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**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENTS 86 THROUGH 121**

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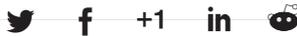
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T-Mobile's rules for radicals



By Brad Reed (<http://bgr.com/author/brad-reed/>) on Jan 8, 2014 at 2:20 PM
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I have no idea if T-Mobile (<http://bgr.com/tag/t-mobile>) CEO John Legere has ever read Saul Alinsky's Rules for Radicals (http://en.wikipedia.org/wiki/Rules_for_Radicals)... but he's sure acting like he has. Rules for Radicals, if you don't know, was manifesto written by left-wing community organizer Saul Alinsky and has acted as sort of a handbook for political activists. The politics of the book itself are irrelevant, however, because its core insights can be applied to the business world as well as the political world.

Once you skip past a lot of the political jargon, Rules for Radicals is basically a book about how smaller groups with fewer resources successfully win public relations battles against larger groups with more resources. I promise I won't make this into one of my undergrad political science classes but there are three "rules" that really stand out for me when thinking about what T-Mobile has been doing to AT&T in recent months: "Whenever possible, go outside the expertise of the enemy"; "ridicule is man's most potent weapon"; and "pick the target, freeze it, personalize it, and polarize it."

How does this apply to T-Mobile's strategy? Well, it's picked [AT&T](http://bgr.com/tag/att) (<http://bgr.com/tag/att>) as its target to ridicule and it's choosing to make the company look ridiculous by making it go outside of its comfort zone.

On the surface this doesn't sound revolutionary since underdog companies have used ridicule to bash established players in ads for years — recall Apple's "I'm a Mac / I'm a PC" campaign against Microsoft and Samsung's campaign making fun of Apple fans if you need examples. But there's a performance art aspect to Legere's

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tactics that makes them much more brazen, in-your-face and, dare I say it, radical than your typical television ad.

Take Legere's decision to crash AT&T's CES party this week. When AT&T reps learned that Legere was at the party, they could have done one of two things. First, they could have let him stay at the party, which meant he would have taken a bunch of goofy pictures of himself standing next to top AT&T honchos and posted them on Twitter. This would have been good for a few laughs at AT&T's expense but it also would have shown that AT&T is a good sport that isn't afraid to let its competitor poke fun at it.

Instead, however, AT&T decided to act like a stuffy, humorless corporate behemoth and toss Legere out of the party (<http://bgr.com/2014/01/07/att-ces-party-john-legere-crash/>). What's more, its actions increased the chance that Legere's decision to crash the party would draw headlines from tech publications, which is exactly what happened.

All of T-Mobile's actions are similarly geared toward making AT&T reactive and uncomfortable. Because he's the head of T-Mobile, a carrier that has traditionally been a second-rate player with a reputation for shoddy service, Legere can act much less professionally than AT&T executives can and can pull off zany stunts like his party-crashing endeavor without looking like a complete jerk.

What's more, Legere and T-Mobile don't face the same intense pressure from Wall Street to deliver sky-high operating margins that Verizon and AT&T do — rather, their investors are for now just happy to see the company is actually improving its market share position. This means T-Mobile can be much more aggressive with its pricing policies and can toss out wireless industry staples such as service contracts and data caps that help the bottom line but that also annoy subscribers.

Doing all this has forced AT&T to play outside of its comfort zone and the company so far has reacted with what can only be described as panic. I honestly never would have thought that AT&T would make a \$200 offer specifically to T-Mobile subscribers to switch carriers based on nothing but a rumor... but that's exactly what it did this week (<http://bgr.com/2014/01/03/att-t-mobile-450-dollar-offer/>).

I'm not sure exactly what AT&T should do to combat Legere's constant barrage against it but the carrier's public relations team could do much worse things this weekend than curling up with a copy of Saul Alinsky writings. Otherwise they'll find themselves making the same sorts of mistakes that other targets have always made when confronting populist insurgencies.

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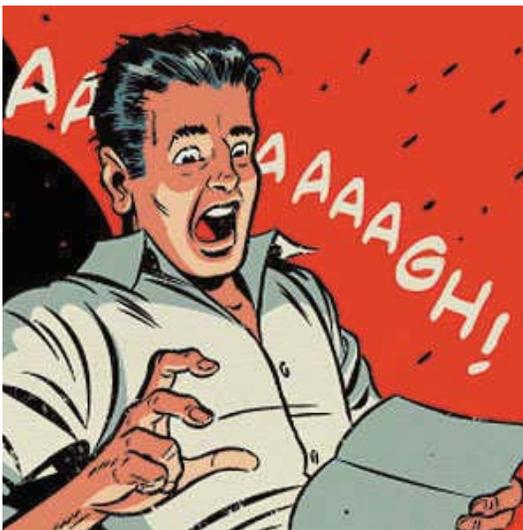
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T-Mobile has asked the Federal Communications Commission to investigate AT&T's "artificially high roaming rates" charged when its customers travel outside of T-Mobile's home service area.

T-Mobile is heavily reliant on AT&T for roaming service outside of major cities and the country's smallest national wireless carrier [complains AT&T is using their market power to put it at a major disadvantage](#), which could force new limits on roaming access in some areas.

T-Mobile provided examples of the damage already done by AT&T's roaming rates:

"Limitless Mobile has severely restricted its customers' access to AT&T's network 'for the sole reason that AT&T's data roaming rates are too high and by continuing roaming access, Limitless could not maintain a commercially competitive retail wireless data offering to the general public,'" T-Mobile told the FCC.

The Rural Wireless Association noted that competing carriers "cannot sustain the provision of data roaming services if [they] must provide that service at a loss."

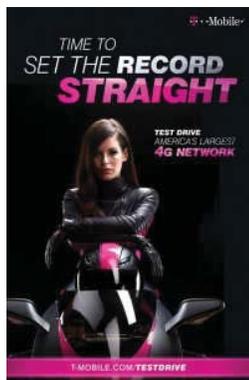
The problem of data roaming rates is getting larger as carrier agreements are due for renewal at many mobile providers. Independent cellular companies are finding AT&T unwilling to renew at prices and terms comparable to their existing contracts. Instead, they face renewal rates that average a minimum of 10 and as much as 33 times higher than the national carriers' retail rates.

For example, T-Mobile's agreement with AT&T includes a data roaming rate that is now 150 percent higher than the average
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domestic rate that T-Mobile pays for data roaming.

This is one thousand percent higher than the data roaming rate negotiated between Leap Wireless and MetroPCS prior to their respective acquisitions, wrote T-Mobile.

With the stark price increases, carriers have begun imposing limits, including speed throttling and data caps, on customers when roaming on AT&T's network.



Because of AT&T's artificially high roaming rates, T-Mobile wireless customers roaming in South Africa have a better user experience than customers roaming on AT&T's network in South Dakota, argues T-Mobile. Their speed is twice as fast, and their data usage is unlimited.

T-Mobile is asking the FCC to intervene by establishing some type of standard about what constitutes "commercially reasonable" roaming rates as part of its 2011 Data Roaming Order, designed to protect competition.

This year, carriers dependent on Verizon Wireless or AT&T to help deliver "nationwide coverage" are negotiating roaming access to the companies' 4G LTE networks for the first time. Most roaming agreements used to only cover 3G service, delivered at a slower speed.

If carriers like Sprint and T-Mobile are unable to negotiate fair terms, both companies will be at a major competitive disadvantage, relegated to providing only regional coverage or charging higher prices for roaming service.

AT&T vice president of regulatory affairs Joan Marsh said T-Mobile's request [bordered on being illegal](#), in direct violation of the Telecommunications Act. Marsh argued T-Mobile and other carriers should be incentivized to build their own networks instead of relying on cheap roaming access from companies like AT&T. Marsh added any move by the FCC to set rates or benchmarks would be beyond the FCC's mandate. Wireless carrier rates are deregulated and not subject to common carrier regulation.

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PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 88**

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)
)
Reexamination of Roaming Obligations of) WT Docket No. 05-265
Commercial Mobile Radio Service)
Providers and Other Providers of Mobile)
Data Services)

**COMMENTS OF CELLULAR SOUTH, INC.
ON PETITION FOR EXPEDITED DECLARATORY RULING
FILED BY T-MOBILE USA, INC.**

Cellular South, Inc. (d/b/a C Spire Wireless) (“C Spire”), by its attorneys and pursuant to Section 1.2(b) of the Commission’s Rules,¹ hereby respectfully submits these Comments on the petition for expedited declaratory ruling filed by T-Mobile USA, Inc. (“T-Mobile”) in the above-referenced docket.² The requested ruling would provide guidance and clarification regarding the criteria used to determine whether the terms of a data roaming agreement meet the “commercially reasonable” standard prescribed in Section 20.12(e) of the Commission’s Rules.³

I. INTRODUCTION.

Competitive mobile wireless carriers are facing substantial difficulties in their efforts to provide seamless data services to their customers. These difficulties largely stem from carriers’

¹ 47 C.F.R. § 1.2(b).

² T-Mobile, Petition for Expedited Declaratory Ruling Regarding Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services, WT Docket No. 05-265 (filed May 27, 2014) (“Petition”).

³ 47 C.F.R. § 20.12(e) (providing that wireless carriers are required to offer data roaming arrangements to other providers “on commercially reasonable terms and conditions”). *See Wireless Telecommunications Bureau Seeks Comment on Petition for Expedited Declaratory Ruling Filed by T-Mobile USA, Inc. Regarding Data Roaming Obligations*, Public Notice, DA 14-798 (June 10, 2014).

inability to evaluate the commercial reasonableness of proposed terms and conditions for data roaming agreements, and these difficulties will likely become even more acute until the Commission takes expeditious action to clarify the commercial reasonableness standard and to ensure the realization of its data roaming goals.

The Commission acted in 2011 to promote the widespread availability of data roaming capabilities, in order to advance its goal of ensuring that all Americans have access to competitive broadband mobile data services.⁴ Now, three years later, it is clear that this goal is slipping beyond reach, in spite of the Commission's efforts in the *Data Roaming Order* to construct a workable data roaming standard.

Data roaming arrangements are critically important to wireless carriers because of the increasing consumer demand for mobile data services.⁵ As C Spire has explained, “consumers who are relying on mobile data services in growing numbers also expect that these data services will work whether at home or outside their carrier’s home market area.”⁶ All carriers—and especially competitive wireless carriers—must have access to data roaming on commercially reasonable terms to meet the basic consumer demand for seamless data services.

⁴ See *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, WT Docket No. 05-265, Second Report and Order, 26 FCC Rcd 5411 (2011) (“*Data Roaming Order*”), *aff’d sub nom. Cellco Partnership v. FCC*, 700 F.3d 534 (D.C. Cir. 2012). On June 25, 2014, the Chief of the Wireless Telecommunications Bureau issued an Order on Reconsideration denying a petition for reconsideration of the *Data Roaming Order*, which was filed by Blanca Telephone Company four years ago, and which sought reconsideration of the Commission’s decision not to adopt a uniform time limit or “shot clock” for all data roaming negotiations. *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, WT Docket No. 05-265, Order on Reconsideration, DA 14-865 (WTB June 25, 2014).

⁵ See Petition at 3.

⁶ Comments of Cellular South, Inc., WT Docket No. 05-265 (filed June 14, 2010) (“C Spire 2010 Comments”), at 13 (internal quotation marks omitted).

Reliable access to data roaming, however, is frustrated by a dysfunctional marketplace in which AT&T and Verizon Wireless (the “Big Two” national wireless carriers)—which are “must-have” roaming partners for many other wireless providers—are asserting their dominant market power and exploiting to their advantage the lack of clarity in the Commission’s “commercially reasonable” data roaming standard.

The fact that market power and anti-competitive incentives are trumping the Commission’s efforts to “promote consumer access to nationwide mobile broadband service”⁷ is a compelling reason for Commission action. T-Mobile has presented a persuasive case for the steps the Commission should take, demonstrating that its proposals to clarify application of the “commercially reasonable” standard will serve to enhance the effectiveness of the data roaming rule.

II. DISCUSSION.

Market failures continue to frustrate the Commission’s data roaming goals today—three years after the *Data Roaming Order* was adopted. C Spire supports T-Mobile’s proposed clarifications of the “commercially reasonable” standard for data roaming agreements because the clarifications will provide greater opportunity for competitive wireless carriers to obtain data roaming agreements and provide the seamless data services wireless customers demand.

A. Competitive Wireless Carriers Are Thwarted in Their Efforts To Obtain Commercially Reasonable Data Roaming Agreements with the Big Two National Wireless Carriers.

As T-Mobile observes, cellular carriers will likely always need data roaming on commercially reasonable terms in order “to offer customers the widest possible coverage footprint.”⁸ The

⁷ *Data Roaming Order*, 26 FCC Rcd at 5411 (para. 1).

⁸ Petition at 3 (footnote omitted).

problem is that the lack of a competitive market in many areas is crippling carriers' efforts to obtain data roaming on commercially reasonable terms.

C Spire identified this problem four years ago, explaining that the seamless use of mobile services was eroding because, as the large national carriers continued to consolidate their holdings and gain more and more sizable market share, their need for roaming arrangements with other carriers, particularly competitive wireless carriers, was diminishing.⁹

C Spire argued that, if the Commission was not successful in promulgating an effective data roaming mandate, "this consolidation and the burgeoning market power of the large carriers" would enable them to continue to decline to enter into data roaming agreements with competitive wireless carriers, or to offer arrangements at unreasonable rates and with unreasonable terms and conditions.¹⁰

The Commission attempted in the *Data Roaming Order* to curb the effects of these alarming market failures by requiring carriers to negotiate and implement data roaming agreements with commercially reasonable terms and conditions, noting that the rule it adopted:

includes the ability to offer individualized, commercially reasonable terms, including rates, and to evaluate a number of factors on a case-by-case basis in determining commercial reasonableness. We find that this approach strikes the best balance between concerns over the potential for congestion or other harms from roaming traffic and the significant benefits that data roaming arrangements can provide to consumers.¹¹

Unfortunately, real-world industry experience during the three years since the *Data Roaming Order* was adopted demonstrates that this approach for ensuring commercially reasonable terms and

⁹ C Spire 2010 Comments at 17.

¹⁰ *Id.* at 18.

¹¹ *Data Roaming Order*, 26 FCC Rcd at 5424 (para. 23).

rates is not working. The marketplace problems that C Spire and other parties described four years ago continue to worsen.

As T-Mobile explains, competitive carriers continue to face exclusionary actions by AT&T and Verizon, including the denial of data roaming agreements on commercially reasonable terms and conditions. AT&T and Verizon account for approximately 67 percent of all wireless service revenues, they have substantial spectrum holdings,¹² and “[t]his market dominance is only expected to increase as the two largest carriers continue to purchase substantial spectrum assets through piecemeal transactions and enter into arrangements to acquire their competitors.”¹³

The problem currently gripping the data roaming marketplace has been succinctly described by Youghioghny Communications, which has explained that “[t]he structural dynamic of the roaming market leaves AT&T and Verizon, which have the most ubiquitous coverage, in a position to dictate roaming terms. They can and do charge whatever they want because there are no practical alternatives for most carriers in many areas.”¹⁴

B. Clarifications of the “Commercially Reasonable” Standard Proposed by T-Mobile Will Better Ensure That the Data Roaming Rule Provides Consumer Benefits and Enhances Competition as the Commission Intended.

As T-Mobile explains, the Commission had the foresight in the *Data Roaming Order* to provide a framework for revisiting its decisions and taking additional action. The Commission

¹² Petition at 7 (citations omitted).

¹³ *Id.* (footnote omitted).

¹⁴ Letter from Donald J. Evans, Fletcher, Heald & Hildreth, P.L.C., Counsel to Youghioghny Communications, LLC, to Marlene H. Dortch, FCC, WT Docket No. 13-193 (filed Feb. 3, 2014), at 2, *quoted in* Petition at 18.

announced its commitment to monitor developments in the commercial broadband data marketplace,¹⁵ and it invited parties to file declaratory ruling petitions to resolve controversies concerning the data roaming rule.¹⁶ Continuing and worsening marketplace failures make additional Commission action necessary, and C Spire strongly supports the actions proposed by T-Mobile.

Benchmarks.—C Spire endorses T-Mobile’s view that the Commission should adopt prospective guidance “to provide necessary clarity in individualized negotiations and to help parties better evaluate the commercial reasonableness of offered terms and to reach agreements.”¹⁷ Given the fact that a prominent barrier faced by competitive wireless carriers seeking data roaming agreements is the excessive, anti-competitive rates being imposed by must-have roaming partners, the four rate benchmarks proposed by T-Mobile are urgently needed to provide this guidance.

■ *Retail rates.*—C Spire agrees with T-Mobile that retail mobile data pricing should serve as a “natural benchmark” for wholesale mobile data rates.¹⁸ The current problem is that the wholesale roaming rates of must-have roaming partners “are intended to, and have the effect of, keeping retail data rates unnecessarily high for the wireless customers of competitors.”¹⁹ To curb this anti-competitive pricing, the Commission should adopt a benchmark based on a public interest policy that it is not commercially reasonable for a roaming partner to impose wholesale roaming rates that are substantially higher than retail rates charged to consumers.

¹⁵ *Data Roaming Order*, 26 FCC Rcd at 5427 (para. 27); *see* Petition at 4.

¹⁶ *Data Roaming Order*, 26 FCC Rcd at 5412 (para. 2); *see* Petition at 4.

¹⁷ Petition at i.

¹⁸ *Id.* at 12.

¹⁹ *Id.* *See* Cellular South Reply Comments, WT Docket No. 05-265, filed Nov. 28, 2007, at 2 (noting that “[l]arge carriers can and do frustrate market actions by refusing to negotiate roaming agreements and by only offering roaming agreements at exorbitant rates”).

■ *Rates charged to foreign carriers.*—Comparing rates for foreign carriers to wholesale roaming rates for other carriers would be probative because foreign carriers have the benefit of a relatively competitive market for wholesale roaming in the U.S. As T-Mobile explains, since foreign carriers generally do not compete for customers in the U.S., there is little incentive for the Big Two carriers to raise data roaming costs for these carriers.²⁰

■ *Rates charged to Mobile Virtual Network Operators.*—C Spire agrees with T Mobile that examining whether a wholesale roaming rate substantially exceeds prices paid by Mobile Virtual Network Operator (“MVNO”) customers for wholesale data services would be instructive, because providing data services to MVNOs is similar to providing data roaming services. As T Mobile explains, in both cases the network service provider “is allowing another operator’s customers to use its network to retrieve and deliver data.”²¹

■ *Rates charged by other carriers.*—C Spire agrees that the reasonableness of a roaming rate proposed in a negotiation should be measured against other competitively negotiated wholesale roaming rates. T-Mobile points out, for example, that AT&T’s rate charged to T-Mobile for data roaming is “very high . . . when compared to the rates that other carriers charge T-Mobile for data roaming.”²² In C Spire’s view, the benchmark proposed by T-Mobile would help to clarify whether such a pricing practice of a must-have roaming partner is commercially reasonable.

Clarifying the Build-Out Factor.—One of the non-exclusive factors the Commission adopted in the *Data Roaming Order* for purposes of applying the commercial reasonableness test

²⁰ Petition at 14.

²¹ *Id.* at 15.

²² *Id.*

is “the extent and nature of providers’ build-out”²³ C Spire agrees with T-Mobile that the Commission should clarify that this factor does not permit host carriers to deny roaming, or impose commercially unreasonable terms, in cases in which a requesting carrier has substantially built out its facilities but does not cover a particular area.²⁴

The factor adopted by the Commission is useful in preventing carriers with very limited networks (or with no networks) from utilizing data roaming agreements to “piggyback” on other carriers’ networks. On the other hand, C Spire supports the argument that the factor should not penalize carriers that have built out their networks, but have refrained from building out facilities in discrete areas because of the considerations referenced by T-Mobile, including significant build-out costs, zoning limitations, the inability to recover investments, or other similar factors.²⁵

Existing and Future Agreements.—The Commission, seeking to discourage frivolous claims challenging the commercial reasonableness of terms and conditions in a signed data roaming agreement, indicated in the *Data Roaming Order* that it “will presume in such cases that the terms of a signed agreement meet the reasonableness standard”²⁶ C Spire supports T-Mobile’s proposal that the Commission should clarify that this presumption does not apply in the case of future data roaming agreements or proposed agreements.

Competitive wireless carriers, even after adoption of the *Data Roaming Order*, continue to face the prospect of having no alternative other than to sign data roaming agreements with must-have roaming partners that impose “the highest possible prices on terms highly unfavorable to”

²³ *Data Roaming Order*, 26 FCC Rcd at 5453 (para. 86).

²⁴ Petition at 22.

²⁵ *See id.*

²⁶ *Data Roaming Order*, 26 FCC Rcd at 5451 (para. 81).

the competitive wireless carrier involved.²⁷ It would be unreasonable and contrary to the Commission’s data roaming policies for the presumption established in the *Data Roaming Order* to be construed as permitting the rates and terms incorporated in these existing agreements to “be used to judge the commercial reasonableness of future agreements.”²⁸ C Spire agrees with T-Mobile that such an interpretation “could essentially gut the ‘commercially reasonable’ standard by effectively extending the past exercise of market power to future arrangements.”²⁹

The Commission’s Authority.—C Spire’s previous argument that “adoption of a data roaming mandate is well within the Commission’s authority established in Title III of the [Communications] Act [of 1934]”³⁰ has been validated by the U.S. Court of Appeals for the D.C. Circuit,³¹ and C Spire agrees with T-Mobile that the declaratory ruling sought by T-Mobile also is encompassed within the Commission’s broad spectrum management authority under Title III.³²

Moreover, C Spire supports T-Mobile’s analysis that its proposed clarifications of the “commercially reasonable” standard do not constitute common carrier regulation because the clarifications would not interfere with the ability of mobile data service providers to negotiate the terms and prices of data roaming agreements on an individualized basis.³³ Finally, C Spire believes

²⁷ Petition at 18.

²⁸ *Id.* at 19.

²⁹ *Id.* at 20.

³⁰ C Spire 2010 Comments at 4 (footnote omitted).

³¹ *Cellco Partnership v. FCC*, 700 F.3d at 537 (holding that “Title III of the Communications Act of 1934 plainly empowers the Commission to promulgate the data roaming rule”), *cited in* Petition at 23.

³² Petition at 24.

³³ *Id.* at 25-27.

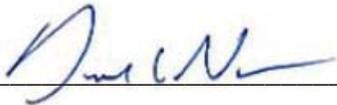
that T-Mobile is correct in arguing that the benchmarks it proposes “would not amount to ‘pre-scriptive’ regulation of data roaming rates.”³⁴

IV. CONCLUSION.

For the reasons discussed above, Cellular South, Inc. (d/b/a C Spire Wireless) respectfully requests the Commission to grant the petition for expedited declaratory ruling submitted by T-Mobile USA, Inc., and to adopt the clarifications to the “commercially reasonable” data roaming standard proposed by T-Mobile in its petition.

Respectfully submitted,

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July 10, 2014

³⁴ *Id.* at 27 (footnote omitted).

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 89**

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

)	
In the Matter of)	
)	
Reexamination of Roaming Obligations of)	WT Docket No. 05-265
Commercial Mobile Radio Service Providers and)	
Other Providers of Mobile Data Services)	
)	

**COMMENTS OF NTELOS HOLDINGS CORP. IN SUPPORT OF PETITION FOR
EXPEDITED DECLARATORY RULING OF T-MOBILE USA, INC.**

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July 10, 2014

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**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

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In the Matter of)	
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Reexamination of Roaming Obligations of)	WT Docket No. 05-265
Commercial Mobile Radio Service Providers and)	
Other Providers of Mobile Data Services)	
)	

**COMMENTS OF NTELOS HOLDINGS CORP. IN SUPPORT OF PETITION FOR
EXPEDITED DECLARATORY RULING OF T-MOBILE USA, INC.**

NTELOS Holdings Corp. (“NTELOS”),¹ by its attorneys, hereby respectfully submits these comments in support of the *Petition for Expedited Declaratory Ruling* filed by T-Mobile USA, Inc. in the above-captioned proceeding (the “Petition”).² NTELOS joins T-Mobile in urging the Commission to issue clarifying guidance to assist all wireless carriers in determining whether the terms of any given data roaming agreement or proposal are “commercially reasonable,” as intended by the 2011 *Data Roaming Order*.³ In support, the following is respectfully shown:

¹ For purposes of these Comments, the term “NTELOS” refers to NTELOS Holdings Corp. and all of its FCC-licensed subsidiaries.

² *Petition for Expedited Declaratory Ruling of T-Mobile USA, Inc.* in WT Docket No. 05-265 (filed May 27, 2014) (“*T-Mobile Petition*”). See also *Wireless Telecommunications Bureau Seeks Comment on Petition for Expedited Declaratory Ruling Filed by T-Mobile USA, Inc. Regarding Data Roaming Obligations*, WT Docket No. 05-265, Public Notice, DA 14-798 (rel. June 10, 2014).

³ See generally *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, Second Report and Order, 26 FCC Rcd. 5411 (2011) (“*Data Roaming Order*”), *aff’d sub nom. Cellco P’ship v. FCC*, 700 F.3d 534 (D.C. Cir. 2012).

I. INTRODUCTION AND SUMMARY

NTELOS is a regional provider of high-speed voice and data services to businesses and approximately 468,000 retail subscribers in most areas of Virginia and West Virginia, and select areas of Maryland, Ohio, Kentucky, North Carolina and Pennsylvania. NTELOS' licensed territories have a total population of approximately 9.0 million residents, of which its wireless network covers approximately 6.0 million residents. NTELOS competes in its service areas against the nationwide wireless carriers, and it actively innovates and offers competitive services to its customers.

NTELOS applauds the Commission for seeking comment on T-Mobile's Petition concerning the state of the data roaming market. Access to commercially reasonable data roaming rates is critical to a wireless carrier's – especially a small, mid-tier or regional carrier's – ability to provide competitive services to its customers. In the *Data Roaming Order*, the Commission adopted rules in the hopes that roaming regulations would help level the uneven bargaining power present in roaming negotiations. However, the Commission also recognized that such a lofty goal may not be easily accomplished by these regulations, and therefore reserved the right to take additional action to ensure that such goals were, in fact, achieved.

In these Comments, NTELOS joins T-Mobile in asserting that additional action by the Commission is necessary to fix the broken market for data roaming at commercially reasonable rates that still exists despite the adoption of the *Data Roaming Order*. Namely, wireless carriers are still facing significant challenges with securing commercially reasonable roaming agreements. The continued problems are due, in part, to the continued consolidation of the wireless industry, which has increased the dominance of AT&T and Verizon in several aspects of the wireless market, including wholesale inputs such as roaming. The fact is, many carriers remain unable to obtain data roaming rates on commercially reasonable terms and conditions.

Therefore, NTELOS agrees with T-Mobile that explicit Commission guidance and clarity on the meaning of “commercially reasonable” is needed at this time, and NTELOS supports T-Mobile’s request to establish benchmarks and adopt certain clarifications concerning this standard. Specifically, NTELOS strongly supports the proposed retail benchmark based on a measure of retail price for wholesale mobile data pricing. NTELOS also supports the proposed benchmark to consider rates that facilities-based carriers charge Mobile Virtual Network Operators (MVNOs) for data. With respect to T-Mobile’s proposed benchmark based on rates negotiated with foreign carriers, as well as the benchmark based on other competitively negotiated wholesale rates, NTELOS also agrees that such rates may play an important role in helping to clarify the commercially reasonable standard.

In addition, NTELOS agrees with T-Mobile that certain clarifications relating to roaming are necessary. NTELOS strongly encourages the Commission to clarify that the *Data Roaming Order* presumption that a signed roaming agreement meets the commercially reasonable standard does not apply with respect to future or proposed roaming agreements. NTELOS highlights the fact that roaming negotiations are still taking place on uneven playing fields, and therefore even if an agreement is reached, it cannot be presumed that the agreed roaming rates are reasonable since oftentimes carriers may agree to commercially unreasonable roaming rates in order to ensure proper coverage.

II. THE ABILITY TO PROCURE COMMERCIALY REASONABLE ROAMING AGREEMENTS IS CRITICAL TO WIRELESS CARRIERS' ABILITY TO PROVIDE COMPETITIVE SERVICES TO CONSUMERS

A. Data Roaming Is Critical To Nationwide Coverage

Every wireless carrier, big or small, relies on roaming partners to help create a national footprint.⁴ Indeed, there is not a single mobile wireless provider that has built out its entire licensed service area.⁵ While roaming is important for all wireless carriers, small, mid-tier and regional carriers find this element critical to their ability to provide competitive wireless services to consumers. Simply put, without access to nationwide data roaming, competitive carriers cannot provide competitive services.

The Commission has recognized the critical role that roaming plays for competitive carriers in the wireless ecosystem. In its most recent report on competition in the wireless marketplace, the Commission explicitly recognized that “roaming remains particularly important for small and regional providers with limited network population coverage to remain competitive by meeting their customers’ needs for nationwide service.”⁶ In addition, the Commission has also noted that access to roaming is “particularly important for consumers in rural areas – where mobile data services may solely be available from small rural providers.”⁷

NTELOS agrees that roaming agreements are exceedingly important to providing its customers with a competitive wireless product. NTELOS’ customers have come to expect

⁴ *T-Mobile Petition*, 2.

⁵ *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Sixteenth Report, 28 FCC Rcd. 3700, ¶ 208 (2013) (“*Sixteenth Competition Report*”).

⁶ *Id.*

⁷ *Data Roaming Order*, ¶ 30.

unfettered nationwide wireless service – for a reasonable price. As a regional carrier, NTELOS relies heavily on roaming agreements to provide uninterrupted service to its customers.

NTELOS has a limited spectrum footprint (due in part to nationwide spectrum constraints) and must rely on other carriers in order to provide nationwide coverage; a feature that is table stakes for a competitive wireless provider. NTELOS, like T-Mobile, finds it “unrealistic to expect that [NTELOS] will ever be able to provide 100 percent coverage of the entire United States on its own network alone.”⁸ Therefore, NTELOS, like all wireless carriers, needs the ability to obtain data roaming agreements on commercially reasonable terms and conditions and offer the maximum coverage possible in order to just be competitive in the wireless marketplace.⁹

B. The Data Roaming Order

In recognition of the important role that data roaming plays for all wireless carriers – and the need for reasonable practices surrounding these arrangements – the Commission opened a proceeding to investigate data roaming practices and examine whether there was a need to adopt regulations on roaming agreements. The overwhelming majority of commenters favored adoption,¹⁰ arguing that “given increasing consolidation and other constraints, roaming arrangements for commercial mobile data services at present are often difficult to obtain, and when available, are offered on unreasonable terms and conditions.”¹¹ NTELOS recognized the unequal bargaining power that was present at the data roaming negotiation table, and highlighted

⁸ *T-Mobile Petition*, 3.

⁹ See *T-Mobile Petition*, 3, Mosa Decl. ¶ 5, Farrell Decl. ¶¶ 30-32.

¹⁰ In fact, the only commenters opposing adoption of a data roaming rule were Verizon and AT&T.

¹¹ *Data Roaming Order*, ¶ 11.

the need for “a process at the FCC to resolve roaming questions.”¹² NTELOS further emphasized the role that data roaming played in its business, defining the input as a “critical component needed by virtually every carrier in the industry to be able to compete and expand.”¹³ NTELOS expressed serious concern at the growing level of market concentration in the wireless industry, noting that “[w]here NTELOS was formerly able to negotiate reciprocal roaming agreements with a web of smaller carriers, most of those carriers have disappeared [due to] consolidation of wireless carriers.”¹⁴

The Commission found that it would serve the public interest to adopt a data roaming rule that “require[s] providers of commercial mobile data services to offer data roaming agreements on commercially reasonable terms and conditions.”¹⁵ The Commission recognized that “the availability of data roaming arrangements can be critical to providers remaining competitive in the mobile services marketplace... [as] consumers expect to be able to have access to the full range of services available on their devices wherever they go.”¹⁶ The Commission also expressed concern regarding the unequal bargaining power present in roaming negotiations.¹⁷

¹² Comments of NTELOS Inc., 7 (filed June 14, 2010) (“*NTELOS Data Roaming Comments*”). NTELOS emphasized that due to consolidation in the industry, “NTELOS needs other carriers for roaming but the national carriers no longer need NTELOS – as Verizon has on several occasions reminded NTELOS.” *Id.* at 7.

¹³ Reply Comments of NTELOS Inc., 7 (filed July 12, 2010) (“*NTELOS Data Roaming Reply Comments*”).

¹⁴ *NTELOS Data Roaming Comments*, 7-8.

¹⁵ *Data Roaming Order*, ¶ 13.

¹⁶ *Id.* ¶ 15.

¹⁷ “Consolidation in the mobile wireless industry has reduced the number of potential roaming partners for some of the smaller, regional and rural providers. In addition, this consolidation may have simultaneously reduced the incentives of the largest two providers to enter into such arrangements by reducing their need for reciprocal roaming.” *Data Roaming Order*, ¶ 27.

In adopting the regulations in the *Data Roaming Order*, the Commission wanted to avoid the industry reaching a point where AT&T or Verizon “might halt the negotiations of roaming on their advanced mobile data networks altogether in the future in the absence of Commission oversight.”¹⁸ In addition to seeking to address the broken state of the data roaming market in 2011, the Commission also anticipated that actions may need to be taken in the future if the intended goals of the *Data Roaming Order* were not being fulfilled. First, it noted “the serious risk [that AT&T and Verizon would] not be willing to offer roaming arrangements that cover [4G LTE] networks anytime in the near future, except in very limited circumstances.”¹⁹ Second, the Commission emphasized that it would continue to monitor the development of the marketplace and would “take additional action if necessary to help ensure that our goals in this proceeding are achieved.”²⁰ Here, NTELOS joins T-Mobile in asserting that the time has come for the Commission to take additional necessary action to fix a data roaming market that still fails to function in a meaningful way for competitive carriers, and as a consequence, consumers.

C. Despite Adoption Of The *Data Roaming Order*, Wireless Carriers Face Significant Challenges With Securing Commercially Reasonable Roaming Agreements

The concerns NTELOS expressed regarding data roaming and the future of the wireless industry were submitted to the Commission almost exactly four years ago. Unfortunately, despite the adoption of the *Data Roaming Order* in 2011, the circumstances surrounding data roaming have become even worse. The most recent wireless competition report concluded that “the ability [of providers] to negotiate data roaming agreements on non-discriminatory terms and

¹⁸ *Id.* ¶ 28.

¹⁹ *Id.* ¶ 27.

²⁰ *Id.*

at reasonable rates remains a concern.”²¹ This is due in large part to the continued consolidation of the wireless industry.

Consolidation has led to AT&T and Verizon’s domination of the wireless industry. Viewed together, they have the broadest coverage, the greatest spectrum holdings and most subscribers and revenues in comparison to the rest of the industry. This is in part due to their abundance of resources and ability to out-bid smaller carriers at auctions, but also due to the seemingly-nonstop transactions allowing them to acquire competitors throughout the wireless industry. This domination also transfers into the roaming sector, as Verizon and AT&T’s dominance allows them the ability to act in an anti-competitive way with respect to the critical input of roaming. As rural provider Youghioghenny Communications, LLC (“Youghioghenny”) explained, “in order to have competition [in the roaming market], the first requirement is that there must be competitors, and the current race toward consolidation violates that basic precept.”²² The roaming partner pool is declining at an increasingly alarming rate due to potential partners being swept up by Verizon and AT&T. As these options decrease, so does competition, leaving Verizon and AT&T as almost-required roaming partners through the country. In this powerful position, Verizon and AT&T are now able to dictate roaming rates because they are often the only potential roaming providers in a given area. From this follows the disappearance of reasonable roaming rates. Verizon and AT&T do not offer reasonable roaming rates because they do not have to.

These two largest carriers have enhanced their industry dominance by acquiring numerous competitors through transactions. Many of these “competitors” were small, mid-tier

²¹ *Sixteenth Competition Report*, ¶ 210.

²² *Ex Parte Presentation* filed by Youghioghenny Communications, LLC in WT Docket No. 13-193, 1 (filed Feb. 6, 2014) (“*Youghioghenny Feb. 6 Ex Parte*”).

and regional carriers that cannot obtain the resources to effectively compete with the larger carriers. As recognized by Youghioghney, “[t]he loss of roaming service cripples independent carriers and ultimately drives them into the arms of the majors who have their control of the roaming market to exploit this chokehold.”²³ Former carriers, such as MetroPCS, Allied Wireless, and Leap Wireless have all cited difficulty in obtaining reasonable roaming rates as significant reasons for exiting the market, despite the adoption of the *Data Roaming Order*. MetroPCS explained that “reasonably-priced voice, and particularly data, roaming arrangements have been extremely difficult to obtain, despite the existence of [the FCC data roaming rules]” as a reason for its decision to merge with a nationwide carrier.²⁴ Allied also emphasized the disadvantage it faced by “high and increasing roaming costs.”²⁵ Most recently, Leap Wireless decided to merge into AT&T in part “because the combined company will offer a significantly greater on-net footprint than Leap could possibly hope to obtain.”²⁶

Each of these transactions eliminated a potential “reasonable roaming partner”²⁷ from the marketplace, making it even more difficult for competitive carriers to procure commercially reasonable roaming agreements. As AT&T and Verizon continue to surpass other carriers in terms of spectrum holdings, subscribers and revenues, they continue to lose any incentive they

²³ *Id.* at 5.

²⁴ MetroPCS/T-Mobile Public Interest Statement, 18-19 (Lead File No. 0005446627) (Filed Oct. 18, 2012).

²⁵ Allied Wireless/AT&T Public Interest Statement, 22 (Lead File No. 0005632405) (Filed Feb. 5, 2013).

²⁶ Leap/AT&T Public Interest Statement, 18-19 (Lead File No. 0005860676) (Filed Aug. 1, 2013).

²⁷ Reasonable roaming partners are generally industry participants that “have a reciprocal need to enter into roaming relationships with other competitive carriers in order to fill gaps in their own network” – such as the ones NTELOS formerly worked with as noted above. *See Ex Parte Presentation* filed by Competitive Carriers Association in WT Docket No. 13-193, 3 (filed Jan. 3, 2014) (“*CCA Jan. 3 Ex Parte*”).

might have had enter into a commercially reasonable roaming agreement. Indeed, with each transaction that is approved, the greater the negotiating power of AT&T and Verizon grows, and the smaller the bargaining power of a competitive carrier becomes.

This elimination of competitors has affected the ability of many small, mid-tier and regional carriers to obtain commercially reasonable roaming rates. Certainly, there is no lack of evidence in the record to support this assertion. As the Petition recognized, a recent survey conducted among members of NTCA – The Rural Broadband Association found that the majority of respondents “categorized their experience in negotiating data roaming and in-market roaming agreements with other carriers as moderately to extremely difficult.”²⁸ In addition, Youghioghenny recognized that AT&T and Verizon, with the broadest nationwide coverage, can dictate unreasonable roaming terms for the industry: “[t]hey can and do charge whatever they want because there are no practical alternative for most carriers in many areas.” Furthermore, Youghioghenny has explained that the complaint process offered by the FCC as recourse is not an option as “there is no compelling legal constraint on AT&T’s ability to charge high rates, and then dare smaller carriers to file a complaint.”²⁹

In addition, the Competitive Carriers Association (“CCA”), an association of which NTELOS is a member, has repeatedly informed the Commission of the problems that its members are having in procuring reasonable roaming agreements. CCA has stated on several occasions since the adoption of the *Data Roaming Order* that its members “have been unable to obtain reasonable data roaming rates, particularly for 4G LTE roaming, from the two largest

²⁸ NTCA, *NTCA 2013 Wireless Survey Report*, at 3 (Jan. 2014), available at <http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2013ntcawirelessurvey.pdf>.

²⁹ *Ex Parte Presentation* filed by Youghioghenny Communications, LLC, in WT Docket No, 13-193, 3 (filed Feb. 3, 2014) (“*Youghioghenny Feb. 3 Ex Parte*”).

carriers, AT&T and Verizon.”³⁰ It has recognized that AT&T and Verizon’s “size and dominant power” have allowed them to “effectively hamstring the ability of competitive carriers to compete by refusing to offer data roaming on reasonable terms and conditions.”³¹ And on more than one occasion, CCA has pointed out that the Commission’s prediction in the *Data Roaming Order* had come true – the serious risk that AT&T (or Verizon) would not enter into 4G roaming agreements, is now a reality.³² These actions and other offers to providers of similar services reflect the overall anti-competitive nature of AT&T and Verizon actions with respect to data roaming.

These problems will not fix themselves. Small, mid-tier and regional carriers are still facing significant obstacles in their ability to secure commercially reasonable roaming rates during negotiations set on level playing fields. The *Data Roaming Order* provided a good starting point in establishing the “commercially reasonable” standard, including certain factors and limitations to the rule and a vow to evaluate this standard in the roaming context on a case-by-case basis.³³ However, despite the Commission’s intentions to promote “widespread availability of data roaming capability” by requiring parties to agree to “commercially reasonable terms and conditions,” additional guidance is now needed.³⁴

³⁰ See *Ex Parte Presentation* filed by Competitive Carriers Association in WT Docket No. 13-193, 3 (filed Dec. 12, 2013) (“*CCA Dec. 12 Ex Parte*”).

³¹ See *id.*

³² See, e.g., *id.* 5 (“AT&T currently has no 4G LTE roaming agreements with any other U.S. carrier.”); *CCA Jan. 3 Ex Parte*, 1-2 (“we are not aware of AT&T entering into any 4G LTE roaming arrangements with other U.S. carriers.”).

³³ *Data Roaming Order*, ¶¶ 42-43.

³⁴ *Id.* ¶ 1.

III. COMMISSION GUIDANCE AND CLARITY ON THE “COMMERCIALLY REASONABLE” STANDARD IS NEEDED

As noted above, the *Data Roaming Order* appeared to anticipate that roaming-related issues would continue, despite adoption of the data roaming rules, and the Commission noted its intent to address any petitions for declaratory rulings expeditiously. NTELOS urges the Commission take expeditious action on T-Mobile’s Petition and issue additional guidance and clarity on the “commercially reasonable” standard.

NTELOS has first-hand experience in the world of “commercially reasonable” data negotiations, and has found that numerous offers and negotiations have not resulted in “commercially reasonable” rates. Such commercially unreasonable offers come into sharp focus when compared to retail plans currently offered by nationwide carriers, as well as the underlying cost to provide data service.

For instance, during negotiations with certain potential roaming partners,³⁵ NTELOS was offered data roaming rates ranging from \$0.10 – 0.25 per MB of data, or approximately \$100 - \$250 per GB, a stunningly high price when compared to current rates actually charged by carriers to their retail customers. AT&T is currently charging its retail customers as low as \$7.50/GB for high-data users under a shared data plan.³⁶ AT&T’s shared plan also values smaller amounts of data, such as 10 GB at \$10.00 per GB.³⁷ Verizon similarly offers its retail customers a shared data plan for 10 GB at \$160, or \$16.00/GB (which includes unlimited voice,

³⁵ NTELOS has entered into a strategic network alliance with Sprint pursuant to which, among other things, NTELOS and Sprint provide data roaming services to each other. Because said agreement covers other significant rights and obligations of the parties, including, without limitation, network build out requirements and the exclusive provision of selected wholesale services, such arrangement is not referenced or otherwise considered herein.

³⁶ See AT&T, Mobile Share Value Plans, <http://www.att.com/shop/wireless/data-plans.html#fbid=X9PrR1QMRqJ> (last visited July 9, 2014).

³⁷ See *id.*

so this plan effectively values the voice component at \$ 0.00).³⁸ T-Mobile also points to data demonstrating that both AT&T and Verizon's offers may average out at \$15/GB for retail customers.³⁹ Comparing Verizon and AT&T's retail rates to certain roaming rates offered to NTELOS, the proposed roaming rate is approximately *10 to 25 times higher than what is being charged to retail customers*.⁴⁰

To put this pricing in perspective, Youghioghenny has found, and the T-Mobile Petition highlights, that "data costs no more than \$2.20 - 2.40 per GB to deliver to a wireless subscriber." That estimate is about *50 to 125 times less than what was offered to NTELOS*.⁴¹ NTELOS believes that this practice of offering inflated roaming rates to competitive carriers is quite common. Such an inflated price should certainly not be considered "commercially reasonable" under the Commission's intended definition of the term.

While NTELOS' example provides such a large differential between the offered rate and the retail rate charged by the carrier to its customers that it would be difficult to *not* recognize the unreasonableness of the offer, it is sometimes difficult to evaluate roaming offers, and, therefore, not all carriers may be able to easily distinguish whether offered rates and conditions are

³⁸ See Verizon, The More Everything Plan, <http://www.verizonwireless.com/wcms/consumer/shop/shop-data-plans/more-everything.html> (last visited July 9, 2014).

³⁹ *T-Mobile Petition*, Farrell Decl., ¶ 66, Table 1.

⁴⁰ As noted by T-Mobile, the fact that AT&T offered Leap a "steeply discounted" roaming rate that was negotiated as part of a "break up fee" in the event that the AT&T and Leap deal would be terminated also demonstrates that "the roaming rates currently offered by AT&T are artificially high." *T-Mobile Petition*, 9.

⁴¹ Youghioghenny has noted that "[t]he time-tested measuring rod for assessing the reasonableness of telecom rates is cost, for if a rate in a presumptively competitive market is consistently above costs by a factor of 10, 20 or even 50 fold, there has certainly been a market failure which requires redress." *Youghioghenny Feb. 6 Ex Parte*, 3.

commercially reasonable or not.⁴² This is due in large part to the fact that most roaming agreements and negotiations are confidential, signed under non-disclosure agreements with little to no public data available on current rates or agreements.⁴³ While this practice is understandable due to the nature of the information contained in these agreements, participating parties should be provided some level of clarity or predictability on what is considered commercially reasonable. Therefore, in lieu of a carrier's ability to measure offered rates against (non-existing) public market roaming information, the Commission must offer guidance and additional clarity on the meaning of "commercially reasonable" in the context of data roaming to assist these parties. Industry participants will benefit from additional guidance that focuses on what the term "commercially reasonable" means and what defines the parameters of this standard. Doing so will not only encourage fair practices on the data roaming playing field, but will also assist the Commission in resolving disputes, as well as help avoid potential time-consuming complaints in the future.

IV. NTELOS SUPPORTS T-MOBILE'S REQUEST TO ESTABLISH BENCHMARKS AND CLARIFICATIONS REGARDING THE COMMERCIALLY REASONABLE STANDARD

NTELOS agrees with T-Mobile that establishing certain benchmarks and providing certain clarifications on the commercially reasonable standard can assist the industry in future roaming negotiations. This guidance should encourage a baseline understanding of the

⁴² As CCA has noted, "competitive carrier[s] cannot discern whether the terms and conditions offered by AT&T and Verizon are in line with those offered to other carriers." Competitive Carriers Association, "A Framework for Sustainable Competition in the Digital Age: Fostering connectivity, innovation and consumer choice," WT Docket No. 13-135, 15 (filed Dec. 4, 2013) ("CCA Competition Whitepaper").

⁴³ As Youghioghney has noted, "[t]he hidden rate structure obviously fosters discrimination in rates and also makes it more difficult to determine whether the rates being offered are reasonable." *Youghioghney Feb. 3 Ex Parte*, 2.

commercially reasonable standard and should establish “predictable criteria” surrounding roaming rates and negotiations.⁴⁴ Most importantly, any guidance should be designed to mitigate the effects of the unequal bargaining power that is often present in data roaming negotiations.

Based on its own experience with data roaming negotiations, NTELOS strongly supports T-Mobile’s proposed retail benchmark based on a “suitable measure of retail price” for wholesale mobile data pricing.⁴⁵ Comparing roaming rates to retail rates is a reasonable practice because retail prices are generally set to at least recover costs of providing a service. As T-Mobile’s Senior Vice President, Dirk Mosa states, “the actual cost to provide a megabyte of data to roaming partners mirrors the cost to provide a megabyte for one’s own customers.”⁴⁶ And, as detailed above, NTELOS can attest to roaming rates demanded by potential partners that are “on average, many times higher than the price charged for the same unit of data in even the most expensive retail data plans.”⁴⁷ Therefore, rather than have the potential roaming partner assume that such a rate is commercially reasonable, and the potential home partner disagree, roaming negotiations would benefit from a firm understanding that these proposals would not be considered “commercially reasonable.”

Establishing a benchmark below retail prices would also likely be welcome by competitive carriers due to the ease with which it could be applied. Publicly available retail data, along with a carrier’s own internal data, would easily assist the carrier in evaluating offered rates. Furthermore, the benchmark would be flexible so that when prices of retail rates decline,

⁴⁴ See *T-Mobile Petition*, 11.

⁴⁵ *Id.* at 12.

⁴⁶ See, e.g., *id.* Mosa Decl., ¶ 21.

⁴⁷ *Id.* at 12. See also discussion *supra* Section III.

roaming rates would decline as well.⁴⁸ This benchmark could also substantially decrease the instances of Commission intervention (and amount of FCC time and resources expended) to evaluate these situations on a “case-by-case basis” because the information would be readily available to carriers, better equipping providers to make a determination about whether the offered roaming are commercially reasonable “more consistently and more quickly.”⁴⁹

NTELOS also shares T-Mobile’s concern that in some cases, high wholesale roaming rates “are intended to, and have the effect of, keeping retail data rates unnecessarily high for the wireless customers of competitors.”⁵⁰ As a result T-Mobile explained that it has “been forced to throttle and cap its customers’ ability to roam on [the partner’s] network due to unreasonably high data roaming rates.”⁵¹ NTELOS has also limited its customers’ ability to roam on certain networks. Youghiogeny recognized this problem as well, noting that “[t]he rates charged for roaming are so high that no carrier can profitably afford to let its customers roam on a high cost roaming partner because the roaming charges would quickly exceed the rates paid by the customer to the home carrier.”⁵²

Indeed, if NTELOS had to enter into such an unreasonable roaming arrangement in an attempt to offer competitive services to its customers, it may quickly find itself actually losing

⁴⁸ See, e.g., *T-Mobile Petition*, Mosa Decl., ¶ 21 (noting that “costs to produce a megabyte continue to decline, with 4G/LTE being more efficient than its predecessor technologies... consequently, commercially reasonable rates should also decline over time due to the lower costs associated with the new technologies.”).

⁴⁹ *Id.* at 10. Of course, NTELOS recognizes that there may be situations where such information is not readily available, or other variables exist. Such an understanding further emphasizes the need to establish other benchmarks and/or clarifications to assist in the assessment of offered roaming rates.

⁵⁰ *T-Mobile Petition*, 12.

⁵¹ *Id.* at 13.

⁵² *Youghiogeny Feb. 6 Ex Parte*, 4.

money on any customers that used their devices on such roaming partner's network. For example, at a data roaming cost to NTELOS of approximately \$1 for each song that a customer downloads or streams, it is clear that it would not take many songs before the cost to NTELOS would exceed the entire monthly revenue that it receives from that customer. Video streaming would be even worse by orders of magnitude. This is an undesirable outcome and cannot be what the Commission intended.

Similarly, NTELOS also supports T-Mobile's proposed benchmark to "consider the rates that facilities-based carriers charge Mobile Virtual Network Operators [MVNOs] for data."⁵³ While NTELOS agrees that there are differences between MVNO agreements and roaming agreements, the end result is generally the same: a negotiated agreement that permits an operator's customers to use another operator's network.⁵⁴ Indeed, these rates should be within the same price-point, as the T-Mobile declaration explains, and NTELOS agrees, "there is no reason why the wholesale rates for minutes and megabytes charged to other carriers (*i.e.* roaming) should be so much higher than the wholesale rates for minutes and megabytes charged to MVNOs."⁵⁵ As the Petition reports, T-Mobile's MVNO rates "have been falling over time and that actual average price per MB was below 3 cents by 2013."⁵⁶ Similar to the proposed retail benchmark, this too, should be applied as a baseline – allowing the negotiating parties to have a general sense of a "reasonable" standard when they enter into negotiations. For instance, offering MVNOs significantly cheaper rates (than offered wholesale roaming rates) for similar traffic, such as roaming, should be viewed as presumptively unreasonable by the Commission.

