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January 31, 2013

**VIA ELECTRONIC DELIVERY**

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Room TWA325
Washington, DC 20554

**Re: WT Docket No. 12-69**

Dear Ms. Dortch:

Vulcan Wireless LLC ("Vulcan") urges the Commission to adopt a decision to restore interoperability in the Lower 700 MHz band as soon as possible, with an effective date within the next twelve to eighteen months. More than three years have passed since the Commission first received a petition seeking resolution to the severe deployment obstacles that have resulted from the unprecedented and unforeseeable creation of two overlapping band specifications for the Lower 700 MHz band.[1] As the record before the Commission reflects, this development has (i) substantially reduced the availability and affordability of A Block end user equipment, (ii) hindered the development of nationwide roaming agreements, (iii) raised the switching costs for consumers seeking to change service providers, (iv) stifled competition for pricing and services, (v) delayed the deployment of advanced mobile wireless services, (vi) stranded billions of dollars invested in networks and infrastructure, and (vii) exacerbated the spectrum crunch by preventing the full and efficient use of licensed spectrum.

By restoring the band plan framework that existed at the time Lower A Block licensees were bidding for spectrum in Auction 73, the Commission can stem these public interest harms, promote innovation and investment in wireless services, create thousands of additional jobs, and encourage competition—benefits that would accrue not only to consumers, but to all wireless carriers.

Vulcan has been especially active in exploring a variety of new wireless services and technologies to deploy in its licensed markets, but has been severely hamstrung by the deployment barriers created by the lack of interoperability. This filing provides greater detail regarding the benefits of interoperability—particularly for a greenfield operator such as Vulcan—as well as the minimal costs of restoring interoperability through a single unified band class.

[1] *See* 700 MHz Block A Good Faith Purchaser Alliance, Petition for Rulemaking Regarding the Need for 700 MHz Mobile Equipment to be Capable of Operating on All Paired Commercial 700 MHz Frequency Blocks (filed Sept. 29, 2009).

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Restoring Lower 700 MHz interoperability can be accomplished through a number of alternative routes at minimal cost. However, as Vulcan has previously explained, the Commission need not decide which of these alternatives is best. Rather, it need only specify that, by a date certain, all devices capable of operating on any paired spectrum block in the Lower 700 MHz band be capable of operating across *all* paired spectrum blocks in the Lower 700 MHz band.[2] Consequently, industry can then jointly determine whether achieving interoperability should be accomplished through either Band Class 12, expansion of Band Class 17, or incorporation of a "dual band" mobile device solution. That approach would make clear that this proceeding is fundamentally about restoring competition, enhancing consumer welfare, and promoting the efficient use of spectrum.

**AT&T's "Fall Back" Objection to Restoring Interoperability Is Refuted by Marketplace Realities**

The development of a more robust equipment market in which more carriers have greater access to mobile handsets and devices—with economies of scale that would lower prices and enhance consumer choice—would be one of the primary benefits to result from restored interoperability in the Lower 700 MHz band.[3] In its prior filings, AT&T has claimed that this benefit may not materialize because not all Lower A Block licensees fall back to the same 3G GSM air interface that AT&T employs.[4] Accordingly, AT&T argues, Lower A Block licensees using the CDMA air interface would still be required to work with manufacturers to obtain CDMA-equipped devices, and would not benefit from AT&T's GSM-based handsets.

This claim lacks merit. All of the required hardware components in a CDMA phone are present in a GSM phone.[5] Thus, if the FCC were to require the restoration of interoperability, a CDMA provider operating in the lower 700 MHz band could order a mobile device with the same hardware specifications used by AT&T's GSM phones, and provide that device to its CDMA customers. The device would only require a software modification to successfully function on its CDMA network. Therefore, both CDMA and GSM carriers can equally benefit from the device cost advantages derived from interoperability.

