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Challenges and opportunities of broadcast-broadband convergence

Workshop role and agenda

Phillipa Marks

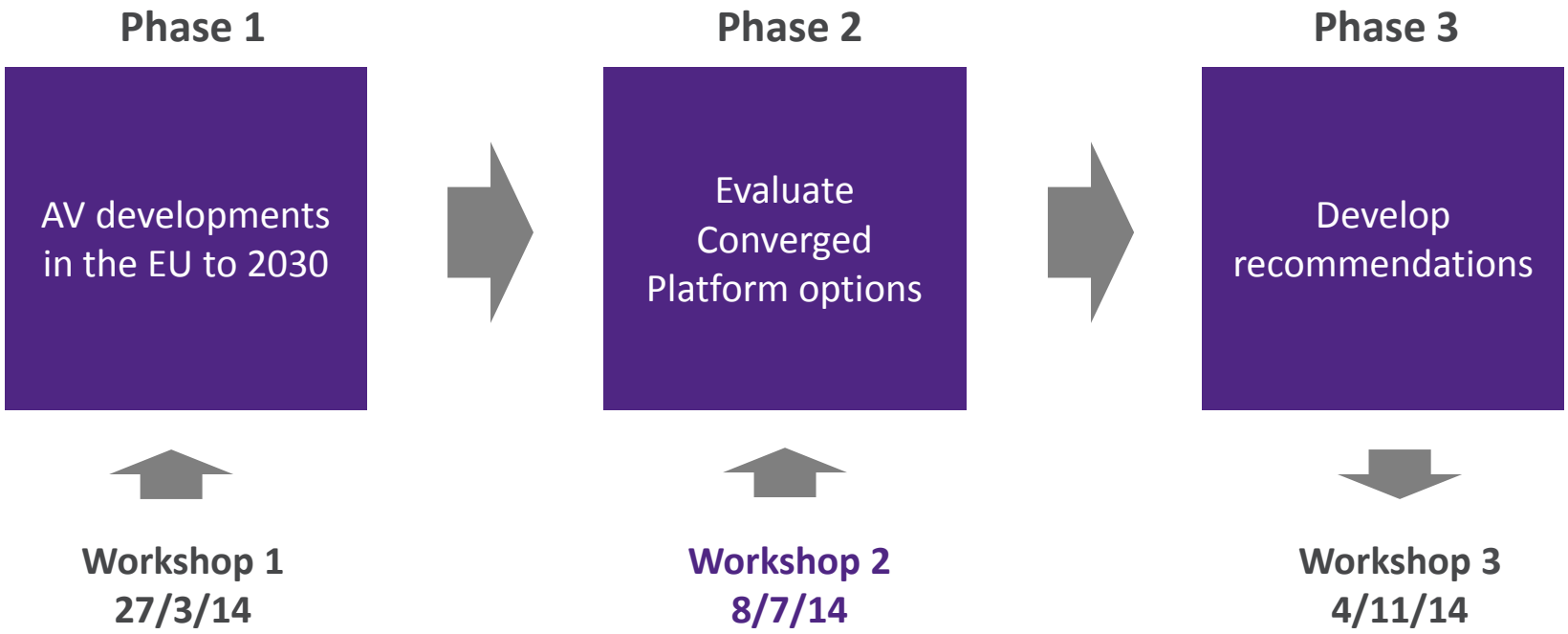
Second stakeholder workshop

8 July 2014

Study objectives

- To explore future developments in the delivery of audio-visual and Internet services over the next 15 years
- To explore how these developments will impact on evolution of terrestrial wireless access networks and especially DTT and Mobile (broadband) networks
- To assess the social and economic merit in moving to a converged platform (CP) which uses UHF spectrum for both terrestrial broadcast and mobile services
  - Convergence at the ***platform*** level
  - Broad evaluation required which takes account of other users e.g.
    - Programme making and special events (PMSE) and other incumbent users
    - Public Protection and Disaster Relief (PPDR)
    - White space devices (WSD)
- Our focus is one issue – a converged platform at UHF - but could inform the wider issue of the long term future of the UHF band

The study process and the stakeholder workshops



- Since Workshop 1: Written feedback (12 parties); discussions with additional stakeholders (15 parties); definition and evaluation of options for CP
- Workshop 2: Feedback on the day and in writing within one week

Key contextual points in our Phase 2 work

- The 700MHz band will be vacated by DTT in a 2017-2025 timeframe
- In many countries there is a move to DVB-T2 in the same or longer timeframe
- These developments require complex (and potentially costly) changes to UHF spectrum use (nationally and across Europe) and changes to consumer equipment
- Hence we assume introducing a converged platform at UHF in parallel with these developments is not possible i.e. the converged platform occurs after 2025.
- We assume overnight transition to a converged platform is not feasible i.e. simulcasting is required to maintain coverage of public service broadcasting services
- Incumbent spectrum uses that need to be taken into account include radio astronomy, wind profilers and wireless audio (PMSE) applications.
- Terminology:
  - eMBMS refers to the current version of the technology
  - LTE-B refers to future development of eMBMS

The agenda for today

CPs – options and challenges

- Deriving a shortlist of options
- Spectrum release and SFNs
- Transition issues

Discussion

60 mins

Economic costs and benefits

- CBA approach
- Benefits and costs
- Tentative conclusions

Discussion

60 mins

Lunch Break

Qualitative and other factors

- Mobile sector view
- Qualitative issues
- Other spectrum uses – team and other views

Discussion

120 mins

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Challenges and opportunities of broadcast-broadband convergence

Options for a converged platform

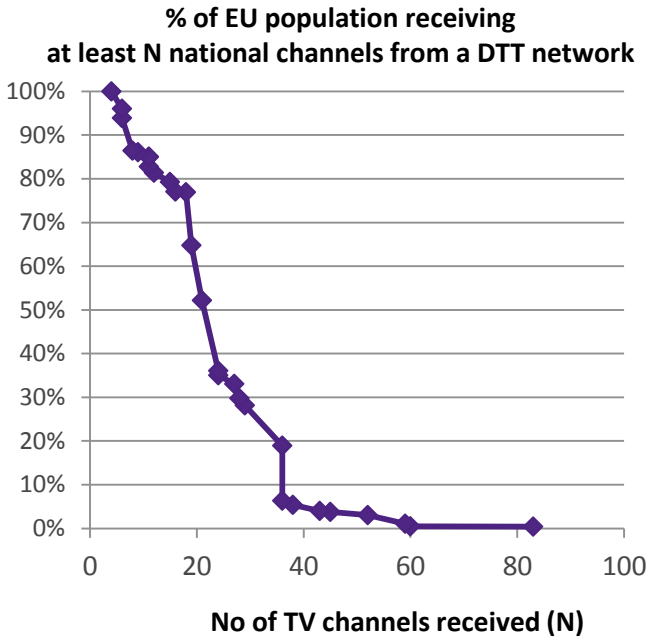
William Webb

Second stakeholder workshop

8 July 2014

Seeking converged platform options for evaluation

- Should the same infrastructure be used for TV broadcast and mobile services?
- We are looking for
  - TV coverage and content delivery equivalent to HPHT counterfactual
  - Spectrum release which can then be used for other applications
  - Economic viability
  - A viable transition to a converged platform
- We consider two levels of TV broadcast demand:
  - Case 1 – 60 Mbps (60 SD channels by 2025?)
  - Case 2 – 180 Mbps (180 SD channels by 2025?)



