



commonwealth Spectrum Management

25 – 27 OCTOBER 2017, LONDON, UK

Internet of Things & Basic Broadband Access: Spectrum Implications

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Report of the Commonwealth Spectrum Management Forum 2017

London, November 3-5, 2017

The 2017 Commonwealth Spectrum Management Forum took place in London, November 3-5, 2017. The forum was organised by the Commonwealth Telecommunications Organisation (CTO) and was hosted by Inmarsat at its Head Office, 99 City Road, London, England EC1Y 1AX. Dignitaries at the well-attended Forum included: Hon Anusha Rahman Ahmad Khan, Minister of State for Information Technology, Pakistan; Hon Paul Lewis, Minister of Communications, Works & Labour, Montserrat; Engr. Shola Taylor, Secretary General of the CTO; Philip Marnick, Group Director, Spectrum, Ofcom, UK; Mario Maniewicz, Deputy Director, Radiocommunications Bureau, ITU, who represented Francois Rancy, Director, Radiocommunications Bureau, ITU; and Michele Franci, Chief Technology Officer, Inmarsat.

In his welcome remarks, Philip Marnick, Group Director, Spectrum, Ofcom, UK, welcomed delegates to the UK, and commended the CTO for convening a forum to discuss the key issues of spectrum management. On his part, Mario Maniewicz, Deputy Director, Radiocommunications Bureau, ITU, stressed that spectrum is key to the development of the digital economy. He outlined the role of the ITU and urged all countries to increase their participation in ITU-R Study Groups. He praised the CTO for organizing the Forum, as events like this contribute to consensus building.

Michele Franci, Chief Technology Officer, Inmarsat, welcomed delegates and stated that Inmarsat was proud to host a CTO event, and noted that all the topics of the Forum are key to economic growth. He said that the work of Inmarsat is principally to bridge communication gaps, often in life-saving situations.

Shola Taylor, Secretary General of the CTO, welcomed delegates, especially the Ministers from Pakistan and Montserrat. He said that we live in exciting times of IoT and Artificial Intelligence (AI). He highlighted the challenges faced by regulators and added that CTO forums like this one are meant to address challenges faced by various stakeholders in the ICT sector. He praised the global coordination work of the ITU and of particular interest for this Forum, the work of the ITU-R Study Groups. He reminded delegates of the mandate given to the CTO by Commonwealth ICT Ministers to coordinate Commonwealth positions in global forums. He thanked Inmarsat and the Sponsors; Inmarsat, GSMA, Huawei, ESOA, and the support of partners like the Ofcom and the BBC, for enabling the Forum to take place.

SESSION ONE: LEADERS SESSION: CHALLENGES OF NATIONAL SPECTRUM PLANNING: FROM 2G TO 5G

Chair: Shola Taylor, Secretary-General, Commonwealth Telecommunications Organisation

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The high-level panel comprised of:

- Hon Anusha Rahman Ahmad Khan, Minister of State for Information Technology, Pakistan
- Hon Paul Lewis, Minister of Communications, Works & Labour, Montserrat
- Fabio Leite, Vice President, Global Spectrum Regulatory Policy, Inmarsat
- Chris Woolford, Director of International Spectrum Policy, Ofcom, UK
- Austin Nwaulune, Director, Spectrum Administration, Nigerian Communications Commission, Nigeria

Chris Woolford, Director of International Spectrum Policy, Ofcom, UK, set the scene by identifying the main challenges to spectrum planning as:

- Spectrum clearance
- Spectrum sharing and co-existence issues
- International harmonisation
- Receiver parameters

He highlighted the following:

- 5G may be an opportunity to do some things differently,
- On spectrum sharing, there is need for change of mindset that avoids confrontation and develops a cooperative approach.
- Higher frequency bands offer new opportunities.
- Current international frameworks are slow and bureaucratic

He called for:

- Greater flexibility and more responsive national and international frameworks
- A move away from large co-ordinated clearance programmes to making spectrum available when and where needed
- Speeding up global identification work to better keep pace with industry developments.

Hon Anusha Rahman Ahmad Khan, Minister of State for Information Technology, Pakistan, outlines remarkable progress that Pakistan has achieved in ICT, especially in the development of appropriate light regulation and in utilization of Universal Service Funds (USF). She stressed that spectrum is a scarce resource and therefore should not sit idly.

