

Exploiting the digital dividend: Second Member States' workshop

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26 June 2009

Ref: 13496 266

Disclaimer: This is a working version of the slides for the sole purpose of supporting the discussion at the second Member States' workshop. What follows does not reflect any official views from the European Commission.



Objectives of this workshop

- The first objective is for the study team to present:
 - the economic analysis conducted since the last workshop
 - a revised set of recommended options for action
 - our final recommended actions, along with the rationale for them
- The second is to seek feedback from Member States on our analysis and recommendations

Workshop agenda

- 10:10 Key findings from the first Member States' workshop
- 10:25 Socio-economic analysis of the supply and demand for spectrum in the 470–862MHz band
- 11:00 High-level options for action and recommendations
- 11:30 Open discussion of the the high-level recommendations
- 12:45 Lunch
- 13:30 Detailed options for EU-level action
- 14:10 Socio-economic analysis of specific actions and proposed recommendations
- 14:50 Open discussion of the specific recommendations
- 15:50 Closing comments by the Commission
- 16:00 End

Agenda

Key findings from the first Member States' workshop

Socio-economic analysis of supply and demand for UHF spectrum

High-level options for action and recommendations

Open discussion of the the high-level recommendations

Detailed options for EU-level action

Socio-economic analysis of specific actions and recommendations

Open discussion of the specific recommendations

Key findings from the first Member States' workshop

- The first Member States' workshop was held on 15 April 2009 in Brussels
- It had two principal objectives:
 - to seek Member States' views on the European dimension for each of the potential uses of the digital dividend and the identified options for European coordinated action
 - to allow Member States to participate in an open exchange of views on scope, nature and timeframe of any action
- The workshop was made up of five sessions

The five workshop sessions

- **Session 1:** What European action could be taken to encourage the efficient use of the 470–862MHz band by broadcasting networks?
- **Session 2:** What European action could be taken to facilitate wireless broadband use of the digital dividend?
- **Session 3:** What European action could be taken regarding the use of interleaved spectrum?
- **Session 4:** What European action could be taken regarding other potential uses of the digital dividend?
- **Session 5:** What other measures could be taken to encourage the more efficient use of the 470–862MHz band in the long term?

Input from Member States is key to the study's success

Session 1

Increasing efficiency of broadcast networks

- Italian spectrum management authority, Agcom, gave a presentation regarding the implementation of single frequency networks (SFNs) for DTT
- Three main topics were discussed:
 - DTT transmission technologies – there were some indications that any migration should be market driven
 - DTT receivers – most favoured European action to ensure receivers are MPEG-4 compatible, but there were some concerns over similar action for DVB-T2
 - DTT deployment topologies – most appeared not to favour action to encourage the wider adoption of SFNs

Session 2

Facilitating wireless broadband use

- The Czech Telecoms Office gave a presentation describing current DTT roll-out and the Spanish Ministry of Industry, Tourism and Trade presented the difficulties of making the 470–862MHz band available for new uses
- Three main topics were discussed:
 - the creation of the 790–862MHz sub-band – many favoured non-mandatory European action to designate this sub-band for wireless broadband services; indications were given that action should be taken rapidly to give the market confidence; unresolved challenges remain
 - the renegotiation of DTT assignments in that band – European assistance to help negotiate with non-EU countries was welcomed
 - the creation of additional sub-bands – concern was expressed over such plans sending the “wrong signals” to industry

Session 3

Supporting uses of interleaved spectrum ('white spaces')

- Ofcom (UK) gave a presentation describing issues relating to services ancillary to broadcasting and programme-making (SAB/SAP) and cognitive technologies
- Two main topics were discussed:
 - **SAB/SAP** – the market for this service encompasses two very different user types with different characteristics, which impedes harmonisation; note that CEPT is currently studying technical issues
 - **cognitive technologies** – Member States noted the uncertainty surrounding the development of these technologies, but are keen for Europe to benefit from a common market for equipment

Session 4

Enabling other potential uses

- Two main topics were discussed:
 - **broadcast mobile TV** – no additional European action needed
 - **public protection and disaster relief (PPDR)** – most Member States did not support European action for PPDR; bands other than 470–862MHz could be used for such services
 - A wide range of other potential uses were identified including potential military use
-

Session 5

Other efficiency measures

- Two main topics were discussed:
 - reconfiguring assignments
 - spectrum efficiency means different things to different stakeholders
 - the life-cycle of technical solutions for the band is getting shorter with solutions becoming rapidly obsolete
 - the debate regarding the appropriateness of another major regional reorganisation of the band, which may be needed between 2015 and 2018
 - researching frequency-agile FDD

Progress since the first workshop

- The interim report and additional sections have been submitted
- The socio-economic analysis of the benefits and costs of the main options has been completed
- Detailed draft recommendations have been developed

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Detailed options for EU-level action

Socio-economic analysis of specific actions and recommendations

Open discussion of the specific recommendations

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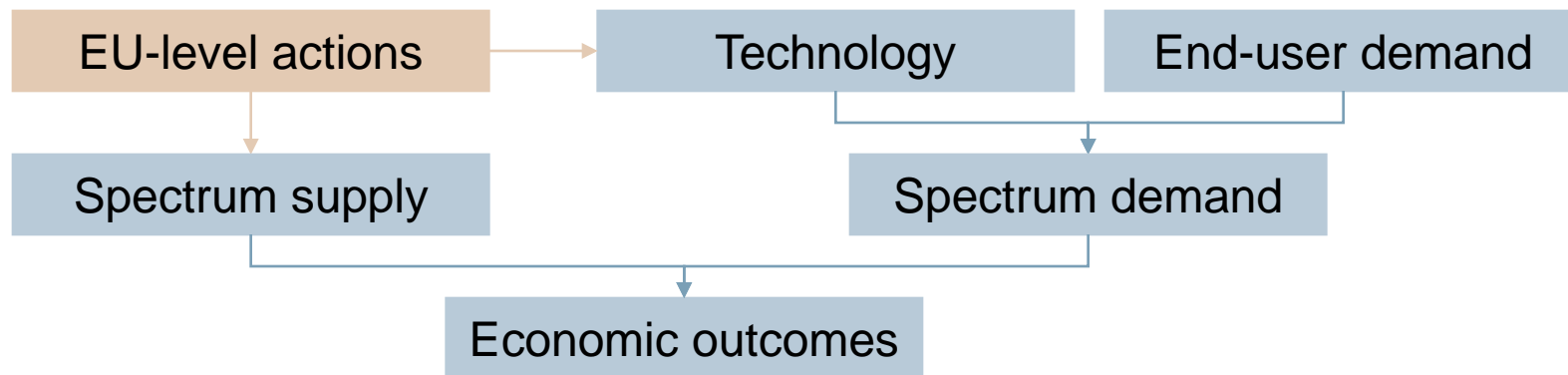
Socio-economic analysis of supply and demand for UHF spectrum

Approach

Results

Observations from the modelling

Approach to modelling



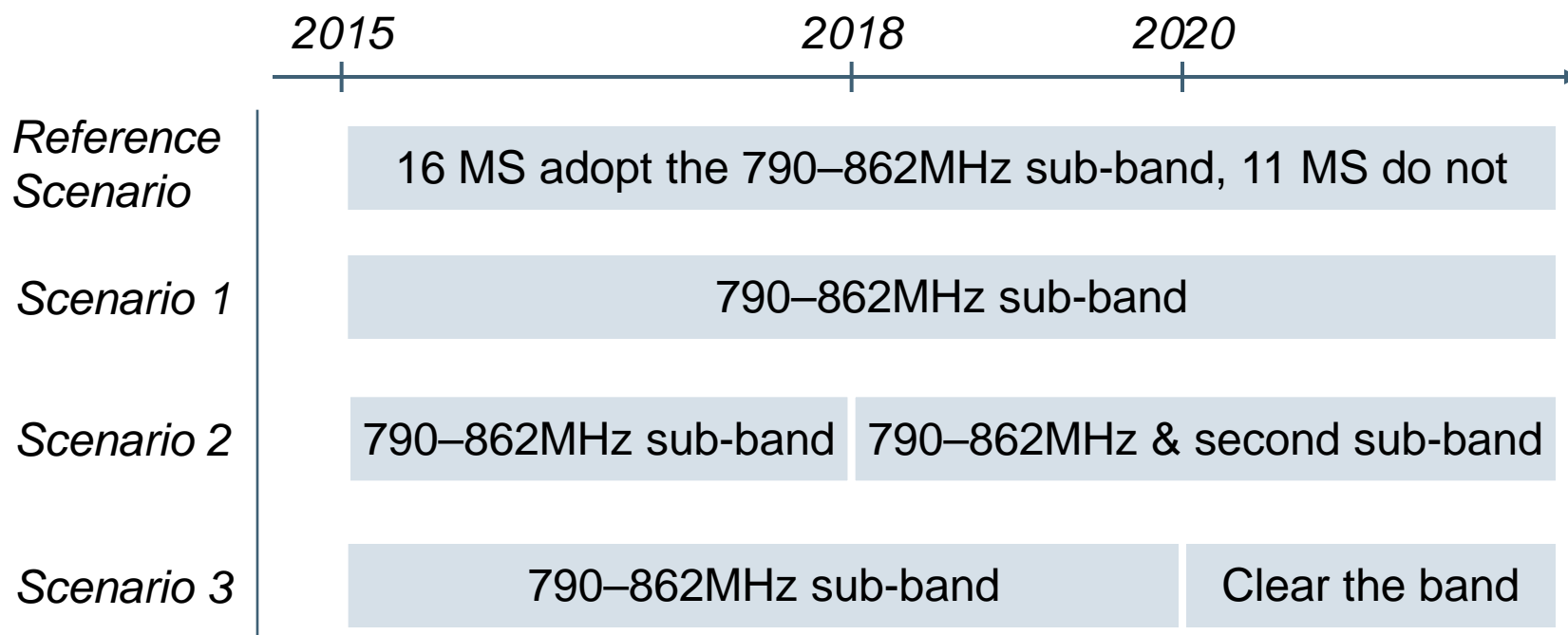
- Rather than starting with possible actions and analysing their effects, we analysed how economic outcomes might vary under combinations of scenarios for spectrum supply and demand
- We then considered what European action could be taken to promote those scenarios that emerged as the most beneficial

