Ofcom Spectrum Advisory Board

Annual Report 2017 - 2018

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Foreword by the new OSAB's Chair

It is with great pleasure I take over as the Chair of OSAB. I have been a member of the committee for the past number of years and I know it to be a vibrant and engaged committee and one that is committed to thinking about long-term issues for Ofcom.

I would like to acknowledge the work of my predecessor David Meyer. David has been an excellent Chair of OSAB. He always had his finger on the pulse of key issues for Ofcom and he chaired meetings with enthusiasm, skill, and in an open and welcoming manner. His eloquence in summing up the outcomes of meetings will not be surpassed!

I would also very much like to take a moment to remember Mike Walker who sadly passed away this year. Mike has been a member of OSAB since 2010. Mike was a very talented and very able man. He was ill for a number of years before he passed away. He never let his illness get in the way of his zest for life and he never made it an issue. We remember Mike for the great service he gave to OSAB and we remember him for his intelligence, humour, generosity and kindness.

I look forward to my term ahead as Chair of OSAB. I believe Ofcom to be one of the most forward-thinking regulators in the world. I look forward to working with my colleagues on OSAB and I hope to do the role as Chair justice.

Linda Doyle

Section 2

Introduction

Background

2.1 The Ofcom Spectrum Advisory Board (OSAB) was established on 19 May 2004 to provide independent advice to Ofcom on strategic spectrum management issues. OSAB provides Ofcom with:

- A rapid way to test new ideas across a wide range of experts;
- A means of identifying issues that are beyond Ofcom's regulatory "headlights"; and
- A demonstration of Ofcom's commitment to consult in an open and collaborative manner.

Annual report

2.2 This document reports on OSAB 2017-2018 activity. It is intended to summarise selected discussions throughout the year and its content is based on the published minutes of OSAB meetings.

Work Programme for 2017-18

2.3 OSAB is responsible for agreeing its own work programme. During this year, the discussions focussed on the following macro-topics:

- 5G
- The impact of emerging technologies and trends on regulations
- The future of the satellite sector

The Year Ahead

2.4 OSAB sets its agenda from meeting to meeting depending on progress made in particular areas, time available and topics arising. It deliberately does not plan a year ahead to allow for flexibility and responsiveness to development(s) in the telecom sector.

Section 3

Summary of the OSAB discussions

5G

3.1 Various OSAB sessions focussed on 5G. In the following we summarise the different topics discussed.

5G markets and the UK's 5G testbeds and trials

3.2 A presentation was given about the government plan to facilitate a market for 5G, that was based on the following actions. First, a program of 5G testbeds and trials, with the aims of stimulating investment, creating a UK digital leadership, and driving productivity and growth. Second, a 5G innovation network, to link up testbeds and trials with other 5G activities, and to share knowledge. Third, to allocate and assign the right spectrum for 5G. The OSAB members discussed the value of 5G testbeds and trials for Ofcom, to understand the emergence of new services and the capabilities of 5G technologies and the related requirements for spectrum, infrastructure and deployment.

Ofcom's activities for 5G at mm-wave

3.3 An Ofcom member asked OSAB a series of short questions, as a way to collect OSAB's feedback on Ofcom's activity on mmWave. The first question was about use cases for 5G mmWave. OSAB was asked whether 5G mmWave could provide a good solution for FWA in the UK, also considered the various US activities on-going at that moment, and whether there was a demand for 5G mmWave for industrial applications. The OSAB members pointed out the uncertainty around the use cases for mmWave, and emphasised the difficulty of policy making under such uncertainty. An OSAB member provided some examples where FCC needed to face hugely challenging fast-paced environments and how they managed to come up with the required regulation. OSAB members also pointed out to the importance of analysing the impact of new emerging requirements (like ultra-low latency) on spectrum policies. The second question was about the implications of site acquisitions for the deployment of small cells. The OSAB members provided comments about the difficulty of site acquisition in UK. The third question was about the status of the standardisation works, and whether 3GPP was the only body working on specifications for 5G mmWave. The OSAB members confirmed the focus of other standardisation bodies (like IEEE) on high mmWave bands (like the 60 GHz band).