⁵³ *T-Mobile Petition*, 14.

⁵⁴ *See id.* at 15, Farrell Decl., ¶ 82.

⁵⁵ *Id.* at 15, citing Mosa Decl., ¶ 27.

⁵⁶ *Id.* Farrell Decl., ¶ 83.

NTELOS also supports T-Mobile's other two proposed benchmarks. With respect to T-Mobile's benchmark based on "rates that T-Mobile has negotiated with non-affiliated foreign carriers,"⁵⁷ NTELOS recognizes the important role that these rates may play in helping to determine the commercially reasonable standard, and believes that this benchmark should be adopted along with the other benchmarks proposed by T-Mobile. With respect to the benchmark based on the comparison of wholesale roaming rates to other competitively negotiated wholesale roaming rates, NTELOS agrees that this benchmark should be used with caution, as some of the previously negotiated rates may not be commercially reasonable themselves. But, NTELOS also sees value in including this proposed benchmark in the Commission's guidance, because those agreements that are, in fact, commercially reasonable (i.e., a roaming agreement reached between carriers with equal bargaining power) would be extremely helpful comparison going forward.

Finally, in a similar vein, NTELOS strongly encourages the Commission to clarify that the *Data Roaming Order* presumption that a signed roaming agreement meets the commercially reasonable standard "does not apply with respect to *future* agreements or proposed agreements."⁵⁸ Indeed, as described herein, roaming negotiations are currently taking place on an uneven playing field. The unequal market power of the participants results in unequal bargaining power. As a consequence, "the simple fact that an agreement has been reached does not mean that the terms of the agreement can be presumed to be reasonable."⁵⁹ Small, mid-tier and regional carriers have long-recognized the problems surrounding roaming negotiations, but

⁵⁷ *Id.* at 13-14.

⁵⁸ *Id.* at 16-17.

⁵⁹ *Id.* at 17.

at the same time, have all needed roaming agreements to effectively compete in the wireless marketplace. In many instances, carriers have had no other choice but to enter into agreements where they are being charged commercially unreasonable prices to offer a service their customers demand. Such agreements, reached under such unequal circumstances, should not be used to evaluate future agreements. Doing so would only continue to encourage unreasonable roaming rates. Accordingly, NTELOS urges the Commission to adopt the requested clarification.

V. CONCLUSION

Based on the foregoing reasons, NTELOS respectfully requests that the Commission grant T-Mobile's *Petition for Expedited Declaratory Ruling* and provide much-needed guidance and clarity on the "commercially reasonable" standard in the context of data roaming agreements.

Respectfully submitted,

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July 10, 2014

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 90**

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)
)
Reexamination of Roaming Obligations of) WT Docket No. 05-265
Commercial Mobile Radio Service Providers and)
Other Providers of Mobile Data Services)

To: The Commission

**REPLY COMMENTS OF
RURAL WIRELESS ASSOCIATION, INC.**

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SUMMARY

The Rural Wireless Association, Inc. (“RWA”) supports those comments that have been filed in response to T-Mobile USA, Inc.’s petition for expedited declaratory ruling that seek FCC clarification of the criteria to be used to determine whether the terms and conditions of any given wholesale data roaming agreement meet the “commercially reasonable” standard outlined in the Data Roaming Order and codified in Section 20.12 of the Commission’s Rules. All commenters, with the exception of AT&T and Verizon, seek FCC clarification of what is considered “commercially reasonable.”

It is clear from the comments filed in this proceeding that the way in which AT&T and Verizon measure whether a wholesale data roaming rate is “commercially reasonable” is vastly different than the way the rest of the commenters in this proceeding measure commercial reasonableness. Since there is no yardstick to measure the commercial reasonableness of these rates, there are significant problems in the marketplace. These problems include the loss of competition through consolidation and carriers going out of business, the loss of services to rural consumers, and the very real threat of increased retail data rates for rural subscribers to offset carriers’ wholesale data roaming costs.

Verizon and AT&T have taken the position that it is commercially reasonable for them to charge wholesale data roaming rates that are so high as to be unaffordable to rural carriers and their customers. RWA argues the Commission should clarify that wholesale data roaming rates are *per se* commercially unreasonable if they exceed, by any degree, the retail data rate the must-have carrier or requesting carrier charges its retail customers. This clarification would provide the industry with the necessary guidelines to allow for the continued provision of vital nationwide data roaming services to rural Americans.

Verizon and AT&T argue the Commission lacks the authority to clarify what constitutes commercially reasonable terms and conditions. However, the Commission has the regulatory authority under Title III of the Communications Act, of 1934, as amended (the “Act”), which authority has been upheld the D.C. Circuit Court, to impose data roaming obligations on facilities-based providers of commercial mobile data services to other such providers on commercially reasonable terms and conditions, and this authority extends to its ability to clarify these obligations.

It is clear from the comments filed in this proceeding that roaming market players have divergent views on what constitutes commercially reasonable wholesale data roaming terms and conditions. The Commission must clarify the data roaming rule and establish benchmarks the industry can use to determine whether wholesale data roaming rates are commercially reasonable. RWA strongly urges the Commission to clarify that data roaming rates are *per se* commercially unreasonable if they exceed, by any degree, the retail data rate the host carrier or requesting carrier charges its retail customers.

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)
)
Reexamination of Roaming Obligations of) WT Docket No. 05-265
Commercial Mobile Radio Service Providers and)
Other Providers of Mobile Data Services)

**REPLY COMMENTS OF
RURAL WIRELESS ASSOCIATION, INC.**

The Rural Wireless Association, Inc. (“RWA”), by its attorneys, respectfully submits these reply comments in support of those comments supporting the petition for expedited declaratory ruling filed by T-Mobile USA, Inc. (“T-Mobile”).¹ RWA strongly supports those commenters who urge the Commission to provide additional clarification and direction with regard to what constitutes “commercially reasonable” terms and conditions. It should be noted that every commenter, except AT&T and Verizon, agrees that this clarification is needed.²

¹ *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, WT Docket No. 05-265, Petition for Expedited Declaratory Ruling of T-Mobile USA, Inc. (filed May 27, 2014) (“*T-Mobile Petition*”).

² Comments of NTCH, Inc., Flat Wireless, LLC and Buffalo-Lake Erie Wireless Systems Co., LLC, WT Docket No. 05-265 at p. 2 (filed July 10, 2014) (“NTCH Comments”) (the data roaming rule “has ended up having no impact on the roaming marketplace because the ‘commercially reasonable’ standard is toothless, vague and very difficult to enforce”); Comments of NTELOS Holdings Corp. In Support of Petition for Expedited Declaratory Ruling of T-Mobile USA, Inc., WT Docket No. 05-265 (filed July 10, 2014) (“NTELOS Comments”) (strongly supporting adoption of a retail benchmark based on a measure of retail price for wholesale mobile data pricing); Comments of NTCA - The Rural Broadband Association, WT Docket No. 05-265 (filed July 20, 2014) (“NTCA Comments”) (agreeing that guidance is needed to provide clarity in negotiations and help parties evaluate the commercial reasonableness of offered data roaming agreement terms); Comments of PinPoint Wireless, Inc., WT Docket No. 05-265 (filed July 10, 2014) (“PinPoint Comments”) (urging the Commission to take steps to promote transparency and clarity in the roaming marketplace); Comments of Limitless Mobile, Inc., WT Docket No. 05-265 (filed July 10, 2014) (“Limitless Comments”) (lack of clarity and direction from the Commission regarding what constitutes commercially reasonable wholesale

Commercially unreasonable wholesale mobile data roaming rates impact all roaming carriers and consumers across the country. Despite Verizon’s position to the contrary,³ the Commission’s data roaming rules are not working and the roaming market is dysfunctional and must be addressed by the Commission.⁴ The Commission adopted the data roaming rule, which “require[s] providers of commercial mobile data roaming services to offer data roaming arrangements on commercially reasonable terms and conditions, subject to specified limitations....”⁵ The Commission adopted these rules in order to foster investment and innovation in the use of spectrum and the development and deployment of data network facilities

data roaming rates and the imbalance of bargaining power in the market, has hurt competition and drastically reduces consumer choice); Comments of Comptel, WT Docket No. 05-265 at n. 6 (filed July 10, 2014) (“Comptel Comments”) (clarification is needed for determining the commercial reasonableness of proffered terms and conditions, and the “commercially reasonable” standard is too vague to adequately protect the public interest); Comments of Cellular South, Inc. (d/b/a C Spire Wireless), WT Docket No. 05-265 (filed July 10, 2014) (“C Spire Comments”) (competitive mobile carriers face substantial difficulties providing seamless data services to customers due in large part to their inability to evaluate commercial reasonableness of proposed data roaming terms and conditions); Comments of The Blooston Rural Carriers, WT Docket No. 05-265 (filed July 10, 2014) (“Blooston Rural Carriers Comments”) (supports T-Mobile request for clarification, seeks 60-90 day shot clock and notes that rural carriers may face great difficulty in meeting their Mobility Fund public interest obligations if wholesale data roaming rates are not reduced); Comments of Competitive Carriers Association, at p. 2 WT Docket No. 05-265 (filed July 10, 2014) (“CCA Comments”) (“T-Mobile’s proposed benchmarks for assessing whether the data roaming rates are commercially reasonable would provide sorely-needed guidance to the industry...); Comments of Sprint Corporation, WT Docket No. 05-265 (filed July 10, 2014) (“Sprint Comments”) (the Commission must clear up industry confusion regarding implementation of the data roaming rules); Comments of Truphone, Inc. and Truphone Limited, WT Docket No. 05-265 (filed August 11, 2014) (supports T-Mobile’s request for clarification).

³ See Verizon Comments at p.3.

⁴ See *T-Mobile Petition* at p. 10.

⁵ *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, Second Report and Order, 26 FCC Rcd. 5411 at ¶ 13 (rel. April 7, 2011) (“*Data Roaming Order*”); see also 20 C.F.R. § 20.12(e).

and services, competition for mobile broadband business by multiple providers, and the availability of advanced and innovative mobile services with seamless nationwide coverage.⁶

The FCC’s policy objectives have been thwarted by dominant carriers with superior bargaining power who have taken advantage of the confusion surrounding what constitutes “commercially reasonable” data roaming terms and conditions. As a result, competition and rural consumers are suffering. Commercially unreasonable data roaming rates are forcing rural carriers to consider leaving the market or discontinue services to subscribers, are delaying carriers’ deployment of new infrastructure and services to rural America, and will eventually result in higher retail rates for rural consumers. To address these public interest harms, the Commission must clarify what constitutes “commercially reasonable” mobile data roaming terms and conditions.

I. CLARIFYING THE TERM “COMMERCIALLY REASONABLE” AS PROPOSED BY RWA DOES NOT CONSTITUTE COMMON CARRIAGE REGULATION.

RWA disagrees with AT&T’s argument that the clarification requested in T-Mobile’s petition would transform the data roaming rules into common carriage regulation.⁷ Clarifying what constitutes “commercially reasonable” does not remove carriers’ flexibility to negotiate and develop individually tailored agreements. RWA’s requested clarification would describe the maximum wholesale data roaming rate that would be considered “commercially reasonable.” This clarification is clearly needed given the fact that AT&T’s and Verizon’s interpretations of

⁶ *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, Order on Reconsideration and Second Further Notice of Proposed Rulemaking, WT Docket No. 05-265 (rel. April 21, 2010) (“*2010 Order on Reconsideration*”).

⁷ AT&T Opposition at p. 32.

what constitutes commercially reasonable rates, terms and conditions for wholesale data roaming services is so far afield from the rest of the commenters in this proceeding.

The D.C. Circuit Court upheld the Commission finding that the data roaming rule does not relegate mobile data providers to common carrier status. Despite AT&T's argument to the contrary, clarifying what constitutes "commercially reasonable" terms and conditions would not constitute common carrier regulation. Specifically, in response to a challenge by Verizon that the data roaming rule relegates mobile-data providers to common carriers, the court found that:

[i]f a carrier is forced to offer service indiscriminately and on general terms, then that carrier is being relegated to common carrier status. But perhaps more importantly, the Commission has significant latitude to determine the bounds of common carriage in particular cases. Moreover, there is an important distinction between the question whether a given regulatory regime is *consistent* with common carrier or private carrier status, and the *Midwest Video II* question whether that regime *necessarily confers* common carrier status. Accordingly, even if a regulatory regime is not so distinct from common carriage as to render it inconsistent with common carrier status, that hardly means it is so fundamentally common carriage as to render it inconsistent with private carrier status. In other words, common carriage is not all or nothing--there is a gray area in which although a given regulation might be applied to common carriers, the obligations imposed are not common carriage *per se*. It is in this realm--the space between *per se* common carriage and *per se* private carriage--that the Commission's determination that a regulation does or does not confer common carrier status warrants deference. Such is the case with the data roaming rule.⁸

The court found the Commission's data roaming rule falls within this "grey" area, and is not inconsistent with private carrier status because:

the data roaming rule leaves substantial room for individualized bargaining and discrimination in terms. The rule expressly permits providers to adapt roaming agreements to individualized circumstances without having to hold themselves out to serve all comers indiscriminately on the same or standardized terms.

⁸ *Cellco Partnership v. FCC*, 700 F.3d 534, 547 (D.C. Cir. 2012) (internal citations omitted).

Given this... the data roaming rule does ‘not amount to a duty to hold out facilities *indifferently* for public use.’”⁹

While the clarification requested by both T-Mobile and RWA will provide additional guidance to carriers as to what constitutes commercially reasonable wholesale data roaming rates, neither clarification would require carriers to “hold themselves out to serve all comers indiscriminately on the same or standardized terms.” Carriers will continue to have the opportunity to negotiate individual wholesale data roaming agreements, with whatever commercially reasonable terms and conditions the parties deem appropriate given individual circumstances, within the guidelines of ensuring that the wholesale data roaming rates do not exceed, and may include any rate below, the retail data rate the must-have¹⁰ carrier or requesting carrier charges its retail customers.¹¹

RWA agrees with CCA that “the guidance requested in the Petition would still leave substantial room for individualized bargaining and arrangements, and preserve the discretion contained within the language of the rule...”¹² Adopting retail data rates as the benchmark for determining whether wholesale data roaming rates are commercially reasonable, as

⁹ *Cellco*, 700 F.3d at p. 548 (emphasis in original, internal citations omitted).

¹⁰ RWA considers a must-have carrier to be the only wireless carrier that is able to provide the requesting carrier with wireless data roaming services in a market that has significant “map value” to the requesting carrier. “Map value” is used in the wireless industry to describe a service area that adds significant value to a carrier’s network by satisfying the demand of the carrier’s customers. Examples of areas with map value include, but are not limited to, major Interstates; areas covering hundreds of square miles; markets that fill-in a carrier’s doughnut hole-shaped service territory; and rural markets that are immediately adjacent to a carrier’s service territory.

¹¹ This retail data rate could be based on the prevailing nationwide retail data rate, the local data rate, the data rate charged to foreign carriers whose customers roam on a must-have carrier’s network, or the data rate charged to MVNOs.

¹² CCA Comments at p. 9.

recommended by RWA in its Comments in this proceeding,¹³ also leaves substantial room for individual bargaining, negotiation and discretion between roaming partners. However, RWA disagrees with CCA's example for describing how carriers will continue to be able to use their discretion to negotiate individual wholesale data roaming agreements. Specifically, CCA states that "...rural areas are often more costly to serve and therefore carriers serving these areas should be capable of recouping these deployment costs through fair and economically reasonable roaming rates."¹⁴ RWA strongly encourages the Commission to adopt the retail data rate the must-have carrier charges its retail customers as the appropriate benchmark for determining whether the wholesale data roaming rate is *per se* commercially unreasonable, including data roaming services being provided in rural areas.¹⁵ It is safe to assume that the prevailing retail data rates offered to retail customers will properly account for host carriers' costs of providing data services in any market, including in rural areas, and as such, those retail data rates are an appropriate benchmark for determining the commercial reasonableness of the wholesale data roaming rates offered to roaming partners for those exact same data services.

II. TITLE III OF THE ACT PROVIDES THE COMMISSION THE AUTHORITY TO CLARIFY SECTION 20.12 OF THE RULES AND THE CLARIFICATION PROPOSED BY RWA WILL ALLOW INDIVIDUALIZED BARGAINING.

Verizon argues that the FCC does not have the authority under Title III of the Act to clarify what constitutes a commercially reasonable rate stating that because the FCC "elected not to adopt requirements linking voice roaming rates to rates for retail or MVNO services in the

¹³ Comments of the Rural Wireless Association, Inc., WT Docket No. 05-265 at p. 7 (filed July 10, 2014) ("RWA Comments").

¹⁴ CCA Comments at p. 9.

¹⁵ This retail data rate could be based on the prevailing nationwide retail data rate, the local data rate, the data rate charged to foreign carriers whose customers roam on a must-have carrier's network, or the data rate charged to MVNOs. *See* Comments of the Rural Wireless Association, Inc., WT Docket No. 05-265 at ¶ 15 (filed July 10, 2014) ("RWA Comments").

common carrier voice roaming regime, it certainly could not adopt such requirements in a more ‘flexible’ Title III regulatory regime.”¹⁶ The Commission elected not to adopt benchmarks in the voice roaming proceeding because it was not convinced consumers would be harmed by its failure to do so.¹⁷ It is clear from the comments in this proceeding that competition and consumers are being harmed by the Commission’s failure to establish criteria for determining whether wholesale data roaming rates are commercially reasonable. Furthermore, the fact that the Commission elected not to adopt benchmarks in the voice roaming proceeding does not mean the Commission cannot do so here. As discussed above, the Commission has established, and the D.C. Circuit Court has upheld, that the Commission has statutory authority under Title III of the Act to impose data roaming obligations on facilities-based providers of commercial mobile data services to other such providers on commercially reasonable terms and conditions, and this authority extends to its ability to clarify these obligations as requested by T-Mobile and RWA.¹⁸

Specifically, the Commission has found that Section 301 of the Act provides it with the authority to regulate “radio communications” and “transmission of energy by radio.”¹⁹ Section 303 of the Act provides the Commission with “the authority to establish operational obligations for licensees that further the goals and requirements of the Act if the obligations are in the ‘public convenience, interest, or necessity.’”²⁰ The Commission has determined that “reasonable

¹⁶ Verizon Comments at p. 7.

¹⁷ See *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers*, Report and Order and Further Notice of Proposed Rulemaking, 22 FCC Rcd 15817 at ¶ 37 (2007) (“*Voice Roaming Order*”).

¹⁸ *Cellco*, 700 F.3d 534 (“Title III of the Communications Act of 1934 plainly empower the Commission to promulgate the data roaming rule.”).

¹⁹ *2010 Order on Reconsideration* at ¶ 66 citing 47 U.S.C. § 301.

²⁰ *2010 Order on Reconsideration* at ¶ 66 citing 47 U.S.C. § 303 (“stating that if the ‘public convenience, interest, or necessity requires’ the Commission shall ... prescribe such restrictions and conditions, not inconsistent with law, as may be necessary to carry out the provisions of the Act”); *Schurz Communications, Inc. v. FCC*, 982 F.2d 1043, 1048 (7th Cir. 1992)

roaming obligations can serve the public interest by promoting competition, investment, and new entry while facilitating consumer access to ubiquitous service.”²¹ Furthermore, the Commission is obligated to advance the objectives outlined in Section 309(j)(3) of the Act, which include “the development and rapid deployment of new technologies, products and services for the benefit of the public... without administrative or judicial delays; [and] ... efficient and intensive use of the electromagnetic spectrum...”²² In addition, the FCC has found that imposing automatic data roaming obligations is supported by Section 303(g) of the Act, which requires the Commission to “[s]tudy new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest...”²³

Clarifying that wholesale data roaming rates that exceed retail data rates are *per se* commercially unreasonable falls within the FCC’s authority under Title III of the Act. This clarification will give all carriers significant direction with regard to their negotiations concerning data roaming services, while continuing to provide carriers with the flexibility to negotiate and develop “individually tailored arrangements.”

RWA proposed in its comments that the Commission find that wholesale data roaming rates that exceed retail rates are *per se* commercially unreasonable. Adopting this clarification for determining whether the terms and conditions of a proffered agreement are commercially reasonable is supported by the Commission’s authority under Title III of the Act, which authority has been upheld by the D.C. Circuit. The guidance requested by T-Mobile and RWA leaves substantial room for individualized bargaining and negotiations. Furthermore, as stated by the

(Communications Act invests Commission with ‘enormous discretion’ in promulgating licensee obligations that the agency determines will serve the public interest).

²¹ 2010 Order on Reconsideration at ¶ 67.

²² 47 U.S.C. § 309(j)(3).

²³ 47 U.S.C. § 303(g).

D.C. Circuit in *Cellco v. FCC, Midwest Video II* makes it clear that “not every limitation on an entity’s discretion concerning with whom and how it will deal is necessarily common carriage.”²⁴

III. IMPLEMENTATION OF THE DATA ROAMING RULES HAS FAILED TO MEET THE COMMISSION’S STATED POLICY OBJECTIVES; CLARIFICATION BY THE FCC OF WHAT CONSTITUTES “COMMERCIALY REASONABLE” WILL CURE THIS DEFICIENCY.

In 2011, the Commission imposed data roaming obligations on mobile data roaming service providers in order to serve the public interest by promoting competition, investment, and new entry while facilitating consumer access to ubiquitous service. These policy objectives are the cornerstone of the Commission’s data roaming rules. While the Commission attempted to adopt rules that balance these objectives, this has not occurred in practice, as evidenced by the record in this proceeding. Clarification of the data roaming rules is needed to effectively carry out the Commission’s mobile data roaming policy objectives.

Faced with “take it or leave it” data roaming agreements with commercially unreasonable data roaming rates, terms and conditions, RWA members have been forced to accept such agreements, or refused to accept such terms, forcing them either to limit their customers’ ability to access certain larger carriers’ networks or continue to provide customers with essential nationwide data roaming services, but at a financial loss. If RWA members continue to provide their customers with nationwide plans under these scenarios, they will not be in business much longer.

²⁴ *Cellco*, 700 F3d 534, 547 (citing *FCC v. Midwest Video Corp. (Midwest Video II)*, 440 U.S. 689, 99 S. Ct. 1435, 59 L. Ed. 2d 692 (1979)).

IV. AT&T ATTEMPTS TO JUSTIFY CHARGING COMMERCIALY UNREASONABLY HIGH WHOLESALE DATA ROAMING RATES ON MISSTATED FCC POLICY.

RWA strongly disagrees with AT&T's interpretation of the policy objectives the FCC adopted when it implemented the data roaming rule. As discussed above, the Commission's policy objective was to "serve the public interest by promoting competition, investment, and new entry while facilitating consumer access to ubiquitous service."²⁵ This policy objective includes the goal of ensuring that roaming carriers do not rely on data roaming services *in lieu of* investing in their own home networks.

AT&T attempts to justify its commercially unreasonable wholesale data roaming rates and twists the Commission's policy objectives by inferring that the Commission gave carriers permission to charge wholesale data roaming rates that are so high that these carriers have no choice but to build new networks outside of their current home networks rather than roam on another carrier's network. For example, AT&T states in its opposition that "the Commission reiterated its finding from the 2010 *Order on Reconsideration* that 'the relatively high price of roaming compared to providing facilities-based service will often be sufficient to counterbalance the incentive to 'piggy back' on another carrier's network.'"²⁶ The FCC intended this statement to refer to "in-home network roaming" where multiple parties have licensed spectrum in the same area.

AT&T also states that "[t]he Commission had previously found that the fact that 'roaming rates [are] *much higher* than retail rates' would preserve investment incentives, and the

²⁵ 2010 *Order on Reconsideration* at ¶ 67.

²⁶ AT&T Opposition, WT Docket No. 05-165 (filed July 10, 2014) at pp. 8-9 (*citing Data Roaming Order* at ¶ 51).

Commission cited that prior finding with approval in the *Data Roaming Order*.²⁷ AT&T misquotes this paragraph of the *2010 Order on Reconsideration*. The Commission did not make a finding that roaming rates that are much higher than retail rates would preserve investment incentives. Paragraph 32 of the *2010 Order on Reconsideration* states:

32. AT&T argues that, if the first carrier providing coverage in a given area were required to provide automatic home roaming service to its competitors' customers, there would be no reason for competitors to build out their own networks in that area [citation omitted]. We disagree. Carriers deploying next generation networks will still have incentives to build out to ensure that their subscribers receive all of the benefits of the carriers' own advanced networks.⁹⁰

⁹⁰ SpectrumCo Petition for Reconsideration at 12-13 and Reply at 4 (also noting that with roaming rates being much higher than retail rates, a smaller carrier cannot expect to compete when its subscribers are roaming all the time or even a large percentage of the time.) *See also*, MetroPCS Petition for Reconsideration at 12 noting it is simply not economically feasible or sound business practice for any carrier to pursue a strategy based on roaming at the expense of building its own network.

The Commission is citing to SpectrumCo's petition for reconsideration for support that carriers will continue to have incentives to build out their home networks even if they initially provide service through roaming agreements. Even if the Commission had made a "finding" that roaming rates much higher than retail were justified to preserve infrastructure investments, which it did not, the Commission was once again discussing investing in infrastructure in the roaming carrier's home network, not nationwide. AT&T is attempting to validate charging commercially unreasonable wholesale data roaming rates in an effort to force roaming carriers to expand their networks rather than roam on AT&T's network.

The Commission initially discussed the comparison of roaming costs and network deployment costs in the *2010 Order on Reconsideration* in the context of elimination of the home exclusion rule. Once the home exclusion rule was eliminated, carriers were required to

²⁷ AT&T Opposition at p. 9 citing *2010 Order on Reconsideration* at ¶ 32 n. 90.

provide roaming services under reasonable terms and conditions even in areas where a roaming carrier held spectrum. The Commission again made this comparison in the *Data Roaming Order* when it declined to adopt AT&T's proposal that a carrier be required to provide data roaming only to carriers that have built substantial networks of their own.²⁸ In both instances the Commission continued to require that roaming terms and conditions be reasonable.

At no time did the Commission endorse or promote the policy that nationwide carriers should charge commercially unreasonable wholesale data roaming rates in order to discourage carriers from roaming on a carrier's network. When the Commission adopted the *Data Roaming Order*, its intention was to ensure that carriers have access to vital data roaming services in order to ensure consumers have access to nationwide data services. The Commission balanced the need for access to data roaming services against ensuring that carriers did not rely on data roaming as the "primary" means of serving subscribers rather than deploying new infrastructure.²⁹

RWA members are not using roaming arrangements as a "primary" means of serving subscribers. AT&T's suggestion that charging commercially unreasonable data roaming rates that are so high that they are resulting in carriers leaving the market will somehow provide incentives for RWA carrier members to invest in infrastructure, and that this scenario is somehow validated by Commission policy, is misplaced. AT&T's Opposition implies that the Commission's rules condone, or even encourage, facilities-based carriers such as AT&T to charge unreasonably high data roaming rates in an effort to force small, rural carriers with non-nationwide footprints, and who clearly have neither the spectrum nor the financial wherewithal, to invest in infrastructure rather than seek data roaming services. AT&T states "the Commission

²⁸ *Data Roaming Order* at ¶50.

²⁹ *Data Roaming Order* at ¶ 21.

made clear that it *expected* roaming rates to be ‘much higher’ than retail rates, to ensure that requesting providers like T-Mobile continue to have an incentive to build out their broadband networks.”³⁰

Even if RWA’s member carriers built out 100% of their licensed footprints, those carriers would still be charged the dominant carrier’s commercially unreasonable wholesale data roaming rates that are applied to large and regional carriers across the country. RWA’s carrier members will never be in a position to construct nationwide networks and will always be reliant on roaming partners to provide their subscribers with nationwide data plans. Under AT&T’s interpretation of the FCC’s policy, RWA members who are small, rural carriers that seek data roaming agreements with AT&T are financially punished with commercially unreasonable data roaming rates that are likely to eventually push them out of the mobile data marketplace because they do not have the spectrum or the financial ability to build their own nationwide networks.

While some carriers have spectrum with near-nationwide footprints but have not yet deployed nationwide networks, RWA members, among others,³¹ simply do not have the spectrum needed, or the financial wherewithal, to deploy nationwide networks. RWA members, whose rural carrier members serve fewer than 100,000 customers, will never be in a position to build nationwide networks and will always rely on roaming partners to provide rural consumers with nationwide service plans.

While AT&T’s position is that excessively high wholesale data roaming rates will push carriers to deploy their own infrastructure, the opposite has happened. As outlined below,

³⁰ AT&T Opposition at pp. 12-13 (emphasis in original).

³¹ See NTELOS Comments at p. 5 (NTELOS has a limited spectrum footprint (due in part to nationwide spectrum constraints) and must rely on other carriers in order to provide nationwide coverage... [and] needs the ability to obtain data roaming agreements on commercially reasonable terms and conditions and offer the maximum coverage possible in order to just be competitive in the wireless marketplace.”).

wholesale data roaming rates currently being charged by must-have roaming partners have actually stifled the ability of rural carriers to deploy infrastructure and new services. In addition, at least one RWA member is being pushed out of business as a result of commercially unreasonable wholesale data roaming rates. These rates have also resulted in (1) market consolidation; (2) consumers being denied access to certain carrier networks; and (3) the real potential of higher retail rates being charged to rural consumers. Given the public interest harms that have resulted from the wholesale data roaming rates currently being charged by must-have carriers, it is clear there is no legitimate commercially reasonable basis for carriers to charge wholesale data roaming rates that exceed retail prices.³² Furthermore, the Commission has stated that “conduct that unreasonably restrains trade... is not commercially reasonable.”³³

V. TODAY’S WHOLESALE DATA ROAMING RATES HARM COMPETITION AND RURAL CONSUMERS.

As evidenced by the comments in this proceeding, competition and consumers have been harmed by AT&T’s and Verizon’s pricing policies.³⁴ RWA’s small rural carrier members rely on roaming partners to provide subscribers with nationwide service. Even if they built out 100% of their licensed territories, they would rely on roaming partners to provide nationwide service.

³² See also Comptel Comments at p. 3 (T-Mobile’s “proposed benchmarks are extremely generous especially since it is difficult to contemplate a legitimate commercially reasonable basis for a host provider’s wholesale roaming rates to exceed its retail pricing to any degree.”).

³³ *Data Roaming Order* at ¶ 85.

³⁴ Further evidence of these harms has been found by another federal communications regulatory body. The Canadian Radio-television and Telecommunications Commission (“CRTC”) recently conducted an investigation to “assess the impact of wholesale data roaming agreements on the competitiveness of the Canadian wireless industry and the choices available to Canadians.” The CRTC found national carriers had the ability to use wholesale roaming agreements as a strategic tool to ensure that new entrants do not become effective competitors. In addition, the Canadian Telecommunications Act was amended to establish caps on wholesale mobile wireless roaming rates based on retail rates. See Canadian Radio-television and Telecommunications Commission, Telecom Decision CRTC 2014-398, File Nos. 8620-C12-201317230 and 8620-C12-201312082 (Ottawa, July 31, 2014).

When a small carrier's subscribers roam, particularly if they roam a large percentage of the time, the carrier's costs of providing service increase significantly. Many times these costs exceed what the carrier can reasonably expect to recoup from its subscribers and remain competitive. If a carrier has a number of subscribers that roam a large percentage of the time, the carrier cannot afford to support those customers on its network.

RWA has at least one member carrier that is being pushed out of business due to commercially unreasonable wholesale data roaming rates, and has many others who are incurring significant costs as a result of wholesale data roaming rates and are considering their options. NTELOS Holdings Corp. ("NTELOS") points out that "[f]ormer carriers, such as MetroPCS, Allied Wireless, and Leap Wireless have all cited difficulty in obtaining reasonable roaming rates as significant reasons for exiting the market, despite the adoption of the *Data Roaming Order*."³⁵ Limitless Mobile, Inc. ("Limitless") and PinPoint Wireless, Inc. ("PinPoint") make clear that rural customers are being harmed by current wholesale data roaming rates. Consumers are being harmed because they are being denied nationwide coverage because rural carriers are restricting access to nationwide networks as a result of commercially unreasonable roaming rates, consumers are losing the benefits of competition by the exit of local competitors from the marketplace, and consumers are facing higher retail rates from rural carriers that are forced to pass their wholesale data roaming costs through to consumers.³⁶ Comptel also correctly points

³⁵ NTELOS Comments at p. 9 *citing* MetroPCS/T-Mobile Public Interest Statement, 18-19 (Lead File No. 0005446627 (filed Oct. 18, 2012)) (one reason MetroPCS decided to merge with T-Mobile was the fact that "reasonably-priced voice, and particularly data, roaming arrangements have been extremely difficult to obtain, despite the existence of [the FCC data roaming rules]"); *see also* Allied Wireless/AT&T Public Interest Statement, 22 (Lead File No. 0005632405) (filed Feb. 5, 2013) (NTELOS notes that "Allied also emphasized the disadvantage it faced by 'high and increasing roaming costs'").

³⁶ *See* Limitless Comments at p. 4 (Limitless restricted customer access to "the AT&T network for the sole reason that AT&T's data roaming rates are too high and by continuing roaming

out that carriers seeking wholesale roaming arrangements compete with the host provider for retail customers, thereby giving the host carrier the incentive to raise the competitor's costs by charging commercially unreasonable roaming rates.³⁷

As outlined by PinPoint, if wholesale data roaming rates are not lowered, rural carriers face the prospect of (1) continuing to offer nationwide roaming to subscribers at competitive retail rates at a loss; (2) passing wholesale data roaming costs on to rural consumers through higher retail rates, which will likely result in the carrier going out of business because the carrier's retail rates are not competitive;³⁸ or do what Limitless was forced to do and (3) restrict subscriber access to certain networks.³⁹ Any of these scenarios will likely result in the carrier going out of business.⁴⁰ The options faced by rural carriers support the argument that today's wholesale data roaming rates are commercially unreasonable and must be addressed by the Commission.

Absent FCC intervention, roaming rates will continue to be much higher than retail rates, and small rural carriers will be unable to compete. The Commission should clarify that wholesale data roaming rates are *per se* commercially unreasonable if they exceed retail data rates. Many of today's wholesale data roaming rates are commercially unreasonable because they force competitors out of the market; restrict rural consumers' access to nationwide data services; or force rural carriers to charge much higher retail prices, resulting in the pass-through of commercially unreasonable wholesale roaming costs to rural consumers.

access, Limitless could not maintain a commercially competitive retail wireless data offering to the general public”).

³⁷ Comptel Comments at p. 4.

³⁸ PinPoint Comments at p. 7 (filed July 10, 2014); *see also* NTELOS Comments at p. 16 *citing* T-Mobile Petition at p. 12 (“high wholesale roaming rates ‘are intended to, and have the effect of, keeping retail data rates unnecessarily high for the wireless customers of competitors’”).

³⁹ Limitless Comments at p. 4.

⁴⁰ *See* PinPoint Comments at p. 7 (filed July 10, 2014).

VI. RWA SUPPORTS ADOPTION OF A ROAMING NEGOTIATION SHOT CLOCK.

RWA supports adoption of a roaming negotiation shot-clock as proposed by NTCA⁴¹ and the Blooston Rural Carriers⁴² that would address the time frame within which carriers must respond to a request to begin roaming negotiations. NTCA correctly notes that while the *Data Roaming Order* admonished carriers to “avoid actions that unduly delay or stonewall the course of negotiations...” there are no “regulatory teeth” to the Commission’s rules.⁴³ Currently, RWA members wait months to even begin negotiating roaming agreements. These delays are exacerbated by network evolutions. Specifically, data roaming agreements covering 2G services are not applicable to areas where the host carrier is providing 3G or 4G LTE services. In order for a roaming carrier to access either of these higher evolution networks, it must negotiate new wholesale data roaming agreements. Negotiating new roaming agreements each time a host carrier’s network is upgraded causes significant delays and added expenses. For these reasons, RWA supports adoption of a shot clock for the conclusion of negotiations and execution of a mutually acceptable wholesale data roaming agreement.⁴⁴

VII. CONCLUSION.

Mobile broadband is at a critical state in its development, and the massive consolidation of this industry has resulted in a significant lack of competition in the mobile broadband ecosystem. Roaming services are needed to ensure competition and the provision of ubiquitous nationwide services to rural consumers. Currently, there is no yardstick to measure the commercial reasonableness of wholesale data roaming rates, which is causing significant

⁴¹ NTCA Comments at pp. 6-8.

⁴² Blooston Rural Carriers Comments at pp. 1-3.

⁴³ NTCA Comments at p. 6.

⁴⁴ Blooston Rural Carriers Comments at pp 1-3.

problems in the marketplace. Verizon and AT&T have taken the position that it is commercially reasonable for them to charge wholesale data roaming rates that are so high as to be unaffordable to rural carriers and their customers. The fact that AT&T's and Verizon's interpretations of what constitutes commercially reasonable rates, terms and conditions for data roaming services is so far afield from the rest of the commenters in this proceeding makes it clear that FCC clarification is needed. Clearly the Commission must establish some benchmarks the industry can use to determine whether wholesale data roaming rates are commercially reasonable. RWA strongly urges the Commission to clarify that wholesale data roaming rates are *per se* commercially unreasonable if they exceed, by any degree, the retail data rate the must-have carrier or requesting carrier charges its retail customers.

Respectfully submitted,

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August 20, 2014

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 91**

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services)	WT Docket No. 05-265
)	
Petition for Expedited Declaratory Ruling of T-Mobile USA, Inc.)	DA 14-798
)	

To: Chief, Wireless Telecommunications Bureau

REPLY COMMENTS OF THE BLOOSTON RURAL CARRIERS

The law firm of Blooston Mordkofsky Dickens Duffy & Prendergast, LLP (“Blooston”), on behalf of its rural telephone and wireless carrier clients (the “Blooston Rural Carriers”), respectfully submits these reply comments in support of T-Mobile USA’s Petition for Expedited Declaratory Ruling and request for prospective guidance on the “commercially reasonable” standard in the context of data roaming. Aside from comments by AT&T and Verizon (a.k.a., the “Big Two”), which urge the Commission to preserve the status quo (to their tremendous advantage), the record in this proceeding shows unanimous support for the modest and reasonable clarification of the Commission’s Rules that is sought by T-Mobile. Because the guidance sought by T-Mobile is desperately needed by a wide range of rural and competitive wireless carriers, and because the availability of commercially reasonable terms and conditions for 4G data roaming services from the Big Two is essential to any carrier that wishes to participate in the Mobility Fund Phase II proceeding, the FCC should promptly grant T-Mobile’s Petition and issue much needed guidance on the commercially reasonable standard. In addition, the Commission should adopt a “shot clock” for data roaming negotiations so that the Big Two

cannot simply ignore requests from small carriers, and it should strongly consider RWA's proposal to require all carriers to confidentially file their data roaming agreements with the FCC so that the Commission's staff can have a better understanding of the rates, terms and conditions that are being forced on small carriers.

I. Competitive Carriers Unanimously Support the T-Mobile Petition

Upon review of the comments in this proceeding, the record shows unanimous support for the Commission to adopt four benchmarks for assessing the commercial reasonableness of data roaming agreements that were proposed by T-Mobile.¹ Those benchmarks include: (1) whether the wholesale data roaming rate substantially exceeds the retail rate; (2) whether the wholesale data roaming rate substantially exceeds roaming rates charged to foreign carriers when their customers roam in the United States (and vice versa); (3) whether the wholesale data roaming rate substantially exceeds the price for wholesale service charged to MVNOs; and (4) how the proposed wholesale roaming rate compares to other competitively negotiated wholesale roaming rates. The data roaming market has not developed as the Commission intended when it adopted its *Data Roaming Order* in 2011, and a lack of access to data roaming services on commercially reasonable terms and conditions is hampering the ability for small, mid-tier and regional carriers to compete in the marketplace as the FCC intended.

The Blooston Rural Carriers agree with commenters that have characterized the commercially reasonable standard of the data roaming rule as “toothless, vague and very difficult

¹ See, e.g., July 10 Comments of COMPTTEL (COMPTTEL Comments) at p. 3; July 10 Comments of NTCA – The Rural Broadband Association (NTCA Comments) at pp. 5-6; July 10 Comments of Cellular South, Inc. (C Spire Comments) at pp. 6-8; July 10 Comments of NTELOS (NTELOS Comments) at pp. 14-19; July 10 Comments of Rural Wireless Association, Inc. (RWA Comments) at p. 4; July 10 Comments of Sprint Corporation (Sprint Comments) at pp.2-4.

to enforce.”² Competitive carriers should not be forced into years of pleading and unreturned phone calls, or the prospect (and expense) of filing a formal complaint with the FCC, just to get the prospect of data roaming discussions with the Big Two. A persistent inequity in bargaining power has left small and regional wireless carriers with little hope of securing data roaming agreements, much less reasonable data roaming terms and conditions. In those instances where small and regional carriers have been successful in securing data roaming rights, the likelihood that most carriers have been forced to accept data roaming terms and conditions on a “take it or leave it” basis rather than true arms-length negotiation means that existing agreements cannot be used as a basis for what is commercially reasonable in future agreements. That only preserves the status quo, and overwhelming competitive advantages enjoyed by the Big Two. For this reason, the Blooston Rural Carriers also agree with T-Mobile and commenters who believe that the terms of existing data roaming agreements cannot and should not be viewed as a benchmark for what is deemed commercially reasonable in future roaming negotiations.³

II. Opponents of T-Mobile’s Request for Clarification of the “Commercially Reasonable” Standard Fail to Show Why Prospective Guidance is Not in the Public Interest

In contrast to the overwhelming weight of industry opinion, the Big Two are the only entities that are content with the current vagaries of the “commercial reasonableness” standard. They claim that the rules are working,⁴ and that T-Mobile’s requested rate benchmarks are improper.⁵ However, quite the opposite is true. The record shows that competitors to the Big

² Comments of NTCH, Inc., Flat Wireless, LLC and Buffalo-Lake Erie Wireless Systems Co (NTCH/Blue Comments) at p. 2.

³ See, e.g., T-Mobile Petition at pp. 16-22; Comments of NTELOS at p. 18.

⁴ See July 10 Opposition of AT&T (AT&T Opposition) at pp. 7-16, July 10 Comments of Verizon (Verizon Comments) at pp. 7-9.

⁵ See AT&T Opposition at pp. 26-32; Verizon Comments at pp. 9-14.

Two are faced with little or no choice for roaming partners due to increasing concentration in the wireless market, and the ever-increasing size and scope of the Big Two's businesses (*i.e.*, such as through AT&T's proposed acquisition of DirecTV) only magnifies the disparities between the industry's largest and smallest carriers, and heightens the ability (and likelihood) for the Big Two to cause anticompetitive harm. Small and rural carriers have significant incentive to construct and operate high quality networks in their home markets, to attract and maintain a loyal customer base. However, these entities cannot provide nationwide service in markets where they don't have spectrum, and in areas where they have spectrum but have not yet been able to extend service. Even nationwide carriers such as Sprint and T-Mobile have areas where demand from their customers may be limited, and where buildout by multiple carriers may not be the best use of limited resources.

T-Mobile is not urging the Commission to make "sweeping changes" to its *Data Roaming Order*, as Verizon suggests,⁶ or to "unlawfully *rewrite*, rather than clarify, those rules in ways that would limit marketplace flexibility", as AT&T argues,⁷ but rather seek modest and reasonable clarifications that will help parties to better evaluate the commercial reasonableness of data roaming terms offered. The Blooston Rural Carriers agree with T-Mobile that this will facilitate the negotiation process and ability competitive carriers to secure data roaming agreements for the benefit of their customers.

Contrary to the Big Two's assertions that "the existing rules are working,"⁸ the record in this proceeding shows that the status quo is clearly not working. T-Mobile and competitive

⁶ Comments of Verizon at p. 1.

⁷ AT&T Opposition at p. 2.

⁸ See AT&T Opposition at pp. 7-16, Verizon Comments at pp. 7-9.

carriers have presented a compelling case for measured action by the Commission. Verizon argues that T-Mobile should use the remedies provided in the *Data Roaming Order* to resolve its dispute with AT&T. However, a petition for declaratory ruling was not only one of the remedies that the Commission mentioned in the *Data Roaming Order*, it was the very first remedy that the Commission offered.⁹ The Blooston Rural Carriers applaud T-Mobile seeking clarification of the Commission's Rules in a manner that involves other carriers to contribute to the record, and that if granted, will have the force of precedent.

Finally, the guidance sought by T-Mobile, competitive carriers and consumer advocates is not rate regulation, as Verizon and AT&T each assert, and it is appropriately sought in the context of a petition for declaratory ruling. T-Mobile and supporting commenters are not asking the FCC to rewrite any existing rules, but rather to provide prospective guidance on what constitutes "commercially reasonable terms and conditions" as called for in Section 20.12(e) of the Commission's Rules.

III. The Commission Can Further Assist the Ability of Small and Rural Carriers to Initiate Negotiations and Secure Data Roaming Agreements by Adopting "Shot Clock" Procedures

In their initial comments, both the Blooston Rural Carriers and NTCA urged the Commission to adopt "shot clock" procedures to promote meaningful negotiations for data roaming agreements. The comments of NTCA provided the Commission with empirical evidence of the challenges that small and rural service providers have faced in seeking to negotiate roaming agreements with national carriers. In this regard, a 2013 survey of NTCA's

⁹ See *Data Roaming Order*, 26 FCC Rcd 5411 at 5412 (2011). In the second paragraph of the *Data Roaming Order*, the FCC stated: "To resolve disputes arising pursuant to the rule we adopt here, we provide that parties may file a petition for declaratory ruling under Section 1.2 of the Commission's rules or file a formal or informal complaint under the rule established herein depending on the circumstances specific to each dispute" (*emphasis added*).

member companies (which include many of the Blooston Rural Carriers) found that 41% of respondents cited the ability to negotiate roaming agreements with national carriers as a major concern, and that more than half of those that attempted to negotiate data roaming and/or in-market roaming agreements with other providers characterized the process as “moderately to extremely difficult.”¹⁰ This prevalence of delay has substantially hindered the ability of small and rural carriers to launch service with a competitive wireless offering. Despite the Wireless Bureau’s recent decision not to adopt a “shot clock” in the context of a June 2011 Petition for Reconsideration of the *Data Roaming Order* filed by Blanca Telephone Company, the Blooston Rural Carriers believe that significant changes in the wireless marketplace and burgeoning consumer demand for mobile data services make a more compelling case for the Commission to include a “shot clock” in its interpretation of what is commercially reasonable under the data roaming rule in 2014.

IV. The FCC Should Consider Imposing a Requirement for Carriers to File All Data Roaming Agreements with the FCC

In its comments, RWA made a compelling case for the Commission to require carriers to file their domestic data roaming agreements with the FCC.¹¹ While this is beyond the scope of relief sought by T-Mobile in its Petition, the Blooston Rural Carriers agree with RWA and other commenters¹² that confidentiality has been a barrier to market transparency and a disincentive to seeking FCC guidance on data roaming agreements. Requiring carriers to file their roaming agreements with the Commission would be an effective way to educate the Commission about the domestic roaming marketplace and provide the Commission with context for determine which contract terms and company practices are, and which are not, commercially reasonable.

¹⁰ NTCA Comments at p. 3 (citing to NTCA’s 2013 Wireless Survey Report (*released* January 2014)).

¹¹ RWA Comments at pp. 9-10.

¹² *See, e.g.*, Comments of Limitless Mobile, LLC (Limitless Comments) at pp. 6, 8-9.

CONCLUSION

The Blooston Rural Carriers reiterate their request that the Commission clarify the data roaming rules as requested herein, on an expedited basis.

Respectfully submitted,

THE BLOOSTON RURAL CARRIERS



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Roaming Obligations)	

REPLY COMMENTS OF COMPETITIVE CARRIERS ASSOCIATION

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REPLY COMMENTS OF COMPETITIVE CARRIERS ASSOCIATION

Competitive Carriers Association (“CCA”) hereby submits this reply to comments filed in connection with the petition of T-Mobile USA, Inc. (“T-Mobile”) for expedited declaratory ruling, seeking further guidance on the criteria used to determine whether the terms of a data roaming agreement or proposal satisfy the “commercially reasonable” standard set forth in the Commission’s rules.¹

I. INTRODUCTION AND SUMMARY

Consistent with the wide-ranging support for the adoption of the current data roaming rules,² the record reflects a consensus in favor of granting T-Mobile’s Petition seeking additional guidance from the Commission on the requirement to provide data roaming on commercially reasonable terms and rates. There is broad agreement that it is in the public interest to ensure that *all* carriers have reasonable and reliable access to data roaming. The support CCA expressed in its opening comments for guidance in the form of benchmark rates and terms found in other wholesale

¹ T-Mobile USA, Inc., Petition for Expedited Declaratory Ruling, Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services, WT Docket No. 05-265 (filed May 27, 2014) (“Petition”); *see also* 47 C.F.R. § 20.12.

² *See Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, Second Report and Order, 26 FCC Rcd 5411 ¶ 11 (2011) (“Data Roaming Order”), *aff’d sub nom. Cellco P’ship v. Fed. Comm’n*, 700 F.3d 354 (D.C. Cir. 2012).

agreements is reinforced by the comments of numerous carriers and groups representing wireless providers and consumers. These comments confirm that competitive carriers have continued to experience difficulties in reaching data roaming agreements with the largest carriers even after the adoption of the *Data Roaming Order*. The growing disparity in negotiating leverage between the largest carriers and all other carriers has allowed the largest carriers to exploit the ambiguity in the “commercially reasonable” standard for data roaming.

AT&T and Verizon are conspicuously alone in opposing T-Mobile’s proposed guidance. They endeavor to paint a rosy picture of the data roaming marketplace. However, AT&T and Verizon’s arguments and claims do not withstand empirical scrutiny.

Furthermore, there is substantial support in the record confirming that Title III of the Communications Act confers ample authority on the Commission to issue guidance in the form of the proposed benchmarks to effectuate the purpose and intent of its data roaming rule. Consistent with the existing factors set forth in the *Data Roaming Order*, the additional guidance sought would not run afoul of the common carrier prohibition on data roaming services. In particular, AT&T and Verizon ignore the Commission’s invitation in the *Data Roaming Order* for carriers to propose additional factors and seek further clarification of the commercial reasonableness standard, and the Commission’s express endorsement of a petition for declaratory ruling as the appropriate procedural vehicle for such requests.

CCA thus urges the Commission to grant T-Mobile’s Petition expeditiously to provide much-needed guidance to the industry as carriers work to meet the growing mobile broadband needs and demands of consumers.