Hon Paul Lewis, Minister of Communications, Works & Labour, Montserrat, outlined the role of ICT in the economy of Monserrat, despite the challenge of a small population.

Austin Nwaulune, Director, Spectrum Administration, Nigerian Communications Commission, Nigeria, described the main challenge as technology convergence while regulation is not converged.



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Fabio Leite, Vice President, Global Spectrum Regulatory Policy, Inmarsat, talked of the challenge for satellite operators where spacecrafts are designed for long term use, yet the tech revolution is evolving faster and faster. He said that in view of this, investments in satellite systems need regulatory certainty.

Recommendation 1

The session ended with a recommendation calling on CTO to prepare a paper of spectrum sharing best practices.

SESSION TWO: SPECTRUM REQUIREMENTS FOR EFFECTIVE DEPLOYMENT OF IOT

Chair: Hon Paul Lewis, Minister of Communications, Works & Labour, Montserrat

Keynote Address: ITU-R studies in support of the Internet of Things, by Mario Maniewicz, Deputy Director, Radiocommunications Bureau, ITU

Mario Maniewicz explained that the Internet of Things (IoT) is the infrastructure of the information society that enables a wide range of devices to be sensed or controlled remotely and to exchange data via the Internet infrastructure. Typical characteristics of IoT are: Low energy consumption, Low cost per device, High number of connected devices, Ultra-low latency and high reliability, and Low data rate/Small message size. Example of Applications include: Home automation, automotive, healthcare, industrial, environment, agriculture, smart cities, and monitoring. He stressed that:

- The ITU-R Study Groups are developing technical and operational standards to facilitate the deployment of IoT on a global basis, including harmonized frequency spectrum and appropriate regulatory regimes.
- A variety of radio technologies will be used to implement the Internet of things in both “unlicensed bands” and licensed bands.
- Associated aspects will also be addressed at the forthcoming WRC-19 agenda items 1.11, 1.12, 1.13, 1.16 and 9.1 (issues 9.1.5 & 9.1.8)

Fabio Leite, Vice President, Global Spectrum Regulatory Policy, Inmarsat, emphasized that satellites have a small but critical role in IoT deployment, especially in the L-band. He referred delegates to Inmarsat’s recent paper on “The Future of IoT in Enterprise - 2017”, that is based on the views of 500 enterprise IoT decision-makers. He gave an example of how satellites can be used to upgrade software in cars wherever they may be in the planet.

Pasquale Cataldi, Senior Researcher, Nominet UK, stated that despite the apparent scarcity of spectrum, observations of actual usage suggest it is far from full, and noted that dynamic spectrum access can increase spectrum use efficiency through sharing while protecting incumbents.



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SESSION THREE: PROVIDING BASIC ACCESS TO ICT: CHALLENGES OF SPECTRUM PLANNING

Chair: Hon Anusha Rahman Ahmad Khan, Minister of State for Information Technology, Pakistan

Keynote: Universal Access Challenges and Implications for Spectrum Planning, by Kojo Boakye, Africa Public Policy Manager (Connectivity & Access), Facebook

Kojo Boakye said that through the High Altitude Platform System (HAPS) project, Facebook intends to address the challenge of billions of unconnected people on earth, most of whom live in the developing world. He identified connectivity barriers as 3As; Awareness, Affordability and Accessibility

Key attributes of Facebook's Aquila solar aircraft:

- Airframe is lightweight, but strong
- Entirely powered by the sun via solar cells covering the top of the aircraft
- Electric motors and lithium ion batteries ensure continuous operation day and night
- Communication payload located in the front "belly" section of the aircraft

Spectrum for use by HAPS was accepted as Agenda Item 1.14 at WRC-19 and is the subject of ongoing ITU-R studies

Martin Jarrold, Chief, International Programme Development, GVF and Bashir Patel, Regional Advisor/Expert, Inmarsat, concurred with the keynote presenter that Satellite technology works in synergy with other technologies.

Recommendation 2

The Forum recommended that the CTO should prepare a paper that:

- Gives examples of countries that have the most widespread ICT infrastructure, and
- Recommends best practices on how this can be duplicated in other countries.

