

GTech Surveys Limited

Swan House

Television Reception Impact Assessment

Planning Condition 35

CHANGE HISTORY

Issue	Date	Details of Changes	
0.0	15/12/2023	Working draft	
0.1	21/12/2023	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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Professional broadcast trained project engineers deliver, and supply Market UK Limited 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

This assessment details the findings of a television signal survey within the potential television signal impact areas previously identified, relating to the Swan House development in Manchester. Planning condition 35 associated with the development states;

Notwithstanding the TV reception survey prepared by G-tech, stamped as received by the City Council, as Local Planning Authority, on the 27 September 2018, within one month of the practical completion of each phase of the development or before the residential element of the development is first occupied, whichever is the sooner, 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.

The relevant TV signal survey area for the development was reassessed and a site visit was then subsequently conducted to establish the existing television reception conditions.

Digital terrestrial television (DTT also known as Freeview) broadcasts currently serve the study area well and reception conditions are optimal. This is due to the proximity of the area and the main regional DTT transmitter (Winter Hill), which provides robust coverage throughout Manchester. No mitigation measures are required to restore the optimal reception of DTT transmissions.

With respect to digital satellite television services (such as Freesat and Sky), existing coverage is good because no obstructions exist on the required line-of-sight views from the satellite dishes to the serving satellites. Reception conditions are likely to be good throughout the study area.

This report provides the existing level and quality of television signal reception within the survey area and can be used for reference. This report has been produced to discharge planning condition 35.

1 - Introduction

This assessment details the findings of a practical completion television signal survey within the potential signal impact areas previously identified, relating to the consented Swan House development in Manchester.

Planning condition 35 associated with the development states;

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The background of work is presented in the following report, “Television and Radio Reception Impact Assessment – Swan House, Manchester”, GTech Surveys Limited, dated 19th July 2018.

GTech Surveys Limited is a consultant member of the Confederation of Aerial Industries.

NB - Since the 2018 survey work, the entire suite of digital terrestrial television (DTT) transmissions emanating from the main regional DTT transmitter (located at Winter Hill) has changed due to the requirement of additional radio spectrum required for the rollout of 4G mobile phone networks. A number of high-definitions transmissions have ceased transmission all together. In addition, since the 2018 survey, a lot has changed within the study area, hence the requirement to ‘re-baseline’. Consequently, this assessment aims to provide an understanding of existing coverage around the Site and if required, sets out suitable mitigation to ensure that any receptor (television viewer) can still receive interference free television broadcasts.

The Site and Development

Figure 1 shows the location of the Site.

