

May 7, 2021

Regan Smith  
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Re: Docket No. 2020-11  
Exemptions to Prohibition Against Circumvention of Technological Measures Protecting  
Copyrighted Works

Dear Ms. Smith and Mr. Gray:

I write to respond to your April 27 post-hearing letter requesting the materials that I referenced during the April 21 hearing related to Proposed Class 10 (Computer Programs – Unlocking) that were not included in our written comments. In particular, I cited to three reports from the Global mobile Suppliers Association (“GSA”) to illustrate the rapid increase in cellular-enabled devices with 5G capabilities in the last three years. In March 2019, GSA had identified 33 announced 5G devices from 23 vendors in 7 different form factors.<sup>1</sup> By March 2020, GSA had identified 253 announced 5G devices from 81 vendors in 16 different form factors, including the first 5G-enabled laptops, TVs, and tablets.<sup>2</sup> And by April 2021, GSA had identified 703 announced 5G devices from 122 vendors in 22 different form factors.<sup>3</sup> It should be noted that some of the 22 form factors, such as 5G modules,<sup>4</sup> can be deployed across a wide range of use cases that are not directly tracked by the GSA reports.<sup>5</sup> For example, one distributor of Quectel’s 5G modules described the target applications as including:

- Telematics & transport** – vehicle tracking, asset tracking, fleet management
- Energy** – electricity meters, gas/water meter, smart grid
- Payment** – wireless pos [point of service], cash register, ATM, vending machine
- Security** – surveillance, detectors
- Smart city** – street lighting, smart parking, sharing economy
- Gateway** – consumer/industrial router

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<sup>1</sup> GSA, 5G Device Ecosystem (Mar. 2019). Per this report, “announced” devices includes both available and forthcoming devices. A true and correct copy of this report is attached hereto as **Exhibit C** and incorporated herein by reference. GSA Reports are available at <https://gsacom.com/reports/> (free registration required).

<sup>2</sup> GSA, 5G Device Ecosystem Report Executive Summary (Mar. 2020). A true and correct copy of this report is attached hereto as **Exhibit D** and incorporated herein by reference.

<sup>3</sup> GSA, 5G Ecosystem Report Executive Summary (Apr. 2021). A true and correct copy of this report is attached hereto as **Exhibit E** and incorporated herein by reference.

<sup>4</sup> Although “module” and “modem” sound similar, they do not mean the same thing. A module incorporates the cellular modem (i.e., baseband chip) into an integrated circuit with other electrical components which can be adapted to a wide range of possible use cases. See <https://perma.cc/5Y4Z-SGX3>.

<sup>5</sup> This is relevant because there was some discussion during the 2018 Class 5 hearing on unlocking about limiting the “all devices” exemption to particular use cases, such as industrial or agricultural applications. See Tr. at 196:07-20 (Apr. 23, 2018) (“So a lot of your uses seem to be industrial- or farm-related uses. Would that be a way to define this category that would be satisfactory?”) (Stacy Cheney, NTIA).

**Industry** – industrial PDA [personal digital assistant], IPC [industrial PC], rugged tablet, pipeline monitoring, robot, motor/pump control

**Healthcare** – personal/pet tracker, wearable, home automation, remote medical equipment

**Agriculture & environment** – environmental monitoring, farmland monitoring, farm machinery management.<sup>6</sup>

Importantly, the cellular modem (i.e., baseband chip) used in the Quectel module cited above is the same cellular modem that is found in many 5G phones, tablets, and laptops – the Qualcomm Snapdragon X55 modem. The fact that the same modem is used across device categories means that the technological protection measure (TPM) should be the same across device categories. In 2018, the Copyright Office identified the relevant TPM in the unlocking context as a lock in the software on a device’s baseband chip, which allows the device to communicate with a cellular network.<sup>7</sup> Circumvention to “unlock” a wireless device for use on other networks can occur by “modifying a bit on [the] baseband,” which in effect removes the software lock that prevents a device from being used on another carrier.<sup>8</sup>