Defining the promising options

- We started by considering the TG6 Scenarios
  - Three scenarios describe enhanced HPHT broadcasting rather than CPs. Not considered further
  - A further three scenarios look at how to free spectrum for other applications but not the converged platform element. Not considered further
  - One scenario describes an HPHT LTE converged platform. Considered and rejected – see next slide
  - One scenario describes an LPLT DVB converged platform. Assessed in detail
  - Two scenarios describe variants of an LPLT LTE-Broadcast converged platform. Assessed in detail
- Our promising converged platform options for detailed assessment are:
  - LPLT with LTE-B broadcast transmission and unicast mobile SDLs
  - LPLT with DVB broadcast transmission and unicast mobile SDLs

Why we have rejected some options

HPHT with LTE

- LTE is generally less spectrum efficient than DVB-T2 so this option might not release spectrum
- If only broadcast content is sent via LTE there are fewer opportunities for converged services
- Coverage might not enable handheld reception and changes would be needed to LTE standards and devices

LTE eMBMS

- Cyclic prefix is too short for rural coverage
- No ability to work with a supplemental downlink
- No ability to allow “unregistered” users to access the service
- But all these features can be added to the specification to create an enhanced LTE-Broadcast (LTE-B) standard

Use of SFNs is critical for spectrum release

- If SFNs could be used throughout a country then only around 6 multiplexes (48MHz of spectrum) are needed with DVB-T2 and HEVC coding
- Currently repeat patterns of around 5 apply. If this continues then around 240MHz is required for a six multiplex transmission and no spectrum is released
- Using LPLT reduces the interference zone between areas of different content from perhaps 50-100km to 5-10km
  - This implies that SFNs might be possible over much of the country – perhaps 80-90% for most countries depending on regional content
- There are claims that regional co-channel SFNs are possible by redrawing regional boundaries and using high discrimination rooftop antenna :
  - This might be possible but the cost and complexity of implementation could be high
  - Further study is needed here
- For our CBA we assume that:
  - Co-channel SFNs are possible for regional broadcasting
  - International spectrum planning is required to deal with cross border interference

The transition process is complex

1. Upgrade the LTE standard to LTE-B (LTE option only) and wait for equipment availability to upgrade TV sets etc (LTE option only)
2. Equip LPLT sites with the necessary transmitters and backhaul capacity. This might require upgrades to ~1/3 of macrocell sites of one mobile network
3. Set aside simulcast UHF spectrum for use by the converged platform alongside the spectrum used by the HPHT DTT platform
4. Carry out frequency coordination to avoid cross-border interference with neighbours
5. Switch on the national LPLT broadcast transmission
6. Initiate a programme to upgrade end-user equipment from DVB to LTE receivers (LTE option only)
7. Test the need for aerial realignment to receive the LPLT broadcast transmission
8. Provide realignment support as required
9. Progressively switch off the HPHT DVB transmission

Finding simulcast spectrum is hard

- We believe it will be necessary to simulcast (both HPHT and LPLT) for several years while antenna realignment and other adjustments are made
- This requires additional spectrum, especially if all services are provided on both platforms
- We assume that the 700MHz band will already have been vacated by broadcasting
- There will be cross-border constraints on the use of the remaining spectrum
- It may not prove possible to find enough spectrum - especially with the Case 2 TV traffic load (6 muxes)
- Even where it is possible, costly retuning of the HPHT transmitters may be needed to create a temporary band for the LPLT transmission
- A pan-European planning round (the next GE-06) may well be needed to coordinate all this
- Estimates of these costs are included in our CBA

The DVB and LTE-B options compared

- The DVB option has two main advantages over the LTE broadcast option:
  - There are no upgrade costs for TV receivers
  - DVB offers potentially higher spectrum efficiency (>3.5 bits/Hz compared to >2 bits/Hz for LTE). This makes the migration easier and increases the spectrum released
- The main drawbacks of the DVB option relative to the LTE broadcast options are:
  - Upgrade and maintenance of two separate technologies on the same LPLT infrastructure is more costly
  - It is harder to develop interactive services
- Both have challenges for mobile reception
  - DVB-T2 is not optimised for mobile use although handheld variants are in development
  - LTE-B might not be suited for fast-moving terminals because of the large number of OFDM channels needed

Summary

- Of all the scenarios put forward only LPLT, using either LTE-B or DVB transmission, appears to deliver spectrum release and convergence benefits
- There is no clear preference between LTE-B and DVB:
  - DVB offers a simpler transition
  - LTE-B is likely to deliver greater convergence benefits
- A critical issue is the extent to which regional co-channel SFNs can be deployed using LPLT. Without this little spectrum will be released
- Pan-European action is likely to be needed to plan and coordinate a transition to an LPLT network
- The transition will be difficult and may not even be possible in some cases - depending on simulcasting requirements, number of muxes and cross-border interference

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Challenges and opportunities of broadband-broadcast convergence