II. THE RECORD REFLECTS BROAD SUPPORT FOR T-MOBILE'S PROPOSED BENCHMARKS

A. There Is Clear Evidence in the Data Roaming Marketplace of Problems that Could Be Alleviated by T-Mobile's Proposed Clarifications

Virtually all of the comments filed in this proceeding reflect fervent support for T-Mobile's Petition. Commenters, aside from AT&T and Verizon, express the unanimous view that reasonable and reliable access to data roaming is in the public interest, and that there is a critical need for additional guidance in applying the standard for commercial reasonableness.³ Once again, the record affirms the vital importance of data roaming particularly as data usage continues to increase exponentially.⁴ The ability to procure commercially reasonable roaming agreements is essential to facilitation of the provision of competitive wireless services, which consumers now expect will include nationwide coverage and seamless data services.⁵ Thus, without data roaming, non-nationwide carriers, particularly those that serve rural areas, will struggle to compete,⁶ especially in a consolidating market. In addition, roaming expenses constitute a significant component of the

³ See, e.g., Comments of Sprint Corporation, WT Docket No. 05-265 at 2, 4 (filed July 10, 2014); Comments of Cellular South, Inc. (d/b/a C Spire Wireless), WT Docket No. 05-265 at 2-3 (filed July 10, 2014) ("C Spire Comments"); Comments of COMPTTEL, WT Docket No. 05-265 at 2 (filed July 10, 2014) ("COMPTTEL Comments"); Comments of Rural Wireless Association, Inc., WT Docket No. 05-265 at i (filed July 10, 2014) ("RWA Comments"); Comments of NTCA – The Rural Broadband Association, WT Docket No. 05-265 at 1, 4 (filed July 10, 2014) ("NTCA Comments").

⁴ See, e.g., RWA Comments at 2 ("It is well established that consumers expect their mobile service providers to offer competitive broadband services and that data roaming arrangements are integral to a rural carrier's ability to provide ubiquitous nationwide services and remain competitive in the mobile services marketplace."); C Spire Comments at 2.

⁵ Comments of NTELOS Holdings Corp., WT Docket No. 05-265 at 4-5 (filed July 10, 2014) ("NTELOS Comments"); COMPTTEL Comments at 2; C Spire Comments at 2; Comments of PinPoint Wireless, Inc., WT Docket No. 05-265 at 1-2 (filed July 10, 2014) ("PinPoint Comments"); Comments of Limitless Mobile, LLC, WT Docket No. 05-165 at 2 ("Limitless Comments"); RWA Comments at 6.

⁶ See, e.g., RWA Comments at 2; NTCA Comments at 2.

overall cost of service to subscribers, particularly for rural and regional wireless carriers.⁷ Ensuring access to data roaming on reasonable rates and terms is therefore crucial to achieving the Commission’s goals of increasing customer choice and boosting the expansion of advanced wireless services in areas that are currently unserved or underserved.

Based on a keen understanding of the importance of data roaming and the associated public interest benefits, the Commission adopted requirements obligating carriers to enter into data roaming agreements, including the obligation to provide roaming on “commercially reasonable” terms.⁸ This standard is judged through a “case-specific . . . fact-intensive analysis,”⁹ to allow for adequate flexibility and individualized negotiations based on a number of variables. Unfortunately, as reflected in the record, industry experience demonstrates that the standard adopted is not working as intended.¹⁰ All commenters, aside from AT&T and Verizon, denounce the wholesale roaming market as uncompetitive.¹¹ Several commenters describe the challenges they face in obtaining data roaming in regions where it is most needed, which suggests that AT&T and Verizon have used the ambiguity in the “commercially reasonable” standard to impede negotiations and to preclude roaming arrangements.¹² In other instances, AT&T and Verizon have used their dominant positions as providers of nationwide roaming capabilities to strong-arm small carriers into executing data

⁷ Comments of the Blooston Rural Carriers, WT Docket No. 05-265 at 3 (filed July 10, 2014) (“Blooston Comments”).

⁸ *Data Roaming Order* at ¶ 13.

⁹ Sprint Comments at 3.

¹⁰ *See, e.g.*, C Spire Comments at 5-6; Sprint Comments at 2; NTCA Comments at 3.

¹¹ *See, e.g.*, NCTA Comments at 4; Comments of NTCH, Inc., Flat Wireless, LLC, and Buffalo-Lake Erie Wireless Systems Co., LLC, WT Docket No. 05-265 at 1 (filed July 10, 2014) (“NTCH/Flat/Blue Comments”); Comments of Public Knowledge, Open Technology Institute at New America Foundation, Benton Foundation and Common Cause, WT Docket No. 05-265 at 5 (“PK/OTI/Benton/CC Comments”).

¹² *See, e.g.*, NTCH/Flat/Blue Comments at 2, 4 (citing unsuccessful negotiations with Verizon and Cricket during its merger with AT&T); NTELOS Comments at 13 (urging that roaming rates that are exponentially higher than retail rates offered to customers of AT&T should not be considered commercially reasonable).

roaming arrangements containing commercially *unreasonable* terms.¹³ Competitive carriers also have suffered the same experience that T-Mobile describes in the Petition of being forced in certain cases to limit or cap roaming because of the exorbitant rates charged by the home carrier.¹⁴

In addition, service to consumers in rural areas funded by Mobility Fund support could be made vulnerable by the lack of access to data roaming on reasonable terms. Rural carriers receiving Mobility Fund support are required to provide service at a price that is reasonably comparable to rates charged for similar services in urban areas. It is difficult, and in some cases impossible, for such rural carriers to satisfy this requirement if the roaming arrangements needed to enable the provision of comparable services are inaccessible.¹⁵ Thus, in such cases, the lack of reasonable roaming arrangements would put Mobility Fund recipients at risk of falling short of their obligations and losing funding, which would diminish the availability of wireless services in rural areas and undermine the goals of universal service. Such examples highlight the very real and detrimental impact that the lack of clarity in the commercially reasonable standard has had on the provision of service to consumers.

Commenters agree with CCA's assessment that the imbalance between the two largest carriers and all other carriers has been exacerbated by increased consolidation in the industry.¹⁶ As a result, AT&T and Verizon continue to have little incentive to negotiate fair or reasonable roaming

¹³ See, e.g., RWA Comments at 7; PinPoint Comments at 2; Limitless Comments at 2-3.

¹⁴ See, e.g., Limitless Comments at 4; NTELOS Comments at 16; see also PK/OTI/Benton/CC Comments at 5.

¹⁵ Blooston Comments at 3; see also NTCA Comments at 4 (commercially unreasonable roaming rates and terms could jeopardize providers' ability to meet Mobility Fund requirements, which would foreclose a potential source of funding for rural networks).

¹⁶ See, e.g., RWA Comments at 5 (citing the unprecedented consolidation in the wireless industry, which has resulted in the failure of competition in the mobile data roaming market and commercially unreasonable rates); see also NTELOS Comments at 7-8.

rates.¹⁷ Several commenters cite the harm that this vast disparity in the marketplace ultimately has on competition and consumer choice, and ask the Commission to restore a more balanced dynamic to data roaming negotiations among parties that otherwise have disparate market power.¹⁸

Because market failures continue to frustrate the Commission's data roaming goals, CCA echoes commenters' requests for expeditious Commission action in this proceeding.¹⁹ There is overwhelming endorsement in the record of the benchmarks and clarifications sought in the Petition.²⁰ Retail rates and MVNO service rates serve as natural benchmarks for wholesale mobile data rates.²¹ Roaming rates should not be exorbitantly higher than retail rates charged to consumers. In addition, foreign roaming rates provide another reasonable benchmark because AT&T and Verizon do not have the same incentives to raise data roaming costs for foreign carriers that are not competing for U.S. customers.²² Commenters overwhelmingly agree that these benchmarks would provide clarity and predictable enforcement criteria for carriers when determining whether the terms proposed for a data roaming agreement meet the "commercially reasonable" standard.²³ Issuing the proposed guidance would mitigate the effects, described above, of the grossly unequal bargaining power enjoyed by AT&T and Verizon and would address the unwillingness of the largest wireless

¹⁷ See NTCH/Flat/Blue Comments at 4; PK/OTI/Benton/CC Comments at 5-6 (observing that AT&T and Verizon can artificially increase the cost of data roaming for rivals, which in turn allows them to charge artificially inflated prices to their own customers).

¹⁸ See, e.g., PinPoint Comments at 2-3; Blooston Comments at 3-4.

¹⁹ See, e.g., C Spire Comments at 6; NTELOS Comments at 12.

²⁰ See, e.g., NTELOS Comments at 12, 14; C Spire Comments at 6; NTCA Comments at 1; COMPTTEL Comments at 4.

²¹ C Spire Comments at 6-7.

²² *Id.*

²³ Sprint Comments at 4; NTELOS Comments at 15; NCTA Comments at 5.

carriers to enter into fair data roaming arrangements with facilities-based providers, as the rules are intended to do.²⁴

B. Only AT&T and Verizon Are in Favor of Maintaining the *Status Quo*

In the face of an overwhelming record pointing to the contrary, the two largest carriers maintain that there is no evidence of any problem in the data roaming marketplace. AT&T and Verizon each argue that the need for Commission action is obviated by allegedly numerous data roaming agreements that have been entered into since the adoption of the *Data Roaming Order*, as well as purported overall declines in data roaming rates.²⁵ AT&T states that it has entered into 30 data roaming agreements since the adoption of the *Data Roaming Order*, and Verizon states that it has entered into 48 new or renewed data arrangements at rates that have declined by 40 percent in that same period.²⁶ Moreover, AT&T and Verizon each claim that the fact that no complaints have been filed regarding data roaming is indicative of the absence of any issues for the Commission to address.²⁷ This picture painted by the two dominant players in the market, however, is far removed from the reality that other carriers have experienced.

As an initial matter, it is unclear what agreements and arrangements AT&T and Verizon are including in their optimistic enumeration of their data roaming agreements. Neither AT&T's nor Verizon's comments specify whether these agreements are limited to domestic roaming partners or if they include international roaming agreements (for example, AT&T's recent LTE roaming

²⁴ NTCH/Flat/Blue Comments at 4; NTELOS Comments at 15.

²⁵ Comments of AT&T, WT Docket No. 05-265 at 10 (filed July 10, 2014) (“AT&T Comments”); Comments of Verizon, WT Docket No. 05-265 at 8-9 (filed July 10, 2014) (“Verizon Comments”).

²⁶ See AT&T Comments at 10-11; Verizon Comments at 8-9.

²⁷ AT&T Comments at 10; Verizon Comment at 9.

agreement with Canada's Rogers Communications).²⁸ AT&T and Verizon's claims also do not expressly state how many (if any) of these operators are facilities-based versus MVNOs. Moreover, it is unclear how many of Verizon's "roaming" agreements are part of its "LTE in Rural America" program, in which its partner carriers are required to build out a network according to Verizon's specifications, using Verizon's spectrum and connecting directly to Verizon's core network.²⁹ To the extent LRA agreements are included, Verizon's offer to roam based on a condition that essentially requires the other carrier to construct a part of Verizon's network should not be viewed as evidence of a well-functioning roaming market, and therefore these arrangements should not influence the Commission's consideration of T-Mobile's Petition.

AT&T's purported evidence of a well-functioning marketplace likewise fails to hold water. AT&T cites to a reduction in the average price per megabyte of data roaming purchased by T-Mobile over the past several years as dispositive proof of an absence of any cause for concern.³⁰ This is illusory for several reasons. First, the data is in the aggregate, and not indicative of negotiations with any one particular carrier that may or may not have market power. Additionally, it is apparent from the data that the volume of wholesale roaming purchased by T-Mobile increased substantially year-over-year (going from 144 million MB of traffic in 2012 to 267 million MB of

²⁸ See AT&T Comments at 10; Verizon Comment at 9; see also Chris Welch, *AT&T Partners with Rogers to Offer LTE Data Roaming in Canada*, THE VERGE, Dec. 9, 2013, <http://www.theverge.com/2013/12/9/5191592/att-partners-with-rogers-to-offer-lte-roaming-canada>.

²⁹ Kevin Fitchard, *Verizon's 4G Network is About to Get a Lot More Rural*, GIGAOM, Sept. 18, 2012, <http://gigaom.com/2012/09/18/verizons-4g-network-is-about-to-get-a-lot-more-rural/>. Recently Verizon announced that it would make AWS-1 spectrum available to "an unspecified number of its [18 LRA] partners." Phil Goldstein, *Verizon to Give Rural LTE Partners Access to its AWS Spectrum, 'XLTE' Network*, FIERCEWIRELESS, Aug. 7, 2014, <http://www.fiercewireless.com/story/verizon-give-rural-lte-partners-access-its-aws-spectrum-xlte-network/2014-08-07>. Assuming all 18 LRA partners have entered into separate agreements for out-of-market AWS roaming, these agreements would make up the vast majority of Verizon's purported negotiations.

³⁰ AT&T Comments at 11 (*citing* Decl. of Joseph Farrell, D.Phil., Ex. 2 to Petition at Table 6).

traffic in 2013). AT&T makes no mention of this fact, nor does it account for the potential effect that volume discounts likely played on these price reductions. AT&T also fails to caveat its claims with the well-recognized fact that, as T-Mobile and other operators began deploying 4G networks (and as investments in 3G networks finished depreciating) costs would naturally fall as well. Finally, AT&T also disregards Dr. Farrell’s remarks accompanying the data that “the average domestic wholesale data roaming rate that T-Mobile paid in 2013 is 3.6 times the maximum retail rate that Verizon charges a user of 1,700 MB per month, six times the rate AT&T charges, over seven times the rate that T-Mobile charges, and over ten times Sprint’s maximum rate.”³¹

More critically, the record demonstrates that smaller carriers have had no choice but to accept unfavorable data roaming terms from these “must-have” roaming partners in order to offer a competitive service to customers.³² The fact remains that carriers with a modest facilities-based footprint must rely on roaming partners for broader coverage.³³ And with consumers’ expectation that wireless services must be available on a nationwide basis, AT&T and Verizon have become essential roaming partners for virtually all competitive carriers.

Although AT&T claims that VoLTE roll out will expand the universe of roaming partners,³⁴ clear and effective data roaming requirements are necessary in the meantime to ensure that the imbalance in negotiating positions for data roaming does not allow the largest carriers to take advantage of their dominant position. AT&T’s attempt to hold against T-Mobile the fact that

³¹ Decl. of Joseph Farrell, D.Phil. Ex. 2 to Petition at ¶ 86.

³² *See, e.g.*, PinPoint Comments at 5; C Spire Comments at 8; RWA Comments at 5; NTELOS Comments at 8.

³³ *See, e.g.*, Limitless Comments at 3 (describing the pressure to enter into a new data roaming agreement with AT&T in critical adjacent service areas in order to effectively compete).

³⁴ AT&T Comments at 14.

competitors (such as T-Mobile) are moving to VoLTE rings particularly hollow once one realizes that AT&T has refused to announce a date by when it expects to launch the service.³⁵

Furthermore, the “must-have” nature of roaming partners with broader coverage necessarily means that parties will be less likely to file complaints if they have no choice but to accept unfavorable terms. The lack of roaming complaints, thus, is not a useful measure of the effectiveness of the rules. Nevertheless, CCA is aware of at least one complaint filed by NTCH against Verizon, contradicting the claims of AT&T and Verizon that no claims have been filed.³⁶

Given the extreme disparity in the negotiating positions of the two largest carriers versus all other competitive carriers, the exorbitant data roaming rates experienced by carriers commenting in this proceeding reflect the entrenched advantage that the two largest carriers hold. Although AT&T claims that as a “net purchaser” of roaming it has no incentive to increase roaming rates,³⁷ this reasoning is flawed. AT&T relies on roaming for only a small portion of its coverage; meanwhile, many smaller carriers rely on roaming for the vast majority of their nationwide coverage. The reality is that the largest carriers today do not need reciprocal roaming arrangements as they once did, which has resulted in these carriers cherry-picking the places where they send inbound roaming while locking smaller carriers out of the same sort of access.³⁸ Thus, AT&T actually would benefit from high market prices for roaming because such prices have only a relatively small impact on its own business, but have a devastating impact on its competitors. This is particularly so because AT&T and Verizon—as a result of industry consolidation—have a significantly larger customer base

³⁵ Mike Dano, *AT&T Admits to VoLTE Delay, Won't Offer New Launch Date*, FIERCEWIRELESS, Feb. 26, 2014, <http://www.fiercewireless.com/story/att-admits-volte-delay-wont-offer-new-launch-date/2014-02-26>.

³⁶ *See NTCH, Inc. v. Cellco Partnership dba Verizon Wireless*, EB-13-MD-006 (filed Nov. 22, 2013).

³⁷ *See* AT&T Comments at 19.

³⁸ *See* RWA Comments at 6; *see also* NTCH Comments at 4 (“as the two major carriers have achieved near ubiquity of footprint nationwide, they have lost any incentive whatsoever to negotiate fair or reasonable roaming rates”).

over which to spread roaming costs. In any event, any downward trend in roaming rates that AT&T and Verizon claim exists does not address the overwhelming record evidence that the terms and practices (not just the rates) around roaming offered by AT&T and Verizon are not commercially reasonable.

Notably, AT&T cites to the Data Services Hub program established by Sprint and CCA, arguing that the existence of such programs shows that there is no need to adopt T-Mobile's proposed benchmarks.³⁹ AT&T's argument is a red-herring, flowing from its unfamiliarity with the Data Services Hub and its skewed view of the current data roaming marketplace. While the Hub facilitates efficient interconnection and data exchange from a technical perspective, the business terms are still negotiated bilaterally. But more importantly, AT&T has it backwards: the creation of such programs illustrates the continued importance of roaming service and demonstrates what can be accomplished when parties act in a commercially reasonable manner.⁴⁰ Moreover, the fact that such successful arrangements among carriers exist does not and should not provide AT&T and Verizon with an excuse to perpetuate anti-competitive behavior.

Finally, AT&T's and Verizon's arguments that adopting T-Mobile's proposed benchmarks would diminish investment incentives are contradicted by the Commission's recognition that carriers with limited footprints need to rely on roaming partners to offer the level of service coverage that consumers have come to expect.⁴¹ In adopting the *Data Roaming Order*, the Commission found that data roaming requirements would provide incentives for all carriers to invest in and deploy advanced networks, promoting competition among multiple providers.⁴² The D.C. Circuit likewise summarily

³⁹ See AT&T Comments at 15.

⁴⁰ See, e.g., Sprint Comments at 7 (citing programs that provide the capabilities to help reduce roaming costs and accelerate the deployment and utilization of 4G LTE across rural America).

⁴¹ See AT&T Comments at 27; Verizon Comments at 7.

⁴² *Data Roaming Order* at ¶ 13.

dismissed this weak argument in upholding the data roaming rule.⁴³ Indeed, even AT&T acknowledges that roaming arrangements such as those facilitated by the Data Services Hub program provide incentives for further facilities-based investment.⁴⁴

III. THE RECORD CONFIRMS THAT THE COMMISSION HAS AMPLE AUTHORITY TO MAKE THE PROPOSED CLARIFICATIONS

Commenters in this proceeding vehemently agree that adopting T-Mobile's proposed clarifications to the "commercially reasonable" standard is well within the Commission's broad statutory authority under Title III to manage spectrum use.⁴⁵ Sprint, C Spire and the public interest joint commenters all echo CCA's agreement with T-Mobile's analysis, which concludes that the proposed clarifications in the Petition are wholly consistent with the D.C. Circuit decision upholding the data roaming obligations, and do not run afoul of the prohibition on common carrier regulation of mobile Internet providers acknowledged by the court.⁴⁶ Using the proposed benchmarks to supplement the factors that the Commission has already established to measure commercial reasonableness does not constitute common carrier regulation, and would not result in the implementation of a price cap.⁴⁷

AT&T inaccurately characterizes the proposed benchmarks as having the effect of unlawfully relegating data roaming providers, *i.e.*, imposing "unlawful common carrier regulation."⁴⁸ Both CCA and T-Mobile have acknowledged that not all of T-Mobile's proposed benchmarks are meant to apply in all circumstances, but instead should be considered as factors in evaluating the commercial reasonableness of offered roaming rates and terms – *i.e.*, exactly the

⁴³ *Cellco P'ship v. Fed. Comm'n's Comm'n*, 700 F.3d 534, 550-51 (D.C. Cir. 2012).

⁴⁴ See AT&T Comments at 15.

⁴⁵ See Sprint Comments at 9; C Spire Comments at 9.

⁴⁶ Sprint Comments at 9; C Spire Comments at 9-10; PK/OTI/Benton/CC Comments at 11.

⁴⁷ See, *e.g.*, Sprint Comments at 10; C Spire Comments at 9-10.

⁴⁸ See AT&T Comments at 34.

approach upheld by the D.C. Circuit.⁴⁹ And T-Mobile does not suggest, as Verizon characterizes the proposal, “linking” roaming rates to rates for retail or MVNO services.⁵⁰ Instead, T-Mobile’s proposed approach is fully consistent with the factors for commercial reasonableness adopted in the *Data Roaming Order*, which AT&T recognizes are not exclusive or exhaustive.⁵¹ The proposed benchmarks are merely additional factors to help inform the analysis established in the data roaming rule to determine commercial reasonableness.⁵² And because the proposals “are well rooted in the data roaming rule, the proposed guidance should remain safely within the bounds of the Commission’s jurisdictional authority.”⁵³ Significantly, issuing the proposed guidance would still allow carriers a high degree of flexibility to negotiate terms and rates.⁵⁴ Therefore, adoption of the proposed benchmarks reflects a moderate proposal that does not cross the line into common carrier regulation.

Not surprisingly, AT&T and Verizon are the only parties to assert that T-Mobile’s Petition is procedurally infirm. They argue that the *Data Roaming Order* provides only for a case-by-case assessment of commercial reasonableness and that a petition for declaratory ruling is not the appropriate procedure to address T-Mobile’s request.⁵⁵ However, like CCA, other commenters agree that the Commission clearly anticipated parties needing further clarification of the commercially reasonable standard which affirms the view that T-Mobile’s Petition is procedurally appropriate.⁵⁶ Indeed, the *Data Roaming Order* addresses not only complaints, but also disputes

⁴⁹ CCA Comments at 9-10; Petition at ii.

⁵⁰ See Verizon Comments at 7.

⁵¹ AT&T Comments at 8.

⁵² Sprint Comments at 9.

⁵³ *Id.* at 10.

⁵⁴ C Spire Comments at 9; COMPTTEL Comments at 3; Sprint Comments at 3.

⁵⁵ Verizon Comments at 3; AT&T Comments at 17, 36.

⁵⁶ See, e.g., C Spire Comments at 5-6.

more generally, and provides a framework for revisiting the Commission’s decisions and taking additional action. Moreover, evaluating the commercially reasonable standard only in the context of a complaint has not resulted in incentives to negotiate in good faith.⁵⁷ The Commission acknowledged in the *Order* that its rules “already provide for the use of petitions for declaratory ruling for the purpose of ‘ . . . removing uncertainty’” related to data roaming issues.⁵⁸ Indeed, the Commission states several more times in the *Data Roaming Order* that a petition for declaratory ruling is the proper vehicle.⁵⁹

IV. CONCLUSION

For the foregoing reasons and as stated in opening comments in this proceeding, CCA urges the Commission to grant T-Mobile’s Petition and to issue guidance in the form of T-Mobile’s proposed benchmarks. Such guidance would ensure that the “commercially reasonable” standard established in the Commission’s data roaming rules can be implemented to promote greater access to data roaming on reasonable terms. The record in this proceeding strongly supports this outcome, and CCA respectfully requests that the Commission expeditiously grant the Petition.

⁵⁷ NTCH/Flat/Blue Comments at 5.

⁵⁸ See *Data Roaming Order* ¶ 75 n.231; see also 47 C.F.R. § 1.2 (specifying that petitions for declaratory ruling are appropriate procedural vehicles for “removing uncertainty”).

⁵⁹ *Data Roaming Order* at ¶ 77 (“When roaming-related complaints or petitions for declaratory ruling are filed, we intend to address them expeditiously); *id.* at ¶ 2 (“To resolve disputes arising pursuant to the rule we adopt here, we provide that parties may file a petition for declaratory ruling under Section 1.2 of the Commission’s rules . . .”); *id.* at ¶ 8 (“In order to address disputes relating to the rule we adopt, we also set out a complaint process for such disputes, and also permit disputes to be brought through petitions for declaratory ruling, depending on the circumstances specific to each dispute”); *id.* at ¶ 82 (“We note that the Wireless Telecommunications Bureau has delegated authority to resolve other disputes with respect to the data roaming rule adopted herein”); see also 47 C.F.R. § 20.12(e)(2) (“Whether the appropriate procedural vehicle for a dispute is a complaint under this paragraph or a petition for declaratory ruling under § 1.2 of this chapter may vary depending on the circumstances of each case.”).

Respectfully submitted,

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DOCUMENT 93**

US Machine-to-Machine (M2M) Communications

Markets

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I

Introduction to M2M Communications

MACHINE-TO-MACHINE COMMUNICATIONS

Introduction

This Frost & Sullivan research service on the Machine-to-Machine (M2M) communications markets presents an analysis of the key market trends and opportunities in the connected machines space in the United States. It amends and updates the 2012 study on the same topic and presents updated forecasts and other related information on the key market trends and dynamics. The term "M2M" is quite broad as M2M connections can be used across the wireless and wireline domains, and connectivity for deployed endpoints can be provided via cellular/mobile, satellite, wireline/Internet, and other private and public telecommunication networks. Additionally, both short- and long-range access technologies can be leveraged to provide M2M connectivity. This report is focused on the cellular M2M connectivity space in the United States and identifies the market opportunity from a cellular-enabled connected devices perspective only. Throughout this study, the terms "M2M" and "cellular M2M"; "cellular" and "mobile"; "operators", "mobile operators", "cellular operators", and "mobile network operators (MNOs)" are used interchangeably.

Key Market Definitions

M2M communication refers to digital communication between an endpoint and an enterprise's backend system over cellular networks. A sensor-based tank monitoring system that monitors liquid in a storage tank and sends an automated message to a central monitoring station when the level of the liquid in the tank goes below a certain level is an example of automated M2M communication. An in-vehicle navigation system that communicates with the service provider's backend, in response to specific commands of a human operator, to present the relevant information to the vehicle's driver or passengers, is another example of M2M communication.

According to Numerex Corporation, M2M communications consists of using a device (for example, a sensor and a meter) to capture an event (for example, temperature, inventory level, location, or environment status), which is then relayed through a network (for example, wireless, wired or hybrid) to an application (software program), to translate the captured event into meaningful information (for example, there is a breach, corrosion requires attention, items need to be restocked, or an accident has occurred). This definition can be applied to both one-way and two-way communication scenarios where a device can be remotely monitored, information can be collected and analyzed, and the device itself can perform certain functions based on commands from the enterprise or the service provider's backend.

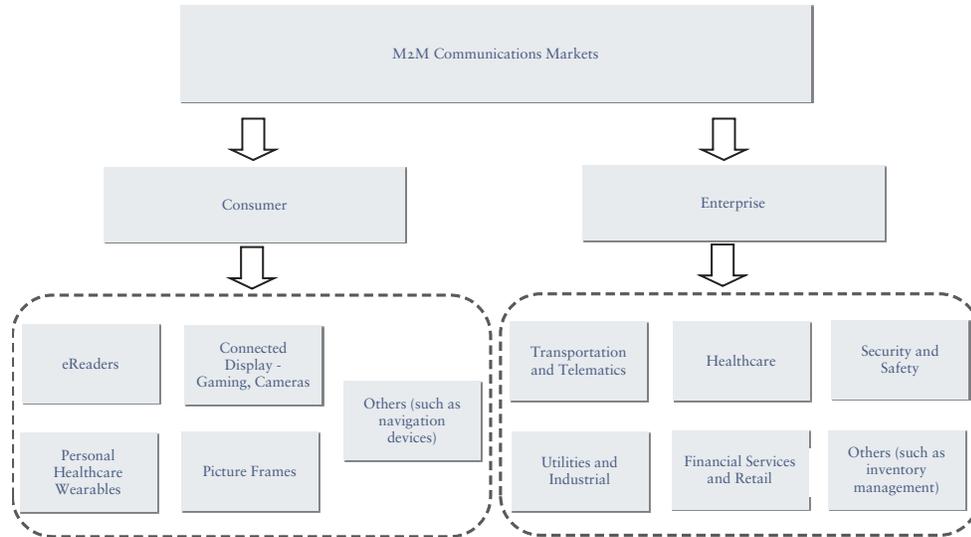
Various "integrated" services, such as smartphone applications that can be used to monitor remote endpoints, are increasingly becoming available. Depending upon the system architecture, some of these applications may (or may not be) classified as M2M. An M2M application is one that sends data to an enterprise backend (i.e, facilitates data exchange between a remote asset and an enterprise backend). A Smartphone application that displays data about the state of a particular endpoint by plugging into that enterprise's backend is not a true M2M communication system, even though it is indirectly communicating with the remote asset or the endpoint. Another criterion for defining M2M could be based on the level of "human involvement". M2M communication services may refer to only those solutions that facilitate digital communication between remote or in-field enterprise endpoints and enterprise backend without human intervention.

Market Segmentation and Forecast Methodology

Exhibit 1 shows the market segmentation in the Total US M2M Communications Markets in 2012.

EXHIBIT 1

Total M2M Communications Markets: Market Segmentation, US, 2012



Note: The industry tends to separate M2M into the "Consumer" and the "Enterprise" categories. The "Consumer" category is not that big overall and the bulk of the market opportunity is really defined by the important "Verticals" which fall under the Enterprise umbrella.

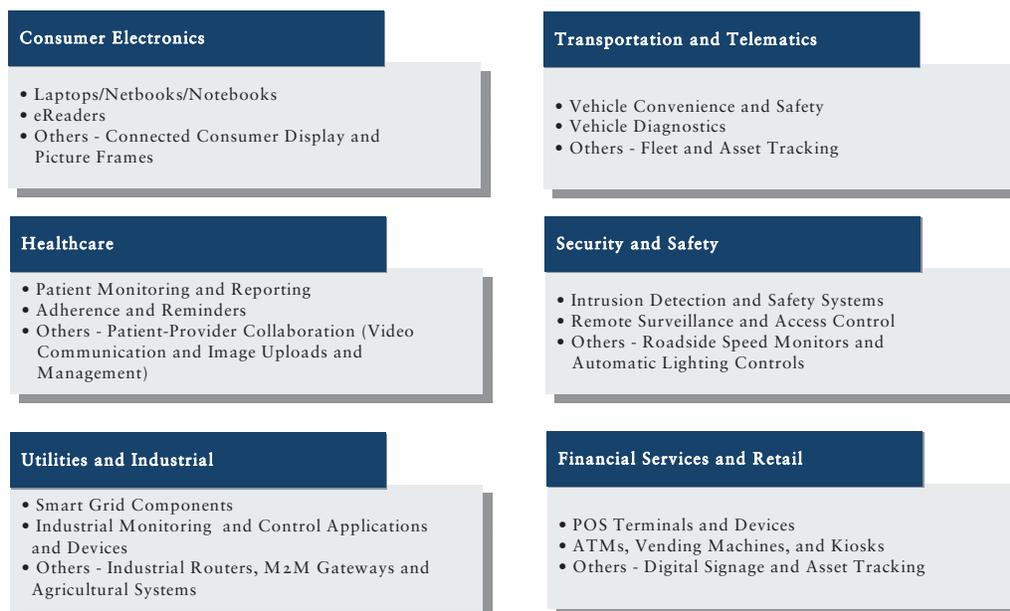
Some operators also include Mobile Computing devices (comprising of Laptops, Netbooks, Notebooks and Tablets) in the Consumer M2M category. However, Frost & Sullivan does not include Mobile Computing devices in M2M and it is not a part of the analysis.

Source: Frost & Sullivan

Exhibit 2 shows the M2M categories and sub-categories in the Total US M2M Communications Markets in 2012.

EXHIBIT 2

Total M2M Communications Markets: M2M Categories and Sub-categories, US, 2012



Note: Frost & Sullivan also has an "Others" category that represents unique connected devices and solutions that may not be included into any other pre-defined categories. The "others" category merely represents any possible new implementations that may arise in M2M and hence, does not contain any analysis.

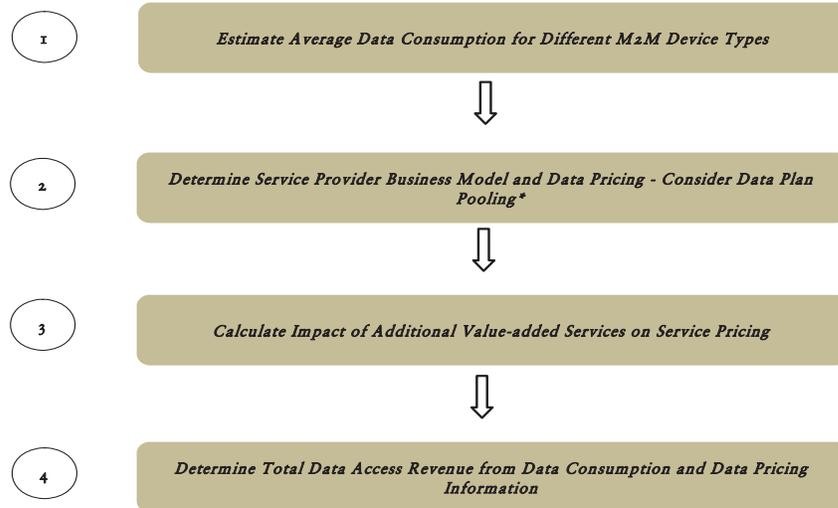
Source: Frost & Sullivan

Frost & Sullivan has estimated the number of M2M connections across different industry segments and has used the average revenue per connected device/unit (ARPU) to establish the market potential. The overall opportunity in the M2M space is largely defined by the service revenues that accrue to the wireless service providers for providing connectivity to the endpoints. Depending upon the business model, mobile operators can also generate more revenue by providing additional service, support, and marketing and distribution services. For example, they could charge a premium in M2M by offering retail solutions (direct to consumers or enterprises); while they may primarily get data access revenue from providing wholesale M2M. In many cases, mobile operators may also charge a fixed minimum price for providing connectivity to M2M endpoints. Mobile operators can sell connectivity services directly to customers (i.e, minimal involvement), or they may also sell solutions through partners (i.e, maximum involvement) where connectivity is bundled along with the M2M solution. The pricing and revenue for mobile operators and M2M service providers depend upon multiple factors, including bandwidth consumed, application and cloud platform resources consumed, number of connections, and ultimately, the business model of the M2M customer.

Exhibit 3 shows the methodology for estimating M2M data access revenue in the Total US M2M Communications Markets in 2012.

EXHIBIT 3

Total M2M Communications Markets: Methodology for Estimating M2M Data Access Revenue, US, 2012



Key: * Data access could be bundled along with service pricing; it is assumed that all the data used is paid for (either by the end user or by the solution provider).

Source: Frost & Sullivan

Summary of Findings and Key Conclusions

Below are some key findings of this research.

- All verticals continue to contribute to the market growth. However, in terms of connections, the Transportation and Telematics market (including fleet and asset tracking) and Utilities and Industrial market—particularly connected (or smart) utility meters—continue to grow at a faster pace than others. The Consumer market, which has been the growth driver for the US M2M communications industry for several years, is likely to remain strong over the forecast period, as well.
- M2M is likely to remain a high-margin, low-cost, and low-ARPU business for mobile operators in the long run. This is particularly true for mobile operators that are heavily dependent on wholesale M2M mobile virtual network operators (MVNOs) that buy bandwidth at wholesale rates and build M2M solutions on top of that. In order to achieve the desired level of scale, automation, and service penetration, mobile operators have to invest in appropriate technical platforms and personnel. Once the initial challenges are addressed, it is only a matter of time before M2M becomes a highly profitable business for US mobile operators.
- Overall, M2M deployments do not yet generate a large amount of data bandwidth. As a result, pure-play M2M data access revenue is relatively small when compared to total mobile data revenue. However, this is expected to change rapidly when Third-generation (3G) and Fourth-generation (4G) cellular networks start to become a common communication medium for M2M applications.
- M2M application platforms are critical for the growth of the industry. These platforms help simplify M2M application development and ongoing management, and are likely to see strong adoption during the forecast period. The challenge for M2M cloud platform providers will be to generate increased revenue, in line with the strong growth of M2M data volumes (or transactions).
- "Minimal" involvement, "moderate" involvement, and "close" involvement in direct sales to M2M customers are the three high-level go-to-market strategies of US mobile operators. It is extremely difficult for mobile operators to work on a one-to-one basis with smaller entities that want to leverage the power of mobility for their connected deployments. This is where dedicated M2M service providers come into the picture. By providing a highly focused set of offerings for M2M, these service providers are likely to emerge as the preferred choice for the small and medium business (SMB) segment.

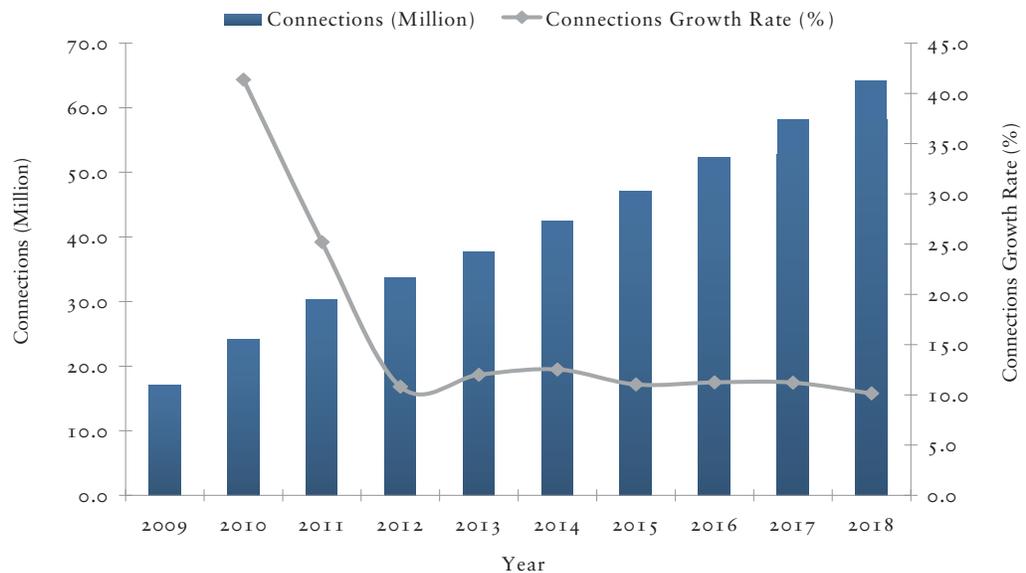
- The migration of M2M to 3G and 4G networks could happen sooner than initially expected. With AT&T, the present market leader in M2M communications, recently announcing its intention to shut down its slower second-generation (2G) networks over the next five years (by 2017), new M2M customers are likely to adopt high-speed wireless networks to ensure long-term continuity of their connected deployments. On the other hand, other mobile operators, such as Sprint and T-Mobile USA, which are likely to continue to run their 2G networks for a relatively longer period of time, could benefit from AT&T's decision by providing cheaper 2G-based services for M2M.
- M2M application development and management platforms, reporting and management interfaces, M2M test beds and innovation centers, cloud computing, secure M2M connectivity, professional services, industry vertical expertise and mobility experts, and integrated wired/wireless M2M services are likely to be the crucial differentiating factors for mobile operators and their partners in the long run in the US M2M communications markets. Long-term success in M2M communications will also depend on the operators' ability to nurture, develop, and support their wholesale initiatives. Tier-1 mobile operators are also increasingly offering "branded" vertical M2M products in partnership with specialized solution providers. However, mobile operators have to be careful to not compete directly with M2M wholesale service providers.
- A significant amount of data (or transactions) is expected to be generated by the millions of M2M endpoints that are likely to be connected over cellular networks. Storage, analysis, and interpretation of this massive amount of data could easily become a major industry challenge. The threat of network resources getting overwhelmed from this "big data" phenomenon is quite real. The problem will only get worse with time, unless the industry aggressively deploys the necessary storage and computing resources to address this issue. This makes it critical for mobile operators and their partners to provide appropriate platforms, software, and infrastructure components to help in M2M application development, deployment, and management.
- The full impact of the proposed nationwide high-speed public safety network on M2M communications is still unclear. However, it is fair to assume that certain markets, such as Security and Safety, and Transportation and Telematics, could see growth in M2M connectivity due to deployments on this network. While this may or may not benefit commercial cellular operators in the United States, it will definitely benefit other industry participants, such as M2M application platform providers and M2M hardware vendors.

- The total number of M2M connections in the United States is expected to increase from 33.6 million in 2012 to 64.2 million in 2018. While this is lower than the 2012 forecast from Frost & Sullivan, it does not indicate a lower adoption of wireless in the M2M communications markets. The M2M connectivity architecture of connect-aggregate-transport-monitor leads to multiple connected endpoints supported by a single or a set of gateways. There is no doubt that at some point in future, the number of directly connected machines will outnumber the number of mobile phone connections. However, from a revenue perspective, it will take longer for the pure-play M2M market to generate more revenue than the traditional consumer voice and data services business.

Exhibit 4 shows the connections forecast in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 4

Total M2M Communications Markets: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

2

M2M Device Cloud Platforms

ROLE AND IMPORTANCE OF M2M DEVICE CLOUD PLATFORMS

Introduction

Common industry challenges include the lack of a standard set of technologies around which an M2M application can be built, rapid lifecycle of devices and device components, longer time-to-market for new M2M applications, and lack of qualified personnel to develop new M2M applications. By providing access to a standard set of published interfaces or APIs, M2M cloud platforms shorten the time to develop and bring new applications to the market. For example, M2M cloud platforms could take the data flow coming from the M2M endpoint and put it into a reusable object model. This allows companies that want to build M2M applications to use the reusable object model to build their applications (versus just building off data streams). This approach can greatly improve the time taken to develop applications. Frost & Sullivan's research has indicated time savings of more than 60.0 percent, when M2M cloud platforms are used for building M2M applications.

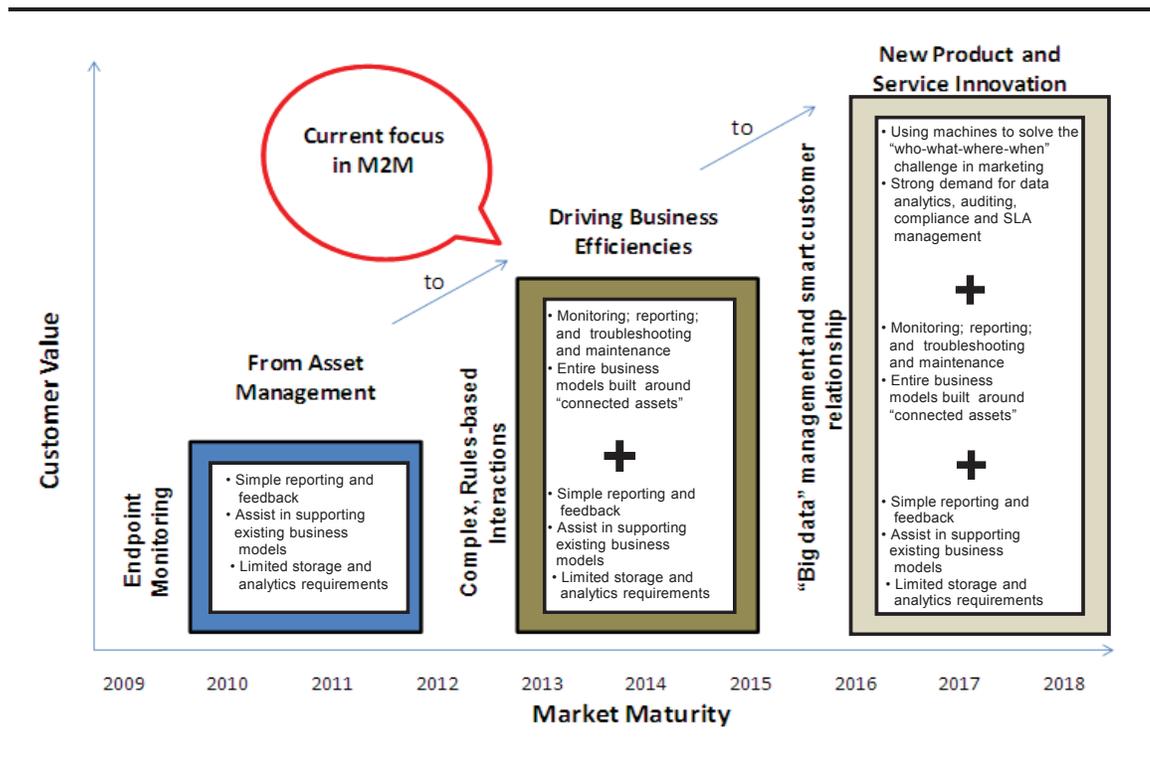
Customers can use the standard set of web technologies to communicate with the M2M cloud platform, which then takes care of the downstream communication to and from M2M endpoints. In order to be used across different industry verticals, the M2M cloud platform has to support different embedded technologies that are used in the industry. This is typically achieved through small software client applications (or "agents") that can be installed/pre-integrated in different devices (for example, at the micro-controller level) and helps to deliver an "out-of-the-box" connectivity with the M2M cloud platform. These software clients can also be downloaded and installed separately on M2M devices.

Traditional M2M applications are linear and are mostly "devices speaking to applications". The new generation of M2M applications are likely to be collaborative and take advantage of services that are in the cloud. For example, in tracking systems, geo-location can be combined with traffic information and route stops to know exact time of arrival of fleet vehicles. This supplementary information can be provided by the M2M cloud platform, which can, in turn, pull this information from other data sources including other cloud platforms. Adding context, combining multiple data points, and providing enterprise-grade security, availability, and scalability are some additional benefits of M2M cloud platforms.

Exhibit 5 represents the market evolution and roadmap in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 5

Total M2M Communications Markets: Market Evolution and Roadmap, US, 2009-2018



Source: Frost & Sullivan

M2M Cloud Platform Architecture

The M2M cloud platform is made up of the infrastructure and the platform layers, with software applications built on the platform layer and offered as a service if required. Hence, the three layers of a cloud platform can be Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS).

Exhibit 6 shows the three layers of an M2M device cloud in the Total US M2M Communications Markets in 2013.

EXHIBIT 6

Total M2M Communications Markets: The Three Layers of an M2M Device Cloud, US, 2013



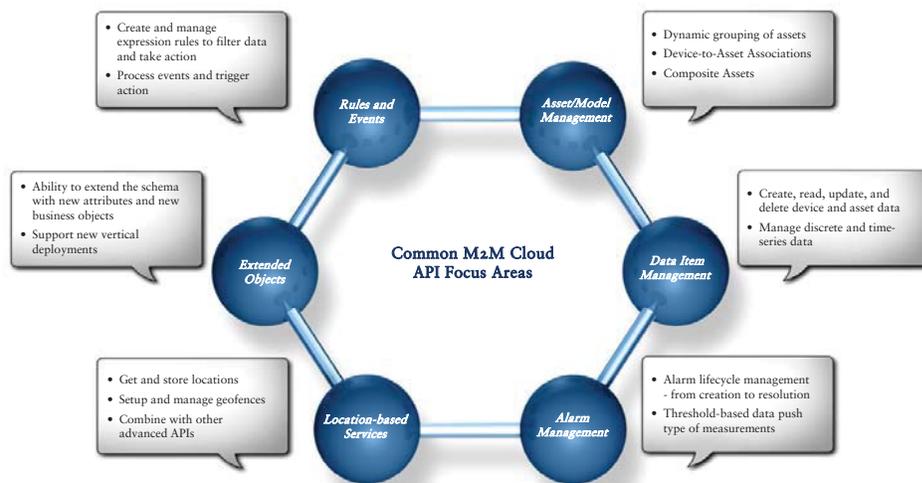
Source: Digi International Inc.; Frost & Sullivan

By offering infrastructure as a service, M2M cloud vendors can help deliver scalable applications. The vast requirements of data storage, data retrieval, and data analysis, along with secure M2M connectivity can be addressed at the IaaS layer. Access to this foundational layer can then be provided through a middleware layer—PaaS—by exposing common software functions through APIs to help with faster custom application development. Then, on top is the SaaS layer, which is usually a software application that can be used to leverage the full power of the PaaS and the IaaS layers to manage connected M2M endpoints. The pricing for this SaaS layer is usually on a monthly subscription basis and the cost of the underlying infrastructure components can be built into this pricing. Leading M2M cloud vendors aspire to provide all three layers of the cloud. However, customers can also develop or purchase different applications that can then leverage the full power of the underlying PaaS and the IaaS layers through published APIs. In the latter scenario (of not using the cloud vendor's SaaS application, if available), the PaaS and the IaaS layers can be monetized separately.

Exhibit 7 shows some commonly used API focus areas for M2M cloud platforms in the Total US M2M Communications Markets in 2013.

EXHIBIT 7

Total M2M Communications Markets: Some Commonly Used API Focus Areas for M2M Cloud Platforms, US, 2013



Source: Axeda Corporation; Frost & Sullivan

Billing and Pricing Models

A variety of billing and pricing models exist for the M2M cloud providers. A SaaS offering can be offered on a 'per active connection' basis, while the infrastructure and the platform can be monetized on a 'per transaction' basis. Other parameters, such as number of connections, amount of data sent (and hence storage required), and time, can also be used to price the M2M cloud platform and the infrastructure. For example, M2M cloud platform providers can separate their offerings into "management service" and "application services". Management services may include managing the connectivity, uptime, software, and firmware of the equipment, while application services may include data collection and analysis. Frost & Sullivan has observed per connection pricing for management services, while data or transaction-related pricing can be used for application services. However, just from an infrastructure perspective (IaaS), a tiered transactions-based pricing structure is generally used for monetization. For example, a cloud platform provider can offer its services for \$20,000 per year for up to 25,000 transactions per day and include 30 GB of storage. On the other hand, another cloud provider may charge a fixed, per connection fee for each supported deployment. To summarize, the SaaS providers may collect a fixed fee per connection in a given time period (monthly or yearly), while the platform providers are more likely to charge on a per transaction basis. In many cases, the platform provider and the application provider may be the same. In that case, the software application pricing includes the platform charges. So, the 'per unit' pricing for software usage includes the platform usage charges. M2M cloud providers can also monetize high-demand cloud services, such as long-term storage of time-series data. While the SaaS pricing can include data storage for a short duration of time, long-term storage of time-series data can be offered on a premium basis.

Market Forecasts for M2M Device Cloud Platforms

Frost & Sullivan has estimated the M2M platform opportunity for the IaaS and PaaS providers in the United States.

Exhibits 8 and 9 present the cloud platform revenue from M2M transactions in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 8

Total M2M Communications Markets: Cloud Platform Revenue from M2M Transactions, US, 2009-2018

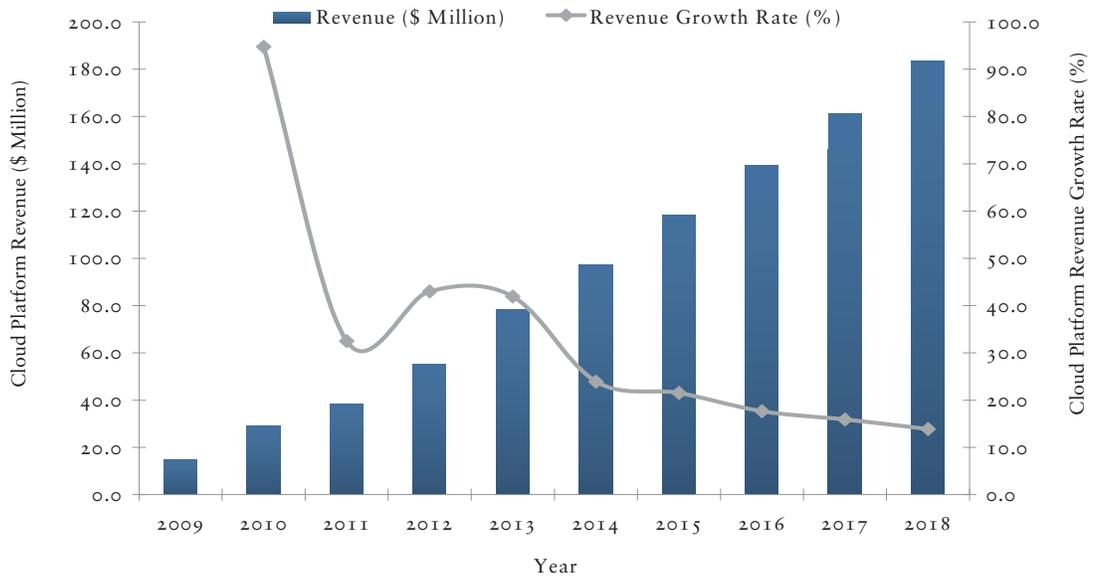
Year	Cloud Platform Revenue (\$ Million)	Cloud Platform Revenue Growth Rate (%)
2009	15.0	--
2010	29.2	94.8
2011	38.7	32.5
2012	55.3	43.0
2013	78.5	41.9
2014	97.3	23.9
2015	118.3	21.5
2016	139.1	17.6
2017	161.3	15.9
2018	183.7	13.9

Compound Annual Growth Rate (2012-2018): 22.1%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 9

Total M2M Communications Markets: Cloud Platform Revenue from M2M Transactions, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 8 and 9 represent only the transaction-based revenue opportunity for M2M IaaS providers in the United States. Applications can be built on top of available M2M cloud platforms and can then be licensed to customers according to the application pricing model (for example, per user per month). The total opportunity for M2M cloud, which includes IaaS, PaaS, and SaaS, along with other value-added or specific services, could be significantly higher.