There is no reason to believe that there would be device-specific TPMs for each of the many form factors of cellular-enabled devices that employ the same cellular modem (i.e., baseband chip). The manufacturer of the modem (who ISRI understands is also the originator of the associated TPM) often has no control over what form factors will eventually house their modem.<sup>9</sup> As a result, chipset manufacturers like Qualcomm design their modem chipsets to be compatible across form factors. When Qualcomm released their Snapdragon X55 5G modem, they touted it as being “[d]esigned to bring 5G to all connected devices: from mobile devices, such as smartphones or mobile hotspots, to fixed wireless devices, such as routers and CPEs, to Always Connected PCs, XR devices, cars, and more.”<sup>10</sup> It is very unlikely that Qualcomm or any chipset manufacturer would go through the effort of creating different, device-specific TPMs for their modems, especially when the scope of possible form factors is undefined at the time their modems (and associated TPMs) are released into the world. It seems much more plausible that Qualcomm would opt for a “one-size-fits-all” TPM for each of its modems that would be form-factor agnostic than that it would go through the trouble of generating a separate TPM for each potential form factor.

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<sup>6</sup> See <https://perma.cc/N2UA-6J7R>. To enable this wide range of use cases, Quectel’s 5G modules are equipped with Qualcomm’s Snapdragon X55 5G modem. Quectel is not the only manufacturer of 5G modules equipped with Qualcomm’s X55 modem. Another manufacturer, Sierra Wireless, refers to their modules equipped with X55 modems as “future-proof form factors.” See <https://perma.cc/9CRJ-7J8K>. A full table with additional manufacturers of such modules equipped with Qualcomm X55 modems (and the described use cases for each module) is attached hereto as **Exhibit A** and incorporated herein by reference.

<sup>7</sup> 2018 Recommendation at 146. The term “baseband chip” and “modem” are synonymous, as the baseband processor is part of a device’s modem chipset. See, e.g., <https://perma.cc/7JTD-5LZK> (“Qualcomm supplies ‘modem’ chips, also sometimes called baseband processors, that connect mobile phones to wireless data networks.”); see also <https://perma.cc/3VG6-LHSF> (“Snapdragon X55 is part of a comprehensive modem-to-antenna solution which includes the baseband, RF IC, and complete RF front-end for mmWave and sub-6 GHz.”); <https://perma.cc/PXC2-E3UV> (“The Intel® XMM™ 7360 series combines the Intel® X-GOLD™ 736 baseband with the Intel SMARTi™ 5 transceiver in a compact, power-efficient design.”).

<sup>8</sup> 2018 Recommendation at 146, citing Tr. at 140:11–17 (Apr. 23, 2018) (Wiens, iFixit).

<sup>9</sup> This is especially true for the modules equipped with the Qualcomm Snapdragon X55 modem (summarized in Exhibit A), which are capable of being deployed in a wide range of use cases.

<sup>10</sup> See <https://perma.cc/L5UG-2GE9>. Additionally, Qualcomm says that the X55 modem “enable[s] OEMs to bring blazing fast connected devices to global networks *in nearly any form factor*.” *Id.* (emphasis added).

Given that the relevant TPM is associated with the cellular modem – and given that the same cellular modem is used across a wide range of device categories – it does not make sense for an unlocking exemption to include certain device categories but exclude others when the thing that matters most for copyright purposes – the modem and its associated TPM – remains unchanged. More explicitly, unlocking a 5G laptop or Internet of Things (IoT) module equipped with a Qualcomm X55 modem should involve circumventing the same TPM found in a 5G phone or tablet equipped with an X55 modem, and thus should be treated the same for § 1201 purposes.

The Qualcomm Snapdragon X55 modem is not the only cellular modem used across a wide range of device categories. But despite the explosion in the number of vendors and form factors of 5G devices in the last three years, there has only been a modest increase in the total number of 5G modems (and vendors of these modems). In November 2019, GSA identified just 4 commercially available 5G modems from 3 vendors (Qualcomm, Samsung, and HiSilicon).<sup>11</sup> By September 2020, that number had increased to just 8 modems from 5 vendors (Qualcomm, Samsung, HiSilicon, UNISOC, and MediaTek).<sup>12</sup> The most recent chipset report (January 2021) identified 11 total cellular modems, with the number of vendors remaining unchanged.<sup>13</sup>