SESSION FOUR: BEYOND DIGITAL SWITCHOVER: THE FUTURE OF BROADCASTING AND SPECTRUM IMPLICATIONS

Chair: Phelisa Nkomo, Board Chairperson, Media Development and Diversity Agency (MDDA), South Africa

Phelisa Nkomo kicked off the session with a background paper on "Beyond Digital Switchover: The Future of Broadcasting and Spectrum Implications". She talked of the 4th Industrial revolution and gave examples of people following unfolding stories from Twitter or Facebook before traditional news outlets can cover the story. She quoted examples of changes brought about by the onset of social media like the #FeesMustFall student protests that erupted on South African University campuses in 2016.



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She described the role of the Media Development & Diversity Agency (MDDA); a public-private partnership set up by an Act of Parliament in 2002 with the mandate to encourage ownership of, and access to, media by historically disadvantaged and historically diminished indigenous language and cultural groups.

She talked of the digital migration challenge for the MDDA's broadcasting stakeholders where digital terrestrial television (DTT) requires members to have equipment and capacity to compete in a digital environment.

Catherine Westcott, Communications Regulation Specialist, BBC World Service, UK, delivered a keynote speech on "Beyond the Digital Switchover: The British Experience". She described the UK digital switchover as a phased and planned switchover between 2008 and 2012 which resulted in an increase of TV channels from 5 to over 70. The transition was run by an entity called Digital UK that is jointly owned by BBC, ITV, Channel 4 and Arqiva. SHE TALKED OF THE BBC pioneering the concept of on-demand viewing with "iPlayer" in 2014, well before Netflix. She ended with a note that as the BBC seeks to create outstanding content, it will need to "ride two horses" simultaneously, investing in digital, mobile and personalized services to keep pace with technology change and audience expectations."

Jon Steel, Director, Communications and Public Affairs, Digital UK, said that although Digital UK was responsible for digital switch over, the main funding came from the BBC. The UK had a strong content development sector, strong broadcasters, and 60% of population already had digital TV sets. Switchover happened in 2012. The country went from 5 to 40 channels.

Palesa Kadi, Counsellor, ICASA, South Africa, talked about the state of public broadcasting in South Africa, emerging patterns of content development, and the offering of broadband and spectrum. She touched on the issue of high data costs and the public outcry for a review of data prices, which ICASA is considering. She described the digital transition process in the country and was hopeful for successful completion.

Laurent Boduseau, Senior Spectrum Director, GSMA, said that Digital switchover has been beneficial for the mobile industry. He said that a lot of work is going on at CEPT level observing how users are using 4G and 5G to view content. He stated that the mobile industry still needs plenty of spectrum, but it may need to settle for the 'salami approach' where they take a small slice of the spectrum at time.

However, the broadcasters were adamant that they don't want to see further salami slicing of the spectrum.



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DAY TWO OCTOBER 26, 2017

SESSION FIVE: SPECTRUM MANAGEMENT IN PRACTICE - EXPERIENCE AROUND THE GLOBE

Chair: Fabio Leite, Vice President, Global Spectrum Regulatory Policy, Inmarsat

Raj Sivalingam, Executive Director for Telecommunications, TechUK, presentation showed that a World Class Economy with emerging digital applications of Artificial Intelligence, Virtual Reality, Cloud Computing, Internet of Things (IoT), Voice Recognition (VR) will need great connectivity, such as:

- Seamless connectivity including WiFi in public places
- Harnessing diversity in technologies including high throughput satellites

He identified imperatives for great connectivity as:

- For Government and regulators: policies must prioritize cost of implementing the infrastructure
- For industry: greater willingness to collaborate across industrial ecosystems (e.g. between rail or automotive sectors and the digital industries)

Norizan Baharin, Chief Officer, Spectrum & Numbering Management, MCMC, Malaysia, stated the objectives of the Malaysian Communications and Multimedia Commission (MCMC) as:

- Efficient use of spectrum
- Provision of spectrum for public, private and communities
- Benefit to consumers for services derived from use of spectrum
- Encourage use of available wireless technologies for provision of wide range of wireless services
- Harmonize usage of spectrum across borders, regionally and internationally

She recounted the Spectrum Reallocation in 900Mhz and 1800Mhz Bands, to 4 major cellular operators for more equitable access. To deal with the migration challenges, MCMC relaxed mandatory standards for Quality of Service (QoS) on Public Cellular until end of 2017 to allow operators to resolve operational and network performance issues.

