the findings of a comprehensive desk-based study, the existing signal reception conditions around the site, and identifies what effects the development may have on the reception of television and radio broadcast services. A planning condition associated with the scheme states;

Assess the impact of the development on television signal reception within the potential impact area identified in (a) above 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 in the survey carried out in (a) above unless otherwise agreed in writing with the City Council as local planning authority.

During October 2018, a pre-construction television reception impact assessment was undertaken to assess the possible impacts and effects upon television reception in the study area. The study concluded that the taller elements of the proposed development may cause disruption to satellite television reception in well defined areas to the immediate northwest of the site. Some minor disruption to satellite television reception was reported and consequently the developer engaged with adjacent land and property owners and has since rectified any interference issues relating to satellite television service reception.

This report follows the following structure:

Chapter 1 introduces the work

Chapter 2 describes the available television and radio services in the survey area

Chapter 3 describes the pre-construction television and radio reception conditions around the Site

Chapter 4 describes the existing television and radio reception conditions around the Site

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

Chapter 6 describes any suitable mitigation measures for any affected TV viewer or radio listener

Chapter 7 presents the conclusion

This study was undertaken in March 2021 to investigate whether the development has caused any interference to local television and radio broadcast reception. Subsequently, the impacts and effects on VHF (FM) radio, digital terrestrial television and digital satellite television service reception are discussed. The report also details the existing reception conditions for future reference.

2 - Available Television and Radio 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 1. 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>

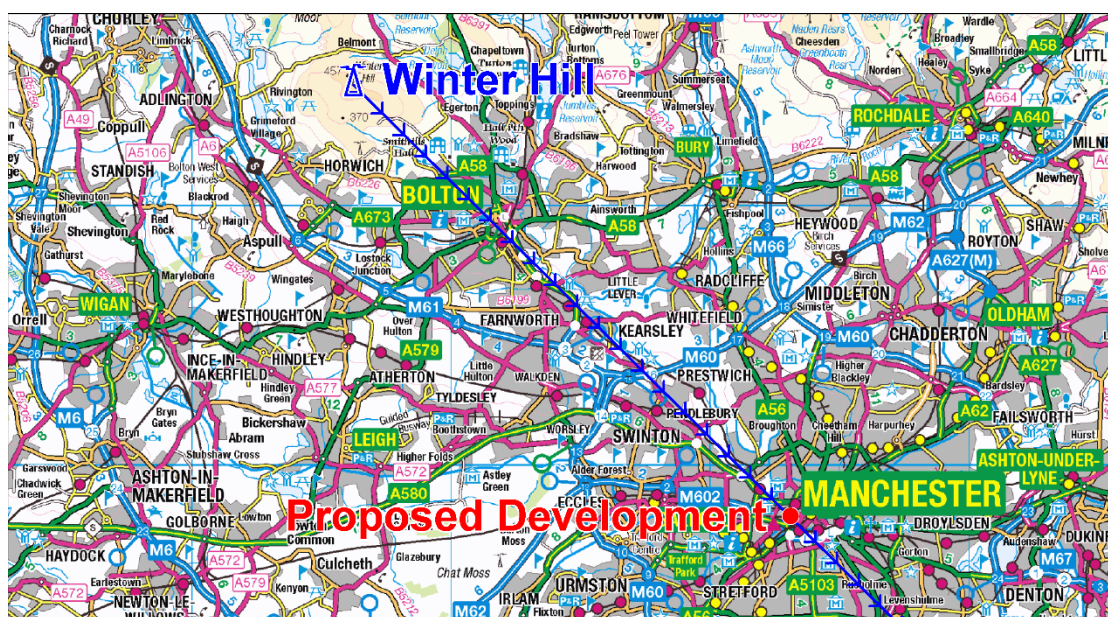


Figure 1 - The Location of the Winter Hill Transmitter, the Proposed Development's location and the direction of the incoming DTT signals at the Site

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.

