DVB-T2: An Update from the UK Rollout

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Plans to launch HD services in the UK using DVB-T2

- **Upgrade path** for DTT platform (Freeview) using **DVB-T2 and MPEG-4**:-
  - in **one step**, minimising disruption to broadcasters and viewers
  - one BBC multiplex cleared - then **only** suitable for new (HD or SD) services as existing Freeview receivers will not decode this DVB-T2 multiplex – existing DVB-T/MPEG-2 services will continue to be received on Freeview receivers
  - BBC is leading the UK ‘**T2 programme**’, in partnership with other PSBs within a regulatory framework set by the DCMS, Ofcom and the BBC Trust

- Plan to launch at least an initial three PSB HD channels at **end 2009**, in the Granada ITV region. DTT HD services will then be launched, **region by region**, across the UK following digital switchover - regions that have already switched will be retrofitted

- **But** it does require reorganisation of the multiplexes and a major upgrade of transmission infrastructure
The HD services

- Capacity to provide **4-5 PSB HD services universally** at around **8 Mbps** per service with **no** extra spectrum in the UK. Other HD services could be provided later through the Digital Dividend (or through a migration of further multiplexes to DVB-T2)

- As multiplex operator, BBC was allocated one HD-sized slot for **BBC HD**

- Following a competitive selection process (“beauty parade”), Ofcom announced in October 2009 the award of two HD slots to:
  - ITV (and the other Channel 3 licensees) for **ITV1 HD** and,
  - jointly, Channel 4 (for **C4 HD** in England, Scotland and Northern Ireland) and S4C (for **S4C HD** in Wales)

- In February 2009, Ofcom confirmed two bids for a fourth HD slot – from **C4/S4C** and from **five**. Ofcom are accepting comments until 6 March and expect to make an announcement in April 2009
What happens to multiplex capacity at switchover?

**Before switchover**
- Mux 1 - BBC
- Mux B - BBC
- Mux 2 - Digital 3&4
- Mux A - SDN
- Mux C - Arqiva
- Mux D - Arqiva

**From switchover**
- PSB1 - BBC
- PSB3 - BBC
- PSB2 - Digital 3&4
- COM4 - SDN
- COM5 - Arqiva
- COM6 - Arqiva

24Mbps total extra capacity from switch from 16QAM to 64QAM

BBC Distribution
What happens to multiplex capacity at ‘DVB-T2 day’?

From switchover

- PSB1 - BBC
- PSB3 - BBC
- PSB2 - Digital 3&4
- COM4 - SDN
- COM5 - Arqiva
- COM6 - Arqiva

24 Mbps

From ‘DVB-T2 day’

- PSB1 - BBC
- PSB3 - BBC
- PSB2 - Digital 3&4
- COM4 - SDN
- COM5 - Arqiva
- COM6 - Arqiva

24 Mbps

8Mbps+ extra capacity from switch to DVB-T2

SD services displaced to other multiplexes

32 Mbps+
Reminder of DVB-T2 Commercial Requirements

- Must be able to use existing domestic receive aerials and existing transmitter infrastructure
  - Intended primarily for services to fixed and portable receivers
- Minimum of 30% capacity increase over DVB-T
  - With same planning parameters as DVB-T
- Improved SFN performance
- Mechanism for service-specific robustness
- Bandwidth and frequency flexibility
- Mechanism to reduce peak-to-average power ratio
## UK DVB-T2 capacity estimate (untested)

<table>
<thead>
<tr>
<th>Current UK mode</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>64QAM</td>
</tr>
<tr>
<td>FFT size</td>
<td>2K</td>
</tr>
<tr>
<td>Guard Interval</td>
<td>1/32</td>
</tr>
<tr>
<td>FEC</td>
<td>2/3 CC + RS (8%)</td>
</tr>
<tr>
<td>Scattered Pilots</td>
<td>8.3%</td>
</tr>
<tr>
<td>Continual Pilots</td>
<td>2.0%</td>
</tr>
<tr>
<td>Frame structure overhead</td>
<td>1.0%</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Normal</td>
</tr>
<tr>
<td>Capacity</td>
<td>24.1 Mbit/s</td>
</tr>
</tbody>
</table>

DVB-T2 Capacity = DVB-T Capacity + 50%

on top of the 50% efficiency savings from MPEG-4
Structure of the Programme

Executive Board

Stakeholders Group

Programme Steering Group

Programme Control Group

Programme Lead (SRO)

