

Introduction

I would like to thank IFT of Mexico for the opportunity to comment on the consultation document "Analysis of the band 57 - 64 GHz for its possible classification as free spectrum". As one of the leading global mmWave vendors, we are pleased to participate in this consultation, and we will comment on the topics related to our products and worldwide experience, including membership in the ETSI mmWave standards committees.

1. What comments suggest that the Institute classify the 60 GHz frequency band as a free spectrum? Do you consider this to be an adequate measure? Justify your answer.

Our comments:

- a. Frequency range: Earlier this year (July 14th), the United States' communications regulator, FCC, made rules pertaining to high-frequency airwaves that will open up more high-frequency spectrum for commercial use and lay the foundation for the next evolution of wireless technology. Because of the 14GHz-wide bandwidth, the airwaves are especially good for high-capacity uses, both in fixed operations outdoors for backhaul extensions and for networking equipment indoors, such as letting users to send data between HD TVs and video players within the same room. The new rules open up 7GHz of additional bandwidth in the 60GHz frequencies. This step by top U.S. regulators reinforces the goal of using mmWave technology to deliver affordable gigabit capacities to break the Digital Divide. The digital divide is an economic and social inequality with regard to access to, use of, or impact of information and communication technologies (ICT). The divide refer to inequalities between individuals, households, education institutes, or geographic areas, usually at different socioeconomic levels or other demographic categories. The new spectrum release will significantly enhances the Mexican government ability to reduce the digital divide:
 - i. Medical. Today's medical technology is heavily using digital communication for enhancing medical services by allowing, real-time, interference-free high-capacity connectivity to serve crucial medical data transactions.
 - ii. Education. The new spectrum release will significantly enhances educational institutes ability to deploy affordable and reliable:
 1. High capacity internet connections
 2. Video surveillance networks
 3. Educational LAN to LAN connections
 - iii. Residential broadband. The new 60GHz spectrum, with the new US FCC technical specifications, enables production of highly reliable, small and easy to deploy Gigabit capacity dense urban connection

gear. The new technology already identified by both US FCC and leading operators such as AT&T as the next generation technology for wire-free residential broadband services. AT&T promo video:

https://youtu.be/ZF09OWzv_pw

- b. Link to FCC decision paper: https://apps.fcc.gov/edocs_public/attachmatch/DOC-340301A1.pdf
- a. Scalability. 60GHz Band comes inherently with a significantly higher re-use factor thus channels overlap and/or side-lobes interference is minimal. The highly directional, "pencil-beam" propagation characteristics of 60GHz wireless systems mean that users can plan and deploy networks with an extremely high degree of frequency reuse. No frequency coordination is required, and links may be deployed very close to one another with minimal interference concerns. Due to antenna transmission patterns (beam width 4-5 times narrower), it can assume a re-use factor that is around 50 times higher in the 60GHz Band compared to other free to use bands 2.4/5GHz. That extremely high re-use factor, alongside with inherent limited physical range (due to the high oxygen absorption) makes it an adequate measure perfectly applicable for a license-exempt band.

Summary: I believe that releasing the complete 57-71GHz band, will position Mexico's communication authorities among the leading and most innovative regulators while enabling the local economy and society to benefit from this future ready technology.

2. What regulatory aspects should be considered in the classification process of the band? Justify your answer.

The type approval process. The requirement should be clear and simple. The process should take no more than a few days for approving utilization of new equipment in Mexico. The technical aspects should ensure well defined maximum Tx power and minimal antenna gain, just as defined by US FCC. Such approach will enable relaxed utilization of this band. The US FCC approach proved to enable fast, reliable and robust, variety of affordable services deployments such as: Education institutes, Medical centers, Surveillance networks and more. See sample deployments pictures from the USA:



US FCC 60GHz rules: <https://www.fcc.gov/document/part-15-rules-unlicensed-operation-57-64-ghz-band>

3. Do you believe that there is currently an optimal technological ecosystem in the 60 GHz frequency band? Justify your answer.

The 60GHz band ecosystem is one of the fastest growing sector among wireless technologies. Today, there are >80 countries around the world who already released the 60GHz band for public usage. Just as correctly described by the IFT analysis, there are 2 parallel fast growing applications utilizing the 60GHz bands:

- a. WiGig for multimedia indoors. WiGig is actually the next evolution of the well know Wi-Fi which is available today at 2.4GHz and 5GHz bands. All major silicon firms such as Qualcomm and Intel are offering today very affordable components that have integrated 3 band solution (2.4GHz + 5GHz + 60GHz). Leading laptops and networking gear vendors have integrated those components in their consumers' appliances.
- b. Wireless connectivity outdoors radios. 60GHz outdoors radios are the world's fastest growing segment in the outdoors connectivity segment. With >20 different vendors offering their products, 60GHz products are constantly improving and bringing very efficient and competitive offering for the benefit of public and private networks around the world.