She summarized the challenges of Digital Terrestrial Television and Digital Switchover as:

- Staggered DTT implementation because analogue TV channels and wireless microphone are still operational until ASO
- Restacking to DTT spectrum block (470MHz to 694MHz) within 6 months
- To achieve similar/better coverage of current analogue TV (98%) for DTT network
- Public education and awareness
- Short simulcast of analogue TV and DTT until ASO date

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- Distribution of Set-Top Boxes to identified households with lower income
- Frequency harmonisation in border areas – requires agreement with neighbouring countries (Brunei Darussalam, Indonesia, Singapore and Thailand; different ASO dates)

She elaborated on the overall Universal Service Provision (USP); its objective, service targets and evolution. She also touched on the spectrum implications of providing basic broadband access to USP areas and described the Multi-Operator Radio Access Network (MORAN), that uses a combination of Microwave Link and VSAT for backhaul.

Austin Nwaulune, Director, Spectrum Administration, NCC, Nigeria, talked about Spectrum management in Africa and Nigeria in particular, and stressed the point that auctions are the preferred method of awarding licenses, because of the perceived transparency of auctions processes.

Kirk Sookram, Executive Officer - Technology & Engineering, Telecommunications Authority of Trinidad and Tobago, talked about Spectrum management in the Caribbean and touched on Telecommunications Authority of Trinidad and Tobago's experience as a converged regulator.

Peng Zhao, Spectrum Policy Director, GSMA, appealed to regulators to publish frequency plans to give operators clarity that is needed to commit investments.

SESSION SIX: SPECTRUM PRICING

Chair: Oliver Holland, Research Fellow, King's College London, UK

Stephen Talbot, Head of International Spectrum Policy – SITE (Strategy, International, Technology and Economics) Group, Ofcom, UK, talked about types of spectrum fees: free, cost-based pricing, and Administered Incentive Pricing (AIP) -where spectrum is scarce. He described how, where and when the three types have been used in the UK but stressed that policies which inflate spectrum prices end up harming consumers.

Oliver Chapman, Spectrum Policy Senior Manager, GSMA, said that the goal of spectrum pricing is to promote, and not undermine, the optimal use of spectrum for the benefit of society. He highlighted how high auction prices have led to poor consumer outcomes and how high reserve prices have led to auction failures. He outlines 4 policy recommendations for effective pricing:

1. Set modest reserve prices and annual fees, and rely on the market to set prices
2. License spectrum as soon as it is needed, and avoid artificial spectrum scarcity
3. Avoid measures which increase risks for operators.
4. Publish long-term spectrum award plans that prioritise welfare benefits over state revenues.



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Martin Simião Langa, Head of Frequency Management Department, Communications Regulatory Authority (INCM), Mozambique, talked about the Mozambican experience and that spectrum and other license fees are used for covering the spectrum management duties; market regulation and to cover the unserved areas.

Graham Butler, Chairman, Bitek Group, outlined the need for new Universal Service Fund (USF) plans that are based on data.

While acknowledging that spectrum prices should not be so high as to burden consumers, Hon Anusha Rahman Ahmad Khan, the Pakistan Minister of State for Information Technology, said that it is going to be an uphill task to convince governments in the developing world to give 5G spectrum for less than they got for 4G. She called on the CTO to prepare a paper on the matter and to begin sensitizing member states.

Recommendation 3:

CTO should prepare a paper explaining that policies that hike spectrum prices do risk harming consumers.

SESSION SEVEN: SPECTRUM AUCTION, TRADING, LEASING, AND RENEWAL

Chair: David Harmon, Vice President, Global Public Affairs, Huawei

Shola Taylor, Secretary-General, Commonwealth Telecommunications Organisation (CTO), explained that spectrum must be well managed to ensure effective use. He elaborated why spectrum auctions are popular. He reported that prices paid at auctions do not always equate to actual value. He attributed this to factors like: Efficiency of auction, market forces and uniqueness of the opportunity. He also stated that auction designs range from simple to complex, and that auctions are inappropriate for public-domain spectrum such as for defense and emergency services. He concluded by stressing the importance of multi-stakeholder engagement in the auction process as it inculcates trust among all players involved.