Scenarios

- We considered:
 - three spectrum supply scenarios (Scenarios 1–3)
 - plus a Reference Scenario, representing the likely outcome in the absence of European-level coordination
 - six spectrum demand scenarios (Scenarios A–F)

Note that we have included some radical spectrum supply scenarios in our analysis (e.g. clearance of DTT from the entire 470–862MHz band), in order to test them against potentially extreme demand scenarios (e.g. a new, currently unknown high-value use emerges)

Spectrum supply scenarios



Note: MS means Member States

We have calculated the incremental benefits and costs of realising each of the scenarios versus the Reference Scenario

Benefits and costs of each

	Scenario 1: Creating the sub-band	Scenario 2: Second sub-band	Scenario 3: Band clearance
Benefits	<ul style="list-style-type: none"> • Wireless broadband (WBB) in the sub-band in all Member States • No sterilisation • Economies of scale, roaming, and certainty in the sub-band 	<ul style="list-style-type: none"> • Benefits of first sub-band • WBB/other use in the second sub-band • Economies of scale, roaming, and certainty in second sub-band 	<ul style="list-style-type: none"> • Benefits of first sub-band in short term • No sterilisation • Large amount of spectrum for other uses
Costs	<ul style="list-style-type: none"> • Loss of DTT channels/cost of upgrading networks • Frequency replanning • Realigning/replacing aerials and set-top boxes 	<ul style="list-style-type: none"> • Costs of first sub-band • Further loss of DTT channels/cost of upgrading networks • Further frequency replanning • Further realigning/replacing aerials 	<ul style="list-style-type: none"> • Development of an alternative universal service TV service (including cost of deploying satellites) • Loss in value from removing DTT platform • Reduction in TV platform competition

Spectrum demand scenarios [1]

Two DTT scenarios

- Low:
 - Consumers have relatively modest value for DTT
 - Increasing demand for non-linear interactive services which are more suited to other platforms
- High:
 - Consumers place a high value on DTT, resulting in high demand

Three WBB/other use scenarios

- Low WBB:
 - WBB complements fixed broadband and subscribers accept lower speeds for a mobile service
- High WBB:
 - mobile broadband is ubiquitous
 - WBB is the main medium for fixed broadband in rural areas
- High WBB & a new high value use:
 - as above for WBB
 - in addition a new use emerges that attracts significant consumer demand and requires additional spectrum

Spectrum demand scenarios [2]

Wireless broadband

		Wireless broadband		
		Low	High	High with new use
DTT	Low	Scenario A	Scenario B	Scenario C
	High	Scenario D	Scenario E	Scenario F

We then calculated the economic impact of each supply scenario (Scenarios 1–3) under each demand scenario (Scenarios A–F)

Modelling approach

- The approach is “top-down”
- We focused on DTT and wireless broadband as they are the two drivers of economic demand
- We used the results of previous studies for the private value generated
- These were coupled with cost estimates for network alterations on consumer equipment upgrades

Limitations of the modelling

- Our modelling approach has limitations, particularly for the more radical scenarios (e.g. clearance of the band):
 - ▶ we only captured private value aspects for which quantitative evidence exists
 - ▶ the following are excluded from the modelling:
 - effects on competition (particular reduction in TV platform competition)
 - incremental private value of the DTT platform
 - external value (e.g. economic growth)
 - public value (e.g. public service and regional policy benefits of DTT)
 - ▶ further, any decision in favour of clearance beyond the 790–862MHz sub-band will have political ramifications, and therefore, will need to be a political decision

Agenda

Socio-economic analysis of supply and demand for UHF spectrum

Approach

Results

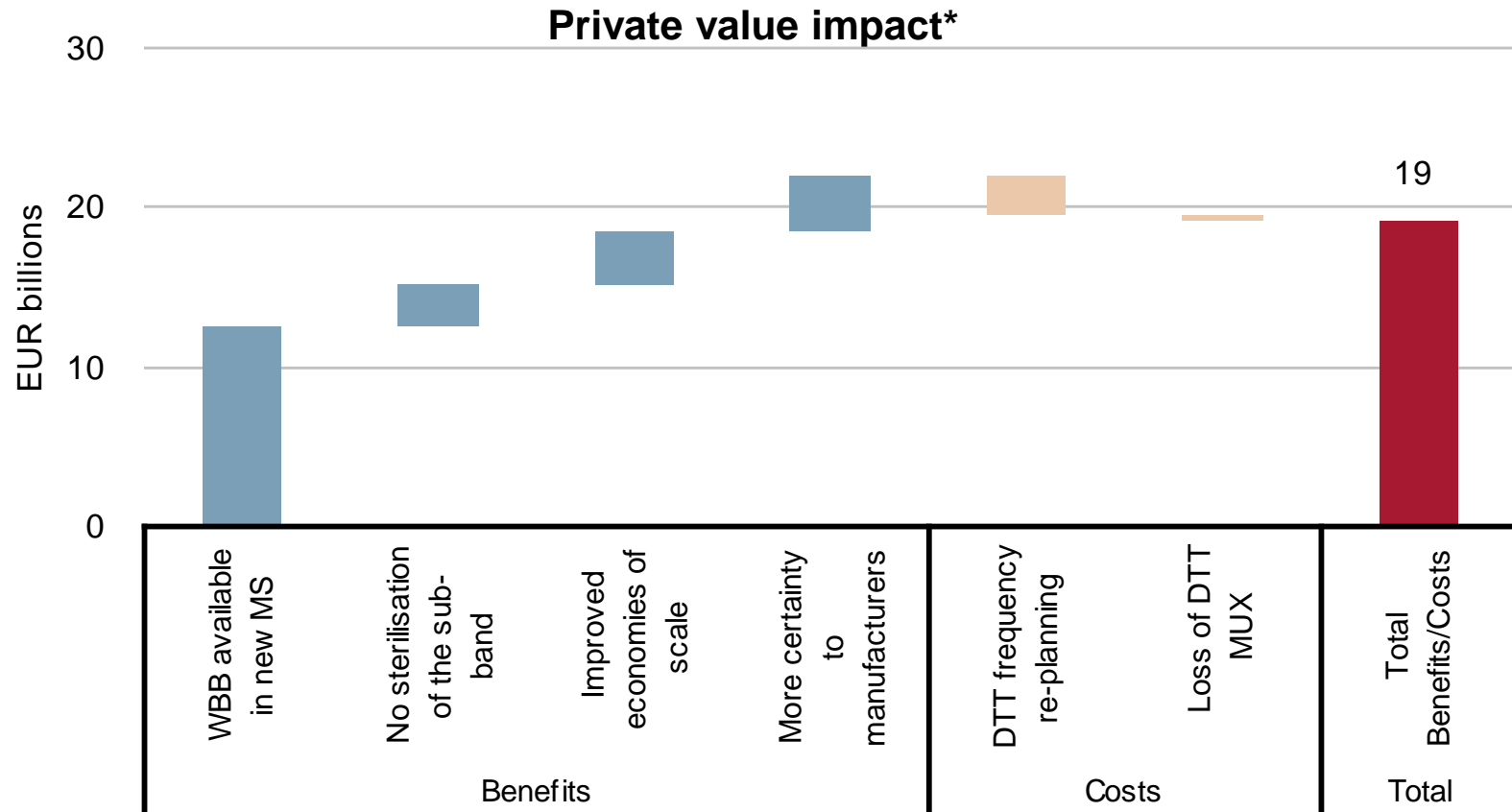
Observations from the modelling

Discussion of results

- With three spectrum supply scenarios and six demand scenarios it is not possible to discuss all of the results in detail
- Instead I will:
 - discuss the detailed results for two spectrum demand scenarios:
 - Scenario D: high demand for DTT but low demand for WBB
 - Scenario E: high demand for both DTT and WBB
 - present a summary of all of the results