Presentation about mid-band spectrum developments in US

3.4 A presentation was given on mid-band spectrum developments in US, discussing the role of both licensed and unlicensed/shared spectrum to enable 5G services. The presenter talked about the importance of both mid-band and mmWave for 5G, but mentioned that most of the interest was being focused on the middle bands. He explained which bands had been identified for 5G use, for either unlicensed and licensed use, and how the FCC generated the policy framework around these. He then provided a summary of the on-going discussion in US on the possibility of opening the 6 GHz band for unlicensed use. During the discussion, OSAB members stressed the importance of looking at new ways of sharing spectrum, to enable all possible users and not leaving anyone behind. An Ofcom member mentioned the recent works carried for 5.8 GHz, and the fact that UK had recently opened this band for licence-exempt use.

The future of Mobile Network Operators (MNOs) and small cells as-a-service

3.5 A presentation was given on the future of MNOs. The presentation first discussed a set of trends in the mobile market:

- Trend 1. Demand is changing.
- Trend 2. There is conflict of interest in the traditional MNO/MVNO interaction and there is a need for more efficient mechanism for accommodating MVNOs on the network.
- Trend 3. In the future, mobile infrastructure will be deployed in places very different from the traditional masts.
- Trend 4. Spectrum is still not used in an optimal way. The example of the multi-tiered Citizens Broadband Radio Service (CBRS) framework was given as a tentative to find a balance between different spectrum needs.

3.6 The presenter and OSAB then discussed possible ways to address these emerging trends. In particular, they discussed the benefits of the “open access market” model, where capacity is bought and sold at different spatial and temporal resolutions. Capacity can be bought in advance (forward market) or be bought and sold in real-time (real-time market). OSAB also discussed the impact of new technologies, like blockchain, as enablers for the model above described.

Summary

3.7 Together with delivering faster and better mobile broadband, 5G is expected to enable more revolutionary uses in sectors such as manufacturing, transport and healthcare. Monitoring 5G testbeds and trials is valuable for Ofcom, to better understand the requirements on spectrum and the implications on other policy aspects.

3.8 Supporting a very different set of existing and new uses cases, requires a variety of spectrum bands at low, mid and high frequencies. The insights from OSAB helped to shed some more light on the role of mmWave and on the role of unlicensed spectrum. Ofcom will keep monitoring potentially disruptive spectrum models, like the open access market model.

The impact of emerging technologies and trends on regulations

3.9 One of OSAB roles is to discuss emerging technologies and trends and recent changes in the legislation, and their impact on Ofcom. In the following we summarise the topics discussed this year.

Hybrid access overview

3.10 A presentation was given on hybrid access, a technology that allows bonding mobile and fixed networks in a way to provide consumers with higher speeds, beyond the capacity of their fixed broadband connection. The presenter discussed benefits, architectural requirements, different types of implementations, and gave examples of how hybrid access is triggered in ADSL networks. The OSAB members then discussed the presentation. OSAB made the point that with the user being able to use together mobile and WiFi, it was not clear which service provider would be accountable. Moreover, there could be an impact on the ability of switching between different providers. OSAB also made the point that the regulatory structure should take into account the impact of “softwarisation” and virtualisation on the provider/consumer relation.

How to regulate innovation and innovate regulation

3.11 A presentation was given to discuss if the current regulatory methodology is fit for purpose for this part of the 21st century. In particular, the presentation focussed on the use of distributed ledgers (blockchain) to manage and regulate spectrum, and to allow the regulator to react more rapidly to changes in the market. OSAB discussed the possibility to use blockchain for some the spectrum frameworks already in place (in particular “Whitespaces”) and agreed that setting conditions in a distributed ledger process had to include ways of controlling interference. OSAB pointed out that blockchain could be an enabler for more flexibility and more efficiency in allocating spectrum. OSAB suggested Ofcom should work with universities and other players to explore ways of using blockchain for spectrum management.