Chris Woolford, Director of International Spectrum Policy, Ofcom, UK, talked about the role of the Radio Spectrum Policy Group (RSPG) in developing mechanisms to better share best practice and build knowledge and understanding on the topic of spectrum awards between Member States. RSPG has reported that while, no one size fits all, there are some common principles and objectives that should be followed when designing awards. He listed the common principles as:

- Transparency
- Award is understood by potential bidders
- Encourage participation
- Minimise uncertainty
- Minimise risk of inefficient outcomes



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- Incentivise bidders to bid in a manner expected of normal competition
- Clarity in respect of any policy objectives

Common objectives:

- Efficient use of spectrum
- Efficient assignment of spectrum. i.e. Spectrum is assigned to the bidders that value it most
- Ensuring and/or safeguarding competition by say promoting new entrants or ensuring minimum number of competitors
- Increasing broadband penetration and roll-out and/or enhancing coverage in rural areas
- Promoting innovation
- Promoting business opportunities and employment (economic development)

On 5G, he stated that Ofcom's objective is to ensure that spectrum is not an inhibitor to early 5G roll out.

Austin Nwaulune, Director, Spectrum Administration, NCC, Nigeria, talked about the Nigerian experience with auctions.

Peng Zhao, Spectrum Policy Director, GSMA, gave several examples of telcos bidding high in auctions and failing to raise operational funds.

SESSION EIGHT: EFFICIENT SPECTRUM UTILISATION

Chair: Eng. Hilário Tamele, Director, Radiocommunication and Technology, INCM, Mozambique

Abimbola Alale, MD/CEO, NigComSat, Nigeria, stated that satellite technology is crucial for delivery of broadband services because broadband is more than just high speed. It is about: flexibility, scalability, application support, cost efficiencies, productivity. She observed that while, Satellite broadband requires high initial investment, it has the advantage of easy reach to rural areas and challenging terrains. She listed advantages of broadband via satellite as: Easy and fast deployment, Wider coverage, no geographic/political boundaries, Cover all terrain, Simple network topology, Uniform quality/distance independent, and Multicast advantage. She concluded by stating that Satellite broadband is bridging gaps everywhere, and it is therefore necessary to preserve spectrum for traditional, new and future satellite applications.

Kumar Singarajah, Director, Regulatory Affairs and Business Development, Avanti Communications Group, elaborated how a combination of satellite and terrestrial wireless offers a win-win approach to efficient spectrum utilization, while Martin Jarrod urged that efficiency should be measured in terms of meeting user needs.

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Kirk Sookram, Executive Officer - Technology & Engineering, Telecommunications Authority of Trinidad and Tobago, talked about how satellite technology assisted Caribbean countries in quick restoration of communications services after the recent devastating hurricanes.

Victor Findlay, Ag. Director General, NatCom, Sierra Leone, also talked about the crucial roles satellites played after the mud-slides in Free-town, Sierra Leone.

DAY THREE OCTOBER 27, 2017

SESSION NINE: PLANNING FOR WRC-19: PROGRESS AND REGIONAL PREPARATIONS

Chair: Edmund Katiti, Commonwealth WRC Coordinator

Mario Maniewicz, Deputy Director, Radiocommunications Bureau ITU, explained that the World Radiocommunications Conference (WRC) is the sovereign body that agrees the treat. Agreement is reached by consensus. He went on to explain the following:

- WRC Cycle
- ITU-R Study Groups - Calendar
- Regional Groups - preparation for WRC-19
- Inter-Regional Workshops for WRC-19
- CPM-19
- Conference Proposals Interface for WRC-19
- WRC-23 preliminary Agenda Items

The work of Study Groups for forever on-going, and in recent years, most proposals come from Coordinated Common Proposals Groups rather than from the Regions.