More than that, over the past year there's been much fanfare about mmWave and 60GHz fixed wireless from major brands such as Google, Facebook and AT&T to name a few. These companies invested heavily in wireless technologies R&D during the recent years, and have just started reveal the conclusions which are all leading to unmatched scalable wireless

technology that will enable a better and faster connected world. Facebook even noted that they are working on making this technology open and interoperable, to allow further products' prices reductions.

Facebook's project: <https://code.facebook.com/posts/1072680049445290/introducing-facebook-s-new-terrestrial-connectivity-systems-terragraph-and-project-aries/>

4. In the international environment, there are several applications and technologies that operate in the 60 GHz frequency band. What kind of applications, technologies or services do you think could be implemented in Mexico?

Based on our vast experience with implementing 60GHz around the world, we believe that the Mexican economy can benefit from the 60GHz band in variety of applications:

- a. Government enhanced video surveillance networks: The physical and electromagnetic capabilities of 60GHz band, along with its gigabit capacities and scalability, allows for implementing very reliable and very dense video surveillance networks that easily allow implementation of cutting edge megapixel ultra-HD cameras anywhere around any city. Not just that, the ultra-high re-use factor allows to deploys such networks within days. Such scalable capabilities will enable the Mexican authorities fast and reliable rollout of cutting edge security networks to further enhance urban experience and safety in any city.
 - b. Medical, Educational and Residential. See the answer to Q.1.
 - c. Smart City. The emergence of affordable high capacity connections is paving the way for faster and more powerful smart-cities projects. Such projects are heading to significant enhance public owned networks by heavily relaying of connected devices (IoT – internet of things) environment. Reliable high capacity backhaul connectivity is a major fundamental milestone in every urban network. It will significantly improve city services by enabling efficient systems to monitor and control in real-time. The capacities enabled by 60GHz radios, will enable any municipal authority to lay a robust network that will convey multiple services concurrently, including video surveillance for traffic and environmental monitoring as well as public Wi-Fi that also helps to attract tourists.
5. Do you consider the operation of different applications, technologies or services feasible in the 60GHz frequency band? Or do you consider it appropriate to define segments of the 60 GHz frequency band for specific applications, technologies or services? Justify your answer.

I believe that a fully uncoordinated approach is sustainable in the long term. mmWave in general, and particularly 60GHz band, are the wireless technologies with the highest re-use factor available today and for the foreseeing coming years.

Example 1:

- Simulations with 200 links per square km (8 different networks deployed)
- Resulting that 1GHz in the 60GHz band (overall 7-14GHz) is sufficient to ensure an acceptable risk of interference (< 2% of cases) even in worst case scenario.

Example 2:

- 5200 links simulations at 16 square km (2 different networks deployed)
- Resulting that 91% of the links can use the same 250MHz channel and with using only 3 x 250MHz channels the solution can scale to >50,000 links and ensure an acceptable risk of interference (< 2% of cases)

Such scalability is unmatched by any other wireless technology and allows for relaxed rollout of high capacity advanced services for many years to come.

6. To encourage the proper functioning of applications, technologies or services in the 60 GHz frequency band, what operating conditions do you consider appropriate? (It is suggested to include in the response at least the following parameters: transmission power, antenna gain, effective radiated isotropic power (ERPE) and EIRP density). Justify your answer.
7. If the 60 GHz band is classified as free spectrum, would you like to see any technical or regulatory restrictions for this band? Justify your answer.
8. What standards, recommendations and/or reports do you consider applicable to the classification process of the 60GHz band as a free spectrum?

Combined Answer (for Q. 6-8):

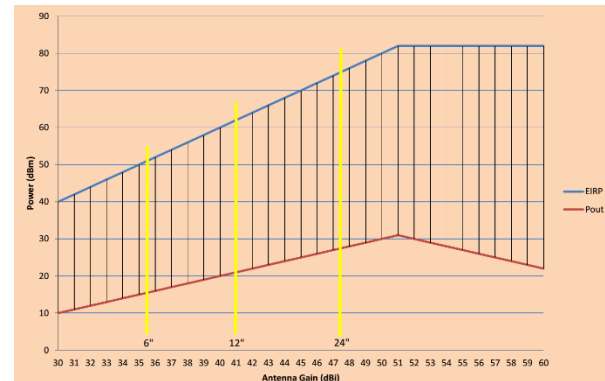
Unlicensed. No allocation. 60GHz, just as Wi-Fi today, should be available for free utilization - as an enabler for high capacity wireless applications. 60GHz, extend and complement 2.4GHz and 5GHz WLAN. 60GHz band provide a solution in dense urban environments with hot spot coverage without sacrificing throughput. The 60GHz Band comes inherently with a significantly higher re-use factor thus channels overlap and/or side-lobes interference is minimal. The highly directional, "pencil-beam" propagation characteristics of 60GHz Band wireless systems mean that users can plan and deploy networks with an extremely high degree of frequency reuse. No frequency coordination is required, and links may be deployed very close to one another with minimal interference concerns.

