

June 28, 2021

Planning for WLAN use in the 6 GHz band  
Radio Spectrum Management Policy and Planning  
Ministry of Business, Innovation and Employment  
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## 1 Introduction

Qualcomm Incorporated (Qualcomm) welcomes the opportunity to provide input to the Radio Spectrum Management (RSM) consultation *Planning for WLAN use in the 6 GHz band* (the consultation).

Qualcomm is the world's leading wireless technology innovator and the driving force behind the development, launch, and expansion of 5G. When we connected the phone to the internet, the mobile revolution was born. Today, our foundational technologies enable the mobile ecosystem and are found in every 3G, 4G, and 5G smartphone. We bring the benefits of mobile to new industries, including automotive, the internet of things, and computing, and are leading the way to a world where everything and everyone can communicate and interact seamlessly. From our homes to airports, campuses, and the enterprise, Qualcomm's Wi-Fi solutions build on our world-class engineering capabilities to connect users and devices.

Qualcomm Incorporated includes our licensing business, Qualcomm Technology Licensing (QTL), and the vast majority of our patent portfolio. Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all our engineering, research, and development functions, and substantially all of our products and services businesses, including our Qualcomm CDMA Technologies (QCT) semiconductor business. One of our major areas of focus is the development of advanced wireless technologies, including 5G and Wi-Fi-based technologies.

Qualcomm supports the development of a forward-looking plan for the 6 GHz band such as that proposed by the RSM. These types of plans are an important tool for industry to understand the spectrum and timeline priorities of the government. This in turn allows the industry to provide input on the suitability of the plan, the market readiness of technology, the state of development of product ecosystems, and allows prospective licensees of the radio spectrum to plan their future spectrum and network investments.

## 2 Status and impact of 6 GHz devices

In a little more than a year, our industry has gone from having no spectrum footprint in the 6 GHz band to regulatory decisions covering nearly 54% of the global GDP, with nearly 42% of GDP having opened or

proposed opening the full 6 GHz band to free use. This swift action is happening in part because governments around the world have recognized the key role that robust broadband connectivity plays in the lives of their citizens, the resiliency of their economies, and in supporting national 5G deployments. The COVID-19 pandemic has brought these realities into sharp focus.

Wi-Fi standards for the 6 GHz band are in place and ready for use when the spectrum is made available. Wi-Fi 6E is a term that will be used to distinguish devices that will offer the features and capabilities of Wi-Fi 6 – including higher performance, lower latency, and faster data rates – extended into the 6 GHz band as it becomes available.<sup>1</sup> Wi-Fi CERTIFIED 6™, or Wi-Fi 6 is the industry certification program based on the IEEE 802.11ax standard, which provides higher data rates, increased capacity, and greatly enhanced performance in environments with many connected devices, and improved power efficiency.<sup>2</sup>

To expand 5G's reach beyond traditional public mobile networks, 3GPP completed two projects in Release 16 that are essential for new vertical deployments. The first is 5G NR-U, allowing 5G to operate in unlicensed spectrum. It defines two operation modes, anchored NR-U requiring an anchor in licensed or shared spectrum and standalone NR-U that – like Wi-Fi – utilizes only unlicensed spectrum, i.e., does not require any licensed spectrum. It is the first time that 3GPP has defined a cellular technology for “standalone” usage in unlicensed spectrum. Release 16 not only supports the existing global 5 GHz unlicensed band widely used by Wi-Fi and LTE licensed-assisted access (LAA) today but also opens the door to the 6 GHz band that brings a massive 1200 MHz of unlicensed bandwidth. Release 16 was completed in 3Q20.