On overlapping frequency bands, he stressed that studies are being conducted to address mutual compatibility & sharing feasibility among the services/applications for which allocation/identification is envisaged. He listed preliminary Agenda Items for WRC-23 as:

- Res. 361 (WRC-15) – Spectrum for GMDSS modernization & implementation of e-navigation
- Res. 656 (WRC-15) – Possible new allocations for EESS (active) for spaceborne radar sounders @ 45 MHz
- Res. 657 (WRC-15) – Spectrum needs & designation of radio services for space weather sensors
- Res. 161 (WRC-15) – Possible new allocations for FSS @ 37.5-39.5 GHz
- Res. 235 (WRC-15) – Spectrum use and needs of existing services @ 470-960 MHz in Region 1 and possible regulatory actions @ 470-694 MHz in Region 1

Luciana Camargos, representing CITEL, went through Inter- American proposal definitions covering different stages of:

- Preliminary Views (PV)

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- Preliminary Proposal (PP)
- Draft Inter-American Proposal (DIAP)
- Inter-American Proposal (IAP)

She reported that so far CITELE has the following as Draft Inter-American Proposals:

- Agenda Item 1.11: Railway Train and Tracksides – NOC
- Agenda Item 1.12: ITS Harmonization – NOC
- Issue 9.1.3: technical and operational issues and regulatory provisions for new NGSO systems in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz bands allocated to FSS - NOC

And the following Inter-American Proposal:

- Issue 9.1.8: Narrowband and broadband machine-type communication infrastructures – NOC

Stephen Talbot, Head of International Spectrum Policy - SITE (Strategy, International, Technology and Economics) Group, for CEPT, opened with a disclaimer, clarifying that he was presenting his personal view of the status of CEPT preparations for WRC-19. He listed CEPT proposed items as:

- Agenda Item 1.7 (Regulatory/Spectrum needs for nano- and pico- satellites)
- Agenda Item 1.13 (IMT including “5G” in bands above 24 GHz)
- Agenda Item 1.5 (Regulatory requirements for ESIM)
- Agenda Item 1.14 (Regulatory requirements, including spectrum for HAPS)
- Agenda Item 7

Shola Taylor, Secretary-General, Commonwealth Telecommunications Organisation (CTO), reminded delegates of the Commonwealth ICT Ministers Meeting 2014 that mandated the CTO to coordinate Commonwealth positions at international ICT fora like ITU Meetings, ICANN, IGF and other relevant international ICT fora.

He recalled that the CTO convened the first Commonwealth Preparatory Meeting for WRC-15. The meeting was held in London on 7-9 October 2015 to discuss:

- Radio Assembly elections candidatures
- Additional Spectrum for IMT
- Use of FSS for Unmanned Aircraft
- Global Flight Tracking
- Global Harmonisation on Earth Stations on Mobile Platforms (ESOMPs)
- Future studies on spectrum for IMT above 6 GHz

The preparatory provided an opportunity for Commonwealth countries to develop consensus on the above Agenda items. The meeting with the election of an overall coordinator for WRC and Coordinators for key Agenda items. Coordinators were tasked with following up assigned Agenda



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items during WRC-15, and keeping Commonwealth delegates updated through weekly meetings of the Commonwealth group during WRC-15.

A summary Report of the preparatory meeting covering Agenda Items for WRC-15 and proposed Action by Commonwealth Countries was shared with all Commonwealth Member States for their use at WRC-15. It was noted that the document proved to be very useful especially to delegates attending WRC for the first time. Final positions adopted by WRC-15 were the same as those recommended by the Commonwealth preparatory meeting.

The first Conference Preparatory Meeting (CPM-1) for WRC-19 was held from 30 November – 1 December 2015. The 2nd Session which prepares a consolidated report that will be used in support of the work of the WRC-19 will take place from 18-28 February 2019.

Why is Commonwealth Coordination important:

- Strategic importance of Commonwealth of Nations – size, diversity, development status
- Sensitization of issues
- Ensures ‘voice’ to countries who are unable to participate

Commonwealth position for agenda items for WRC-19 will be identified, bearing in mind regional positions. A Commonwealth Coordination meeting to be convened in 2019 in preparation for WRC-19.

