

Interim 600MHz Multiplex Indicative Proposal

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Subject to Contract

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1 Introduction

Following the release of the UHF strategy statement “Securing Long Term Benefits from Scarce Low Frequency Spectrum”, Arqiva has been asked by Ofcom to provide an Indicative Proposal for the provision of Transmission Services in respect of two multiplexes at a number of the broadcast sites.

1.1 Disclaimer

The information contained in this document has been compiled by Arqiva to outline some options for the provision of an Interim 600MHz Transmission solution; however this document does not constitute a recommendation, commitment, offer or agreement by Arqiva. While the information contained in this document is based on the best available information, site surveys and detailed site by site analysis has not been possible in the time available and, as a result, technical solutions may be subject to modification as more detailed information comes to light.

For the purpose of this proposal, and as discussed with Ofcom, the list of 30 sites has been chosen based on indicative population coverage and ease of implementation.

2 Executive Summary

In order to support this Interim Multiplex proposal, Arqiva has developed a combined Network Access and MTS solution (Transmission Service solution) to deliver 2 multiplexes at 10, 20 or 30 of the highest population sites, for a 5 year term as quickly and cost effectively as possible. This solution has been prepared at the request of Ofcom and this note will confirm Arqiva's correspondence with Ofcom.

The Interim Multiplex solution contemplates the support of two multiplexes in the 600MHz band on frequencies defined as Layer 7 and Layer 8 in the 600MHz plan provided by Ofcom in association with the 600MHz plan.

A significant change since the original 600 MHz published reference offer (“the Original 600MHz Reference Offer”) is the ability to now use more S1 / S2 antennas, this is due to the following:

- Transmitter powers assumed for the Interim Muxes are much lower than those assumed for the original 600MHz Reference Offers. In the original 600MHz Reference Offers ERPs of up to -10 dB below PSB power were contemplated and, where this was not supportable on existing antenna infrastructure, new antennas were proposed. In the Interim Mux solution, the ERPs and transmitter power are lower than those contemplated in the original 600MHz Reference Offers which has allowed a greater number of existing antennas to support the Interim Multiplexes and reduced the need for new antennas. The Transmitters proposed at the majority of sites are the low power DTT transmitter systems.
- The original 600MHz Reference Offer assumed that BOTH Main and Reserve antennas would be required to support the service. For the Interim Multiplexes this requirement has been relaxed and, where only one antenna can support the services, then this has been offered without a reserve antenna system. In some cases, single antennas which also allow half antenna reserve operation have been offered (but this is not true of all sites). This leads to a situation where a number of sites will have NO reserve antenna capability, and service will experience an outage in the event of an antenna fault and the SLA will be adjusted accordingly.

Antenna systems (including combiner units and feeders) are very reliable but, in the event of a major fault, a prolonged outage will occur. The Indicative Proposal has been provided to minimise the cost and duration of the Interim Multiplex rollout programme and the scope of the antenna works has therefore been kept to a minimum and, as a result, non-redundant antenna systems will be provided at a number of sites. The SLA shown in section 4 therefore relates solely to the availability of the transmitter systems and does not include the performance of the antennas the configuration of which will need to be discussed and agreed on a site by site basis.

New antennas are to be provided at Mendip and Sandy Heath since the antennas at these sites have no capability at all for interim muxes (and also some restrictions at Mendip). At Winter Hill, the D3 antenna is rotated by moving distribution feeders. For Emley Moor it is proposed to re-use the Channel 5 antenna, but new feeders will be required.

Should alternative levels of antenna redundancy be requested then Arqiva will review potential solutions, but it should be noted that any alternative options will likely increase the scope and cost of the implementation programme.

In this Indicative Proposal it is proposed that, at the majority of sites, existing low power DTT transmitter systems – originally deployed for the original 1998 DTT rollout – will be redeployed. These systems, which were gradually switched off over the course of the DSO programme, will be able to support the provision of a low power Interim 600MHz network. As stated above, the Interim Network sites will, in some cases, be greater than 10 dB below the ERP of existing PSB services.

This Indicative Proposal is for Transmission Services only (hill top site services) and excludes Compression and Distribution services. It will be the responsibility of the customer to provide ASI feeds to the Transmission equipment and such additional services may be procured from Arqiva.