Wi-Fi has proven to be a key driver of digital resilience and innovation during the COVID-19 pandemic. The study results reveal that industry-wide support for Wi-Fi growth and development is essential to continue realizing the benefits Wi-Fi technology provides. By the end of 2021 there will be 16.4 billion Wi-Fi devices in use.<sup>3</sup> Market adoption of Wi-Fi 6 will grow to 2.2 billion shipments in 2021, including nearly 340 million Wi-Fi 6E products which are capable of operating in the 6 GHz band.<sup>4</sup> Wi-Fi 6 and access to the 6 GHz band enables a suite of advanced applications—such as multigigabit video streaming, unified communications, cloud computing, and immersive telepresence—the combined effects of which could exponentially increase Wi-Fi value in years to come.<sup>5</sup>

Global Fixed/Wi-Fi will increase to 52.6% of total Internet traffic in 2021. The majority of this traffic is IP video traffic and will be supported on 27.1 billion networked devices. Furthermore globally, the average Wi-Fi speeds from mobile devices will double from 2016 to 2021, from 18.2 Mbps to 37 Mbps and globally.<sup>6</sup>

According to ABI Research, COVID-19's impact on Wi-Fi infrastructure indicates that existing infrastructure is inadequate. Wireless networks are now facing higher demand with more traffic, and users are finding their existing home Wi-Fi networks, inadequate or incapable of supporting the recent 80% increase in upload traffic. Many users are still using older Wi-Fi equipment with legacy Wi-Fi

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<sup>1</sup> <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-brings-wi-fi-6-into-6-ghz>.

<sup>2</sup> IEEE 802.11 ax ([https://standards.ieee.org/project/802\\_11ax.html](https://standards.ieee.org/project/802_11ax.html)) and Wi-Fi 6 (<https://www.wi-fi.org/discoverwi-fi/wi-fi-certified-6>).

<sup>3</sup> International Data Company databases, 2020.

<sup>4</sup> *Ibid.*

<sup>5</sup> *Ibid.*

<sup>6</sup> [https://www.cisco.com/c/dam/m/en\\_us/solutions/service-provider/vni-forecasthighlights/pdf/Global\\_2021\\_Forecast\\_Highlights.pdf](https://www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecasthighlights/pdf/Global_2021_Forecast_Highlights.pdf).

standards, such as 802.11n, rather than the latest Wi-Fi 6, which has been specifically designed to deal with better provision in more crowded networks.<sup>7</sup>

Globally, the gigabit Wi-Fi hotspot market is expected to grow with a compound annual growth rate (CAGR) of 14.2% during the forecast period from 2020 to 2028. The market is driven by the increasing adoption of smart devices across the globe.<sup>8</sup>

At Qualcomm, we view mobile 4G and 5G and Wi-Fi networks as complementary. For example, class-licensed technologies may provide local area and offload services, and licensed 5G NR provides mobile, fixed wireless access, wide-area networking services, and backhaul. As the capability of mobile 4G and 5G networks increases additional capacity and technology enhancements on complementary networks and services are also required and there is a net increase in demand for general user radio licensed spectrum.

In May 2020 Qualcomm Technologies, Inc. progressed technology enhancements when it launched the Qualcomm® FastConnect™ mobile connectivity subsystem and the Qualcomm® Networking Pro Series Wi-Fi Access Point platforms with Wi-Fi 6E operation using 6GHz. There have been multiple OEM product announcements using these technologies and numerous Mobile Handset and Access Points Wi-Fi 6E product designs are currently under development.

### 3 Responses to the RSM's Consultation Questions

In this response, Qualcomm provides information related to the continued progress on the planning of the 6 GHz band for radio local area networks (RLANs) and other unlicensed technologies. Technologies enabled by class licenses (including New Zealand's General User Radio License for Short Range Devices, GURL-SRD) are widely used in everyday life to connect innumerable devices from smartphones and personal computers to baby monitors, security cameras, and IoT devices in residential, educational and commercial settings. While class-licensed technologies like Wi-Fi and 5G NR-U are uniquely suited to share with other applications operating in the same frequency band, the pressure on these technologies to deliver reasonable last-mile throughput across a range of devices will only increase. Opening additional spectrum in the 6 GHz band for class-licensed technology like Wi-Fi and NR-U enables higher performance and seamless end-to-end connectivity within the wireless device ecosystem.