SESSION TEN: 5G ISSUES AND SPECTRUM REQUIREMENTS

Chair: Mike Goddard, International Spectrum Policy Advisor, Real Wireless, UK

Cesar Gutierrez, Head, Wireless Regulatory Policy (MEA), Huawei, laid out Huawei’s view on spectrum requirements for 5G.

- 3300-4200 MHz range is key for 5G. In this range he recommended:
 - TDD frequency arrangement
 - Inter-operator synchronization and alignment of UL/DL transmissions
 - Contiguous 100 MHz per operator
- 26 GHz and 40 GHz are the most promising mmWave bands
- Bands below 1 GHz for extensive coverage reaching 100km or more. 700 MHz is the prime candidate

Aarti Holla Maini, Secretary General, EMEA Satellite Operators Association (ESOA), talked about the role of Satellites in 5G deployment in terms of coverage, capacity and cost. In all these areas satellites offer cost-effective solutions that are complementary to terrestrial systems. She showed that to provide Unlimited, Ubiquitous, Resilient, and Affordable communications, spectrum is not the problem; It’s Money. To enabling a Win-Win for Society as a Whole:

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- Regulators should license spectrum that is already available for 5G/IMT
- Cooperation between industry players is key and must be fostered
- Change in mind-set is required to see different technologies as complementary
- 360° view is required on how to achieve 5G

Olayinka Oduwole, Research Fellow, 5G Innovation Centre, University of Surrey, UK, stressed the need for collaboration amongst different service providers in the deployment 5G which will be used to increase capacity of 4G networks in densely populated areas like Malls.

Ross Bateson, Special Advisor, GSMA, made the point that big markets are looking at 28GHz band for 5G.

Martin Jarrold, Chief, International Programme Development, GVF, said that spectrum is a valuable and finite resource and urged exploration of synergies of collaboration in use of existing bands. He stressed that satellite is integral to 5G.

Lasse Wieweg, Director, Government and industry relations, Ericsson, said that 5G is the technology that will be global and will be spectrum hungry. While 26GHz will be good for outdoors, C band will be needed to penetrate indoors.

Chris Woolford, Director of International Spectrum Policy, Ofcom, UK, said that c-Band spectrum sharing can be possible with protection of incumbents.

Luciana Camargos, representing CITEL, said that in the CITEL region there is need for the smaller economies to come forward to discuss the spectrum for 5G, otherwise, 5G spectrum will be determined just by the US and Canada.

Bashir Patel, Regional Advisor/Expert, Inmarsat, stressed the point that satellite operators have made substantial investments, especially in spacecrafts, and therefore need long term clarity on spectrum plans to continue making the necessary investments. He reminded participants that during WRC-15 the developing world was opposed to sharing of C-Band as they rely on it for critical applications.

SESSION ELEVEN: CLOSING CEREMONY

The closing ceremony started with highlights from Forum Report, which were presented by the Rapporteur, Edmund Katiti, Commonwealth WRC Coordinator.

In closing remarks on behalf on the Forum Host, Inmarsat, Bashir Patel, Regional Advisor/Expert, Inmarsat, conveyed Inmarsat's pleasure at the success of the events as witnessed in the lively

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discussions. He thanked CTO for choosing a very apt theme of Internet of Things. He pointed out how in the case of Inmarsat IoT started by way of remote sensing in 1985, and is now being brought into the home.

In his closing address, Shola Taylor, Secretary-General, Commonwealth Telecommunications Organisation (CTO), thanked the ITU for full collaboration with the CTO. He noted that the 3-day Forum was very lively and interactive, thanks to the expertise and interest of the speakers, panelists and the delegates. He went on to thank the following sponsors and partners for making the event possible; Inmarsat, Huawei, GSMA, ESOA, Ofcom, and the BBC.

He then asked the delegates to participate in planning for next year's Forum by proposing a theme and/or sessions titles. The following were proposed:

- Dynamic Spectrum Access
- Spectrum for Emergency Services
- Incorporating Satellites into 5G
- Digging deep into 5G
- Contribution of Spectrum in the Digital Economy
- Cognitive Radio Spectrum
- Looking into Study Group Results to develop Early Consensus
- Developing Consensus towards WRC-19

Finally, he thanked the staff of CTO and Inmarsat for all the background work that allowed the Forum to run smoothly, before declaring the Forum closed.