The economic costs and benefits of a converged platform

David Lewin

Second Stakeholder workshop

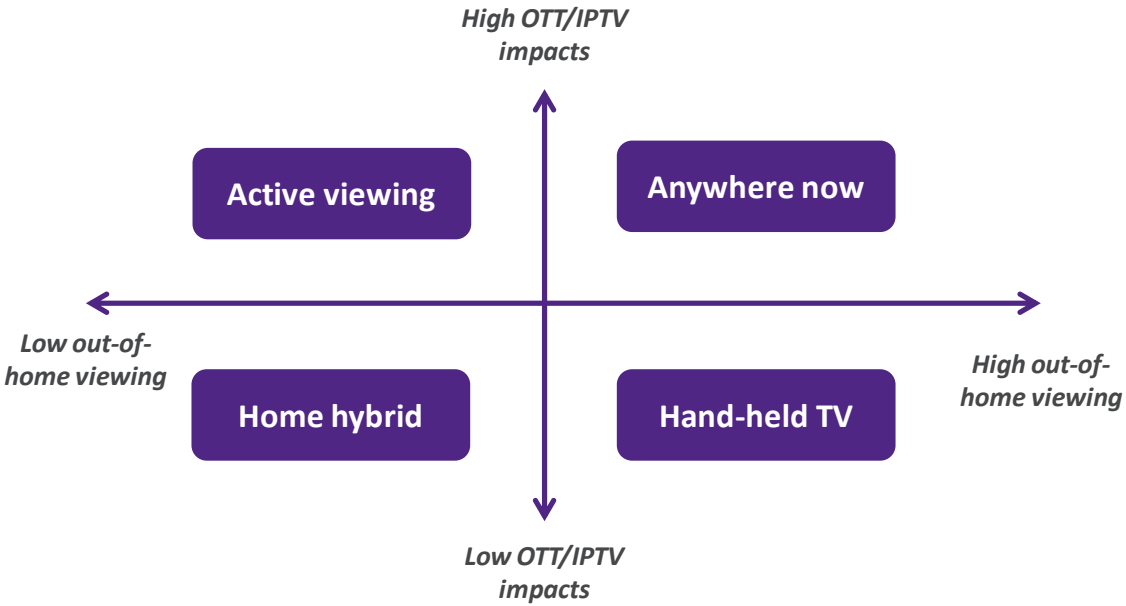
8 July 2014

Our approach

- Estimate the incremental costs and benefits of moving DTT broadcast to an LPLT network relative to a counterfactual in which:
  - DTT uses 224 MHz of sub-700 MHz spectrum with DVB on an HPHT network…
  - …to deliver 60 **or** 180 Mbps of TV capacity with regional variations
- Consider a hypothetical case study country with 20 million population and 10 million TV households
- Base our assumptions on the available evidence, make them explicit, seek feedback and carry out sensitivity analysis
- Calculate the NPV of these incremental costs and benefits using:
  - A 4% pa discount rate for recurring costs and benefits
  - Over a 20 year period
  - With all costs and benefits at 2014 prices
- Estimate how these costs and benefits vary

How do the costs and benefits vary?

- LTE-B **or** DVB option for LPLT
- Level of 2014 DTT penetration (10%, 40%, **or** 70% of households)
- Support for main DTT TV sets only **or** for all DTT sets with rooftop aerials
- High **or** low impact of OTT/IPTV by 2030:
  - 10% **or** 70% reduction in number of primary DTT households
- High **or** low level of out-of-home viewing



The potential benefits of a converged platform

- **Potential Benefit 1**: release of sub-700 MHz spectrum for mobile unicast supplemental downlinks (SDLs) to:
  - Create additional capacity
  - Create in-building and rural capacity more cheaply than using high-frequency spectrum
- **Potential Benefit 2**: better mobile TV than use of DVB over an HPHT network
- **Potential Benefit 3**: easier integration of linear broadcasting and interactive services on mobile devices (LTE-B option only)

Quantifying the benefits of spectrum release

- Benefits measured by price which mobile operators are willing to pay for sub-700 MHz spectrum
- Value declines with each additional tranche of sub-1 GHz spectrum released
- Value of 2.6 GHz spectrum is a possible floor on value of sub-700 MHz spectrum
- Need to adjust value to:
  - Subtract any migration costs for displaced incumbent use e.g. PMSE
  - Discount for poor antenna performance at low UHF frequencies
  - Discount for temporary sterilisation of mobile use during the transition period

Spectrum	€/MHz pop	Comment
800 MHz band	0.53	Average EU auction price
700 MHz band	0.22	Ofcom CBA
2.6 GHz band	0.07	Average EU auction price
Sub 700 MHz: lower limit mid point high limit	 0.07 0.14 0.22	Range used

The other potential benefits

Better mobile TV

- Defined as simulcasting linear TV to mobile devices
- Evidence of lack of willingness to pay for mobile TV:
  - Failure of DVB-H in Europe and mediaFLO in the US
  - Demand in Korea and Japan only for a free service
- So economic benefits of mobile TV likely to be small however it is implemented

Integration of broadcast TV with interactive services on the move

- Small % of benefits of such integration will be generated on the move:
  - If 90 to 95% of viewing remains in the home
  - Hybrid TV will offer integration there
- Scale of revenues and benefits from integration of linear and interactive services not yet clear
- So no evidence yet of substantial benefits from this source
- But this could change in future if and when demand for interactive multimedia services takes off

- We do not include these benefits in our CBA

The main incremental costs of the converged platform

1. Building the new LPLT DTT network
2. The operating costs (relative to the HPHT opex)
3. Converting end user equipment and reorienting aerials towards the new transmitters
4. The spectrum coordination required to:

   Create the simulcast spectrum for the transition period

   Avoid cross-border interference
5. The costs of mitigating co-channel interference between regional SFNs

- The key assumptions used in estimating these costs are listed on the backup slides. Please do comment

The incremental costs and benefits in the base case

- We define the base case for the hypothetical country as :
  - 40% DTT household penetration in 2014
  - LTE-B option
  - 60 Mbps of TV broadcasting capacity
  - Support for primary DTT TV sets only
- Key findings based on our assumptions:
  - The move to a LPLT DTT leads to opex savings
  - With low OTT/IPTV impacts
    - There is a big cost in converting end-users to LTE-B receivers
    - The prospects of net benefits are poor
  - With high OTT/IPTV impacts there are reasonable prospects of net benefits

	OTT/IPTV impacts on DTT	
Costs (€m)	**Low**	**High**
Capex for LPLT network	189	189
NPV of opex	-98	-98
End user costs	382	141
Spectrum coordination	80	80
Regional SFNs	36	12
Total	**589**	**323**
Benefits (€m)		
Lower limit	**203**	**203**
Midpoint	**450**	**450**
Higher limit	**698**	**698**

Benefits > costs

The DVB vs LTE options - base case + high OTT/IPTV impacts

- Advantages of DVB:
  - A well developed ecosystem
  - Lower end user adaptation costs
  - Higher spectral efficiency so (slightly) higher benefits
  - Mobile TV works in high-speed vehicles
- Disadvantages of DVB:
  - Higher opex and capex for the LPLT network
  - Higher total costs in the base case if high OTT/IPTV impacts
  - Harder to deliver integration of broadcast and interactive services
- Merits of DVB and LTE-B options similar but LTE-B option generates bigger net benefits

Costs (€m)	DVB	LTE-B
Capex for LPLT network	244	189
NPV of opex	33	-98
End user costs	57	141
Spectrum coordination	80	80
Mitigating interference	12	12
Total	**426**	**323**
Benefits (€m)		
Lower limit	218	203
Midpoint	**482**	**450**
Higher limit	**746**	**698**
Net benefits (€m)		
Lower limit	-208	-120
Midpoint	**56**	**127**
Higher limit	**319**	**375**

Benefits > costs

Costs vs benefits – other cases - 1

- How do the costs and benefits compare:
  - For member states with different levels of DTT penetration?
  - For different levels of support for DTT TV sets?
  - For low as well as high OTT/IPTV impacts?
- The three categories of member state considered

Country type	I	II	III
% DTT primary households in 2014	<20%	20-60%	>60%
% of EU population	42%	34%	24%
Assumed % DTT primary households	10%	40%	70%

