Affordability starts with Spectrum
How do pricing and effective assignments impact connectivity?
Moderator
Lucas Gallitto
Head of LATAM
GSMA
Agenda

Moderator: Lucas Gallitto, GSMA, Head of LATAM

Welcome Remarks
Luciana Camargos, Head of Spectrum, GSMA
12:15 - 12:20

The GSMA view
Luiz Felippe Zoghibi, Spectrum Engagement Director, GSMA
12:20 - 12:25

Regulatory Perspective
Armando Fuentes Rodríguez
Administrador General, ASEP, Panamá
12:25 - 12:30

Stefan Schnorr, State Secretary
Federal Ministry for Digital and Transport, Germany
12:30 - 12:35

New developments: Spectrum impact on QoS
Ceri Howes, VP Government and External Affairs, Opensignal
Ian Fogg, VP Analysis, Opensignal
12:35 - 12:45

Roundtable Discussion
12:50 - 13:40

Closing Remarks
13:40 - 13:45
Welcome Remarks
Luciana Camargos
Head of Spectrum
GSMA
Connectivity evolves, more spectrum is needed
The right amount of spectrum unlocks socio-economic benefits.

$961\text{ BN}$... but spectrum constraints restrict value.

The Socio-Economic Benefits of Mid-band 5G GSMA Intelligence 2022
Spectrum is needed across 3 ranges:

- **Dense Urban**: 3.5 GHz, 4.8 GHz, 6 GHz
  - City-wide speed coverage layer, 5G only

- **Suburban**: 600-900 MHz
  - Deep indoor and rural coverage layer, legacy technologies and 5G

- **Rural**: 1.5-2.6 GHz
  - Basic capacity layer, legacy technologies and 5G

- **Upper mid-bands**: 3.5 GHz, 4.8 GHz, 6 GHz
  - City-wide speed coverage layer, 5G only

- **High-bands**: mmWaves
  - Super high capacity hot-spots, 5G only

**Needs**

Demand always higher than supply.
## The right T&Cs bring more investments

<table>
<thead>
<tr>
<th>Legal and Regulatory Certainty</th>
<th>Affordable Spectrum Prices</th>
<th>Well-planned Assignment Processes</th>
<th>Carefully Considered Obligations</th>
</tr>
</thead>
<tbody>
<tr>
<td>License duration of more than 20 years</td>
<td>Set fair prices</td>
<td>Auctions are common methodology, but are not the only solution</td>
<td>No service and technology restrictions</td>
</tr>
<tr>
<td>Establish a license-renewal process:</td>
<td>Use annual fees to recoup costs – not maximise revenues</td>
<td>Make spectrum available as soon as practical</td>
<td>Use coverage obligations with caution and target them to actual needs</td>
</tr>
<tr>
<td>Presumption of Renewal</td>
<td>Renewal process should not be costly</td>
<td>Avoid any type of artificial scarcity</td>
<td>Discount obligations from reserve prices</td>
</tr>
<tr>
<td>3-4 years in advance</td>
<td>High prices impact investment:</td>
<td>Have an open conversation with the industry</td>
<td></td>
</tr>
<tr>
<td>No new T&amp;Cs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GSMA Ministerial Programme
Regulatory Perspective
Panamá
Armando Fuentes Rodríguez
Administrador General
ASEP
EL ESPECTRO: la autopista invisible para la revolución digital

MWC Barcelona 2023
27 FEBRUARY – 2 MARCH, 2023

MESA REDONDA
POLITICA DE ESPECTRO COMO PILAR DEL CIERRE DE LA BRECHA DIGITAL

Poner a disposición de los operadores móviles espectro radioeléctrico adicional.

Facilitar a los operadores móviles la implementación de soluciones que permitan atender la creciente asimetría del tráfico de datos.

Promover normativas y reglamentaciones técnico-regulatorias que coadyuven en el acceso de la población a la banda ancha.