Architecture & Assurance

Programme Manager

PMO

Assurance (BBC)

Infrastructure Sourcing and Operations

Commercial, Contracts, Financial

Technical Standards & Trials

Policy & Regulatory Planning

HD Content Planning & Production

Marketing

Communications & Consultation

Other programmes

Structure of the Programme
DVB-T2 timeline for UK implementation

- **2006**: T2 Study Mission
- **2007**: TM-T2 ad hoc group
- **2008**: T2 VLSI development
- **2009**: T2 Receiver development
- **2010**: HD T2 services
Upgrading big transmitters

Antennas

Feeders

Combinder System

Transmitter

Other services

Distribution Circuits

Network Terminal Equipment (NTE)

SI Multiplexing (SIPSI/SIM)

Monitoring and Control

Transmitter Input Equipment (TIE)

DVB-T Modulator

DVB-T Modulator

[Image of a large transmission tower with associated equipment and processes]
Upgrading small transmitters

Antennas → Combiner System → Transposer or Re-transmitter

Other services

Feeders
UK DVB-T2 Pilot/Trial Project

- Ofcom and the BBC are running a pilot project to test and validate the DVB-T2 standard and to inform the decision on the initial UK transmission mode. Ofcom is leading/facilitating the co-ordination of the project and the BBC is leading the working group.
- Tests of rotated constellations, different FFT sizes, Doppler performance, phase noise performance, scattered pilot patterns …
- Ofcom will consult/decide on the mode in mid 2009 - hopefully giving an overall capacity available of 36 or maybe as much as 40 Mbps.
- Ofcom has a requirement for coverage to match 98.5% (universal).
- The pilot project will cover measurements of the DVB-T2 standard:
  - In the laboratory
  - Using vehicle based coverage/reception measurements
  - Real life reception in the home
- Measurements will be based on transmissions:
  - From the Guildford transmitter
  - In the London area from the Crystal Palace main transmitter

Ofcom
Office of Communications

BBC

BBC Distribution
Crystal Palace – upgraded by Arqiva

- Crystal Palace launched DVB-T2 test transmissions on 20/02/09 using a DVB-T2 modulator supplied by Enensys
- Field trials are now occurring in the London area
- Test transmissions will be available throughout 2009 both for the trials and to enable an open on-air test transmission for product testing and development
UK DVB-T2 Pilot/Trial Project - Participants

- A number of parties have agreed to participate in the UK technical pilot trials and to provide the required resources (findings from the UK pilot will be published):
  - the **broadcasters** who will initially launch services on the multiplex – the BBC, ITV and Channel 4 with S4C
  - the **transmission infrastructure provider** - Arqiva
  - a number of potential DVB-T2 **manufacturers** (integrated digital televisions, set-top boxes and silicon manufacturers) - Panasonic, Pace, Humax, Sony, Sidsa, NXP and ST-Microelectronics
  - the **regulator**, Ofcom chairs the pilot steering group
UK DVB-T2 Pilot/Trial Project

- Seven transmission modes have initially been selected that are closest in planning parameters to the 64-QAM DVB-T mode
- This list will be pared down at an early stage with laboratory testing and probably only 2-3 modes will need to be tested in field trials
- The UK Joint Frequency Planning Project will predict the coverages for different modes (when we know the planning parameters)
- Prototype consumer DVB-T2 transmission and reception equipment is becoming available and the BBC is offering support to manufacturers
- Some the standard will be tested to ensure that commercial receivers work (e.g. multiple PLPs) even if not used for initial launch configuration
- Harsher Digital Television Group tests for impulse noise may be required
World’s first DVB-T2 transmissions and receiver

- BBC began the world’s **DVB-T2 compliant test transmissions on 27/06/08** from Guildford transmitter
- Transmission facilities were provided by Arqiva to support DVB standardisation and UK DVB-T2 project

- On its 60th birthday, **BBC R&D demonstrated a real-time demodulator** receiving compliant DVB-T2 signals – a world first for a live end-to-end DVB-T2 chain
- There was a demonstration of the DVB-T2 modulator and demodulator on the **DVB stand at IBC** in 2008. The BBC modulator and demodulator are available for licensing.
Early Launch Sites