Costs vs benefits – other cases - 2

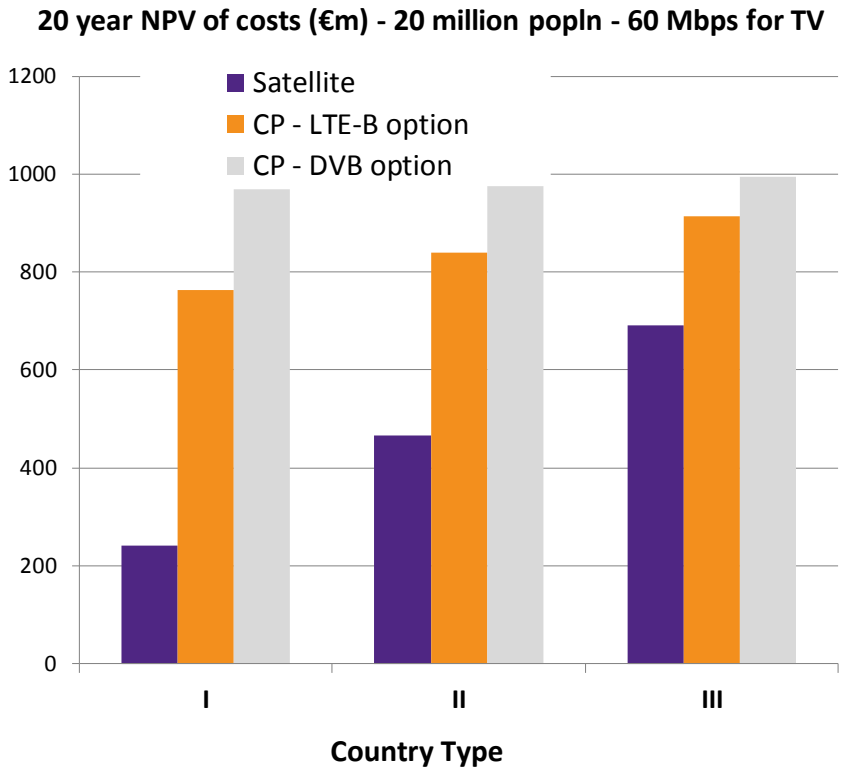
- The economic case is weakest in member states with high current DTT penetration
- The economic case is strongest if:
  - The high OTT/IPTV impact scenario is realised
  - Requirements are restricted to supporting primary DTT TV sets

Country type	I	II	III
Costs (NPV €m)			
Low impacts - primary DTT TV sets only	335	589	842
Low impacts - any roof top fed DTT TV set	744	1043	1341
High impacts - primary DTT TV sets only	238	323	408
High impacts - any roof top fed DTT TV set	365	430	555
Benefits (NPV €m) midpoint estimate	450	450	450

Benefits>costs

The cost effectiveness of satellite DTH

- The economic case for an LPLT DTT network (using LTE-B) is strongest where:
  - High OTT/IPTV impacts
  - Low current % DTT households
  - Support for primary DTT TV sets only
- But in these circumstances free-to-view DTH satellite offers a lower cost approach than DTT
- Only if the TV broadcast load increases from 60 to 180 Mbps does this conclusion change



See backup slides for key assumption on satellite DTH costs

Tentative conclusions – 1

- The incremental ***benefits*** from moving to a converged platform are highly uncertain:
  - Evidence to date indicates benefits from mobile TV are small
  - Not yet any evidence of substantial benefits from integration of broadcast and interactive services on the move
  - Wide range of estimates of benefits of UHF spectrum release (from €200m to €750m in the hypothetical case study country)
- The incremental ***costs*** of a converged platform are more certain:
  - Building the LPLT broadcast network
  - Ensuring end-users can use it
  - Creating the simulcast spectrum and mitigating interference effects
- There may be offsetting benefits through modest reductions in operating costs

Tentative conclusions – 2

- The incremental costs are lowest:
  - If and when OTT/IPTV impacts are strongest
  - If the converged platform only supports primary DTT sets
  - In member states where current DTT penetration is low
- In these circumstances net benefits would be generated through moving to a converged platform
- But in the same circumstances moving to free-to-view DTH satellite would generate significantly greater net benefits
- The case for a converged platform is substantially more difficult to make if the TV broadcast load is increased from 60 to 180 Mbps
- These conclusions are likely to be valid as we vary the population and population density from that used in the CBA example given here

Back-up slide 1

Category	Assumption
Case study country	10 million TV households
Converged platform costs	3300 base station sites to be upgraded
	€42000 per site upgrade for LTE-B option and 40% more for DVB option
	€9500 per year per site operating costs for LTE-B and 40% more for the DVB
	€50 million pa operating costs for existing HPHT DTT platform
	€50 million for new platform development
	5 year simulcast period for HPHT and LPLT with 20% pa upgrades
End-user transition costs	€70 per DTT TV set for LTE-B and €0 per DTT TV set for DVB
	20% of households require aerial reorientation at €70 per household
	€40 million to €80 million for transition management costs
Freeing simulcast spectrum and dealing with cross-border interference	Average per country of €10 million for spectrum coordination and planning
	Average per country of €70 million for retuning of HPHT DTT networks to implement spectrum changes
Mitigating co-channel interference between regional SFNs	5% new high discrimination aerials at €200 per aerial installed to enable regional SFNs
Other main assumptions	No additional expenditure needed to improve network reliability of LPLT DTT platform
	No problems with safe radiation emissions
	20% capacity upgrade for LPLT backhaul (given prior upgrade of mobile backhaul to LTE using fibre and Gbps microwave by 2025)

Back-up slide 2

Parameter	Value
Satellite capacity required for free-to-view service (Mbps)	60
Cost of managing the transition (€m)	40
Operating cost per Mbps for the satellite service (€000 pa)	120
Cost of upgrading each DTT household to receive the satellite service (€)	250
Average cost of developing new platform for free to view satellite service – given these platforms already exist in many member states (€m)	25

Challenges and opportunities of broadcast-broadband convergence and its impact on mobile spectrum

A mobile industry perspective

Wladimir Bocquet, Senior Director of Spectrum Policy, GSMA

08 July 2014

AGENDA

- GSMA Overview
- Mobile Markets
- New Trends in Content Consumption
- 700MHz band in Europe
- Sub-700MHz band in Europe
- Summary