Second, contrary to AT&T's prior assertions,[6] approximately half of the 700 MHz A Block licensees are either GSM or greenfield operators. The greenfield operators, such as Vulcan, have no legacy 2G or 3G systems, and would rely upon roaming partners to provide coverage outside of their home 4G network. Accordingly, Vulcan (and similarly situated providers) can source devices to support either or both GSM and CDMA technologies, and can therefore share in the economies of scale and efficiencies in the equipment market from interoperability. Furthermore, as described further below, Vulcan is considering a variety of business models and business partnerships to deploy its network. The business models under evaluation include providing data services to consumers and businesses

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[2] Reply Comments of Vulcan Wireless LLC, WT Docket No. 12-69 (filed July 16, 2012).

[3] *See id*. at 23.

[4] *See, e.g.,* Comments of AT&T Services, Inc., WT Docket No. 12-69, at 10-16 (June 1, 2012) ("*AT&T Comments*"); Reply Comments of AT&T Services Inc., WT Docket No. 12-69, at 10-16 (July 16, 2012); Reply Comments of AT&T Services, Inc., Attachment B: Report of Mark A. Israel, Michael L. Katz & Allan L. Shampine, WT Docket No. 12-69, at 24-26 (July 16, 2012); Reply Comments of AT&T Services Inc., Attachment C: Reply Declaration of Michael Prise & Jeffrey Howard, WT Docket No. 12-69, at 4-10 (July 16, 2012).

[5] In making its assertion, AT&T relies upon the fact that there are differences in hardware reference designs for CDMA and GSM phones. However, the practical implications of these differences are irrelevant for the reasons noted above.

[6] *See, e.g.*, *AT&T Comments* at 4 (asserting that "the A Block licensees are CDMA carriers and thus need devices that fall back to CDMA").

that "bring their own devices" to the Vulcan network. With the restoration of interoperability, Vulcan could provide 4G LTE service to consumers by simply making it a downloadable app on existing mobile devices. In addition, potential partners available to Vulcan in deploying its network include GSM operators.

Third, with the advent of multi-technology chipsets, a single, unified 700 MHz band would benefit all Lower A Block licensees, regardless of which air interface technology they employ (including CDMA operators such as C Spire and US Cellular). Multi-technology chipsets, such as those made by Qualcomm[7] and used by AT&T,[8] permit the same chip to support a variety of air interfaces, including CDMA, GSM, and LTE. Using firmware, these chipsets can be programmed to support 4G, as well as 3G and 2G technologies.[9] As explained by Qualcomm in 2012, its "newest generation of Gobi modem chipsets will allow mobile device OEMs to design products that can operate on nearly any mobile broadband network worldwide."[10]

The fallacy of AT&T's "fall back" objection is manifest in the marketplace with the very devices that are sold today. Currently, a Verizon iPad equipped with WiFi and 4G LTE capabilities can operate on AT&T's 3G network.[11] Even though Verizon's 3G network is based on CDMA and AT&T's 3G network is based on GSM technology, the Verizon iPad supports *both* air interfaces. This development not only illustrates the value of multi-technology chipsets, it underscores how important it is for band classes to include a large number of spectrum blocks. Consumers with a Verizon iPad can receive service on AT&T's 3G network because the band classes for Verizon's 3G network (cellular and PCS bands) and AT&T's 3G network (cellular and PCS bands) are identical and cover the full range of spectrum blocks in the respective bands. If any of those bands were artificially limited to only one or a few blocks within the spectrum band, the capabilities made possible by multi-technology chipsets would greatly diminish. For example, if Band Class 2 (for the 1.9 GHz PCS band) was bifurcated into six separate band classes—one for each of blocks A, B, C, D, E and F in the PCS band—the multi-technology chipset could incorporate only some of those band classes, and consumers might be unable to use Verizon's iPad on AT&T's 3G network.