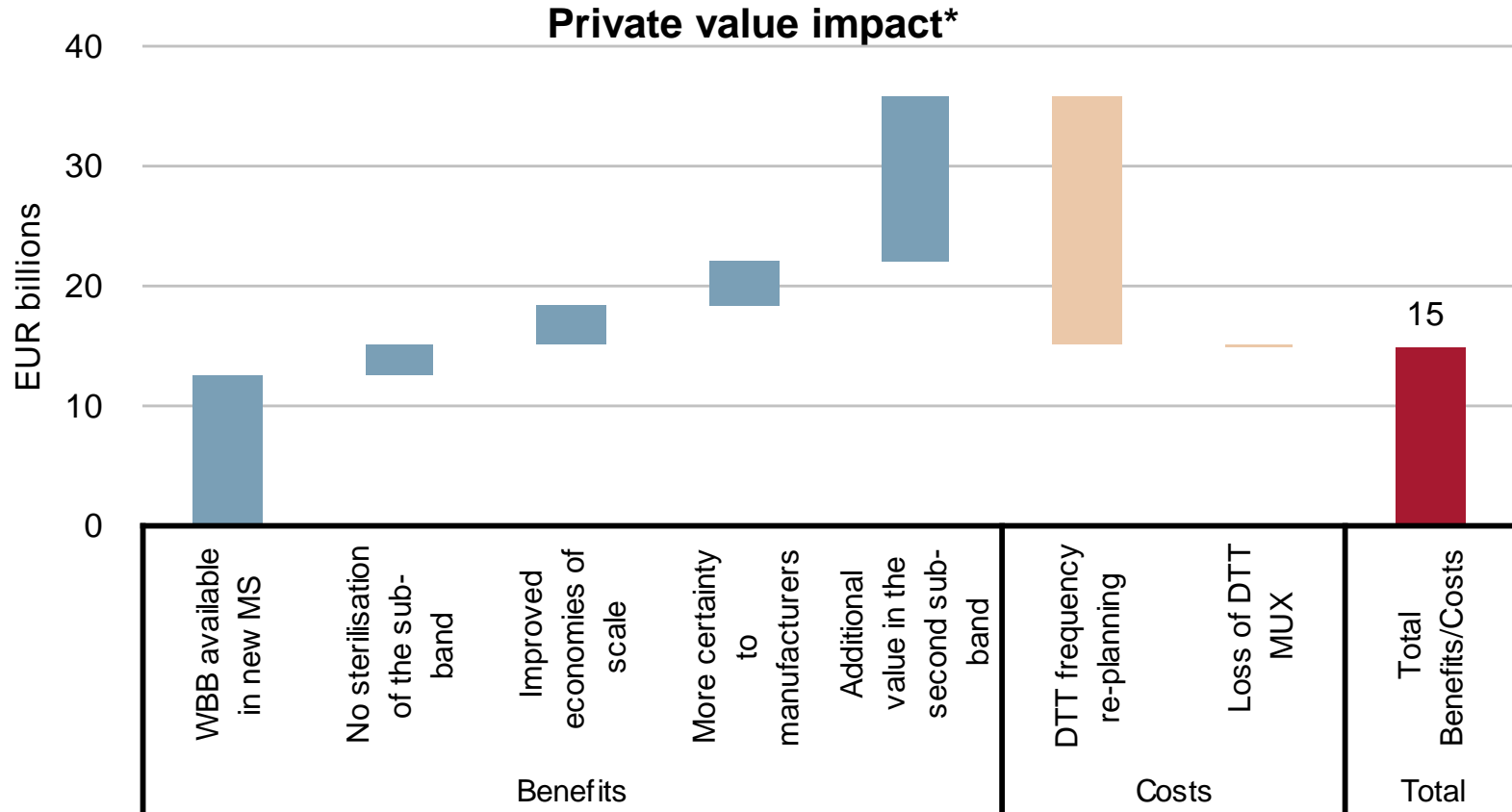
Scenario D: high demand for DTT, low for WBB

Scenario 1: adoption of the first sub-band only



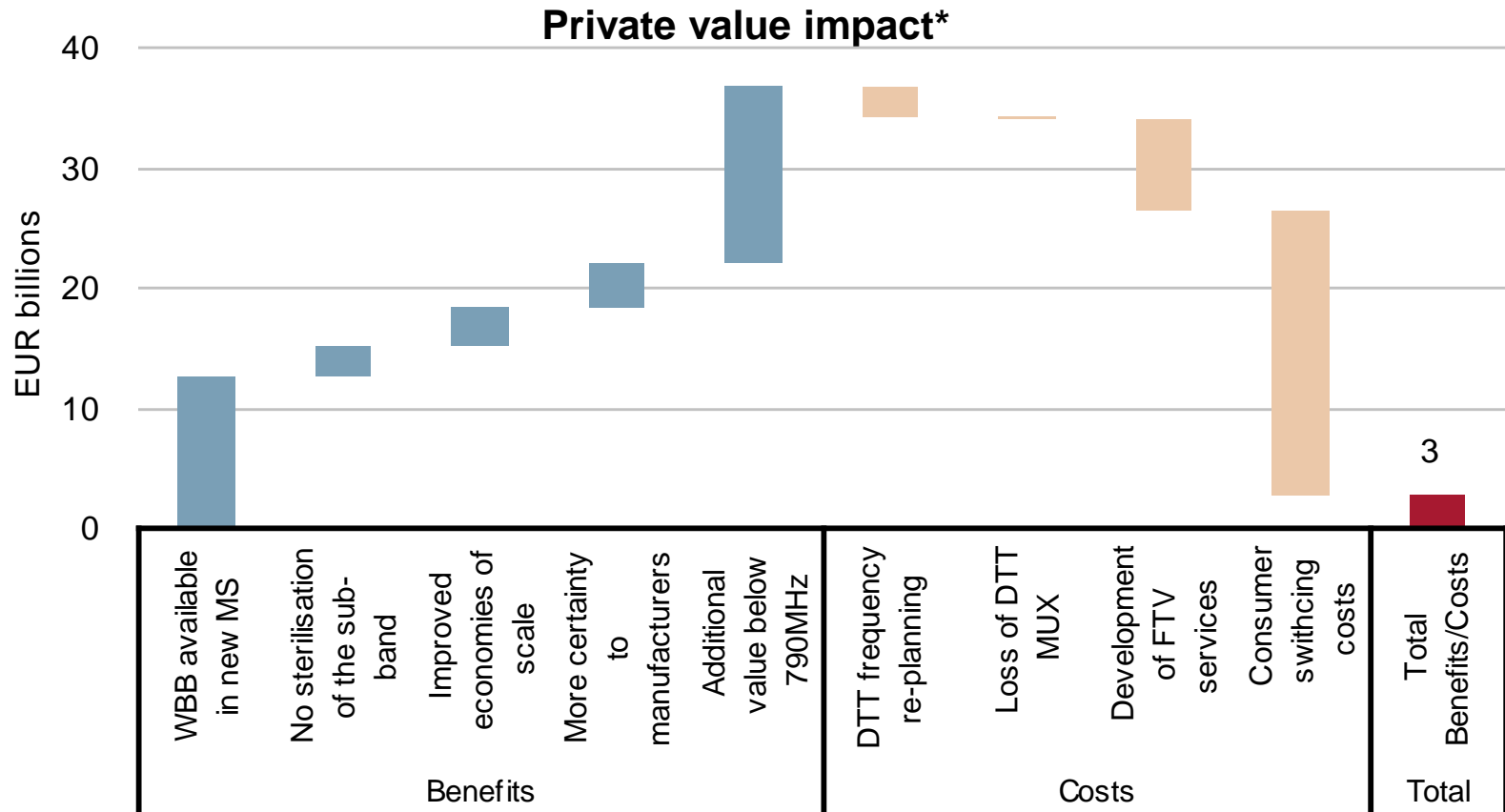
* NPV over 15 years
MUX means multiplex

Scenario D: high demand for DTT, low for WBB Scenario 2: adoption of the second sub-band