The fact that there are so few commercially available 5G modems (and vendors) relative to the number of 5G devices (and vendors) is not due to the novelty of 5G. The same phenomenon is seen when looking at 4G/LTE devices and the corresponding modems. In their June 2019 report on the LTE device ecosystem, GSA identified 14,250 LTE devices from 710 suppliers.<sup>14</sup> But in their November 2019 chipset report, GSA identified only 24 commercially available LTE modems from just 6 vendors – HiSilicon, Intel, Qualcomm, Samsung, Sanechips (formerly ZTE), and UNISOC.<sup>15</sup> Given the discrepancy between the number of cellular modems (both 4G/LTE and 5G) and the number of cellular-enabled devices, it is no surprise that the same modems are used across many device categories and across suppliers of these devices.<sup>16</sup>

The discrepancy between the number of available modem chipsets and the number of 5G devices (and the respective original equipment manufacturers) creates a business environment where manufacturers of cellular modems (e.g., Qualcomm) design their chips to be compatible

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<sup>11</sup> GSA, LTE, 5G and 3GPP IoT Chipsets: Status Update (Nov. 2019). A true and correct copy of the relevant pages of this report are attached hereto as **Exhibit F** and incorporated herein by reference.

<sup>12</sup> GSA, LTE, 5G & 3GPP IoT Chipset Report: Status Update September 2020 (Sept. 2020). A true and correct copy of this report is attached hereto as **Exhibit G** and incorporated herein by reference.

<sup>13</sup> GSA, LTE, 5G & 3GPP IoT Chipset Report: Status Update January 2021 (Jan. 2021). A true and correct copy of this report is attached hereto as **Exhibit H** and incorporated herein by reference.

<sup>14</sup> GSA, Status of the LTE Ecosystem (June 2019). A true and correct copy of the relevant pages of this report are attached hereto as **Exhibit I** and incorporated herein by reference.

<sup>15</sup> See Exhibit F. From our research, the Qualcomm LTE modems (e.g., Snapdragon X5, X7, X12, X16, X20, X24) and Intel LTE modems (e.g., XMM 7160, 7260, 7360, 7480, 7560, 7660) were most commonly found in cellular-enabled devices sold in the U.S.

<sup>16</sup> To support this claim, we prepared a table that tracks the modems found in cellular-enabled laptops (both 4G/LTE and 5G) and show that each laptop uses a modem found in devices that are already covered by the exemption. This table is attached hereto as **Exhibit B** and incorporated herein by reference.

with a wide range of frequency bands in the 4G/LTE and 5G spectrums.<sup>17</sup> This ensures that their chips can be used in the greatest number of devices and on as many carriers across the globe as possible. As a result, when a device is locked to a specific carrier, it is almost always the TPM that prevents the device from being used on another network, rather than underlying technical limitations based on the cellular modem or the device itself.<sup>18</sup>

The additional clarity about the nature of the TPMs in additional classes of devices and the compatibility of cellular modems across carriers further demonstrates that § 1201 is the sole barrier that prevents wireless devices from being unlocked to switch carriers. The analysis that follows addresses “how these materials support the request in Class 10 to permit unlocking devices other than those listed in the current exemption,” as invited by the post-hearing letter.

Unlocking any wireless device simply to allow it to be used on an alternative wireless network is a fair and non-infringing use for the same reasons the Office has previously recognized for allowing the unlocking of phones, tablets, portable mobile connectivity devices, and wearables. As mentioned in the April 21 hearing, in 2018, the Office removed a similar device limitation from the § 1201 exemption for security researchers because the use was narrowly tailored to a specific purpose and the purpose was consistently non-infringing across device categories.<sup>19</sup> Here, ISRI’s all-devices request is similarly narrowly tailored to a specific purpose – unlocking to allow consumers and recyclers to switch wireless carriers. Circumventing a TPM for anything other than this very limited purpose would remain a violation of § 1201.