GSMA BY THE NUMBERS

MEMBERSHIP

800
mobile operators in over 220 countries

230 associate members

MOBILE REACH

6.6 billion
mobile connections

3.2 billion
individual subscribers

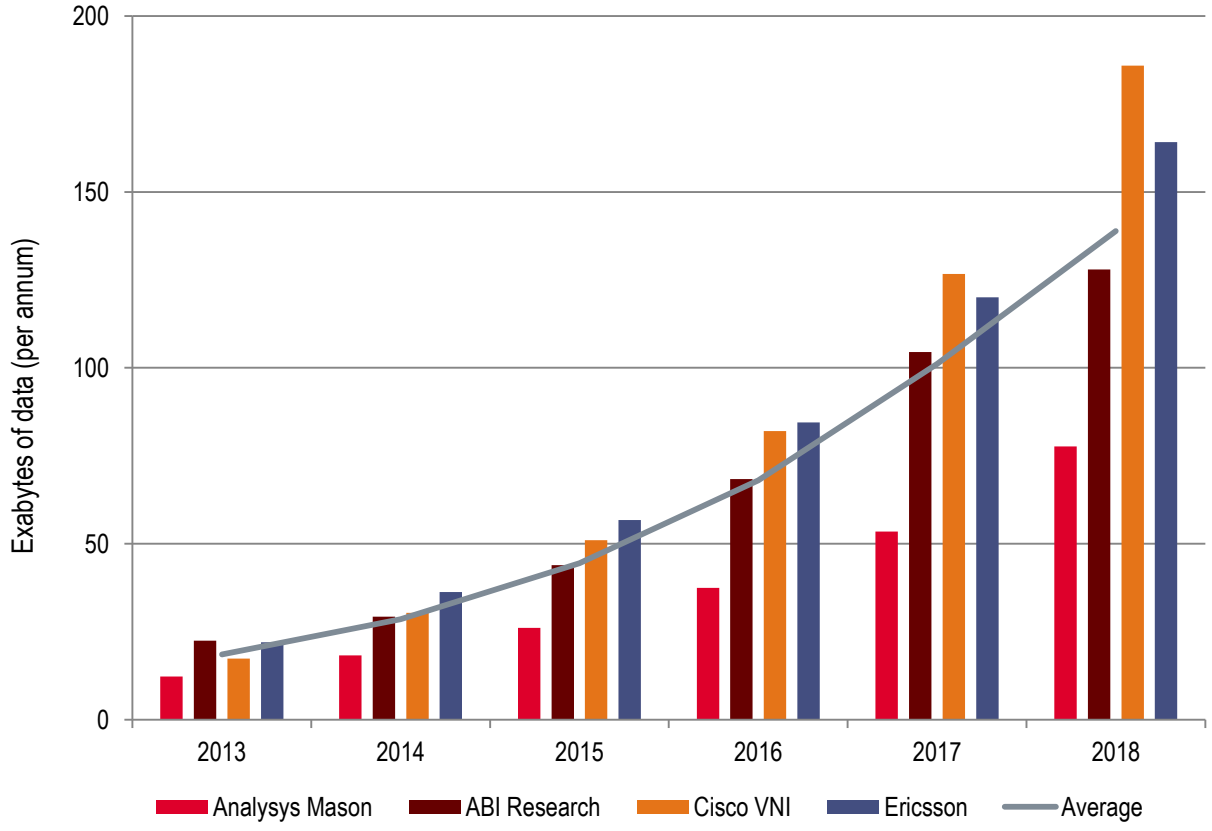
PRESENCE

Offices in
9 countries
serving every region

Staff based in
26 countries
representing
36 nationalities

GLOBAL DATA TRAFFIC FORECAST

Global mobile data traffic is expected to increase tenfold between 2013 and 2018



The growing adoption of data services has become the major source of traffic since 2010

Mobile data traffic is growing exponentially and can exceed forecasts dramatically

Sources

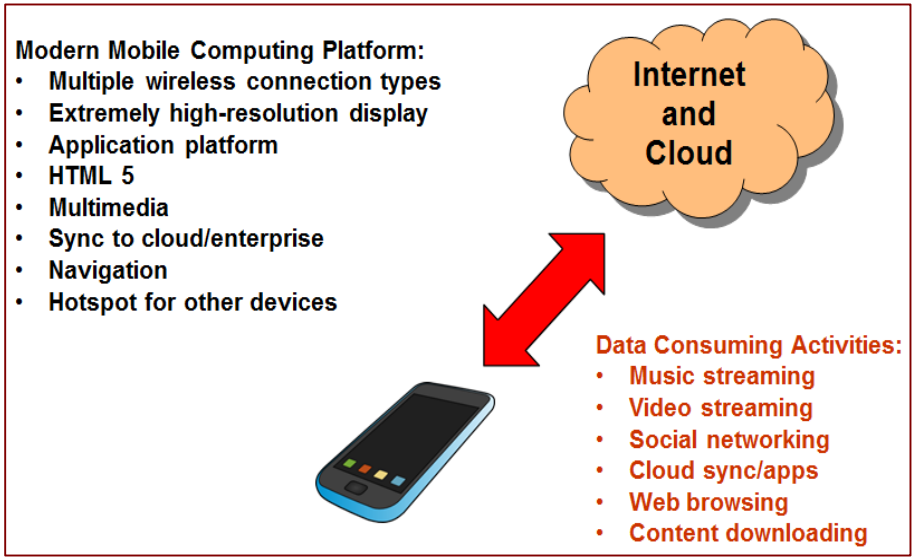
Analysys Mason, Global Mobile Network Traffic, Nov 2013
ABI Research, Mobile Data Traffic & Usage, July 2013
Cisco VNI Mobile Forecast, Feb 2014
Ericsson Mobility Report, June 2014

Nb. ABI Research data missing for 2014-2016 so has been estimated

EXPONENTIAL GROWTH IN DATA TRAFFIC

Global mobile data traffic is expected to increase tenfold between 2013 and 2018

- Multiple factors contribute to explosive data growth:
  - **Increasing number of mobile connections**
  - **Major smartphone & table take-up**
  - **Faster mobile broadband networks**
  - **Growing data usage *per connection* from apps & services especially video**



- Mobile operators must use all three capacity enhancing solutions:
  1. **More spectrum efficient technologies** (e.g. LTE & LTE Advanced)
  2. **Denser networks** (i.e. cell splitting & small cells)
  3. **More spectrum**

EVOLUTION OF CONSUMPTION TRENDS

TV content consumption is changing with a shift from terrestrial TV delivery to broadband, cable and satellite delivery in many European countries

- Recent data, published by the European Commission (Source: Special Eurobarometer 414, March 2014), shows
  - The number of European households with a TV that report using **terrestrial TV has fallen by 10% since 2011**
  - There are **only five EU countries where the majority of people use DTT**

- DTT subscriptions in the Netherlands **dropped from 11% to 8% between Q1 2013 and Q1 2014** with the latest quarter the first ever when fiber has a bigger market share than DTT

- Ericsson predicts **half of all TV consumption will be on-demand by 2020** in Western Europe

EVOLUTION OF CONSUMPTION TRENDS

Mobile devices are also becoming a major way to consume audio-visual content and generational differences in content consumption means the trend is towards IPTV

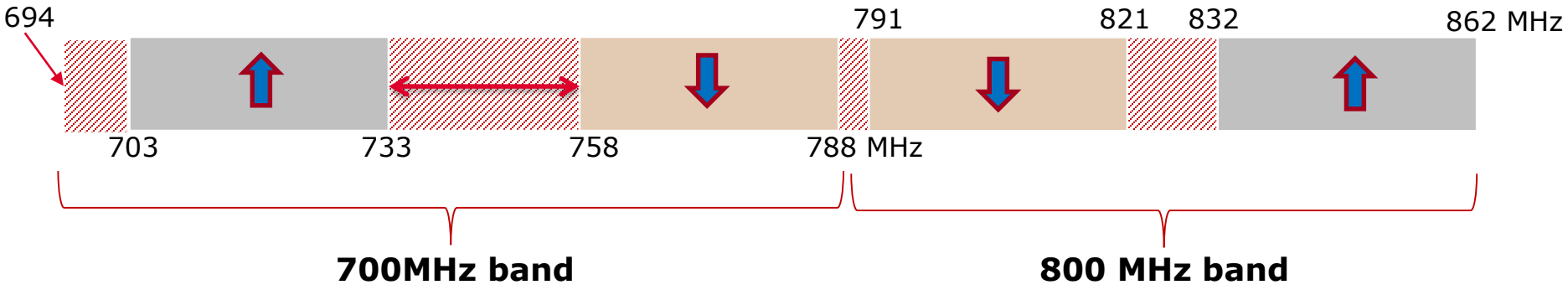
- Significant **mobile data traffic** is already video as content providers increasingly use mobile apps
  - **Ericsson's 2013 TV and Media study** highlights that 72% of people surveyed use mobile devices at least weekly to view videos and 42% do this outside the home
  - **Younger viewers** are increasingly choosing to consume TV content over the Internet, indicating a major shift in the future of audio-visual content delivery
  - **Older viewers** are also increasingly consuming on-demand content and this will likely continue as smart TV and smartphone adoption grows