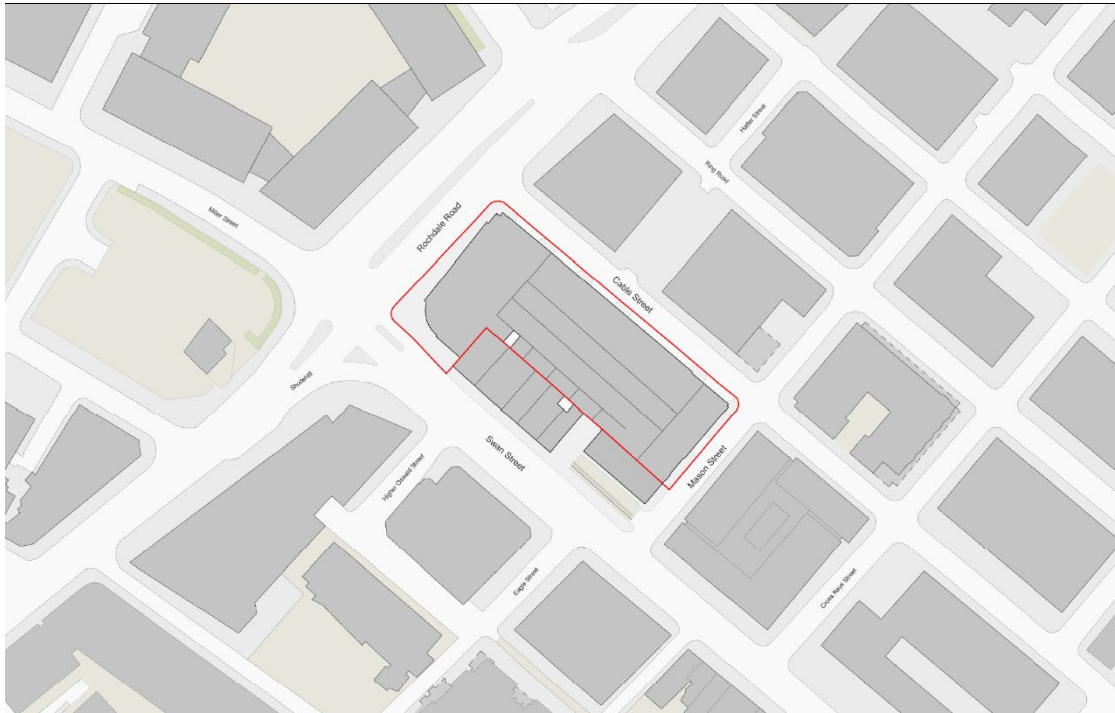


Figure 1 - The Location of the Site and the Site Application Boundary

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 and a site visit was then subsequently conducted to establish the existing television reception conditions. The work was undertaken during December 2023.

This report follows the following structure:

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

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

- Chapter 3 describes the existing television reception conditions around the Site

- Chapter 4 identifies any required mitigation in order to restore optimal reception conditions

- Chapter 5 presents the conclusion

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 transmitter (grid reference SD 66053 14463), on a bearing of 310° (with respect to true north) and 24km away. The Winter Hill transmitter is shown with respect to the Site in Figure 2. In Figure 2, the direction of the incoming DTT signals at the Site from the Winter Hill transmitter is indicated by the blue arrowed line.

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

Information regarding the Granada TV region and the Winter Hill transmitter can be found on the Digital UK website - <http://www.digitaluk.co.uk>

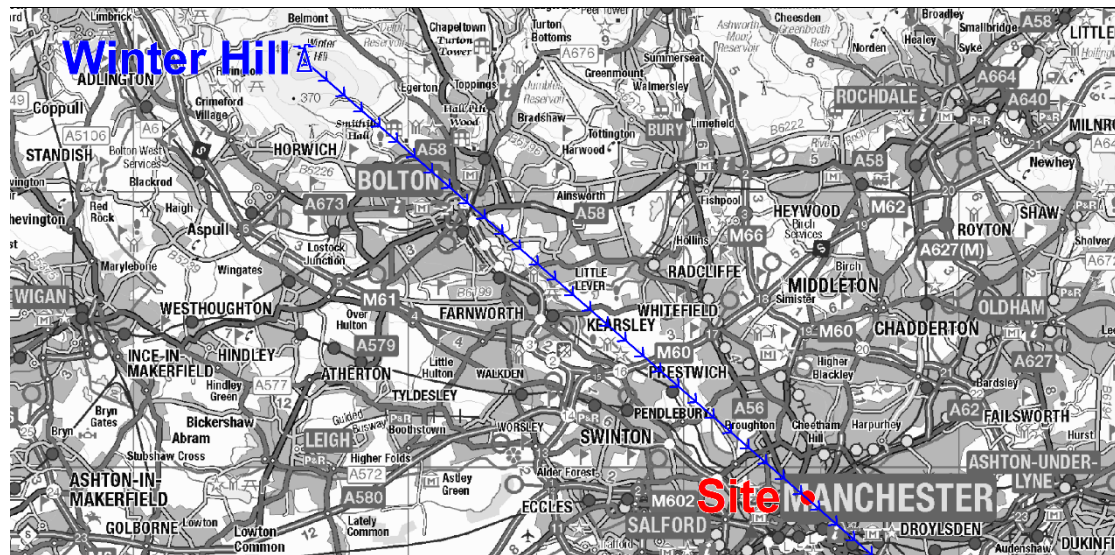


Figure 2 - The Locations of the Winter Hill Transmitter and the Site

Non-Terrestrial Television Services (Digital Satellite Television)

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

3 - Survey Methodology & Description of Baseline

Due to the complex nature of television interference in densely built up urban environments, investigations must be undertaken in a number of different areas around a site to fully evaluate any potential interference effects. As identified in the previous study, measurements were undertaken up to one kilometre from the Site, but mainly focused around the Site and areas to the immediate northwest and southeast, the areas where any possible interference could occur. These locations were visited to record the existing signal levels and qualities. The locations are identified in Figure 3, and the measurements are detailed in Table B, found in the Appendix - *Signal Measurements*. The following data was recorded:

- Field strength and technical signal measurements of DTT transmissions from the main serving transmitter (Winter Hill)
- 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. During the survey, no assessment was made of reception conditions within viewers' homes. Equipment details are detailed in the Appendix - *Survey Equipment*.