Moreover, this purpose is consistently non-infringing across the many different form factors noted above, whether it be a phone, tablet, laptop, or IoT module. ISRI believes this to be the case not just because our exemption is narrowly tailored to a specific purpose (as in the security research exemption), but also because the nature of the TPM should be the same across each of these form factors (given that the same modems are used). The purpose and character of the use is the same (i.e., making nominal functional changes to enable interoperability). The nature of the copyrighted work is the same (i.e., firmware associated with the baseband chip). And circumventing the same TPM in devices not currently covered by the exemption will similarly have no effect on the market for or value of copyrighted works (a unique feature of firmware is that there is not a separate market for firmware outside of the device that it is attached to, so there is no market substitute). Finally, the same pro-consumer and pro-competitive benefits that justify allowing the unlocking of phones and tablets (and that warranted the 2015 exemption and renewal during the last triennial) also justify the unlocking of laptops and many other devices/form factors incorporating the same

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<sup>17</sup> For example, the Qualcomm X55 modem can access nearly every cellular network available in the U.S. and many other countries, from 2G to 5G, and is compatible with all major U.S. carriers. The modem can connect to millimeter-wave 5G signals, which are most common in large cities, as well as lower-band spectrum, which is more common in less densely populated areas of the country. *See, e.g.*, <https://perma.cc/RK79-J4LH>.

<sup>18</sup> ISRI’s initial comments cited the Lenovo Flex 5G laptop, which was released as a carrier exclusive on Verizon’s network. 2020 ISRI Class 10 Initial Comments at 8. This laptop contains the aforementioned Qualcomm X55 modem and is compatible with all major U.S. carriers. The exclusivity of this laptop to Verizon and the inability of consumers to use the laptop on AT&T or T-Mobile is an artificial limitation due to the presence of a TPM; it is *not* due in any way to the device’s underlying technical capabilities. On the other hand, to the extent that some laptops or other wireless devices are sold in an unlocked state, it is important to reiterate that there would be no effect on or harm to any devices that are not locked from granting the requested exemption for those that are.

<sup>19</sup> 2018 Recommendation at 313 (recommending the removal of the “device limitation” for security researchers).

small number of cellular modems. Prohibiting consumers from unlocking their devices in order to switch to a better or cheaper wireless carrier threatens consumer choice and inhibits competition. Preventing consumers from switching carriers – whatever the device – artificially restricts consumer freedom, an effect that is not a proper purpose of copyright law.<sup>20</sup> Rather, consumers should have the ability to select cellular plans based on their respective merits – such as coverage, price, and support – without fear of running afoul of § 1201, and recyclers should be able to efficiently and economically enable these choices.

A consumer or recycler wishing to unlock a laptop, virtual reality headset, or IoT module for the limited purpose of switching to a different wireless provider stands in the same position from a copyright law standpoint as one wishing to unlock a phone or tablet. There is no legal reason to treat them differently under § 1201. Thus, a broader exemption covering all wireless devices is warranted.

Finally, to address possible objections that the Motor & Equipment Manufacturers Association (MEMA) might raise regarding the facts presented in this letter, any concerns that unlocking a cellular-enabled module would lead to safety or security issues would be unfounded and reflect a misunderstanding of the purpose of our exemption. There is no basis in the record from this cycle or previous cycles (either in MEMA’s comments or elsewhere) to suggest that circumventing a TPM for the limited purpose of unlocking to switch carriers would undermine security or safety systems in the way that MEMA describes. ISRI expects the nature of the TPM in the automotive context to be virtually the same as the TPMs seen in other contexts (given the limited subset of cellular modems and associated TPMs) and has seen no evidence to suggest that circumventing that specific TPM has caused any unintended effects in the devices currently permitted by the unlocking exemption. Moreover, an exemption narrowly tailored for the specific purpose of allowing owners and recyclers to switch wireless carriers does not permit bypassing additional TPMs for any other purpose or use – doing so would remain illegal under § 1201. As a result, MEMA’s concerns about vehicle safety are of no moment; bypassing any TPM for the purpose of modifying the vehicle systems described would not be covered by an unlocking exemption.

We hope that this letter and the accompanying exhibits serve as useful additions to the record. Please let us know if there is any other information you need from us.

Sincerely,



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*Certified Law Student*



Phil Malone  
*Counsel for Institute of Scrap Recycling Industries (ISRI)*

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<sup>20</sup> 2015 NTIA Letter at 36 (“The use of technology to deter wireless device owners from moving among wireless carriers—and claiming that the technology is an access control under the DMCA—is one of the earliest and most enduring examples of Section 1201 being used to further interests that are unrelated to copyright protection. [T]he practice of locking wireless devices has ‘forced consumers to acquire new devices when they switch operators, unnecessarily increasing the cost of the new service,’ which ‘not only harms consumers, but also creates an artificial barrier within the market that limits device portability, hindering competition among providers.’”).