Car Connectivity Consortium (CCC) public response to the:

"Presidential Memorandum, *Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy,* and the *National Spectrum Strategy.*

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Foreword from CCC President Alysia Johnson.

The protection of the ultra-wideband (UWB) spectrum is paramount, particularly in the context of its crucial role in innovations such as digital key for cars. As the automotive industry undergoes a transformative shift towards digitalization, the reliance on UWB for secure and efficient communication between vehicles and their corresponding digital keys has become increasingly vital. With a substantial market for automobiles, based on a five-year standard development track, the proliferating integration of UWB in digital car key systems enhances security, convenience, and user experience. Ensuring the safeguarding of the UWB spectrum is essential to prevent interference and maintain the reliability of digital key technologies. The protection of this spectrum not only safeguards the investment and efforts of automotive manufacturers but also contributes to the overall safety and seamless operation of the evolving digital automotive landscape.

As an organization that represents the vast majority of participants in the vehicle and device community worldwide, the Car Connectivity Consortium (CCC) is very open to help policymakers to understand this particular unique use case enabling the seamless access to cars, to illustrate the painless coexistence of this technology with existing radio services, including sensitive Federal applications in the band, and to identify potentially suitable ways to share spectrum with new spectrum applications in the 7.2-8.4GHz band.

About CCC, use of UWB and spectrum

The CCC is a cross-industry organization advancing global technologies for smartphone-to-car connectivity solutions. CCC has developed the CCC Digital Key Specification and Certification Program, an open standard to allow smart consumer electronic devices, such as smartphones, to act as vehicle keys and more. CCC Digital Key securely and conveniently enables the normal lock, unlock and start engine functions, but goes further to allow key sharing, offering access to friends or valets, and many more features by using phones and other devices.

Now over 200 strong, the CCC member companies consist of consumer electronics manufacturers and vehicle manufacturers, automotive tier-1 suppliers, semiconductor manufacturers, security product suppliers, and more. The Board of Directors of CCC includes individuals from charter member companies Apple, BMW, DENSO, Ford Motor Co., General Motors, Google, Honda, Hyundai, Mercedes-Benz AG, NXP, Panasonic, Samsung, Thales, Volkswagen and Xiaomi.

Since 2017, UWB technology typically has been used for proprietary secure ranging applications in automotive markets. HELLA GmbH and LEAR Corp. implemented a secure ranging solution to accompany the passive keyless entry system used at the time. This UWB solution is available now from numerous car manufacturers and has been proven to be reliable and highly secure while fulfilling the stringent requirements of quality and durability that the car industry requires. The inclusion in the key fob has also shown that the technology can be very low power and suited to battery-operated applications.

Since its completion in April 2020, vehicle and phone OEMs have started the implementation of the CCC Digital Key Release 2 in end-user products. With the completion of Digital Key Release 3 in May 2021, UWB radios utilized in both vehicles and smartphones are being deployed and utilized for CCC Digital Key functions.

UWB secure ranging is a core technology that enables Digital Key 3.0. Based on the IEEE 802.15.4z standard, it defines secure ranging, preventing car theft while preserving full user convenience.

There are numerous car OEMs already on the market with the UWB systems (both Digital Key 3.0 as well as enhancements to the previous inductive based passive entry systems) which provide the unique distance bounding technology and its loss or elimination will entail significant costs - microcontrollers, smartphone and vehicle manufacturers; not to mention the problems for customers as the overall security will be significantly reduced.

UWB secure ranging works by sending pulses of radio energy, measuring the time to cover the distance between transmitter and receiver. By using strong encryption technology this distance measurement cannot be hacked by car thieves, and the distance can be established quickly, precisely and securely.

UWB secure ranging consumes very little power and is ultra-precise – better than 5 cm in a typical Digital Key application. Unlike many other distance measurement technologies, UWB works in adverse environmental conditions: fog, smoke, rain and in multi-path reflective conditions.

Outside of Digital Key, UWB secure ranging is being used in many different applications to benefit both users of consumer electronics (smartphones, watches, etc.) and vehicles of many types.

Within smartphones, UWB is used with smart tags to allow owners to find lost items, not only providing angular direction and distance, but also azimuth or elevation. Many more applications that build upon these features are envisioned soon. Likewise, with vehicle applications, benefits based on the unique features of UWB can identify children left behind in a potentially hot car, as well as many more safety and convenience benefits. Taken together, applications that utilize UWB spectrum's unique qualities are strongly accelerating adoption in the primary markets of smart consumer electronic devices and vehicles, as well as opening opportunities for smaller companies to innovate with niche products, potentially benefitting those with disabilities, among other groups.