#### 3.1 Do you agree with RSM's proposal on making the 5925 - 6425 MHz available for WLAN use?

Qualcomm strongly supports the RSM's proposal to re-plan the 6 GHz band to enable usage by unlicensed devices and technologies. We encourage the expedient replanning of the 5925-6425 MHz range extended to the range 5925 – 7125 MHz (see section 3.2 below), to accommodate the rapidly growing demand for wireless connectivity driven not only by the COVID-19 pandemic but by the steady growth in wireless data consumption across multiple device form factors and service offerings. The 6 GHz band can benefit from a regulatory framework similar to that employed in the 5 GHz band to support next-generation Wi-Fi, i.e., IEEE 802.11ax (Wi-Fi 6) and 802.11be (EHT), as well as 5G NR technologies for license-exempt spectrum, 5G NR in unlicensed spectrum (5G NR-U), and future

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<sup>7</sup> <https://www.broadbandtechreport.com/wireless/article/14174610/abi-demand-spikes-suggest-need-for-fasterwifi>.

<sup>8</sup> <https://www.globenewswire.com/en/news-release/2020/10/09/2106204/28124/en/Global-Gigabit-WiFi-Hotspot-Markets-2020-2028-Increasing-Demand-for-Reliable-and-Fast-Internet-Connectivity-for-Employees-and-Students-Operating-from-Home-is-Driving-the-Growth.html#:~:text=Globally%2C%20the%20gigabit%20WiFi%20hotspot,smart%20devices%20across%20the%20globe>.

technologies that improve overall system throughput, reliability, and network responsiveness. All this innovation can be accomplished while protecting incumbent 6 GHz licensed services and future 5.9 GHz C-V2X services from interference.

### **3.2 Wi-Fi 6 in the 6 GHz band (known as Wi-Fi 6E) will expand capacity while taking advantage of greenfield spectrum that will not require interoperability with existing 6 GHz Wi-Fi technology, as would be the case if the technology were deployed in the 2.4 GHz or 5 GHz bands. Opening the entire 1200 MHz of the 6 GHz band would enable significantly improved user experience and spectral efficiency. What are your views on the potential future use of 6425 - 7125 MHz for new applications (e.g., Wi-Fi or IMT)?**

Qualcomm supports the use of the full 6 GHz band (5925-7125 MHz) for use by unlicensed devices and technologies. The recent proliferation of wireless technologies operating in unlicensed frequencies has significantly increased demand for this spectrum. Allocating the full 1200 MHz for WLAN use will bring the greatest benefit to New Zealand.

General User Radio Licensed access (also known as unlicensed, class licensed or license exempt access<sup>9</sup>) of the full 6 GHz band is key to enabling the rapid expansion of 5G networks via technologies such as next generation Wi-Fi. It is a key enabler of 5G and high-capacity broadband. Researchers have noted that the widespread adoption of Wi-Fi in consumer devices such as laptops and the original iPhone fueled demand for mobile data access, which in turn drove rapid adoption of mobile broadband services. And as more consumers began to use more data-intensive devices, they relied more on Wi-Fi offload—both for affordability and quality-of-service. Today, roughly half of global mobile data is offloaded onto Wi-Fi, and by 2022, nearly 60 percent of global mobile data traffic is projected to be offloaded onto the fixed network through Wi-Fi or femtocells.

Around the world, many leading economies have opened, or are in the process of opening, the full 5925-7125 MHz band for WLAN use. Given this global momentum, much of the equipment developed in the coming years is expected to support the entire 1200 MHz of the 6 GHz band, as markets such as Brazil, Canada, Chile, Korea, Saudi Arabia, and the United States are enabling the band for such operations.

Qualcomm notes that the rapid allocation of the full band for WLAN use is necessary to realize the full economic and social benefits of new wireless technologies. In this regard, RSM should not delay a decision until the final outcome of WRC-23, especially considering that in ITU Region 3 only the top 100 MHz of the band (7025-7125 MHz) is to be studied for a possible IMT identification. The 5925-7125 MHz range is already allocated to the mobile service on a primary basis and could be assigned to unlicensed technologies.

A wide range of settings and uses cases increasingly rely on unlicensed or license-exempt spectrum for their broadband needs. As demand has increased, locations including schools, industrial sites, medical facilities, and transportation hubs have deployed Wi-Fi infrastructure more densely to meet capacity needs. However, today we have reached the practical limit of how densely Wi-Fi access points (APs) can be deployed due to the resultant increase in radio frequency interference (both co-channel and adjacent channel interference). To meet growing needs for broadband capacity the industry must deploy wider channel bandwidths that are, in turn, enabled by opening the full 1200 MHz of the 6 GHz band.