Therein lies the problem faced by Lower A Block licensees. The creation of Band Class 17 has marginalized and orphaned the Lower A Block spectrum, and the marketplace has demonstrated that

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[7] *See* Qualcomm, *Our Businesses*, *available at* http://www.qualcomm.com/about/businesses. Qualcomm has led the way in manufacturing multi-technology chipsets capable of flexibly supporting UMTS or CDMA, including flagship chips such as the MSM8960 and the MDM9615.

[8] An examination of AT&T's current line of LTE-capable phones reveals that more than half of their current sales line supports multi-technology chipsets. This percentage will increase over time as Qualcomm's newer, multi-technology chipsets are employed in future phone products. Notably, the list of multi-technology devices includes the iPhone, which accounted for 84.3% of AT&T's smartphone sales in the fourth quarter of 2012. Press Release, AT&T, *Strong Growth in Wireless and U-verse Drives Revenue and Adjusted Earnings Per Share Growth in AT&T's Fourth-Quarter Results* (Jan. 24, 2013). Assuming that half of non-iPhone sales also supported multi-technology chipsets, it is possible that more than 92% of AT&T's smartphone devices sold support multi-technology chipsets.

[9] *See* Comments of Qualcomm Inc., Development of the Nationwide Interoperable Public Safety Broadband Network, Docket No. 120928505-2505-01, at 7 (Nov. 9, 2012), *available at* http://www.ntia.doc.gov/files/ntia/qc_comments_on_firstnet_noi.pdf.

[10] Press Release, Qualcomm, *Qualcomm Third Generation LTE Chipsets Are First to Support HSPA+ Release 10, LTE Advanced with LTE Carrier Aggregation* (Feb. 27, 2012).

[11] To do so, the consumer need only replace the micro-SIM card in the iPad. *See* Wendy Li, *New Verizon iPad Can Work with AT&T Network*, International Business Times (Mar. 19, 2012), *available at* http://www.ibtimes.com/new-verizon-ipad-can-work-att-network-426920.

carriers without Lower A Block spectrum have no incentive to include Band Class 12 in their devices. Restoring interoperability would resolve this problem, and ensure that multi-technology chipsets in the future can be designed to incorporate all paired spectrum blocks in the Lower 700 MHz band. This would in turn increase competition among wireless carriers and allow consumers to switch providers without requiring them to purchase new mobile devices. And since many of the new mobile devices used by consumers include tablets and iPads costing up to $900 and laptops costing even more, the benefits of empowering consumers to seek out competitive wireless offerings for the devices they own would be significant.

Finally, the rapid proliferation of LTE as the 4G standard also discredits AT&T's "fall back" claim. Just as most wireless operators are no longer concerned about falling back to their 2G platforms, in the near future carriers will not be concerned about falling back to their 3G technologies. Consequently, even if AT&T's claim were valid, it will disappear in the near future, and by no means justifies a permanent barrier to interoperability in the Lower 700 MHz band.

**Restoring Interoperability Would Facilitate Vulcan's Deployment of Innovative Wireless Services**

In addition to promoting economies of scale and alleviating the equipment-related challenges for the Lower A Block, restoring interoperability would spur the development of innovative wireless services provided by Lower A Block licensees, including Vulcan. Having explored a number of different deployment options and technologies, Vulcan knows well the marketplace innovation and investment that will follow from restoring interoperability in the Lower 700 MHz band. Since acquiring its Lower A Block licenses in Auction 73 (for approximately $113 million),[12] Vulcan has investigated a variety of build-out options, strategies, and technologies to offer an innovative mobile wireless service across its licensed markets.