* NPV over 15 years
MUX means multiplex

Scenario D: high demand for DTT, low for WBB Scenario 3: clearance of the band

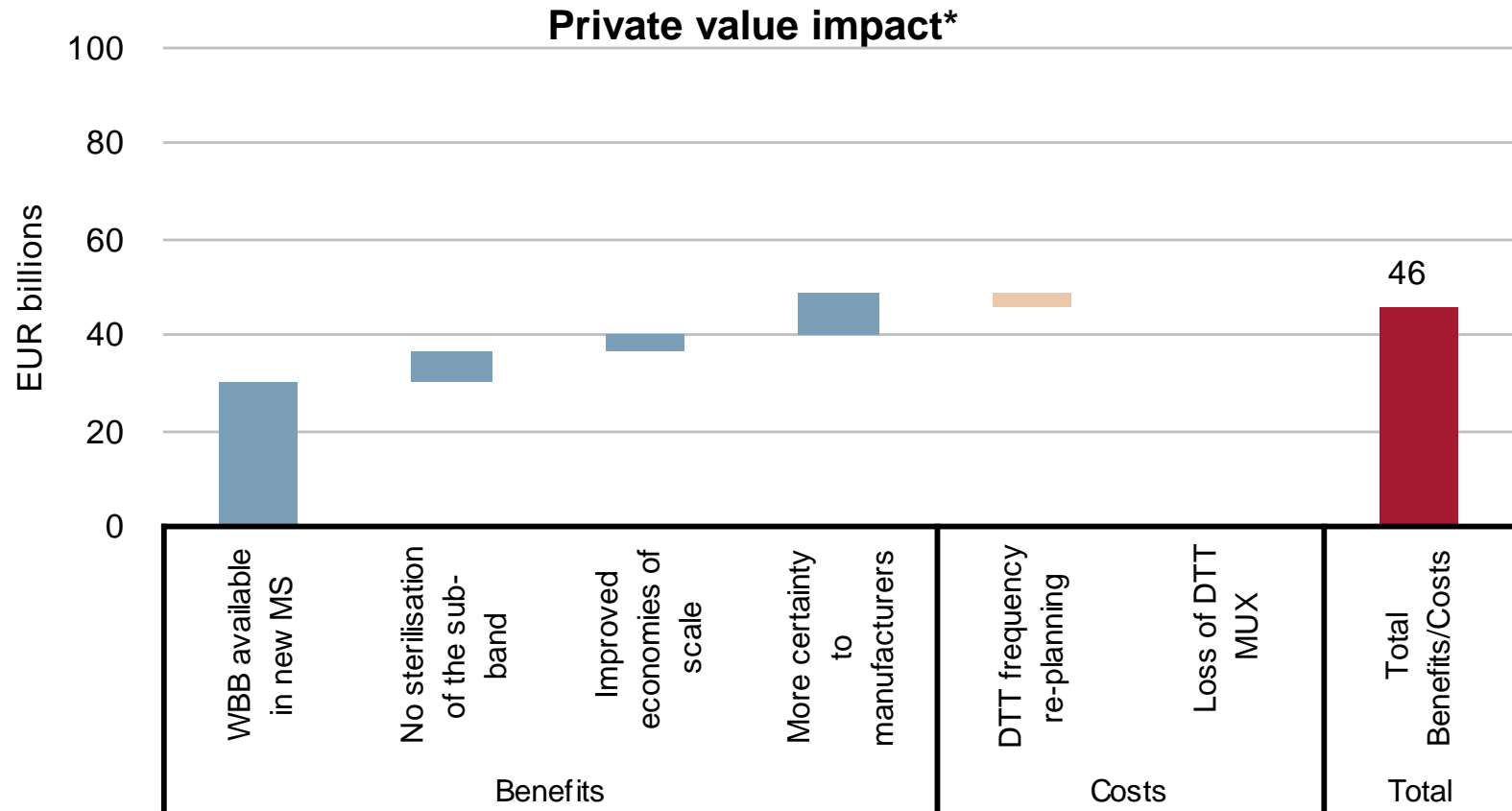


* NPV over 15 years

FTV means free-to-view, MUX means multiplex

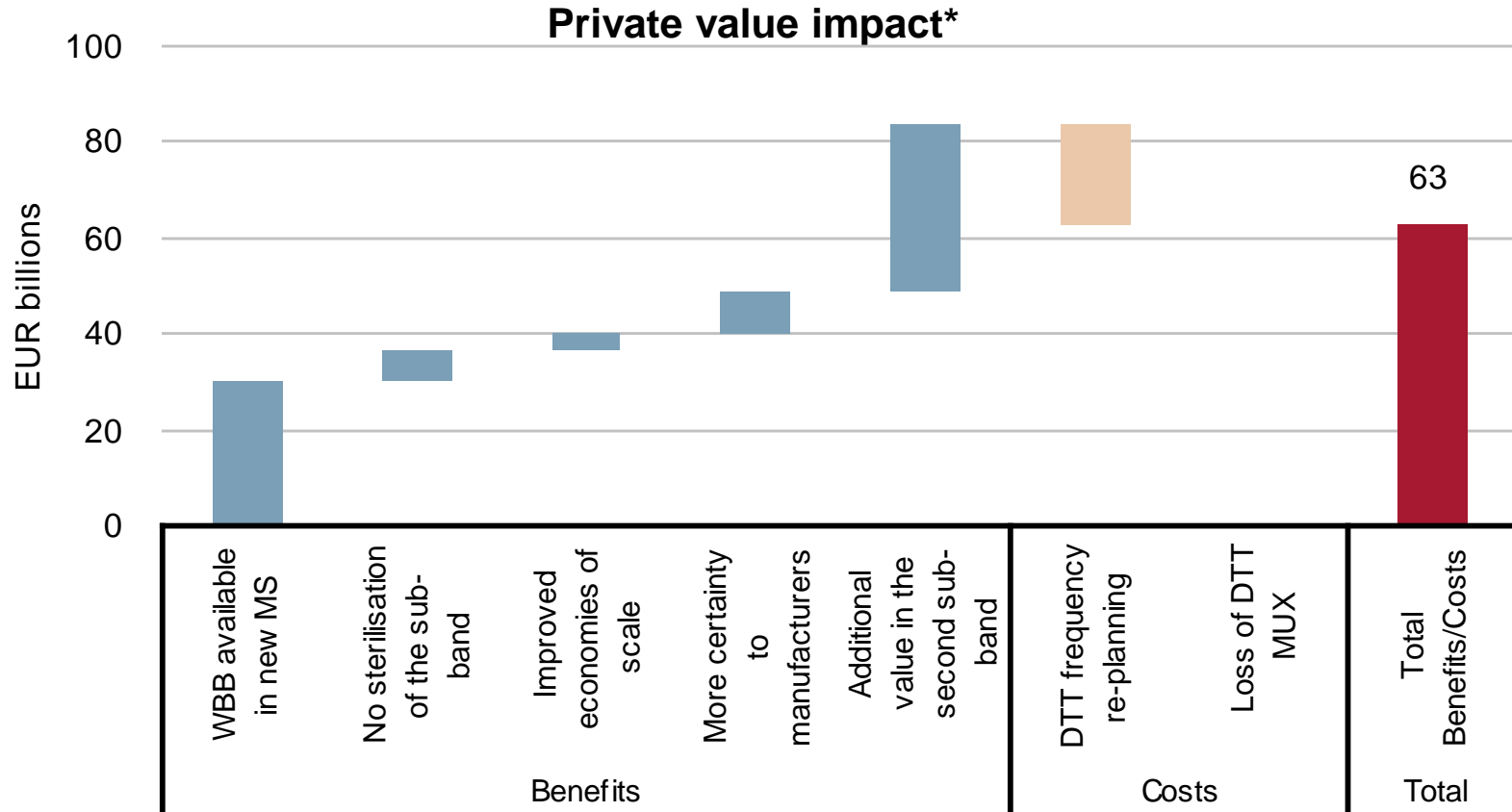
Scenario E: high demand for DTT and WBB

Scenario 1: adoption of the first sub-band only



* NPV over 15 years
MUX means multiplex

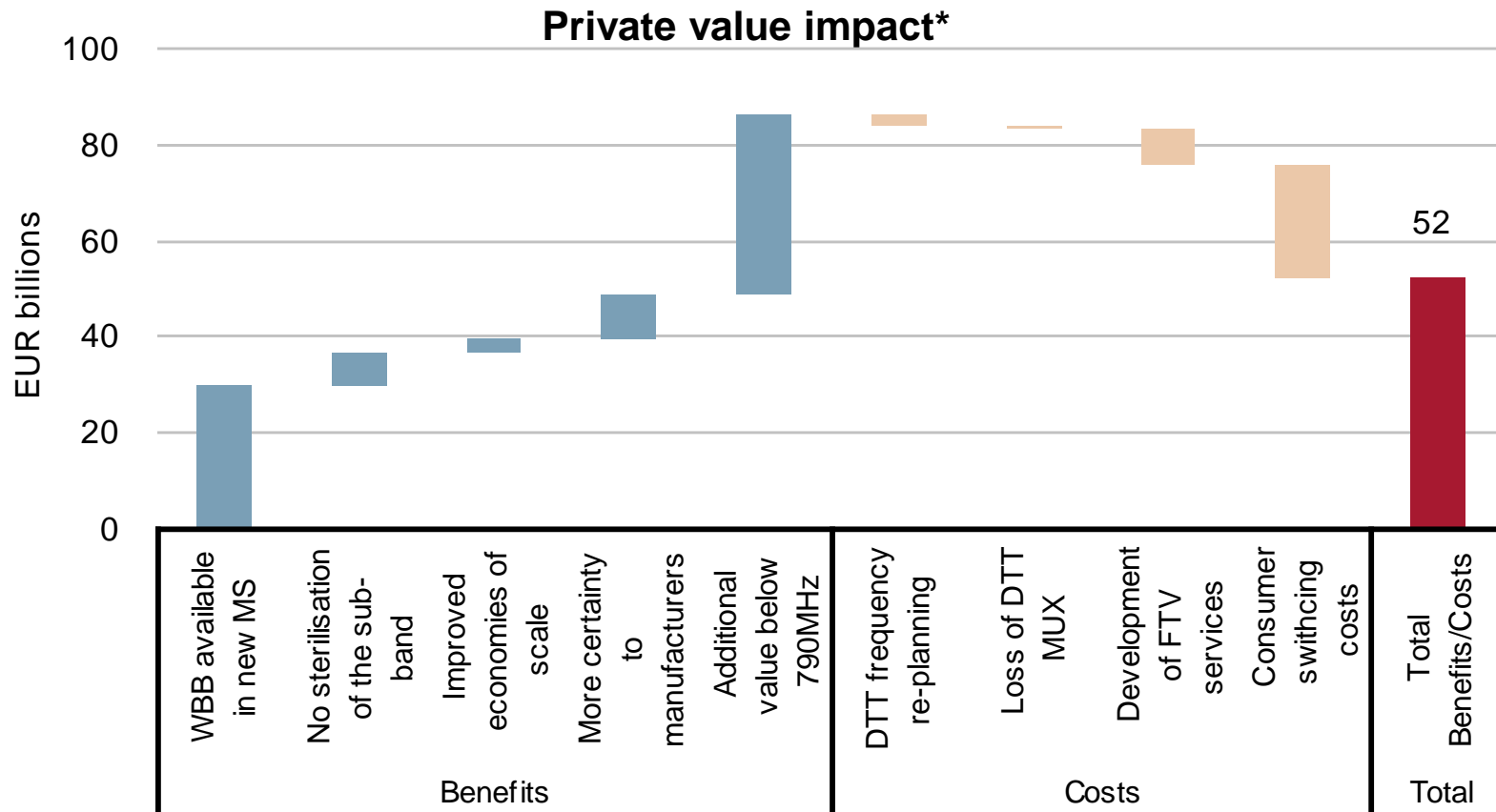
Scenario E: high demand for DTT and WBB Scenario 2: adoption of the second sub-band



* NPV over 15 years
MUX means multiplex

Scenario E: high demand for DTT and WBB

Scenario 3: clearance of the band



* NPV over 15 years
MUX means multiplex

Summary of all results

	Scenario 1 <i>(adoption of the first sub-band only)</i>	Scenario 2 <i>(adoption of the second sub-band)</i>	Scenario 3 <i>(clearance of the band)</i>
Scenario A <i>(DTT low, WBB low)</i>	EUR20 billion	EUR16 billion	EUR3 billion
Scenario B <i>(DTT low, WBB high)</i>	EUR47 billion	EUR64 billion	EUR53 billion
Scenario C <i>(DTT low, WBB high & new use)</i>	EUR47 billion	EUR77 billion	EUR98 billion
Scenario D <i>(DTT high, WBB low)</i>	EUR19 billion	EUR15 billion	EUR3 billion
Scenario E <i>(DTT high, WBB high)</i>	EUR46 billion	EUR63 billion	EUR52 billion
Scenario F <i>(DTT high, WBB high & new use)</i>	EUR46 billion	EUR76 billion	EUR97 billion

Disclaimer: These slides do not reflect any official views of the European Commission

Red indicates the private value associated with the optimal supply scenario

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Socio-economic analysis of supply and demand for UHF spectrum

Approach

Results

Observations from the modelling

High-level observations

- The Reference Scenario is inferior to the supply scenarios, irrespective of the demand scenario
- The key drivers of private value are forecasts of demand for wireless broadband and other new services, rather than DTT
- Lower demand for wireless broadband favours fewer changes to existing spectrum allocations; higher demand favours more changes:
 - although our assessment is limited to private value effects *only*
- The spectrum supply scenario which maximises private value varies by wireless broadband demand scenario:
 - any recommended action needs to be sufficiently flexible/robust to cope with the potential evolution of demand for wireless broadband and other new uses

Observations: Scenario 1 (adoption of the first sub-band only)

- There is an economic benefit for all Member States in adopting the sub-band, even before European dimension benefits are included:
 - however, we cannot take into account the exact national circumstances for all Member States
- Nevertheless, the scale of the private value benefits for wireless broadband means that there would need to be compelling grounds for *not* adopting the sub-band
- We found no strong evidence to suggest that the inclusion of external value would alter our high-level results

Our modelling suggests firm action to adopt the sub-band

Observations: Scenario 2 (adoption of the second sub-band)

- This scenario is preferable for a medium range of demand:
 - under low-demand scenarios for wireless broadband/other uses, it is optimal to clear only the 790–862MHz sub-band (Scenario 1)