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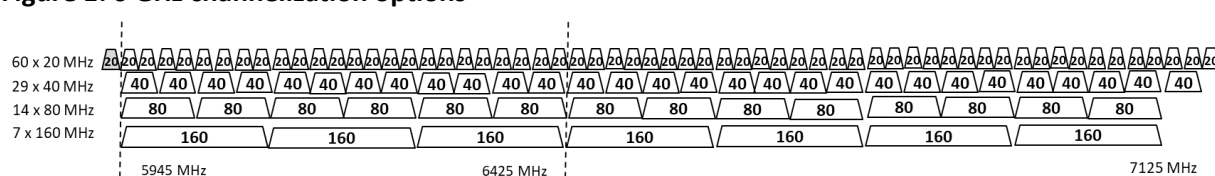
<sup>9</sup> In this document the terminology, unlicensed, licence exempt, class license and General User Radio License are considered equivalent

In addition, the current 40 MHz Wi-Fi channel sizes are increasingly insufficient to address the steep growth in the number of devices and higher bandwidth requirements per user. Wi-Fi topologies in the 5 GHz band typically are limited to a density of 1 access point (AP) every 12m (111m<sup>2</sup>). To ensure that each AP does not degrade the experience of a neighboring AP, non-overlapping channels are required. Reducing AP spacing by as little as 1m, e.g., 1 AP every 11m (93m<sup>2</sup>), results in channel reuse that adversely impacts the bandwidth benefit of 40 MHz vs signal quality, leading to a decrease in throughput and increased latency, impacting the quality of voice and video applications. This means 40 MHz channels are the maximum bandwidth that can be supported in these dense networks.

However, 40 MHz channel sizes are insufficient to address the steep growth in the number of devices per user and higher bandwidth requirements per user. This means that to retain the expected quality of service for users, 80 MHz and 160 MHz channels are needed. Without wider channels (e.g., 80 and 160 MHz), there will be a detrimental impact on real-time high-quality voice and video services, and immersive services such as augmented and virtual reality (AR/VR) will be starved of sufficient capacity.

Additionally, opening up the full 6 GHz band for WLAN use will have tremendous benefits for the economy and connectivity in New Zealand. And the economic benefits of Wi-Fi would be available now. Wi-Fi standards for the 6 GHz band are in place and ready for use when the spectrum is made available. For example, in the United States, the FCC has already published its test requirements for the 6 GHz band, and devices have already been certified. By 2021, the Wi-Fi Alliance is projecting 300 million “6E” chipsets will be shipped. By contrast, delaying a decision on the upper part of the band and ultimately designating it for IMT would tie this spectrum up for years while incumbents are relocated. Without the full band, New Zealand would not be able to enjoy the full benefit of future Wi-Fi technologies that can fully utilize multiple wide channels and their associated advanced technologies further reducing economic benefit.

**Figure 1: 6 GHz channelization options**



To solve the bandwidth crunch, the full availability of 5925-7125 MHz is necessary. The possible channelization options are shown in Figure 1 above. The additional 1.2 GHz of channels provided by Wi-Fi 6E provides a roughly equivalent number of 80 MHz channels in 6 GHz as there are 40 MHz channels in 5 GHz.

The spatial frequency reuse scheme, in which access points automatically sense available channels and serve their users in different channels from those used by nearby access points, minimizes interference between the service sets, or cells, composed by the access points and their client devices. If only 500 MHz (5925-6425 MHz) are made available, only 3 x 160 MHz channels, in the bottom row of Figure 1, can be used. The additional 700 MHz (6425-7125 MHz) allows an additional 4 x 160 MHz channels. This limits the frequency reuse factor to 3 instead of 7, whereas the same channel frequency in a cell will be allocated in other cells with a closer proximity (2 cells separation). If the full 1200 MHz is available, the

same channel frequency in a cell will be allocated in other cells beyond a 2-cell separation. The possibility of co-frequency interference is thereby minimized.