The digital economy act 2017

3.12 An OSAB member gave a presentation on the Digital Economy Act 2017 which had recently received Royal Assent, summarising the key provisions of the act. The

OSAB members discussed the presentation and offered various comments related to Ofcom. In particular, they suggested that Ofcom should have role in defining the compensations to be paid to consumers when providers fail to meet specified standards or obligations. OSAB also noted that public sector data sharing could facilitate many of the spectrum-related Ofcom's activities. For example, it could facilitate dynamic spectrum access applications, in particular in the context of smart cities.

The emergence of Low-Power Wide Area Networks (LPWAN)

3.13 A presentation was given to provide an overview on long range wireless networks. The presenter emphasised that the key enabler to increase the adoption of IoT services was the capability to support long range and low power requirements. The presenter and OSAB members discussed the different available connectivity platforms for IoT and the implications for spectrum.

Summary

3.14 One of the challenges for regulators today is that the pace of change is accelerating: the difficulty in taking the right choice, based on the available evidence, is increasing.

3.15 This year OSAB identified three emerging technologies for Ofcom to monitor: hybrid access, blockchain and LPWANs. Ofcom will keep engaging with Academia, Industry and other players to monitor these and other emerging technologies.

The future of the satellite sector

3.16 OSAB held the annual workshop on the future of the satellite sector. In the following we summarise the items discussed.

Introduction and overview

3.17 Philip Marnick explained that the space sector is going through a period of significant change. As a consequence, innovative new services are being proposed and financed. Existing radio regulations have been set up predominantly to deal with large satellites operating from Geostationary orbits[1], part of the rationale for this event therefore was to understand if these regulations were fit for purpose given

[1] Geostationary orbit is an orbit around 36,000m above the surface of the Earth where the satellite 'falls' at the same rate that the Earth turns and therefore appears to remain stationary above the Earth. These orbits are particularly useful for telecommunications

proposals for mega-constellations, small sat and cubesat missions planned for non-geostationary orbits[2].

Spectrum sharing vs protection

3.18 Overall, the discussions centred on opportunities for spectrum sharing (e.g. exploiting 5G architecture) and areas where space services might require spectrum protection (safety-of-life applications or earth science bands which are used for public good like weather prediction and climate science). Space operators were broadly open to sharing spectrum with other sectors over the longer term but stressed the need for spectrum certainty for existing services given the timelines of space missions (10-15 years).

Global Navigation Satellite Services (GNSS)

3.19 Intentional interference to GNSS and other satellite services in L-band seem to be on the rise globally, whether through jamming, spoofing or cyber attacks. This was highlighted as a potential topic for further discussion by the OSAB.

New services

3.20 Newer space operators expressed frustration at regulatory time lines given that a cubesat can now be designed, built and launched in under a year, whereas co-ordination for a communications satellite can take up to 7 years.

Speakers also discussed potential spectrum and regulatory requirements for commercial space launch from the UK as well as some rather exotic commercial projects for on-orbit servicing, debris removal, space mining and communications constellations around the moon. These might require new spectrum allocations depending on how the market develops.

Summary

3.21 The explosion in activity in the space sector is producing interesting regulatory challenges. However, as society develops a dependence on space-delivered services it also raises questions about the sector's resilience to external threats.

[2] Non-Geostationary Orbits are closer to the Earth than Geostationary orbits. The satellite moves relative to the Earth's surface. Depending on their altitude, satellites will complete one orbit between 90mins and 12hrs

3.22 The space sector recognised the need for greater spectrum sharing, provided this did not impact on safety-of-life or public good services. 5G could also be an opportunity for greater spectrum sharing and collaboration between sectors.