3 Technical Description

This section provides a technical description of the systems that are proposed in respect of Interim 600MHz Multiplexes and the scope of the implementation project. Alternative technical solutions are of course feasible and Arqiva would be pleased to explore and evaluate such alternatives as and when requested by interested parties.

3.1 Antenna Systems

In order to minimise build out time, the Interim 600MHz solution is based on use of existing antennas at all sites except Mendip and Sandy Heath. At both of these sites, a new 'slot' antenna system will be provided..

The use of existing antennas, which were originally built and optimised to operate at alternative frequencies to those for the Interim Multiplexes, will lead to a compromised performance:

- The antenna pattern provided by the existing antennas will be worse than would normally be accepted by broadcasters and significant null depths will be present at a number of sites. Arqiva can provide expected antenna performance patterns on request, but cannot guarantee actual pattern performance at this time.
- At a number of sites reserve antenna systems are not provided within this Indicative Proposal to minimise the scope, duration and cost of the rollout programme. This will lead to an impact on service availability in the event of an antenna fault or as a result of planned or emergency works at a given site. Where Reserve antenna systems are available, it should be noted that there may be limits on the permissible transmitter power which, in turn, will limit the ERP and coverage when compared with normal operational conditions

3.2 Combiner Systems

In order to minimise the scope, cost and complexity of the Interim Multiplex system, use of existing combiners (to access the high power DTT antennas) is proposed at the majority of sites.

Where use of high power DTT antenna is proposed, the wideband port of an existing combiner unit will be used. A single filter unit will be provided to combine the two Interim Multiplex services. Where access to both the Main and Reserve high power antenna and combiner system is possible, a patch panel will be provided to access the wideband ports of both combiner chains.

Where a new separate antenna system is proposed for the Interim Multiplexes, a single filter unit will be provided along with a new Power Divider to access the upper and lower feeders.

In both cases a single filter unit is proposed to minimise scope, cost and complexity.

3.3 Transmitter Systems

In this Indicative Proposal it is proposed that, at the majority of sites, existing low power DTT transmitter systems – originally deployed for the original 1998 DTT rollout – will be redeployed. These systems, which were gradually switched off over the course of the DSO programme, will be able to support the provision of a low power Interim 600MHz network.

Where low power DTT transmitters are not suitable, it is proposed that alternative transmitter systems will be provided.

As stated above, the Interim Network sites, in some cases, will be greater than 10 dB below the ERP of existing PSB services.

In order to support DVB-T2 transmissions new modulators will be provided. In order to manage the DVB Service Information to enable cross-carriage between multiplexes, SI managers will be provided.

4 Service Level Agreements

The Transmitter System Service Level Agreement is specified below.

Transmitter System Target Availability*	
Based on -3dB down on normal operating ERP (except where otherwise stated) (Post 12 month period following Actual Service Start Date)	99.7%

** It should be noted that the Target Availabilities above EXCLUDE the combiner and antenna subsystems which will need to be dealt with on a site by site basis.*

In the event of a Transmitter system fault all sites will operate at -3 d/B below normal operating ERP except at the following sites which will be -6 d/B below normal operating ERP.

- Emley Moor
- Winter Hill

The Antenna System configuration, comprising the Combiner System, Feeder and Antenna, will vary on a site by site basis. It should be noted that at the following sites there will be no reserve antenna system:

- Pontop Pike
- Rowridge
- Bilsdale
- Waltham
- Hannington
- Angus
- Caradon Hill
- Beacon Hill

At the other sites, access will be available to either reserve antenna or half antenna operation will be possible. It should be noted that power may be limited when in a backup antenna configuration and the service may be subject to interruption in order to rectify the original fault.

5 Population coverage and Rollout Plan

The rollout plan has been produced based upon the prioritisation of the Sites in maximum population coverage order depending upon the required scope of works.

