GTPRN

Global Telecoms Policy Research Network

GTPRN March 2021 Newsletter

Welcome to the GTPRN March 2021 Newsletter

In March 2021 newsletter, news and vacancies are shared. GTPRN team grateful for the time been invested in writing and reading for the authors and readers who are supporting the volunteering effort made by the team during the last months.

This issue has an exclusive article from one of the main international experts in the field, Prof. Michael J. Marcus, who has conducted an article on the policy and technical challenges in allocations above 100 GHz and its impact on the potential of other radio services. In the light of the importance of these THz for 6G, the article reveals new regulatory and technical aspects. It suggested that cooperative efforts are needed from all concerned parties to participate in ITU international deliberation. check the article at the end of this newsletter. Prof. Marcus is considered as one of the idols for modern spectrum management where all of us should be grateful for his seminal contribution when it comes to Wi-Fi regulations.

Mr. George Salama, Twitter Head of Public Policy, Government & Philanthropy Middle East, North Africa, Pakistan & Afghanistan, has kindly shared his personal views regarding internet governance in pandemic times, which highlights the importance of open internet and freedom of expression as a key principle. The need to distinguish and defines the differences between free speech and hateful conduct. Throughout COVID-19, some regulators and policymakers sought the importance to develop media and regulation laws to overcome the raised concerns. To keep the internet open to surpass the effects of the pandemic, more efforts and developments from all stakeholders are needed. Check his article at the end of this newsletter.

Regarding telecom and policy news, please check the following list:

- How well is 5G shaping up?
- ITU News Magazine - World Radio Day 2021
- ZTE launches i5GC to support private 5G networks for vertical industries
- Integrated Telecom begins second phase of its 5G coverage in Saudi Arabia with 1000 additional sites.
- The FCC considers auctioning 2.5 GHz and 3.45 GHz bands later in 2021
- EU Commission proposes new Regulation to ensure EU travelers continue to benefit from free-roaming

Last but not least, an excellent opportunity in Syracuse University's School of Information Studies for scholars to fill an open-rank tenure-track faculty position to start in Fall 2021. More information can be found here.

Finally, please share with us and with the GTPRN community your articles, views, news, announcements. If you have a specific topic that you want to share an update or opinion on in one to three pages, please do not hesitate to share it with us via news@gtprn.org

Kindly also help us by spreading the word about the GTPRN community and forward this newsletter to your colleagues or students. You are more than welcome to join our Facebook or LinkedIn Groups, or to subscribe directly to our website www.gtprn.org where you have the chance to comment on each article or post.

Take care and stay safe.

Rolla Hassan Hamza

GTPRN Team - news@gtprn.org

Technical and Spectrum Policy Challenges for Use of Spectrum above 100 GHz

Michael J. Marcus, Sc.D., F-IEEE

Adjunct Professor of Electrical and Computer Engineering
Northeastern University, Boston USA
(FCC, Retired)

100 GHz marks the upper end of almost all commercial use of the spectrum today, but advancing technology and new demands for spectrum-related services results in growing interest in spectrum above this frequency. ITU allocations presently end at 275 GHz although there are parts of the Radio Regulations that explicitly deal with frequencies as high as 450 GHz[1]. ITU appears to claim jurisdiction as high a 3,000 GHz or 3 THz. (Authors differ on where radio spectrum end and infrared begins with the transition usually being given as between 1 and 3 THz.)

As technology passes the 100 GHz, we are discovering new technical issues as well as unusual regulatory issues. On the technical side it is well known that wavelength scales inversely with frequency. So at 100 GHz the wavelength is 3 mm, halving to 1.5 mm at 200 GHz, etc. This means that modest size antennas can have dimensions that are many wavelengths so their beams can have well focused mean beams. Another characteristic of this upper frequencies is that atmospheric absorption[2], which is increases exponentially with distance, can have a major impact on propagation so that after some distance it totally dominates the normal free space propagation, which only grows as the inverse square of distance. This atmospheric absorption varies with frequency, humidity and altitude, generally increasing in frequency and decreasing with altitude although at certain frequencies with strong molecular resonances, like the water resonance at 183 GHz, absorption can increase dramatically in the region near the resonances. This absorption is shown in Figure 1.