 - under high-demand scenarios for wireless broadband but excluding demand for other uses, this scenario is optimal
 - under high-demand for wireless broadband and other uses, this scenario is less valuable than clearing the band (Scenario 3)
- However, our modelling approach may have reduced the range of outcomes under which this scenario appears optimal:
 - we may have overestimated the value from clearing the band

The case for this option depends heavily on future demand

Observations: Scenario 3 (clearance of the band)

- In the most aggressive demand scenarios for wireless broadband and other services, this scenario appears optimal
- Once additional factors excluded from our modelling are considered, this scenario may be less attractive:
 - loss of value from the loss of DTT platform competition is not included
 - there is evidence to suggest that consumers favour DTT
- Further, clearance of DTT from the band would be politically sensitive, and therefore would need to be a political decision

Early action to commit to realising this scenario appears unwarranted, but despite it being a radical scenario, there is a clear case for keeping this option open

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Potential areas for high-level action

- Creation of 790–862MHz sub-band suitable for medium/low-power services e.g. WBB
- Further clearance of high-power DTT from 470–862MHz:
 - creating a second sub-band **or**
 - promoting the long-term clearance of the entire band
- Encouraging the use of interleaved spectrum
- This section gives our assessment of these areas for possible action and our recommendations for action to be taken *now*

Creating the sub-band [1]

- There is a clear economic case for action:
 - the first Member States' workshop and the RSPG's Position Paper (April 2009) showed a preference for non-obligatory action
 - but our modelling suggests EUR19 billion to EUR47 billion benefit over the Reference Scenario
- 2015 is earliest realistic date for the sub-band to be created:
 - high-power interference on the EU's eastern border needs to be resolved
 - realistic timeline for migration of DTT out of the sub-band (e.g. Spain: not before 2015)

Creating the sub-band [2]

- There is no need to abandon technology neutrality (the WAPECS concept):
 - technology-neutral award processes can determine the best mix in each Member State
 - high-power DTT is not specifically precluded, provided interference caused to neighbouring countries is no more than from a medium-power use
 - but conformity with CEPT FDD band plan is necessary to achieve scale economies and roaming benefits

Creating the sub-band [3]

Recommended action 1

- Member States should be *required* to:
 - clear the 790–862MHz sub-band so that it may be used for WBB
 - impose technical restrictions to prevent cross-border emissions exceeding medium-power uses (e.g. WBB)
 - do so by 2015
- Member States should be *encouraged* to:
 - award spectrum on a service and technology-neutral basis
 - ensure that spectrum winners can deploy WBB using the FDD band plan suggest by CEPT
 - if awarding specifically for WBB, impose this band plan
 - share plans early with other Member States

Further clearance of 470–862MHz [1]

