About GSMA

- Representing the interests of the worldwide mobile communications industry. Nearly 800 operator members covering over 200 countries.

- More than 200 associate members from the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organization.

- 6 billion active mobile connections worldwide, with 3 billion connections from the Asia Pacific.

www.gsma.com
What is the DD?

Regional differences of DD allocations for Mobile:

- WRC’07 identified the 700 MHz band for the Americas & APAC regions (698-806 MHz)
- DD band for Europe is the 800 MHz band (790-862 MHz)
APT Harmonised Band Plan

Asia Pacific Telecommunity Wireless Forum decided in September 2010:

- A lower guard-band of 5 MHz should be allocated between 698-703 MHz
- An upper guard-band of 3 MHz should be allocated between 803-806 MHz
- The 2 x 45 MHz FDD structure should include a 10 MHz centre-band gap
- Lower block (703-748 MHz) should be allocated for mobile ‘uplink’ transmissions

Harmonized FDD arrangement of the 698-806 MHz band

Source: APT Report 14 “Harmonized Frequency Arrangements for the Band 698-806 MHz”
Current Status: APT 700 MHz FDD band plan

- ITU work is complete
  - APT 700 MHz band plans included in ITU-R Recommendation M.1036
    “Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT).”

- 3GPP Standardization is complete

- CITEL in November 2011 adopted a Recommendation which included the APT FDD 700 MHz band plan as one of two options

- Australia and a number of South American countries have announced plans to adopt the APT band plan

- Japan and Papua New Guinea awarded licences
Why Harmonisation Matters

- Economies of scale
- Handsets affordability
- Reducing cross-border interference
- International roaming
Economies of Scale

Impact of economies of scale on device costs

Figure 4: Average selling price for handsets (ASP)

Source: LECG, Strategy Analytics and Yankee Group

Cost effective roll-out of networks for operators
Affordable access to handsets and services for consumers
Coverage Effect of Low Frequencies

Low frequency bands = coverage bands

High frequency bands = capacity bands

Lower frequencies mean fewer base stations needed to produce geographic coverage for increased rural adoption of services and indoor coverage in city areas.

Operators need 700 MHz band and 900 MHz band to deliver cost-efficient indoor city coverage and rural coverage.

The propagation characteristics of spectrum

Source: BBC R&D.
Allocation to mobile will have positive economic impact

GDP increase with US$1,070B, taxes with US$215B in addition to 1.4M new business and 2.7M new jobs

**GDP increased US$ 1,070B 2014-2020 (NPV US$ 960B)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental GDP [US$ B]</th>
</tr>
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<tbody>
<tr>
<td>2014</td>
<td>40.1</td>
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<tr>
<td>2015</td>
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<td>2016</td>
<td>121.5</td>
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<td>148.3</td>
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<td>2018</td>
<td>181.0</td>
</tr>
<tr>
<td>2019</td>
<td>218.8</td>
</tr>
<tr>
<td>2020</td>
<td>262.6</td>
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</table>

**Government revenues up US$ 215B**

**NPV US$182B**

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental tax [US$ B]</th>
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<tbody>
<tr>
<td>2014</td>
<td>6.8</td>
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<td>2015</td>
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<td>2016</td>
<td>20.7</td>
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<td>2017</td>
<td>27.6</td>
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<td>2018</td>
<td>37.1</td>
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<tr>
<td>2019</td>
<td>47.8</td>
</tr>
<tr>
<td>2020</td>
<td>60.1</td>
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</table>

**1.4M new business activities by 2020**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative new business activities [M]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.1</td>
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<tr>
<td>2015</td>
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<td>2016</td>
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<td>2017</td>
<td>0.6</td>
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<tr>
<td>2018</td>
<td>0.8</td>
</tr>
<tr>
<td>2019</td>
<td>1.1</td>
</tr>
<tr>
<td>2020</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**2.7M additional jobs created by 2020**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative new jobs [M]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.2</td>
</tr>
<tr>
<td>2015</td>
<td>0.6</td>
</tr>
<tr>
<td>2016</td>
<td>0.9</td>
</tr>
<tr>
<td>2017</td>
<td>1.3</td>
</tr>
<tr>
<td>2018</td>
<td>1.7</td>
</tr>
<tr>
<td>2019</td>
<td>2.2</td>
</tr>
<tr>
<td>2020</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Allocation to DTT a much smaller economic impact

GDP increased US$ 111B 2014-2020
(NPV US$ 95B)

Government revenues up US$ 44B
(NPV US$39B)

1.1K new business activities by 2020

Cumulative new business activities [M]

0.001
0.001
0.001
0.001
0.001
0.001
0.001
0.001

Cumulative new jobs [M]

0.07
0.07
0.07
0.07
0.07
0.07
0.07
0.07

1. Incl. new independent businesses as well as new departments/units/business areas within existing firms
Note: NPV discounted by study country government security rates for each cluster; 1.5% for Korea, 2.8% for Malaysia, 4.0% for Indonesia and 5.0% for India
Source: Datamonitor; EIU; OECD; World Bank; National statistics units; BCG analysis
700 MHz band to mobile

Allocation of 698-806 MHz band to mobile will have significant incremental economic benefits over broadcasting

GDP increased US$ 959B 2014-2020 (NPV US$ 865B)

Cumulative new business activities [M]

1.4M new business activities by 2020¹

Government revenues up US$ 171B (NPV US$144B)

Cumulative new jobs [M]

2.7M additional jobs created by 2020

¹ Incl. new independent businesses as well as new departments/units/business areas within existing firms

Note: NPV discounted by study country government security rates for each cluster; 1.5% for Korea, 2.8% for Malaysia, 4.0% for Indonesia and 5.0% for India

Source: Datamonitor, EIU, OECD, World Bank; National statistics units; BCG analysis

THE BOSTON CONSULTING GROUP
Delays will have major impact on GDP & jobs

Delaying the decision have major impact on short term GDP effects...