Annex 1

Membership of OSAB[3]

Professor Linda Doyle (Chair) [June 2009]

Linda Doyle is Professor of Engineering & The Arts and Vice President and Dean of Research in Trinity College, University of Dublin, Ireland. Prior to taking up her current role, she was the Director of CONNECT. CONNECT is a national research centre focused on future networks and communications. Her expertise is in the fields of wireless communications, cognitive radio, reconfigurable networks, spectrum management and creative arts practices. She has raised over 70 million in research funding in the past decade and has published widely in her field. Prof. Doyle has a reputation as an advocate for change in spectrum management practices and has played a role in spectrum policy at the national and international level. She is a Fellow of Trinity College Dublin. She is on the Board of the Festival of Curiosity -- a STEM outreach activity for children based on a city-centre yearly science festival. She is a judge in the BT Young Scientist, Ireland's premier science competition for school children. She is on the Boards of the Douglas Hyde Gallery and Pallas Studios. Prof. Doyle is a Director of Xcelerit and SRS.

Greg Bensberg MBE [June 2014]

Gregory Bensberg is currently the General Manager of Digital UK Ltd, the UK's main commercial public service DTT multiplex carrying ITV and Channel 4 services to over 98% of UK households. He is a leading authority on both the technical and regulatory aspects of digital broadcasting and has over 30 years' experience as a regulator and digital broadcast engineer.

He has previously worked as a policy and technical expert for Ofcom, the UK government and the Independent Television Commission for over 20 years. He acted as a key technical and regulatory adviser to a number of Government Ministers between 2002 and 2003 whilst they were developing the UK government's switchover policy. He was also responsible for leading Ofcom's spectrum clearance programme (800 MHz and 2.6GHz) which enabled the UK's 4G spectrum auction in 2013.

He developed and led the planning and licensing of the UK's digital switchover programme (including its UHF spectrum strategy) and its adoption of the DVB-T2 standard and the launch of terrestrial HD services in 2009. He also led Ofcom's Digital Dividend Review project in 2005/06, which laid out the process and principles for the eventual European digital dividend programme.

Gregory is a chartered engineer and holds an MBA and BSc. He joined the ITC in 1992 after spells working for Marconi, the IBA, Quantel and Thames Television.

[3] After each member is given the date that their appointments to OSAB started.

He was awarded an MBE in 2014 for services to communications and media.

Wassim Chourbaji [October 2016]

Wassim Chourbaji is Qualcomm's Senior Vice President and Head of Government Affairs for Europe, the Middle East and Africa. He oversees Qualcomm's public policy, regulatory affairs and senior government relations across the region. Mr Chourbaji leads a senior team responsible for technology, intellectual property, digital economy, spectrum, standardization, data and competition policies. He has been appointed member of the UK's Ofcom Spectrum Advisory Board and is also the Chairman of TechUK Communication Infrastructure Council. Mr Chourbaji studied engineering and mathematics.

Mischa Dohler [January 2016]

Mischa Dohler is full Professor in Wireless Communications at King's College London, driving cross-disciplinary research and innovation in technology, sciences and arts. He is the Director of the Centre for Telecommunications Research, co-founder and member of the Board of Directors of the smart city pioneer Worldsensing, Fellow of the IEEE, Editor-in-Chief of the Transactions on Emerging Telecommunications Technologies and the EAI Transactions on the Internet of Things, and a Distinguished Member of Harvard Square Leaders Excellence.

He is a frequent keynote, panel and tutorial speaker, and has received numerous awards. He has pioneered several research fields, contributed to numerous wireless broadband, IoT/M2M and cyber security standards, holds a dozen patents, organized and chaired numerous conferences, has more than 200 publications, and authored several books. He has a citation h-index of 43.

He acts as policy, technology and entrepreneurship adviser, examples being Richard Branson's Carbon War Room, David Willetts' 8 Great Technology Fund, Regulator Ofcom, UK House of Parliament, UK Ministries, EPSRC ICT Strategy Advisory Team, European Commission, Tech London Advocate, ISO Smart City working group, and various start-ups

He is also an entrepreneur, composer & pianist, and fluent in 6 languages. He has talked at TEDx. He had coverage by national and international TV & radio, and his contributions have featured on BBC News and the Wall Street Journal.