Propiciar las condiciones para el desarrollo de la infraestructura de telecomunicaciones a nivel nacional.
EVOLUCIÓN: VALOR DEL ESPECTRO PARA EL SERVICIO MÓVIL CELULAR

1997
Banda: 850 MHz
Precio base por MHz: US$ 2,9 MM

2008
Asgnación de Espectro en la Banda de 700 MHz
Precio estimado = $3.2 MM/MHz

2014–2015
Asgnación de espectro (AWS, 700 y 1900), sin costo, por incrementos del tráfico de red por Pandemia.
Medida Temporal de Abril 2020 Abril 2022

2017

2020

2022

Precio Ref. $3.6 MM/MHz
Precio Pagado: $1.2 MM/MHz

Reducción del precio del espectro AWS en un 64%

Licitación PCS
Precio Ref. $1.91 MM/MHz
Precio Pagado: $2.87 MM/MHz

Operadores muestran interés por AWS pero indican que el precio es oneroso
Precio estimado = $3.4 MM/MHz
BENEFICIOS SOCIALES

La reducción del precio del espectro en un 64%, revela un acertado conocimiento del rol estratégico del Regulador en la gestión de este recurso.

La suma de 120 MHz (AWS) al total de espectro disponibles para los operadores móviles permitirá la expansión de sus redes lo que impactará directamente en la mejora de la cobertura y la calidad del servicio.

La reducción en el precio del espectro ha incentivado a los operadores de telefonía móvil a invertir en la expansión de sus redes, impactando sus costos de operación.

El acceso de los operadores al espectro correcto, en el momento adecuado y a precios y condiciones razonables, es fundamental para expandir y mejorar los servicios de banda ancha móvil.

La disponibilidad de espectro se convierte en una herramienta de inclusión tecnológica que permite reducir la brecha digital, llevando conocimiento y nuevas tecnologías de información a zonas de difícil acceso.
Dr. Armando Alonso Fuentes Rodríguez
Administrador general de la Autoridad Nacional de los Servicios Públicos (ASEP)
Email: arfuentes@asep.gob.pa
Germany

Stefan Schnorr
State Secretary
Federal Ministry for Digital and Transport
New developments: Spectrum impact on QoS

Ian Fogg
VP Analysis
Opensignal

Ilaria Bencivenga
Policy Manager
Opensignal
How Spectrum Affects Global Mobile Network Experience

February 2023
Ian Fogg, VP Analysis, @ianfogg42, ianfogg@mastodon.social
Ceri Howes, VP Government and External Affairs
How Spectrum Affects Global Mobile Network Experience

• Goals
  o Investigate how the amount of spectrum relates to the quality of mobile users’ experience
  o Provide quantitative evidence to support discussions around:
    - Spectrum licensing
    - Coverage obligation terms
    - Debates with other spectrum users on allocation of spectrum for mobile usage, e.g. 6G, TV, WiFi for example in the run up to WRC

• Approach
  - Analyze >115 international countries/markets and approximately 300 operators
  - Means results are relevant globally
  - Investigate various experiences, e.g. Video Experience, Games Experience, Download & Upload Speed
  - Enables analysis how markets differ based on various segmentations

• Initial Findings
  o Globally we observed faster 4G and 5G download speeds with wider spectrum bandwidths dedicated to connections
  o At this relatively early stage of 5G deployment, the correlation between bandwidth used and average speeds is stronger for 4G (R2 = 0.37) than for 5G (R2 = 0.19)
  o 5G Download speeds across regions rise with more bandwidth
  o Video Experience — we see affects of spectrum capacity for mobile video streaming, a key drive of mobile data usage for users worldwide.
  o Games Experience — also see an impact, even though multiplier gaming is based on reliable fast transmission of small packets of data.
  o Conclusion: greater spectrum availability improves many aspects of the mobile experience.
Globally, more spectrum capacity boosts users’ average speeds

4G: Average Download Speed vs Spectrum Capacity

5G: Average Download Speed vs Spectrum Capacity

Data collection period: 1 November – 29 January 2023
The study details results in over 115 markets globally.