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental GDP loss [US$ B]</th>
<th>Direct loss</th>
<th>Indirect loss</th>
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</thead>
<tbody>
<tr>
<td>2014</td>
<td>-26.6</td>
<td>-27 B</td>
<td>-51 B</td>
</tr>
<tr>
<td>2015</td>
<td>-34.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>-65.3</td>
<td>-92 B</td>
<td>-80 B</td>
</tr>
<tr>
<td>2017</td>
<td>-46.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>-15.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>-18.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>-200 K-500 K fewer jobs per year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

... and reduce job opportunities

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental jobs [M]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.2</td>
</tr>
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<td>2015</td>
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</tr>
<tr>
<td>2018</td>
<td>1.2</td>
</tr>
<tr>
<td>2019</td>
<td>1.5</td>
</tr>
<tr>
<td>2020</td>
<td>1.8</td>
</tr>
</tbody>
</table>

-200K-300K fewer jobs per year

THE BOSTON CONSULTING GROUP
Two likely scenarios that would create cross-border interference in the region

Any two high-power signals on the same frequency will risk interference

If digital signals\(^1\) directly interfering which each other on the same frequency, the signals risk either cancelling each other out, or one signal over-powers the other in the following cases:

- **Signal overload** occurs when signal from interference source 1 will be swamped so the signal cannot be transmitted
- **Receiver is not able to distinguish the wanted signal from the unwanted signal**

![Diagram of two base stations interfering with each other]

Two scenarios may arise in Asia that would cause cross-border interference

1. **FDD vs TDD technology used across borders**
   - **Frequency Division Duplex**: supports two-way radio communication by using two distinct radio channels
   - **Time Division Duplex**: uses a single frequency to transmit signals in both the downstream and upstream directions

2. **Only half of the intended spectrum is allocated to IMT, whilst the rest is allocated to DTT services**
   - **Direct cross-border interference** will occur in the portion of the spectrum allocated to DTT, if neighbouring countries were to allocate the whole spectrum to IMT

Such interference will cause a reduction in quality of the desired signal

Both allocations will result in interference issues with neighbouring countries

---

1. Digital signals are still by definition radio signals which, if directly interfering, will react like a radio frequency interference

Source: Expert calls

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Potential implications of non-harmonisation

We model a representative country X with three neighbouring countries

Model a representative country X
- Country X is a medium developed economy in APA standards
- Country X share borders with one developed country (A-cluster), one medium developed country (B-cluster) and one less developed country (C-cluster)

Country X adopts a non-harmonised solution affecting the digital dividend

Country X adopts a non-harmonised 700 band solution, as a result of either
- Spectrum split between digital broadcasting (DTT) and mobile services (IMT)
- Use of TDD technology rather than FDD

Implications of non-harmonisation will be assessed for both own and neighbouring countries

i Effect on own country
- Interference mitigation cost
- Loss of 700 band mobile coverage
- Increased handset costs

ii Effect on neighbouring countries
- Cross-border interference
Both country X and neighbours will have reduced benefits.

**i) Benefits of the 700 band reduced by 5-30% for country X**

- GDP: -5%
- Tax revenues: -18%
- New businesses: -30%
- Jobs created: -30%

**ii) Neighbouring countries experience reduction in benefits vs base case**

- **Country A**
  - GDP: -3%
  - Tax revenues: -12%
  - New businesses: -11%
  - Jobs created: -10%

- **Country B**
  - GDP: -1%
  - Tax revenues: -6%
  - New businesses: -8%
  - Jobs created: -7%

- **Country C**
  - GDP: -1%
  - Tax revenues: -4%
  - New businesses: -8%
  - Jobs created: -8%

Source: Datamonitor; EIU; OECD; World Bank; National statistics units; BCG analysis
Spain redepolyed 800 MHz band to Mobile after initial DTT allocation

Spain allocated 800 band to DTT in 2005

- Spain and Portugal coordinated allocation of 800 MHz band to broadcasting in 2005
  - Spain released the new DTT broadcast plan in 2005 stating that the 800MHz band would be allocated to DTT
  - Allocation of channels announced by end of 2005 and switchover planned to start in 2009

However, needed to redeploy to harmonize with EU

- However, rest of Europe and WRC decided to allocate the whole 800MHz band to mobile services
  - Broad alignment among large European nations
  - Larger estimated benefit of mobile services relative to broadcasting services

Spanish politician decided to redeploy the spectrum allocation to mobile services

- Decision made in a response to recommendations from the European Commission
  - Main argument was that it would benefit the economy

Process criticised for being non-transparent

- Critiques argue for lack of assessments and consultations during the process
  - Lack of formal cost-benefit analysis prior to the allocation of services (i.e. mobile allocation)
  - Agreement for mobile usage reached only four days before the analogue switch-off was completed
  - EC currently investigating Spanish scheme which compensates digital terrestrial broadcasters' extra cost of parallel broadcasting

Source: Econstor, GSA, Press search

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Recommendation

- Allocate the 698-806 MHz band to Mobile
- Adopt the APT harmonised 2x45 MHz band plan
  - for scale in handset and network equipment production
  - to reduce cross-border interference
  - Promote international roaming
- To reap full benefits allocate sooner rather than later
THANK YOU!

Chris Perera  Senior Director Spectrum Policy & Regulatory Affairs, Asia Pacific

cperera@gsm.org  Visit http://www.gsma.com/spectrum/