- Launch of PSB HD services in the UK will follow the regional rollout of Digital Switchover (DSO), starting in late 2009
- Some key population centres would therefore need to wait until late in the switchover programme until HD services became available on Freeview
- Therefore, following a request from the BBC, Ofcom consulted on whether additional frequencies could be temporarily assigned. In December 2008, Ofcom confirmed that PSB HD services could launch ahead of DSO in some areas
- Following Ofcom’s Statement, the PSBs are assessing
  - the potential increase in the percentage of the population that could access HD on DTT at various stages of switchover with these early sites
  - the financial, technical and practical aspects of upgrading specific transmitters to DVB-T2 in advance of their planned switchover dates
- At this stage, early launch sites seem very worthwhile and it is likely that as a minimum London (Crystal Palace) would be upgraded early
UK PSBs developed a service specification - to develop a minimum receiver specification for a set-top box (STB), Integrated Digital TV (iDTV) and Digital Television Recorder (DTR) under the direction of DTG Launch Group.

The DTG receiver specification references sections in the DTG HD D-Book (the UK specification for the DTT platform) - version 6 finalised in March 2009 including:

- support for DVB-T2 modulation
- support for High Definition broadcast video and audio surround services
- support for multiple languages
- HD MHEG for interactivity, MHEG interaction channel including AV support
- HD subtitles and Audio Description in the receiver-mix format
- HD content protection and management
- Service Information & selection
- Push VoD (coming soon!)

PSBs consulted manufacturers - there was a broad consensus that a small scale launch (limited number and volume of receivers) is feasible in late 2009, with a full consumer launch possible by the 2010 World Cup. Many chipset and receiver manufacturers have committed to develop DVB-T2 products.
In January 2009, Ofcom consulted on the use of AVC level 4.2 and the related inclusion of 1080p50 as a broadcast video format focused on:
- future-proofing benefits of 1080p50
- technical benefits/challenges
- costs/delay resulting from longer development timescales

In February Ofcom concluded that the use of 1080p50 as a broadcast format would present a significant risk to the launch of the DVB-T2 platform in the UK, therefore decided to adopt an AVC level of 4.0 in the Reference Parameters, not to include 1080p50 as a permissible broadcast video format (but it is required for output/display in the T2 programme’s receiver specification)

This will be Ofcom’s recommended option when they consult on Reference Parameters later in 2009 and Ofcom expect this to remain the case for at least the life of DVB-T2 receiving equipment in the UK.

However the decision was finely balanced and early prototype chipsets were becoming available with a potential 1080p50 capability. Other platforms launching outside the UK would need to revisit this decision depending on their own particular launch windows.
The receiver specification in the DTG D Book has been rewritten to clarify the requirements for different types of product:
- SD receiver, SD recorder, HD receiver, HD recorder

A comprehensive interoperability test and conformance regime is being developed for each of these product types to ensure receiver compliance and the success of the Freeview HD platform (through the Freeview HD and Freeview+ HD trademark licences).

DTG will involve manufacturers in the design of testing processes and facilities.

Test streams already being made available to silicon manufacturers seeking to explore their products’ performance and capability.

Testing of multiple PLP streams for conformance testing (both FPGA and VLSI).
Marketing and communications partnerships

- BBC developed initial lines for industry to ensure consistent messaging
- Digital UK manages switchover messaging
- The BBC, PSBs, Ofcom and Freeview will:
  - co-ordinate the communications and marketing of HD services.
  - work closely with manufacturers and retailers (through Intellect)
  - ensure viewers know what services will be available where and when
  - ensure viewers know how to receive these services
  - Liaise with Digital UK and the Digital Switchover Help Scheme
- Freeview will:
  - ensure compliance/interoperability of equipment (using DTG Testing)
  - Play a key role in the signposting of DVB-T2 products using the Freeview HD and Freeview+ HD logos
Conclusions

- Plans for the implementation of 4-5 HD services on DTT using MPEG-4 and DVB-T2 in the UK are well developed, underway and on-track
- Plans to test and validate the new DVB-T2 standard are well underway and the capacity improvements are looking good
- Prototype transmission and reception equipment for DVB-T2 is starting to become available and commercial product is still looking possible for the launch at end 2009
- The receiver specification is now complete and the transmission system specification is being finalised
- Although the UK is pursuing an aggressive early launch with DVB-T2, it is hoped that other countries will follow suit in reaping the benefits of a gradual adoption of the more spectrum efficient DVB-T2 standard for some new services.