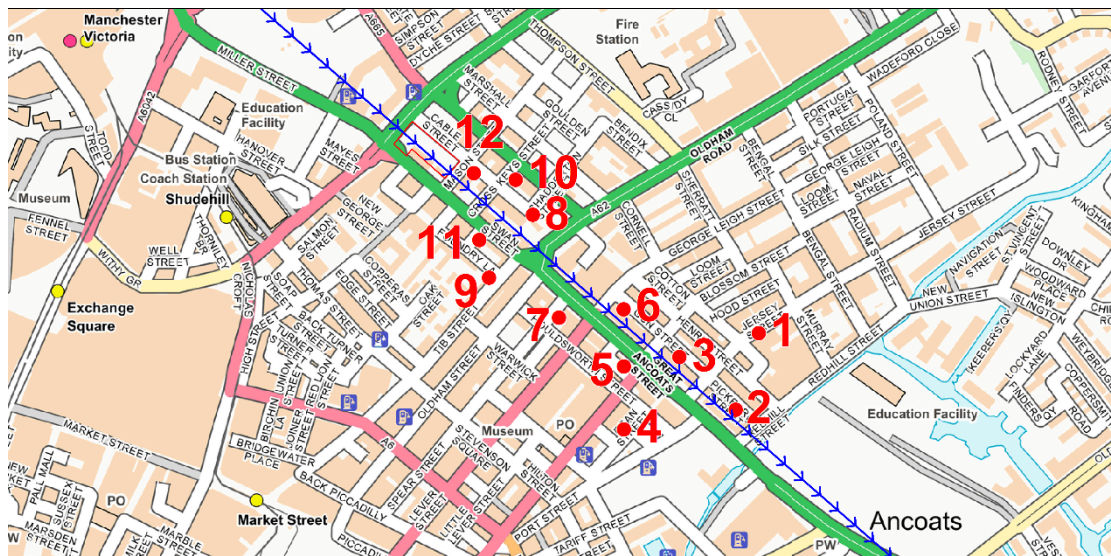


Figure 3 - Surveyed Locations. The blue arrow indicates the direction of the incoming DTT signals from Winter Hill transmitter. The Site is delineated in red

Survey Results and Observations

In general, building use around the Site is mainly for commercial with some high-rise residential use. There are a number of significantly tall new developments around the Site. To the immediate north of the Site, the Moda Angel Gardens building is likely to dominate local reception conditions due to its massing and height. In addition, the CIS Tower will also have a significant dominating effect upon local reception conditions.

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.

DTT transmissions from the Winter Hill transmitter employ a guard interval in the digital transmission, which ensures resilience against the interference caused by signal multipath in densely cluttered areas (similar to those investigated during the survey work). In addition to the embedded protection in the DVB-T2² 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.

When visible during the survey, all signal receiving antenna systems are mounted on rooftops, ensuring optimal reception conditions. All terrestrial television antennas were noted to be directed towards the Winter Hill transmitter, which was expected because it is the main regional transmitter for Manchester city.

Overall, DTT services currently provide good coverage and service in the study area. The taller buildings and structures to the north of the Site are likely to dominate reception conditions.

Digital Satellite Television - Freesat and Sky

During the survey, few satellite dishes were seen mounted on existing properties due to building use and height in the survey area. Additional dishes may be mounted on rooftops and at the rear of properties; 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*

² - Digital Video Broadcasting – Second Generation Terrestrial

4 - Mitigation Measures

The Planning Conditions states that mitigation (*measures to maintain at least the pre-existing level and quality of signal reception*) should be identified and applied if reception degradation has occurred;

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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.

However, as no interference to the reception of any television or radio broadcast platform has been identified, no mitigation measures are required to restore optimal television broadcast service reception.

5 - Conclusions

A survey has been performed to record the existing levels and qualities of television signals in locations where possible interference effects may occur, arising from the Swan House development in Manchester. Planning condition 35 associated with the development states;

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The study has focused on the reception of the two television broadcast platforms that could possibly be impacted by the development; digital terrestrial television (DTT – commercially known as Freeview); and digital satellite television services (such as Freesat and Sky).

Digital Terrestrial Television (DTT) - Freeview

The study area is currently well served by DTT transmissions from the main regional transmitter at Winter Hill. Existing tall and wide structures (including the CIS Tower and Moda Angel Gardens building) are already likely to dominate reception conditions, however, coverage is still good and DTT services are robustly received in the identified areas around the Site.

Digital Satellite Television - Freesat & Sky

The reception of digital satellite services is optimal because all satellite dishes are located on rooftops and exposed parts of existing buildings which offers the clearest line-of-sight (LOS) from the satellite dish to the serving satellite. It is considered that digital satellite television reception conditions are currently robust around the Site and throughout the wider study area.