[1] ITU Radio Regulation 5.564A (RR5.564A)
[2] Recommendation ITU-R P.676-12, Attenuation by atmospheric gases and related effects, (08/2019) https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.676-12-201908-I!!PDF-E.pdf

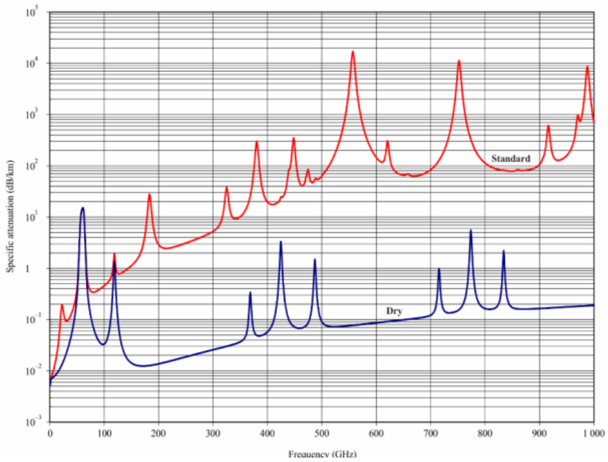

Figure 1. Specific attenuation due to atmospheric gases, calculated at 1 GHz intervals, including line centres (From Recommendation ITU-R P.676-12)

Figure 1 shows the sea level absorption. For satellite uplinks the signals passes through altitudes with decreasing pressures and thus decreasing concentration of gases. At higher altitudes the concentration of gases is so low that propagation nears free space losses again past that point. Thus, computing losses for such satellite paths is a complex integration of losses along the signal path although software[3] is readily available to handle this calculation.

The initial allocations above 100 GHz were made at WARC-79 and most of the present allocations, include a large number of passive allocations were made at WRC-2000. Most of the passive allocations are included in Radio Regulation 5.340 (RR5.340), a framework initially developed decades earlier for passive allocations in much lower bands with very different propagation characteristics, that begins with the phrase: “All emissions are prohibited in the following bands” and which then enumerates 21 bands between 1400 MHz and 252 GHz. Table 1 below shows how these bands are distributed across the spectrum:

[3] https://www.itu.int/md/R15-WP3M-C-0337/en; https://www.mathworks.com/help/phased/ug/modeling-the-propagation-of-rf-signals.html

Band	Frequency (GHz)	Number of Passive Blocks	Fraction of Band Passive
UHF	0.3-3	2	1%
SHF	3-30	3	2%
EHF	30-300	15	15%

Table 1: Distribution of RR5.340 passive bands

In UHF and SHF passive bands are a minor matter using 2-3% of available spectrum and not dividing up other spectrum much, but in EHF is involved 15% of spectrum and divided the spectrum into 15 different blocks.

Figure 2 below shows this along with other characteristics of spectrum in the 95-275 GHz range:

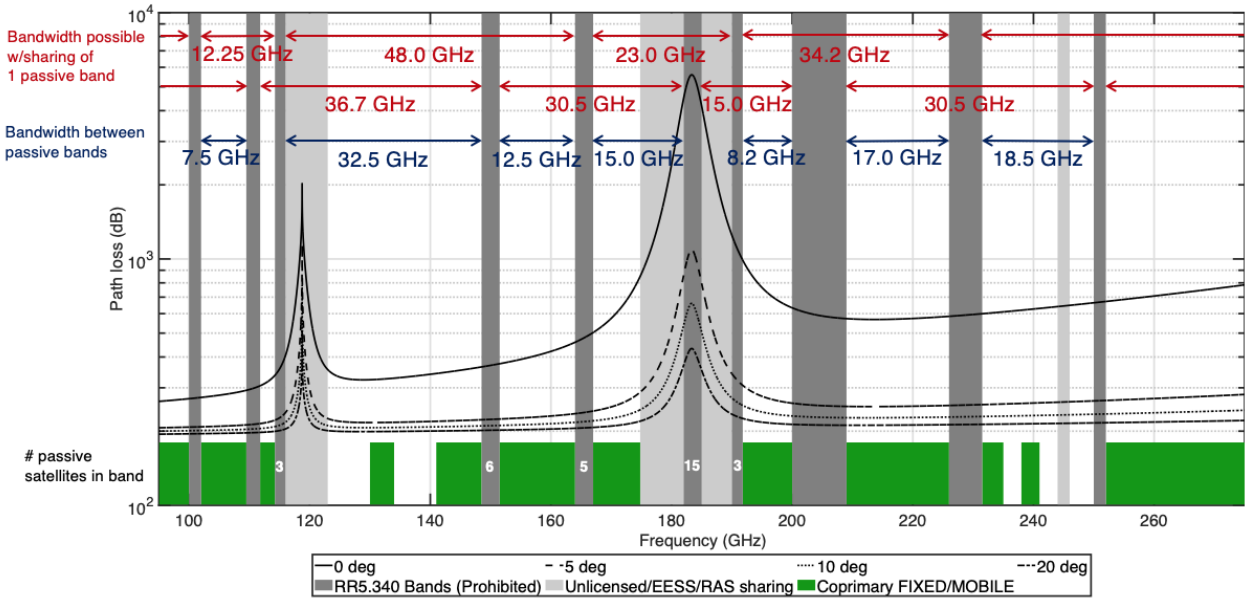

Figure 2: 95-275 GHz spectrum characteristics (J. Jornet & X. Cantos Roman, Northeastern University)

It can be seen that the largest contiguous block available between 5.340 bands is 32.5 GHz. While this is a huge bandwidth, with today's ever-expanding communications bandwidth it is conceivable that larger contiguous bandwidths might be needed and as its discussed below noncommunications equipment using larger bandwidth are being markets and used in likely violation of RR5.340.

Why would one want to use this exotic, perhaps even quirky, part of the spectrum? The main reason is the potential of very large bandwidths to support large information transfer rates for specialized applications where fiber optics is not a viable alternative. Fiber optics has modest costs for the fiber and the necessary electronics but can have large installation costs and long installation delays that depend critically on the location terrain and whether existing duct space is available long the desired path. Fiber installation may require local government approvals. Such costs and delays may make fiber unattractive for short term events in remote places that only have a temporary need for broadband connectivity. It also means that in case of failure of fiber due to disasters such as hurricanes and earthquakes that the fiber can not be replaced quickly so that radio-based broadband links could be very useful for near term network restoration in such disasters.

A recent article on 6G requirements[4] stated a need for 1 Tbps for "extreme capacity xhaul". With such data rates and their possible growth with time, 32.5 GHz does not look like such a large bandwidth to meet such large volumes economically at these frequencies. However, ITU has not yet formally established in Study Group 5 deliberations the numerical requirements for 6G xhaul.

Finally there are short range applications called terahertz spectroscopy of ultrawideband-like transmissions of signals occupying bandwidths such that shown in Figure 3 below:

---

[4] D. Belot, *et al.*, "Spectrum Above 90 GHz for Wireless Connectivity: Opportunities and Challenges for 6G", *Microwave Journal,* September 2020
https://www.microwavejournal.com/articles/34546-spectrum-above-90-ghz-for-wireless-connectivity-opportunities-and-challenges-for-6g