██████ believes that technical specifications are essential to ensure fair, secure and scalable utilization of the 60GHz band. With that said, and based on our global experience, we believe

that the American FCC approach proved to be the most appropriate to enable the people (and not just operators) to highly benefit from this band.

FCC (also adopted by the Canadian regulator, IC) rules limit the average power density of any emission in this band to $9 \text{ W/cm}^2 = [10\text{W (40 dBm)}]$ and the peak power density to $18\text{W/cm}^2 [20\text{W (43 dBm)}]$, measured at a distance of 3 meters from the radiating structure.

The US FCC adopted an innovative approach of not dictating antenna gain as a standalone parameter. This smart approach considers the combined antenna gain and Tx power (EIRP) as a guideline to ensure fair and efficient spectrum utilization. That ratio is illustrated on the next chart.



US FCC ratio between antenna gain, Pout and EIRP

Max EIRP = (85 dBm minus 2 dB for every dB that the antenna gain is below 51 dBi)

Notes:

- The 500mW peak transmitter output limit applies to transmitters with an emission bandwidth of at least 100 MHz and is reduced for systems that employ narrower bandwidths. See 47 C.F.R. 15.255(e)
- Eliminate the transmitter ID requirements for all 60 GHz devices
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US FCC 60GHz rules: <https://www.fcc.gov/document/part-15-rules-unlicensed-operation-57-64-ghz-band>

9. In addition to the 60GHz band, what bands or frequency segments do you consider to be potential for classification as a free spectrum? Justify your answer.

Releasing the 57-64GHz band is exposed to high oxygen absorption which severely limits link range to 1km or less. This band already proving to deliver street level and campus high capacity and affordable connectivity around the world. Since the emergence of WiGig technology and consumer electronics devices adopting it availability, regulators are exploring more potential frequencies to allow even further scalability for longer term. Regulators identified spectrum above 64GHz as both available (in most cases) and less exposed to high oxygen absorption.

- Japan issued 60 GHz radio regulations for unlicensed utilization in the 59–66 GHz band. The 54.25–59 GHz band is however allocated for licensed use. (~12GHz of spectrum)
- UK OFCOM expanded the 57-64GHz band up to 66GHz (~9GHz of spectrum)
- One of the most recent 60GHz spectrum releases happened to be in South-Africa, and here the local regulator, ICASA, released 57-66GHz to enable longer reach and denser implementations.
- Early this year, US FCC did the most advanced move by expanding the 57-64GHz band up to 71GHz https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-89A1.pdf while noting:
 - *"This action will provide more spectrum for unlicensed uses such as Wi-Fi-like 'WiGig' operations and short range devices for interactive motion sensing."*
 - *"Our action here creates a 14-gigahertz segment of contiguous spectrum in these frequency bands to encourage the development of new and innovative unlicensed applications, and promote next generation high-speed wireless links with higher connectivity and throughput, while alleviating spectrum congestion from carrier networks by enabling mobile data offloading through Wi-Fi and other unlicensed connections."*

10. Finally, do you have any comments or additional information that you consider relevant to the process of classifying the 60 GHz band as a free spectrum?

In countries where a license exempt approach was adopted, the 60GHz Band is gaining momentum as the relief band for the oversubscribed and interference-challenged 2.4GHz and 5GHz bands, especially with the recent introduction of the 802.11ac technology with its ultra-wide (up to 160MHz) channels, and the emerging LTE-U (which is seriously considering the same Wi-Fi spectrum). The 60GHz Band is also recognized as a complementary technology for Wi-Fi networks operating over above-mentioned bands: backhauling Wi-Fi access networks over the 60GHz Band enables significantly enhanced services also for city surveillance networks, which are today equipped with 4K-HD and multi-focal megapixel cameras that are hungry for reliable connectivity solutions and have found the-60GHz Band to be the perfect match. We believe that for Mexico, the IFT move to enable 60GHz as a free spectrum for the people, while traditional 6-38GHz bands are owned by commercial-operators, will encourage the local economy to use and benefit from affordable reliable high capacity solution which is perfectly matching the digital era we are living in today.

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