VHF (FM) Radio

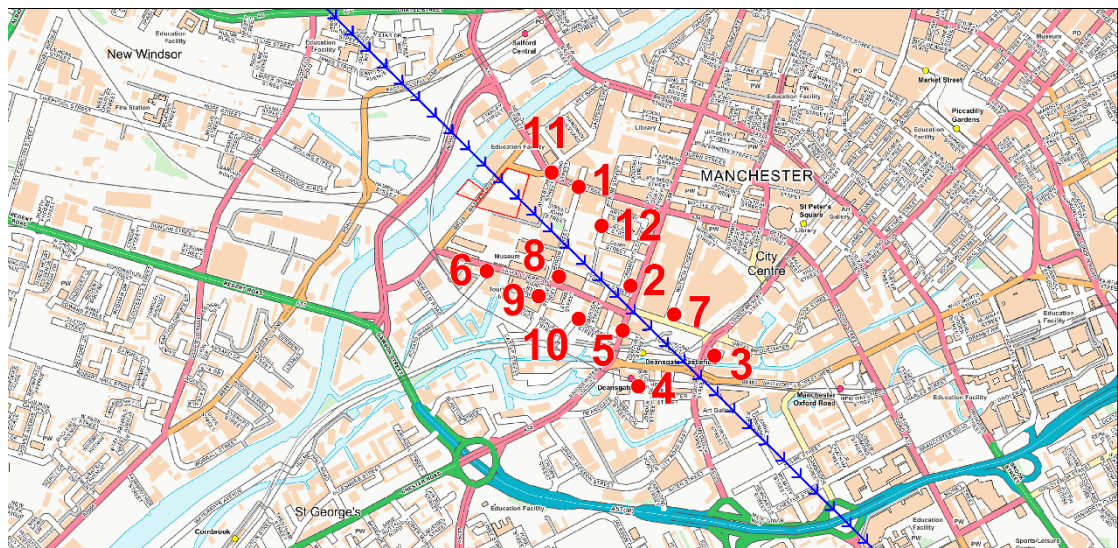
The areas around the Site are served by VHF (FM) radio services of

BBC Radio 1, 2, 3, and 4 from the Holme Moss transmitter (NGR SE 09550 04050)

Technical transmission information for each radio service at the aforementioned transmitter site is detailed in Table B in the Appendix - *VHF (FM) Radio Transmission Frequencies*.

The baseline signal reception survey was conducted during October 2018. 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 1, and the measurements are detailed in Table C, found in the Appendix – *2018 Signal Measurements*. The following data was recorded:

- 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*.



8

Survey Results and Observations

In general, building use around the development was mainly for commercial use. There were typical city centre residential developments located around the scheme. There was a significant amount of building work occurring in the area, especially to the west, in Salford. There were also a number of existing tall and wide buildings around the site. All signal receive antenna systems were mounted on building sides or rooftops, ensuring optimal reception conditions. All terrestrial television antennas were directed towards the Winter Hill transmitter, however, due to the nature of building use around the site, few antennas could be seen during the survey work.

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. At all locations, received signal levels were well in excess of recommended minimum amounts and the technical quality of received signals was found to be good. DTT services provided good coverage and service throughout the study area.

Digital Satellite Television - Freesat & Sky

Few dishes were noted during the survey. Dishes may have also be mounted on rooftops which would not be visible from street level. No existing interference was identified for any satellite television platform.

4 - Survey Methodology & Description of Existing Reception Conditions

The signal reception survey was conducted during March 2021. The same locations were visited as were during October 2018. These are identified in Figure 1, and the measurements are detailed in Tables D and E, found in the Appendix - *2021 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
- Field strengths of VHF (FM) radio transmissions from the serving transmitter

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. VHF (FM) radio field strength measurements were taken with a resonant half wavelength folded dipole antenna at 2 metres 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*.

Survey Results and Observations

In general, building use around the Site is still mainly for commercial use. There are a number of new developments around the Site and significant construction work in the wider area. 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.