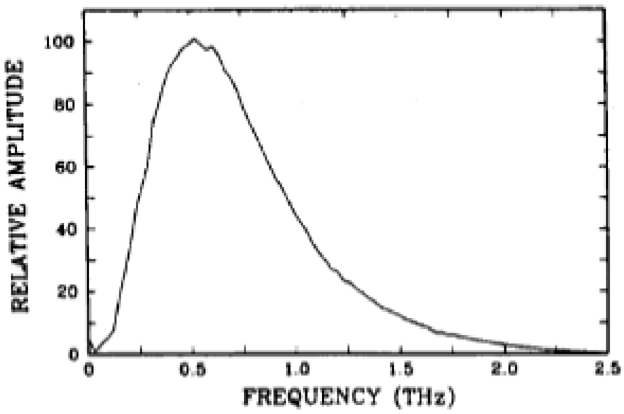

Figure 3: Bandwidth of a type of terahertz spectroscopy system[5]

Terahertz spectroscopy is used to characterize surfaces and materials a few cm away, usually, but not always, in indoor applications. One commercial use is for real time quality control of rapidly moving sheet products such as plywood or wallboard for quality control and process control purposes.[6] Several companies around the world are selling these products although it would appear that their use violates RR5.340.[7]

RR5.340 presently and clearly forbids "all emissions" in the 11 bands above 100 GHz and many in the passive community treat that prohibition as a sacred trust that is not only inviolable but that makes discussions of possible harmful interference-free sharing near blasphemous.[8] But while that total prohibition makes technical sense in the lower bands where RR5.340 was initially formulated, does it really make sense in its present form above 100 GHz? Most of the present passive allocations above 100 GHz were adopted at WRC-2000 at the request of inputs to the conference from both the US and CEPT.[9] Both the US and CEPT included in their request to the conference drafts of a possible

[5] Daniel Mittleman, *Sensing with Terahertz Radiation*, 2003
[6] https://terahertztechnology.blogspot.com/2012/07/automation-and-control-technology-inc.html
[7]https://www.google.com/search?q=terahertz+spectroscopy+manufacturers&oq="terahertz+spectrospy"+manufactur
[8] T. Youell, "US THz advocates to take fight to new ITU-R venue", *PolicyTracker*, Jan 22, 2021
[9] USA Proposals for the Work of the Conference, WRC-2000, Doc. 12-E
http://handle.itu.int/11.1004/020.1000/4.126.51.en.101
European Common Proposals for the Work of the Conference, WRC-2000, Doc. 13-E,
http://handle.itu.int/11.1004/020.1000/4.126.51.en.101

resolution that included a study of whether sharing of such passive bands with active services was possible. With some changes these proposed resolutions were adopted was WRC-2000 Resolution 731 (Res. 731).[10] At WRC-19 Res. 731 was updated with new material concerning sharing studies above 275 GHz but the original provisions for 71-275 GHz remained unchanged.[11]

Res. 731 asks ITU-R to "continue its studies to determine if and under what conditions sharing is possible between active and passive services in the frequency bands above 71 GHz, such as, but not limited to, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz;". These enumerated bands include both RR5.340-protected bands and other bands with coprimary passive allocations. Res. 731 makes clear that any ITU-R action on sharing in 71-275 GHz has no formal impact on spectrum use and any change in RR5.340 must happen with approval of such changes at a future WRC. Realistically that is unlikely to happened before 2031. It also explicitly defines the protection criteria that passive services are entitled to: for passive satellites ITU-R RS.2017 and for radio astronomy ITU-R RA.769 and ITU-R RA.1513 and Report ITU-R RA.2189.