Because coverage conditions can be classed as good, and no mitigation measures are required to restore the optimal reception of television services, planning condition 35 with respect to Swan House can now be discharged.

APPENDIX

Television Transmission Frequencies

Signal Measurements

An Overview of Signal Measurements

Survey Equipment

Calculation of Received Field Strength

Mapping Data

Television Transmission Frequencies³

Digital TV Multiplex	Multiplex Operator	UHF Channel Number⁴	Channel Frequency Fc (MHz)⁵	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 Digital Terrestrial Television Services

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

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

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

5 - 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

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	31 554.00 Arqiva A	37 602.00 Arqiva B
1	FS	82.7	79.5	84.2	81.6	85.2	87.0
	CSI	23.0	22.2	-	21.1	19.2	21.0
	MER	32.3	30.8	-	30.9	31.2	30.2
2	FS	86.3	86.0	86.9	79.4	82.0	86.0
	CSI	21.3	24.1	-	26.6	26.3	20.1
	MER	29.1	31.3	-	31.0	31.4	30.0
3	FS	86.0	87.8	84.2	85.6	84.9	88.5
	CSI	24.2	22.9	-	24.5	23.6	22.2
	MER	31.0	32.4	-	30.9	31.0	30.2
4	FS	80.7	80.0	87.3	86.4	85.6	78.9
	CSI	21.6	25.6	-	21.7	20.4	23.1
	MER	31.6	31.2	-	29.6	32.9	31.2
5	FS	82.8	85.1	83.0	80.6	81.3	86.0
	CSI	22.4	22.3	-	23.6	20.9	21.0
	MER	31.6	30.9	-	32.8	29.5	31.2
6	FS	87.1	78.8	88.0	87.6	84.0	82.6
	CSI	19.8	20.6	-	24.6	19.1	25.3
	MER	31.4	30.7	-	30.9	31.8	30.0
7	FS	85.0	80.2	84.0	87.2	84.5	85.0
	CSI	21.6	23.3	-	20.8	20.1	21.0
	MER	31.5	30.4	-	30.2	32.2	30.6
8	FS	76.1	87.2	80.3	82.9	76.9	77.2
	CSI	22.2	20.1	-	20.7	23.8	21.9
	MER	31.1	31.5	-	30.3	31.5	32.4
9	FS	86.9	87.8	89.2	80.8	86.2	81.8
	CSI	26.3	21.5	-	20.9	22.2	21.0
	MER	32.0	30.5	-	32.8	32.0	32.2
10	FS	85.7	84.6	88.5	80.8	86.2	78.5
	CSI	23.6	25.1	-	20.6	20.6	22.1
	MER	31.1	31.7	-	30.9	32.1	31.2
11	FS	87.6	84.3	80.8	82.9	87.0	84.7
	CSI	23.5	28.9	-	22.6	20.1	21.7
	MER	31.0	32.1	-	31.6	31.1	32.7
12	FS	84.5	84.2	87.1	80.5	82.4	84.4
	CSI	20.7	19.5	-	21.6	22.2	22.0
	MER	30.6	31.1	-	31.2	32.1	31.8

Table B - Winter Hill Digital Television Services

Frequencies listed are in MHz

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

CSI Channel Status Information (%)

MER Modulation Error Ratio (dB)

An Overview of Signal Measurements

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

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

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

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

However, the BER provides a very narrow signal measurement range. Even for vanishingly small BER readings, a small drop in the level of received DTT signal can push the DTT receiver over the digital cliff edge beyond the point of system failure. The CBER is closely related to the BER providing a wider signal measurement range. Depending on the type(s) of unknown disturbance(s) affecting our DTT installation (noise, co-channel or adjacent PAL, co-channel DTT, etc.), the CBER corresponding to the reference QEF BER of 2×10^{-4} varies between 4 and 7 in 100. 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.

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 performance⁶. 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.

⁶ - 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.

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.
----------	--

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



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*

Calculation of Received Field Strength

The Field Strength (dB μ V/m) is derived from the Terminated Level (dB μ V) as measured at the input of the measurement receiver.

Field Strength (dB μ V/m) = Terminated Level (dB μ V) – 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

Mapping Data

This report includes mapping and mapping data provided by Ordnance Survey (OS), under the terms of the Open Government Licence, OS data Crown copyright and database copyright (2023).

DISCLAIMER

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

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

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

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

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

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

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