¹ - Signal levels as specified by -

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*

Digital Satellite Television - Freesat & Sky

During the survey, few satellite dishes were noted near the site. More dishes may be mounted on rooftops and at the rear of properties; however, these would not be visible from the street.

VHF (FM) Radio

VHF (FM) radio reception conditions were deemed to be good² throughout the study area. In-car reception was deemed to be good at all locations. This is due to the proximity of the Holme Moss high-power radio transmitter with respect to the site.

² - Minimum Recommended Field Strengths for Acceptable Levels of VHF (FM) Radio Service

Monophonic audio - 40 dBµV/m

Stereophonic audio (excellent quality) - 54 dBµV/m

Source - https://www.ofcom.org.uk/data/assets/pdf_file/0013/54310/annex-f.pdf

5 - Predicted Impacts and Effects

Methodology

To assess the effects of the development upon television and radio 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 and radio 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 reflections³. Due to the existing robust coverage in the survey area and ability of the received DTT signal to overcome multipath interference, the development has not had any adverse effect upon the reception of Freeview television services. No mitigation measures are required because no interference effects have been observed.

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.

Using the mathematical tangent function and based on the 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 113m from the base of the building. This area extends in a northwesterly direction (323.5 degrees with respect to true north) from the building's base. During the construction, the developer engaged with adjacent property owners and ensured that mitigation solutions to restore optimal satellite reception were implemented. Now that satellite dishes have been moved to new locations, there is no further opportunity for the development to disrupt the reception of digital satellite television services.

3 - 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.

VHF (FM) Radio

Modelling VHF (FM) radio interference in a cluttered urban environment is not possible due to the number of constantly changing variables. VHF(FM) broadcast radio reception is robust throughout this part of the country; evident by the survey results and signal availability with a typical car radio. Whilst any structure will change local signal propagation characteristics, due to the technical methods involved with encoding and receiving the transmissions, reception remains possible. No mitigation measures are required because no interference effects have been observed.

Broadcast platform	Area(s) of predicted interference	Risk of interference & reasoning	Mitigation
DTT (Freeview)	Non-identified	No because coverage is robust	Not required
Digital Satellite TV (Freesat & Sky)	113m to the NW of the proposed building	No because all satellite dishes in the identified area have been relocated	Not required
VHF(FM) Radio	Non-identified	No because coverage is robust	Not required

Table 1 - Summary of Predicted Interference

Predicted Effects - Conclusions

The development has not caused any interference to the reception of digital terrestrial television (Freeview) services.

The development and the use of tower cranes did cause some disruption to digital satellite television reception for owners of adjacent properties to the northwest of the Site. The developer assisted the owners with mitigation and by relocating satellite dishes to new locations the interference ceased.

The proposed development has not caused any interference to VHF(FM) radio reception.

6 - Mitigation Measures

As described in the pre-construction reception assessment, interference to satellite television reception was possible for a small number of users located to the immediate northwest of the site. The developer engaged with these users and satellite dishes were relocated to new positions where the interference ceased. The planning condition associated with the scheme states;

Assess the impact of the development on television signal reception within the potential impact area identified in (a) above 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 in the survey carried out in (a) above unless otherwise agreed in writing with the City Council as local planning authority.

As suitable mitigation has now been applied and no further interference has been noted or identified, no further mitigation measures are required to restore the optimal reception of broadcast services for any television user or radio listener.

7 - Conclusions

A desktop-based study and a signal survey have been performed to assess the effects and impacts on the reception of television and radio broadcast services from the Manchester Goods Yard development in its current state. A planning condition associated with the scheme states;

Assess the impact of the development on television signal reception within the potential impact area identified in (a) above 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 in the survey carried out in (a) above unless otherwise agreed in writing with the City Council as local planning authority.

The study has focused on the reception of VHF (FM) radio and 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 the lack of viewers and existing good coverage in any theoretical signal shadow area, the development has not had any adverse effect upon the reception of Freeview television services.