- Forecasts of evolving **linear and nonlinear viewing trends must measure all device platforms** (TV, PC, tablet or mobile) – **not just large TV screens** –

TIMELY RELEASE OF THE 700MHz BAND

RATIONALE	- Satisfying the exploding demand for mobile broadband - Ensuring all citizens, whether in metropolitan or rural areas, benefit from the key socio-economic benefits of broadband connectivity
EU DIGITAL AGENDA	Alongside the 800 MHz band, this would give the EU a powerful opportunity to deliver on the Digital Agenda objective of universal high-speed broadband access (i.e. 30Mbit/s for all EU citizens by 2020)
TIMELY DECISION	A timely decision to begin this process would allow Member States to release the 700MHz band to the market, preferably, between 2018 and 2020 and potentially earlier in some countries

PREFERRED BAND PLAN – 700MHz BAND



2x30MHz	- Consist of 703-733MHz (uplink) paired with 758–788MHz (downlink) as the preferred 700MHz band plan - Harmonise the regulatory and technical conditions for the 700MHz band plan with the Asia Pacific band plan to maximise economies of scale
733-758MHz	- Support, when implementing the preferred band plan for the 700MHz and 800MHz bands, that the duplex gap be used for public commercial mobile networks (supplemental downlink) - Recognize, however, that some governments may want to consider another option – use of the duplex gap for Public Protection/Disaster Relief (PPDR) mobile broadband applications

Source: http://www.gsma.com/spectrum/wp-content/uploads/2014/05/GSMA-Recommended-Band-Plan-for-Digital-Dividend-2-in-ITU-Region-1.pdf

SUB-700MHz BAND AND CONVERGENCE

DIVERSITY ACROSS EUROPE	- The differing use of terrestrial broadcast and IPTV, and the availability of low cost, high speed broadband, around Europe means there is unlikely to be a single 'one-size-fits-all' solution so requires a more flexible approach
CONVERGENCE IN EUROPE	- Conduct some analysis on convergence between mobile broadband and broadcast in the sub-700MHz band under the remit of the existing EU research projects - Review of the sub-700MHz band no later than 2020 to ensure Europe can respond to fast changing mobile and media markets
PREPARING CONVERGENCE	- Incorporate the results of the research on convergence as well as the other work being conducted as part of the WRC-15 - Support a co-primary allocation in the sub-700MHz band at WRC-15 (subject to possible provisions in the Radio Regulations)

SUMMARY

Address the 700MHz and sub-700MHz bands as two distinct issues

- Allows swift progress on the release of the 700MHz band
- Gives more time to address the issues in the sub-700MHz band such as the differing needs of the EU Member States and the evolving nature of the broadcast and mobile broadband markets

Timely release of the 700MHz band is critical

- A timely decision to begin this process would allow Member States to release the 700MHz band to the market, preferably, between 2018 and 2020 and potentially allow for earlier release in some countries
- Need for a clear roadmap detailing the different actions to be taken to minimise the transition time for the change of use

Long term approach to address the sub-700MHz band

- Ensuring broadcast and mobile broadband services share a co-primary allocation in the sub-700MHz band (i.e. 470-694MHz) at WRC-15 gives Member States the ability to react to the rapidly evolving mobile and media markets rather than being constrained by the current Radio Regulations

GSMA RESOURCES

Digital Dividend Toolkit

www.gsma.com/digitaldividendtoolkit

An online resource offering the latest policies, perspectives and best practices for securing and implementing Digital Dividend spectrum for mobile broadband.

Digital Switchover Guide

www.gsma.com/spectrum/digital-switchover

An interactive tool that describes how to manage the conversion to digital television and release Digital Dividend spectrum for mobile.

Mobile Policy Handbook

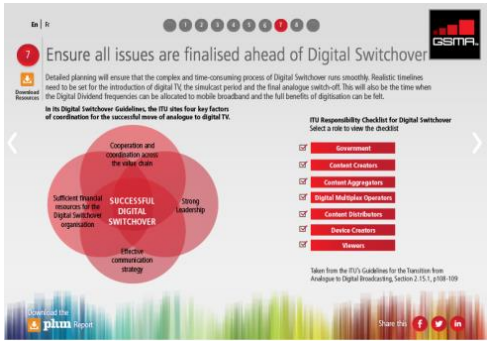
www.gsma.com/publicpolicy/handbook

A portal to GSMA positions on mobile policy issues, including spectrum management and licensing.

GSMA Spectrum Resources

www.gsma.com/spectrum/resources

Our library of research, reports, case studies and collateral.



THANK YOU

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Challenges and opportunities of broadband-broadcast convergence

Qualitative issues

David Lewin

Second Stakeholder workshop

8 July 2014

Qualitative factors to consider

- Given current evidence the cost benefit analysis indicates that:
  - A converged platform (CP) might generate net benefits if the high OTT/IPTV scenario is realised
  - In these circumstances a move to satellite DTH is likely to be more cost-effective
- The case for a CP could strengthen as AV markets develop and new evidence emerges. But there are other factors to consider:
  - Would a CP be less reliable than the current HPHT DTT network?
  - What are the environmental impacts of a CP?
  - What would be the impact on radio broadcasting?
  - How might the costs and benefits of a move to a CP be aligned?
  - Would a move to a CP need EU-wide commitment and coordination?

The reliability of a converged platform

- How does the reliability of an LPLT DTT network compare with that of an existing HPHT DTT network?
- A key measure is the uptime of the network
- The HPHT network broadcasting regulators typically require up-times of:
  - 99.5% to 99.8% for a main transmitters
  - 99% for other transmitters
- Reliability figures for LPLT mobile networks are usually commercially confidential. But in the Middle East, where standards and performance are published:
  - The requirement is for 99% uptime across the network (UAE, Qatar)
  - The operators deliver between 99.8 and 100% (UAE)
- Based on this limited evidence there does not appear to be a major reliability problem - but this requires further research based on EU data
- Our cost benefit analysis does not include any additional costs to improve LPLT reliability