- There is potentially an economic case for *future* action:
 - *additional* value is estimated to be up to EUR30 billion from a second sub-band at 694–790MHz and up to EUR51 billion from total clearance, if demand for WBB/other future uses is sufficiently high
- But the case depends on uncertain demand:
 - a loss of up to EUR17 billion value is estimated relative to clearing the first sub-band only, if demand for WBB proves weak
- However, the above results are limited to a private value assessment, and exclude external value impacts
- Further, any decision to clear DTT from the band would need to be a political decision

Further clearance of 470–862MHz [2]

- In summary, there is no *current* case for further clearance until this market uncertainty is resolved
- However, a review regarding potential action to prepare for further clearance is recommended in the short to medium term
 - research and preparation may be required in advance in order to inform this review

Further clearance of 470–862MHz [3]

Recommended action 2

- No action is needed currently to require or encourage further spectrum clearance
- However, we recommend a review in short to medium term to:
 - assess the evidence to date and the likely evolution of WBB and other uses, and estimate costs associated with partial or total clearance
 - decide whether it is appropriate to commence further clearance, and if so, its extent and timescale
- But research may be initiated ahead of this review, including investigating costs and logistics and review necessary platform upgrades

Interleaved spectrum use [1]

- There is no immediate shortage of interleaved spectrum for SAB/SAP:
 - our modelling suggests widespread national SFN deployment is unlikely if only the first sub-band is adopted
 - reserving interleaved spectrum may impede flexibility for future spectrum reorganisation

Interleaved spectrum use [2]

- The need for action to safeguard SAB/SAP use may arise, depending on plans for further clearance e.g.:
 - promoting more spectrally efficient (digital) technologies
 - coordinating accommodation outside the 470–862MHz band (e.g. 1452–1559MHz, 1785–1800MHz)
- Cognitive technologies are not a use, but a family of technologies:
 - they adapt to spectrum availability, rather than requiring spectrum allocations on a primary basis
 - interleaved spectrum is available to support further development

Interleaved spectrum use [3]

Recommended action 3

- No action is needed to require or encourage Member States to reserve interleaved spectrum
- No action is needed to encourage interleaved spectrum users to migrate to more spectrally efficient equipment or use spectrum outside the 470–862MHz band
- A review should be carried out alongside a review of possible further partial or total clearance of the 470–862MHz band

Summary of recommended high-level actions [1]

- All Member States should be required by 2015 to clear the 790–862MHz sub-band and impose technical restrictions to prevent high-power cross-border interference
- Member States should be encouraged to award spectrum on a service- and technology-neutral basis, but in a manner that is compatible with CEPT FDD band plan for WBB (or if allocating spectrum specifically for WBB, to impose this band plan)
- Member States should also be encouraged to share plans early with other Member States

Summary of recommended high-level actions [2]

- Research should begin *now* on a possible second sub-band or total clearance, particularly regarding the:
 - size, frequency location and band plan
 - cost and feasibility
 - necessary platform upgrades to maintain universal free-to-view TV
- Aim for a review in the short to medium term to:
 - consider the evidence and projections for WBB evolution
 - decide whether action is warranted to prepare for further clearance
 - consider actions to safeguard users of interleaved spectrum (such as encouraging more spectrally efficient technologies and/or making spectrum available elsewhere)

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Summary of recommended high-level actions

- All Member States should be required by 2015 to clear the 790–862MHz sub-band and impose technical restrictions to prevent high-power cross-border interference
- Member States should be encouraged to award spectrum on a service- and technology-neutral basis
- Research should begin *now* on a possible second sub-band or total clearance, particularly regarding the:
 - size, frequency location and band plan
 - cost and feasibility
 - necessary platform upgrades to maintain universal free-to-view TV
- A review in short to medium term to decide whether action is warranted to prepare for further clearance, and consider actions to safeguard users of interleaved spectrum

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Potential areas for sector-specific actions

- This morning we set out and discussed our recommended actions for the coordinated allocation of the digital dividend
- These actions have detailed implications for individual uses and sectors
- In this presentation we ask:
 - what is the ‘European dimension’ to these issues (as opposed to issues that can be resolved by individual Member State)?
 - what kinds of EU-level action might be considered?
- Lee will explain our recommended actions in the next presentation

Agenda

Detailed options for EU-level action

DTT

Broadcast mobile TV

Wireless broadband

SAB/SAP

PPDR

Cognitive technologies

Innovation reserve

DTT: European dimension (interference management)

- DTT signals travel over long distances
- A decision by one Member State to reserve spectrum for DTT will restrict neighbouring Member States' ability to deploy new uses
- Adopting more spectrally efficient broadcasting network techniques, could free up spectrum for other uses
- Future DTT spectrum replanning will potentially require substantial multilateral negotiations:
 - especially if national SFNs were widely adopted

DTT: European dimension (standards)

- There is variation and uncertainty over standards, technologies and topologies between Member States (MPEG-4, DVB-T2, SFNs and receiver equipment)
- Coordination could facilitate:
 - technical efficiency of spectrum use
 - improved economies of scale and certainty of take-up for equipment manufacturers
- A lack of standards for interference rejection of DTT receivers may prevent new use in the band

DTT: potential areas for action

- There are four areas in which EU-level action may be beneficial:
 - ▶ receiver specifications
 - ▶ adopting advanced DTT transmission technologies
 - ▶ coordinating DTT deployment topologies
 - ▶ brokering multilateral negotiations on replanning

DTT: receiver specifications [1]

- Should there be minimum standards for new receivers?
 - ▶ currently manufacturers have little incentive to maximise the interference tolerance in receivers
 - ▶ the universal adoption of minimum standards could allow more of the 470–862MHz band to be used for new services (both within and between Member States)
 - ▶ the early introduction of standards is advisable to allow current receivers time to expire before 2015 (the lifetime of a receiver is assumed to be five years)

DTT: receiver specifications [2]

- Should there be guidelines or a requirement for the inclusion of MPEG-4 and/or DVB-T2 in all sold receivers?
- This would:
 - increase the likelihood of these transmissions standards being adopted
 - give certainty to manufacturers of reception and transmission equipment
 - reduce future migration costs, but at additional cost in the short run
- However, there is a risk that these standards may not be optimal in the long term

DTT: transmission technologies

- Action to promote common transmission technologies would help establish economies of scale, certainty for manufacturers (hence timely availability), and spectral efficiency (hence easier replanning of the first sub-band)
- Should MPEG-4 only, or MPEG-4 and DVB-T2 be adopted?
 - the case for MPEG-4 appears strong
 - but less certain for DVB-T2
- Should these be guidelines or requirements?
 - a requirement would maximise certainty, economies of scale, and coordination
 - guidelines would allow late adoption and wait-and-see approach (to DVB-T2 especially)

DTT: topologies

- The wider use of SFNs could greatly increase spectral efficiency and may be desirable/necessary as part of the EU-wide adoption of a second sub-band (below 790MHz)
- But it would be costly and would require extensive multilateral coordination
- Questions to consider:
 - should the wider adoption of SFNs be encouraged?
 - should it be required?
 - in which channels?
 - in what timescale?
- How could the Commission play a constructive role in brokering multilateral negotiations over coordination issues arising from SFN deployment (and in other contexts)?

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Detailed options for EU-level action

DTT

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Broadcast mobile TV: European dimension

- Enthusiasm for broadcast mobile TV as a leading potential use of digital dividend spectrum has diminished due to doubts about consumers' willingness to pay
- There is nevertheless a potential rationale for EU-level coordination of frequencies for broadcast mobile TV:
 - broadcast mobile TV is likely to be integrated within cellular phones or WBB devices – economies of scale are important
 - it can be deployed in Member States using their existing DTT allocations e.g. in place of a DTT multiplex
 - but different choices of frequency by Member States will require handsets to support a wider tuning range if they are to be made to a common specification, which raises manufacturing costs

Broadcast mobile TV: potential EU-level actions

- Guidelines for a common frequency range could provide certainty and economies of scale for manufacturers
- There is a need for balance:
 - if the range is too narrow it may reduce tuning component costs but deter some Member States from supporting mobile TV at all
 - if it is too wide it may increase scale but risk different broadcast mobile TV allocations being made over a wide range within the 470–862MHz band, and impede the creation of a second sub-band

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Detailed options for EU-level action

DTT

Broadcast mobile TV

Wireless broadband

SAB/SAP

PPDR

Cognitive technologies

Innovation reserve

Wireless broadband: European dimension

- We have already set out our recommendations for coordinated EU-level spectrum allocation based on:
 - economies of scale being key to the provision of consumer equipment (e.g. mobile terminals)
 - importance of cross-border roaming
 - scope for cross-border interference and sterilisation of wireless broadband services
 - contribution of WBB to European policy goal of universal high-speed broadband availability under the i2010
- Here we will consider the flexibility of WBB systems and the challenges this creates for European coordination