The total market opportunity for M2M cloud vendors depends upon the number of supported connections, the number of transactions, and the amount of data that is stored over the long and short-term periods. According to Frost & Sullivan's research report titled "Analysis of the North American Machine-to-Machine Software and Services Market " (code number NB48-10), brand name, reliability, delivery time, pricing, integration capabilities (including integration with enterprise resource management platforms), customer service abilities, and product portfolio are the key competitive factors in the North American M2M application cloud platforms. Frost & Sullivan also believes that a broad connectivity framework, a comprehensive capability set (including multiple APIs to address the common communication needs of different verticals), a success-based pricing, broad support for multiple hardware types, pre-integration with mobile operator systems, and ease of use are some of the other important factors for the success of M2M cloud platform vendors.

3

Total US M2M Communications Markets

MARKET DYNAMICS

Industry Challenges

Exhibit 10 shows the impact of the top eight industry challenges in the Total US M2M Communications Markets from 2013 to 2018.

EXHIBIT 10

Total M2M Communications Markets: Impact of Top Eight Industry Challenges, US, 2013-2018

Challenge	1-2 Years	3-4 Years	5-6 Years
Justifying continued investments in M2M platforms	High	Medium	Medium
Leveraging benefits of mobility	High	Medium	Medium
Nurturing the M2M application development community	High	Medium	Medium
Lack of standardization	Medium	Medium	Medium
Need for integrated M2M solutions	Medium	Medium	Medium
Continued uncertainty around 4G LTE	Medium	Medium	Low
Getting consumers to pay for enhanced connectivity	Medium	Medium	Low
Managing the significant storage and reporting infrastructure requirement in M2M communications	Medium	Medium	Low

Source: Frost & Sullivan

JUSTIFYING CONTINUED INVESTMENTS IN M2M PLATFORMS

Mobile operators need to invest in appropriate systems, tools, and service and support capabilities to compete effectively in the US M2M communications markets. For mobile operators, this involves taking a big "leap of faith" in hopes of generating volume (and revenues) from their M2M initiatives. Operators also have to share APIs with their partners in order to allow them to leverage various network capabilities in a secure manner. As LTE is introduced, managing the bandwidth consumption of millions of connected broadband M2M devices will inevitably become a challenge. These and other issues continue to pose challenges to mobile operators who want to see as many M2M connections on their networks as possible. Nevertheless, they may struggle to keep up with the ever-increasing demands of this ecosystem.

LEVERAGING BENEFITS OF MOBILITY

M2M deployment can be supported over wireline, wireless, or hybrid networks (such as fixed and short-range wireless network, fixed and private wireless network, and even fixed and satellite networks). It is extremely important for the cellular industry to actively communicate the economic and operational benefits of mobility to their buyers in order to continue to drive the adoption of cellular services. This is especially true for fixed M2M endpoints, such as industrial-grade routers, where being "mobile" is not a key requirement. This does not mean that there is no room for cellular in fixed connected environments. However, it may be harder to achieve good penetration in fixed connectivity environments.

NURTURING THE M2M APPLICATION DEVELOPMENT COMMUNITY

M2M application development remains a complex and time consuming process, especially when it is done without using an application development platform. The skill sets of an embedded application developer are different from the skill sets of a web developer. Consequently, a web developer cannot easily code for the embedded environment. The need for custom application development is unlikely to be eliminated for M2M communications. Nevertheless, any approach that helps to simplify M2M application development—either by proactive sharing of industry best practices or by providing off-the-shelf tools to help application development—should definitely be a priority. M2M cloud platform vendors and mobile operators are the two likely entities that can help with this initiative in the short term.

LACK OF STANDARDIZATION

Lack of true standardization in M2M communications continues to remain a major industry challenge. M2M solutions have to be customized according to the specific business needs of customers. However, there is no cross-vertical "plug-and-play" architecture that can help improve product integration and implementation time. The true benefits of M2M are likely to be realized only when disparate application types can communicate seamlessly with each other to help businesses improve different aspects of their internal and external processes. Addressing industry fragmentation that occurs at the lower layers (physical, addressing, and transport) is expected to be a long-drawn process. However, it is necessary to usher in the next-generation of M2M communication.

NEED FOR INTEGRATED M2M SOLUTIONS

Specialized (or niche) M2M hardware vendors who rely on a "hardware-only" strategy are likely to find themselves at a competitive disadvantage in the long run. M2M hardware providers clearly need to offer additional value (in the form of innovative application development frameworks, for example) to command a premium over simple hardware pricing. A one-size-fits-all approach in M2M is likely to become less effective. The rapidly evolving needs of the M2M ecosystem will be better served by flexible implementations that allow customers to seamlessly integrate various components (such as M2M modules, gateways, and cloud platforms) in a manner that is best suited to their business model. Devising an effective strategy for long-term success in M2M communications is likely to be a challenge for leading hardware solution providers.

CONTINUED UNCERTAINTY AROUND 4G LTE

There is a significant amount of uncertainty over the deployment of 4G LTE M2M solutions, especially in the public safety domain. While public safety agencies have been allocated dedicated spectrum for deployment of a nationwide, inter operable wireless network, deploying such a network is a time consuming and an expensive endeavor. Various approaches, including private-public partnerships and government support, have been proposed to fund deployment of the nationwide public safety network. However, the expectations and requirements of private industry participants from a shared wireless network can be very different to those of public safety agencies. High cost of LTE modules and global spectrum fragmentation in 4G services are some other challenges.

GETTING CONSUMERS TO PAY FOR ENHANCED CONNECTIVITY

It could be a challenge to encourage consumers to pay for enhanced connectivity in their daily lives. For example, while the vision of a connected car is extremely interesting, there is no guarantee that a majority of car owners will be willing to pay a monthly subscription charge for in-car communication services. This could end up making the pay-as-you-go model a necessity in the consumer M2M communications business. Industry participants have to be careful to not end up creating solutions that do not have any practical applicability. It is important for them to clearly understand the value that they offer to consumers and price their services accordingly.

MANAGING THE SIGNIFICANT STORAGE AND REPORTING INFRASTRUCTURE REQUIREMENT IN M2M COMMUNICATIONS

M2M cloud platforms will be expected to support both wireless and wired M2M deployments and will have to be designed to provide the necessary storage, management, analytics, and reporting capabilities for the hundreds of millions (and possibly billions) of connected devices within the next five to 10 years. In many cases, storing and managing data pertaining to user records management, data stream monitoring for threshold alarm applications, other call detail records (CDRs), and other similar data sets, require the use of high quality, high-performance data management platforms. Increasing average data consumption for M2M endpoints also increases the storage requirement across the board for a majority of M2M deployments. All these transaction records have to be archived for a certain time period and analyzed, as required. Providing the appropriate storage and computing resources to manage the transaction data could be a challenge in the US M2M Communications markets.

Market Drivers

Exhibit 11 shows the market drivers ranked in order of impact in the Total US M2M Communications Markets from 2013 to 2018.

EXHIBIT 11

Total M2M Communications Markets: Market Drivers Ranked in Order of Impact, US, 2013-2018

Rank	Driver	1-2 Years	3-4 Years	5-6 Years
1	Strong support of tier-1 mobile operators	High	High	High
2	Efforts of independent M2M service providers and M2M mobile virtual network operators	High	High	High
3	The connected vehicle opportunity	High	High	High
4	Cloud-based M2M applications platforms	Medium	Medium	Medium
5	High-speed networks and next-generation M2M	Medium	Medium	Medium
6	Public safety networks	Medium	Medium	Medium
7	Strategic partnerships with system integrators	Medium	Medium	Medium
8	Push towards a smarter, greener planet	Low	Medium	High

Source: Frost & Sullivan

STRONG SUPPORT OF TIER-1 MOBILE OPERATORS

M2M represents the most attractive opportunity for mobile operators in the United States to increase connections and revenue. Providing dedicated teams, systems, and technologies to simplify M2M communications is at the core of mobile operators' strategy in the United States. Mobile operators have also established various "Centers of Excellence" in M2M communications to facilitate development, deployment, and management of connected endpoints on their networks. Mobile operators are also willing to offer customized service plans to accommodate the unique business models of M2M customers. Overall, operator support remains one of the biggest drivers in the M2M communications markets.

EFFORTS OF INDEPENDENT M2M SERVICE PROVIDERS AND M2M MOBILE VIRTUAL NETWORK OPERATORS

M2M aggregators and M2M managed service providers, such as KORE Telematics, Numerex Corporation, Wylless, M2M Data Smart, Aeris Communications, RACO Wireless, and others that lease wholesale wireless capacity from MNOs and provide complete airtime/connectivity, development, and professional services solutions, continue to be the key solution providers in the US M2M communications markets. These independent M2M service providers have been particularly successful in providing connectivity to the SMB segment. Other key success factors for independent M2M service providers include offering specialized technologies and features for specific industry verticals and, in many cases, offering more flexible payment terms. Frost & Sullivan's research indicates that in 2012, leading independent M2M service providers have posted more than 30.0 percent growth in connections, which is above the industry growth rate. Independent M2M service providers have made a significant contribution towards the growth of the US M2M communications markets.

THE CONNECTED VEHICLE OPPORTUNITY

The connected car opportunity—defined as embedded and aftermarket M2M solutions that provide intra and inter-vehicle communication to help improve the driver experience, increase vehicle performance, and ensure vehicle, personal, and asset safety services—is expected to help drive the growth of the US M2M communications markets in a big way. The recently announced agreement between AT&T and OnStar LLC, a subsidiary of General Motors Corporation (GM), to wirelessly deliver safety, security, diagnostic, and infotainment services to most Chevrolet, Buick, GMC, and Cadillac vehicles, beginning in 2014, is an indication of things to come in the connected car M2M segment. This market is likely to drive growth in terms of number of connections and in terms of M2M revenue, due to the large amount of bandwidth consumed and transactions generated from in-car services.

CLOUD-BASED M2M APPLICATION PLATFORMS

In the past, M2M application providers have had little choice but to develop and manage the entire communication system on their own. However, in-house development, deployment, and management of M2M applications can be a very costly affair and can also lead to issues with application scalability and upgrades. M2M application platforms provide a standardized set of APIs to make it easier to build M2M applications. They also allow for easier access, analysis, and manipulation of the stored transaction data, which helps customers to improve their business operations. Integration with operator-supported wireless subscription management systems, a pay-as-you-go (or a pay-as-much-as-you-use) pricing structure, out-of-the-box applications, and operator support with marketing further help to drive adoption of M2M cloud platforms in the United States.

HIGH-SPEED NETWORKS AND NEXT-GENERATION M2M

The advent of high-speed 4G LTE wireless networks is expected to support the demands from high-bandwidth M2M applications. Examples include video and multimedia applications for digital signage, remote monitoring, home and in-vehicle entertainment, remote patient monitoring, and secure and robust enterprise data connectivity. Differentiated bandwidth pricing, subsidized pricing of high-speed wireless modules, such as modems and gateways, ready-to-deploy vertical industry solutions, and bundled cloud-based platform solutions are all part of operators' strategy to help drive adoption of LTE for M2M communications.

PUBLIC SAFETY NETWORKS

A nationwide, interoperable public safety wireless network is now closer to reality with the US Government allocating an additional 10.0 MHz of spectrum under the Middle Class Tax Relief and Job Creation Act of 2012. Public safety and law enforcement agencies are likely to use the network for a wide range of secure voice, video, and data communication services, including remote monitoring, security and surveillance, and even sensor-based monitoring of the nation's critical infrastructure. It is also proposed to allow utilities and other critical infrastructure companies to have shared access to the public safety spectrum, although discussions regarding "right to use" and "right to prioritize" are still ongoing. Overall, the rollout of the public safety network is expected to drive deployment of different types of remote monitoring, security, safety, and surveillance M2M solutions.

STRATEGIC PARTNERSHIPS WITH SYSTEM INTEGRATORS

M2M Systems integrators help to develop out-of-the-box solutions and provide custom product development and ongoing consulting and support services. M2M application platform providers, hardware vendors, and mobile operators have established preferred partnerships with leading systems integrators to deploy M2M solutions. Partnerships, such as those between Axeda Corporation and Wipro Technologies for simplified M2M deployment and between General Electric (GE) and multiple partners for GE's recently announced "Industrial Internet" initiative, are expected to fuel growth of M2M communications.

PUSH TOWARDS A SMARTER, GREENER PLANET

Increasing business efficiency, delivering better services to customers and partners, and ensuring sustainable business operations are the three most important benefits of M2M. Automated, effective, and intelligent monitoring of technologies that are used in our daily lives can help reduce dependence on energy sources, reduce pollution, help in improved distribution of wealth, and make the world a better place to live in. Government mandates, aging population, pressure on non-renewable energy sources, increasing pollution, tough economic conditions, low cost of wireless bandwidth, reducing hardware costs, and trends in distributed workspace are all helping to boost the adoption of M2M solutions.

FORECASTS FOR THE US M2M COMMUNICATIONS MARKETS

Market Forecasts

Exhibit 12 shows the Market Engineering measurements in the Total US M2M Communications Markets in 2012.

EXHIBIT 12

Total M2M Communications Markets: Market Engineering Measurements, US, 2012

Market Engineering Drives Market Strategy and Planning



Measurement Name	Measurement	Trend
Market Stage	Growth	-
Revenues (2012)	\$2,048.5 million	Increasing
Potential revenues (maximum future market size)	\$4,483.0 million	Increasing
Base year market growth rate (2012)	18.9%	Increasing
Compound annual growth rate (CAGR)	13.9%	-
Price sensitivity	High	Increasing
Customer type	Enterprises from different industry verticals, including Utilities and Industrial, Transportation and Telematics, Security, Retail, Healthcare, Financial Services, and others	Increasing
Competitors (active market competitors in base year)	100-150	Decreasing
Degree of competition	High	Increasing
Degree of technical change	High	Increasing
Customer satisfaction	8	Increasing
Customer loyalty	9	Increasing
Market concentration (percent of base year market controlled by top 3 competitors)	89.6%	Increasing

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 13 and 14 show the connections forecast in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 13

Total M2M Communications Markets: Connections Forecast, US, 2009-2018

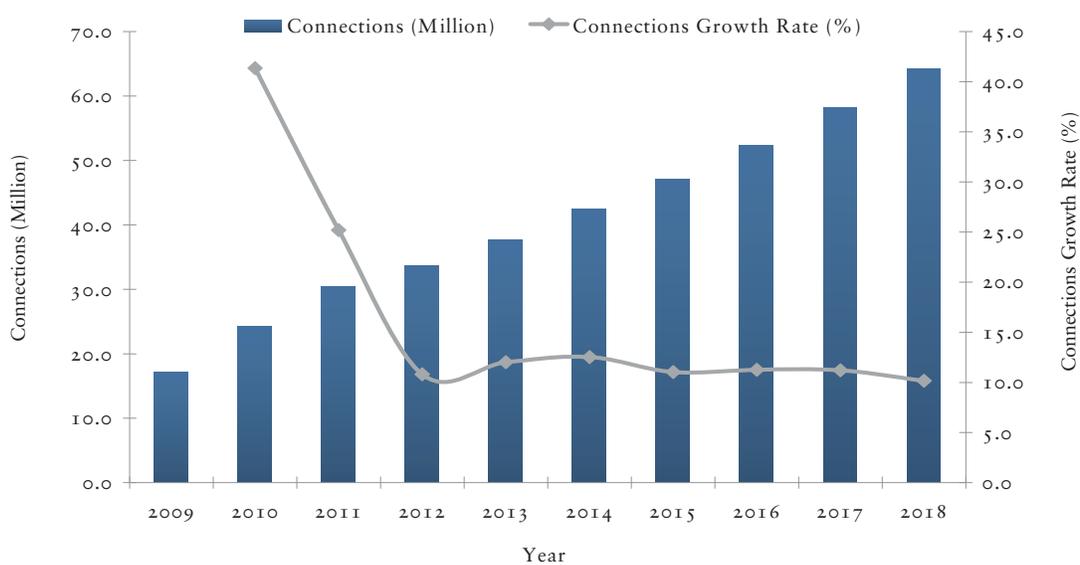
Year	Connections (Million)	Connections Growth Rate (%)
2009	17.2	--
2010	24.2	41.4
2011	30.4	25.2
2012	33.6	10.8
2013	37.7	12.0
2014	42.4	12.5
2015	47.1	11.0
2016	52.4	11.3
2017	58.3	11.2
2018	64.2	10.2

Compound Annual Growth Rate (2012-2018): 11.4%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 14

Total M2M Communications Markets: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 15 and 16 show the consumer and enterprise connections forecast in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 15

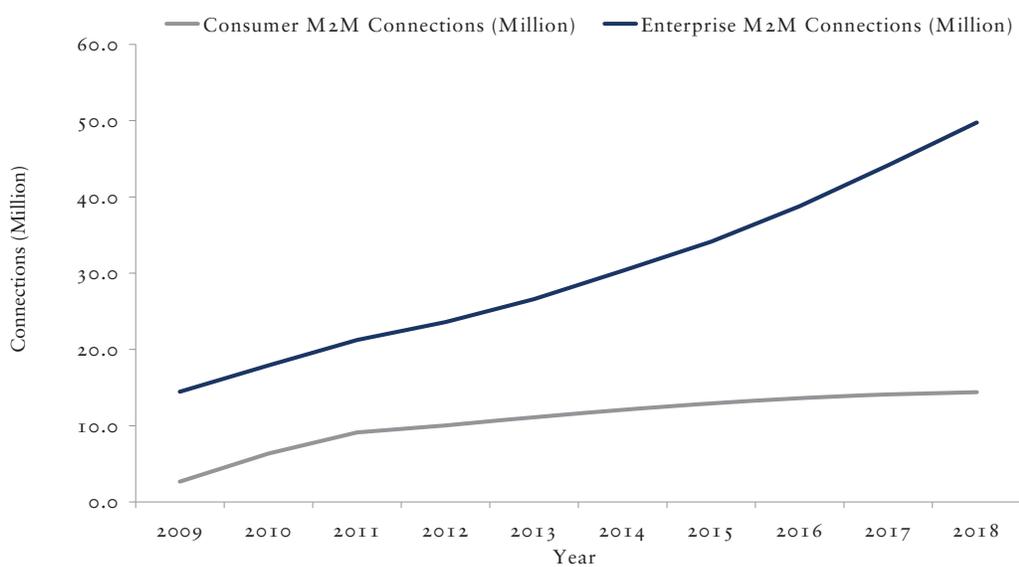
Total M2M Communications Markets: Consumer and Enterprise Connections Forecast, US, 2009-2018

Year	Consumer M2M Connections (Million)	Enterprise M2M Connections (Million)
2009	2.7	14.5
2010	6.4	17.9
2011	9.1	21.2
2012	10.0	23.6
2013	11.1	26.6
2014	12.1	30.3
2015	12.9	34.1
2016	13.6	38.8
2017	14.1	44.2
2018	14.4	49.8

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 16

Total M2M Communications Markets: Consumer and Enterprise Connections Forecast, US, 2009-2018

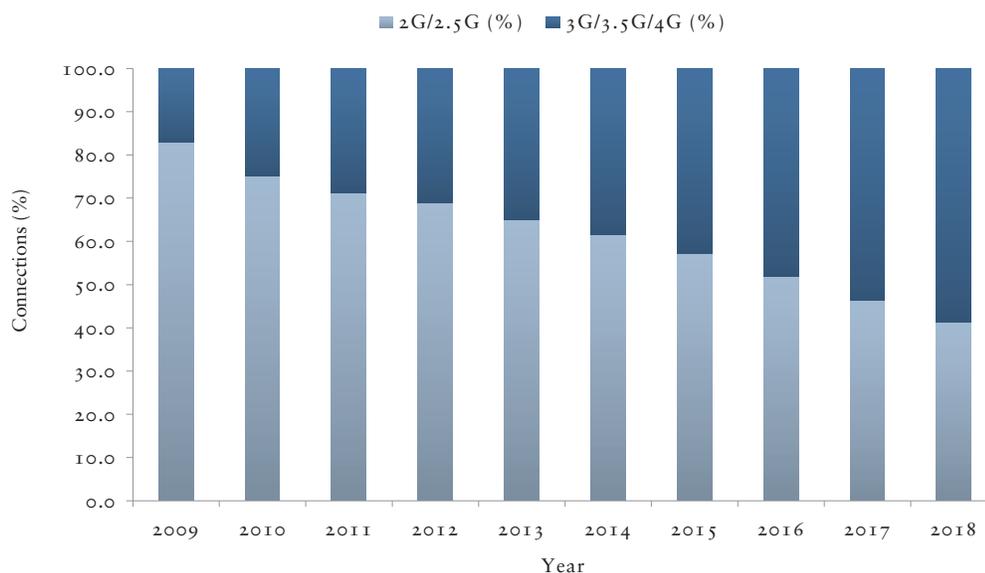


Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibit 17 shows the percent of M2M connections by 2G/2.5G and 3G/3.5G/4G protocols in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 17

Total M2M Communications Markets: Percent of M2M Connections by 2G/2.5G and 3G/3.5G/4G Protocols, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 18 and 19 show the data consumption forecast in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 18

Total M2M Communications Markets: Data Consumption Forecast, US, 2009-2018

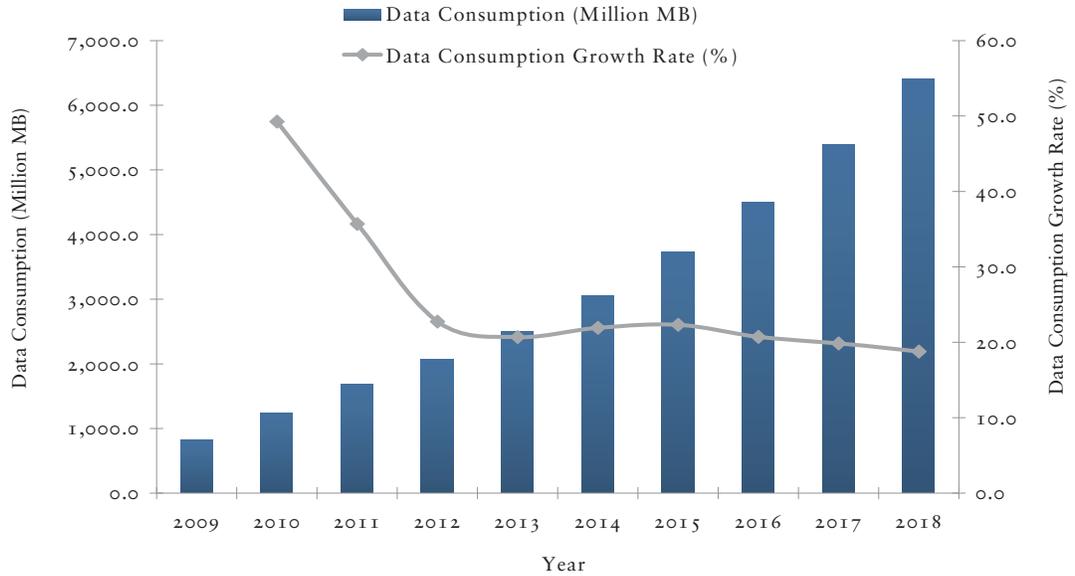
Year	Data Consumption	
	(Million MB)	Growth Rate (%)
2009	833.9	--
2010	1,244.6	49.2
2011	1,688.6	35.7
2012	2,072.5	22.7
2013	2,501.3	20.7
2014	3,049.4	21.9
2015	3,729.8	22.3
2016	4,502.8	20.7
2017	5,396.9	19.9
2018	6,411.1	18.8

Compound Annual Growth Rate (2012-2018): 20.7%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 19

Total M2M Communications Markets: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 20 and 21 show the data access revenue forecast in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 20

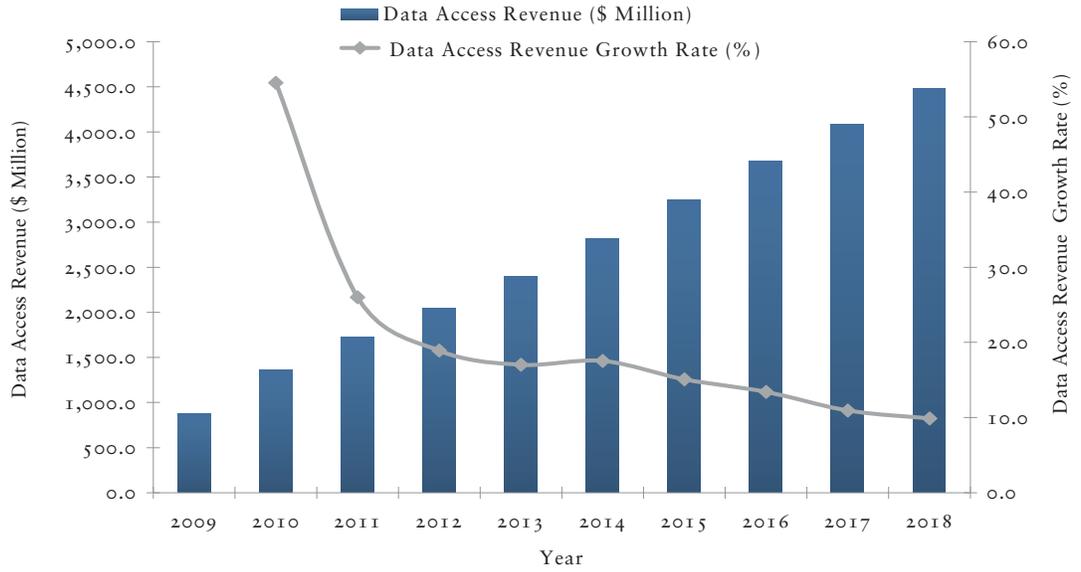
Total M2M Communications Markets: Data Access Revenue Forecast, US, 2009-2018

Year	Data Access Revenue	
	Data Access Revenue (\$ Million)	Growth Rate (%)
2009	884.7	--
2010	1,367.2	54.5
2011	1,722.7	26.0
2012	2,048.5	18.9
2013	2,397.2	17.0
2014	2,817.5	17.5
2015	3,242.4	15.1
2016	3,677.6	13.4
2017	4,080.0	10.9
2018	4,483.0	9.9
Compound Annual Growth Rate (2012-2018): 13.9%		

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 21

Total M2M Communications Markets: Data Access Revenue Forecast, US, 2009-2018

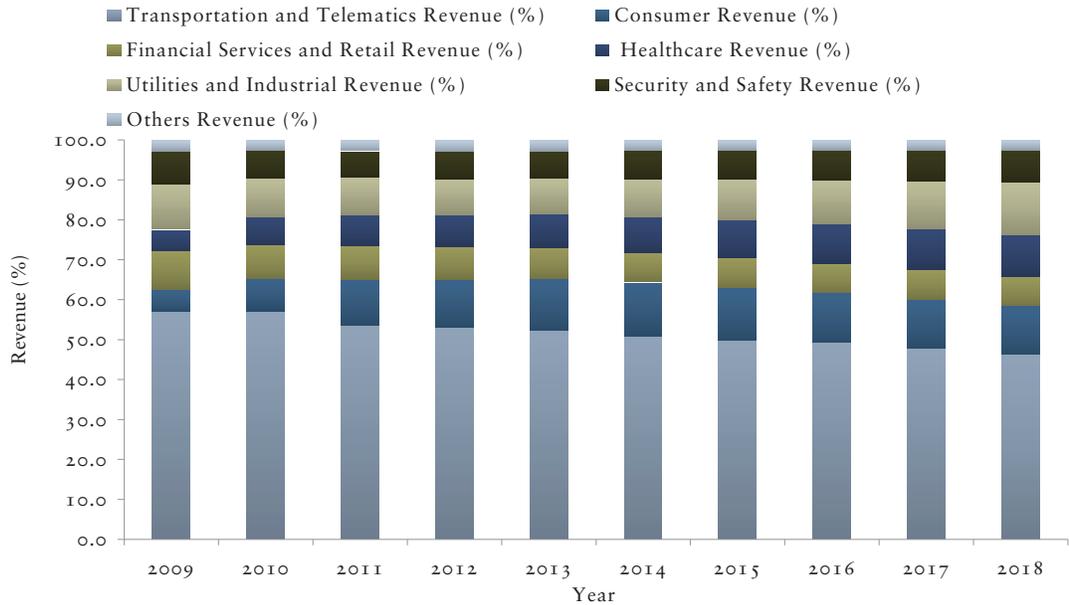


Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibit 22 shows the percent of data access revenue by M2M verticals in the Total US M2M Communications Markets from 2009 to 2018.

EXHIBIT 22

Total M2M Communications Markets: Percent of Data Access Revenue by M2M Verticals, US, 2009-2018



Note: Other revenue opportunities in M2M include ruggedized gateways and routers used in niche industry verticals.

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

The main observations from Exhibits 12 to 22 are as follows:

- The total number of M2M connections in the United States is expected to increase from 33.6 million in 2012 to 64.2 million in 2018. While this is lower than the 2012 forecast from Frost & Sullivan, it does not indicate a lower adoption of wireless in the M2M communications markets. The M2M connectivity architecture of connect-aggregate-transport-monitor leads to multiple connected endpoints supported by a single or a set of gateways. At some point in future, the number of directly connected machines is expected to outnumber the number of mobile phone connections. However, it will take a long time for the pure-play M2M market to generate more revenue than the traditional consumer voice and data services business.
- The share of mobile broadband networks in M2M is expected to increase rapidly during the forecast period. Tier-1 mobile operators, such as AT&T, have announced that they will be switching off the slower 2G networks within the next few years. Frost & Sullivan expects nearly 59.0 percent of M2M connections in the United States to be supported by the high-speed mobile broadband networks in 2018.

- Almost every category is expected to witness increased M2M data consumption on an aggregate basis, as well as on a per unit basis. Total data consumption in the US cellular M2M communications markets is expected to increase from 2,072.5 million MB in 2012 to 6,411.1 million MB in 2018.
- Data access revenue from M2M is expected to increase from \$2,048.5 million in 2012 to \$4,483.0 million in 2018. These figures are lower than the 2012 forecast from Frost & Sullivan, largely due to the declining base price for M2M connectivity services. It should also be noted that these are just the baseline access revenue. Service providers may be able to levy a "value-driven" pricing, independent of the amount of data consumed as well. Pricing for M2M also depends upon the number of connected units per deployment and per customer, the duration of commitment, the frequency of usage of network resources (such as the number of times a network cloud platform is accessed in a given time period), how a particular M2M application connects/re-connects, need for secure VPNs, static IP, and other technical and business factors.
- Mobile operators can provide wholesale, as well as retail solutions in M2M. The pricing models change accordingly. For example, wholesale M2M data pricing is noticeably more economical than a retail M2M data pricing. However, the wholesale model mandates a higher level of commitment from the entity purchasing the M2M bandwidth.

COMPETITIVE AND MARKET SHARE ANALYSIS

Competitive Analysis

Exhibit 23 shows the competitive structure of the Total US M2M Communications Markets in 2012.

EXHIBIT 23

Total M2M Communications Markets: Competitive Structure, US, 2012

Number of Companies in the Market	100-150—including mobile network operators, M2M MVNOs, M2M hardware providers, M2M cloud providers, application service providers (ASPs), system integrators, professional consulting organizations, M2M platforms providers, and others.
Types of Competitors	<p>Mobile operators, such as Verizon Wireless, AT&T, Sprint Nextel, T-Mobile USA, and U.S. Cellular.</p> <p>M2M virtual network providers/bandwidth resellers-KORE Telematics, RACO Wireless, Numerex Corp, Wylless Inc, Aeris Communications, M2M DataSmart, nPhase, and others.</p> <p>M2M management platform providers-Jasper Wireless, nPhase, Amdocs, and others</p> <p>Application developers and application enablement solution providers-Axeda Corporation, Digi International Inc. Viewbiquity, LLC, and others.</p> <p>M2M Module and Hardware Providers-Sierra Wireless, Telit Communications PLC, Cinterion Wireless Modules GmbH (Gemalto NV), Digi International Inc, and others.</p> <p>M2M Systems Integrators and ASPs</p>
Distribution Structure	Operators can offer M2M solutions directly to the end user (consumer or the enterprise segment) and may also work with partners to offer bandwidth and service management capabilities for M2M connectivity. Third-party hardware providers and M2m application platform providers can also work directly with enterprise customers.
Notable Mergers and Acquisitions	<p>Gemalto acquires Cinterion and SensorLogic.</p> <p>Telit acquires Motorola Solutions' M2M module business unit</p>
Key End-user Groups	<p>Consumer segment-largely for productivity, entertainment, communication, and healthcare applications and services.</p> <p>Enterprise segment-for connecting remote, in-field deployed assets across different industry verticals.</p>
Competitive Factors	<p>Network coverage, ease of M2M solution deployment, availability of vertical solutions and data pricing</p> <p>Asset management and reporting and feedback platforms</p> <p>Strategic M2M MVNO relationships</p> <p>Module and device availability and pricing</p> <p>Long-term strategy for 4G (and ability to overcome the expected 4G challenges of spectrum fragmentation, higher device pricing, and others)</p>

Source: Frost & Sullivan

M O B I L E O P E R A T O R S

Complexity in M2M solution development and deployment is a major industry challenge. New types of M2M implementations generally need customized support in the form of new device types and form factor, battery management and ergonomics, new pricing models and revenue settlements supported by appropriate rating and mediation capabilities, application support, support for different network and device identifier types, organization training, regulatory requirements, and others. Frost & Sullivan firmly believes that mobile operators that can help address the complexity of M2M solution development and deployment will emerge as the preferred choice for customers in the US M2M communications markets.

Every leading mobile operator has a wholesale and a retail offering for M2M communications, and also has a dedicated team and department focused on generating more business from M2M communications. Tier-1 mobile operators support an array of unique and customized pricing plans for their M2M deployments, which helps to ensure that their customer get a good return on investment from wireless services. For example, data consumption-based pricing may be more suitable for applications that send a predictable stream of packet data, while exception or incident-based pricing is more suitable for certain medical or healthcare solutions. Overall, the five critical "Ps" of M2M include People, Platforms, Pricing, Processes, and Partnerships. These factors are likely to determine which operator will emerge as the leader in the long run in the US M2M communications markets. At present, this position is held by AT&T, in terms of the number of M2M connections. However, other mobile operators are also doing a good job in executing their next-generation M2M strategies and the competitive structure of the US M2M communications markets could look very different in the long-term.

M 2 M M V N O s

KORE Telematics, Aeris Communications, RACO Wireless, Numerex Corporation, Wylless, and M2M DataSmart are some important M2M MVNOs in the US M2M communications markets. Frost & Sullivan's research indicates that several of these MVNOs support hundreds of thousands (even millions) of M2M connections. Additionally, more than one leading M2M MVNO is known to be growing at a rate higher than the average industry growth rate. It is no coincidence that the SMB segment tends to prefer working with M2M MVNOs for their connectivity requirements. Tier-1 mobile operators also realize the importance of M2M MVNOs in expanding their wholesale M2M business and are actively supporting these entities in any way they can in order to help them in their business.

It is important to note that M2M MVNOs can offer a domestic, multi-network service delivery option to customers. For example, leading M2M MVNOs allow their customers to choose between GSM, CDMA, and LTE technologies and hence select the best option according to their business needs. However, M2M MVNOs have to be "smart" about who they work with to ensure that managing their carrier relationships does not become a challenge for their competitive strategies. In other words, a national and a global coverage should be an asset and not a liability for M2M service providers. For example, any operator that comes on-board has to be fully committed to the success of M2M. It has to be able to provide the required integration, service, and support capabilities to drive the growth of the entire ecosystem. Other parameters, including multiple network technology options, network technology roadmap, cost of roaming, and ability to deliver a unified and integrated global connectivity management service (through cloud-based M2M management platforms) are also important in the context of regional (and global) M2M connectivity.

Market Share Analysis

AT&T remains the leader in the US M2M communications markets with respect to the number of M2M connections. In 2012, it held a share of 48.1 percent. The company ended 2012 with an impressive achievement of nearly 14.3 million direct M2M connections. AT&T continues to significantly expand its product portfolio and has also announced some big wins in M2M communications recently. Other mobile operators, such as Sprint and T-Mobile USA, are also growing at an attractive pace and are preparing their long-term LTE-based M2M strategies. AT&T's decision to stop supporting the 2G network could benefit other operators in the short run. However, the effect is likely to be minimal on AT&T's business and the company is set to usher in its next generation M2M consumer and enterprise solutions.

Exhibits 24 and 25 show the tier-1 mobile operator market share by M2M connections in the Total US M2M Communications Markets in 2012.

EXHIBIT 24

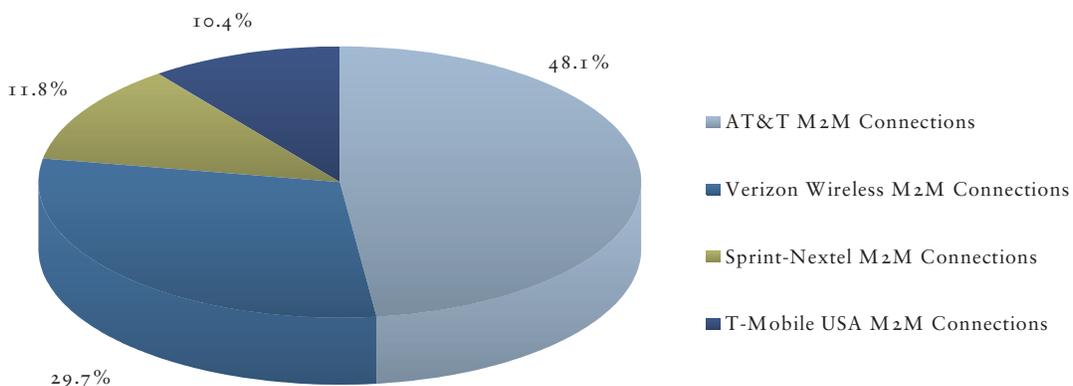
Total M2M Communications Markets: Tier-1 Mobile Operator Market Share by M2M Connections, US, 2012

Company	2012 (%)
AT&T	48.1
Verizon Wireless	29.7
Sprint-Nextel	11.8
T-Mobile USA	10.4
TOTAL	100.0

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 25

Total M2M Communications Markets: Tier-1 Mobile Operator Market Share by M2M Connections, US, 2012



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 24 and 25 represent the relative market share by M2M connections (and not by M2M revenue) for tier-1 mobile operators only. Proprietary M2M pricing structure and confidentiality agreements prevent Frost & Sullivan from commenting on mobile operators' market shares by M2M revenue. However, the number of M2M connections are available from financial reports in the public domain and are used to estimate the market shares by connections.

4

Consumer M2M Communications Market

INTRODUCTION

Introduction to Consumer M2M Communications

This category consists of direct-to-consumer (or consumer-facing) electronic devices such as eReaders, gaming consoles, connected cameras, picture frames, personal navigation devices, and other specialized communication devices used for serving various communication, information, and entertainment requirements of consumers. Consumer M2M devices tend to have a dedicated rate plan for wireless data services. They may also use an existing M2M rate card. M2M data plans for consumer devices are usually separate from M2M data plans used for the broad category of Mobile Computing devices that include laptops, net books/notebooks, wireless routers, and other similar devices. Mobile operators clearly specify that the data plans applicable to mobile computing cannot be used with any M2M device.

The Consumer market has been a top-performing category for M2M communications. However, it may not be the largest category towards the end of the forecast period. This is not to say that this market will not grow. Innovative devices, such as the connected SAMSUNG Galaxy Camera™ running on AT&T's 4G network, may boost market growth. Moreover, certain consumer devices are grouped with other categories, such as healthcare. This tends to reduce the forecast for this market.

MARKET OPPORTUNITY AND FORECASTS

Forecasts for the Consumer M2M Communications Market

Mobile operators have to provide various services to support the business-to-consumer (B2C) and the business-to-business-to-consumer (B2B2C) deployment models that are part of the Consumer M2M communications market. Mobile operators may bill the end customer directly in the case of a B2C model, or work on a wholesale, revenue share, or a fixed amount per month basis for a B2B2C type of service. This also underscores the importance of having appropriate billing and data management systems in the operator's backend to be able to accommodate all these business requirements.

Exhibits 26 and 27 show the connections forecast in the US Consumer M2M Communications Market from 2009 to 2018.

EXHIBIT 26

Consumer M2M Communications Market: Connections Forecast, US, 2009-2018

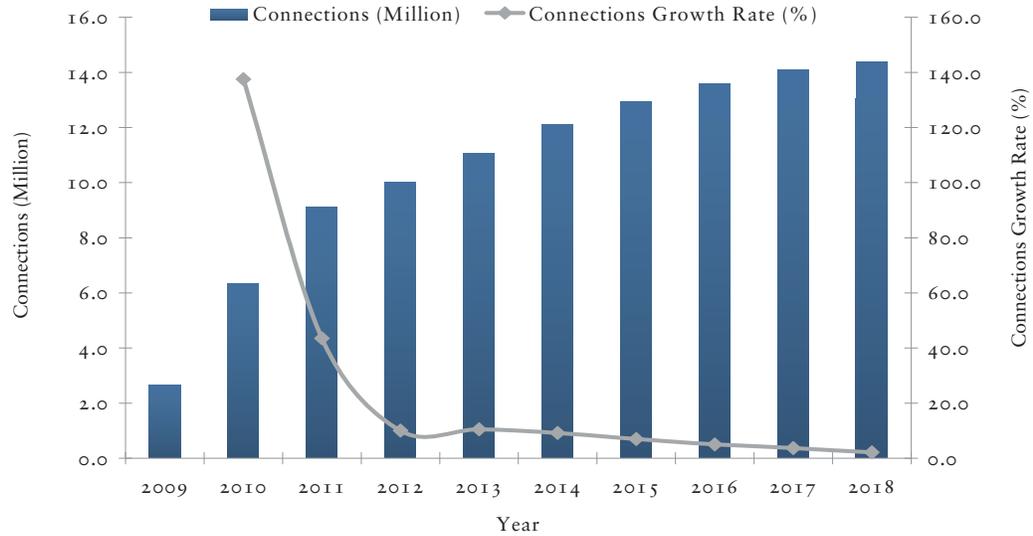
Year	Connections (Million)	Connections Growth Rate (%)
2009	2.7	--
2010	6.4	137.6
2011	9.1	43.5
2012	10.0	10.0
2013	11.1	10.5
2014	12.1	9.2
2015	12.9	7.0
2016	13.6	5.1
2017	14.1	3.7
2018	14.4	2.1

Compound Annual Growth Rate (2012-2018): 6.2%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 27

Consumer M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 28 and 29 show the data consumption forecast in the US Consumer M2M Communications Market from 2009 to 2018.

EXHIBIT 28

Consumer M2M Communications Market: Data Consumption Forecast, US, 2009-2018

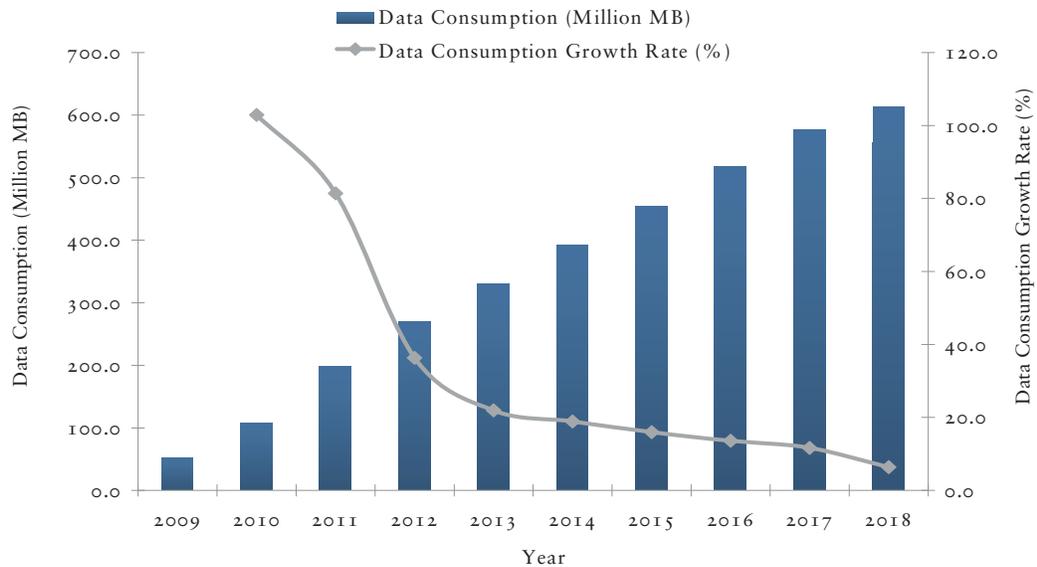
Year	Data Consumption (Million MB)	Data Consumption Growth Rate (%)
2009	53.9	--
2010	109.3	102.9
2011	198.4	81.5
2012	270.4	36.3
2013	329.8	21.9
2014	392.2	18.9
2015	454.8	16.0
2016	516.7	13.6
2017	577.1	11.7
2018	613.9	6.4

Compound Annual Growth Rate (2012-2018): 14.6%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 29

Consumer M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 30 and 31 show the data access revenue forecast in the US Consumer M2M Communications Market from 2009 to 2018.

EXHIBIT 30

Consumer M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

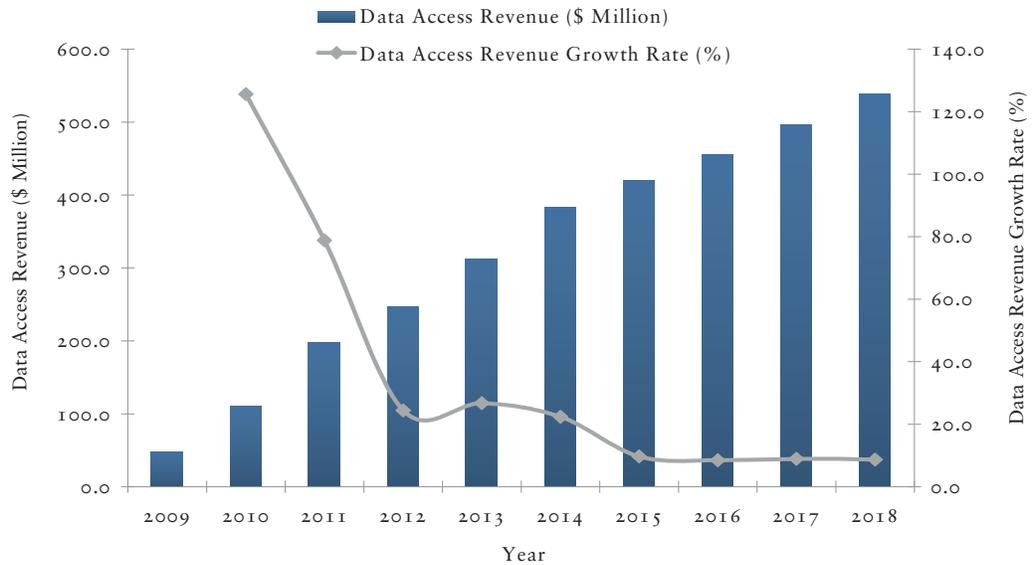
Year	Data Access Revenue	
	Data Access Revenue (\$ Million)	Growth Rate (%)
2009	49.1	--
2010	110.8	125.6
2011	198.2	78.8
2012	246.6	24.4
2013	312.5	26.7
2014	382.5	22.4
2015	419.6	9.7
2016	455.2	8.5
2017	495.9	8.9
2018	538.8	8.7

Compound Annual Growth Rate (2012-2018): 13.9%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 31

Consumer M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 26 to 31 are as follows:

- Total M2M connections in the Consumer market is expected to increase from 10.0 million in 2012 to 14.4 million in 2018.
- Data consumption by M2M devices in the Consumer market is expected to increase from 270.4 million MB in 2012 to 613.9 million MB in 2018.
- Data access revenue from M2M devices in the Consumer market is expected to increase from \$246.6 million in 2012 to \$538.8 million in 2018.

5

Transportation and Telematics M2M Communications Market

INTRODUCTION

Introduction to Transportation and Telematics M2M Communications

Transportation and Telematics is expected to emerge as the largest market in the US M2M communications markets. This market consists mainly of the following types of M2M applications:

- Embedded and aftermarket cellular vehicle telematics for commercial and passenger vehicles—applications include vehicle convenience and safety, vehicle diagnostics, fleet management, vehicle data services (such as in-vehicle WiFi), and others.
- Asset tracking and trace applications, such as package tracking—these may not necessarily be related to a vehicle per-se, but are more related to keeping track of important packages as they are shipped through the supply chain.
- Other related services—these include M2M communications offered to the emerging Electric Vehicle segment.

Forecasts for the Transportation and Telematics Communications Market

Frost & Sullivan firmly believes that Transportation and Telematics M2M communication represents the largest opportunity in wireless M2M. Some key developments and other trends that have an impact on service adoption within this market are as follows:

- Partnership announcement between AT&T and OnStar LLC, a subsidiary of General Motors Corporation (GM)—AT&T has been selected to provide wireless safety, security, diagnostics, and infotainment services to most Chevrolet, Buick, GMC, and Cadillac vehicles, beginning in 2014 in the United States and Canada. The multi-year agreement calls for AT&T to enable millions of GM cars, trucks, and crossovers with 4G LTE mobile internet access, provide the latest wireless technology to power GM's safety and security services offered by OnStar, as well as a new suite of infotainment services, such as streaming audio, web access, applications, and even video for back-seat passengers. AT&T will also enable GM's in-vehicle Wi-Fi hotspots and voice calling services. The partnership will focus on developing new communication applications for the vehicle designed to deliver more efficiency while also enhancing the driving and travelling experience. Frost & Sullivan believes that this is a significant win for AT&T, which will help the company to further consolidate its market leadership position in M2M communications. More importantly, by providing connected car services to entry, mid, and premium passenger car segments, this initiative will help drive adoption of vehicle telematics in the United States. It is also important to note that other leading passenger vehicle OEMs have also adopted a "Connected" strategy and are working with other mobile service providers to embed cellular connectivity within their vehicles. Finally, the availability of various aftermarket, standards-based solutions also helps to establish wireless connectivity in different vehicles. The embedded, as well as aftermarket segments are likely to see strong demand for replacement sales for wireless modules and other related hardware in order to ensure compatibility with the available cellular network technologies.