Vulcan's pursuit of cutting edge technology is consistent with the values, ideology, and history of its visionary founder, Paul G. Allen. Since co-founding Microsoft in 1975, Mr. Allen has been a leading participant and investor in some of the most forward-thinking wireless and media companies, and has played a central role in building out new communications platforms. For example, Mr. Allen was a controlling shareholder in Metricom Incorporated, which deployed the country's first multi-city high-speed wireless network. At a time when Internet access was primarily relegated to deskbound access over traditional phone lines via 56K modems, Metricom allowed consumers and businesses to access the Internet wirelessly on laptops, using technology and state-of-the-art provisioning that doubled the speeds of traditional Internet access at a highly competitive price. Likewise, in 1998, Mr. Allen purchased a controlling interest in Charter Communications, now the nation's fourth-largest cable operator (offering video, voice, and data services to approximately 5.2 million residential and business customers in 25 states).[13]

Mr. Allen has also been active in fostering the ecosystem of software and hardware that is necessary to support advanced wireless networks. For example, he was an early investor in Audience.com, a leading provider of advanced voice and audio processors for mobile products (including smartphones), which developed the world's first smart sound processor for mobile devices.[14]

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[12] *See* Auction of 700 MHz Band Closes, *Public Notice*, DA 08-595 (rel. Mar. 20, 2008).
[13] *See* About Charter Communications, *at* http://www.charter.com/about.
[14] *See* About Audience, *at* http://www.audience.com/about-audience/about-audience.

Likewise, to help wireless service providers meet their infrastructure needs, Mr. Allen was a significant investor in TowerCo, once the nation's fifth largest provider of wireless communications towers.[15]

Mr. Allen's storied history of developing and promoting new technologies and networks illustrates the value that he and Vulcan can bring to the wireless industry. These projects have provided him with a depth of experience that Vulcan can draw upon in deploying an innovative greenfield service that consumers will demand and value.

Vulcan has already taken a number of significant actions to that end. For example, Vulcan has been in negotiations with an electric utility cooperative to create a joint venture that would use Vulcan's A Block spectrum in EA170 to support a regional fixed LTE service. This venture can serve as a model for other potential deployments within the Vulcan licensed areas. Although the venture considered deploying both fixed and mobile LTE service across this network, the key engineer managing that project has informed Vulcan that the lack of interoperability in the Lower 700 MHz band has significantly influenced the decision to not include mobile LTE service at this time. As a result, consumers will be limited to only a fixed broadband service with no mobile functionality for now.

Similarly, Vulcan has been in discussions to partner with a consortium of local carriers for possible service to consumers in rural parts of Oregon. But these discussions have been stunted by the lack of Lower 700 MHz interoperability, which has prevented the cooperative from securing an LTE roaming agreement with another carrier.

Finally, Vulcan has explored partnerships with major information and telecom service providers to possibly deploy a hybrid network that would feature an LTE component over Vulcan's licensed spectrum. To this end, Vulcan has engaged other telecommunications carriers, satellite providers, fiber operators, and TV broadcasters to discuss a combined service that would use new mobile technologies and standards, some of which are not yet offered anywhere in the country. However, the uncertainty created by the absence of Lower 700 MHz interoperability has contributed to the delay in these discussions.

The foregoing efforts illustrate the types of partnerships that Vulcan believes will be important to creating and rolling out new, innovative wireless services—especially those that have a mobile component, which is increasingly essential as consumers expect mobile capabilities to meet their communications needs. By restoring interoperability as soon as possible, the Commission can accelerate such innovation and spur consumer adoption of advanced mobile wireless technologies.

**Restoring Interoperability Would Benefit Greenfield and Incumbent Wireless Providers Alike**

The lack of interoperability in the Lower 700 MHz band has been especially problematic for smaller, rural, and greenfield service providers, such as Vulcan. As the Commission has previously noted, "[b]arriers to entry in the mobile wireless services industry include various regulatory and non-regulatory factors, such as access to spectrum, tower siting policies, large sunk costs for network deployment, and the magnitude of marketing and advertising expenditures on brands and services."[16]

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[15] *See* Press Release, TowerCo, *TowerCo Announces Tower Purchase Agreement* (rel. Oct. 18, 2012).

[16] Wireless Telecommunications Bureau Seeks Comment on the State of Mobile Wireless Competition, WT Docket No. 11-186, *Public Notice*, DA 11-1856 (rel. Nov. 3, 2011).