POSSIBLE SHARING STRATEGIES

Most, but not all, fixed communications systems operate at low elevation angles. The spectrum above 95 GHz is well known to be significantly affected by atmospheric absorption. For unintended illumination of passive satellites by terrestrial fixed paths, the main beam power of the transmitter is greatly attenuated by such absorption before it reaches a satellite. The curves in Fig. 2 show this attenuation to an NGSO orbit of 400 km for elevation angles between 0 and 20 degrees. This shows that, for low elevation angle narrow beams, main

[10] https://www.itu.int/net/ITU-R/conferences/docs/ties/res-731-en.pdf
[11] https://www.itu.int/oth/R0A060000A1/en

beam illumination of satellite is generally not an issue at these frequencies due to very high attenuation . But for higher elevation angles from antenna sidelobes the attenuation to orbit decrease quickly until at zenith it is not much greater than much lower bands without absorption. This leads then to two possible strategies for prevent power from terrestrial links from reaching passive satellites in order: suppression of high elevation angle sidelobes and antenna nulling of radiation patterns towards known satellite positions.

All antennas of finite size much have sidelobes. A goal for the antenna designer is to move them to azimuths and elevations where they cause minimal adverse impact. Previous sharing studies of millimeterwave spectrum with passive satellites have used assumptions of typical dish antennas used at lower bands.[12] In lower bands only limited sidelobe suppression is needed to coexist with other spectrum users. Harmful interference-free sharing with passive satellites is much more challenging and possibly impossible with practical equipment under 100 GHz. But the unusual absorption characteristics of higher spectrum along with the small wavelengths that get even smaller with increasing frequency enables consideration of novel antenna designs that would be infeasible at much smaller bands.

While there is no legal requirement for international notification of passive satellite orbits and frequency coverage data, in practice the ITU and World Meteorological Organization have data bases that include such satellites and orbit and frequency data. In the case of bands with few satellites in orbit, sharing may be possible by using multiple element antennas that point a null towards the path that a satellite is passing on. This may become impractical if there are so many

[12] [Rep. ITU-R SM.2450-0 (06/2019) Sharing and compatibility studies between land-mobile, fixed and passive services in the frequency range 275-450 GHz https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-SM.2450-2019-PDF-E.pdf

satellites in the band that there is a high likelihood of several being at high elevation angles at the location where the transmitter may be.

BURDEN OF SHARING REQUIREMENT

Resolution 731 also requests that "to the extent practicable, the burden of sharing among active and passive services should be equitably distributed among the services to which allocations are made". This implies that both active services and passive services should consider modifications to their technical designs and operations in order to allow as much as possible operations of both without harmful interference to maximize the productive use of the radio spectrum.

RECENT ITU-R ACTIONS

For the November 2020 meeting of ITU-R WP1A, the US submitted an input proposing studies of possible sharing of passive spectrum under the terms of Res. 731. This was submitted to WP1A because ITU-R had assigned such studies to that group since WRC-2000. This action drew outrage from many in the passive community who may have been unaware that Res. 731 studies were an integral part of the WRC-2000 actions that created most of the passive bands above 100 GHz. One advocate for passive interests was quoted by a publication as saying, "The US was trying to use WP1A as a stalking horse to make inroads into the protection of passive services…The decision of ITU-R is to tell everyone that responsible parties are not in 1A but any responsibilities lie in other groups as they always have…" The publication went on to say this individual felt "it is unlikely WP 7D will take action as it believes the bands are sacrosanct and sharing studies are improper. This is because footnote 5.340 of the Radio Regulations forbids all transmissions in a series of bands, including several above 100 GHz." Thus, there are major disagreements about the legitimacy of sharing studies, notwithstanding the history of the concurrence of the creation of the passive bands and RR5.340 following parallel request of US and CEPT and in the same action at the same conference!

After the US submitted this input to the meeting -- but before the meeting actually occurred --the chairs of ITU-R study groups 1,5, and 7 issued a joint letter stating that while this work was previously assigned to Working Party 1A, that to "better coordinate the work between ITU-R Study Groups 1, 5 and 7" and "to avoid duplication of work" that Working Parties 7C and 7D will be the lead groups working in close cooperation with Working Parties 5A and 5C. So the ITU-R leadership has now endorsed the concept of Res. 731 sharing studies but has placed it mainly in the preserve of Working Parties 7C and 7D with inputs from Study Group 5. It remains to be seen how receptive the passive community will be to objective sharing studies.