- Commercial and fleet vehicles are projected to continue to fuel the demand for connected vehicle services in the United States. Public safety and law enforcement, transportation and logistics, education, construction, railroad, services industry, and various other industry verticals continue to use vehicle telematics to track assets and people and for business process optimization. The usage-based insurance (UBI) segment also continues to grow owing to greater acceptance from consumers. It is no coincidence that solutions for automatic vehicle location (AVL), fleet management, field force management, asset tracking, asset management, and in-vehicle security and surveillance together represent a large percentage of the approved M2M solutions offered by tier-1 mobile operators in the United States. Thus, Transportation and Telematics is one of the fastest growing markets in M2M communications in the United States. This also conforms to the hypothesis that verticals in the M2M industry that have a lot of mobility and movement requirements tend to have higher growth projections.

Exhibits 32 and 33 show the connections forecast in the US Transportation and Telematics M2M communications Market from 2009 to 2018.

EXHIBIT 32

Transportation and Telematics M2M Communications Market: Connections Forecast, US, 2009-2018

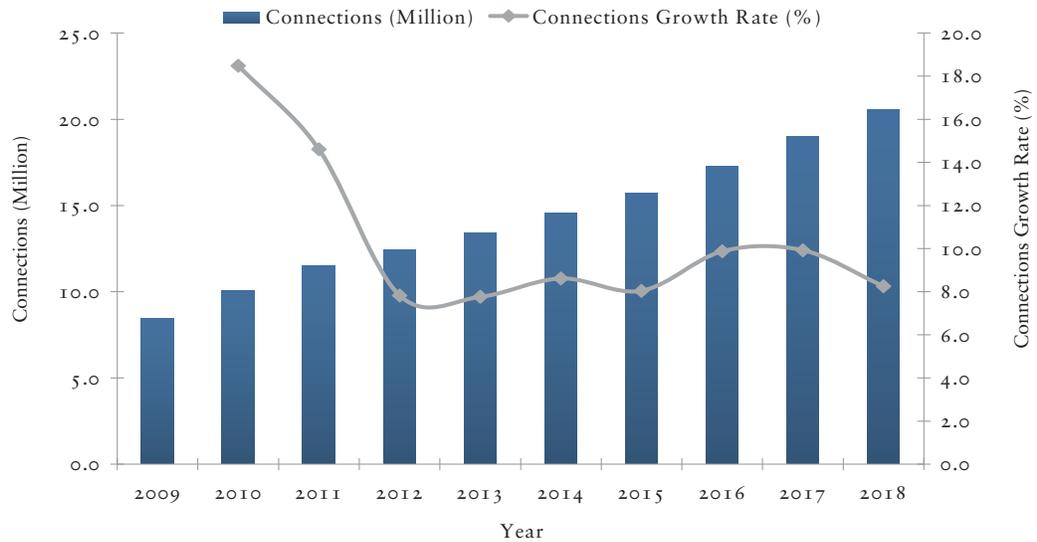
Year	Connections (Million)	Connections Growth Rate (%)
2009	8.5	--
2010	10.1	18.5
2011	11.5	14.6
2012	12.4	7.8
2013	13.4	7.8
2014	14.6	8.6
2015	15.7	8.0
2016	17.3	9.9
2017	19.0	9.9
2018	20.6	8.3

Compound Annual Growth Rate (2012-2018): 8.7%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 33

Transportation and Telematics M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 34 and 35 show the data consumption forecast in the US Transportation and Telematics M2M communications Market from 2009 to 2018.

EXHIBIT 34

Transportation and Telematics M2M Communications Market: Data Consumption Forecast, US, 2009-2018

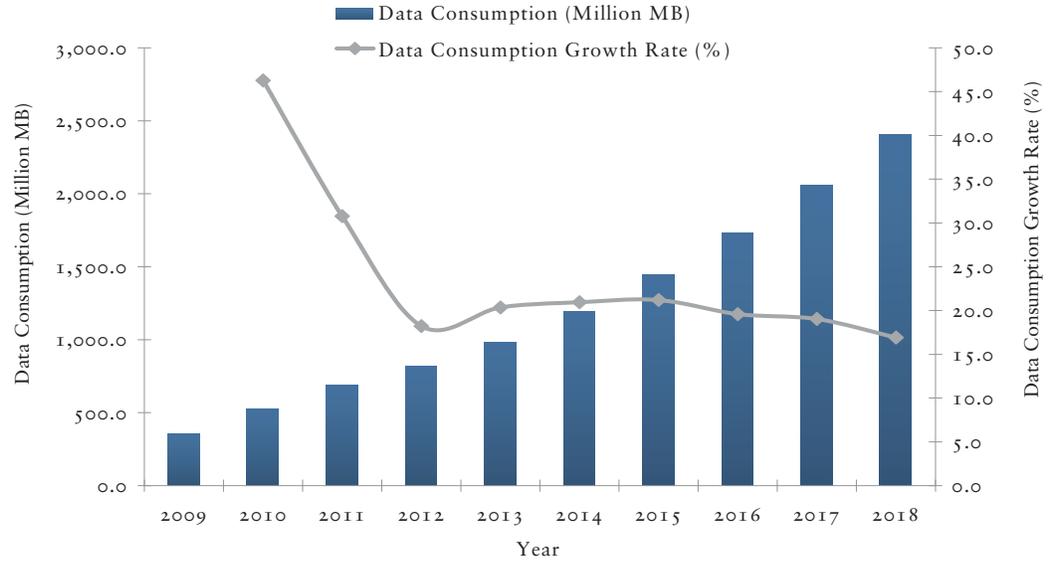
Year	Data Consumption	Data Consumption
	(Million MB)	Growth Rate (%)
2009	362.1	--
2010	529.6	46.3
2011	692.7	30.8
2012	818.9	18.2
2013	985.5	20.3
2014	1,192.0	20.9
2015	1,444.5	21.2
2016	1,727.4	19.6
2017	2,056.0	19.0
2018	2,403.6	16.9

Compound Annual Growth Rate (2012-2018): 19.7%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 35

Transportation and Telematics M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 36 and 37 show the data access revenue forecast in the US Transportation and Telematics M2M communications Market from 2009 to 2018.

EXHIBIT 36

Transportation and Telematics M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

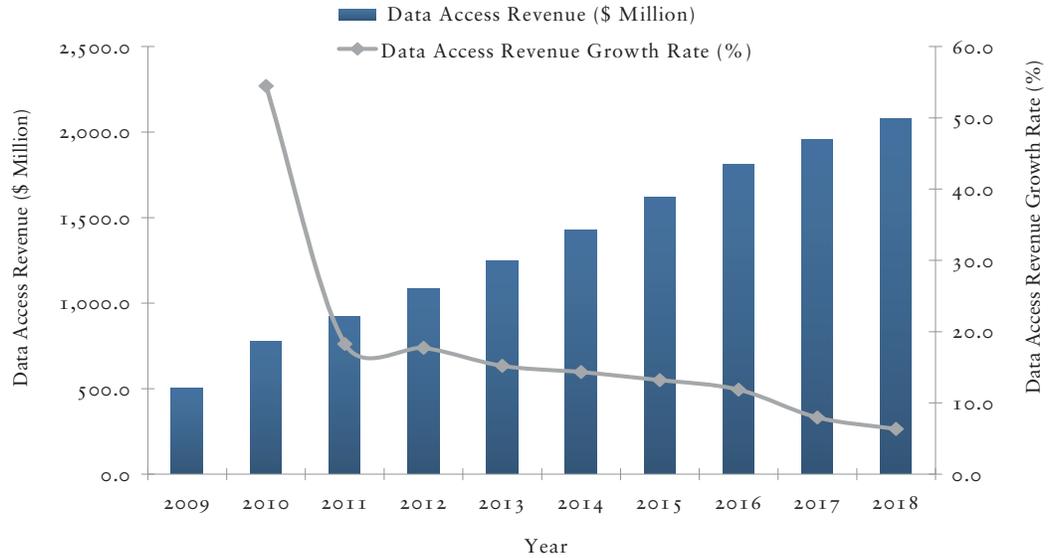
Year	Data Access Revenue	
	Data Access Revenue (\$ Million)	Growth Rate (%)
2009	504.4	--
2010	779.3	54.5
2011	921.8	18.3
2012	1,085.3	17.7
2013	1,250.2	15.2
2014	1,429.3	14.3
2015	1,617.9	13.2
2016	1,809.9	11.9
2017	1,954.2	8.0
2018	2,078.3	6.4

Compound Annual Growth Rate (2012-2018): 11.4%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 37

Transportation and Telematics M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 32 to 37 are as follows:

- M2M connections in the Transportation and Telematics market are expected to increase from 12.4 million in 2012 to 20.6 million in 2018.
- Data consumption by M2M devices in the Transportation and Telematics market is expected to increase from 818.9 million MB in 2012 to 2,403.6 million MB in 2018.
- Data access revenue from M2M devices in the Transportation and Telematics market is expected to increase from \$1,085.3 million in 2012 to \$2,078.3 million in 2018.

6

Financial Services and Retail M2M Communications Market

INTRODUCTION

Introduction to Financial Services and Retail M2M Communications

The Financial Services and Retail M2M market is made up of specialized connected devices or solutions that are used for service vending, transaction processing, reporting, authentication, and authorization. Examples of such devices include POS terminals and devices, connected vending machines, kiosks and ATMs, connected coffee brewers and laundry machines, and other self-serve appliances. Digital signage is also included in the retail sub-segment. The Financial sub-segment is generally characterized by low data, high-frequency transactions, while the Retail sub-segment also includes high-bandwidth applications, such as digital signage. In-store video-security deployments are included as part of the Security and Safety M2M market although it can be argued that these should be a part of the Financial Services and Retail M2M market.

MARKET OPPORTUNITY AND FORECASTS

Forecasts for the Financial Services and Retail M2M Communications Market

The Financial Services and Retail M2M market continues to grow at a healthy rate. On the financial side, solutions that allow payments to be collected through smartphone devices have become extremely popular, especially in the SMB category. However, such solutions are not considered part of this analysis. From a pure-play Financial Services and Retail M2M perspective, the opportunity in this market will primarily be driven by the large number of specialized wireless-enabled payment terminals and by providing connectivity for vending machines. The migration to cashless vending services is also expected to become a major driver for this market. On the retail side, introduction of nation-wide high-speed 4G LTE networks is expected to support the economical and efficient transfer of large amount of data and boost the adoption of digital signage solutions.

Exhibits 38 and 39 show the connections forecast in the US Financial Services and Retail M2M Communications Market from 2009 to 2018.

EXHIBIT 38

Financial Services and Retail M2M Communications Market: Connections Forecast, US, 2009-2018

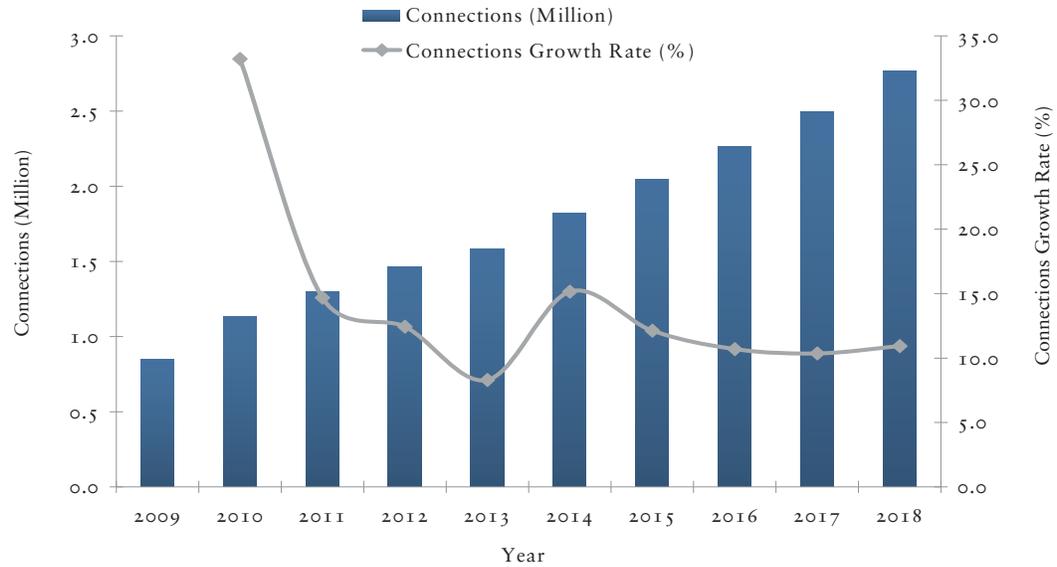
Year	Connections (Million)	Connections Growth Rate (%)
2009	0.9	--
2010	1.1	33.2
2011	1.3	14.7
2012	1.5	12.4
2013	1.6	8.3
2014	1.8	15.2
2015	2.0	12.1
2016	2.3	10.7
2017	2.5	10.4
2018	2.8	10.9

Compound Annual Growth Rate (2012-2018): 11.2%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 39

Financial Services and Retail M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 40 and 41 show the data consumption forecast in the US Financial Services and Retail M2M Communications Market from 2009 to 2018.

EXHIBIT 40

Financial Services and Retail M2M Communications Market: Data Consumption Forecast, US, 2009-2018

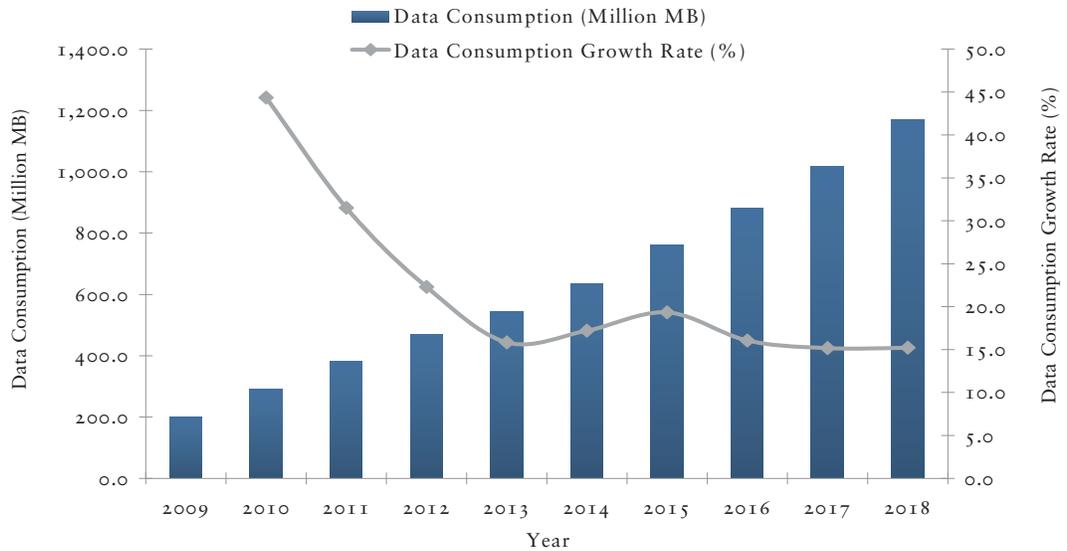
Year	Data Consumption	
	(Million MB)	Growth Rate (%)
2009	201.9	--
2010	291.5	44.4
2011	383.4	31.5
2012	468.8	22.3
2013	543.1	15.8
2014	636.6	17.2
2015	759.7	19.3
2016	881.7	16.1
2017	1,015.5	15.2
2018	1,170.0	15.2

Compound Annual Growth Rate (2012-2018): 16.5%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 41

Financial Services and Retail M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 42 and 43 show the data access revenue forecast in the US Financial Services and Retail M2M Communications Market from 2009 to 2018.

EXHIBIT 42

Financial Services and Retail M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

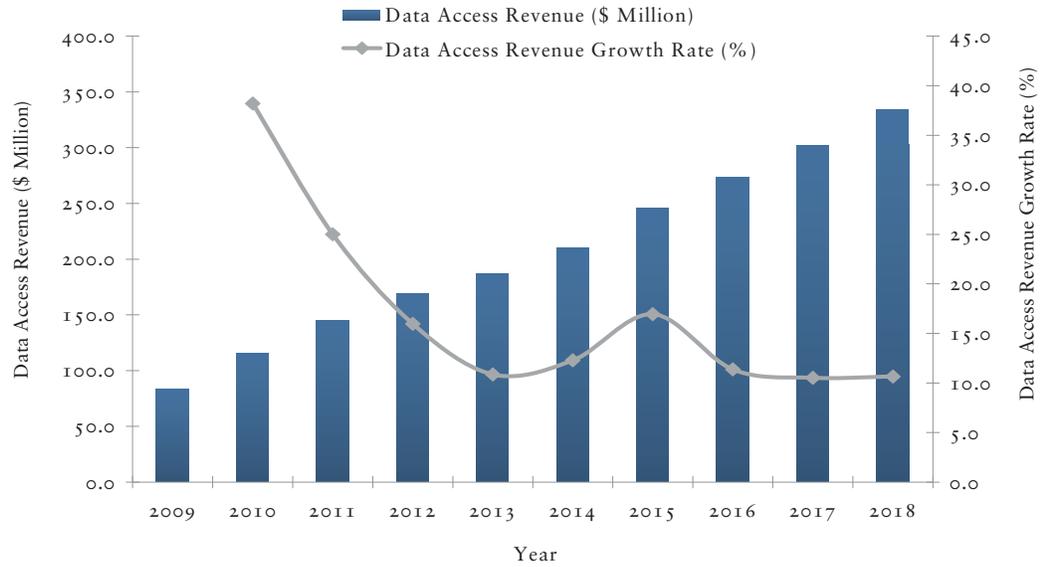
Year	Data Access Revenue	
	(\$ Million)	Growth Rate (%)
2009	84.2	--
2010	116.3	38.2
2011	145.4	25.0
2012	168.6	16.0
2013	187.0	10.9
2014	209.9	12.3
2015	245.5	16.9
2016	273.4	11.4
2017	302.2	10.5
2018	334.4	10.7

Compound Annual Growth Rate (2012-2018): 12.1%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 43

Financial Services and Retail M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 38 to 43 are as follows:

- Total M2M connections in the Financial Services and Retail market are expected to increase from 1.5 million in 2012 to 2.8 million in 2018.
- Data consumption by M2M devices in the Financial Services and Retail market is expected to increase from 468.8 million MB in 2012 to 1,170.0 million MB in 2018.
- Data access revenue from M2M devices in the Financial Services and Retail market is expected to increase from \$168.6 million in 2012 to \$334.4 million in 2018.

7

Healthcare M2M Communications Market

INTRODUCTION

Introduction to Healthcare M2M Communications

M2M opportunity in the Healthcare market is defined by connected, specialized devices and applications that serve the connectivity and reporting needs of the healthcare providers and patients and are used in the hospitals, pharmacies, private residences, or nursing homes. Examples of such devices include wireless peripherals for patient monitoring (such as Verizon SureResponse Personal Monitor, Cardio Net's MCOT wireless heart monitor system, and Braemar's Cardiac Event Monitors), and dosage monitoring products such as Vitality Glow-caps. Smartphone-based healthcare solutions that provide physical collaboration, patient and equipment monitoring, drug reference and dosage confirmation, and other services are not considered in this analysis.

MARKET OPPORTUNITY AND FORECASTS

Forecasts for the Healthcare M2M Communications Market

From a mobile operator's perspective, data pricing, fixed pricing over device lifetime, and value-based pricing remain the main revenue opportunities in the Healthcare M2M market. Some healthcare devices can be deployed for a certain time period (for example, to monitor heart rates over a period of 30 days) and the device OEM may reimburse the mobile operator for the network usage. In other words, the person using the healthcare device may not be directly responsible for paying the wireless data charges. In other cases, there may be a monthly service charge for the actual user of the Healthcare M2M solution—either billed by the mobile operator or through a credit card—that can be shared between the M2M solution provider (or the enterprise customer offering that particular solution) and the mobile operator. Certain consumer-oriented healthcare solutions may also be classified into the "Consumer" M2M category.

Several mobile operators consider the Healthcare market to be of utmost importance. The market's data storage, cloud computing, secure communication, and transmission needs make it an ideal choice for providing communication, monitoring, and collaboration solutions. Consequently, Healthcare M2M may be included as a sub-segment within the entire Healthcare Mobility market.

Exhibits 44 and 45 show the connections forecast in the US Healthcare M2M Communications Market from 2009 to 2018.

EXHIBIT 44

Healthcare M2M Communications Market: Connections Forecast, US, 2009-2018

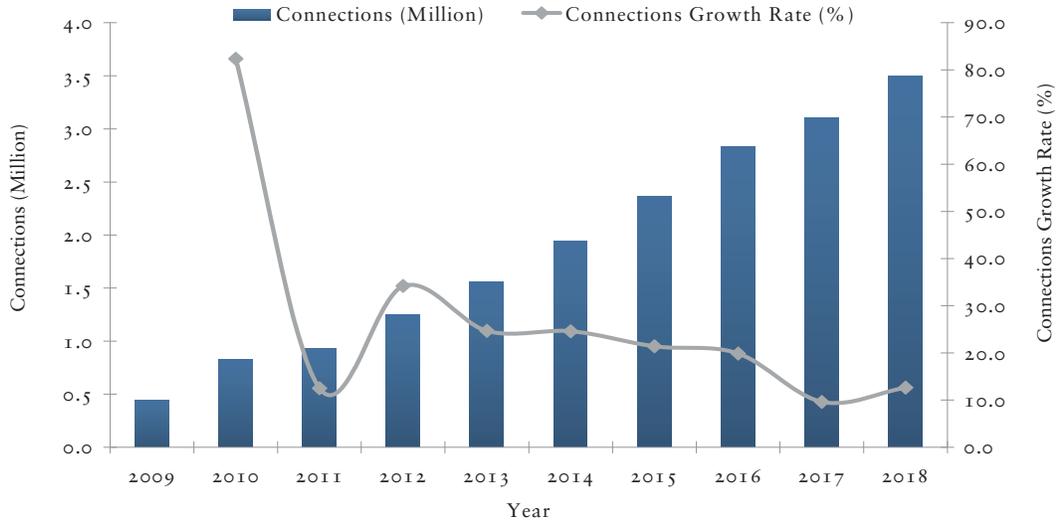
Year	Connections (Million)	Connections Growth Rate (%)
2009	0.5	--
2010	0.8	82.4
2011	0.9	12.5
2012	1.3	34.2
2013	1.6	24.7
2014	1.9	24.6
2015	2.4	21.4
2016	2.8	19.9
2017	3.1	9.6
2018	3.5	12.6

Compound Annual Growth Rate (2012-2018): 18.7%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 45

Healthcare M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 46 and 47 show the data consumption forecast in the US Healthcare M2M Communications Market from 2009 to 2018.

EXHIBIT 46

Healthcare M2M Communications Market: Data Consumption Forecast, US, 2009-2018

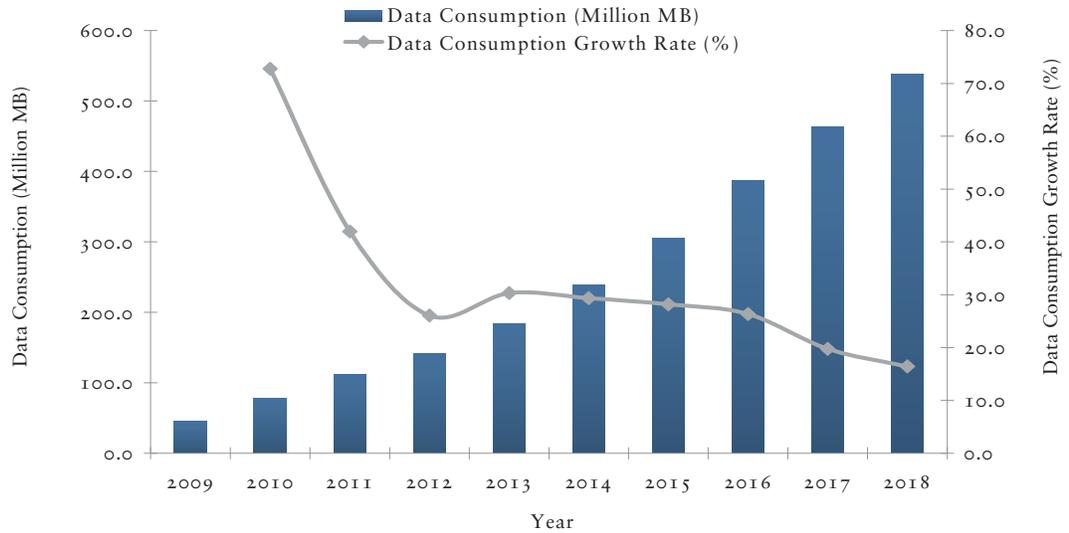
Year	Data Consumption	Data Consumption
	(Million MB)	Growth Rate (%)
2009	45.8	--
2010	79.1	72.8
2011	112.3	42.0
2012	141.6	26.1
2013	184.5	30.3
2014	238.6	29.3
2015	305.8	28.2
2016	386.3	26.3
2017	462.7	19.8
2018	538.5	16.4

Compound Annual Growth Rate (2012-2018): 24.9%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 47

Healthcare M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 48 and 49 show the data access revenue forecast in the US Healthcare M2M Communications Market from 2009 to 2018.

EXHIBIT 48

Healthcare M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

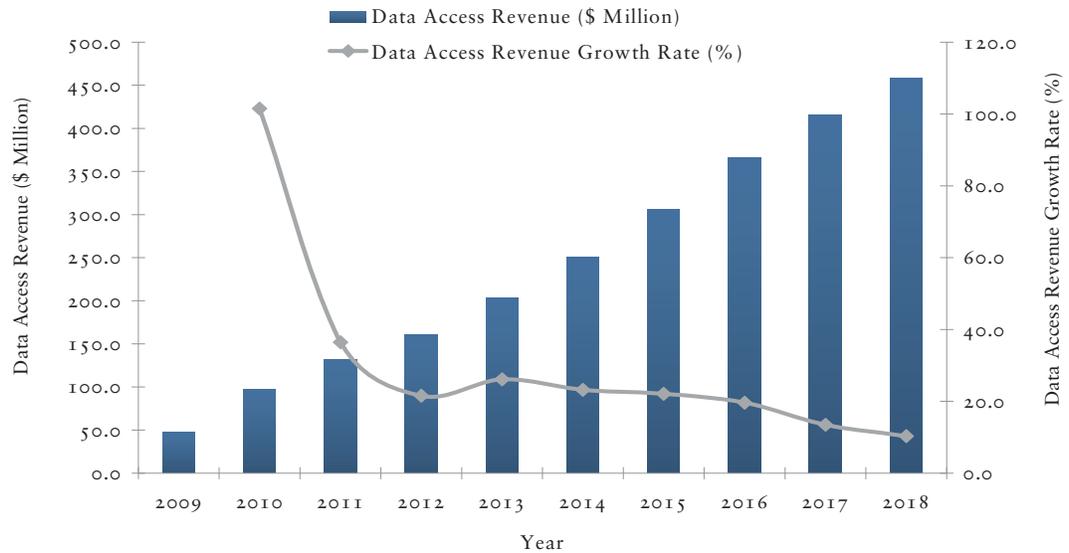
Year	Data Access Revenue	
	Data Access Revenue (\$ Million)	Growth Rate (%)
2009	48.3	--
2010	97.2	101.5
2011	132.7	36.5
2012	161.2	21.5
2013	203.4	26.1
2014	250.6	23.2
2015	305.9	22.1
2016	366.0	19.6
2017	415.3	13.5
2018	458.1	10.3

Compound Annual Growth Rate (2012-2018): 19.0%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 49

Healthcare M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 44 to 49 are as follows:

- The total number of M2M connections in the Healthcare market is expected to increase from 1.3 million in 2012 to 3.5 million in 2018.
- Data consumption by M2M devices in the Healthcare market is expected to increase from 141.6 million MB in 2012 to 538.5 million MB in 2018.
- Data access revenue from M2M devices in the Healthcare market is expected to increase from \$161.2 million in 2012 to \$458.1 million in 2018.

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Utilities and Industrial M2M Communications Market

INTRODUCTION

Introduction to Utilities and Industrial M2M Communications

Opportunities in the Utilities and Industrial M2M market consist of providing wireless connectivity to specialized devices and modules for service management, such as monitoring of water, gas, and electricity usage and for industrial use, such as supervisory control and data acquisition (SCADA), building automation, and remote machine diagnostics (enhancing the automation of industrial, infrastructure, or facility-based processes). These could be two separate segments by themselves. However, for the purpose of this research, Frost & Sullivan has combined the utility and the industrial M2M opportunities into one market. The home automation opportunity, which is emerging as a strategic solution for US mobile operators, is also included within this market.

Forecasts for the Utilities and Industrial M2M Communications Market

Various pilot programs are underway in the field of Smart Energy in the United States. This industry continues to work on data traffic "aggregation" model, where the cellular connectivity may or may not extend directly all the way to the endpoint (or device) that is being monitored or controlled. Remote monitoring of assets in the agriculture and energy sectors including oil and gas are also some major application areas for M2M in the Utilities and Industrial market. Mobile operators, such as AT&T, continue to work with strategic partners to bring complete remote monitoring, home automation and smart grid and utility solutions to the market. For example, AT&T's Digital Life is a web-based remote monitoring and automation platform that is targeted at the home automation and home security market. Mobile operators believe that Connected Home solutions can help them increase their ARPU anywhere between \$3 and \$10 per connected home. Mobile operators clearly believe that their strategic assets, such as cloud platforms, help them to serve the needs of this high-value segment and thereby expand their offerings beyond voice, video, and data to Connected Home services. Discussions have also been held over allowing utility companies to leverage the nationwide public safety LTE network to provide Smart Grid services. However, the final outcome of these initiatives remains unclear.

The Utilities and Industrial market is projected to have one of the highest, if not the highest, number of direct M2M connections. For example, out of approximately 150 million electricity meters presently deployed in the United States, even a 10 percent penetration of cellular connectivity to meters will result in more than 15 million meters being connected. The term Advanced Metering Infrastructure (AMI) is also used to refer to these types of deployments. However, AMI is a subset of the overall smart utility framework that envisions digital communication overlays and interfaces with the utility networks. Within the utility segment, various short-range technologies will continue to co-exist with the cellular networks(that are used to provide long-range backhaul services). Historically, 900 MHz RF Mesh, tower-based smart meter communications and short-range wireless technologies, such as ZigBee and others based on the 802.15.4 standard, have been used for WAN access, neighborhood area networks (NANs), and home area networks (HANs), while cellular connectivity has been largely used for facilitating backend connectivity.

Embedded modules or specialized devices and external wireless gateways and routers are used within industrial, manufacturing, fabrication, and other production environments. Hardware and software solutions exist to connect industrial systems, such as programmable logic controllers (PLC), sensors, and other equipment that use standard industrial communication protocols, to M2M applications over cellular networks. Intelligent M2M gateways that enable communication between reporting agents that leverage different types of machine protocols to the enterprise backend platforms over cellular networks are an example of how wireless M2M can be used within an industrial environment. The main opportunity for wireless hardware providers and MNOs exist in providing connectivity devices to facilitate a wide range of telemetry and SCADA applications to facilitate management of remote assets. These industrial routers are likely to have a separate pricing plan, which may be different from the pricing plan for consumer-oriented wireless routers.

Exhibits 50 and 51 show the connections forecast in the US Utilities and Industrial M2M Communications Market from 2009 to 2018.

EXHIBIT 50

Utilities and Industrial M2M Communications Market: Connections Forecast, US, 2009-2018

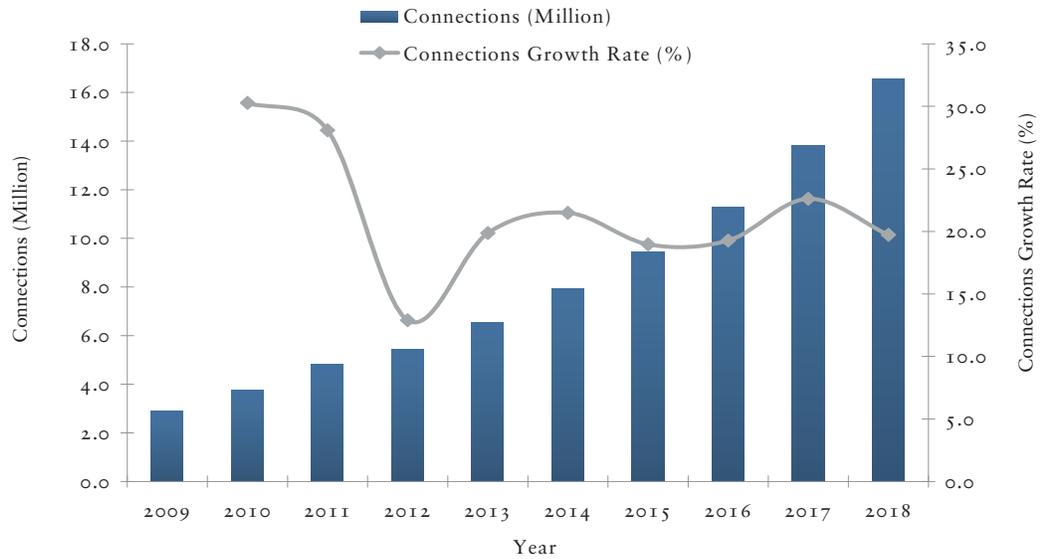
Year	Connections (Million)	Connections Growth Rate (%)
2009	2.9	--
2010	3.8	30.3
2011	4.8	28.1
2012	5.5	12.9
2013	6.5	19.9
2014	7.9	21.5
2015	9.5	19.0
2016	11.3	19.3
2017	13.8	22.6
2018	16.6	19.7

Compound Annual Growth Rate (2012-2018): 20.3%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 51

Utilities and Industrial M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 52 and 53 show the data consumption forecast in the US Utilities and Industrial M2M Communications Market from 2009 to 2018.

EXHIBIT 52

Utilities and Industrial M2M Communications Market: Data Consumption Forecast, US, 2009-2018

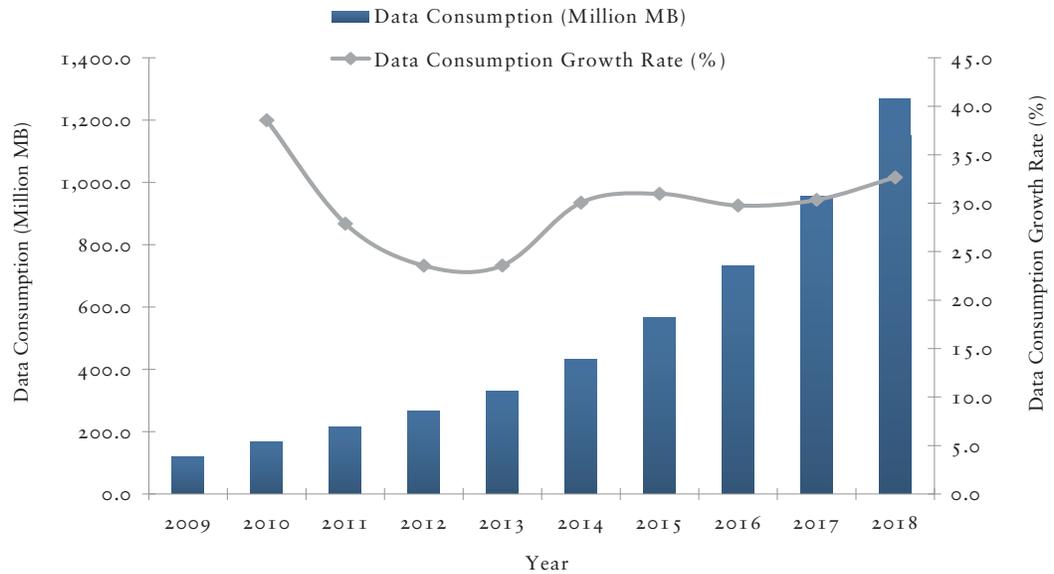
Year	Data Consumption (Million MB)	Data Consumption Growth Rate (%)
2009	122.6	--
2010	169.9	38.6
2011	217.3	27.9
2012	268.5	23.6
2013	331.8	23.6
2014	431.5	30.0
2015	565.2	31.0
2016	733.4	29.8
2017	955.9	30.3
2018	1,268.2	32.7

Compound Annual Growth Rate (2012-2018): 29.5%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 53

Utilities and Industrial M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 54 and 55 show the data access revenue forecast in the US Utilities and Industrial M2M Communications Market from 2009 to 2018.

EXHIBIT 54

Utilities and Industrial M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

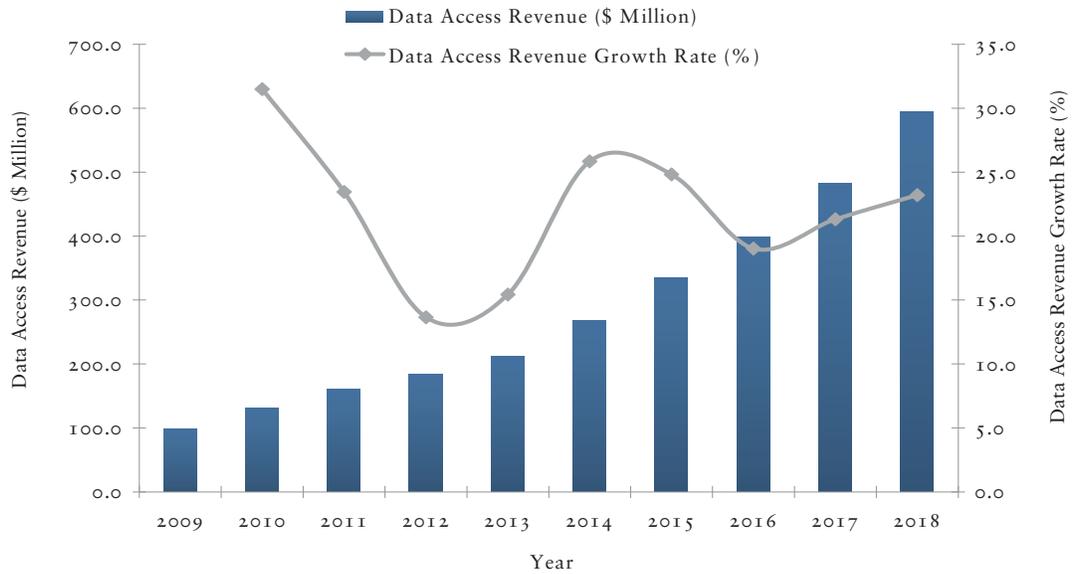
Year	Data Access Revenue	
	Data Access Revenue (\$ Million)	Growth Rate (%)
2009	99.9	--
2010	131.3	31.5
2011	162.1	23.4
2012	184.3	13.7
2013	212.7	15.4
2014	267.7	25.8
2015	334.1	24.8
2016	397.7	19.0
2017	482.5	21.3
2018	594.5	23.2

Compound Annual Growth Rate (2012-2018): 21.6%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 55

Utilities and Industrial M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 50 to 55 are as follows:

- The total number of M2M connections in the Utilities and Industrial market is expected to increase from 5.5 million in 2012 to 16.6 million in 2018.
- Data consumption by M2M devices in the Utilities and Industrial market is expected to increase from 268.5 million MB in 2012 to 1,268.2 million MB in 2018.
- Data access revenue from M2M devices in the Utilities and Industrial market is expected to increase from \$184.3 million in 2012 to \$594.5 million in 2018.

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Security and Safety M2M Communications Market

INTRODUCTION

Introduction to Security and Safety M2M Communications

The Security and Safety M2M market largely includes vertical applications and devices that serve the surveillance and security needs of consumers, enterprises, and law enforcement agencies. These applications and devices are primarily used for intrusion detection, remote surveillance, access control, curfew enforcement, individual/offender monitoring, and even alcohol monitoring and home surveillance. Some of the security applications, such as remote monitoring and surveillance, could be classified as belonging to other verticals, such as industrial and home automation, part of the Utilities and Industrial market, vehicle telematics, or asset tracking and tracing. Consequently, it is important to think of both, the device and application type, as well as the context, when defining the opportunity for this market.

MARKET OPPORTUNITY AND FORECASTS

Forecasts for the Security and Safety M2M Communications Market

The advent of high-speed 4G LTE wireless networks is expected to support the demand from high-bandwidth security and surveillance machine-to-machine (M2M) applications. The deployment of the National Public Safety Broadband Network (NPSBN)—which is a 4G network—is also likely to drive growth of high-bandwidth video-based security applications. However, there are certain important parameters that should be considered before deploying any wireless/cellular safety and surveillance implementation.

- **Bandwidth Limitations of Cellular Networks**—at any given point in time, tens (or hundreds) of thousands of devices may be attempting to access the network's resources. Depending upon the network traffic conditions, the amount of bandwidth available for video surveillance can vary widely. An effective understanding of the actual ground situation can only be achieved by delivering clear images in real-time or near-real-time. This makes it critical to leverage advanced solutions that can intelligently shape the data stream to manage the quality of experience according to the prevailing network traffic conditions.
- **Situational Awareness**—it is impossible to make critical decisions with incomplete information. There is a wealth of enterprise/organization data that resides in the operations center of various surveillance and monitoring implementations. These include, but are not limited to, maps and building plans including the layouts of different building automation systems and utility networks, and the employee list and their personal access codes. Mobilizing all these data sets and providing them in a single interface can help in presenting a complete picture of the ground realities, which is critical for an effective and safe response to incidents.
- **Monitoring, Interacting, and Controlling On-site Platforms**—Remotely closing the doors of a classroom, to contain a person with a firearm in a school is one example of such a system. Similarly, containing a fire in a building by activating the backup fire extinguishing system from a safe distance can help prevent loss of lives and material. Any solution that can interact with different automated building management systems from a safe distance can be extremely valuable in case of an emergency. Such implementations can also be used by organizations to improve efficiency in daily operations. For example, city authorities could use interactive implementations to re-route traffic according to congestion levels in different parts of a city, thereby improving traffic management.

Alarm and monitoring services can be provided as a package to customers. These services can be bundled into the price of the product or offered on a subscription basis. Certain solutions may use a special-purpose SIM card (or a user identify module) provided by the mobile operator or may already have an in-built connectivity module. The subscriber then needs to pay for usage according to the pricing specified by the solution providers. This is generally true for cellular alarm systems and remote home monitoring solutions. Device OEMs can also provide offender monitoring solutions to appropriate Government or law enforcement agencies that can use these to monitor suspects or convicts. It is generally the device OEM's responsibility to work with the cellular operator to reimburse them for providing connectivity, such as direct data access, location determination services, etc. Tracking devices may also be integrated with smartphone or cell phone-based access and monitoring, which could command a premium.

Exhibits 56 and 57 show the connections forecast in the US Security and Safety M2M Communications Market from 2009 to 2018.

EXHIBIT 56

Security and Safety M2M Communications Market: Connections Forecast, US, 2009-2018

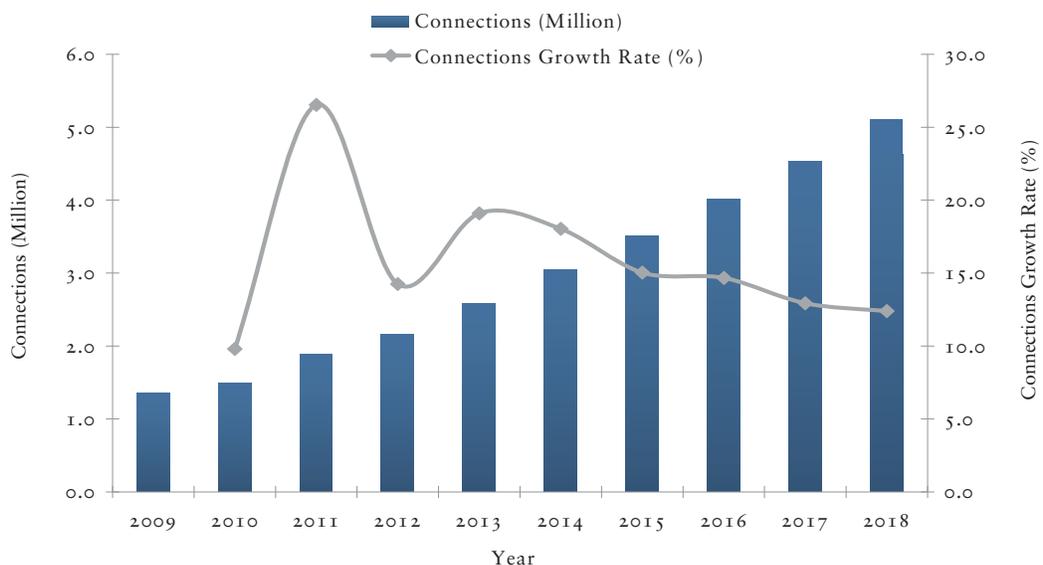
Year	Connections (Million)	Connections Growth Rate (%)
2009	1.4	--
2010	1.5	9.8
2011	1.9	26.5
2012	2.2	14.3
2013	2.6	19.1
2014	3.0	18.0
2015	3.5	15.0
2016	4.0	14.7
2017	4.5	12.9
2018	5.1	12.4

Compound Annual Growth Rate (2012-2018): 15.3%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 57

Security and Safety M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 58 and 59 show the data consumption forecast in the US Security and Safety M2M Communications Market from 2009 to 2018.

EXHIBIT 58

Security and Safety M2M Communications Market: Data Consumption Forecast, US, 2009-2018

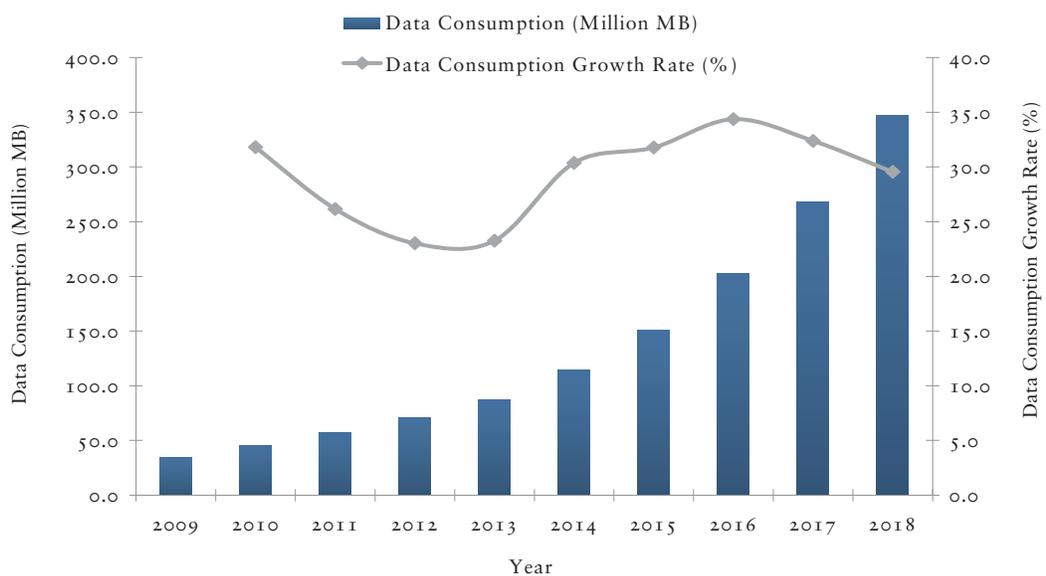
Year	Data Consumption	
	(Million MB)	Growth Rate (%)
2009	34.8	--
2010	45.8	31.8
2011	57.8	26.2
2012	71.1	23.0
2013	87.7	23.3
2014	114.3	30.4
2015	150.7	31.8
2016	202.4	34.4
2017	267.9	32.4
2018	347.2	29.6

Compound Annual Growth Rate (2012-2018): 30.2%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 59

Security and Safety M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 60 and 61 show the data access revenue forecast in the US Security and Safety M2M Communications Market from 2009 to 2018.

EXHIBIT 60

Security and Safety M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

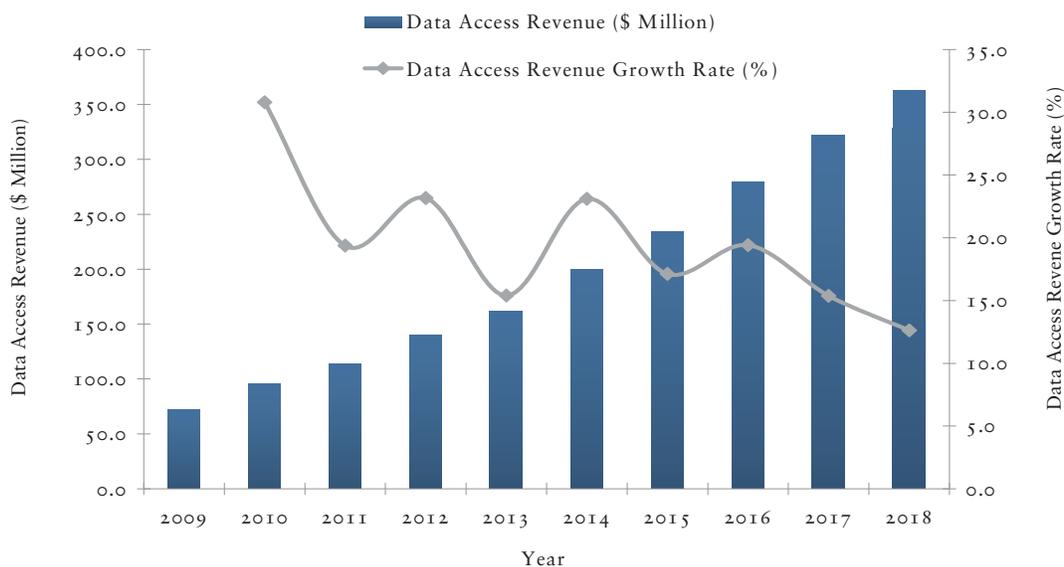
Year	Data Access Revenue	
	(\$ Million)	Growth Rate (%)
2009	73.1	--
2010	95.6	30.8
2011	114.1	19.4
2012	140.5	23.2
2013	162.1	15.4
2014	199.6	23.1
2015	233.8	17.1
2016	279.1	19.4
2017	322.0	15.4
2018	362.7	12.6

Compound Annual Growth Rate (2012-2018): 17.1%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 61

Security and Safety M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 56 to 61 are as follows:

- The total number of M2M connections in the Security and Safety market is expected to increase from 2.2 million in 2012 to 5.1 million in 2018.
- Data consumption by M2M devices in the Security and Safety market is expected to increase from 71.1 million MB in 2012 to 347.2 million MB in 2018.
- Data access revenue from M2M devices in the Security and Safety market is expected to increase from \$140.5 million in 2012 to \$362.7 million in 2018.

IO

Other M2M Opportunities

INTRODUCTION

Introduction to "Others" M2M Communications Opportunities

The "Others" category includes unique M2M devices and solutions that may not be included in any pre-defined category. These are largely used by the enterprise vertical. For example, certain horizontal M2M solutions, such as ruggedized gateways and routers, can be used across different industry verticals, some of which may be quite unique and not easily classified into various markets. This market includes all these deployments.

MARKET OPPORTUNITY AND FORECASTS

Forecasts for the "Others" M2M Communications Market

The opportunity in this market includes data usage charges, and other associated fees that may be generated when the mobile operator helps with service branding, marketing, and distribution. It may also be a revenue share type of an arrangement, depending upon the service agreement and business relationship between the enterprise and the mobile operator.

Exhibits 62 and 63 show the connections forecast in the US Others M2M Communications Market from 2009 to 2018.