Scenarios	Station	Target Service Start Date based upon July 2013 start
Top 10	Crystal Palace	Dec-13
	Sutton Coldfield	Dec-13
	Craigkelly	Jan-14
	Black Hill	Jan-14
	Rowridge	Jan-14
	Winter Hill	Feb-14
	Pontop Pike	Feb-14
	Divis	Mar-14
	Wenvoe	Mar-14
	Bilsdale	Mar-14
Top 20	Waltham	Mar-14
	Hannington	Mar-14
	Tacolneston	Apr-14
	Ridge Hill	Apr-14
	Belmont	May-14
	Oxford	May-14
	Durris	May-14
	Emley Moor	Jul-14
	Mendip	Aug-14
	Sandy Heath	Sep-14
Top 30	Fenton	Jul-14
	Sheffield	Jul-14
	Fenham	Aug-14
	Angus	Aug-14
	Caradon Hill	Sep-14
	Beacon Hill	Sep-14
	Caldbeck	Oct-14
	Moel Y Park	Oct-14
	Darvel	Nov-14
	Bluebell Hill	Nov-14

The Table below shows indicative coverage based upon theoretical antenna patterns and low power transmissions as shown in Appendix A. The population figures are for illustrative purposes only. Actual population coverage may depend upon domestic reception systems (since operation in 600MHz will be outside of the traditional band in some areas).

Number of Sites	Indicative Population Coverage (Cumulative)
10	46.1%
20	64.4%
30	68.8%

The coverage is based on the DVB-T2 mode currently in use within the UK DTT network (256 QAM 2/3), to ideal receive antennas inside the 6 Core Digital Preferred Service Area (DPSA) for the 30 stations. The channel frequencies have been assumed as per Layer 7 and Layer 8 of the original 600 MHz Reference Offer

6 Charges

Please find below a Summary table for the charges, further information/breakdown can be made available upon request. These charges have been calculated based on the previous 600MHz Reference Offers and in accordance with Ofcom guidelines.

£'000	Charges per multiplex in a dual multiplex environment		
	10 sites	20 Sites	30 Sites
Network Access Fee	2,828	5,008	6,259
Managed Transmission Fee	349	758	1,118
Transmission Fee	3,176	5,766	7,376
Network Access Pass Through	87	164	209
MTS Electrical Charge (indicative)	119	240	272
Total Fee (indicative)	3,382	6,170	7,857

Charging Notes:

- Charges are calculated at February 2013 pricing ex VAT
- Charges are due from contract award annually through out the 5 year period and are subject to RPI
- Charges in the table above are annual and steady state from completion of build programme
- Charges Ramp up during build programme
- Charges are for a single mux in a dual mux environment i.e. that two multiplexes will be implemented simultaneously
- Charges assume July 2013 contract award & June 2018 contract end
- Charges are for a Transmission Services (i.e. Network Access and Managed Transmission Services combined). The breakdown of the charges shown for NA and MTS are indicative only and, as agreed with Ofcom, are not capable of acceptance individually
- MTS electricity charges are pass through and the figure provided in the charging table above is an indicative figure only
- Full terms and conditions will be provided upon request by Ofcom

Appendix A Summary of Proposed Transmission Characteristics for Interim Muxes (February 2013)

Deviations from the currently expected number and type of 600 MHz DTT multiplex services broadcasting from the 30 sites listed below will be treated as an exceptional risk. ERPs are specified when operating into the Main Antenna system, using the specified Transmitter.

Site	Main Antenna	Antenna Fault	Layer 7			Layer 8		
			Transmitter	Channel	Normal Operating ERP	Transmitter	Channel	Normal operating ERP
Crystal Palace	S1 @ 212 m for Ch 33 S2 @ 204 m for Ch 35	S3 reserve	Crystal Palace 2 1500 W	33	15.6 kW	Crystal Palace B 1420 W	35	13.5 kW
Winter Hill	D3 (requires rotation) @ 237 m	Half antenna	Croydon BBC1 3400 W	31	14.0 kW	Croydon BBC2 3400 W	37	14.0 kW
Sutton Coldfield	S1 @ 264 m	S2 reserve	Belmont 1 386 W	33	6.4 kW	Sutton Coldfield A 386 W	35	8.3 kW
Craigkelly	S1 @ 131 m	S2 reserve	Craigkelly 1 386 W	33	2.3 kW	Craigkelly B 500 W	34	3.0 kW
Black Hill	C5 Antenna (Old Mast) @ 264m	Half antenna	Rumster Forest D 730 W	32	9.4 kW	Stockland Hill C 970 W	35	12.5 kW
Divis	S1 @ 148 m	S2 reserve	Divis 2 500 W	33	4.4 kW	Divis D 386 W	34	3.4 kW