Digital Satellite Television - Freesat & Sky

The taller element of the development caused disruption to the reception of digital satellite television services in a well-defined area to the northwest of the Site, within 113m from the base of the building. A mitigation solution was applied (the repositioning of satellite dishes to new locations without an obscured line-of-sight view to the serving satellites) and this successfully restored the reception of all satellite television services. No other interference has been noted or is now expected.

VHF(FM) Radio

The development has not impacted the reception of VHF (FM) radio services. Coverage is still robust within the survey area.

Overall, the development caused some highly localised disruption to the reception of digital satellite television services to the immediate northwest of the site (particularly adjacent buildings along Water Street). Suitable mitigation was applied, and the interference ceased. No further or new interference is expected for any television or radio broadcast platform. This report provides the existing level and quality of radio and television signal reception in the survey area and can be used to discharge the associated planning condition.

APPENDIX

Television Transmission Frequencies

VHF (FM) Radio Transmission Frequencies

2018 Signal Measurements

2021 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

VHF (FM) Radio Transmission Frequencies

Service	Frequency (MHz)	Transmitter Power (kW)
BBC Radio 1	98.9	250
BBC Radio 2	89.3	250
BBC Radio 3	91.5	250
BBC Radio 4	93.7	250

Table B - Holme Moss VHF (FM) Radio Services

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

2018 Signal Measurements

Measurement Point Number	Channel Frequency Service	50 706.00 BBC A	59 778.00 D3&4	54 738.00 BBC B -	58 770.00 SDN	49 698.00 Arqiva A	37 602.00 Arqiva B -	55 746.00 COM7	31 554.00 COM8
1	FS CSI MER	86.5 24.7 31.7	90.9 25.7 30.0	73.8	87.1 23.8 29.6	87.2 19.7 31.1	90.6 30.4 30.2	73.0	74.3
2	FS CSI MER	87.2 26.1 32.7	84.4 28.3 30.2	101.4	91.1 27.4 30.8	89.0 29.0 31.8	74.2 33.3 31.9	75.0	73.3
3	FS CSI MER	81.6 21.1 31.1	79.2 23.1 32.2	82.3	83.1 19.8 31.0	88.7 18.8 31.4	82.6 19.3 27.8	72.3	70.6
4	FS CSI MER	75.1 29.6 29.3	86.7 23.8 31.6	84.9	84.9 29.7 29.3	86.1 26.6 31.5	87.0 20.5 31.3	78.0	76.7
5	FS CSI MER	87.9 18.4 30.6	90.9 20.6 29.5	90.2	91.8 29.1 28.9	84.8 28.5 29.3	71.4 20.8 30.2	70.3	69.3
6	FS CSI MER	83.4 20.2 30.2	76.6 25.5 31.8	78.0	90.6 30.2 30.0	91.1 23.5 30.3	84.9 18.7 31.2	73.5	74.4
7	FS CSI MER	84.7 24.5 29.5	86.7 32.7 31.6	83.9	76.3 22.6 31.4	95.0 25.0 30.9	84.3 20.8 29.9	72.5	69.5
8	FS CSI MER	83.9 21.0 31.8	86.5 25.1 31.7	88.2	75.7 22.0 31.0	86.9 18.3 31.4	86.0 26.9 30.3	71.0	70.9
9	FS CSI MER	84.6 17.2 30.1	84.5 24.4 30.9	93.0	74.8 32.4 28.9	87.7 28.7 30.2	90.3 29.2 31.7	72.7	75.7
10	FS CSI MER	80.7 29.5 31.7	87.9 27.5 30.2	90.0	79.8 20.4 31.3	86.7 21.3 29.9	81.0 29.6 31.8	78.4	73.5
11	FS CSI MER	85.2 27.2 30.8	86.7 27.6 30.2	81.0	87.2 21.3 31.3	79.4 31.6 29.5	88.5 23.9 29.9	74.7	76.4
12	FS CSI MER	82.7 27.5 30.7	86.5 22.0 29.4	86.1	84.8 30.2 31.3	84.2 28.0 30.2	81.4 25.9 31.6	73.2	67.4