EXHIBIT 6 2

"Others" M2M Communications Market: Connections Forecast, US, 2009-2018

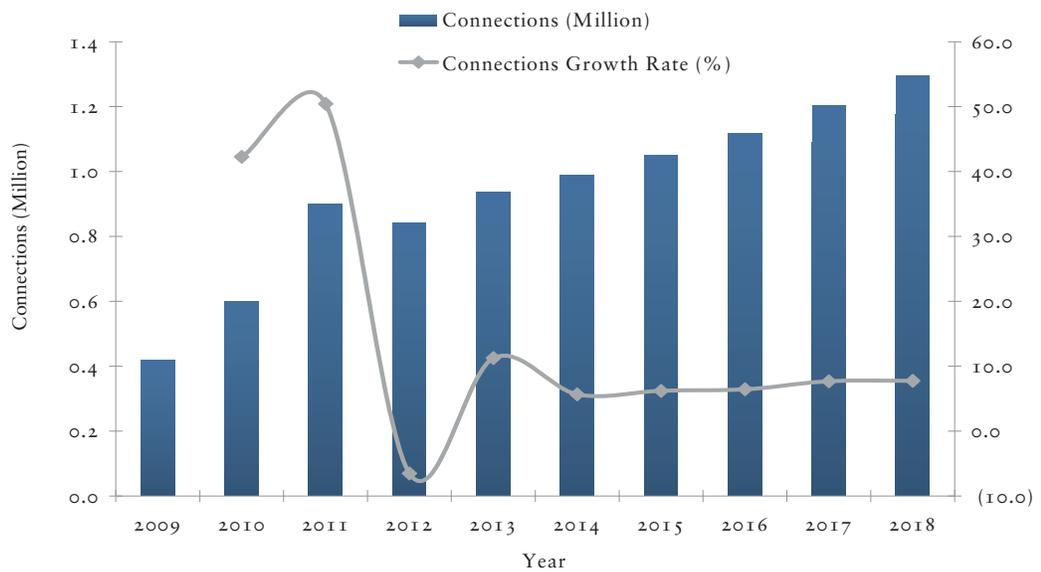
Year	Connections (Million)	Connections Growth Rate (%)
2009	0.4	--
2010	0.6	42.3
2011	0.9	50.4
2012	0.8	(6.5)
2013	0.9	11.2
2014	1.0	5.7
2015	1.1	6.2
2016	1.1	6.5
2017	1.2	7.7
2018	1.3	7.7

Compound Annual Growth Rate (2012-2018): 7.5%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 6 3

"Others" M2M Communications Market: Connections Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 64 and 65 show the data consumption forecast in the US Others M2M Communications Market from 2009 to 2018.

EXHIBIT 64

"Others" M2M Communications Market: Data Consumption Forecast, US, 2009-2018

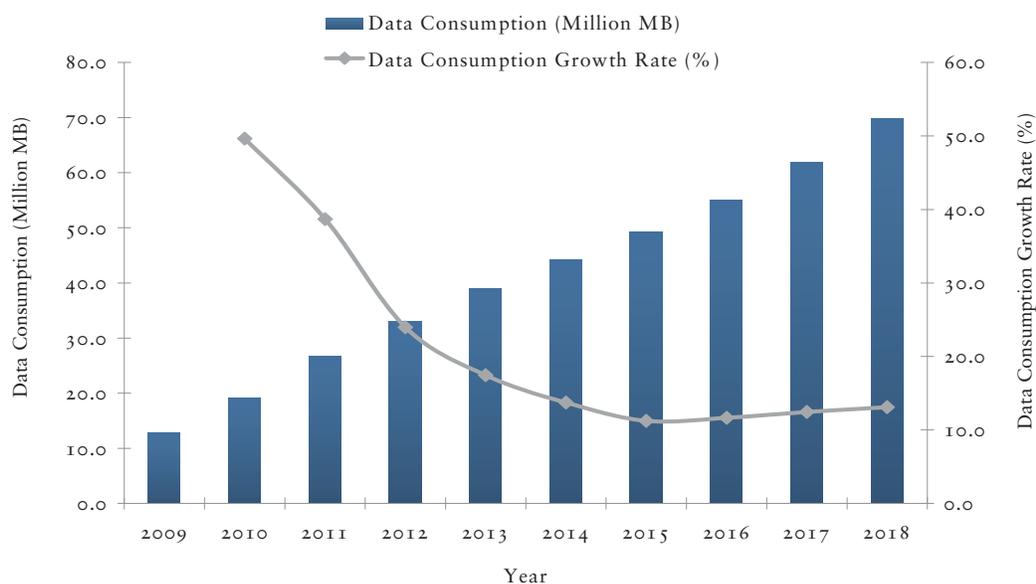
Year	Data Consumption	Data Consumption
	(Million MB)	Growth Rate (%)
2009	12.9	--
2010	19.3	49.6
2011	26.7	38.7
2012	33.1	24.0
2013	38.9	17.5
2014	44.2	13.7
2015	49.2	11.2
2016	54.9	11.6
2017	61.8	12.4
2018	69.8	13.1

Compound Annual Growth Rate (2012-2018): 13.2%

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 65

"Others" M2M Communications Market: Data Consumption Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Exhibits 66 and 67 show the data access revenue forecast in the US Others M2M Communications Market from 2009 to 2018.

EXHIBIT 66

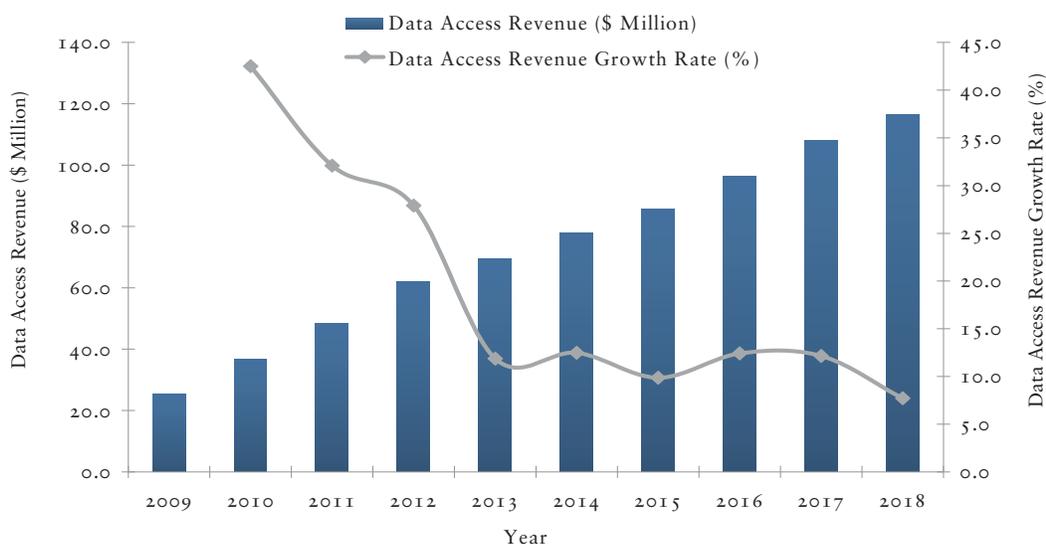
"Others" M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018

Year	Data Access Revenue	
	Data Access Revenue (\$ Million)	Growth Rate (%)
2009	25.7	--
2010	36.7	42.5
2011	48.4	32.1
2012	62.0	27.9
2013	69.3	11.9
2014	78.0	12.5
2015	85.7	9.9
2016	96.3	12.4
2017	108.0	12.1
2018	116.3	7.7
Compound Annual Growth Rate (2012-2018): 11.1%		

Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

EXHIBIT 67

"Others" M2M Communications Market: Data Access Revenue Forecast, US, 2009-2018



Note: All figures are rounded. The base year is 2012. Source: Frost & Sullivan

Key takeaways from Exhibits 62 to 67 are as follows:

- The total number of M2M connections in the Others market is expected to increase from 0.8 million in 2012 to 1.3 million in 2018.
- Data consumption by M2M devices in the Others market is expected to increase from 33.1 million MB in 2012 to 69.8 million MB in 2018.
- Data access revenue from M2M devices in the Others market is expected to increase from \$62.0 million in 2012 to \$116.3 million in 2018.

II

Conclusion

THE LAST WORD

Summary

Increasing business efficiency; delivering better services to customers and partners; and ensuring sustainable business operations are the three most important benefits of M2M. There is a growing realization about the benefits of mobility in a wide range of industries, which helps to drive adoption of M2M. Providing the appropriate tools, networks, solutions and personnel to help enterprises design, develop, and manage scalable, distributed, and customizable M2M implementations is critical for success of mobile operators' M2M initiatives. M2M solution providers should also provide high-quality support and consulting to continuously improve their customers' operations, thus helping them realize greater cost savings over time. Solutions providers that make it easy to deploy and manage M2M solutions will have a clear competitive advantage in the U.S. M2M communications market. The inherent complexity in M2M can be solved to an extent by deploying cloud-based M2M platforms that allow for easier application development, deployment and ongoing management and reporting. Overall, M2M represents a significant market opportunity for mobile operators in the United States.

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 94**

AT&T M2M (Machine to Machine) Communications Snapshot

<p>The What</p>	<ul style="list-style-type: none"> As a leader in machine-to machine (M2M) communications, AT&T is helping to lead the emergence of the real-time, adaptive enterprise. Our goal is to help drive wireless capabilities into a wide variety of devices beyond traditional handsets, allowing our business customers to reduce operational costs and enable new revenue opportunities. AT&T defines M2M communications as a set of networking and IT technologies, which connects the physical systems of the world. (Such as power meters, trucks, containers, cars, pipelines, wind farm turbines, vending machines and any electronic device which would benefit from 2-way communications.) AT&T uses Network, Service and Application Delivery Platforms with Expertise, Experience, Alliances and Professional Services to enable deployment of M2M solutions that fit customers' needs across a range of industries.
<p>The Why</p>	<ul style="list-style-type: none"> According to ABI Research, "cumulative cellular M2M connections will rise from about 110 million connections in 2011 to approximately 365 million connections by 2016." [Source: ABI Research, Cellular M2M Connectivity Services, December 30, 2011.] Through the Emerging Devices Organization (EDO), AT&T is mobilizing everything by embedding wireless capabilities into new categories of devices – eReaders, dog collars, pill caps, photo frames, car ignition switches, smart meters and more. Connecting to the mobile internet changes the fundamental nature of a device, giving it new features and capabilities that make it better and more useful. Our Advanced Mobility Solutions organization helps enterprise customers select, build, integrate, deploy, and manage M2M solutions to lower operational costs and develop new revenue opportunities. AT&T M2M technology allows businesses to sense issues with their machines and assets, analyze the problem using backend software, and respond the situation in a quick and cost-effective manner. AT&T services simplify deployment of M2M wireless solutions by providing expert assistance and tools to help define, build, integrate, deploy and manage the cost-effective M2M solution that's right for each of our business customers. We continue to invest in our M2M service delivery and application platforms to fully automate service provisioning and billing, while optimizing troubleshooting, application integration, and managed services. <ul style="list-style-type: none"> Enterprise On-Demand is a comprehensive online environment

AT&T M2M (Machine to Machine) Communications Snapshot

	<p>for ordering, real-time activation, online trouble ticket management and reporting</p> <ul style="list-style-type: none"> ○ AT&T Control Center, powered by Jasper Wireless helps companies manage large-scale wireless deployments by delivering real-time access and leading-edge development, management and diagnostic tools to reduce operational expenses, address new revenue streams and improve time to market for new categories of connected devices on AT&T's network. ● To support multinational enterprise customers and connected device manufacturers, AT&T provides a single SIM that offers expansive global coverage. The SIM, along with AT&T Control Center powered by Jasper Wireless, gives businesses and M2M suppliers the ability to manage global wireless device deployment and operations across markets. ● AT&T helps orchestrate hardware, connectivity, platforms, applications, infrastructure, professional services, and managed services for custom M2M solutions. ● With millions of endpoints already connected, our customers recognize AT&T's success in developing an ecosystem to serve enterprise needs.
<p>Stats & Facts</p>	<ul style="list-style-type: none"> ● AT&T has one of the world's most advanced and powerful global backbone networks, which carries more than 28.9 petabytes of data traffic on an average business day and includes more than 917,705 fiber route miles worldwide. ● AT&T offers the broadest international coverage of any U.S. wireless carrier, delivering data service in more than 200 countries through roaming agreements. ● AT&T has been serving the M2M market for more than a decade, supporting millions of M2M end points. We ended 2011 with 13.1 million connected devices on our network. ● AT&T has certified 1,200 varieties of connected devices, with labs dedicated to bringing new devices to market, global roaming and integrated SIM provisioning, billing and reporting tools. ● In March 2012, Current Analysis honored AT&T with the highest possible rating (5 stars) in Global M2M Services and Strategies. [Source: Current Analysis, "Product Assessment: AT&T - Global M2M Services and Strategies", March 2012.] ● According to Frost & Sullivan, "AT&T continues to be a market leader in the U.S. cellular M2M communications market." [Source: Frost & Sullivan,

AT&T M2M (Machine to Machine) Communications Snapshot

	<p>“U.S. Cellular M2M Communications Market”, May 2011.]</p> <ul style="list-style-type: none">• AT&T was ranked as the preferred carrier sales channel for M2M solutions in a survey of IT decision-makers who use or plan to use M2M services. [Source: Yankee Group Anchor Report, “A Closer Look at M2M Carrier Strategy”, December 2010.]
Additional Resources	<ul style="list-style-type: none">• <u>AT&T Enterprise Mobility</u>• <u>AT&T Mobility Solutions Media Kit</u>• <u>AT&T Machine-to-Machine Solutions</u>

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TECHNOLOGY

AT&T M2M Strategy In Fast Lane With Connected Cars

By REINHARDT KRAUSE, INVESTOR'S BUSINESS DAILY
Posted 09/30/2014 02:43 PM ET

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AT&T (T) says it expects to provide high-speed wireless data service to 10 million vehicles by 2017, up from just 2 million as of Sept. 30. AT&T updated its wireless strategy at an investors day held in Atlanta on Tuesday. AT&T stock was flat in afternoon trading in the stock market today. In April, AT&T added Volvo to its growing roster of auto customers. AT&T has signed ...

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Shira Levine

"Benefitting from the sheer scale of the Chinese market, China Mobile is the global M2M connections leader, with over 32 million M2M connections served in 2013."
 Godfrey Chua, Directing Analyst
 M2M and The Internet of Things



China Mobile, AT&T, and Vodafone among world's top M2M service providers

Campbell, CALIFORNIA, May 29, 2014—Market research firm Infonetics Research released excerpts from its latest *Worldwide M2M Service Provider Leadership Analysis* report, which profiles and analyzes the 10 largest machine-to-machine (M2M) service providers based on cellular M2M connections served: **AT&T, China Mobile, China Unicom, Deutsche Telekom, Orange, Sprint, Telefónica, Telenor, Verizon, and Vodafone.** The 28-page report identifies the factors for success that are common among the world's leading M2M providers.

ANALYST NOTE

"One of the key traits that enables the service providers in our *machine-to-machine leadership report* to be successful amid the great breadth and chaos of M2M is focus—the ability to identify the key vertical segments and hone resources on those that offer scale and growth. In the boundless world of M2M and the Internet of Things, focus is table stakes" says **Godfrey Chua**, directing analyst for M2M and The Internet of Things at Infonetics Research.

Chua adds, "Focus also means understanding the unique nature of M2M services and the importance of enabling technologies such as connectivity and application platforms purpose-built for M2M, like those from **Axeda** and **Jasper**. Platforms are essential to scaling and differentiating services and bringing solutions to market faster, allowing monetization to begin at an earlier stage."

M2M LEADERSHIP HIGHLIGHTS

- Benefitting from the sheer scale of the Chinese market, **China Mobile** is the global M2M connections leader, with over 32 million M2M connections served in 2013 (+43% from 2012)
- **AT&T**, the reigning M2M leader in North America, comes in #2 overall in connections thanks to a large U.S. M2M market coupled with global roaming agreements
- Hot on the heels of AT&T, **Vodafone** rounds out the top 3, owing to its strong global presence, breadth of operations, and homegrown connectivity platform
- Currently, the most popular vertical M2M segment among service providers is automotive/transport/logistics

M2M REPORT SYNOPSIS

Infonetics' annual *M2M service provider leadership report* profiles and analyzes 10 of the leading M2M service providers in the world influencing the Internet of Things (IoT), currently **AT&T, China Mobile, China Unicom, Deutsche Telekom, Orange, Sprint, Telefónica, Telenor, Verizon, and Vodafone.** These companies together account for over 100 million cellular M2M connections, nearly half the global M2M cellular installed base.

The report includes global M2M service revenue and connection forecasts and profiles providers' approaches to and activities in the M2M/IoT space, examining their M2M connections, total M2M revenue, scope of M2M operations (including partnerships and agreements), and resources (people) devoted to M2M. To [buy the report](#), contact Infonetics: <http://www.infonetics.com/contact.asp>.

RELATED REPORT EXCERPTS

- Infonetics' **May M2M and The Internet of Things research brief**
- Mobile machine-to-machine (M2M) module market to nearly double to \$2.9 billion by 2018
- M2M service providers discuss strategy and name top platform vendors in Infonetics survey
- As businesses turn to the Internet of Things for growth, M2M WAN connections set to triple by 2018
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- The Role of Service Delivery Platforms in M2M and IoT ([View on-demand](#))
- Reinventing the Economics of Healthcare with M2M (Sep. 9: [Sponsor](#))

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AT&T announces LTE launch for September 18



Mobile By [Jennifer Bergen](#) Sep. 15, 2011 5:42 pm



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AT&T's CFO John Stephens chose an unusual place to announce that the company would be launching its **LTE** network this Sunday, Sept. 18. Stephens announced the news at the Bank of America Merrill Lynch Media, Entertainment & Communications conference (BAMLMEC?), which is a conference we're hearing about for the first time. *Where* he dropped the bomb doesn't actually matter. What really matters is that we now have a date for the launch of AT&T's LTE network.

To start, AT&T will launch in only five markets with just 15 more going live by the end of the year to cover 70 million people. So who are the lucky AT&T customers to have first access to the carrier's LTE network? Residents of Atlanta, Chicago, Houston, San Antonio, and Dallas will get first dibs. Verizon's LTE network is currently live in 143 markets and cover over 160 million people, so AT&T has a long way to go.

A little under a month ago, **AT&T released two LTE devices**, which

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...network, which is not quite 4G. Now the two products can run freely on the LTE network, and actually, that's all that can work on the network. AT&T doesn't actually have any LTE smartphones just yet.

AT&T has yet to release any official data on speeds, but AT&T did say its LTE 3G service would be "comparable to Verizon's LTE 4G network." Verizon's network supposedly gets download speeds of 5-Mbps to 12-Mbps and 2-Mbps to 3-Mbps upload speeds.

In addition to the dongle and hotspot mentioned above, AT&T also released the LTE-capable [HTC Jetstream tablet](#) at the end of August. Starting at \$699.99, the tablet is a little on the pricey side, but it comes with the option of a 3GB per month data plan for \$35.

AT&T said it won't offer any LTE smartphones until the end of 2011 at the earliest, which gives us more reason to believe that the iPhone 5 won't be equipped for LTE. That being said, AT&T didn't mention anything about LTE smartphone data pricing. However, it did say that it will charge \$50 for 5 GB of data for its data-only LTE devices.

via [Fiercewireless](#)

Tags: 4g 4G LTE at&t launch LTE LTE network september 18 verizon



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News Release

Verizon Wireless Launches The World's Largest 4G LTE Wireless Network On Dec. 5

Laptop Users Benefit First from Fastest and Most Advanced Wireless Network, Arriving in 38 Major Metropolitan Areas with New Value-Priced 4G Data Plans

For customer inquiries, please call 800-922-0204 or go to

Contact Us (<http://www.verizonwireless.com/b2c/vzwfly?go=/ContactUsControllerServlet>)

November 30, 2010

Jeffrey Nelson

Jeffrey.Nelson@VerizonWireless.com (<mailto:Jeffrey.Nelson@VerizonWireless.com>)

917-968-9175 (mobile)

BASKING RIDGE, NJ — Verizon Wireless announced today it is turning on the world's first large-scale 4G LTE network on Sunday, Dec. 5. Verizon Wireless' 4G LTE Mobile Broadband network will be the fastest and most advanced 4G network in America. Business users will be the first to take advantage of the 4G LTE network with speeds up to 10 times faster than the company's 3G network.

With the launch, Verizon Wireless is also offering new value-priced 4G LTE Mobile Broadband data plans starting at \$50 monthly access for 5 GB monthly allowance, as well as two new 4G LTE USB modems: the LG VL600 which will be available at launch, and the Pantech UML290, available soon.

Dan Mead, president and chief executive officer of Verizon Wireless, said, "Beginning Sunday, Verizon Wireless is making the best network even better. Our initial 4G LTE launch gives customers access to the fastest and most advanced mobile network in America and immediately reaches more than one-third of all Americans, right where they live. That's just the start. We will quickly expand 4G LTE, and by 2013 will reach the existing Verizon Wireless 3G coverage area."

Road warriors using laptops will immediately benefit from Verizon Wireless' 4G LTE Mobile Broadband network with super-fast connectivity that's up to 10 times faster than the company's current 3G network. The company expects 4G LTE average data rates in real-world, loaded network environments to be 5 to 12 megabits per second (Mbps) on the downlink and 2 to 5 Mbps on the uplink.

Mead continued, "We are building our 4G LTE network with the same commitment to performance and reliability for which we have long been recognized. Our commitment to superior network performance, combined with broad 4G coverage areas and the strong value of our data plans make 4G LTE Mobile Broadband the best choice for laptop users."

4G LTE Mobile Broadband Data Plans, Devices and Coverage Areas

Verizon Wireless customers can choose from two 4G LTE Mobile Broadband data plans: \$50 monthly access for 5 GB monthly allowance or \$80 monthly access for 10 GB monthly allowance, both with \$10/GB overage. For laptop connectivity, two 4G LTE USB modems will be initially available: the LG VL600 is available at launch and the Pantech UML290 will be available soon, each \$99.99 after \$50 rebate with a new two-year agreement. Both USB modems provide backward-compatibility with Verizon Wireless' 3G network. If laptop users travel outside of a 4G LTE coverage area, they will automatically stay connected on the company's 3G network.

The two modems harness the power of the company's 4G LTE Mobile Broadband network to help enterprise, business and government customers make their workforces more productive, providing super-fast laptop connectivity. Both modems will be available in Verizon Wireless Communications Stores, online at www.verizonwireless.com (<http://www.verizonwireless.com>), by phone by calling 1-800 256-4646 and through the company's business sales channels.

The company expects consumer-oriented handsets will be available by mid-2011. Verizon Wireless 4G LTE

coverage area maps will be available online on Dec. 5. Today, customers can go to www.verizonwireless.com/4Glte (<http://www.verizonwireless.com/4Glte>) to check if their addresses will be in the initial 4G LTE coverage area.

Spectrum and Network Partners

By leveraging its 700 MHz spectrum for LTE deployment in the United States, Verizon Wireless is capable of

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mobile broadband network.

Visit www.verizonwireless.com/lte (<http://www.verizonwireless.com/lte>) for more information about Verizon Wireless' 4G LTE network.

Verizon Wireless 4G LTE Initial Major Metropolitan Area Deployment (Dec. 5, 2010)

- Akron, Ohio
- Athens, Georgia
- Atlanta, Georgia
- Baltimore, Maryland
- Boston, Massachusetts
- Charlotte, North Carolina
- Chicago, Illinois
- Cincinnati, Ohio
- Cleveland, Ohio
- Columbus, Ohio
- Dallas-Ft. Worth Metroplex, Dallas, Texas
- Denver, Colorado
- Ft. Lauderdale, Florida
- Houston, Texas
- Jacksonville, Florida
- Las Vegas, Nevada
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- San Diego, California
- San Francisco, California
- San Jose, California
- Seattle/Tacoma, Washington
- St. Louis, Missouri
- Tampa, Florida
- Washington, D.C.
- West Lafayette, Indiana
- West Palm Beach, Florida

Verizon Wireless 4G LTE Initial Commercial Airport Deployment (Airport Name, City, State) Dec. 5, 2010

Austin-Bergstrom International, Austin, Texas

Boeing Field/King County International, Seattle, Washington
Charlotte/Douglas International, Charlotte, North Carolina
Chicago Midway International, Chicago, Illinois
Chicago O'Hare International, Chicago, Illinois
Cincinnati/Northern Kentucky International, Covington, Kentucky
Cleveland-Hopkins International, Cleveland, Ohio
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John F. Kennedy International, New York, New York
John Wayne Airport-Orange County, Santa Ana, California
Kansas City International, Kansas City, Missouri
La Guardia, New York, New York
Lambert-St. Louis International, St. Louis, Missouri
Laurence G. Hanscom Field, Bedford, Massachusetts
Long Beach/Daugherty Field, Long Beach, California
Los Angeles International, Los Angeles, California
Louis Armstrong New Orleans International, Metairie, Louisiana
McCarran International, Las Vegas, Nevada
Memphis International, Memphis, Tennessee
Metropolitan Oakland International, Oakland, California
Miami International, Miami, Florida
Minneapolis-St. Paul International/Wold-Chamberlain, Minneapolis, Minnesota
Nashville International, Nashville, Tennessee
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Newark Liberty International, Newark, New Jersey
Norman Y. Mineta San Jose International, San Jose, California
North Las Vegas, Las Vegas, Nevada
Orlando International, Orlando, Florida
Orlando Sanford International, Sanford, Florida
Palm Beach International, West Palm Beach, Florida
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San Diego International, San Diego, California
San Francisco International, San Francisco, California
Seattle-Tacoma International, Seattle, Washington
St. Augustine, Saint Augustine, Florida
St. Petersburg-Clearwater International, Clearwater, Florida
Tampa International, Tampa, Florida
Teterboro, Teterboro, New Jersey
Trenton Mercer, Trenton, New Jersey

Washington Dulles International, Dulles International Airport, Washington, D.C.
Will Rogers World, Oklahoma City, Oklahoma
William P. Hobby, Houston, Texas

(EDITOR'S NOTE: Media can access high-resolution images and video related to Verizon Wireless' 4G LTE network in the Verizon Wireless Multimedia Library at www.verizonwireless.com/multimedia (<http://www.verizonwireless.com/multimedia>).)

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NOTE: This press release contains statements about expected future events and financial results that are forward-looking and subject to risks and uncertainties. For those statements, which may include or be preceded by such words as "expects," "anticipates," "intends," "plans," "believes," "seeks," "estimates" and similar expressions, we claim the protection of the safe harbor for forward-looking statements contained in the Private Securities Litigation Reform Act of 1995. These forward-looking statements speak only as of the date of this presentation and we undertake no obligation to publicly update or revise them for any reason.

The following important factors, in addition to those discussed under "Risk Factors" in our Annual Report on Form 10-K (No. 333-160446), could affect future results and could cause those results to differ materially from those expressed in the forward-looking statements: changes in economic conditions; our ability to complete transactions relating to acquisitions and dispositions, including the integration of the Alltel business; changes in the ratings of our debt securities or those of Verizon Communications; adverse conditions in the credit markets impacting cost or availability of financing sufficient to meet our capital requirements; our ability to acquire and retain customers; our continued provision of satisfactory service to our customers at an acceptable price; the effects of competition; our ability to adapt to changing conditions in the wireless industry; the ability of our key suppliers to meet their obligations to us; the effects of material changes in available technology, including technology substitution and the cost of deployment; the impact of continued unionization efforts with respect to our employees; adverse regulatory and taxation developments; the effects of litigation; the impact of equipment failures, natural disasters, terrorist acts or other breaches of network or information technology security; and the effects of any required future changes in accounting assumptions.

####

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November 04, 2014

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DOCUMENT 99**

T-Mobile LTE network officially goes live in seven US cities

By **Dan Seifert** on March 26, 2013 11:34 am [✉ Email](#) [🐦 @dcseifert](#)



T-Mobile has officially launched its 4G LTE network today with service in Baltimore, Houston, Kansas City, Las Vegas, Phoenix, San Jose, and Washington DC. The carrier expects to deliver LTE to 100 million people by the middle of 2013 doubling that to 200 million customers nationwide by year's end. Customers will be able to use the new faster service with the **carrier's new rate plans**, which initially went live this past weekend.

T-Mobile has a long way to go to catch up to the other major carriers when it comes to LTE coverage. Both Verizon Wireless and AT&T have



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Page 1010 of 1361.

been rolling out LTE service for a couple of years now, and Sprint launched its LTE network last summer. T-Mobile will be using its **purchase of MetroPCS** to help it launch LTE on the AWS frequencies, in addition to the spectrum it gained from **AT&T's failed buyout in 2012**. The carrier plans to have 200 million people covered by LTE by the end of this year.

JUN 18 T-Mobile's latest 'Uncarrier' feature: Rhapsody Unradio, an odd streaming music service

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Home > News > Tests show AT&T's LTE network is fastest, T-Mobile's HSPA+ "faster" than Sprint's LTE

Tests show AT&T's LTE network is fastest, T-Mobile's HSPA+ "faster" than Sprint's LTE

Posted: 18 Jun 2013, 09:52, by Michael H.

Tags: T-Mobile + AT&T + Verizon + Sprint + Wireless service +



Every year, PCMag drives all around the country to test the wireless carrier networks in 30 different states. The tests are pretty impressive, and quite helpful for those of you who may be unhappy with your service and looking to switch. This year, the big winner was AT&T, which proved to have the fastest LTE, but there were other surprises in the testing as well.

The basic results of the test are this: if you're looking for speed and you live in or around an urban area, AT&T is the best option; but if you're in a rural area, Verizon is the better choice.

The interesting part of the testing is that in most of the areas tested, T-Mobile's HSPA+ network posted faster average download speeds than even Sprint's LTE network. The great equalizer though was T-Mobile's "average time to first byte", which was about 3x slower than any other network. That means, once your download gets going, T-Mobile offers great speeds, but it will likely take a while to get that download going. T-Mobile's LTE network largely gets rid of that delay, but is too small to really make much of a showing in the tests.

If you want to drill down into your specific region of the country to see how each carrier fared, just head to the source.

source: [PCMag](#)

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1. **threeline** (Posts: 259; Member since: 11 Sep 2011)

I feel sorry for Sprint customers. I used be one their victims and didn't know what I was missing until I left. Never again.

posted on 18 Jun 2013, 11:20 1



12. **HASHTAG** (unregistered)
I'm still their victim.

posted on 18 Jun 2013, 13:37 1



23. **Jeradah3** (Posts: 1008; Member since: 11 Feb 2010)
I used to have Sprint and their mobile network was crap!! I have AT&T and im happy to have their LTE network.

Honestly.....every carrier has their issues, BUT you have to decide what issues you're willing to deal with when you sign their 2yr contract

posted on 18 Jun 2013, 15:14 4



26. **Isutigers** (Posts: 759; Member since: 08 Mar 2009)
The reality is that Sprint's LTE network is in it's infancy and just now being deployed vs AT&T and Verizons more mature LTE networks and TMO's much older HSPA network. We'll see how it shakes out next year when Sprint is expected to have LTE on Nextel's 800mhz spectrum and possibly the ultra high speed TD-LTE on Clearwire's spectrum and T-Mobile has had a chance to fully deploy LTE.

Either way, I see Sprint LTE speeds of 20+mbps quite frequently, so it depends on the area.

posted on 18 Jun 2013, 16:58 3



27. **TheRequiem** (Posts: 159; Member since: 23 Mar 2012)
A comment like this shows just how uneducated and out of the loop the general American public is. Sprints new modular technology is new technology and is using superior technology then the other 3. I also significantly doubt the authenticity of a PC publishing company testing cellular networks. I'm not exactly sure where they were testing Sprints LTE network, but in 5 cities I have been to where it is complete, I averaged well over 20mbps. Are they testing in unlaunched cities? Sounds bogus to me. Sprint has 800 LTE coming and lets not forget that Sprint/ Clearwires new network is supposed to be the fastest in the country at 168mbps average sustained in urban areas and the first 2000 sites should be done this month.

posted on 18 Jun 2013, 17:53



33. **ThePro** (Posts: 26; Member since: 03 Nov 2012)
I don't think sprint's network is good in the real world.

I live on a 5-bar area in the suburbs of Washington DC, and I'm getting 50mbps easily outside

Inside I can get around 30mbps with 5 bars

PhoneArena doesn't let me post links, but if you want them, I think you can send me a private and I'll give them.

posted on 21 Sep 2013, 21:44



40. **sdlizard** (Posts: 1; Member since: 21 Sep 2013)
Dude, I'm trying to figure out why you keep getting so sore about everybody's put downs on Sprint. Just because you have good service doesn't mean everybody else does or that we are "uneducated" as you say. I have a samsung galaxy 3 and have had sprint for 2 years as of November. I will promptly be changing to a different carrier. After having Verizon for over 10 years it's hard to go to a service like Sprint when it comes to quality; however Verizon will never get another dime from me but, that's another story. I live in San Diego and I have the worst service I've had ever and they don't even have 4G down here and I've been told for the last 2 years when I purchased my phone that they had it. But no I have horrible 3G and I don't even think it's as good as 3G to be honest. I don't have data service half the time. So you can be happy with your Sprint but there are many of us who are very unhappy and for good reason.

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39. **Maverick1** (Posts: 26; Member since: 30 Sep 2012)

Don't feel sorry for me, I'm a Sprint customer and a very happy one at that. The 3G speeds I get are good: 132 ms Ping, 2.45Mbps down & 0.77Mbps up with no issues streaming pandora, netflix, youtube web browsing etc and simultaneously at that plus upload time to say facebook is within 5-10 seconds. Buffering is a thing of the past since network vision enhancements.

4G LTE speeds , well I've already posted those below so just reference that and performance is instant. Blazing fast!

posted on 18 Jun 2013, 09:05



2. **darkkjedii** (Posts: 12350; Member since: 05 Feb 2011)

AT&T is also spotty as all hell too. At least in the LV.

posted on 18 Jun 2013, 12:27 8



16. **ZeroCide** (Posts: 698; Member since: 09 Jan 2013)

Thats just your iphone doing that. :)

posted on 18 Jun 2013, 17:06



30. **bigdawg23** (Posts: 388; Member since: 25 May 2011)

Not as spotty as Verizon. I was there in March for a meeting. I have an ATT phone and Verizon MiFi. My LTE/Service was more reliable than VZW. I thought it was my MiFi spot until coworkers with the Razor Maxx HD and S3 complained of no signal. This was even outside of the Monte Carlo on the Strip.

posted on 18 Jun 2013, 17:08 1



31. **Blazers** (Posts: 239; Member since: 05 Dec 2011)

Vegas has great coverage with AT&T LTE, unless you live on the outer fringe areas with heavy handed HOAs who don't want cell phone towers in their neighborhoods.

posted on 18 Jun 2013, 09:16 4



3. **Dorothy69** (banned) (Posts: 498; Member since: 21 May 2013)

HA!!!! Try telling that to AT&T customers who live near 14th Street / Union Square in Manhattan and have, not only BAD voice but, ABYSMAL data service on AT&T.

I agree, T-Mobile is better than Sprint but, rapidly declining just as badly.

Verizon is the only carrier with consistent voice and high-speed 4G LTE data service (NATIONALLY)!!

posted on 18 Jun 2013, 09:28 2



4. **clevername** (Posts: 1431; Member since: 11 Jul 2008)

Definitely seeing those great att lte speeds here in riverside, ca and most of SoCal that I go to. Fast and pretty consistent. But if I drive 11 miles north into San Bernardino that consistency drops.

posted on 18 Jun 2013, 12:31



17. **ZeroCide** (Posts: 698; Member since: 09 Jan 2013)

Ican't wait till sprint lights up that area with LTE.

posted on 18 Jun 2013, 09:45 4



5. **wumberpeb** (Posts: 443; Member since: 14 Mar 2011)

I'll take Sprint LTE for their far lower ping than T-Mobile..waiting a few seconds for the connection to even begin would be a bit maddening

posted on 18 Jun 2013, 10:24 3



8. **JDogg5281** (Posts: 60; Member since: 09 Aug 2012)

If you can even find Sprints LTE.....If your not on Sprints LTE your on their 3g network and everyone knows how painfully slow that is. Being on Sprints 3g would be maddening.

posted on 18 Jun 2013, 11:21 4



13. **HASHTAG** (unregistered)

I know! Sprint doesn't even have 3G, it's more like 2G.

posted on 18 Jun 2013, 14:20 1 in response to #13



25. **JEverettnow** (Posts: 209; Member since: 11 Mar 2013)

Its actually slower than 2g at about 200kbps if you are in a good area.

posted on 18 Jun 2013, 17:04 1 in response to #25



28. **TheRequiem** (Posts: 159; Member since: 23 Mar 2012)

No it's not. On their old legacy network yes... But on their network vision overhauled 3G is dramatically faster with lower pings. I get an average of about 50 ping and 2.5-4mbps on their new 3G network. Also if you check LA and Chicago where their new network is mostly complete on sensorly, they have far better performance then other networks.

posted on 18 Jun 2013, 21:51 in response to #28



36. **JDogg5281** (Posts: 60; Member since: 09 Aug 2012)

Far better performance than the other networks really? You might be the first person that has ever said that

posted on 18 Jun 2013, 09:46 2



6. **InspectorGadget80** (Posts: 6674; Member since: 26 Mar 2011)

And I don't see why T-Mobile is trying so hard against AT&T 4G commericals

posted on 18 Jun 2013, 10:21 2



7. **Maverick1** (Posts: 26; Member since: 30 Sep 2012)

It all depends on location so wherever these particular tests are performed doesn't give a clear picture. Many factors will weigh in such as congestion, time of day, population, status of network etc in those areas.

I for one live in an area that's fonomiable when it comes to network speeds on Sprint 4G LTE. 74ms Ping; 35.53Mbps down; 10.43Mbps up

And it will only improve especially more so with Softbank's acquisition of Sprint.

posted on 18 Jun 2013, 10:33 1



9. **Doakie** (Posts: 1304; Member since: 06 May 2009)

WOW. I'm jealous! My Sprint HTC One gets 100-500 Kbps pretty much everywhere in Seattle. It sees LTE but as soon as I initiate a download it boots me back to EVDO which right now is running around 100 Kbps. By the SeaTac Airport I can actually stay on their LTE network and I get a whopping 3000 Kbps down. Where right next to it on my Tmobile Note 2 I get 10-30 Mbps everywhere. Sprint right now is pathetic in Seattle. I've been with them for 12 years now so I'm not quick to jump ship, but if they didn't have a \$350 ETF I'd have transferred our family away a long time ago. So sad when my old EVO 4G got 1.0 Mbps on their EVDO network and 8 Mbps on WiMAX. If anyone can kill the experience of a flagship phone it's Sprint's 3G.

posted on 18 Jun 2013, 17:06 1



29. **TheRequiem** (Posts: 159; Member since: 23 Mar 2012)

Network vision is also underway in Seattle and is only about 25% done, it'll be a lot more exciting when finished. It's only a soft launched market now.

posted on 18 Jun 2013, 11:07



10. **Omarc07** (Posts: 262; Member since: 12 Nov 2012)

like always it depends were one lives over here in los angeles att lte is a mixed bag but still faster than verizon lte ,verizon lte used to be awesome but it slooowed down alot i know people on verizon that get 6 mbps dwn and 1-2 up tops. While att gets a lil bit higher up to 9dwn and 4-5 up. T-Mobile hspa here is awesome theres no denying that i had em and used to get up to 20 mbps but problem with t-mobile is coverage its spotty u walk down the wrong street u on edge while att has more solid data u rarely see edge on att. Sprint has lte here its faast my friend gets like 30 dwn ,15 up but sprints coverage here is worse than tmobile so yea..

posted on 18 Jun 2013, 12:00



15. **Maverick1** (Posts: 26; Member since: 30 Sep 2012)

That's great to hear about your friends speed test on Sprint but I need to ask even though it's not 100% coverage it does pick up signal in roaming status, yes.

posted on 18 Jun 2013, 11:20 1



11. **ahxd717** (Posts: 320; Member since: 08 Dec 2011)

Luckily I've lived in placed where ATT isn't so terrible, as many here on this site have claimed. Although these areas are Indianapolis and Bloomington, IN and have had their LTE for a while. I can't complain about their service.

posted on 18 Jun 2013, 11:45



14. **flynfree** (Posts: 374; Member since: 09 Jun 2013)

I've notice that my tmobile hTc One have a greater 4g/lte reception than to my gnote 2 around our house, only on the left wing my gnote 2 can get LTE and it always drop to 4g, while my hTc One is barely drop the LTE signal (San Diego location). I'm just thinking that the aluminum unibody of this phone maybe! can help the network signal.

posted on 18 Jun 2013, 13:20 1



18. **techaman** (unregistered)

sprint truly is the slowest thing out there the 4g lte is 2.3 mb and the 3g is .004mb thats 56k dial up speed people i told them about this and they said they dont guarantee any speeds so i told them i dont guarantee i will pay them any more cant wait to switch to t mobile no contract.

posted on 18 Jun 2013, 13:24 1



20. **Maverick1** (Posts: 26; Member since: 30 Sep 2012)

Like everyone has said.....

Location Location Location

posted on 18 Jun 2013, 13:21



19. **techaman** (unregistered)

with sprint it takes me 5 to 10 mins to open a full webpage thats chached.

posted on 18 Jun 2013, 13:29 1



22. **Maverick1** (Posts: 26; Member since: 30 Sep 2012)

With 3G I get 132ms Ping; 2.45Mbps down & 0.77Mbps up so it takes 5-10 seconds to open anything on the net and on 4G LTE it's instant.

posted on 23 Jun 2013, 21:06



37. **true1984** (Posts: 593; Member since: 23 May 2012)

if it's cached then that's not Sprint, that's your phone

posted on 18 Jun 2013, 13:24



21. **techaman** (unregistered)

and i am outside of dc the usa capital they had lte in cuba before here who cares about cuba people, am paying 90 a month for crap nothing,

posted on 18 Jun 2013, 14:01



24. **RagingCalm** (Posts: 8; Member since: 22 Jun 2012)

I carry a phone or hotspot from each carrier and travel a lot, and data wise Verizon is consistently the best. T-Mobile are good where they are good but suck where they suck. Five bars of T-Mobile LTE in Vegas or 4G in LA and I consistently can't even open a google map. Sprint are defintely the worst, coverage is spotty most places and data rates suck.

posted on 23 Jun 2013, 21:12



38. **true1984** (Posts: 593; Member since: 23 May 2012)

Sprint doesn't have data rates, they have unlimited data so the rates are only for voice

posted on 18 Jun 2013, 17:42



32. **Monster.Ninja** (Posts: 9; Member since: 10 Jun 2011)



I would be happy with sprint if i could just get a signal strong enough to stream spotify or slacker without having it cut in and out.while jogging around town...

posted on 18 Jun 2013, 18:08 1



34. [sun0066](#) (Posts: 78; Member since: 12 Feb 2011)

I had sprint in the miami area and it was horrible , 3g speed are really slow, that make the internet useless , so the data is unlimited but you can no use it and it is very laggy, so I went to att and everything works as it should, anywhere , perfectly at least in south florida. I went to asheville NC and the signal was not good but still better than sprint, then go figure it out.

posted on 18 Jun 2013, 19:57 1



35. [jsjr76](#) (Posts: 24; Member since: 28 Sep 2010)

T-mobile LTE just went live in Atlanta and I got 37 up and 16 down. That's 35 miles north of the city in Woodstock. That's off of the Atlanta connection via the Speedtest app. Not bad for its first week in Atl. Good for you T-Mo. Sprint, you're the fat kid in the zombie apocalypse. Prepare to be munched. AT&T, you ain't far behind.

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Introducing
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What is LTE Advanced?

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² Limited LTE Advanced availability in select markets. Deployment ongoing. Compatible device required & selection is limited. Faster speeds and greater capacity not guaranteed. Individual speeds will vary.

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GENERAL	2G Network	GSM 850 / 900 / 1800 / 1900 - A1549 (GSM), A1549 (CDMA), A1586 CDMA 800 / 1700 / 1900 / 2100 - A1549 (CDMA), A1586
	3G Network	HSDPA 850 / 900 / 1700 / 1900 / 2100 - A1549 (GSM), A1549 (CDMA), A1586 CDMA2000 1xEV-DO - A1549 (CDMA), A1586 TD-SCDMA 1900 / 2000 - A1586
	4G Network	LTE 700/800/850/900/1700/1800/1900/2100/2600 (1/2/3/4/5/7/8/13/17/18/19/20/25/26/28/29) - A1549 (GSM), A1549 (CDMA) LTE 700/800/850/900/1800/1900/2100/2600 TD-LTE 1900/2300/2500/2600 (1/2/3/4/5/7/8/13/17/18/19/20/25/26/28/29/38/39/40/41) - A1586
	SIM	Nano-SIM
	Announced Status	2014, September Available. Released 2014, September
BODY	Dimensions	138.1 x 67 x 6.9 mm (5.44 x 2.64 x 0.27 in)
	Weight	129 g (4.55 oz) - Fingerprint sensor (Touch ID) - Apple Pay (Visa, MasterCard, AMEX certified)
DISPLAY	Type	LED-backlit IPS LCD, capacitive touchscreen, 16M colors
	Size	750 x 1334 pixels, 4.7 inches (~326 ppi pixel density)
	Multitouch	Yes
	Protection	Shatter proof glass, oleophobic coating - Display Zoom
SOUND	Alert types	Vibration, proprietary ringtones
	Loudspeaker	Yes
	3.5mm jack	Yes
MEMORY	Card slot	No
	Internal	16/64/128 GB, 1 GB RAM
DATA	GPRS	Yes
	EDGE	Yes
	Speed	HSPA 42.2/5.76 Mbps, LTE Cat4 150/50 Mbps, EV-DO Rev.A 3.1 Mbps
	WLAN	Wi-Fi 802.11 a/b/g/n/ac, dual-band, Wi-Fi hotspot
	Bluetooth	v4.0, A2DP, LE
CAMERA	NFC	Yes (Apple Pay only)
	USB	v2.0, reversible connector
	Primary	8 MP, 3264 x 2448 pixels, phase detection autofocus, dual-LED (dual tone) flash, check quality
	Features	1/3" sensor size, 1.5µm pixel size, geo-tagging, simultaneous HD video and image recording, touch focus, face/smile detection, HDR (photo/panorama)
	Video	1080p@60fps, 720p@240fps, check quality
	Secondary	1.2 MP, 720p@30fps, face detection, HDR, FaceTime over Wi-Fi or Cellular
FEATURES	OS	iOS 8, upgradable to iOS 8.1.1
	Chipset	Apple A8
	CPU	Dual-core 1.4 GHz Cyclone (ARM v8-based)
	GPU	PowerVR GX6450 (quad-core graphics)
	Sensors	Accelerometer, gyro, proximity, compass, barometer
	Messaging	iMessage, SMS (threaded view), MMS, Email, Push Email
	Browser	HTML5 (Safari)
	Radio	No
	GPS	Yes, with A-GPS, GLONASS
	Java	No
	Colors	Space Gray, Silver, Gold

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		- Voice memo/dial/command - Predictive text input
BATTERY		Non-removable Li-Po 1810 mAh battery (6.9 Wh)
	Stand-by	(2G) / Up to 250 h (3G)
	Talk time	(2G) / Up to 14 h (3G)
	Music play	Up to 50 h
MISC	SAR US	1.18 W/kg (head) 1.18 W/kg (body)
	SAR EU	0.98 W/kg (head) 0.97 W/kg (body)
	Price group	
TESTS	Performance	Basemark OS II: 1252 / Basemark X: 15841
	Display	Contrast ratio: 1213 (nominal), 3.838 (sunlight)
	Camera	Photo / Video
	Loudspeaker	Voice 66dB / Noise 65dB / Ring 72dB
	Audio quality	Noise -94dB / Crosstalk -73.4dB
	Battery life	Endurance rating 61h

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APPLE IPHONE 6 - USER OPINIONS AND REVIEWS

WaBBy500

Though having an open environment ever heard any of the android accounts hacked ????. While your secure os was hacked most trusted icloud was hacked and you give a damn about being safe and secure in ios. Stop being a fool

2014-11-21 07:26 vbUr R Reply

WaBBy500

Sorry but who said you that note 3 is struggling to get the latest android update, you might have not seen the lollipop build for note 3 in gsmarena yesterday and though your iphone 5 got the ios 8 update but it was the worst thing to happen to it ma...

2014-11-21 06:17 vbUr R Reply

Jess

Yes I did the 8.1.1 update its much better

2014-11-21 05:08 7tEe R Reply

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COLOR

- 5-inch Full HD Super AMOLED™ display
- 16-megapixel camera
- Heart rate sensor†
- Fingerprint scanner

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SPECIFICATIONS

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TYPE

Sprint

COLOR

Charcoal Black

OS

Android™

CAMERA RESOLUTION (FRONT)

CMOS, 2.0 MP

CAMERA RESOLUTION (REAR)

CMOS, 16.0 MP

INTERNET USE TIME

3G: Up to 11 Hours; 4G: Up to 12 Hours; Wi-Fi: Up to 13 Hours*

INTERNAL MEMORY

MAIN DISPLAY RESOLUTION

MAIN DISPLAY SIZE 1031 of 1361.

2 GB RAM, 16 GB ROM**

1920 x 1080 Pixel

5.1"

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OWNER REVIEWS

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I've had all of the Galaxy phones as they've come out. Not a complaint about a single one, and nothing but improvements every time. I can't wait to see what Samsung has in store for the Galaxy S6!

JW2012 on October 31, 2014



Does every feature I've been asking for with all my previous phones. I love it!

Showdown on October 12, 2014



Alright, so this galaxy s5 has been an awesome experience, I love music I love the internet , need space, I like to take pictures , I like my pictures to look nice, I like the sound of my music to sound great, I like to recognize the voices of my family & friends when we talk , this phone has exceeded my expectations in all my favorite areas , it has its own very large storage capacity, takes beautiful pictures , the sound quality is great, I really appreciate its background noise cancellation ability , so I can talk while working using the headset & the person im talkin to can hear me perfectly, all around great device, love the larger screen too.

cre8ter on October 10, 2014

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†This device, S Health, and related software is not intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment or prevention of disease.

**Battery life: Results are based on lab environment testing. Refer to your network carrier's website for network specific talk times. Battery power consumption depends on factors such as network configuration, signal strength, operating temperature, features selected, vibrate mode, backlight settings, browser use, and data and other application usage patterns.*

***Portion of memory occupied by existing content.*

****Water-resistant and dustproof based on IP67 rating, which tests submersion up to 1 meter for up to 30 minutes. Not shockproof. Covers must be tightly closed.*

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Ho's Perspective: Sprint needs to step up its 2.5 GHz LTE deployment

September 29, 2014 | By [William Ho](#)

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Many industry people remember Xohm, Sprint's WiMAX-based "4G" service operating on its 2.5 GHz TDD spectrum. Though the technology is largely a thing of the past and its adoption hotly debated, Sprint saw a chance to race ahead of its competitors with faster than 3G mobile broadband services. As we all know, the bet on WiMAX proved disastrous as the world embraced LTE. Rather than having a year or more lead, Sprint found itself an LTE straggler.



William Ho

Today's landscape sees larger competitors AT&T Mobility and Verizon Wireless exceeding 300 million LTE POPs covered with their respective 700 MHz assets, while upstart T-Mobile US has aggressively used its AWS and PCS spectrum and is on track to meet 250 million POPs covered by the end of the year.

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Though Sprint has already passed the 250 million mark using a small 5x5 MHz sliver of PCS spectrum, rivals implementing 10x10, 15x15 and even 20x20 MHz of bandwidth deliver greater speeds and capacity. While Sprint says that the intensive "rip and replace" of the older CDMA and Nextel infrastructure is largely done, it is still unfinished in the two more important LTE components--800 MHz and 2.5 GHz--of its tri-band Spark strategy. For many years, Sprint has talked up how its 2.5 GHz spectrum holdings, 120-160 MHz deep in some markets, will give it a competitive advantage. Industry watchers continue to wait on its execution while some customers have left for other options. In the context of coverage, Sprint's stated 100 million 2.5 GHz LTE POP target by the end of 2014 just seems inadequate given today's competitive environment.