Consumer demand for mobile handsets and devices is foremost among those barriers to entry. Indeed, mobile devices "directly affect the quality of a consumer's mobile wireless experience, and, hence, they factor into a consumer's choice of a wireless provider."[17] As a result, an entrant's "portfolio of handsets and devices may be a significant non-price factor affecting its ability to compete for customers."[18]

This consideration might have been less of a factor if there were few rural or greenfield licensees in the Lower 700 MHz A Block. But that is not the case. As the Commission has already acknowledged, a significant number of smaller, rural, and regional licensees hold Lower 700 MHz A Block spectrum, all of whom have been adversely impacted by the lack of interoperability.[19] This lack of interoperability has diminished the value of the Lower 700 MHz spectrum, which has ideal propagation characteristics for rural deployment.

Notwithstanding the obvious benefits to greenfield providers, an interoperability solution would benefit all wireless service providers. As such, the Commission has a "longstanding interest in promoting the interoperability of mobile user equipment in a variety of contexts as a means to promote the widest possible deployment of mobile services, ensure the most efficient use of spectrum, and protect and promote competition."[20]

Even AT&T has espoused the benefits of interoperability. For example, during an interview at the Mobile World Congress in November of last year, Randall Stephenson, Chief Executive Officer of AT&T Inc., stated as follows:

> [H]istory has shown that we have to make all of these networks, we have to make all of these operating systems, interoperable. And so to the extent that we can get more openness, more seamlessness, more interoperability among network providers, among apps, among OSs and devices, then the bigger we make this pie, we cause this thing to grow much faster and make it a much more pervasive part of business and society.[21]

Likewise, J.R. Wilson, Vice President of Partnerships and Alliances for AT&T Mobility, has advocated for improved interoperability and compatibility "to deliver a more secure and seamless experience to all end users by driving common specifications across [the Wi-Fi] ecosystem."[22]

**<u>Interoperability Can Be Achieved in the Lower 700 MHz Band at Minimal Cost</u>**

As set forth in the following table, the potential costs of implementing an interoperability solution are minimal. Vulcan has consulted with several engineering consultants, network engineers, and

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[17] Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, WT Docket No. 10-133, *Fifteenth Report*, FCC 11-103 ¶ 65 (rel. June 27, 2011).

[18] *Id.*

[19] Promoting Interoperability in the 700 MHz Commercial Spectrum, WT Docket No. 12-69, *Notice of Proposed Rulemaking*, FCC 12-31 ¶ 22 (rel. Mar. 21, 2012).

[20] *Id.* ¶ 5 n.5

[21] CNBC On-Air Interview of Randall Stephenson, Chief Executive Officer, AT&T Inc. (November 2012), *available at* https://www.dropbox.com/s/6k820ca89c0boff/RandellStevesonMWC.wmv (at the 1:30 mark).

[22] *See* Informa Telecoms & Media, WBA Wi-Fi Industry Report: Global Trends in Public Wi-Fi 4-5 (2012), *at* http://www.informatandm.com/wp-content/uploads/2012/11/WBA_final-pdf.pdf.

chipset consultants to confirm the potential costs set forth below, including those relating to network hardware, network software development, network software testing, network software implementation, device hardware, device software development, and device software testing and qualification. In sum, Vulcan estimates that a large Band Class 17 operator would incur an expense of less than $2 million to achieve interoperability by adopting Band Class 12 as a single, unified band class within the next twelve to eighteen months.