By comparison, with only 5925-6425 MHz available, users would not be able to take full advantage of the benefits of Wi-Fi 6 in the 6 GHz band, and the brunt of that burden in terms of lesser quality and congestion will fall on users of Wi-Fi in enterprises, schools, transportation hubs, and other public venues.

By opening up the full 1200 MHz rather than part of it, the RSM would allow more spectrum to be made available for a range of license-exempt technologies, and it would also enable easier sharing of the band amongst the different users, as usage would be distributed across more spectrum.

**3.3 Do you agree that RSM should include 5925-6425 MHz in the GURL-SRD for WLAN low power indoor and very low power use?**

**3.4 Do you agree that RSM should mandate ETSI EN 303 687 as the radio standard for WLAN use in the 6 GHz band? Is there any other regulatory compliance standard we should consider?**

Qualcomm supports the RSM's inclusion of 5925-6425 MHz, and the full 6 GHz band, in the GURL-SRD for both WLAN low power indoor (LPI) and very low power (VLP) use. We also encourage RSM to consider an approach that would allow standard power (SP) devices with automated frequency coordination (AFC), as is included in regulatory regimes or proposals in countries including Australia, Canada, and the United States. Qualcomm encourages RSM to prioritize LPI and VLP in the short term and consider SP with AFC in the medium term. Please also see our response to Question 3.6.

In the charts below, we propose technical parameters for WLAN operations in the band for all three device classes. These proposals take into account coexistence studies conducted in the United States and Europe,<sup>10</sup> particularly considering the conditions specified by Ofcom in the United Kingdom<sup>11</sup> and the U.S. Federal Communications Commission.<sup>12</sup>

To enable the full utility of class licensed devices in the 6 GHz band, Qualcomm recommends the following power levels (expressed as power spectral density in a 1 MHz bandwidth): for LPI 17 dBm/MHz indoors only, for VLP 1 dBm/MHz in all locations, and for SP 23 dBm/MHz in all location with AFC. Similarly, we recommend the following total EIRP power limits: for LPI 30 dBm, for VLP 17 dBm, and for SP 36 dBm.

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<sup>10</sup> See CEPT Electronic Communications Committee. ECC Report 302, available at <https://docdb.cept.org/download/cc03c766-35f8/ECC%20Report%20302.docx>, ECC Report 316: Sharing studies assessing short-term interference from Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) into Fixed Service in the frequency band 5925-6425 MHz, May 21, 2020, available at <https://www.ecodocdb.dk/download/8951af9e-1932/ECC%20Report%20316.pdf>; and, ECC Decision 20(01): On the harmonised use of the frequency band 5945-6425MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN), Annex 1, A1.2, Nov. 20, 2020, <https://docdb.cept.org/document/16737> (listing technical conditions for LPI and VLP in Europe) (ECC Decision 20(01)).

<sup>11</sup> Ofcom, *Statement: Improving spectrum access for Wi-Fi*, Statement, 4.51, (July 24, 2020), <https://www.ofcom.org.uk/consultations-and-statements/category-2/improving-spectrum-access-for-wi-fi>

<sup>12</sup> *Unlicensed Use of the 6 GHz Band*, Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 18-295 (Apr. 24, 2020) [https://ecfsapi.fcc.gov/file/0424167164769/FCC-20-51A1\\_Rcd.pdf](https://ecfsapi.fcc.gov/file/0424167164769/FCC-20-51A1_Rcd.pdf).

Furthermore, there is a need to protect the C-V2X operations in the 5.9 GHz band immediately below the 6 GHz band. As such, Broadcom, Cisco, Facebook, Intel and Qualcomm have jointly developed a proposal to ensure that VLP devices, particularly those operating in vehicles, can co-exist with CV2X operating below 5925 MHz. Thus, we strongly encourage RSM to implement the following rule:

- (1) VLP devices shall comply with an out-of-band emissions level of -37 dBm/MHz measured by root mean square (RMS) at and below 5925 MHz.
- (2) VLP devices shall prioritize class licensed operations in channels above 6000 MHz before beginning operation below 6000 MHz. Manufacturers shall submit with their application for equipment authorization a declaration that the equipment complies with this prioritization rule.