When Marcelo Claure took the Sprint helm in mid-August, he outlined his priorities: reduce prices, improve the network, and decrease operational costs. Quickly introducing new and reduced pricing plans and promotions of the iPhone launch let Claure check that box, but it's an ongoing process given the competitive backdrop. Decreasing operational costs is also ongoing, but we've

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seen this played out in some fashion in the CFO Bob Brust era. Recall the "no photocopying" and the [offload of 6,000 network operations personnel to Ericsson](#)? Current CFO Joe Euteneuer will surely make his own mark.

However, the network improvement is the most important near term priority for Sprint. Rather than network improvement, Sprint needs network acceleration. Just as he was aggressive in pricing and promotions, Claure has the opportunity to step on the gas to expand the 2014 2.5 GHz target and accelerate the 2015 rollout with at least 250 million POPs covered before the end of next year.

Yet, at the mid-September Goldman Sachs investor conference, Claure revealed that Sprint was taking a different tact. Instead, there wasn't any expansion of the network plan, the plan was to [smartly concentrate the 2.5 GHz buildout in a few cities](#) rather than to fully build out to the previously planned 33,000 sites. This appears to be a revisit of [the strategy Sprint had circa 2012](#) when Sprint provided Clearwire priority markets it needed to build out because of "heavy data tonnage" subscriber demand.

The same logic applies: have an excellent and differentiated data experience where all competitors encounter congestion; leverage the planned two-carrier and three-carrier carrier aggregation to bring about the promised 100-150 Mbps peak speeds to beat rivals, market regionally, increase service and network reputation.

Don't get me wrong, this is good logic and in clarifying with Sprint, their CEO's comments addressed looking at sales and marketing priorities rather than perhaps engineering ones. I do disagree with Claure's comments about not needing "to plaster the nation with 2.5, because it's going to take us too long."

Sprint will still need to address the broadest 2.5 GHz national deployment, because competitors are working on a national consistent and high speed experience. Sprint hasn't discussed any details on what the 2015 POP/market target and ultimately how its 2.5 GHz component will look like relative to competitors. It's well known that high-band spectrum like 2.5 GHz provides great capacity but due to poor propagation characteristics building out coverage gets expensive, and to cover 300 million POPs seems improbable.

To be sure, Sprint's efforts with Competitive Carrier Association (CCA) members can help with some of the Spark buildout and associated roaming [in 27 states while adding 38 million POPs to the tally](#). Beyond this footprint, Sprint needs a wide 2.5 GHz footprint to further the promised differentiated speed experience. What a disappointment for subscribers to drop from a 100+ Mbps experience to one with less than 10 Mbps, dropping to either the thin 5x5 PCS or 800 MHz systems. The future connected car equipped with infotainment systems and mobile hotspots will surely require the bandwidth capability that 2.5 GHz Spark promises.

In the near term, there is the competitive marketing pressure. Verizon has been making inroads in its AWS-based "XLTE" network [hitting a reported 400 markets](#) (its 700 LTE covers 500 markets), giving it greater capacity and speed. T-Mobile has been very assertive publicly with its claim of the nation's fastest LTE speeds with a "Wideband" (i.e. at least 15x15 MHz) LTE moniker. Moreover, the T-Mobile has already started to deploy its low-band 700 MHz A Block spectrum. AT&T has been quieter about any network moves but logically something should be in the works to respond to chief rival Verizon. The takeaway is that AT&T, T-Mobile and Verizon Wireless are moving forward, building upon their national network and speed reputations at a faster pace than Sprint, and leveraging marketing mileage from it. Competitors already have a head start and "[America's Newest Network](#)" may not be able to blunt their advances.

To be sure, accelerating deployment isn't a trivial matter. It requires more capital, planning and vendor infrastructure and device coordination. Obviously, Sprint parent SoftBank has deep pockets and is able to up its commitment beyond its planned levels. At the beginning of the year, Sprint projected \$8 billion in 2014

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capital expenditures. With equipment buying power synergy with Softbank, Sprint dropped the projection to [less than \\$7 billion after last quarter's earnings call](#). Recently, SoftBank has seen its pockets lined by around \$4.6 billion, as the 32 percent investment stake in Alibaba has increased in value, [in light of Alibaba's record initial public offering](#). Given Sprint's capital resourcefulness and additional SoftBank injection, Sprint can accelerate and broaden its 2.5 GHz deployment plans. In doing so, it can narrow and close any competitive gap more quickly. SoftBank Chairman Masayoshi Son has said on many occasions that he [wants to bring higher mobile broadband speeds](#) to the US and he wants to win.

Claire said he [likes being an underdog and winning](#). Stepping on the gas for the 2.5 GHz network is an essential and urgent component for winning.

William Ho is a leading industry analyst, consultant, and commentator at 556 Ventures. He has over 25 years experience in the fixed, internet and wireless sectors. Follow him on Twitter @billho888.

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Filed Under 2.5 GHz, AT&T Mobility, AWS, LTE, Marcelo Claire, Sprint, Sprint Spark, T-Mobile USA, TD-LTE, Verizon Wireless, William Ho, wireless spectrum, XLTE

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PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 105**

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2001

George A. Akerlof, A. Michael Spence, Joseph E. Stiglitz

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Joseph E. Stiglitz - Biographical



I was born in Gary, Indiana, at the time, a major steel town on the southern shores of Lake Michigan, on February 9, 1943. Both of my parents were born within six miles of Gary, early in the century, and continued to live in the area until 1997. I sometimes thought that my peregrinations made up for their stability.

There must have been something in the air of Gary that led one into economics: the first Nobel Prize winner, **Paul Samuelson**, was also from Gary, as were several other distinguished economists. (Paul allegedly once wrote a letter of recommendation for me which summarized my accomplishments by saying that I was the best economist from Gary, Indiana.) Certainly, the poverty, the discrimination, the episodic unemployment could not but strike an inquiring youngster: why did these exist, and what could we do about them.

I grew up in a family in which political issues were often discussed, and debated intensely. My mother's family were New Deal Democrats - they worshipped FDR; and though my uncle was a highly successful lawyer and real estate entrepreneur, he was staunchly pro-labor. My father, on the other hand, was probably more aptly described as a Jeffersonian democrat; a small businessman (an independent insurance agent) himself, he repeatedly spoke of the virtues of self-employment, of being one's own boss, of self-reliance. He worried about big business, and valued our competition laws. I saw him, conservative by nature, buffeted by the marked changes in American society during the near-century of his life, and adapt to these changes. By the midseventies, he had become a strong advocate of civil rights. He had a deep sense of civic and moral responsibility. He was one of the few people I knew who insisted on paying social security contributions for household help - regardless of whether they wanted it or not; he knew they would need it when they were old. (This attitude served me well; in 1993, while many Clinton appointees faced problems in being vetted because of their failure to pay these taxes, I was spared these problems because I had followed his example.)

I went to public schools, and while Gary was, like most American cities, racially segregated, it was at least socially integrated - a cross section of children from families of all walks of life. The Gary public school system was designed to integrate the immigrants who constituted such a large fraction of its inhabitant; here, the melting pot rhetoric that is so important part of America's, self-image was taken seriously. All of us had to learn, for instance, two trades (mine were printing and being an electrician). I had the good fortune of having dedicated teachers, who in spite of relatively large classes, provided a high level of individual attention. My teachers helped guide and motivate me; but the responsibility of learning was left with me, an approach to learning which was later reinforced by my experiences at Amherst.

The extra curricular activity in which I was most engaged - debating - helped shape my interests in public policy. Every year, a national debating topic is chosen. (One year, it was the reform of the agricultural support programs, an issue which I had to grapple with almost forty years later; some of my colleagues in the Clinton Administration too had been debaters, but they got taken up by the sport. I was attracted more by the ideas.) In debate, one randomly was assigned to one side or the other. This had at least one virtue - it made one see that there was more than one side to these complex issues.

The intellectually most formative experiences occurred during the three years 1960-1963 I spent at Amherst college, a small, New England college (at the time, a men's college with around 1000 students). I went to Amherst because my brother had gone there before me, and he went there because his guidance counselor thought that we would do better there than at a large university like Harvard. Amherst is a liberal arts college, committed to providing students with a broad education. (Today, I serve on its board of trustees.) The notion that every well educated person would have a mastery of at least the basic elements of the humanities, sciences, and social sciences is a far cry from the specialized education that most students today receive, particularly in the research universities. But what distinguished Amherst was not only what was taught, but how it was taught, and the close relationships we had with our teachers. The best teachers still taught in a Socratic style, asking questions, responding to the answers with still another question. And in all of our courses, we were taught that what mattered most was asking the right question - having posed the question well, answering the question was often a relatively easy matter.

I thrived on the atmosphere; while until late in my third year, I majored in physics, and enjoyed immensely the camaraderie of the physics students as we strove to solve the hard problems that were assigned to us. I took a smattering of courses in mathematics, history, English, philosophy, and the standard fare of introductory biology and chemistry. I still remember well the courses, and have frequently drawn upon this learning. For instance, the discussions of the encounters between different civilizations that was a major theme in our Freshman history class helped shape my thinking about globalization more than three decades later; I felt I was in a better position to think about the current episode from an historical perspective, and see it more through the eyes of the *other* side.

But while I loved all of these courses, there was an irresistible attraction of economics. My three teachers at Amherst showed me the range of the subject: Arnold Coltery, later to be Dean of Columbia College, was a thoughtful and erudite scholar, from whom I studied both micro-economics and macro-economics. The style of teaching was exemplified by his choice of texts for the micro course. Rather than a standard textbook, he used Abba Lerner's *Economics of Control*, a book written as a theoretical contribution to our understanding of how markets work, an inquiry into whether planning provided an alternative. James Nelson, who taught me introductory economics, was a vivacious policy economist, who conveyed the sense of excitement that came from trying to shape economic policies. Finally, Ralph Beals was a young graduate of MIT, trained in mathematical techniques that were just then coming into vogue. It was not until late in the spring of my junior (third) year that I decided to major in economics; I thought it provided an opportunity for me to apply my interests and abilities in mathematics to important social problems, and somehow, I thought it would also enable me to combine my interest in history and in writing. I wanted it all, and economics seemed to have it all. When I advised my teachers of my decision, they advised me that I should go on to graduate school. What I would study during my senior year would be largely repeated in my first year of graduate school. They then arranged for me to go to MIT, and to receive the finance I required (I had been on full scholarship at Amherst; the modest last minute fellowship from MIT entailed my living on a dollar a day beyond my rent - the number that today is taken as the threshold for absolute poverty.) The flexibility of MIT, and Amherst, - the deadlines for application were well past, the money for fellowships had largely already been dispensed - is a tribute to America's higher educational system, and one of the reasons that it continues to excel. I left Amherst for MIT without a degree, or without any promise of one. It was before I had done my work on the economics of information, and I think I didn't grasp the information that might be conveyed by having a degree from Amherst. I simply wanted to learn as much as I could as quickly as I could - not from any sense of "getting ahead" but simply from an overwhelming sense that there was so much to learn, and one needed to get on with it. (Later, Amherst did give me a degree, and still later, in 1974, they gave me an honorary doctorate.) One of my teachers, and one of the world's greatest economists, Hirofumi Uzawa, when asked where he got his advanced degree, would say they he had no degree to speak of; in academic circles, there is a certain pride in simply having pursued one's studies on one's own, outside the confines of a regular program. If Amherst hadn't given me a degree, I could have given a similar response.

My love of politics first manifested itself in my days at Amherst. I served on the Student Council both in my freshman and sophomore years (there were three representatives from each class), and in junior year, got elected president of the student council. My conviction that if one attains positions of "power" one should view them as opportunities for social

change also manifested itself. I began a campaign to abolish fraternities (to which 90% of the students belonged), because they were socially divisive, and contrary to the spirit of a liberal arts school and community. It was a campaign that was not welcomed by many of my classmates, and it took years to come to fruition, but it did, and I believe that Amherst is the better for it. This was only one of the many issues that I raised in my "activist" presidency. I, like many members of my generation, was concerned with segregation and the repeated violation of civil rights. We were impatient with those (like President Kennedy) who took a cautious approach. How could we continue to countenance these injustices that had gone on so long. (The fact that so many people in the establishment seemed to do so - as they had accepted colonialism, slavery, and other forms of oppression - left a life-long mark. It reinforced a distrust of authority which I had had from childhood.) I marched on Washington - the march where **Martin Luther King** gave his "I have a dream" speech remains an indelible memory. I organized an exchange program with a small, African-American, southern school; I believed it was important for us to understand, as much as we could, what they were confronting. These were the years where many civil rights activists from the North were killed; but in our enthusiasm for doing what was right, these risks never crossed our minds.

Not surprisingly, there was considerable opposition to some of my initiatives, so much so that a recall referendum was initiated. It was also my first encounter with the power of the press and personal rivalries; the editor of the student paper took on the cause of removing me. But my friends and allies beat back the initiative, and I continued to use the platform of the presidency of the student council to promote social change.

Amherst was pivotal in my broad intellectual development; MIT in my development as a professional economist. I spent but two years at MIT as a student (I did my generals in a year and a half, and then began writing my thesis.) It was the hey-day of MIT with first-rate professors (I had at least four Nobel Prize winners as professor: **Samuelson** (Nobel Laureate in 1970), **Solow** (Nobel Laureate in 1987), **Modigliani** (Nobel Laureate in 1985), and **Arrow** (Nobel Laureate in 1972)) teaching first-rate students. My first paper presented at an academic meeting, to the econometric society, was jointly co-authored with George Akerlof, with whom I shared this year's prize. I had many other first rate classmates that were to make truly important contributions to economics.

The particular style of MIT economics suited me well - simple and concrete models, directed at answering important and relevant questions. I sometimes wonder what would have happened had I gone to one of the universities in which other styles of economics were taught, either the abstract general equilibrium models, for which Berkeley was then noted, or the simpler partial equilibrium models for which Chicago was famous. The politics of MIT also suited me well. My teachers were mostly establishment liberals, but there were a few that were more questioning. I wonder too how I would have fared had I gone to one of the schools, like Chicago, where there is a more conservative bent. Would I have changed? Or would I have just been unhappy?

But, as I comment in my Prize lecture, there was an incongruity between many of the models that we were taught and the policy positions that our teachers (and we) believed in. The models seemed more consonant with free market prescriptions, though they were presented more as benchmarks rather than full characterizations.

The students and faculty at MIT were highly interactive. There was a group of friends (mostly from the year ahead of me, including George), which included a few young economists from Harvard, with whom I spent much of my time. We lived economics and politics. We debated about what was wrong with the models that we were being taught. We thought about how we could or would go about changing the models, and occasionally about how we could or would go about changing the world. One of our group was from India (Mrinal Datta-Chaudhuri) and we learned from him a host of stories concerning the colonial experience.

After my first year as a graduate student, I was offered a wonderful opportunity, editing Paul Samuelson's collected papers. I often took Paul as a role model, the expansiveness of his learning, the breadth of his work, his originality and penetration. He wrote forcefully and beautifully. For many years after leaving MIT, I was best known as Samuelson's

editor, which I did not always appreciate, since I wanted to be known for my own work.

The summer after my second year as a graduate student was one of the most exciting. Hirofumi Uzawa had moved from Stanford to Chicago, and had received an NSF grant to bring around a dozen graduate students from around the country to work together on theory. Eytan Sheshinski and his wife Ruthie, George Akerlof, Mrinal Datta-Chaudhuri, Georgio LaMalfa (later to be head of the Republican party of Italy and a minister in several of that country's governments) and his wife, Eva drove off to Chicago. We stopped on the way at my home in Gary for a night, where my parents were delighted to have a chance to meet my friends. At Chicago, we were joined by some of Hiro's Chicago students and by Frank Levy from Yale (who now teaches at MIT), among others. Growth theory was then all the rage, and we did growth theory, day in and day out. Many of us worked on technical change, on work which would be rediscovered, two decades later and popularized under the name of endogenous growth theory. (The fact that the work that was done in this period received so little attention in the subsequent revival of interest in growth theory two decades later has been a subject of some interest to me, as part of what may be thought of as the sociology of knowledge. Economists tend to move in particular circles, defined by their "school" and "subject." Endogenous growth theory in the 80s grew out of the Chicago school, while the earlier work on growth theory was part of the MIT school - treating Uzawa, though a professor at Chicago, as an honorary member of the MIT fraternity. I moved both across schools and subjects. This allowed me to learn from each, and the cross fertilization was highly productive. But it did pose problems. Not being a dues paying member of any particular school/subdiscipline sometimes meant it was more difficult to get one's ideas accepted, or even widely discussed. This was particularly the case in macro-economics, where in the 70s and 80s, the reigning paradigms were either rational expectations/representative agent models or fixed price new Keynesian models. The models that Greenwald and I formulated, focusing on imperfect capital markets, risk averse, credit constrained firms, in which concerns about bankruptcy often play an important role, only became widely accepted after similar ideas were picked up by the card carrying members of the macro-fraternity.)

While the group of us who went to Chicago to study under Uzawa was supposedly chosen for our prowess as students, we shared a broad weltanschauung. As the month of intensive work ended, leaving a lifelong impression on all of us, most of us went up to George's family place on Lake Squam. I was working as Bob Solow's research assistant, and so had to commute from Cambridge.

After two years at MIT (supported in the second year by the National Science Foundation), I received a Fulbright fellowship to Cambridge for 1965-1966. At the time, there were three High Churches in the economics profession: Chicago on the right and Cambridge, U.K. on the left, with MIT being in the center. Cambridge was still basking in the reflected glory of Keynes, who had revolutionized economics some thirty years earlier. Lord Kahn, of the Kahn multiplier (which explained how a dollar of government expenditure had a multiple effect in increasing GDP), Joan Robinson, Nicky Kaldor, James Meade, David Champernowne, Piero Sraffa, these were among the gods that populated the colleges of Cambridge. I wanted to see as many views as I could, and I worried about coming too much under the influence of Samuelson and Solow. Joan Robinson was assigned as my tutor. She had originally wanted me to redo my undergraduate degree - she thought it would take some time to undo the damage of my MIT education, but eventually she was prevailed upon instead to take on the responsibility of my re-education. We had a tumultuous relationship. Evidently, she wasn't used to the kind of questioning stance of a brash American student, even a soft-spoken one from the mid-west, and after one term, I switched to Frank Hahn. He was flamboyant, and always intellectually provocative. Cambridge was in ferment. The quality of the students and the young lecturers matched that of the gray eminences: Jim Mirrlees (later to get the Nobel prize), Partha Dasgupta, Tony Atkinson; Geoff Heal, David Newbery and a host of others. There was a sense of excitement that was associated not just with the generation of new ideas, but with the belief that those ideas were important, and not just for economics, but for society more broadly. As Frank Hahn demonstrated the dynamic instability of the economy (a problem posed by the absence of futures markets going out infinitely far into the future; in technical terms, the absence of a transversality condition), he would excitedly exclaim that he had put another nail in the coffin of capitalism.

One evening I gave a seminar on a paper I was then completing, on the distribution of income among individuals (using the kinds of tools that had been used to describe the dynamics of growth to describe the dynamics of inequality). The discussion had been followed by a lively debate. The next morning, I received a twenty-page comment from **James Meade** (who received the Nobel Prize in 1977), suggesting elaborations and alternative interpretations. There was a sense of a community of scholars trying to understand some very important and complex problems.

My research in this period centered around growth, technical change, and income distribution, both how growth affected the distribution of income and how the distribution of income affected growth. The most important paper to emerge from my thesis, "The Distribution of Income and Wealth Among Individuals,"¹ received considerable attention at the time, but unfortunately, the topic has not been one which has received much attention from the economic profession, so that it has not generated as much follow-on research as I had hoped.

But the subject of the causes and consequences of inequality has remained one of my abiding concerns, one which I pursued as I began to delve into the economics of information.²

My early research project in this area illustrated one feature of my research style which, while it may have contributed to the overall success of some of my research program, was a source of unending frustration. Once I undertook the analysis of a problem, I often looked at it from a variety of perspectives. I approached the problem as a series of thought experiments - unlike many other sciences, we typically cannot do actual experiments. I would construct models changing one assumption or the other. Each would provide some insight into what drove the results. The whole was more than the sum of the parts; while each of the models was, by itself, of some interest, it was the collection of models, and how the results depended on the particular assumptions employed, which provided the greatest insight. My original work thus grew into a monograph of some hundred pages. Unfortunately, the preferred form of expression in the profession was narrowly defined articles, making a single point. I thus had to extract from the longer monograph a series of papers, a process which not only took a long time, but diminished (in my judgment) the insights provided. (This problem was even greater in the next two research projects, one exploring the behavior of the firm under uncertainty, and in particular, the consequences of risk with an incomplete set of risk markets; most (but not all) of that "paper" - an eight hour lecture I delivered in 1970 at Hakone, Japan, in another one of Hirofumi Uzawa's workshops - was published as a series of articles over the next decade.³ The exploration of "Alternative theories of wage determination and unemployment in less developing countries," completed while I was at the Institute of Development Studies at the University of Nairobi in the summer of 1969, was similarly published in a series of articles - the most recent of which was not published until 1992).⁴

Another project that I began in Cambridge concerned the interaction between the distribution of income and short run macro economic behavior. At the time, most macro economic models simply assumed that wages and prices were fixed. But, of course, during the great depression wages and prices had fallen considerably. The problem was not that they were absolutely fixed, but with the dynamics of adjustment. With Robert Solow (Solow and Stiglitz, 1968), I explored these dynamics, to explain the persistence of unemployment. With George Akerlof (see Akerlof and Stiglitz, 1969), I showed how such dynamics can give rise to cyclical behavior. Later work would attempt to provide stronger micro foundations for these adjustment dynamics.

I returned from Cambridge to take up a one-year appointment as an assistant professor at MIT, from which I went to Yale. My teaching at Yale seemingly warranted an indefinite deferment from the Vietnam War draft. During this period, I continued my work on economic dynamics, and began my research on the economics of uncertainty, which in turn, quickly led to the work on the economics of information.

The major concern in my research on dynamics was the stability of the market economy. The standard models assumed that there were future markets extending infinitely far into the future. Following work of Frank Hahn (1966), Karl Shell and I showed that a competitive economy with futures markets extending an arbitrarily large finite number of periods into the future would, in general, exhibit dynamic instabilities; that is, it would take off onto a path that *appeared* to be efficient

and stable, with the inefficiency and instability only manifesting itself some distance into the future (Shell and Stiglitz, 1967). This theme was explored in a variety of different contexts. The subject was central to the on-going debate concerning the efficiency of the capitalist economy. If stability and efficiency required that there existed markets that extended infinitely far into the future - and these markets clearly did not exist - what assurance do we have of the stability and efficiency of the capitalist system? In one important variant on this theme, I assumed that there were rational expectations. Simplistic representative agent models living infinitely long had been constructed, and, not surprisingly, in these models, the problems of instability and inefficiency did not arise. I assumed, on the contrary, that individuals were finitely lived; there were overlapping generations. In that case, there were an infinite number of paths consistent with rational expectations extending infinitely far into the future. (Stiglitz, 1973b.)

This concern with *multiplicity* of equilibrium (both in the short run and the long) was to appear over and over again in my subsequent work, where under a wide variety of circumstances, the economy could be trapped in a "bad" equilibrium. In some cases, some individuals are better off in one equilibrium, some worse off, but in other cases, one equilibrium could Pareto dominate others.⁵

Much of my work in this period was concerned with exploring the *logic* of economic models, but also with attempting to reconcile the models with every day observation. Thus, in much of my earlier work I began by asking what would happen to the standard results if there were not the complete set of risk markets which Arrow and Debreu (Nobel Laureate in 1983) had postulated in their analysis of competitive equilibrium. This was a question which one could approach largely (though not entirely) deductively. (Stiglitz, 1972a, 1982b.) But my research in this area quickly posed problems for which there was no obvious answer: what should (or do) firms maximize? This early work exposed how sensitive not only were the *results* of the standard model to the (clearly unrealistic) assumptions posited, but even the reasonableness of the *assumed* behavior.⁶ As my work progressed, the discrepancies between the kind of behavior *implied* by the standard model and actual behavior also became increasingly clear. In the standard model, the only risk that firms should worry about was the correlation of the outcomes (profits) with the "market"; in practice, businesses seem to pay less attention to that than they do to "own" risk, the chance the project will succeed or fail. In the standard model, everyone agrees about what the firm should do; in practice, there are often heated disagreements. It seemed to me that any persuasive theory of the firm had to be consistent with these, and other, aspects of widely observed firm behavior. (Stiglitz, 1982c, 1989b.)

Economists spend enormous energy providing refined testing to their models. Economists often seem to forget that some of the most important theories in physics are either verified or refuted by a single observation, or a limited number of observations (e.g. Einstein's theory of relativity, or the theory of black holes). Thus, models which suggested that there was no such thing as unemployment, or that it was at most short lived, to my mind were suspect. Economists often like startling theorems, results which seem to run counter to conventional wisdom. Perhaps the most important result in the economics of uncertainty in the 1950s was that of Modigliani and Miller (Nobel Laureate in 1990), who argued that corporate financial structure - whether firms finance themselves with debt or equity - made no difference (other than as a result of taxes). What was interesting about the theory was that it was based on assumptions of rational behavior, and yet if it were true, there was ample evidence of market irrationality - the thousands of people on Wall Street and other financial centers who seemed to be worrying about corporate finance - and for reasons that had nothing to do with taxation. I began my analysis of corporate finance by demonstrating that the result was far more general than they had shown. (Stiglitz, 1969b.) But there were two assumptions that they had ignored, and these turned out to be crucial: they had assumed no bankruptcy and perfect (or at least symmetric) information. Over the succeeding years, I was to explore the consequences of these (related) assumptions, not only for the theories of corporate finance, but also for corporate governance (including takeovers) and macro-economics. As I note in my Prize lecture, the failure of the IMF to take on board fully the consequences of these assumptions played an important role in their policy failures almost three decades later.

My work on the economics of uncertainty led naturally to the work on information asymmetries, and more generally,

imperfect information. In the work on the economics of uncertainty, I explored the consequences, *given beliefs about probability distributions, say, of prices and outputs*, of economic behavior. The standard theory not only had assumed that there was a complete set of markets for these risks, but that beliefs about these probability distributions were exogenous, unaffected by any actions. But individuals and firms spend an enormous amount of resources acquiring information, which affects their beliefs; and actions of others too affect their beliefs.

As I approached the problems that are today referred to as the economics of information, I was greatly helped by the breadth of my education at Amherst and MIT. The problem of how people form their *beliefs* is, of course, the central question of statistics: making inferences on the basis of limited data. The first course for which I served as a teaching assistant was statistics (with Harold Freeman), and it was concerned with using probability theory to make statistical inferences (rather than "classical" statistics). I am sure that I was, at least subconsciously, affected too by the work going on in Cambridge in statistical decision theory, by people like Raiffa, and while I never took a course from him, he was active in the Harvard-MIT theory seminar, and was a presence at the dinners we often had afterwards.

Another set of central insights came from the work that I had been doing in public finance (as it was called at that time; with my 1984 textbook, I helped shift the sub discipline to focus more broadly on the *economics of the public sector*.) As I noted in my Nobel lecture, an early insight in my work on the economics of information concerned the problem of appropriability - the difficulty that those who pay for information have in getting returns. This is, of course, the central concern of *public goods*, one of the main subjects within the economics of the public sector. I recognized that information was, in many respects, like a public good, and it was this insight that made it clear to me that it was unlikely that the private market would provide efficient resource allocations whenever information was endogenous. (See, e.g. Stiglitz, 1987a.) Much of the subsequent work was trying to define more precisely the nature of the market failures.

As I explain in my Nobel lecture, the time I spent in Kenya was pivotal in the development of my ideas on the economics of information. I have often wondered why. I think in part the reason is that seeing an economy that is, in many ways, quite different from the one grows up in, helps crystallize issues: in one's own environment, one takes too much for granted, without asking why things are the way they are. As I studied development, I was forced to think everything through from first principles. Had I grown up in a world in which everyone was a sharecropper, I probably would have accepted this as the way things are. As it was, sharecropping seemed like a peculiar institution, for it seemed to attenuate greatly the incentives workers had to work (since they typically had to give one out of two dollars that they earned to the landlord). Similarly, growing up in Gary Indiana gave me, I think, a distinct advantage over many of my classmates who had grown up in affluent suburbs. They could read articles that argued that in competitive equilibrium, there could not be discrimination, so long as there are some non-discriminatory individuals or firms, since it would pay any such firm to hire the lower wage discriminated - against individuals, and take them seriously. I *knew* that discrimination existed, even though there were many individuals who were not prejudiced. To me, the *theorem* simply proved that one or more of the assumptions that went into the theory was wrong; my task, as a theorist, was to figure out which assumptions were the critical ones.

A topic of abiding concern since I was in high school was *economic organization*. I grew up in the midst of the cold war. At the time, Communism *seemed* to be delivering faster economic growth, but at the expense of liberty. Much of the world seemed to be suffering under the yoke of colonialism, which neither delivered economic growth or democracy, and one which seemed to inconsistent with the principles in which I had been taught, and come to believe. The market economy seemed to be plagued by repeated periods of unemployment, and to leave large fractions of the population in poverty. Yugoslavia's system of self-managed firms intrigued me. Economics seemed to provide the tools with which one could analyze these alternative economic systems. A central question was how, and how well, alternative systems addressed the problems of gathering, analyzing, and disseminating information, and making decisions based on imperfect information. Understanding the limitations of the market - the so-called market failures - became one of the central foci of my research.

I recognized that the standard model was deficient not only in its assumptions about information, but also in ignoring technical change. The latter I thought particularly curious, given the importance that technical change clearly played in our economy. I joined the growing band of those who paid homage to Joseph Schumpeter because of his emphasis on technical change, a subject which was not even broached in the standard first year graduate economics course, let alone in undergraduate principles courses. (I tried to remedy the latter deficiency by introducing a chapter on the subject in my Principles book.) But while I thought that Schumpeter had asked the right question, I was not convinced he gave the right answer. The close links between the work that I had been doing on information and technical change allowed me to begin to formalize models of Schumpeterian competition, and I quickly realized that several of the "accepted" results of Schumpeterian competition were not valid, e.g. that there would necessarily be a succession of short lived monopolies. (See, e.g. Dasgupta and Stiglitz, 1980a, 1980b, 1981, 1988.) I showed that a monopoly, once established, could be persistent, that Schumpeterian competition was not, in general, "efficient," and that in particular the incumbent could/would take actions which deterred entry, that potential competition would not in general suffice to ensure a rapid (efficient) pace of innovation. These ideas are, of course, of particular relevance in the "new economy," which centers around innovation.

There was a rather different strand of literature (often associated with Hayek) which praised the virtues of the market economy, not the basis of the standard competitive (Arrow Debreu) mode, or on the basis of Schumpeterian competition, but rather on "evolutionary" grounds. In the early 70s, I had become fascinated with this alternative approach, and begun to subject it to scrutiny. At the time, there was little formal work on evolutionary modeling, and even later, most of the modeling focused around *describing* (often in simulation exercises) evolutionary processes. I was interested in *evaluating* evolutionary processes. What could one say about whether free markets, by themselves, led to "efficient" or "desirable" evolution? Were there interventions in the market which might "shape" evolution in ways which would lead to better outcomes? Hayek and his disciples had argued for free markets, but never really even addressed these questions. This remains a question that has still not been well investigated, but preliminary results (cited in my Prize lecture) suggest strongly the limitations of unfettered free market evolution. (Part, but only part, of the problem lies with imperfections of capital markets.)

Later, with the collapse of the Soviet system, and the recognition of the problems of socialism more broadly, I rethought the lessons that might be gleaned from the failed experiment. In *Whither Socialism?* (See Stiglitz, 1994) I came to the conclusion that the failure of the socialist economies reinforced my belief in the inadequacy of the competitive equilibrium model. If that model had been correct, market socialism probably could have succeeded. The standard competitive market equilibrium model had failed to recognize the complexity of the information problem facing the economy - just as the socialists had. Their view of decentralization was similarly oversimplified - a point which I had earlier emphasized in my work with Raj Sah, where we had compared hierarchical and polyarchical decision making structures⁷. Here, our concern was not with asymmetries of information or incentives, but with how different economic organizational structures in effect *aggregated* the disparate and limited information of different individuals.

As the former socialist economies decided to make the transition to a market economy, a host of fascinating problems was posed on how best to make that transition. China provided the first venue for looking at these questions, in a series of meetings in 1980 and 1981, and Russia and the other countries of the former Soviet Union and Eastern Europe provide a second. The debates were heated. Much was at stake. And underlying the debate were very different understandings of the fundamentals of a market economy - what was necessary to make it function. My views on the inadequacy of the standard model played a central role in my thinking. I emphasized the importance of competition, corporate governance, finance, and more broadly the institutional (including legal) infrastructure. I did not place much stress on privatization. I was part of a wider school, sometimes referred to as "gradualists," as opposed to the shock therapists that focused on rapid transitions, with quick privatization. The strategy for transition that I advocated was markedly different from that pushed by the IMF and the shock therapists. The failures of so many countries to make a successful transition back to a market economy has provided new insights into what makes market economies function, one which I had occasion to explore during my years as the Chief Economist of the World Bank. There is now a wide consensus on the importance of

the institutional infrastructure, and on the dangers of rapid privatization. (See the references cited in my Prize lecture.)

I referred earlier to my work in the economics of the public sector.⁸ I was convinced that there was an important role for government to play. Given that, it was natural for me to turn to the question of how it could play that role most effectively. (See, e.g. Stiglitz, 1991, 1997a.) One of the main questions with which I was concerned was how to redistribute income in a way as to minimize the loss in efficiency that is inevitably associated with tax distortions. Economics of information had provided a framework within which this question could, for the first time, be addressed in a meaningful way, as I explain in my Prize lecture.

Still another important strand of my research, only tangentially related to my work on the economics of information, concerned industrial organization. In one of my most cited papers, that with Avinash Dixit⁹, we constructed a model in which there are so many firms that each can ignore its impact on others' economic actions, but still, firms face downward sloping demand curves - there is monopolistic competition. This seemed to describe many of the markets in the economy far better than either the models of pure competition, pure monopoly, or oligopoly. (Markets in which information is imperfect are also likely to be characterized by monopolist competition). Little progress on the theory of monopolistic competition had been made in the more than forty years since Edwin Chamberlain first broached the idea. In particular, he had only formulated a partial equilibrium model. We were interested in constructing a general equilibrium model, within which one could assess how well the market functioned, in particular in making the tradeoffs between economies of scale and product diversity. We showed that there was a single borderline case - of immense simplicity - in which the market made that trade-off perfectly; but more generally, it did not.¹⁰

While my work on industrial organization and imperfect information undermined the confidence in the ability of unfettered markets to allocate resources efficiently, there was another strand of research in the economics profession which was trying to argue the contrary. In particular, there were those who argued that even with natural monopoly markets could be efficient; competition for the market could replace competition in the market; all that one required was potential competition. On the face of it, this idea seemed suspect. If it were true, there would be no monopoly rents. And indeed, my suspicions turned out to be true: I showed that even if there were arbitrarily small sunk costs (which there always are) then potential competition would not suffice to limit the abuses of monopoly.¹¹

The most important *systemic* failure associated with the market economy is the periodic episodes of underutilization of resources. Trying to understand why the labor market does not clear - why there is persistent unemployment - has been another abiding concern, one which I have tried to approach from a variety of angles. The work with Solow and with Akerlof cited above focused on the consequences of finite speeds of adjustment. Even if wages fall, if prices fall too, real wages may not adjust very quickly. Subsequent work with Greenwald tried to explain in a more coherent way these speeds of adjustment.¹² The efficiency wage theories (described in greater detail in my Prize lecture) explain why it may pay firms to pay a wage higher than the market clearing wage: the increase in productivity more than offsets the increase in wages. The theory of equity rationing¹³ helped explain why more "flexible" contractual arrangements were not adopted; such arrangements (such as those where wages depend on firm profitability) in effect make the worker have an implied equity stake in the firm, and, given asymmetries of information, the value which workers are willing to assign to such contractual provisions is less than that which is acceptable to the firm.

The 1970s and 1980s represented decades during which the rational expectations/representative agent model was in ascendancy. This model suggested not only that, with rational expectations, government policy was ineffective, but that unemployment was not a serious problem. Neither of these conclusions made much sense to me; and with my former student, Peter Neary, we sought to show that the results depended not on the rational expectations assumption, but on the assumptions concerning wage and price flexibility. We constructed a fixed wage/price model with rational expectations, and showed contrary to the suggestion of the rational expectations school, not only could unemployment be persistent, but that government policy was even more effective with rational expectations that without it (i.e. multipliers associated with government expenditures were larger). The reason was simple: an increase in government

expenditures today had some spill overs to future periods. Today's increased savings translated into tomorrow's increased income, and, with rational expectations, that increased income translated into higher consumption today. We also showed that there were *multiple rational expectations equilibria*: if everyone was pessimistic, then income would indeed be low today *and* tomorrow; but if everyone was optimistic, then both could be high.

Our work also emphasized that it was not just wage and price rigidities which could give rise to macro-economic problems. (This work could be thought of as a revival and formalization of Fisher's earlier work on debt deflation¹⁴.) Incomplete contracts meant that unanticipated changes in wages and prices had large distributional effects, with correspondingly large consequences. While when we first put forward these ideas almost twenty years ago, they met with considerable resistance, they are now coming to be more widely accepted.

While I spent most of my time teaching and doing research, I learned a great deal from the limited amount of consulting I did, and I thought it important to engage in issues of public policy. My first major consulting project was a direct outgrowth of work on imperfect information; it was concerned with the information externalities that arose in the process of oil exploration, externalities which played an important role in a heated dispute between the federal government and the states (which was eventually settled out of court for \$12 billion). A variety of other consultations, typically associated either with antitrust violations or issues of corporate governance, gave me insights both into how real markets work as well as the behavior of firms.

In the 1980s, I was involved in two major public interest litigations, one concerning the treatment of Native Americans, the other with the exploitation of our natural resources. The first, involving the Seneca Indians in upstate New York, gave me further insights into the nature of America's past - and ongoing - exploitation of Native Americans. An unfair lease that had been imposed on the tribe was about to expire, and it insisted that it would renew only on more equitable terms. I helped calculate the magnitude of the amount by which the previous lease had "cheated" them - magnitudes in excess of a billion dollars in present terms - and though the tribe was never compensated for these past injuries, the information I provided did, I think, contribute to a settlement which was far fairer than would otherwise have been the case.

The second suit was one against the federal government. In the 1980s, President Reagan tried to turn over as much of the offshore oil tracts to private companies as fast as he could - the fire sale was a give-away to the oil companies, depriving the American taxpayers of billions of dollars. Working with Jeffrey Leitzinger and a conservation minded NGO, -NRDC, we tried to estimate this cost, and, unsuccessfully, to bloc the fire sales.

I moved to Washington in March 1992 to join the Clinton Administration, first as a member, and then as Chairman of the Council of Economic Advisers, in which capacity I also served as a member of the cabinet. The Council helps formulate economic policies for the Administration, and serves as a consultant for all the agencies in the government. Our span of responsibilities included not only macro-economics, but policies in almost every sphere, from trade to anti-trust, from environment to agriculture, from energy to transportation, from welfare to health, from social security to taxation, from affirmative action, to tort reform. It was a wonderful experience - I had to draw upon all of my previous research, all my connections, and go beyond. I became deeply involved in environmental issues, which included serving on the International Panel for Climate Control, and helping draft a new law (including a new legal framework) for toxic wastes (which unfortunately never got passed). I was pleased to see how ideas that I had helped formulate only a few years earlier, like adverse selection and moral hazard, were now part of the every day language of the policy debate in health care.¹⁵

Perhaps our most important contribution in this period was helping define a new economic philosophy, a "third way," which recognized the important, but limited, role of government, that unfettered markets often did not work well, but that government was not always able to correct the limitations of markets. The research that I had been conducting over the preceding twenty five years provided the intellectual foundations for this "third way."

Being on the Council was particularly exciting for me as a student of the economics of the public sector. I was a fly on the wall - but at the same time - I could work to put into place some of the ideas that I had been developing.

I believe that institutions like the Council play an important role in our democracies. Work on information asymmetries emphasized the importance of incentives and the discrepancy between the incentives of government officials, and in particular professional politicians, and those who they are supposed to serve. As a citizen-bureaucrat, the members of the council, who are typically drawn from academia and return to academia, have markedly different incentives than those of a professional politician. Typically, though not always, the fact that our professional reputations as economists were at stake circumscribed what was said - we could not just be political hacks - and encouraged us to work for the adoption of economic policies that were consistent with economic principles.

When the President was re-elected, he asked me to continue to serve as Chairman of the Council of Economic Advisers for another term. But I had already been approached by the World Bank, to be its senior vice president for development policy and its chief economist. America's economic policy had been successfully redefined, and the economy was performing well. There were many problems yet to be addressed, such as putting social security on a sound financial footing, but I was not optimistic about making progress on most of them in the coming years, given the Republican control of Congress. The challenges and the opportunities in the developing world seemed far greater. I had always wanted to return to the problems of development, and though I had had many visits to developing countries in the twenty five years since leaving Kenya, I had not really been immersed in their problems.

I had no strong agenda, other than doing what I could to promote the development of these countries, in ways which did as much as possible to eliminate poverty. But as I quickly became engrossed in the problems of development, a variety of issues surfaced, the most important of which was the intellectual framework with which development was to be pursued. In a recent article in *Atlantic Monthly*¹⁶ I described a trip to Ethiopia, where I saw the IMF advocate policies of financial market liberalization which made no sense, in which it argued that the country's budget was out of balance - when in my estimate that was clearly not the case - and in which it had suspended its program, in spite of that country's first rate macro-economic performance. More broadly, the IMF was advocating a set of policies which is generally referred to alternatively as the Washington consensus, the neo-liberal doctrines, or market fundamentalism, based on an incorrect understanding of economic theory and (what I viewed) as an inadequate interpretation of the historical data. The IMF was using models that failed to incorporate the advances in economic theory of the past twenty five years, including the work on imperfect information and incomplete markets to which I had contributed. Most importantly, they had departed from the mission for which they had been founded, under the intellectual guidance of Keynes - they actually promoted contractionary fiscal policies for countries facing an economic downturn - and they advocated policies like capital market liberalization, for which there was little evidence that growth was promoted, while there was ample evidence that such policies generated instability.

As an academic I was scandalized; as a former adviser to the President who had helped design a "third way" for the United States - a view of the role of government that was markedly different from that envisioned by the Washington consensus - I was particularly disturbed by the role of the US government (or more accurately, the US Treasury) in pushing these views.

If the IMF had only *pushed* its views - misrepresenting them as the lessons of economic orthodoxy, describing them as if they were Pareto dominant (that is, they were policies which would make everyone better off, so that there were no trade-offs), rather than the policies which reflected the perspectives and interests of particular groups within society - that would have been bad enough. But all too often they used their economic power effectively to *force* countries to adopt these policies, undermining democratic processes. As someone who had grown up in mid-America, strongly inculcated with democratic values, I found this hard to accept; and even more so because the IMF's own governance was so dissonant with democratic principles (a single country has an effective veto; countries like China were long underrepresented, the "governors" of the IMF, those responsible for its decisions, finance ministers and the heads of the

central banks, are hardly representative, and the heads of the central banks themselves are typically not directly democratically accountable).

With the East Asia crisis, my disagreements with the Fund came to a head. The Fund's policies seemed neither to accord with an understanding of the crisis countries (several of which I had studied closely during my East Asia Miracle project) and what I viewed as basic economics, especially as it had come to incorporate concerns about asymmetries of information and bankruptcy, corporate governance and finance, with which I had long been concerned. I argued against their prescriptions, and those within the World Bank broadly agreed. But I made little headway with the Fund. There seemed to be no way out other than to bring the issues out into the public - and since as a democrat, I believed that there should be public discussion of such issues, I had few misgivings. I believe the public pressure that was generated did work; the counterproductive policies of excessive monetary and fiscal stringency were eased.

A third set of controversies was opened up as the World Bank began its ten year review of the transition of the former Communist countries to the market. The failures of the countries that had followed the IMF shock therapy policies - both in terms of the declines in GDP and increases in poverty - were even worse than the worst that most of its critics had envisioned at the onset of the transition. There were clear links between the dismal performances and the particular policies that the IMF had advocated, such as the voucher privatization schemes and excessive monetary stringency. Other failures were related to the inadequate attention given to issues of corporate governance (the importance of which had, for instance, been stressed in my earlier theoretical work (see Stiglitz, 1985a). Meanwhile, the success of a few countries that had followed quite different strategies suggested that there were alternatives that could have been followed. Again, while the IMF defended its previous policies, I believe that the clear lessons that were drawn from these experiences did have some impact on policy prescriptions going forward.

I left the World Bank in January 2000. The US Treasury had put enormous pressure on the World Bank to silence my criticisms of the policies which they and the IMF had pushed, and though the President of the World Bank agreed with the stances I took on most of the issues, he was, I think, less comfortable about open discourse of these issues. I had come to the World Bank under an agreement that I would be more than a corporate spokesperson, that I could speak out on the relevant issues, in a responsible way. I believed, in part, that the credence that would be given to what I said - and my ability to advance the development agenda - depended in part on the perception that I was expressing my views, not just repeating the institution's official views. Under Treasury pressure, it was impossible to maintain this kind of independence, which had been a hallmark of the World Bank's research division, at least from the time that it achieved international prominence under the leadership of Hollis Chenery. I was, in any case, ready to return to academia - when President Clinton had asked me to be his adviser, it had been my intention to come to Washington for only two years; I had stayed seven, and although I had managed in that period to carry out a moderate research program, I had had my fill of bureaucracy. Still, it was a great disappointment to me that my own government should have gone so much against the principles for which I believed it stood, including transparency and the importance of the role of government. (My conversations with the President convinced me that he himself supported both my stances and the values that underlay them, but that the US Treasury often did not adequately inform him about the policies they were advocating, let alone ask for his approval.)

The experiences during the seven years in Washington have helped shape my activities since then. I helped found the Initiative for Policy Dialogue, with support of the Ford, Rockefeller, McArthur, and Mott Foundations and the Canadian and Swedish government, to enhance democratic processes for decision making in developing countries, to ensure that a broader range of alternative are on the table and more stakeholders are at the table. This effort has enlisted the support of dozens of economics and other social scientists throughout the world, in a set of task forces that are intended to lay out alternative policy alternatives in a wide range of areas, and has conducted policy dialogues bringing together academics, government officials, NGO's, labor leaders, and the press in a number of countries, including Serbia, Nigeria, Viet Nam, and the Philippines. Both through the Initiative for Policy Dialogue and independently, I have continued to take an active role advising governments on a broad range of issues, from the role of monetary policy under dollarization

(Ecuador) to the reform of social security systems and second and third generation reforms in China, to the lessons that can be drawn from the past failures and successes for privatization, to the design of macro-economic responses to an economic slowdown.

I have also continued to work actively to change the international economic arrangements, including the international institutions, to make them more transparent, to ensure that the policies that they have been pushing reflect the interests and concerns of the developing countries, and especially the poor within those countries, as well as the advances in economic science of the past quarter century. I have been pleased with the progress that has occurred: perspectives, such as greater reliance on bankruptcy and standstills, that I had long advocated have now either been adopted or are at the center of the policy debate. But much remains to be done, and I anticipate that pushing this agenda will occupy much of my time in the years ahead.

My research agenda too has been greatly affected by these experiences. While I have continued the research program on the economics of information - I have recently completed a book with my long time collaborator Bruce Greenwald which explores more fully the implications of information economics for macro-economics, and monetary theory in particular¹⁷ - I have turned more of my attention to an analysis of the role of information and incentives in political processes, as well as continuing my work on development more generally. (Stiglitz, 2001c.) Another major area of research involves the continuing analysis of the appropriate role of the state in the economy; in particular, how to design policies which combine concerns for economic efficiency, social justice, individual responsibility, and liberal values.

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1. Stiglitz (1969a)

2. See e.g. Stiglitz (1973a, 1975, 1976), Rothschild and Stiglitz (1973, 1982) and Braverman and Stiglitz (1989).

3. Including Stiglitz (1972a, 1972b, 1974a, 1989a)

4. See Stiglitz (1974b, 1982a). See also Stiglitz (1974c, 1992).

5. For a more complete analysis of these multiple equilibria models, see Hoff and Stiglitz (2001). The first example of such multiplicity out of the growth context was my model of equilibrium in stock markets (Stiglitz, 1972a), where the riskiness of the projects chosen by one firm depends on those chosen by other firms. Other examples of multiple equilibria can be found in Stiglitz (1972b, 1974c, 1977, 1995).

6. Sanford Grossman and I pursued these ideas further in Grossman and Stiglitz (1977, 1980).

7. See e.g. Sah and Stiglitz (1985a, 1986).

8. My work in the economics of the public sector has gone through four stages. It began with extensive collaborations with Tony Atkinson and Partha Dasgupta. Diamond and Mirrlees had helped revive interest in Ramsey's work in optimal taxation. They had extended Ramsey's analysis to a general equilibrium context, and *seemed* to incorporate distributional concerns. This work also seemed one of the few positive results in the theory of the second best: even though government could not impose lump sum taxes, one could say something meaningful about what the government should do. But the conclusions were unpersuasive. They suggested, for instance, that the government should not impose taxes on corporations and should not impose tariffs, and Ramsey's earlier analysis suggested that high tax rates ought to be imposed on commodities, like food, with low demand elasticities. Such taxes were regressive, and I could not believe that they were truly "optimal." Atkinson and I (1972) formally incorporated distributional concerns in the design of tax policy, with results that were more in accord with our intuition. Similarly, Dasgupta and I took into account limitations on the ability of the government to impose taxes, and within this broader, and we would argue more realistic framework, tariffs and corporate income taxes did make sense. (Dasgupta and Stiglitz, 1971, 1972, 1974). Later, I began to think of the problem of taxation as an information problem - limited information imposed restrictions on the set of taxes that could be imposed; and asked what were the set of *pareto efficient* tax structures, that is, given the limitations on information, what were the set of tax structures such that no one could be made better off without making anyone worse off. (Stiglitz, 1998b). Within this framework, it became clear that Ramsey's analysis of optimal commodity taxes made little sense; only if the government could not impose income taxes as well as commodity taxes (as was the case in some developing countries) was it of much relevance. (Atkinson and Stiglitz, 1976).

A second set of issues to which I turned was project evaluation, and in particular the determination of shadow wages and discount rates. I argued that one could not calculate shadow wages without a model of the labor market, one which including a theory of wage determination and migration. Once that was done, one obtained results that were markedly different from the "standard" wisdom; for instance, the shadow wage on labor in some central cases was the market wage, *even though there was a high level of unemployment*. (Stiglitz, 1982d and Sah and Stiglitz, 1985b). On the other hand, I argued against the use of market interest rates for project evaluation. (Stiglitz 1982e, Arrow et al., 1996). When I went to the Council of Economic Advisers, many of these views on cost benefit analysis became incorporated in the guidelines issues by the Office of Management- and -Budget for project and regulatory evaluations.

A third quite distinct research project developed the theory of local public goods. Tiebout (1956) had put forward the conjecture that competition among local communities was like competition in markets, and would yield efficient outcomes. My doubts about market competition naturally led me to have doubts about competition in this arena, perspectives that were confirmed as I formalized the theory of local public goods. (Stiglitz, 1977). This project, in turn, led to a joint research project with Richard Arnott on the relationship between expenditures on public goods and land rents: was it possible to finance the optimal supply of public goods by a tax on land only (what I referred to as the Henry George theorem).