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

Key -

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)

2021 Signal Measurements

Measurement Point Number	Channel Frequency Service	32 562.00 BBC A	34 578.00 D3&4	35 586.00 BBC B	29 538.00 SDN	49 698.00 Arqiva A	37 602.00 Arqiva B	55 746.00 COM7
1	FS	89.0	92.9	91.6	94.8	85.3	85.8	80.3
	CSI	23.0	21.5	-	22.8	22.1	24.3	-
	MER	32.7	28.3	-	32.2	30.0	28.8	-
2	FS	86.7	91.8	89.1	82.9	87.3	84.0	80.5
	CSI	22.0	23.0	-	21.8	24.3	21.2	-
	MER	29.7	30.3	-	29.7	30.2	31.8	-
3	FS	92.1	82.4	85.0	95.8	90.8	88.6	85.9
	CSI	26.6	24.4	-	19.1	21.5	24.8	-
	MER	30.6	30.4	-	31.0	30.9	30.9	-
4	FS	93.0	93.2	93.4	88.1	91.7	94.3	85.6
	CSI	21.5	25.0	-	22.7	21.1	28.1	-
	MER	30.5	28.1	-	32.1	30.6	31.5	-
5	FS	88.1	89.2	90.8	86.7	90.1	81.6	76.7
	CSI	20.1	21.1	-	20.1	23.0	24.2	-
	MER	29.6	31.0	-	31.8	31.3	31.7	-
6	FS	92.3	89.5	91.8	91.6	89.5	89.8	80.4
	CSI	23.4	20.8	-	22.4	17.6	17.3	-
	MER	31.4	31.2	-	30.7	31.6	30.1	-
7	FS	84.8	90.0	93.4	88.0	92.7	94.4	75.7
	CSI	23.4	20.4	-	19.5	22.3	22.6	-
	MER	31.0	31.5	-	31.6	32.7	31.3	-
8	FS	88.4	85.9	85.8	90.2	96.6	91.8	87.2
	CSI	22.7	20.0	-	24.7	24.1	19.7	-
	MER	32.0	31.3	-	28.8	30.3	30.2	-
9	FS	96.2	87.6	95.3	95.8	88.4	97.0	81.6
	CSI	23.2	30.8	-	27.3	23.1	25.7	-
	MER	32.5	30.6	-	32.0	31.0	29.6	-
10	FS	90.9	84.4	90.8	93.7	91.7	91.1	86.6
	CSI	25.8	25.4	-	20.0	20.4	27.3	-
	MER	29.4	31.3	-	31.9	31.0	31.2	-
11	FS	93.0	93.0	94.2	92.7	97.0	97.9	87.8
	CSI	20.8	26.9	-	23.2	21.2	28.5	-
	MER	30.0	28.1	-	32.1	31.9	31.5	-
12	FS	87.8	91.3	90.1	87.6	93.1	86.8	77.2
	CSI	19.8	20.8	-	20.8	24.8	25.3	-
	MER	30.6	31.1	-	29.6	31.8	30.9	-

Table D - 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)

Location	Service	Radio 1	Radio 2	Radio 3	Radio 4
1		65.1	68.8	66.0	68.6
2		67.9	62.2	66.9	65.8
3		62.0	66.5	61.3	61.2
4		64.0	69.4	69.7	70.9
5		62.1	65.6	64.6	71.2
6		65.4	63.8	68.1	64.3
7		63.1	65.0	68.0	64.8
8		65.5	64.7	65.4	69.7
9		65.7	66.6	65.9	68.5
10		66.4	69.4	64.9	72.5
11		70.1	69.7	71.9	69.9
12		67.2	67.1	68.4	69.3

Table E - Field Strength Measurements of Holme Moss VHF(FM) Radio Services

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

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 performance⁴. 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.

⁴ - 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

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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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