Data collection period: 1 November – 29 January 2023
Even with the early 5G market, the trend continues
Opensignal approach quantifies the real-world experience

Capturing on-device mobile experience

Analysing billions of records to reveal true experience

Delivering business intelligence for competitive advantage

End to end experience measurements
Representative sample

Innovative Data Science and Analytics

Impartial respected reports Insights into real experience
Leading experiential metrics - from network performance to experience

Games Experience
- Measuring the end-to-end latency, packet loss and jitter on real devices

Voice App Experience
- Measuring the quality of experience for OTT voice services

Availability
- % of time real users have a connection on the best technology

Speed & Latency

Video Experience
- Video streaming on real devices accounting for real end points and traffic shaping

3G

4G

5G

Group Video Calling
- Video and voice experience of multi user video calls

Reach
- The real user experience of network rollout

Live Video Experience
- Real-time video streaming, used for live sports events, news & gaming.
More spectrum capacity also correlates with users’ improved multiplayer gaming & video streaming experience globally.

### Games Experience

<table>
<thead>
<tr>
<th>Bandwidth Range</th>
<th>4G</th>
<th>5G</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 MHz</td>
<td>60.1</td>
<td>73.4</td>
</tr>
<tr>
<td>20-40 MHz</td>
<td>65.0</td>
<td>76.1</td>
</tr>
<tr>
<td>40-60 MHz</td>
<td>70.4</td>
<td>76.4</td>
</tr>
<tr>
<td>above 60 MHz</td>
<td>73.4</td>
<td>79.3</td>
</tr>
</tbody>
</table>

### Video Experience

<table>
<thead>
<tr>
<th>Bandwidth Range</th>
<th>4G</th>
<th>5G</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 MHz</td>
<td>59.4</td>
<td>71.0</td>
</tr>
<tr>
<td>20-40 MHz</td>
<td>65.0</td>
<td>71.2</td>
</tr>
<tr>
<td>40-60 MHz</td>
<td>67.8</td>
<td>69.6</td>
</tr>
<tr>
<td>above 60 MHz</td>
<td>70.4</td>
<td>73.5</td>
</tr>
</tbody>
</table>

Data collection period: 1 November – 29 January 2023
Regionally too, spectrum correlates with average download speed.

**APAC: 4G Download Speed**

<table>
<thead>
<tr>
<th>Total bandwidth in MHz</th>
<th>Average speed (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 MHz</td>
<td>21.1</td>
</tr>
<tr>
<td>20-40 MHz</td>
<td>33.8</td>
</tr>
<tr>
<td>40-60 MHz</td>
<td>47.7</td>
</tr>
<tr>
<td>above 60 MHz</td>
<td>66.5</td>
</tr>
</tbody>
</table>

**APAC: 5G Download Speed**

<table>
<thead>
<tr>
<th>Total bandwidth in MHz</th>
<th>Average speed (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50 MHz</td>
<td>174.0</td>
</tr>
<tr>
<td>50-100 MHz</td>
<td>200.8</td>
</tr>
<tr>
<td>100-150 MHz</td>
<td>254.4</td>
</tr>
<tr>
<td>150-200 MHz</td>
<td>295.0</td>
</tr>
</tbody>
</table>

**Europe: 4G Download Speed**

<table>
<thead>
<tr>
<th>Total bandwidth in MHz</th>
<th>Average speed (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 MHz</td>
<td>31.2</td>
</tr>
<tr>
<td>20-40 MHz</td>
<td>38.3</td>
</tr>
<tr>
<td>40-60 MHz</td>
<td>48.1</td>
</tr>
<tr>
<td>above 60 MHz</td>
<td>51.3</td>
</tr>
</tbody>
</table>

**Europe: 5G Download Speed**

<table>
<thead>
<tr>
<th>Total bandwidth in MHz</th>
<th>Average speed (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50 MHz</td>
<td>125.6</td>
</tr>
<tr>
<td>50-100 MHz</td>
<td>133.9</td>
</tr>
<tr>
<td>100-150 MHz</td>
<td>204.9</td>
</tr>
<tr>
<td>150-200 MHz</td>
<td>291.4</td>
</tr>
</tbody>
</table>

Data collection period: 1 November – 29 January 2023

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In less mature 5G regions we see a trend with 4G, but not yet on 5G.