The CCC is cooperating with several alliances and consortia representing parts of the UWB ecosystem, as well as complementary uses of UWB that use the same spectrum. This includes successfully protecting and coexisting at current power levels with sensitive federal applications in channel 9. CCC's request regarding UWB spectrum should be understood in the context of the full ecosystem of UWB applications currently developing, each application supporting broader adoption of UWB technology thus spawning new innovative applications, all based on world-wide aligned spectrum availability.

Technical Spectrum Facts:

- CCC Digital Key UWB uses IEEE UWB channel 9 (7.737 – 8.236 GHz) with IEEE UWB channel 5 (6.240 – 6.739 GHz) as a backup channel.
- It uses very low power during transmission: more than 1000x lower than a Wi-Fi (-14.3 dBm)
- It spreads its energy over a wide part of the spectrum, thus causing even less interference in narrow-band receivers (-41.3 dBm/MHz).
- UWB ranging transmissions only use the spectrum briefly: between 1-5% during the ranging action. This is called the Duty Cycle.
- Ranging is triggered very selectively and only after establishing a trusted key – car match over Bluetooth. Therefore, ranging will be triggered modestly, while the user is in close proximity of the car. A typical Activity Factor is 0.1% on a daily basis.

- CCC Digital Key UWB handles interference from longer distance narrow-band transmitters very well because the time-domain correlation discrimination in UWB receivers intrinsically filters out such signals.
- However, CCC Digital Key UWB receivers are susceptible to interference from higher power wideband communication transmitters located closely to the UWB receiver. International Mobile Telephony (IMT) and Wi-Fi are key examples.
- High power applications in the 7.7 – 8.3GHz. and 6.2 – 6.8GHz spectrum would overwhelm the sensitive UWB receivers and destroy the growing consumer market.
- CCC Digital Key UWB successfully protects and coexists at current power levels with sensitive federal applications in channel 9.

Strategy correctly highlights the importance of sharing

The CCC strongly supports the aim in the National Spectrum Strategy to significantly expand and improve spectrum sharing capabilities. As emerging technologies and new spectrum-based services continue to proliferate, the demand for wireless connectivity and access to spectrum is growing at an astounding rate every year. However, there is a scarcity of readily available, unused "greenfield" spectrum that can simply be allocated to new uses. This intensifying bandwidth crunch makes it imperative that policymakers prioritize frameworks, incentives and technologies for more intensive and efficient spectrum sharing.

Spectrum is a finite resource, but innovation is boundless when policies encourage it. In developing and adapting spectrum regulations going forward, NTIA and the FCC have a prime opportunity to foster continued American leadership in wireless innovation. They can do so by making expanded, dynamic spectrum sharing a key policy objective and guiding principle. Future spectrum decisions large and small should use increased sharing potential as a lens for evaluation. Holding policies and systems to a metric of total spectrum utility and coexistence ability will motivate the kinds of technological advancements and cooperative behavior between incumbents, including those in the public sector, and new entrants that make intensive bandwidth sharing feasible. This balanced but proactive strategy will best serve America's insatiable spectrum demands now and in the decades ahead.

Implementation should not undermine currently successful forms of sharing

As great strides are made on advanced sharing methodologies, CCC also urges policymakers not to undermine sharing frameworks that work exceptionally well today.

A case in point is UWB technology. CCC members have invested heavily over decades to develop UWB systems and drive adoption. The secure-ranging and position location capabilities of UWB, enabled by precise control of low-power signals across an ultra-wide swath of frequencies, are truly unique and not duplicable through any other wireless means. UWB is the only wireless technology that supports the secure ranging capabilities upon which the CCC Digital Key relies. When the FCC showed bold leadership in 2002 by approving the first UWB rules, it kicked off an innovation cycle that is now finally hitting mainstream commercialization at scale.

However, it took considerable time, investment and coordinated industry efforts in areas like standards-setting to make widespread UWB adoption feasible. Billions of UWB-equipped devices are now produced annually, but only after weathering early competitive storms. We must remember that realizing the full benefits of widely adopted technologies like UWB requires patience.

Policymakers aiming to spur innovation must also demonstrate a long-term commitment to the novel approaches they set in motion.

Altering the regulatory landscape in ways that might inadvertently dampen today's successful UWB sharing techniques could severely undermine confidence in future investment. If innovative spectrum sharing solutions become seen as risky gambles that may later reverse course despite success, wise capital will rapidly flee. The fruits of American wireless innovation require consistent and patient cultivation - not just seeds planted but gardens carefully maintained. Policies that facilitate early adoption of breakthroughs like UWB must provide stable conditions for those technologies to reach maturity. We urge a balanced regulatory approach that provides fertile and reliable ground for pioneering systems like UWB to steadily continue thriving.