GTech Surveys Limited

iQ Student Accommodation

Echo Street, Manchester

Television Reception Assessment

CHANGE HISTORY

Issue	Date	Details of Changes
0.0	01/06/2026	Working draft
0.1	17/06/2026	First draft issue
Author: G Phillips		Reviewer: O Lloyd

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GTech Surveys Limited

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

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

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

T: +44(0) 1926 744771

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Executive Summary

As required in planning condition 29, a signal survey has been performed to assess the existing TV signal reception conditions in previously identified locations. The study has focused on the reception of digital terrestrial television services (DTT is commercially known as Freeview). Planning condition 29 states;

29) Notwithstanding the TV Reception Survey Prepared by Pager Power received by the City Council, as Local Planning Authority, on the 2 May 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 to identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified in the survey carried out above shall be submitted for approval in writing by the City Council, as Local Planning Authority. The measures identified must be carried out either before each phase is first occupied or within one month of the study being submitted for approval in writing 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 Manchester Core Strategy (2012).

Based on an assessment of signal levels and signal qualities, DTT services still provide robust coverage in the study area. Reception conditions are optimal for signal and data decoding. Consequently, no mitigation measures are required to restore reception conditions to baseline levels. This report details the existing level and quality of television signal reception within the survey area and can be used to discharge planning condition 29.

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1 - Introduction

This report outlines the findings of a reception assessment and pre-commencement signal reception survey to assess the existing signal reception conditions and to determine the viewing preference of receptors located in identified areas, located where the iQ development could impact the reception of digital terrestrial television (DTT) services. Planning condition 29 states;

> *Notwithstanding the TV Reception Survey Prepared by Pager Power received by the City Council, as Local Planning Authority, on the 2 May 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 to identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified in the survey carried out above shall be submitted for approval in writing by the City Council, as Local Planning Authority. The measures identified must be carried out either before each phase is first occupied or within one month of the study being submitted for approval in writing 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 Manchester Core Strategy (2012).*

Figure 1 shows the location of the Site.

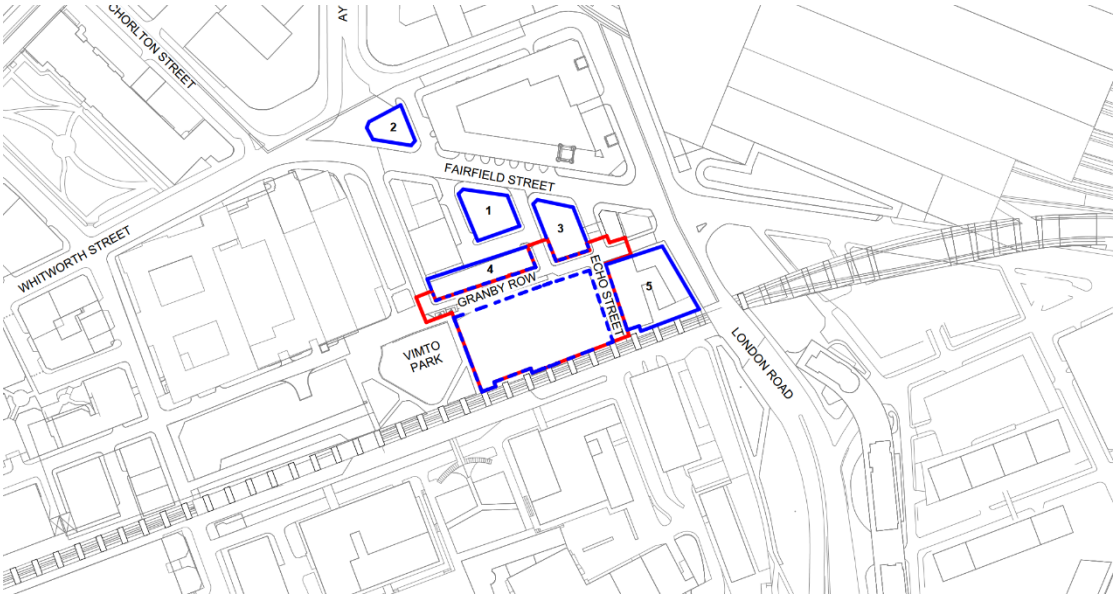


Figure 1 - Location of the Site (delineated in red)