Site	Main Antenna	Antenna Fault	Layer 7			Layer 8		
			Transmitter	Channel	Normal Operating ERP	Transmitter	Channel	Normal operating ERP
Pontop Pike	S1 @ 145 m	NO reserve	Pontop Pike B 1420 W	33	9.5 kW	Pontop Pike C 1420 W	34	9.5 kW
Rowridge HP	S2 @ 156 m	NO reserve	Rowridge B 800 W	31	25.0 kW	Rowridge C 800 W	37	25.0 kW
Wenvoe	S1 @ 258 m	S2 reserve	Wenvoe 2 250 W	31	4.2 kW	Wenvoe 1 730 W	37	12.2 kW
Bilsdale	S1 @ 296 m	NO Reserve	Bilsdale A 500 W	31	5 kW	Bilsdale 1 700 W	37	5 kW
Waltham	S1 @ 260 m	No reserve	Waltham 2 750 W	31	1.4 kW	Waltham A 1000 W	37	1.4 kW
Hannington	S1 @ 142 m	NO reserve	Waltham C 730 W	32	10.0 kW	Darvel D 386 W	34	5.5 kW
Belmont	S1 @ 342m	S2 reserve	Stockland Hill 1 970 W	33	15.4 kW	Belmont C 970 W	35	15.4 kW
Oxford	S1 @ 161 m	S2 reserve	Oxford D 386 W	31	5.8 kW	Oxford C 386 W	37	5.8 kW
Tacolneston	S1 @ 200 m	S2 reserve	Bilsdale 2 750 W	31	10.0 kW	Tacolneston 1 970 W	37	10.0 kW

Site	Main Antenna	Antenna Fault	Layer 7			Layer 8		
			Transmitter	Channel	Normal Operating ERP	Transmitter	Channel	Normal operating ERP
Ridge Hill	S1 @ 162 m	S2 reserve	Darvel A 500 W	32	4.2 kW	Rowridge 2 500 W	34	4.2 kW
Emley Moor	C5 antenna @ 279 m	Half antenna	Dover BBC1 4000 W	32	16.7 kW	Dover BBC2 4000 W	34	16.7 kW
Mendip	New DDR Antenna @ 192m	Half antenna	Ridge Hill 1 1420 W	33	17.5 kW	Crystal Palace C 1420 W	35	17.5 kW
Sandy Heath	New DDR Antenna @ 220 m	Half antenna	Sandy Heath C 1420 W	32	8.4 kW	Sandy Heath D 1420 W	34	8.4 kW
Durris	S1 @ 315 m	S2 reserve	Durris C 970 W	32	12.5 kW	Durris 2 1000 W	35	12.9 kW
Angus	S1 @ 230 m	NO reserve	Divis 1 386 W	31	4.5 kW	Divis B 386 W	37	4.5 kW
Bluebell Hill	S2 @ 49 m	S1 reserve	Bluebell Hill 2 250 W	32	1.4 kW	Bluebell Hill A 250 W	34	1.4 kW
Sheffield	S1 @ 48 m	Half antenna	Sheffield 2 25 W	31	0.2 kW	Sheffield A 25 W	37	0.2 kW
Moel-y-Parc	S1 @ 236 m	S2 reserve	Waltham B 730 W	32	7.3 kW	Heathfield 2 500 W	34	5.0 kW

Site	Main Antenna	Antenna Fault	Layer 7			Layer 8		
			Transmitter	Channel	Normal Operating ERP	Transmitter	Channel	Normal operating ERP
Caldbeck	S1 @ 331 m	S2 reserve	Rowridge A 750 W	32	5.4 kW	Chatton A 500 W	35	3.6 kW
Caradon Hill	S1 @ 234 m	NO reserve	Rowridge D 800 W	31	10.5 kW	The Wrekin east A 250 W	37	2.5 kW
Beacon Hill	S1 @ 100 m	NO reserve	Craigkelly A 500 W	33	4.3 kW	Hastings 2 100 W	34	1.0 kW
Darvel	C5 Antenna @ 110 m	Half antenna	Darvel 1 386 W	31	2.6 kW	Darvel B 386 W	37	2.6 kW
Fenton	S1 @ 50 m	Half antenna	Fenton D 23 W	32	0.14 kW	Pendle Forest 23 W	34	0.14 kW
Fenham	S1 @ 51 m	Half antenna	Fenham C 10 W	31	0.08 kW	Fenham D 10 W	37	0.08 kW

The specified transmitters are subject to change during the commissioning phase. Arqiva reserves the right to substitute the specified transmitter for one of similar (but not identical) transmitter power.