CONCLUSION

Unlike at lower bands, passive allocations above 100 GHz appear to have a major impact on the potential of other radio services in this area where demand and technology are now developing. The WRC-2000 framers of these passive allocations anticipated this issue then and included as an integral part of the decision for these allocation ITU-R studies under Res. 731. to explore the feasibility of sharing subject to explicit quantitative protection goals. Those studies are now getting underway. Let's hope that all parts of the spectrum community can cooperate in objective ways to see if sharing subject to the protection goals is feasible. Interested parties may wish to contact their national WP 5A, 5C, 7C and 7D groups to participate in such deliberations. Alternatively companies and universities may join ITU directly and participate directly in international deliberations.[13]

[13] https://www.itu.int/en/myitu/Membership/Become-a-Member

MICHAEL J. MARCUS

Adjunct Professor of Electrical and Computer Engineering
Northeastern University, Boston USA
(FCC, Retired)

MICHAEL J. MARCUS (mjmarcus@marcus-spectrum.com) is Director of Marcus Spectrum Solutions, Cabin John, Maryland, and an adjunct professor in Northeastern University's Department of Electrical & Computer Engineering. He retired from the Federal Communications Commission in 2004 after nearly 25 years in senior spectrum policy positions. While at the FCC, he proposed and directed the policy developments that resulted in the bands used by Wi-Fi, Bluetooth, and licensed and unlicensed millimeter wave systems above 59

GHz. He was an exchange visitor from the FCC to the Japanese spectrum regulator (now MIC) and has been a consultant to the European Commission and the Singapore regulator (now IMDA). He has also taught in electrical engineering at George Washington University, MIT, and Virginia Tech. During 2012-13 he was chair of the IEEE-USA Committee on Communication Policy and is now its vice chair for spectrum policy. In 2013, he was awarded the IEEE ComSoc Award for Public Service in the Field of Telecommunications “for pioneering spectrum policy initiatives that created modern unlicensed spectrum bands for applications that have changed our world”. He received S.B. and Sc.D. degrees in electrical engineering from MIT.

Internet Governance in Pandemic Times

George Salama
Head of Public Policy & Government Relations
Middle East & North Africa, Pakistan & Afghanistan
Twitter, Inc.

Since its early naissance, the Internet has been a key enabler for growth across multiple fronts. Twenty years ago, no one could have predicted that the Internet would be an integral part of our daily lives. The world has been through many pandemics; however, what really makes the COVID19 pandemic unique is the Internet. During this time of lockdowns. the Internet has had a profound socio-economical impact that has positively affected the continuity of day to day life. It is fascinating to see how the world has swiftly adapted by shifting almost every aspect of our daily lives to the online world (i.e. working from home, home schooling, online shopping, distant video calls with family and friends, entertainment streaming services). The success achieved in this adaptation lies not only in the Internet itself, as a global network of networks, but most importantly in the way the Internet is governed. Openness is the cornerstone of a truly efficient Internet governance model, a model where no one stakeholder controls it. Governing the Internet to reinforce its openness requires a transparent trusted level of cooperation and alignment between all stakeholders (government - private sector - civil society - academia) while safeguarding the principles of freedom of expression, safety, privacy and net neutrality.

A truly Open Internet should not only respect, but also implement freedom of expression principles across all its policy making layers. Over the last decade, the Open Internet has enabled major societal and cultural reforms for the better. An open medium, on an equal footing, characterizes the governing model of the Internet at its best and should stay the common factor across all its policy development stages. The COVID19 pandemic placed online freedom of expression in sharper focus. For example, hateful misleading online content that is targeting groups based on their nationality or ethnicity claiming responsibility for the spread of the virus has no place online, even when it exists offline. Although the current Internet governance mechanisms provide various ways to allow freedom of expression, there is still an urgent need to develop a frame of reference to define the thin line between free speech and hateful conduct. Throughout COVID-19, there has also been a concerning trend where some regulators and policymakers across the world rushed to put in place media laws and regulations that to a great extent limit the free flow of information and networks that are so critical to communities and citizens at this time. It is important to ensure that Internet regulatory frameworks endorse the Internet openness, minorities groups and respect the freedom of expression.