Wireless broadband: FDD inflexibility

- FDD is currently the dominant technology for European WBB and a definite proposition for the 790–862MHz sub-band
- But current requirements for a fixed duplex spacing between the downlink and uplink means an identical, paired-channel allocation is needed across Europe to realise economies of scale and roaming:
 - this limits the scope for other uses to share the band
 - this prevents variation between Member States
- EU-level action taken now to explore more flexible solutions for broadband spectrum could benefit further clearance:
 - it would allow greater scope for the market to determine allocations between WBB and other uses in each Member State within a common sub-band

Wireless broadband: potential EU-level actions

- Two options suggest themselves:
 - encouraging research into frequency-agile wireless broadband systems, such as TDD and variable duplex FDD
 - prioritising access to spectrum for flexible systems in future allocations (after the 790–862MHz sub-band)

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Detailed options for EU-level action

DTT

Broadcast mobile TV

Wireless broadband

SAB/SAP

PPDR

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SAB/SAP: European dimension

- Our high-level conclusion is that interleaved spectrum will remain available for SAB/SAP even after the creation of the first sub-band
- A major EU-level issue is migrating SAB/SAP out of proposed FDD channels without disrupting future reorganisations:
 - several Member States have dedicated SAB/SAP spectrum in the first sub-band
 - if a common destination could be found, this would maximise economies of scale and minimise obstacles to future EU-level replanning
 - an FDD centre gap in 790–862MHz has been suggested but the SAB/SAP community is concerned about interference and the tuning range of current equipment
- In the longer term, further clearance of the band may put pressure on interleaved spectrum availability for SAB/SAP

SAB/SAP: potential EU-level actions

- Produce guidelines or require one or more common sets of frequency channels to be dedicated for SAB/SAP use:
 - these would form a common ‘destination’ for migrations and for Member States wishing to move their current national channels to enjoy economies of scale
 - but some Member States do not have (or need) national channels, and would incur unnecessary equipment replacement costs
- Encourage migration of SAB/SAP to other bands, e.g. 1452–1559MHz and 1785–1800MHz (proposed by CEPT), where the opportunity cost of spectrum may be lower
- Stimulate development of digital technology for SAB/SAP e.g. through support for R&D, administered incentive pricing for SAB/SAP spectrum and a date for digital switchover

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Detailed options for EU-level action

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Innovation reserve

PPDR: European dimension

- There is a significant European dimension:
 - economies of scale (important for the creation of bespoke networks required by PPDR)
 - cross-border interoperability (for cross-border emergency services)
 - cross-border interference management (which has the same issues as commercial WBB)
- But the need for a Europe-wide wireless broadband network for PPDR using digital dividend spectrum is unclear:
 - at the Stakeholders' Hearings some Member States said they had recently invested in PPDR systems elsewhere, and there may be other options e.g. 300–400MHz or satellite in the 2GHz range

PPDR: potential EU-level actions

- Produce guidelines or require Member States to use part of the 790–862MHz sub-band for a PPDR system:
 - this would shield PPDR (like commercial WBB) from interference
 - but has a high opportunity cost of displaced commercial WBB
- Produce guidelines or require Member States to use an alternative sub-band for PPDR in the 470–790MHz range:
 - possible allocation in proximity to the 400MHz band where some Member States have PPDR base stations
 - but heavy DTT use would require extensive DTT replanning

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Cognitive technologies: European dimension

- Cognitive technologies are not a use or a source of spectrum “demand”, but a solution to adapting to available spectrum
- The main European dimension is fostering technical development and promoting a single European market for cognitive technologies (hence economies of scale for potential mass-market applications such as wireless local area networks)
- Key issues are technical parameters, approaches (detection, geolocation databases or beacon reception) and regulatory conditions – to be discussed at WRC-11
- It may be advantageous for Europe to adopt the same technical parameters as other major markets, e.g. the USA – c.f. November 2008 Federal Communications Commission’s (FCC’s) decision

Cognitive technologies: potential EU-level actions

- Help Member States develop a European Common Position (ECP) for WRC-11 regarding regulatory measures for cognitive technologies, possibly aligned with the USA:
 - this is likely to encourage the development of a single market for these technologies, leading to economies of scale
- Produce guidelines or require Member States to adopt a common frequency range(s) for cognitive technologies:
 - but only as a secondary use, hence no guarantee of future interleaved spectrum availability

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Innovation reserve: European dimension

- An innovation reserve is spectrum that would be:
 - available for experimental use
 - be rapidly available for key uses
- We cannot see a distinct European dimension to either, or a need to consider EU-level action:
 - experiments can continue to be facilitated at a national level, for example using interleaved spectrum
 - it is unlikely there would be benefits from economies of scale
 - our high-level options are already designed to ensure that spectrum is made available for key uses in a planned and timely way, e.g. by ensuring that allocations are not made in the interim that could disrupt future plans

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Key findings from the first Member States' workshop

Socio-economic analysis of supply and demand for UHF spectrum

High-level options for action and recommendations

Open discussion of the the high-level recommendations

Detailed options for EU-level action

Socio-economic analysis of specific actions and recommendations

Open discussion of the specific recommendations

Introduction

- In the last presentation, Toby outlined possible sector-specific actions
- I will now evaluate these actions in turn
- Note that these sector-specific actions may be required to support the high-level options for action discussed this morning, or may be warranted in their own right

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DTT: potential areas for action

- We identified four areas in which EU-level action may be required:
 - stipulating receiver specifications
 - adopting advanced DTT transmission technologies
 - coordinating DTT deployment topologies
 - brokering multilateral negotiations on replanning

DTT: receiver specifications [1]

- We identified three options for EU-level action:
 - ▶ producing guidelines for the inclusion of MPEG-4 and/or DVB-T2 in all sold receivers
 - ▶ requiring all sold receivers to be MPEG-4 and/or DVB-T2 compatible
 - ▶ specifying minimum interference rejection standards for DTT receivers

DTT: receiver specifications [2]

- There are both benefits and costs to making all receivers MPEG-4 compatible

Benefits

- Helping prevent delays to the adoption of the 790–862MHz sub-band
- Reducing the cost of MPEG-4 migration

Costs

- Possibly increasing the cost of DTT receivers
- MPEG-4 may not be the optimal choice of technology in the long term

DTT: receiver specifications [3]

Preventing delays to the sub-band

- Studies have estimated a one-year delay would reduce the value of the sub-band by around 10%
- We estimate this is equal to:
 - EUR4.4 billion if demand for wireless broadband is low
 - EUR10.7 billion if demand for wireless broadband is high

Reducing the cost of migration

- Assuming the 15 MPEG-2 only Member States were to upgrade to MPEG-4 in 2015
- We estimate the cost of replacing MPEG-2 receivers would be EUR700 million less if all sold receivers were MPEG-4 compatible by 2012

DTT: receiver specifications [4]

Increasing cost of receivers

- Currently the average cost of receivers is around:
 - EUR30 for MPEG-2
 - EUR80 for MPEG-4
- If all receivers had to be MPEG-4 compatible, they would benefit from economies of scale
- Consumers that would have bought an MPEG-2 receiver would incur an incremental cost
- Consumers that would have bought an MPEG-4 receiver would do so at a lower cost
- We estimate the net cost to be EUR170 million

Non-optimal choice of technology

- This risk appears small:
 - 12 Member States use or plan to use MPEG-4
 - Most equipment manufacturers are already producing MPEG-4 receivers

The benefits of making all DTT receivers MPEG-4 compatible appear to outweigh the costs

DTT: receiver specifications [5]

DVB-T2

- Our modelling shows that DVB-T2 is probably only required if spectrum is cleared for a second sub-band – which is uncertain
- To be consistent with our approach for the second sub-band, we suggest revisiting action for the use of DVB-T2 in receivers alongside a review of possible further partial or total clearance of the 470–862MHz band

Interference rejection

- Minimum standards for receivers would ease the introduction of uses other than DTT into the band
- However, it could increase the cost of receivers
- We expect that this increase in cost would largely be offset by gains in economies of scale

DTT: receiver specifications [6]

Recommended action 4

- All sold DTT receivers in the EU are required to be MPEG-4 compatible as soon as possible and conform to minimum interference rejection standards
- A decision regarding the inclusion of DVB-T2 should be reviewed alongside a review of possible further partial or total clearance of the 470–862MHz band

DTT: transmission technologies [1]

- We identified two options for EU-level action:
 - producing guidelines on the timeline for the adoption of MPEG-4 and/or DVB-T2
 - requiring Member States to adopt MPEG-4 and/or DVB-T2 technologies