David Harrison [ex-officio]

David is Director of Technology Strategy in Ofcom. He is responsible for leading Ofcom's technical research programme and supporting Ofcom policy development across a wide range of areas including: white space and cognitive radio, unlicensed Wi-Fi spectrum, radio switchover, network neutrality and next generation broadband access. David led the UHF Strategy project, which sought to identify the how to best balance the competing demands for UHF spectrum by different services including terrestrial broadcasting and mobile broadband. He has also led work on new approaches to spectrum sharing to increase the future supply of spectrum for mobile broadband and machine to machine applications. More

recently he has been working on the technical criteria needed to provide reliable mobile coverage.

Before joining Ofcom, David worked for the Independent Television Commission where he held the position of Deputy Director of Technology, and before that led the high frequency research and development activities in Thomson Multimedia based in Rennes.

David has published numerous technical papers on RF and high frequency engineering and holds 12 patents. David has a first class honours degree and PhD in Electrical and Electronic engineering. He can be contacted at david.mark.harrison@ofcom.org.uk.

David Meyer (Chairman) [June 2009]

David Meyer served in the British Army's Royal Corps of Signals from 1979-2010, leaving as Brigadier and Deputy CIO. During his career he held positions delivering operational information systems and services; leading units responsible for policy, procurement, operations, signals intelligence and computer network defence; and serving overseas in Croatia, Bosnia, Kosovo, the Democratic Republic of Congo, Iraq and Afghanistan. David joined the Foreign and Commonwealth Office as Chief Information Officer in December 2010. He holds a Master's degree in International Studies and is a Fellow of the British Computer Society and a Chartered IT Professional.

Niall Murphy [June 2014]

Niall is Co-Founder & CEO of EVRYTHNG, a pioneer of the internet of things managing billions of digital identities on the web for consumer products and organizing the world's ecosystem of product lifecycle data. EVRYTHNG was selected by the World Economic Forum in 2018 as a Technology Pioneer, and originated the technology adopted by GS1 and upgrading the global barcode standard to connect every consumer product to the web. A computer scientist by training, Niall is a technologist, serial-entrepreneur and angel investor. With 25 years of experience in innovation and future thinking, Niall has built pioneering businesses in internet infrastructure, the mobile internet and web services in Europe, the US and Africa.

Peter Pitsch [August 20016]

Peter Pitsch currently consults for Intel Corporation. Until May 2018, he was Associate General Counsel at Intel Corporation, specializing in communications policy matters.

Pitsch was the Chief of Staff to the Chairman of the FCC from 1987 to 1989 and Chief of Office of Plans and Policy from 1981 to 1987. From 1980 to 1981, Pitsch was a staff member of the Reagan Administration Transition Team.

Mr. Pitsch received a B.A. in Economics from the University of Chicago in 1973 and his J.D.

from Georgetown University Law Center in 1976.

Gavin Young [May 2009]

Gavin's current role is as Head of the Fixed Access Centre of Excellence within Vodafone. He is responsible within Vodafone Group for the fixed broadband access strategy, architecture and deployment practises across the 17 countries where Vodafone currently has fixed access assets.

Gavin was previously Head of Strategy & Planning in Cable and Wireless Worldwide leading a team of architects responsible for the technology architecture and strategy. He had previously worked at Bulldog Communications (later acquired by C&W Worldwide) where he held a variety of responsibilities from product development through to the network operations and CTO. Prior to that Gavin led the Access Architecture & Design team at BT.

Gavin was a founding director of the Broadband Forum where he was overall Technical Chairman for twelve years. In addition, he has been co-chair of the UK21CN consultation's Broadband Group, chair of the UK NICC's DSL Task Group and also vice-chair of the NICC Ethernet Access Task Group. Gavin also serves on the IET Communications Policy Panel and the Ofcom Spectrum Advisory Board (OSAB).