The environmental impact of a converged platform

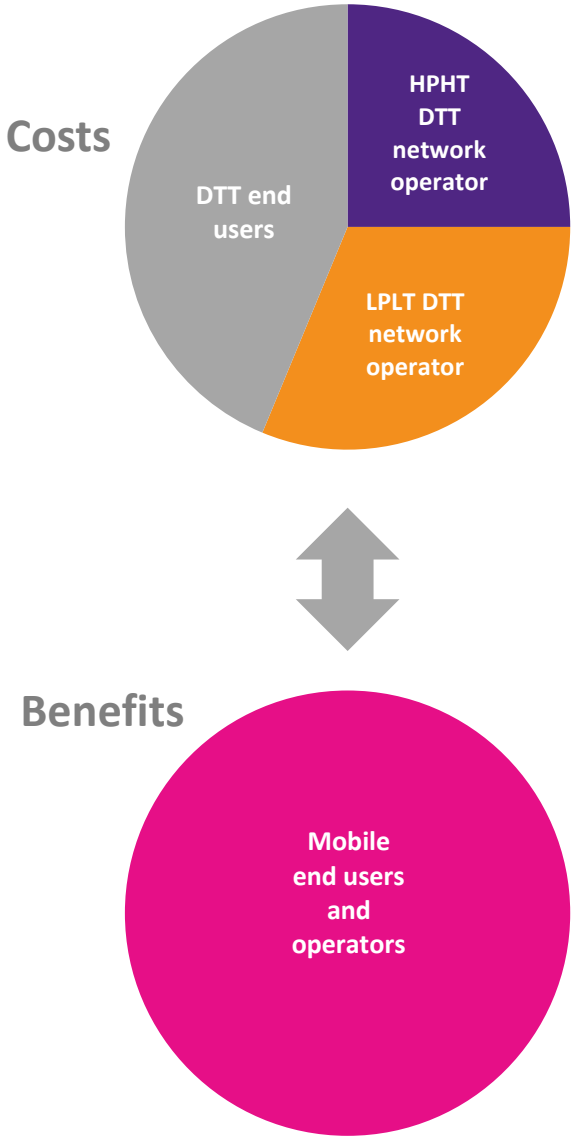
- We do not expect **visual impacts** to be any greater than those generated by adding other frequency ranges to existing base station sites
- On **RF exposure limits**:
  - We estimate there are potential problems with transmission of sub-1 GHz spectrum
    - 12 m radius exclusion zone required by ICNIRP with two 20 MHz carriers at 40W
    - Adding 40 MHz of TV broadcast increases this to 17 metres
    - Adding unicast mobile SDLs using the released spectrum would further expand the exclusion zone
  - Not clear how many urban base stations would be affected. But RF exposure limits could significantly reduce the value to mobile operators of the released spectrum
  - Adding DTT broadcast to an LPLT network would almost certainly cause problems where there are very strict limits eg Brussels, Switzerland
  - We would appreciate more feedback from stakeholders on this issue

The impacts on radio broadcasting

- A CP could in principle carry radio broadcasting as well as TV broadcast services.
- This is unlikely to result in significant benefits from spectrum release:
  - Analogue radio listening is still high and there has been only modest growth in digital radio broadcasting and Internet radio so far
  - The VHF/AM frequencies used by radio are not in high demand from other services
- Nor are there major functional benefits - radio is already available on a mobile basis
- Might moving DTT to an LPLT network increase the costs to radio of continued use of high towers?
  - High towers (possibly shortened?) would remain in use for several wireless services e.g. fixed links, mobile, LPLT DTT and radio broadcasting
  - Getting planning permission for alternative new towers could be difficult in many areas
  - It is possible all services will have to pay more – but this will be spread across many users by 2025-2030.

Aligning costs and benefits in moving to a converged platform

- The distribution of costs and benefits in moving to a converged platform is not aligned
- DTT end users face costs but enjoy no offsetting benefits (cf digital switchover)
- Need to preserve competition between mobile operators following the transition
- So need for a carefully thought through commercial model to deal with these issues



One possible commercial model

The model

- Firms bid to:
  - Build and operate the LPLT DTT network
  - Meet end-user costs of transition
- Bidders compete to offer the lowest subsidy
  - Charges for use of the platform will not recover these costs
- The government pays the subsidy and auctions the release spectrum
- Mobile operators then use the release spectrum to offer competing services

Characteristics

- Competition between mobile operators preserved
- Risks taken by CP bidders and the government
- The government plays an enabling role by aligning costs and benefits

Coordination and commitment

- A move to a CP is likely to require EU wide coordination and commitment by all member states to:
  - Give individual member state governments the confidence to play their enabling role in aligning costs and benefits
  - Give suppliers the confidence required to mass-produce equipment
  - Enable the spectrum coordination required between member states
  - Give (the few) member states where costs might exceed benefits the incentive to make a timely transition
- If and when a CP makes economic sense, such commitment is likely to be needed to make the necessary transition

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Challenges and opportunities of broadcast-broadband convergence

Spectrum issues

Phillipa Marks

Second stakeholder workshop

8 July 2014

Current uses of 470-694 MHz that could be displaced by a converged platform

- **Wireless audio applications (PMSE)** – wireless microphones, in ear monitors, talk back, audio links etc. across the entire band sharing with TV in all EU countries.
- **Radio astronomy** – 608-614 MHz (Channel 37) in some EU countries.
  - Use is specific to certain locations so geographic sharing may be possible.
  - Only substitute is to use data collected from radio telescopes in non-EU countries.
- **Wind profiler radars** – up to 5MHz used at a small number of mainly rural locations in the 470-494 MHz range in some EU countries.
  - Other bands (higher and lower) can be used but will not deliver the same information.
  - Geographic sharing could be possible.

Wireless audio PMSE applications – a major issue

- Requirements vary across countries (and by time and location)
  - EC proposals suggest minimum of 60MHz is made available
  - A study estimates an average daily requirement of 96MHz for Berlin - peak demands can be much higher
- Demand for spectrum is expected to grow even after opportunities for more efficient use addressed
- CEPT/EC/national proposals for additional spectrum partly to address loss of spectrum access in 700MHz and 800MHz bands
  - 800MHz and 1800MHz duplex gaps
  - Sharing with mobile downlink and other services at 1427-1518 MHz
  - Sharing 960-1350 MHz &1525-1710 MHz
- What if all current use was displaced from the UHF band?
  - Using VVA study for the EC we estimate the cost of replacing all current equipment could be up to €700m (assuming equipment is 50% through an 8 year lifetime)

Potential future uses of 470-694MHz

- Mobile broadband for public protection and disaster relief (PPDR)
  - Current proposals are mainly for spectrum above 694 MHz or at 400MHz
  - So there is unlikely to be any material impact from a converged platform
- Unlicensed “white space devices” (WSD)
  - Pilots and trials have been conducted in some EU countries
  - Extent of likely commercial deployment is uncertain
    - In the US where WSD initiatives are more developed
    - But commercial deployments will be affected by a potential significant loss of spectrum access at 500/600MHz when this is auctioned in 2015
  - However, the application may be able to share spectrum with mobile downlink using geographic database approach
  - We conclude no specific action is required regarding WSD.

International developments regarding a converged platform at UHF

- We have not identified any initiatives elsewhere for a converged platform at UHF
- Asia Pacific – little activity
  - Digital switchover has not happened in many countries and so 700MHz release is occurring slowly.
  - Many large countries may not release 700MHz before 2020.
- United States – a market approach
  - 600MHz incentive auction planned for 2015.
  - Up to 126 MHz may be released on a paired and SDL basis. Channel 37 protected for radio astronomy
  - The band plan may vary by area.
  - Would this provide the basis for a global band plan?