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The Assessment

A desktop study was first undertaken, based on broadcast transmission information, plans of the development and maps of the area. The relevant TV signal survey area for the development was identified from the Report[1], and a site visit was then subsequently conducted to establish the existing reception conditions. Consideration has been given to DTT transmissions emanating from the main regional DTT transmitter, located at Winter Hill. The assessment details the existing reception conditions for future reference. This assessment follows the structure:

Chapter 1 introduces the work, the planning condition, the development, the site and format of the assessment

Chapter 2 describes the available terrestrial television services in the survey area

Chapter 3 describes the pre-commencement television reception conditions around the Site

Chapter 4 describes the existing television reception conditions around the Site and any difference between the pre-commencement and existing signal levels

Chapter 5 presents the conclusion

Since 2006, GTech Surveys Limited has been a consultant member of the Trade Association for Content Delivery (Confederation of Aerial Industries Ltd. (CAI)).

This study was undertaken to discharge planning condition 29.

1 - Television Baseline Survey Report iQ Student Accommodation Echo Street, Manchester April 2023

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2 - 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 DTT transmitter (grid reference SD 66053 14463), on a bearing of 311° (with respect to true north) and 25 km from the Site. The Winter Hill DTT transmitter is shown relative to the Site in Figure 2.

Technical transmission information for each DTT service broadcast from the Winter Hill DTT 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 Everyone TV website[2].

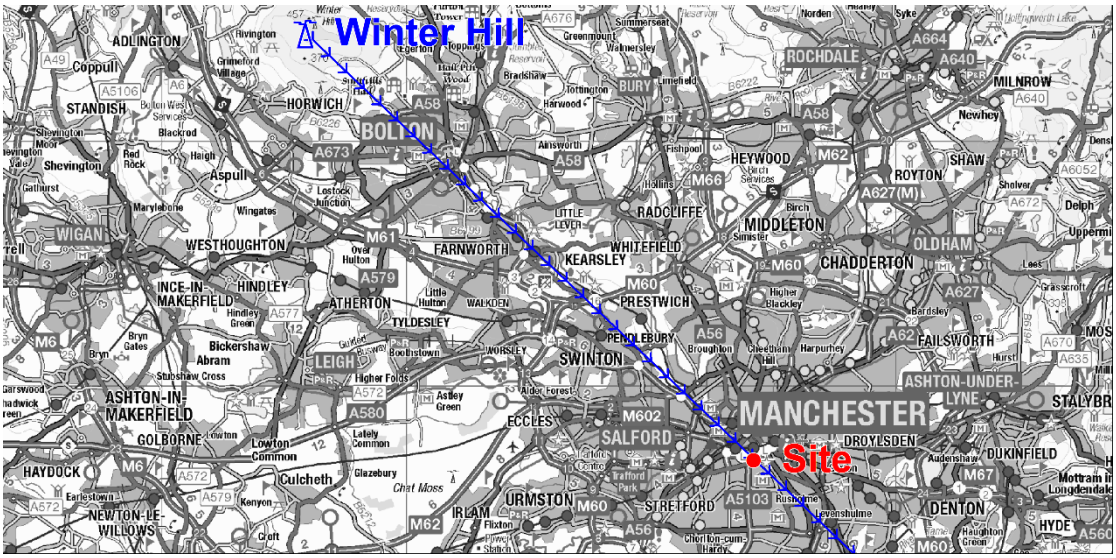


Figure 2 - The Locations of the Winter Hill DTT Transmitter, the Site and the direction of the incoming DTT signals at the Site (indicated by the blue arrowed line)

2 - https://www.everyonetv.co.uk/

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3 - Description of Baseline Reception Conditions

In the pre-commencement study, signal measurements were undertaken up to five kilometres from the Site, as presented in the Report.

These locations are shown in Figure 3 (Figure 7 from the Report) and for better clarity, remapped in Figure 4.