DTT: transmission technologies [2]

Benefits

- Adopting MPEG-4 would reduce the risk of delay in adopting the sub-band:
 - we estimate a one-year delay would cost EUR4.4 billion to EUR10.7 billion
- Adopting DVB-T2 would accelerate the possibility of adopting a second sub-band:
 - we estimate a one-year delay would cost EUR1.7 billion to EUR3.1 billion

Costs

- Broadcasters and consumers may need to replace equipment earlier than otherwise required, or even unnecessarily
- Adopting DVB-T2 may not be required if the second sub-band is not adopted
- We estimate the cost of upgrades across the EU to be:
 - EUR4 billion for MPEG-4
 - EUR10 billion for DVB-T2

DTT: transmission technologies [3]

Recommended action 5

- Produce non-obligatory guidelines for the adoption of MPEG-4 transmission by Member States by 2015
- A review takes place alongside a review of possible further partial or total clearance of the 470–862MHz band to consider non-obligatory guidelines for DVB-T2 transmission
- Member States are requested to share deployment plans for MPEG-4 and DVB-T2

DTT: deployment topologies [1]

- We identified two options for EU-level action:
 - producing guidelines on the timeline for the wider adoption of national SFNs
 - requiring Member States to adopt national SFNs more widely

DTT: deployment topologies [2]

Benefits

- Our modelling suggests that upgrading some or all DTT networks to SFNs is only likely to be required if a second sub-band is adopted

Costs

- We estimate the cost to upgrading networks to national SFNS to be EUR14 billion
- Given the uncertainty over the case for the second sub-band, it is unclear whether further investment in SFNs is a necessary or cost-effective action

DTT: deployment topologies [3]

Recommended action 6

- No specific action is taken in the short term regarding DTT deployment topologies
- A review takes place alongside a review of possible further partial or total clearance of the 470–862MHz band

DTT: brokering negotiations [1]

- Asymmetries in Member States' GE-06 assignments may make negotiation of assignments difficult:
 - some Member States may find themselves disadvantaged by our recommended high-level actions
- Negotiations with non-EU countries may also be assisted by EU-level input
- Any decision to adopt a second sub-band may require a more complex planning of the band:
 - an international conference similar to GE-06 will most probably be required
 - such conferences have lead times of several years (five or more)

DTT: brokering negotiations [2]

Recommended action 7

- The Commission should make itself available as a neutral broker in negotiations between Member States, or between Member States and non-EU countries

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Broadcast mobile TV

- We identified just one option for EU-level action:
 - producing guidelines on the range of frequencies that could be made available for broadcast mobile TV
- The tuning range of DVB-H devices typically covers most of the band (e.g.470–750MHz), therefore benefits would be limited to the cost saving from reducing this range
- If a smaller range was proposed, frequencies at the lower end of the band would be preferable, avoiding a potential second sub-band
- However, there may be downsides to a smaller tuning range:
 - it may not be consistent with existing / planned DVB-H networks
 - equipment in the market tunes across large parts of the band, it is therefore not clear that there would be a significant benefit

We do not believe that EU-level action is warranted for this use

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Wireless broadband [1]

- We identified two options for EU-level action:
 - encouraging research into frequency-agile wireless broadband systems
 - prioritising access to spectrum for flexible systems

Wireless broadband [2]

- Neither of the proposed actions are practical for the 790–862MHz sub-band, however, they may be practical for future releases of digital dividend spectrum
- If greater flexibility can be introduced without unduly increasing technology costs, then the economic benefits could be substantial:
 - Member States whose requirements differ significantly from the European average may no longer need to follow the actions of neighbours in order to realise economies of scale
- Further research into frequency-agile technologies needs to be carried out by manufacturers, but European bodies could influence its direction
- Prioritising access to future releases of spectrum for flexible systems would incentivise manufacturers to undertake research:
 - however, such decisive action could be counter-productive if cost-effective systems do not materialise

Wireless broadband [3]

Recommended action 8

- Research into the development of frequency-agile technologies should be encouraged
- The Commission could consider options to prioritise flexible systems for future releases of digital dividend spectrum. However, it should reserve judgement on whether to implement such a priority until it is sure that there is a robust business case for flexible systems

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SAB/SAP [1]

- We identified four options for EU-level action:
 - producing guidelines on a common set of frequency channels to be dedicated for SAB/SAP use
 - encouraging/requiring Member States to make a dedicated channel available for SAB/SAP
 - encouraging the migration of SAB/SAP to alternative frequency bands
 - supporting the development of digital technology for SAB/SAP

SAB/SAP [2]

- The main benefit of a common frequency range is economies of scale
- It would focus the vast majority of equipment into a small range
- We have calculated a low and high estimate for the benefits of economies of scale:
 - Low: 10% reduction in unit costs if dedicate channels are adopted in common frequency range across the EU
 - High: 20% reduction

Benefits from economies of scale

	<i>Number of Member States adopting common frequencies</i>		
	6	15	27
Low estimate	EUR14m	EUR40m	EUR53m
High estimate	EUR27m	EUR81m	EUR106m

The benefits are relatively modest, but the downsides to providing guidance for a range appear limited

Given that many Member States do not currently have dedicated channels, the case for requiring them to adopt one is not clear

SAB/SAP [3]

- Migration to digital technology or other spectrum bands was considered in the options for high-level action
- We concluded that such action was not warranted either now or in the short to medium term:
 - sufficient interleaved spectrum is likely to be available over this period
- This action should be reconsidered alongside a review of possible further partial or total clearance of the 470–862MHz band

SAB/SAP [4]

Recommended action 9

- Research is undertaken to understand the optimal frequency range for dedicated channels. Guidelines could then be published to encourage Member States to use this range if making a dedicated channel available
- No action is taken now to encourage SAB/SAP users to either migrate to digital equipment or to migrate to other bands. However, such action should be reconsidered alongside a review of possible further partial or total clearance of the 470–862MHz band

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PPDR [1]

- We identified two options for EU-level action:
 - producing guidelines on, or requiring Member States to use part of the 790–862MHz sub-band for a PPDR system
 - producing guidelines on, or requiring Member States to use, an alternative sub-band for PPDR within the 470–790MHz range

PPDR [2]

- Our evaluation of the options shows the following

790–862MHz sub-band

- Is available circa 2012, which is possibly too soon for an EU-wide commitment for a PPDR network
- Has a high opportunity cost, we estimate the cost of reserving 2×16MHz to be EUR13 billion to EUR32 billion

470–790MHz range

- Is available in the medium to long term, which is possibly more realistic
- Has a lower opportunity cost, we estimate the cost of reserving 2×16MHz to be EUR1 billion to EUR3 billion

PPDR [3]

Other spectrum bands

- Options include:
 - 300–400MHz
 - 2GHz (via satellite)
- 300–400MHz may be available in the medium to long term, and may have a lower opportunity cost than either of the other two options

We do not recommend any action at this stage for PPDR, given:

- the high opportunity costs of the 790–862MHz sub-band or spectrum below 790MHz
- the low certainty of demand for spectrum for PPDR in many Member States
- other potentially lower opportunity cost options in other bands

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Cognitive technologies [1]

- We identified two options for EU-level action:
 - developing a European Common Position (ECP) for WRC-11 regarding regulatory measures for cognitive technologies
 - producing guidelines or requiring Member States to adopt a common frequency range(s) for cognitive technologies

Cognitive technologies [2]

- A common position would have two benefits:
 - if adopted by Member States it would ensure economies of scale
 - it would provide confidence to manufacturers, potentially accelerating time to market
- There are few downsides to the EU developing a view on these technical and regulatory parameters (including a common frequency range):
 - the cost of doing so is relatively small
 - it does not require Member States to allow cognitive technologies, this decision remains at the national level
- We suggest using the FCC's decision as a starting point, if these parameters are suitable for the EU, then this would maximise economies of scale

Cognitive technologies [3]

Recommended action 10

- A European Common Position is developed regarding the technical parameters (including frequency ranges) and regulatory conditions for the introduction of cognitive technologies in the 470–862MHz band
- Member States are not required to either adopt this position or permit cognitive technologies

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Summary of recommendations

DTT	<ul style="list-style-type: none"> • All sold DTT receivers to be MPEG-4 compatible and have minimum interference rejection standards as soon as possible • Guidelines for the adoption of MPEG-4 transmission by 2015
Wireless broadband	<ul style="list-style-type: none"> • Research into the development of frequency-agile technologies should be encouraged
SAB/SAP	<ul style="list-style-type: none"> • Guidelines published to encourage Member States to use a common range if making a dedicated channel available
Cognitive technologies	<ul style="list-style-type: none"> • A European Common Position is developed regarding the technical parameters for cognitive technologies

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