**LATAM: 4G Games Experience**

- 0-20 MHz: 57.3
- 20-40 MHz: 62.7
- 40-60 MHz: 65.3
- Above 60 MHz: 67.0

**LATAM: 5G Games Experience**

- 0-50 MHz: 71.4
- 50-100 MHz: 74.4
- 100-150 MHz: 72.9
- 150-200 MHz: 78.5

**North America: 4G Video Experience**

- 0-20 MHz: 54.7
- 20-40 MHz: 59.1
- 40-60 MHz: 61.3
- Above 60 MHz: 65.1

**North America: 5G Video Experience**

- 0-50 MHz: 65.9
- 50-100 MHz: 67.4
- 100-150 MHz: 66.9
- 150-200 MHz: 69.0

Data collection period: 1 November – 29 January 2023
How Spectrum Affects Global Mobile Network Experience

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• Initial Findings
  o Globally we observed faster 4G and 5G download speeds with wider spectrum bandwidths dedicated to connections
  o At this relatively early stage of 5G deployment, the correlation between bandwidth used and average speeds is stronger for 4G ($R^2 = 0.375$) than for 5G ($R^2 = 0.1867$)
  o 5G Download speeds across regions rise with more bandwidth
  o Video Experience — we see affects of spectrum capacity for mobile video streaming, a key drive of mobile data usage for users worldwide.
  o Games Experience — also see an impact, even though multiplayer gaming is based on reliable fast transmission of small packets of data.
  o Conclusion: greater spectrum availability improves many aspects of the mobile experience.
Advancing connectivity for all

**Improving business performance** – commercial and network insights that enable operators to compete and win effectively

**Improving network experience** – competitive intelligence and actionable insights for operators to improve network experience

**Powering sales and marketing** – impactful branded assets across full range of sales and marketing channels to grow market share

**The independent source of the truth** - trusted by stakeholders across the industry to reveal the true end to end network experience
Trusted Independent partner

**Independent**
Editorially independent public reports - never sponsored

**Trusted**
Insights trusted by regulators, analysts and over 150 clients globally

**Revealing Network Experience**
Experiential metrics measuring typical end to end experience

**Scientific Analysis**
Sophisticated methodology applied consistently

**Valued Candid Partner**
Global teams with years of industry experience

Openly sharing the standards we uphold for published content
Why does Opensignal work with governments and institutions?

- Providing independent analytics to support evidence-based regulatory approaches and policymaking
- Helping regulators and policymakers manage consumer expectations and proactively engage with industry (vs a compliance model)
- Independence is critical – a trustworthy third-party source of data is powerful in providing a “buffer” from political pressures and ensuring that connectivity policy is impactful on the ground
- Robust methodology – data integrity and the strictest privacy standards are fundamental to our work
- Regional and international comparisons are possible due to globally standardized methodology
- Evolving the regulatory discussion from static QoS compliance to end-to-end, quality of experience approaches.
2022 government partnerships

Ofcom report shows growing 5G coverage

15 December 2022

Ofcom analysed crowdsourced data from OpenSignal to help judge the quality of service across the UK.

It found for 5G devices many more areas achieve a "high performance" level than for non-5G devices, but found that - even for 5G - few areas met the "highest performance" level.

Ofcom told the BBC it wanted to see investment in 5G networks.

It said "The UK's mobile companies are still in the process of rolling out 5G and are at different stages of extending their networks. So customers' experience will vary by their location and network.

"We'll be taking further steps over the coming year to shine a light on this, so people can see for themselves which operators are leading the way for quality of service."

The number of mobile phones able to use 5G has also risen significantly, doubling in the past year. One in five handsets, the Ofcom report found.

About seven in 10 UK properties can now get reception from at least one mobile operator, a new report from media regulator Ofcom.

This is up from about half of all UK households months ago, the Connected Nations report says.

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Thank you

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Ceri Howes, VP Government and External Affairs
cerihowes@opensignal.com
Roundtable
Lucas Gallitto
Head of LATAM
GSMA
Roundtable Discussion

1) What are the plans for Spectrum in your market to fulfil the needs of next-generation mobile services?

2) How does spectrum pricing sit within the pillars to encourage investments in your market?
Closing Remarks