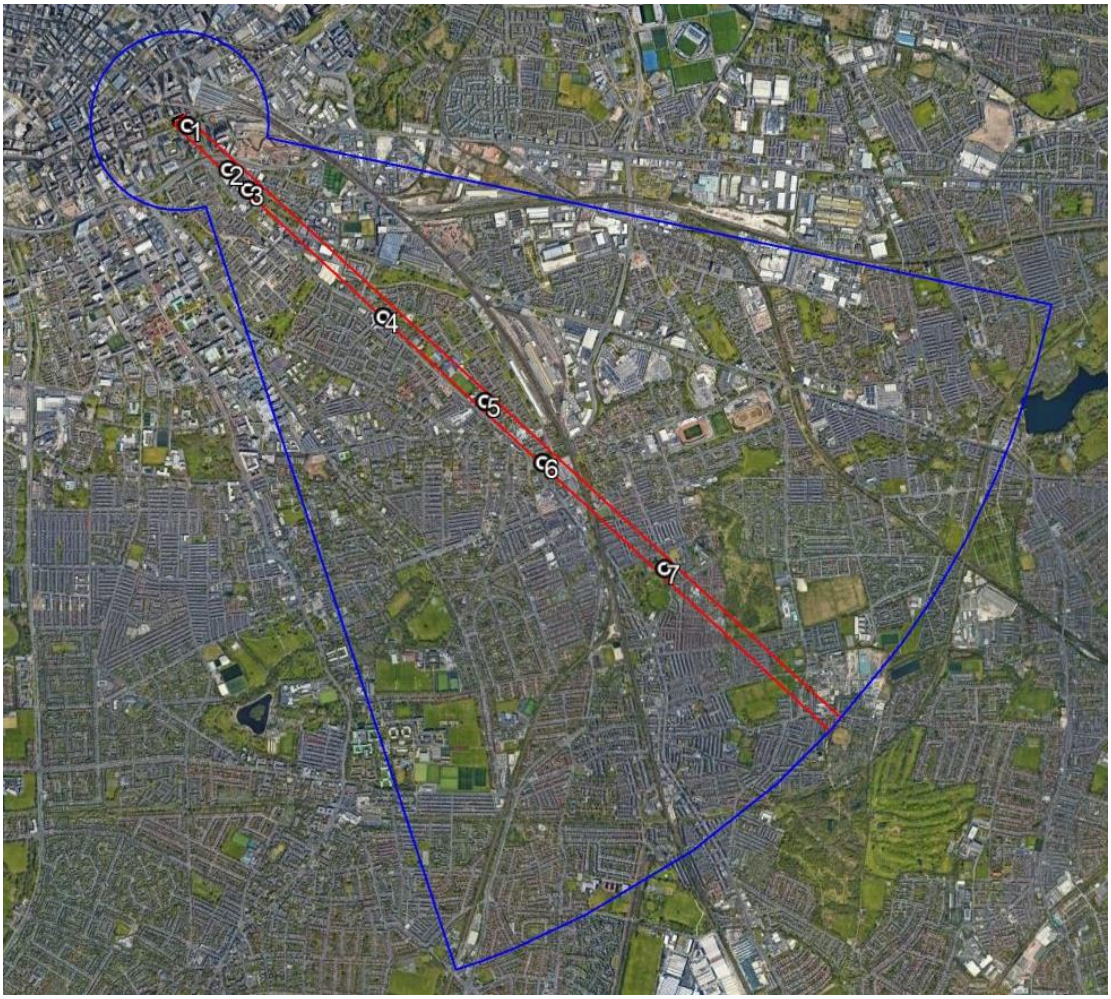


Figure 3 - Survey locations 1 to 7 as presented in the Report

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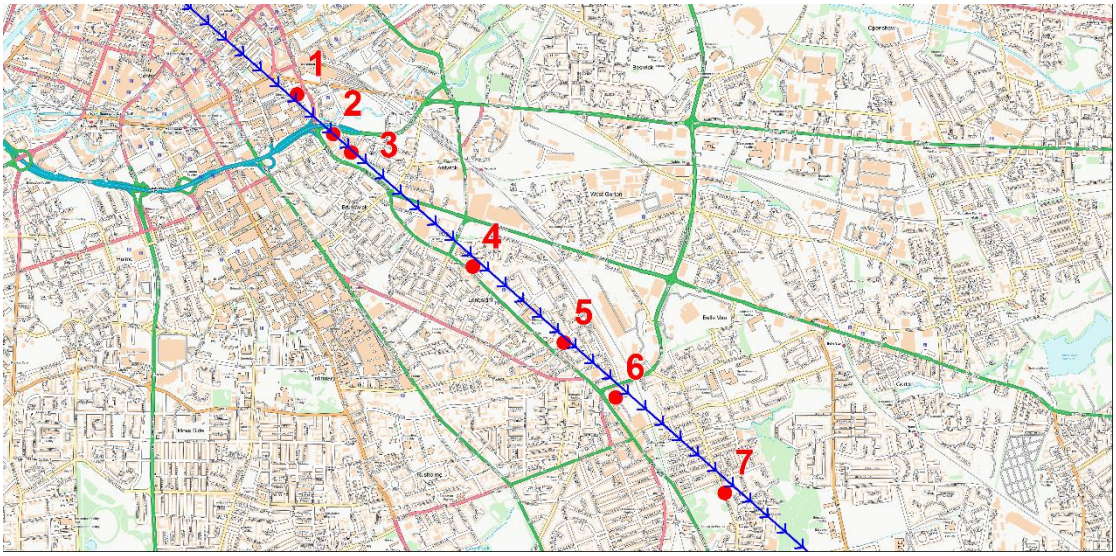


Figure 4 - Surveyed Locations

Reception conditions were noted to be good as expected. This was due to the proximity of the Winter Hill DTT transmitter relative to the study area. Overall, the Report suggested that widespread interference was unlikely to occur and no requirement for pre-emptive mitigation would be required.

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4 - Survey Methodology & Description of Existing Reception Conditions

In this study, measurements were undertaken up to five kilometres from the Site, in the locations as shown in Figure 4. The signal 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 regional transmitter located at Winter Hill

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

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].

DTT services were available at all surveyed locations from the Winter Hill transmitter. DTT services currently provide very good coverage and service throughout the study area. Based on existing signal and technical measurements, all 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).

All terrestrial television antennas observed were directed towards the Winter Hill DTT transmitter. All signal receiving antenna systems are mounted on rooftops, ensuring optimal reception conditions.

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).

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Overall, reception conditions in the study area were noted to be good.

It should be noted that any precise comparison between the April 2023 data and the survey data from June 2026 is not possible. This is because a number of technical details have not been presented in the Pager Power report, namely consideration of antenna feeder loss, antenna gain and equipment set