The requirement for VLP devices to prioritize class licensed operations in channels above 6000 MHz will reduce the likelihood of VLP traffic in the channel adjacent to the 5.9 GHz ITS band when VLP devices operate within vehicles. In the incidences when VLP traffic occurs in the channel adjacent to ITS, the out-of-band emissions limit of -37 dBm/MHz RMS should further help to ensure coexistence.

### **3.5 What are your views on using a licensing approach to support 30 dBm EIRP WLAN devices?**

Qualcomm supports a licensing approach with a total power level of 30 dBm EIRP for WLAN devices. This power level limit is unlikely to cause harmful interference, as supported by analyses from the United States and Brazil. We believe that a location-specific licensing approach would be unnecessary for this power level from a technical perspective, and result in delayed deployment and higher market entry costs for operators.

### **3.6 What are your views on supporting 36 dBm EIRP standard power devices using Automatic Frequency Coordination (AFC) system? Do you have any proposals to provide AFC systems to New Zealand?**

As noted in our response to Questions 3.3 and 3.4, Qualcomm supports a framework that enables standard power operations at 36 dBm with AFC. This power level allows users to experience service quality that is consistent with 5 GHz WLAN networks, especially in outdoor use cases such as open public areas. AFC systems will allow for these use cases while protecting incumbent users. We suggest that the RSM consider the AFC systems such as those that have been recently adopted in the United States and Canada and proposed in Australia.

Both the Wi-Fi Alliance (for IEEE 802.11) and the technology-agnostic Wireless Innovation Forum (WinnForum) have committees focusing on the development of 6 GHz AFC standards. More specifically, the Wi-Fi Alliance AFC Task Group is engaged in projects to develop an AFC-to-AFC device interface specification and the development of certification tests for AFC systems and AFC devices. Standardization of the AFC interface helps to accelerate the availability of AFC devices and AFC systems. As a result, there is a built-in incentive for AFCs to utilize the standards. The interface standard also helps device manufacturers and users because Standard Power APs can be manufactured and used with the confidence that the equipment will interface with any AFC using the standard.<sup>13</sup> The compliance test specifications are addressing compliance of AFC devices, including Standard Power Access Points and Fixed Client Devices, under control of AFC as well as compliance of the AFC Systems to the target regulatory domains.

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<sup>13</sup> In contrast, standardization of AFCs themselves should not be attempted. Outcome-oriented rules frameworks for AFCs are critical, but AFCs themselves should be able to innovate and differentiate offerings above the regulatory minimums.

The Wi-Fi Alliance specifications are flexible to comply with various National Regulatory Authorities requirements and databases for the protection of incumbent services against harmful interference. RSM can monitor these AFC-related activities and decide if the FCC certification rules for AFCs and Standard Power APs are also suitable for New Zealand.

## 4 Conclusion

Qualcomm is encouraged by RSM's continued focus on wireless broadband services and the importance of spectrum arrangements that will enable the deployment of Wi-Fi 6E services in New Zealand. The RSM's stated plans enable all stakeholders to plan for successful wireless technology deployments that deliver enhanced and innovative services to users in New Zealand while maximizing harmonization with global and regional developments.

In order to ensure the greatest utility and socio-economic value of this important spectrum band for New Zealand businesses and consumers, Qualcomm strongly encourages RSM to open the entire 5925-7125 MHz range use on a technology-neutral basis. We encourage RSM to complete consultation process and finalize policy decisions on 6 GHz bands to enable an update to GURL-SRD at the earliest opportunity.

Qualcomm's systems-level research and ecosystem support efforts are both helping the ecosystem with 5G deployments and contributing to the next evolution of 5G and Wi-Fi. We appreciate the opportunity to provide feedback to RSM and would be happy to provide further information that could help RSM to further develop its plans.

Should you have any questions or comments on this submission, please do not hesitate to contact me at +852 6901 0087 (mobile) or [aorange@gti.qualcomm.com](mailto:aorange@gti.qualcomm.com).

Sincerely,



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