| Category | Explanation | Cost |
|---|---|---|
| Network Hardware | An interoperability solution would not give rise to any additional network hardware costs for wireless carriers. Modifying a Band Class 17 base station to support Band Class 12 is purely a matter of software, and no hardware modifications would be required. Moreover, since the use of Band Class 12 would not pose any interference risk to Lower B and C Block operations, no additional base stations would be required to mitigate interference. | $0 |
| Network Software Development | The network software costs to achieve interoperability would be low, and require only a one-time software development effort to add the multi-frequency band indicator ("MFBI") feature to the Band Class 17 operator's software load. This MFBI software feature would involve adding support of additional fields to the broadcast control channel, with minimal development effort. Vulcan estimates that the cost to develop the MFBI feature would be less than $1 million. | <$1 million |
| Network Software Testing | The cost of testing base stations equipped with the network MFBI software feature to ensure the accurate operation with legacy Band Class 17 devices and new Band Class 12 devices would also be less than $1 million. | <$1 million |
| Network Software Implementation | Network software implementation involves the deployment of the new MFBI feature as part of a regularly scheduled software update to the network infrastructure. Operators typically upgrade LTE base stations to new software releases once or twice per year. By bundling the MFBI feature into a regularly scheduled release, wireless carriers would incur no additional network implementation costs to deploy MFBI capabilities. | $0 |
| Device Hardware | Lower 700 MHz licensees would incur no additional costs to procure devices supporting a unified band class across the Lower A, B and C Blocks. The only device hardware components which are different in a Band Class 12 device are the duplexer and receive filters. These hardware components replace the pin-compatible Band Class 17 components. With the same purchasing scale going forward, hardware costs would not increase following interoperability. | $0 |
| Device Software Development | Interoperability would yield no additional costs in connection with device software. Rather, chipset manufacturers would need to only bundle Band Class 12 software into the overall software build for the operator going forward. In the case of a Band Class 17 operator, this would involve a switch of the Band Class 17 module for Band Class 12 software module. Chipset manufacturers such as Qualcomm have already written the software code to support both band classes. Consequently, the net cost of providing a software load for new devices supporting Band Class 12, instead of Band Class 17, would be zero for a chipset provider such as Qualcomm. | $0 |
| Device Software Testing & Qualification | Minimal costs would be required to test and validate the MFBI feature functionality in devices. At an estimate of less than $1,000 per device platform, the net increase in device software testing would be a small percentage of the carrier's overall device-related cost. Until the legacy Band Class 17 devices migrate off of the system, each new device platform may sustain a minor increase of $1,000 to the software testing cost to validate MFBI support. However, when Band Class 17 devices are fully retired, the MFBI feature would no longer be required and this incremental cost would be eliminated. | $1,000 per device platform |

Vulcan has also reviewed and has confirmed with its outside consultants that the potential costs of adopting a "dual band" solution to restore interoperability, as summarized by U.S. Cellular in its

recent ex parte,[23] appear to be reasonable and consistent with industry practice. U.S. Cellular's approach moves the effort of achieving interoperability into the device software by requiring both Band Class 12 and Band Class 17 to be supported on the same chipset ports. This approach to sharing ports and RF components overcomes Qualcomm's earlier claims that interoperability would be difficult to implement because of the chipset limitation of two low-frequency bands.[24] With U.S. Cellular's approach, the second set of low-band ports on the chipset would be available to serve the cellular band. As noted by U.S. Cellular, AT&T may incur modest integration testing costs to validate the dual band solution in future devices. However, this increase would be a short-term cost. When legacy Band Class 17 devices naturally migrate off of the AT&T system in a few years, AT&T can avoid this minor testing cost increase over the long term through a flash cut to Band Class 12.

In view of the foregoing, Vulcan asks the Commission to act promptly in this proceeding and require the restoration of interoperability as soon as possible, with an effective date within the next twelve to eighteen months.

Respectfully submitted,

*/s/ Michele C. Farquhar*

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[23] *See* Ex Parte Letter from Grant Spellmeyer, Executive Director – Federal Affairs and Public Policy, U.S. Cellular, to Marlene H. Dortch, Secretary, Federal Communications Commission (Jan. 24, 2013).
[24] *See* Comments of Qualcomm Incorporated, WT Docket No. 12-69 at 59-60 (filed June 1, 2012).