up. Importantly, the values stated in the Report are either dB (a dB is a logarithmic way of describing a ratio, but it is unclear in the Report which ratio these values relate to) or dBµV (terminated at the receiver), not dBµV/m (decibel-microvolts per meter) as presented to the external antenna, which is the only correct way to accurately assess DTT coverage.

The main difference is that dBµV/m indicates the electric field strength (distance-dependent, used in radiated emissions), while dBµV indicates voltage (load-dependent, used in conducted emissions or component signals). Both are decibel units referenced to 1 µV, but they define different physical quantities, often with a measurement antenna factor separating them.

Detailed Breakdown

dBµV/m (Electric Field Strength): Describes how strong a signal is at a specific spot in space (distance-dependent, typically measured in a far-field chamber). It represents the voltage per unit length of an antenna.

dBµV (Voltage): Describes the voltage across a specific load impedance, usually 50 Ω in RF and 75 Ω in cable television systems.

Analysis has indicated that after ignoring natural variations in survey measurements (expected with any comparative signal survey), there has been no major adverse changes in reception conditions. Nearer the Site, the influences of signal attenuation may be present, identified by lower (but still adequate) field strength readings. Elsewhere, reception conditions remain robust.

Based on signal measurements, all required levels are above recommended minimum amounts, and as such, the development has had a neutral effect upon the quality of received television signals within the study area.

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5 - Conclusions

A desktop-based study and practical completion survey have been performed to assess the existing TV signal reception conditions in previously identified locations. The study has focused on the reception of DTT services.