“An ounce of prevention is worth a pound of cure”

EFSC

European Forum for Spectrum Coexistence

Wolfgang Bilz & Antoine Rothey

July 8th, 2014

EFSC – Who are we?

EUROPEAN FORUM FOR SPECTRUM COEXISTENCE

123 million households and **268 million TV receivers** with terrestrial or cable TV connection
source: Screendigest

107 million broadband, TV & telephony subscriptions throughout the EU
source: Screendigest

55 geostationary satellites complemented by a network of teleports
source: SES

75% of the rail network length, more than 85% of the rail freight business and over 90% of rail passenger operations in EU, EFTA and EU accession countries source: CER

EFSC mission

EUROPEAN FORUM FOR SPECTRUM COEXISTENCE

The EFSC mission is to avoid degradation or interruption of essential and sometimes critical services caused by radio interference.

The example of PMSE

Association of **P**rofessional **W**ireless **P**roduction **T**echnologies

A member of EFSC, APWPT is an independent association, working for the benefit of all Audio / Video / Media professionals who use radio spectrum.

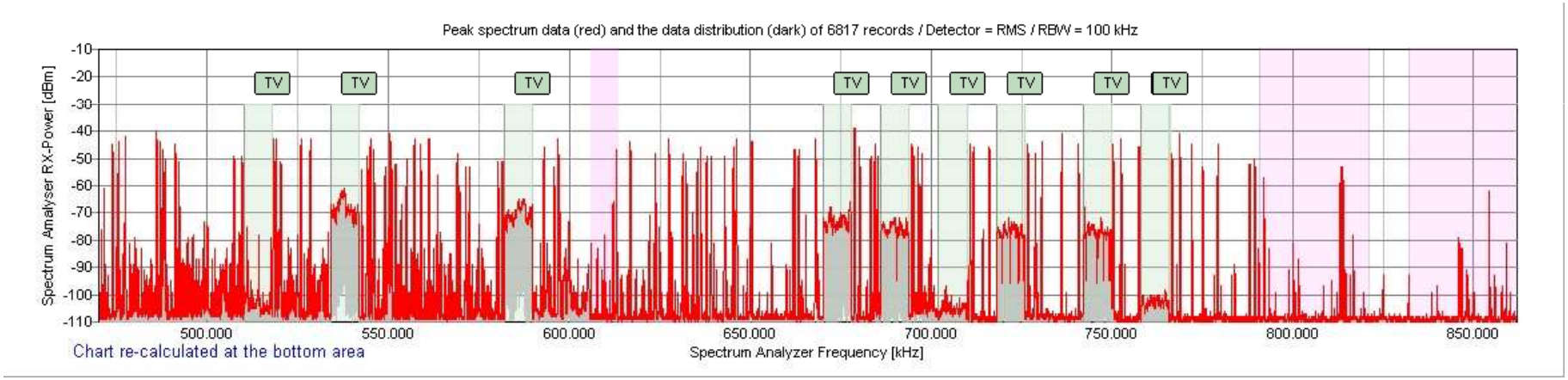
Wireless Production Tools, e.g. wireless cameras or wireless microphones are the first part of the production chain. Every interference does influence the quality of the whole production.

A few Examples: Broadcast, Theaters, Musicals, Presentations, Conferences, Movie productions, Sport Events, Music Performances,...

The example of PMSE

PMSE is sharing the UHF-TV band very succesfully with Broadcast service.

Example: Eurovision Song Contest 2013



>> PMSE needs 100MHz interference free spectrum for daily productions.

>> UHF-TV band is the core band due its propagation characteristics.

The example of PMSE

Concerns:

- IMT as we know it today does not enable proper sharing.
- Current LTE Standards allow a high level ot out-of-band emissions, which can interfere with other services in adjacent bands.
- “Quality of Service” has to be guaranteed as a legal licensing condition enshrined in the 2009 Electronic Communications Regulatory Framework.

Why does COEXISTENCE matter?

Because spectrum policy didn't consider the effects of new technologies on existing infrastructures and equipment neither involved all sectors in the impact assessment.

If it had considered the risk of interference and **COEXISTENCE** it could have prevented consumers impacts such as:

"Interference can lead to the **loss of radio signal in a train, thus creating dangerous situations for the railway system (train driver unable to make an emergency call) or affecting the traffic regularity**."
source: CER

"Interference can lead to **losing satellite signal from outer space for critical services such as for Galileo data networks, emergency communications, air navigation & safety or meteorology** all over the globe, including in Europe. "
source: SES

Proposed solutions

1. European Commission has a leading role to coordinate and Member States need to carry out :
   i. Comprehensive ex-ante **impact assessments considering possible interference issues for radio and non-radio equipment and cost implications**
   ii. Policy recommendations to **pro-actively take mitigation measures** and **define clear responsibilities among stakeholders**
2. The technical conditions for introducing new radio services need to consider from the outset potential impact on already deployed radio and non-radio (including unlicensed) services and equipment

Proposed solutions (cont'd)

3. The cost of replacing existing equipment for consumers and businesses should be considered through appropriate mechanisms (financial compensation)

4. Embed the coexistence principle into EU spectrum policy and legislation

Coexistence by design: Deployed equipment and services, both radio and non-radio, have to be considered from the outset when defining new radio services

To conclude : do we share this principle ?

- « *Vorbeugen ist besser als heilen* »
- « *Mieux vaut prévenir que guérir* »
- « *An ounce of prevention is worth a pound of cure* »

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Challenges and opportunities of broadband-broadcast convergence

Next steps

David Lewin

Second Stakeholder workshop

8 July 2014

Timetable to the end of the study

- Written comments from stakeholders on findings of 2nd workshop by **16 July**
- Draft report to the Commission on assessment of converged platform options by **8 August**
- Carry out Phase 3 of the study:
  - Take account of feedback from stakeholders
  - Develop conclusions on:
    - likely implications of broadband-broadcast convergence by 2030
    - the case for a converged platform
    - the spectrum implications of our findings
  - Develop possible recommendations on:
    - any further technical work required to assess the viability of a converged platform
    - allocation of UHF spectrum between uses
    - any short term changes to regulations
    - any measures required at the EU rather than member state level
- Present findings to third stakeholder workshop on **4 November**
- Plan to publish final report by the **end of 2014**

Key questions for stakeholders

- Do you agree with:
  - Our assessment of alternative uses of UHF spectrum (besides TV broadcasting and mobile broadband)?
  - The choice of converged platform options for evaluation?
  - The logic of our economic assessment?
  - The assumptions we have made in carrying it out?
  - Our tentative conclusion that the case for a converged platform is not yet made?
- If not why not?
- What change in market conditions might trigger a reassessment?
- What are the main implications of our findings?
- What work should be done in the next few years to further assess the viability of a converged platform?
- How do our findings impact on the best long-term strategy for use of UHF spectrum?