Another key factor of Internet governance in pandemic times is online safety and privacy. With the exponential growth of both the Internet and the time spent online, people's online safety is becoming more of a necessity rather than a ‘nice to have ’feature. Online safety is a term that goes all the way from the basic Internet safety measures, such as securing online presence with passwords and authentication, to policy making and Internet governance processes that take into account the protection of people's voices against hateful conduct and exposure to misinformation. The spread of online misinformation around COVID19 has put more responsibility on Internet governance stakeholders to prioritize health above all else. For example, technology companies have had to work to adopt specific policies that surface trusted credible verified content while embracing advanced technologies and machine learning to limit the spread of harmful misleading information. In addition, civil society and safety partners have leveraged the power of the Internet openness to raise community awareness and share critical information about the virus. Keeping everyone safe online is a collaborative effort that requires all stakeholders, all in their respective roles, to advocate for a safer healthier online environment for all.

There is no doubt that the neutral nature of the Internet has shaped people's lives during the pandemic lockdowns for the better. Full access to the Open Internet, with no packet discrimination, does not only open vast entertainment streaming channels for people while staying home, but more importantly helps in boosting the medical sector and those who are on the frontline in fighting the virus. For example, online video conferencing applications connecting healthcare professionals and authorities globally played a crucial role at early stages of the virus spread, in setting up strategies, aligning on the ground efforts and expediting the scientific efforts in the search for vaccines. Similarly, net neutrality made it possible for students to stay home safely while continuing their education remotely and to remain in contact with teachers and online learning resources. The COVID19 pandemic made it crystal clear that the Internet should be governed in a way that keeps it open, neutral. It is essential that regulators, policymakers and Internet providers explore sustainable and innovative ways to boost network capacities while safeguarding neutrality.

In conclusion, Internet governance is needed to prevent the risk of fragmentation, to maintain the Internet interoperability and at the same time to protect people online from bad actors while giving everyone a voice. I believe that the COVID19 pandemic in an offline world would be the worst pandemic ever in human history. Not only has the Open Internet saved people's lives in the fight against the virus, but also has helped in overcoming challenging mental health problems. The world economy will need years to recover from the impact of COVID19 and there is no doubt that the Internet is a key element in speeding up this recovery process. When it comes to the governing model of the Internet, there is no doubt still room for improvement to unleash the full potential of the

Internet. Keeping the Internet open for all is a key element that must be preserved to surpass the effect of the pandemic and to allow the global economy to flourish.

*****Disclaimer: The views in this article are of the author and do not necessarily represent the views of their organization.***

George Salama

Head of Public Policy & Government Relations
Middle East & North Africa, Pakistan & Afghanistan
Twitter, Inc.

George Salama, Head of Public Policy & Government Relations – Middle East and North Africa, for Twitter, Inc. In his role, George is leading the strategic engagement with key governments, political figures, policymakers, regulatory authorities, law enforcement agencies, lawmakers, Civil Society and Media. George is aiming to advance policy beneficial to the platform and its users.

Before Twitter, George was Sr. Manager Public Policy for SAMENA Telecom Council, ICT Industry Association based in Dubai, where he was in charge of setting up and executing the council’s public policy plan and business strategies in a way that positively shapes the ICT industry growth.

Prior to his move to the UAE, George spent over 7 years with the Egyptian Government, National Telecom Regulatory Authority (NTRA), where he was in charge of International Technical Coordination and Internet Public Policy.

George holds MSc Business Information Technology Middlesex University – UK and he is a graduate of the American University in Cairo with a BSc in Computer Science and a minor in Electronics.