Planning condition 29 associated with the development states;

> *Notwithstanding the TV Reception Survey Prepared by Pager Power received by the City Council, as Local Planning Authority, on the 2 May 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 to identify such measures necessary to maintain at least the pre-existing level and quality of signal reception identified in the survey carried out above shall be submitted for approval in writing by the City Council, as Local Planning Authority. The measures identified must be carried out either before each phase is first occupied or within one month of the study being submitted for approval in writing to the City Council as Local Planning Authority, whichever is the earlier.*

Based on signal levels and signal qualities, DTT services provide robust coverage in the study area. Reception conditions were optimal for signal and data decoding. No mitigation measures are required to maintain least the baseline level and quality of signal reception This report details the existing level and quality of television signal reception within the survey area and can be used to discharge planning condition 29.

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Television Transmission Frequencies

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Television Transmission Frequencies

Digital TV Multiplex	Multiplex Operator	UHF Channel Number[5]	Channel Frequency Fc (MHz)[6]	Transmitter Power (kW)
BBC A	BBC	32	562.0	100.0
D3&4	Digital 3 & 4	34	578.0	100.0
BBC B (HD)	BBC	35	586.0	100.0
SDN	SDN	29	538.0	100.0
Arqiva A	Arqiva	31	554.0	100.0
Arqiva B	Arqiva	37	602.0	100.0

Table A - Main Winter Hill DTT Services[7]

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

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

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

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

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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	83.1	84.9	78.0	83.5	84.1	85.0
	CSI	23.1	20.2	-	24.5	21.0	25.2
	MER	30.6	30.4	-	30.2	30.4	30.1
2	FS	83.0	82.4	75.6	84.4	80.6	74.9
	CSI	22.1	25.5	-	22.0	25.9	23.3
	MER	30.2	32.2	-	31.9	31.5	31.9
3	FS	76.2	79.5	81.1	75.9	71.8	78.0
	CSI	22.5	22.1	-	26.1	22.0	23.0
	MER	29.8	30.0	-	30.4	29.7	31.4
4	FS	83.2	85.0	91.2	87.2	93.1	87.8
	CSI	24.3	18.3	-	21.9	22.0	21.9
	MER	32.1	31.1	-	32.5	30.4	31.8
5	FS	91.6	89.4	85.4	86.0	90.0	86.3
	CSI	26.6	25.4	-	19.9	21.8	22.4
	MER	32.9	31.5	-	30.4	32.4	32.1
6	FS	86.1	80.2	80.4	81.9	82.6	80.4
	CSI	21.0	22.5	-	23.9	19.8	24.5
	MER	31.7	32.8	-	32.8	32.3	32.5
7	FS	88.7	97.0	88.2	83.6	88.0	89.0
	CSI	22.7	18.7	-	24.8	22.9	19.5
	MER	30.7	31.8	-	31.3	32.2	32.0
8	FS	81.9	85.0	88.7	84.5	83.7	84.9
	CSI	24.6	25.5	-	22.9	22.2	19.6
	MER	32.3	31.1	-	32.8	31.3	33.6
9	FS	85.0	86.0	87.4	86.1	84.0	85.4
	CSI	23.2	20.4	-	19.5	19.0	22.8
	MER	33.4	32.5	-	31.7	33.5	32.7
10	FS	92.0	91.9	92.0	90.9	91.0	87.0
	CSI	20.5	20.3	-	24.4	22.2	24.9
	MER	32.0	31.1	-	31.6	31.9	33.0

Table B - Winter Hill DTT Services

Frequencies listed are in MHz
Field Strength (FS) values are indicated in dBμV/m (8MHz FFT average hold 5 sec)
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

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interference as 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[8]. 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 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.

8 - *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 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.

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 – 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 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)	7.9 dB

Impedance matching at receiver input and consideration of losses over the feeder runs between 490 MHz and 610 MHz are factored in to calculated FS values.

Andrew out of band rejection filter used to reject unwanted RF interference. Insertion loss 3dB.

Mapping Data

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Planning Condition 29

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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 (https://www.freeview.co.uk/platform-management) before buying TV equipment. GTech Surveys Limited, Ofcom and Digital UK are not responsible for household TV reception arrangements.

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

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