There was a quite different strand of work motivated in part by a request from the U.S. Treasury concerning capital gains taxation. I had done earlier work on the impact of capital gains taxation in the presence of uncertainty, which changed many of the long standing presumptions. (Stiglitz, 1969c). But more complicated issues were raised by the dynamics, and by the obvious use of capital gains as part of tax avoidance strategies. I showed that, were markets perfect, one could take advantage of the special treatment of capital gains taxes to avoid all taxation. (See Stiglitz, 1983a.) Though a variety of provisions of the tax code have been introduced to try to circumscribe such tax avoidance behavior, they are imperfect. At a theoretical level, this led me to consider the general principles of tax avoidance (Stiglitz, 1985b), and had a great deal of influence on my thinking about the problems of tax reform, reflected both in my writing and the advice I gave both while at the Council of Economic Advisers and the World Bank. (See Stiglitz, 1997b, 1998a).

9. See Dixit and Stiglitz (1977).

10. Subsequent work explored alternative versions of monopolistic competition. See Hoff and Stiglitz (1997), Salop and Stiglitz (1977) and Stiglitz (1979a,b, 1986, 1989a).

11. Stiglitz, (1987b).

12. Greenwald and Stiglitz (1989, 1995).

13. Greenwald, Stiglitz, and Weiss (1984)

14. See Fisher (1933).

15. See Stiglitz (1997b, 1998a) for brief descriptions of some of my views concerning these experiences.

16. See Stiglitz (2001a).

17. See Greenwald and Stiglitz (1999).

From *Les Prix Nobel. The Nobel Prizes 2001*, Editor Tore Frängsmyr, [Nobel Foundation], Stockholm, 2002

This autobiography/biography was written at the time of the award and later published in the book series *Les Prix Nobel/Nobel Lectures/The Nobel Prizes*. The information is sometimes updated with an addendum submitted by the Laureate.

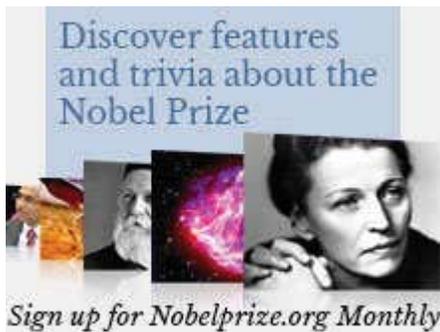
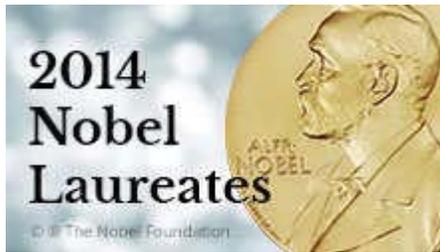
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DOCUMENT 106**



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June 21, 2013

Via Electronic Delivery

Ms. Marlene H. Dortch, Secretary
Office of the Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

**Re: Rural Telecommunications Group, Inc.
Comment Filing on Spectrum Holdings, Incentive Auction, Device
Interoperability and Data Roaming
WT Docket No. 12-269, GN Docket No. 12-268, WT Docket No. 12-69 and
WT Docket No 05-265**

Dear Ms. Dortch:

Because of the relevance of the information included in the attached Comments filed on June 17, 2013 by the Rural Telecommunications Group, Inc. ("RTG") in the Commission's 17th Mobile Wireless Competition Report Proceeding (WT Docket No. 13-135), RTG hereby requests that the Commission also associate the comments with the above-captioned proceedings.

Please do not hesitate to contact me with any questions.

Respectfully submitted,

Rural Telecommunications Group, Inc.

By: */s/ Daryl A. Zakov*

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Its Attorney

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)
)
Wireless Telecommunications Bureau Seeks) WT Docket No. 13-135
Comment on the State of Mobile Wireless)
Competition)

To: The Commission

**COMMENTS OF
RURAL TELECOMMUNICATIONS GROUP, INC.**

**RURAL TELECOMMUNICATIONS
GROUP, INC.**

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Date: June 17, 2013

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SUMMARY

The Rural Telecommunications Group, Inc. (“RTG”) submits these comments to assist the Federal Communications Commission (“FCC” or “Commission”) in analyzing the degree of competition that exists in the mobile wireless industry today. Specifically, RTG suggests four policy changes that, if adopted, could significantly increase the level of competition in the sector. RTG’s comments cover: (1) spectrum caps in general as well as spectrum aggregation limits as part of future FCC spectrum auctions; (2) device interoperability; (3) barriers to a carrier procuring devices; and (4) barriers to a carrier obtaining commercially reasonable data roaming rates.

RTG’s recommendations for improving competition in the mobile wireless sector are quite simple. First, in order to ensure that no fewer than four (healthy) competitors are able to prosper in any particular market, RTG asks the FCC to prohibit any carrier from holding more than 25% of suitable and available spectrum or more than 40% of the suitable and available spectrum below 1 GHz. Because spectrum is a finite resource, RTG also proposes that each new FCC spectrum auction, especially those involving prime, low-band frequencies like the 600 MHz Band, include reasonable spectrum caps that prevent incumbent players from amassing excessive amounts of low-band spectrum and foreclosing existing and new market entrants from accessing newly released low-band licenses. Second, with respect to mobile device interoperability, the Commission should mandate that all mobile devices be fully interoperable within any band with paired spectrum, including the 700 MHz Band and the future 600 MHz Band. Third, because American consumers generally desire to combine their mobile device of choice with their service provider of choice, the FCC should impose rules that prevent mobile device manufacturers from limiting the sale of products and devices to any person (or through any serving carrier) based purely on the geographic location of that person or the serving carrier. Fourth and finally, after

recognizing that access to data roaming is only half the battle faced by small and rural carriers, the Commission must take definitive steps to define a commercially unreasonable data roaming rate. Based on years of industry observation, RTG proposes that any wholesale data roaming rate that is higher than a MVNO, reseller or retail rate offered by the same serving carriers should be labeled as *de facto* commercially unreasonable.

By adopting any of these policy recommendations, the Commission can increase the number of competitors in a market, or level the competitive playing field so that large firms are not always given systemic advantages, or both. An increase in competition, generally speaking, leads to more choices for consumers, which in turn routinely leads to lower prices, better customer service, and a diverse and sophisticated selection of product and service offerings. All of these things are important for every American, but they are especially important for those Americans who live, work or travel in rural markets where there is already a diminished level of choice.

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)
)
Wireless Telecommunications Bureau Seeks) WT Docket No. 13-135
Comment on the State of Mobile Wireless)
Competition)

To: The Commission

COMMENTS OF RURAL TELECOMMUNICATIONS GROUP, INC.

The Rural Telecommunications Group, Inc. (“RTG”)¹ files these comments in response to the Federal Communications Commission’s (“FCC” or “Commission”) public notice (“*Public Notice*”) requesting data and public input that will help the FCC draft the *Seventeenth Report* on mobile competition.² Upon the release of the *Sixteenth Report*, Acting FCC Chairwoman Mignon L. Clyburn noted that since the release of the most recent competition report, the number of Americans with access to two or fewer mobile providers had *increased* by over 600,000 and that the number of Americans still without any type of mobile service option topped 400,000.³

¹ RTG is a 501(c)(6) trade association dedicated to promoting wireless opportunities for rural telecommunications companies who serve rural consumers and those consumers traveling to rural America. RTG’s members are small businesses serving or seeking to serve secondary, tertiary, and rural markets. RTG’s members are comprised of both independent wireless carriers and wireless carriers that are affiliated with rural telephone companies. Each of RTG’s member companies serves fewer than 100,000 subscribers.

² *In the Matter of Wireless Telecommunications Bureau Seeks Comment on the State of Mobile Wireless Competition*, Public Notice, WT Docket No. 13-135, DA 13-1139 (released May 17, 2013) (“*Public Notice*”).

³ *In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Sixteenth Report, Statement of Commissioner Mignon L. Clyburn, WT Docket No. 11-186 (Terminated), FCC 13-34 (released March 21, 2013) (*Sixteenth Report*).

The central purpose of the *Public Notice* is to determine, as accurately as possible, the level of competition in the U.S. mobile industry. When millions of Americans have either no access to the specific service being studied or have a choice of only two or fewer providers (typically the dominant “Twin Bells” of Verizon Wireless and AT&T), this is direct evidence that competition itself is severely threatened. The numbers speak for themselves.

Regardless of the level of technological sophistication offered by today’s mobile devices, the capacity of the underlying networks supporting those mobile devices, or the creativity and efficiency of the software and “apps” utilized by those mobile devices and networks, it is all meaningless to everyday Americans if at the end of the day those mobile wireless services are either completely unavailable due to lack of access in a particular rural market, or the mobile wireless services are offered by so few commercial providers in a given market as to make the term “competition” inapplicable on its face.

Rather than focus on raw data on coverage and service provider density, RTG uses these comments to discuss four specific input and downstream segments that have a disproportionate impact on domestic mobile wireless competition, especially for rural Americans. Specifically, RTG will explain how competition has consistently eroded in the domestic mobile wireless marketplace due to: (1) an over-concentration of spectrum in the hands of certain providers; (2) a lack of mobile device interoperability; (3) the inability of small and rural service providers to procure certain, highly-desirous mobile devices; and (4) the continued inability of small and rural mobile carriers to secure commercially reasonable data roaming rates in a timely manner. By formulating policies that address each of these input segments, the Commission can make tremendous strides (in a relatively short period of time) to foster higher levels of marketplace competition.

I. INSTITUTING A PERCENTAGE-BASED SPECTRUM CAP ON THE TOTAL AMOUNT OF SPECTRUM ONE CARRIER CAN HOLD IN A GIVEN MARKET WILL ALLOW MORE CARRIERS TO ENTER THE MARKETPLACE AND REMAIN COMPETITIVE FOR THE LONG TERM.

Spectrum is a finite resource, and there is a general consensus among industry players, regulators and consumers that more spectrum needs to be re-purposed and dedicated solely to support commercial mobile wireless services. However, even the prospects of new FCC spectrum auctions do not change the fact that: (1) the current pool of licensed spectrum designated only for commercial mobile wireless use is inadequate to support the forecasted growth of broadband applications and is not distributed in a manner that supports a competitive marketplace that encourages an *increase* in market players and a correlating *decrease* in the retail rates consumers pay; and (2) the only way to maintain some degree of equitable spectrum distribution both now and in the future is for the FCC to institute a hard, percentage-based spectrum cap on currently held licenses as well as a cap on how much newly licensed spectrum an individual entity can win in FCC auctions, especially in low-frequency bands like the 600 Megahertz (“MHz”) Band.

A. Promotion of Marketplace Competition Necessitates the Adoption of a Bright Line, Percentage-Based, Spectrum Cap Applicable to All Carriers

RTG has been a long-time proponent of Commission rules that impose sensible limits on the amount of licensed spectrum commercial mobile wireless carriers can hold in any given market.⁴ Both the Commission⁵ and the U.S. Department of Justice (“DOJ”)⁶ have recognized

⁴ *In the Matter of Policies Regarding Mobile Spectrum Holdings*, Comments of the Rural Telecommunications Group, Inc., WT Docket No. 12-269 (filed November 28, 2012) (“*Spectrum Cap Comments*”) at pp. 1-2.

⁵ *In the Matter of Applications of AT&T Inc. and Deutsche Telekom AG for Consent to Assign or Transfer Control of Licenses and Authorizations*, Order, WT Docket No. 11-65, DA 11-1955 (released November 29, 2011) at ¶ 3; see <http://transition.fcc.gov/transaction/DA-11-1955.pdf>.

the competitive harms that result from a degree of spectrum concentration that would result in less than four nationwide carriers. In order to foster competition between no fewer than four separate carriers in each market, the FCC should prohibit any carrier from holding more than 25% of suitable and available spectrum or more than 40% of the suitable and available spectrum below 1 Gigahertz (“GHz”). “Suitable and available spectrum” should include at this time the following spectrum:

- Cellular (824-849 MHz, 869-894 MHz) (50 megahertz total).
- Personal Communications Service (PCS) (1850-1915 MHz, 1930-1995 MHz) (130 megahertz total).
- Specialized Mobile Radio (SMR) (817-824 MHz, 862-869 MHz) (14 megahertz total).
- 700 MHz Band (698-757 MHz, 776-787 MHz) (70 megahertz total).
- Advanced Wireless Services-1 (AWS-1) (1710-1755 MHz, 2110-2155 MHz) (90 megahertz total).
- Broadband Radio Service (BRS) (2618-2673.5 MHz) (55.5 megahertz total).
- Wireless Communications Service (WCS) (2305-2315 MHz, 2350-2360 MHz) (20 megahertz total).

The following bands should be considered suitable and available in the near future:

- AWS-4 (2000-2020 MHz, 2180-2200 MHz) (40 megahertz total).
- AWS-2 (1915-1920 MHz, 1995-2000 MHz) (10 megahertz total).
- AWS-3 (2155-2180 MHz) (at least 35 megahertz available).
- DTV Channels 14-51 (470-698 MHz) (up to 228 megahertz available, depending on outcome of the incentive auction).

The Commission should adopt a process that will allow it to add newly allocated spectrum bands to its list of suitable and available spectrum on a timely basis. Such spectrum should be announced as suitable and available when long-form applications are due for the auction of such spectrum. However, as discussed in greater detail below, the extent to which individual carriers can participate in these future FCC auctions, including the 600 MHz Band “forward” auction,

⁶ United States of America, Department of Justice, Antitrust Division, et. al. vs. AT&T Inc., T-Mobile USA, Inc., and Deutsche Telekom AG, Amended Complaint, Civil Action No. 11-01560 (ESH) at ¶ 36; see <http://www.justice.gov/atr/cases/f275100/275128.pdf>.

must be limited based on a particular carrier's inventory of low-band and high-band spectrum just prior to the beginning of the auction.

Under RTG's proposal, once new spectrum aggregation rules are promulgated, licensees exceeding the 25% or 40% cap will have 18 months to divest themselves of excess spectrum, or alternatively, keep the excess spectrum on a "grandfathered" basis provided certain conditions are adhered to.⁷ The objective of a two-tier, percentage-based spectrum cap is simple: it will ensure that American consumers in all markets benefit from the competitive presence of at least four, spectrum-healthy, facilities-based mobile wireless carriers.

B. The Commission Should Institute Limits on How Much Spectrum Carriers Can Win at FCC Auction for Newly Licensed Spectrum.

The Commission noted in the *Sixteenth Report* that Verizon Wireless, AT&T, T-Mobile, Sprint and Clearwire "hold close to 80 percent of all spectrum, measured on a MHz-POPs basis, that is potentially usable for the provision of mobile wireless services."⁸ Additionally, according to a recent DOJ filing, the Twin Bells of AT&T and Verizon Wireless already control no less than 78% of the suitable and available spectrum below 1 GHz in the United States.⁹ But perhaps most importantly, DOJ has concluded that "it is important that the Commission devise policies that address the allocation of low-frequency spectrum" and that these new policies, particularly when applied to the "auction of new low-frequency spectrum, can potentially improve the

⁷ *Spectrum Cap Comments* at p. i.

⁸ *Sixteenth Report* at ¶ 118.

⁹ *In the Matter of Policies Regarding Mobile Spectrum Holdings*, Ex Parte Submission of the United States Department of Justice, WT Docket No. 12-269 (filed April 11, 2013) ("*DOJ Ex Parte*") at p. 14.

competitive landscape by preventing the leading carriers from foreclosing their rivals from access to low-frequency spectrum.”¹⁰

The 600 MHz Band forward auction, tentatively planned for late 2014, represents the last great swath of sub 1 GHz spectrum that can be harnessed by the country for commercial mobile wireless use. Former FCC Chairman Julius Genachowski has called the 600 MHz Band “highly desirable”¹¹ for mobile broadband while carriers like Verizon Wireless have long acknowledged the operational benefits of low band frequencies (including the 600 MHz Band) over higher frequency bands.¹² DOJ correctly determined that “spectrum policies that promote competition and enhance the potential for entry and expansion in the wireless market play a vital role in protecting, and indeed enhancing, the competitive dynamic to the benefit of American consumers.”¹³ But a straight-up forward auction of 600 MHz Band licenses, without certain limits imposed on legacy carriers, “may not lead to market outcomes that would ordinarily maximize consumer welfare due to the presence of strong... wireless incumbents.”¹⁴ The rules for the forward auction of 600 MHz Band spectrum should be a logical extension of those concepts previously introduced by RTG: namely, all legacy carriers, whether AT&T or Verizon or any other carrier large or small, should be precluded from controlling more than 40% of all suitable and available low-band spectrum (below 1 GHz) in any given market. The debate over

¹⁰ *Id.*

¹¹ “Winning the Global Bandwidth Race: Opportunities and Challenges for Mobile Broadband,” Prepared Remarks of FCC Chairman Julius Genachowski, University of Pennsylvania – Wharton, Philadelphia, PA (October 4, 2012).

¹² Presentation by Tony Melone, Senior V.P. and CTO of Verizon Wireless, Wells Fargo Securities Technology, Media and Telecom Conference (November 10, 2010) at pp. 12-13; http://www22.verizon.com/investor/DocServlet?doc=event_1005_colpre.pdf.

¹³ *DOJ Ex Parte* at p. 8.

¹⁴ *Id.* at p. 10.

whether to institute some type of spectrum cap or bidding rules in the forward auction of 600 MHz Band spectrum is not about the Twin Bells versus the other two national carriers (Sprint and T-Mobile), but rather, it is about whether *any* individual carrier should be restricted from amassing excessive amounts of new spectrum that is universally recognized as being highly conducive for mobile broadband operations.

II. MANDATING DEVICE INTEROPERABILITY THROUGHOUT ALL OF THE 700 MHZ BAND AND THROUGHOUT ALL NEW SPECTRUM BANDS AUCTIONED BY THE FCC IN THE FUTURE WILL REDUCE EQUIPMENT PRICES FOR ALL MARKET PLAYERS AND ALLOW CONSUMERS GREATER FLEXIBILITY TO PORT DEVICES BETWEEN CARRIERS.

RTG concurs with Acting Chairwoman Clyburn that the “current lack of interoperability, in the lower 700 MHz band, is impeding the deployment of competitive options for consumers.”¹⁵ The decision by the Commission to extend the interim construction benchmark dates for Lower 700 MHz Band A Block licensees¹⁶ and B Block licensees¹⁷ is a direct result of the inability of 700 MHz licensees to satisfy their interim construction benchmark deadlines due to the Lower 700 MHz Band ecosystem allowing the creation and development of mobile devices with LTE band classes that purposefully exclude certain license blocks. The creation of sub-set band classes is a recent phenomenon – it never materialized in the Cellular, PCS and AWS-1 Bands -- but such classes have already hindered the ability of small and rural carriers to

¹⁵ *In the Matter of Expanding Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Statement by Commissioner Mignon L. Clyburn, GN Docket No. 12-268, FCC 12-118 (released October 2, 2012).

¹⁶ *In the Matter of Wireless Telecommunications Bureau Seeks Comment on Requests for Waiver and Extension of Time to Construct 700 MHz A and B Block Licenses*, Public Notice, “Wireless Telecommunications Bureau Extends 700 MHz A Block Licensee Interim Construction Benchmark Deadline Until December 13, 2013,” WT Docket No. 12-332, DA 13-210 (released February 13, 2013).

¹⁷ *In the Matter of Wireless Telecommunications Bureau Seeks Comment on Requests for Waiver and Extension of Time to Construct 700 MHz A and B Block Licenses*, Public Notice, “Wireless Telecommunications Bureau Extends 700 MHz B Block Licensee Interim Construction Benchmark Deadline Until December 13, 2013,” WT Docket No. 12-332, DA 13-680 (released April 10, 2013).

acquire mobile devices. As will be explained in greater detail in the next section regarding device exclusivity, the mobile device subsector is plagued by a troublesome axiom: vendors who design, test and manufacture mobile wireless devices will only produce a specific type of mobile device if there is sufficient demand by mobile carriers, and furthermore, that critical mass of demand for broadly inclusive band classes such as LTE Band Class 12 is thwarted when “exclusive” band classes such as LTE Band Class 17 favored by AT&T and LTE Band Class 13 favored by Verizon Wireless are developed and those carriers with 700 MHz Band licenses outside of those band classes are unable to stimulate enough demand to warrant mobile device manufacturers to actually produce devices using the more broadly inclusive band classes.

Correcting the industry-wide problem of a palpable lack of interoperability for LTE devices involves a simple, two-part solution. First, the Commission must issue an order requiring that all mobile devices manufactured for operation in the Lower 700 MHz Band be fully interoperable across all paired spectrum within that band. The Commission’s notice of proposed rulemaking on mobile device interoperability in the 700 MHz Band has been open for over a year,¹⁸ and the device procurement difficulty experienced by small and rural carriers has snowballed into delayed LTE network launches and fewer retail choices for consumers, all of which is harmful to effective competition. The second part of the solution to help reduce the “Tower of Babel” atmosphere brought upon by multiple band classes covering multiple frequencies is to have the Commission mandate that all devices that will be operational in *any* new commercial mobile wireless spectrum auctioned in the future, including the 600 MHz Band, be fully interoperable across the entire licensed band. Commission policies should be designed to benefit America’s paying consumers, and rules mandating universal mobile device

¹⁸ *In the Matter of Promoting Interoperability in the 700 MHz Commercial Spectrum*, Notice of Proposed Rulemaking, WT Docket No. 12-69, FCC 12-31 (released March 21, 2012).

interoperability within a particular spectrum band do just that by allowing a consumer to more easily port a device away from one service provider to another. When the element of device interoperability is removed from a consumer's equation on what device to choose, he or she can then focus on the truly important distinguishing elements such as price, customer service, and local coverage. If a carrier, whether large (like AT&T and Verizon Wireless) or small (like RTG members) is unable to provide the services that truly matter to a paying subscriber, that customer should have the freedom to bring his or her mobile device to a competing carrier and not feel like a hostage solely because that recently purchased (and expensive) smartphone or tablet does not work on adjacent frequencies. RTG is confident that once intra-band device interoperability becomes common place, one barrier to entry for carriers will be erased and one barrier to migration for consumers will also disappear.

III. DETRIMENTAL EXCLUSIVITY AGREEMENTS BETWEEN MOBILE CARRIERS AND MOBILE DEVICE VENDORS HAVE BEEN REPLACED BY VOLUME ORDER LIMITS IMPOSED BY MOBILE DEVICE VENDORS WHICH PREVENT SMALL AND RURAL MOBILE CARRIERS FROM OFFERING HIGHLY-SOUGHT MOBILE DEVICES.

While traditional factors such as price, local coverage and customer service are still guiding factors that influence a particular consumer's choice of mobile wireless carrier, they are by no means the only influences. Americans today, especially younger Americans who are more likely to switch between providers,¹⁹ are also heavily influenced by whether the prospective new carrier of choice offers specific mobile devices operating specific mobile platforms. The prickly matter of device exclusivity agreements between large carriers (like AT&T) and mobile device

¹⁹ "Mobile Trends: Consumer Views of Mobile Shopping and Mobile Service Providers," White Paper by Oracle, released April 2011); <http://www.oracle.com/us/industries/communications/oracle-atg-mobile-wp-345770.pdf> ("Younger consumers tend to jump around more frequently from one mobile provider to the next. 30 percent of respondents ages 18 to 34 have purchased mobile services from two or more providers in the past five years. By comparison, 22 percent of those ages 35 to 54 and 19 percent of those ages 55 and older have used multiple providers. 20 percent of consumers ages 18 to 34 said they are likely to leave their current mobile provider in the next 12 months.") at p. 10.

manufacturers (like Apple) has not disappeared from the industry; it has merely moved downstream to impact the smallest of the nation's mobile carriers who are often located in rural markets serving rural consumers.

When Apple ceased its exclusive distribution agreement with AT&T in 2011 and started selling the iPhone through Verizon Wireless (and later Sprint, T-Mobile and other large and mid-size carriers), it revealed an interesting insight into the relationship between consumer choice and specific mobile devices/platforms. For example, in a survey conducted by ChangeWave Research, in the final months of the AT&T/Apple exclusivity period in 2011, one-in-four (26%) AT&T iPhone subscribers surveyed responded that they would switch specifically to Verizon Wireless once it began selling the iPhone.²⁰ By point of comparison, only 15% of all AT&T subscribers, regardless of the device they were using, were willing to leave AT&T for another service provider. This means that all other factors being equal, a significant number of Apple iPhone consumers wanted to keep using the iPhone but were unable to go to another carrier until AT&T lost its rights to exclusivity. A more recent survey by ChangeWave Research noted that 54% of future smartphone buyers in America "are committed to buying the iPhone."²¹

While these surveys clearly show that Americans have an intense love affair with the Apple iPhone, American mobile wireless consumers desire equally the ability to pair their "device of choice" with their "service provider of choice." For example, this April, a news report surfaced showing that at least 250,000 consumers pre-registered with T-Mobile in order to secure the Apple iPhone 5, despite the fact that by this time well over a dozen carriers in the

²⁰ "New Survey Shows Verizon iPhone Will Have Major Impact on U.S. Wireless Service Providers," Paul Carton, Vice President of Research, ChangeWave Research, (January 13, 2011); <http://investorplace.com/2011/01/impact-verizon-apple-iphone-wireless-service-providers/>.

²¹ "ChangeWave Research Points to Massive Smartphone Buying Wave," MobileMarketingWatch, (January 12, 2012); <http://www.mobilemarketingwatch.com/changewave-research-points-to-massive-smartphone-buying-wave-20347/>.

United States had distribution and sales agreements with Apple to sell the iPhone.²² According to the news report, which relied upon an internal T-Mobile communication, 80 percent of those pre-registering to acquire a new iPhone were already T-Mobile customers. This means that hundreds of thousands of T-Mobile subscribers wanted to obtain an iPhone, but were willing to wait in order to use it with T-Mobile service. The news report also reported that 50,000 of those pre-register requests were from subscribers with service on a competitor of T-Mobile's. This means that most, if not all, of those 50,000 consumers could already purchase an Apple iPhone on a host of other service providers, but they wanted to use it with T-Mobile as the underlying carrier.

Accordingly, there is substantial evidence demonstrating that American consumers, and rationally so, want the ability to purchase the mobile device of their choosing but also have a choice in the underlying service provider. Unfortunately, many rural mobile carriers in the United States today are not only unable to offer the Apple iPhone and other recently launched, popular devices, but those very same carriers are sometimes the only mobile service provider with actual coverage in remote, rural locations. This means two, equally disturbing, things: (1) rural carriers, despite any competitive advantages they may have when it comes to price, local coverage and customer service, are skipped over by local consumers because they happen to not sell a specific product and this severely impacts their ability to compete on a level playing field; and (2) rural consumers are harmed because without the local, rural carrier's ability to offer a specific device, all of the associated applications and services are completely and utterly out-of-reach. In other words, certain rural consumers throughout the U.S. are treated differently and denied devices and services solely because of where they live. The demand by local consumers

²² "Leaked Memo Shows 250K Have Pre-Registered for T-Mobile's Apple iPhone 5," PhoneArena (April 9, 2013); http://www.phonearena.com/news/Leaked-memo-shows-250K-have-pre-registered-for-T-Mobiles-Apple-iPhone-5_id41711.

and rural carriers is there today. Latent demand has always been there. However, impeding the sale in rural America of devices like the iPhone is the reluctance of the vendors to sell those devices in quantities that are not as large (and never will be as large) as those commandeered by the country's largest mobile wireless carriers. This anti-competitive situation is the corollary to the band class and device interoperability situation discussed earlier: there is a small segment of carriers who are denied access to equipment and devices, but often times they are the only carriers available to rural consumers residing in those markets. By mandating device interoperability and preventing device vendors from discriminating against consumers just because of where they live, the Commission can make tremendous strides in removing mobile devices as an input segment that unnecessarily forces consumers to choose between fewer carriers than they would otherwise choose from.

IV. ACCESS TO DATA ROAMING AGREEMENTS DOES NOT ALWAYS GUARANTEE THAT CARRIERS ENJOY COMMERCIALLY REASONABLE DATA ROAMING RATES.

Rural mobile wireless carriers are disproportionately more reliant upon roaming compared to nationwide carriers and even regional carriers. This is so because after their appearance over a quarter-century ago, and after swift adoption by several generations of Americans, "cell phones" are expected to work just like home from coast-to-coast and everywhere in between. While nationwide carriers like the Twin Bells with deep spectrum resources and several decades of a head-start in building out networks rely less on roaming to fill in gaps nationwide, small and rural carriers with more modest spectrum holdings in smaller geographic markets and with less economies of scale and scope need roaming access to the mobile networks of other carriers in order to offer to their current and prospective customers a compelling nationwide footprint. For years larger carriers could strong-arm smaller and rural carriers in roaming negotiations or just deny access to data roaming altogether. Thankfully, in

2011, the Commission adopted the *Second Report and Order*, which mandated that serving carriers extend data roaming to requesting carriers on commercially reasonable terms and conditions.²³ While access to data roaming (at least while using 2G and 3G networks – the jury is still out for 4G LTE networks) seems to no longer be a problem, the wholesale prices that are frequently charged to smaller and rural operators to access data roaming services are far from commercially reasonable. Retail data roaming prices, whether domestic or even international, are fully transparent. Conversely, inter-carrier wholesale data roaming rates are almost universally confidential in nature. Nonetheless, there is a widespread existence of inter-carrier, wholesale data roaming rates which are *higher* than the rates paid by retail consumers and even higher than the rates paid by resellers or MVNOs for those very same network access services. Given the fact that rural carriers need data roaming access nationwide in order to compete effectively, and wholesale data roaming costs are eventually passed on to consumers, it makes it relatively impossible for rural carriers to actually compete when a rural consumer can simply walk across the street and purchase those same services from the roaming partner for less money. This does not mean that the consumer is getting a good deal or making an honest apples-to-apples comparison. Rather, the consumer is being forced to pay whatever the serving carrier is demanding because any competing carrier dependent upon roaming is almost always paying more for roaming access, and by default, forced to offer higher rate plans for all existing and potential consumers. Mandating access to data roaming was only the first half of the battle to create a level playing field in the realm of roaming access. The second and equally important step is to make sure that all carriers across the country, large and small, offer commercially reasonable wholesale data roaming rates. A very simple litmus test to determine whether a rate

²³ *In the Matter of Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, Second Report and Order, WT Docket No. 5-265, FCC 11-52 (released April 7, 2011).

is commercially reasonable is to ask whether the serving carrier's own customers pay lower retail rates for those same services. If the answer is yes, then the higher wholesale rates offered to roaming partners are *de facto* commercially unreasonable. RTG supports industry initiatives and FCC actions that would set a bright line limit on what constitutes commercially reasonable wholesale data roaming rates, and in all instances those rates should never be higher than the retail rates paid by consumers nor the wholesale rates paid by resellers and MVNOs.

V. CONCLUSION

With just a few modest changes to a handful of policies, the Commission can drastically reduce barriers to competition that for the last few years have hindered the full potential of the mobile wireless industry. Rural consumers and the rural carriers that serve them face a gauntlet of obstacles that tilt the competitive playing field against them. Whether it is the Twin Bells hoarding disproportionate amounts of spectrum or mobile device vendors limiting access to interoperable or highly-coveted devices or crucial roaming partners denying access at commercially reasonable roaming rates (or in many cases, all of the above) rural carriers are constantly behind the proverbial eight ball. Ultimately, it is rural American consumers, many without a meaningful choice of service providers, devices and competitive prices, who suffer.

RTG strongly supports the Commission's meaningful, comprehensive examination of industry competition. Only by looking under the hood with a trained eye can it properly diagnose what is working properly and what needs fixing. By adopting the four relatively

modest proposals detailed above, the Commission can watch the collective mobile wireless industry accelerate to success through vigorous competition, and American consumers will reap the benefits.

Respectfully submitted,

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June 17, 2013

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 107**

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)
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Reexamination of Roaming Obligations of)
Commercial Mobile Radio Service Providers)
and Other Providers of Mobile Data Services)
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WT Docket No. 05-265

**COMMENTS IN SUPPORT OF THE
BLANCA TELEPHONE COMPANY
PETITION FOR RECONSIDERATION**

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**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)
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 Reexamination of Roaming Obligations of) WT Docket No. 05-265
 Commercial Mobile Radio Service Providers)
 and Other Providers of Mobile Data Services)
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**COMMENTS IN SUPPORT OF THE
BLANCA TELEPHONE COMPANY
PETITION FOR RECONSIDERATION**

MetroPCS Communications, Inc. (“MetroPCS”),¹ National Telecommunications Cooperative Association (“NTCA”), NTELOS Holdings Corp. (“nTelos”), PRWireless, Inc. *d/b/a* Open Mobile (“PRWireless”), Revol Wireless (“Revol”), Rural Cellular Association (“RCA”), Rural Telecommunications Group, Inc. (“RTG”), and United States Cellular Corporation (“U.S. Cellular”) (collectively, the “Commenters”), by their undersigned counsel and pursuant to the November 21, 2011 *Public Notice*² issued by the Federal Communications Commission (“FCC” or “Commission”) in the above-captioned proceeding, hereby respectfully submit these comments in support of the *Petition for Reconsideration* (“Petition”) by Blanca

¹ For purposes of these comments, the term “MetroPCS” refers to MetroPCS Communications, Inc. and all of its FCC license-holding subsidiaries.

² As published in the Federal Register on December 1, 2011. 76 Fed. Reg. 74,721 – 74, 722 (Dec. 1, 2011).

Telephone Company (“BTC”) of the Commission’s *Second Report and Order* in the above-captioned proceeding.³ For the reasons set forth in greater detail below, the Commenters support the BTC Petition to adopt a “shot clock” for roaming negotiations because without a specific, identifiable timeframe, a host carrier being asked to provide roaming services can delay, hinder and ultimately undermine any potential roaming arrangement. In support, the following is respectfully shown:

I. INTRODUCTION AND SUMMARY

The Commenters support BTC’s Petition, which requests that the Commission “reconsider and reverse its decision declining to ‘adopt a time limit for roaming negotiations to limit the opportunity for host carriers to delay in negotiating roaming agreements.’”⁴ Despite the Commission’s laudable efforts to foster roaming arrangements and further promote consumer access to nationwide mobile broadband service, the *Second Report and Order* does not impose a sufficiently concrete timetable to incent nationwide carriers to negotiate commercially reasonable agreements on a timely basis with small, rural and mid-tier carriers. Without a specific timetable, the largest carriers – who have openly opposed the Commission’s roaming rules -- will have the incentive and the ability to delay any roaming arrangement.⁵

This concern of the Commenters is neither academic nor hypothetical. Since the data roaming rules went into effect in May of this year, the negotiation of data roaming agreements

³ *Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, WT Docket No. 05-265, Report and Order, FCC 11-52 (rel. Apr. 7, 2011), 76 Fed. Reg. 26199 (May 6, 2011) (“*Second Report and Order*” or “*Order*”).

⁴ Blanca Telephone Company, Petition for Reconsideration in WT Docket No. 05-265, 5 (filed June 6, 2011) (quoting the Commission’s *Order*, at ¶ 84) (“*BTC Petition*”).

⁵ Indeed, Verizon has appealed the *Second Report and Order*. See *Cellco Partnership d/b/a Verizon Wireless v. FCC*, Case No. 11-1135 (D.C. Cir. 2011).

has not meaningfully progressed. The Commenters have experienced continued foot-dragging, including unnecessary delays and stonewalling tactics, by large, nationwide carriers. The result is the unavailability of data roaming to more customers serviced by rural, small, and mid-tier carriers and reduced competition to the detriment of the public.

In order to remedy this problem, the Commission should expeditiously grant the Petition and impose strict deadlines for carriers to put forth their best and final offers in the course of data roaming negotiations. In doing so, the Commission would be emulating other successful regulatory schemes where the existence of a shot clock or negotiating timetable has fostered the prompt resolution of voluntarily negotiated commercial arrangements. With this change, the Commission will help ensure that proper incentives are provided for the large, nationwide carriers to “offer data roaming arrangements on commercially reasonable terms and conditions . . . and avoid actions that unduly delay or stonewall the course of negotiations.”⁶

II. COMMISSION ACTION IS WARRANTED

The *Second Report and Order* recognizes the critical and increasing role that data roaming plays in the wireless industry. The data roaming rules were adopted, *inter alia*, to promote the deployment of mobile data networks through widespread availability of data roaming capability.⁷ Specifically, the Commission adopted provisions requiring nationwide providers to offer data roaming arrangements on commercially reasonable terms and conditions, and admonished carriers of their “duty to respond promptly to [negotiation] request[s] and avoid actions that unduly delay or stonewall the course of negotiations.”⁸ While the Commenters

⁶ *Order* at ¶ 43.

⁷ *Id.* at ¶ 1.

⁸ *Id.* at 42.

appreciate the Commission's efforts thus far, the lack of progress following the adoption of the *Second Report and Order* clearly indicates that additional actions must be taken to ensure that this duty is fulfilled by the large, nationwide providers.

Data roaming is absolutely crucial for small, rural and mid-tier carriers who do not have nationwide footprints and are unlikely to be able to put such footprints together in the future due to a lack of available resources and access to additional spectrum. The ability to offer nationwide data service has become a necessity for wireless operators wanting to provide the smartphones and data services demanded by their customers. As a result, non-nationwide carriers have no choice but to rely on roaming agreements with the large, nationwide providers to meet their customers' needs. In addition, a sizable number of consumers select services based on the handsets available,⁹ and increasingly the handsets demanded by consumers are smartphones.¹⁰ Studies show that customers are increasingly demanding smartphones, wireless data usage is increasing exponentially,¹¹ and users expect to be able to use their wireless devices

⁹ A Google study found that approximately 24 percent of consumers made their wireless purchase decision solely on handsets, while 28 percent of consumers said both handset and carrier influenced their purchase decision. Rita Chang, *Proof that Handset Brands Help Sell Wireless Plans*, ADVERTISING AGE, Oct. 27, 2008, <http://adage.com/article/news/proof-handset-brands-sell-wireless-plans/132051/>. A Consumer Union report found that found that 27% of all respondents claimed to have a specific wireless handset in mind when they went shopping for a new wireless phone. *Best Cell Phone Service*, CONSUMER REPORTS, Jan. 2010, available at <http://www.consumerreports.org/cro/magazine-archive/2010/january/electronics-computers/cell-phone-service/overview/cell-phone-service-ov.htm>.

¹⁰ Don Kellogg, *In U.S. Market, New Smartphone Buyers Increasingly Embracing Android*, NIELSENWIRE, Sept. 26, 2011, http://blog.nielsen.com/nielsenwire/online_mobile/in-u-s-market-new-smartphone-buyers-increasingly-embracing-android/ (stating that “[w]hile 43 percent of all mobile subscribers in the US had a smartphone as of August, 56 percent of those who got a new device in the last 3 months chose a smartphone over a feature phone.”).

¹¹ See Amy Vernon, *Mobile Data Surpasses Voice Traffic For First Time*, HOTHARDWARE.COM, Apr. 2, 2010, <http://hothardware.com/News/Mobile-Data-Surpasses-Voice-Traffic-For-First-Time/>.

to receive data services while they are roaming. In light of this evolving market, it is no surprise that wireless service plans and new customer acquisitions are increasingly focused on smartphones and data plans allowing nationwide use. Service providers that are unable to provide competitive nationwide data usage plans are at a severe disadvantage in the wireless marketplace. Inevitably, it ends up being small, rural or mid-sized providers that are unable to obtain reasonable data roaming arrangements. Indeed, the inability of non-nationwide carriers to offer nationwide data services in conjunction with many smartphone offerings has become the latest competitive wedge being used by the largest carriers to further enhance their market power. Ultimately, the lack of data roaming may force further consolidation in an already highly concentrated industry.¹²

While the *Second Report and Order* admonished carriers to “avoid actions that unduly delay or stonewall the course of negotiations,”¹³ the Commission failed to put any regulatory teeth into such arguments by refraining from setting any timing benchmark or “shot clock” for data roaming negotiations. This effectively places the burden on the carrier requesting roaming (the “Requesting Carrier”) to demonstrate inordinate delay by the carrier from which roaming is sought (the “Host Carrier”). Yet, it will be difficult for a Requesting Carrier to prove such stonewalling in light of the unfortunate language in the *Second Report and Order* indicating that some roaming negotiations may be so complex or fact-intensive that a negotiating timetable could be inappropriate.¹⁴ The nationwide carriers are certain to use this language as a shield,

¹² Without data roaming, non-nationwide carriers would be forced into a “Hobson’s” choice – withdraw from the market or only offer voice services. Either would reduce competition and harm consumers.

¹³ *Order* at ¶ 42.

¹⁴ *Id.* at 84. This Commission concern is misguided given the current state of development of roaming arrangements, especially with the largest carriers. The voice roaming market has

particularly since the substantive requirement that carriers offer data roaming on “commercially reasonable” terms is to be judged by the Commission on a “case-by-case basis, taking into consideration the totality of the circumstances.”¹⁵ By creating this fact-intensive standard, the Commission has inadvertently given Host Carriers an easy excuse for delay. The Commission admonition against delay becomes hollow in these circumstances and any Host Carrier who opposes roaming requirements stands to benefit from being intransigent. As noted in detail below, the lack of progress in data roaming negotiations since the adoption of the *Order* confirms this concern.

The core problem is that there is a complete lack of equal bargaining power at the data roaming negotiating table and every incentive for the largest carriers to delay roaming negotiations in order to gain a competitive advantage. The two largest nationwide providers, having little or no incentive to cooperate with the smaller providers, take advantage of this bargaining imbalance to undermine the prospects of an agreement being reached.¹⁶ The resulting inability of small, rural and mid-tier wireless carriers to accommodate their customers’ requests for data services when they travel, severely inhibits their ability to compete even in markets where they have network operations. In this environment, the lack of specific measurable

evolved to the point where certain forms of voice roaming agreements are widely used throughout the industry. And now, these agreements have been adapted to 2G and 3G data roaming. This means that many of the technical issues raised in the early stages of the data roaming debate have been addressed as data agreements have started to emerge. 4G roaming agreements are less prevalent and present some additional issues at this time, but such arrangements would be built on already existing frameworks and should be able to be resolved in a relatively short time frame.

¹⁵ *Order* at ¶ 85.

¹⁶ For instance, in roaming negotiations with one of the Commenters, a large national carrier indicated that it wasn’t interested in the roaming revenue it would receive; it wanted the Requesting Carrier’s customers.

timeframes provides a fertile ground for the largest national carriers to delay any agreement. As noted by BTC, these are the precise harms that the Commission was seeking to minimize or avoid in its *Second Report and Order*.¹⁷

III. ROAMING NEGOTIATIONS HAVE LANGUISHED DESPITE THE ADOPTION OF THE *SECOND REPORT AND ORDER*

The Petition demonstrates that BTC has encountered recurring difficulties in its efforts to secure both voice and data roaming agreements due to the nationwide carriers' lack of cooperation in negotiating roaming agreements on a timely basis with reasonable terms, conditions, and rates.¹⁸ Unfortunately, this same lament is heard throughout the industry by small, rural and mid-sized wireless carriers seeking to obtain roaming agreements with the largest national carriers – AT&T and Verizon. Indeed, the Commenters have experienced inordinate delays during attempts to negotiate data roaming agreements. While the specific circumstances of particular individual negotiations are subject to non-disclosure agreements, some general parameters serve to highlight the problems:

- In one instance, data roaming negotiations have been ongoing for 2 years without resolution. Negotiations have languished between 6 and 28 months for others.
- In some instances, requestors have waited more than 8 months for an initial response, and between 2 and 12 months for a substantive rate proposal. And, more often than not, the wholesale data roaming rate that is offered after considerable delay is many orders of magnitude higher than the offering carrier's retail rates to its own data customers.
- In some instances, after waiting months for a response, the proposal offered is so one-sided that negotiations continue to be delayed even further. Typically, the intervening months are characterized by the obvious use of steering tools to reduce roaming traffic.

¹⁷ See *BTC Petition*, at 7.

¹⁸ *Id.* at 2.

- Rates proposed for more efficient services are higher than rates proposed for less efficient services.
- Requesting Carrier traffic would often be given a lesser priority (or suspended entirely) at any time by the Host Carrier.
- Requesting Carriers often must deal with an ever changing cast of negotiators for the Host Carrier, and each personnel change extends the negotiating timetable.
- Host Carriers often request detailed, long-term traffic projections and propose onerous consequences in the event that the traffic projections are not accurate.
- Host Carriers often inform the Requesting Carrier that, before testing can begin, the Requesting Carrier must enter a testing queue, composed of multiple Requesting Carriers, each with a specific service request of the Host Carrier, for an undisclosed or indeterminate period of time.
- Often, network freezes, lack of human resources and alternative internal priorities are common rationalizations for why Requesting Carriers are delayed in the testing queues. The Requesting Carriers often have no choice but to abide by the excuse given for the delay of the testing queue, and they have little to no means to contest the appropriateness of these unilaterally-imposed delays.
- Generally, efforts to escalate stalled negotiations within the organization of the Host Carrier in order to get to a person with decision making authority are unsuccessful.

Obviously, the admonitions regarding prompt negotiations contained in the *Second Report and Order* are not being taken seriously by the largest national carriers. There is no doubt that one reason for this attitude is that there is nothing in the data roaming rule itself that requires the roaming carrier to negotiate in good faith or to conclude negotiations according to any specific timetable. To the contrary, the rule permits carriers to “negotiate the terms of their roaming arrangements on an individualized basis....”¹⁹ This accords carriers seeking delay great leeway, particularly in light of the Commission’s rationale not to impose a shot clock because some negotiations may be complex and fact intensive. In effect, carriers being asked to grant

¹⁹ 47 C.F.R. § 21.12(e)(1).

data roaming rights can stonewall with impunity since those requesting roaming will be hard-pressed to demonstrate that any rule or policy is being violated.

Notably, recent findings of the Commission and the D.C. District Court in the AT&T/T-Mobile antitrust trial highlight the serious problems facing every small, rural or mid-tier carrier seeking a roaming agreement with a nationwide carrier. The Commission’s recent Staff Analysis and Findings on the AT&T/T-Mobile Transaction recognized that a “[r]oaming agreement between two providers can be difficult to negotiate when there is limited mutual interest”²⁰ which is uniformly the case when the two negotiating parties have vastly different wireless footprints. The Staff Report also cited evidence of opponents of the AT&T/T-Mobile transaction indicating that AT&T has been less than forthcoming in its negotiation of roaming arrangements.²¹ Similarly, faced with sworn allegations that “AT&T has engaged in a pattern and practice of denying roaming agreements to smaller carriers, as part of its efforts to monopolize local markets and to injure competition,” the D.C. District Court in the AT&T/T-Mobile antitrust case denied the motion of AT&T/T-Mobile to dismiss the roaming-based antitrust claims of C-Spire (formerly Cellular South) because of the potential competitive harm caused by reduced access to roaming inputs.²²

In light of these recurring competitive roaming concerns, which the Commenters can attest do not apply only to AT&T, the Commission must put teeth into its effort to discourage stonewalling by requiring Host Carriers to meet reasonable deadlines in the course of fulfilling

²⁰ FCC Staff Analysis and Findings on AT&T and T-Mobile Transaction, WT Docket No. 11-65, ¶ 67 (filed Nov. 29, 2011)(the “Staff Report”).

²¹ Staff Report at ¶ 100, n. 294.

²² See *Sprint Nextel Corporation v. AT&T et al.*, Case No. 1:2011-cv-01600, Memorandum Opinion, 37 – 38 (D.C. Cir. 2011) (filed Nov. 2, 2011).

their obligation to provide data roaming service on commercially reasonable terms and conditions.

IV. SHOT CLOCKS HAVE PROVEN TO BE EFFECTIVE IN ANALOGOUS CIRCUMSTANCES

The Commission refrains from adopting a time limit for roaming negotiations due to possibly complex or fact-intensive issues that might arise during discussions.²³ However, as indicated below, Congressional- and Commission-imposed shot clocks have proven to be an effective tool for fostering negotiations and agreements in circumstances where the parties have unequal bargaining power.

For example, prior to the amendment of the Communications Act (the “Act”) by the Telecommunications Act of 1996 (the “96 Act”), telecommunications carriers were having recurring difficulty negotiating interconnection agreements with incumbent local exchange carriers (“ILECs”) because of the ILEC’s unequal bargaining power. To remedy this situation, Congress amended the Act by adding Section 252, which established “Procedures for Negotiation, Arbitration, and Approval of Agreements.”²⁴ In effect, ILECs were accorded 135 days to negotiate in good faith and reach agreement, at which point they were subject to mandatory arbitration before state commissions in the absence of an agreement.²⁵ There can be no serious dispute that interconnection agreements, as a class, are much more complex and fact-intensive than data roaming agreements. And yet, Congress found it to be necessary and appropriate to adopt a hard deadline by which ILECs would be subject to litigation if an

²³ *Order* at ¶ 84.

²⁴ 47 C.F. R. § 252.

²⁵ Pursuant to Section 252, between the 135th and 160th day after which a request for negotiation has been made, a carrier may petition a state commission to arbitrate any open issues. 47 U.S.C. § 252(b)(1).

agreement was not reached. The Commenters know from personal experience that this deadline worked both to spur negotiations and to foster agreements. Indeed, interconnection agreements started to be entered into within months after the adoption of rules implementing Section 252 of the Act. In contrast, the release of the *Second Report and Order* has not had the desired result of promptly fostering data roaming agreements.

Section 252 of the Act is not the only example of a successful use of a negotiating timetable. Shot clocks have also been effectively utilized by the Commission in analogous circumstances. Tower sites, like data roaming agreements, are a critical input in the wireless marketplace. The inability of a carrier to secure access to a necessary site can severely disadvantage a wireless carrier from effectively participating in the wireless market.²⁶ Nonetheless, the Commission found that wireless service providers “often faced lengthy and unreasonable delays [from state agencies] in the consideration of their facility siting applications, and that the persistence of such delays [was] impeding the deployment of advanced and emergency services.”²⁷ The Commission concluded that the unreasonable delays obstructed the provision of wireless services and were subjecting wireless providers to unreasonably lengthy and costly processes.²⁸ Therefore, the FCC adopted rules that imposed a 90-day deadline to process applications for colocations, and 150 days for new tower applications.²⁹ If an agreement

²⁶ See *Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review and to Preempt Under Section 253 State and Local Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance*, WT Docket No. 08-165, Declaratory Ruling, FCC 09-99 (rel. Nov. 18, 2009) (“*Tower Siting Shot Clock Ruling*”).

²⁷ *Id.* at ¶ 32.

²⁸ *Id.* at ¶ 34.

²⁹ *Id.* at ¶ 32.

was not reached by these deadlines, then the issue would go to court.³⁰ Again, a myriad of separate circumstances and unique facts can pertain to a tower siting application, and yet the Commission found it necessary and appropriate to adopt a limited time constraint for tower siting issues to be resolved by state agencies. Notably, the complaints spotlighted by the Commission in the *Tower Siting Shot Clock Ruling* are similar to the cries the Commission is hearing now with respect to data roaming agreement delays.³¹

In yet another similar circumstance, excessive delays processing pole attachment requests led the Commission to adopt a specific timeline for both pole owners and attachers earlier this year.³² The Commission established a four-stage timeline for pole attachments, with a maximum timeframe of up to 148 days for completion of all stages. The first stage – the survey – (which is most applicable to the current situation) was allotted a 45-day period in which the utility was required to respond to a receipt of an attachment application.³³ The Commission concluded that “having a specific timeline offers certainty to attachers and allows them to make concrete business plans.”³⁴ Such certainty should also be made available in data roaming proceedings, however, the unnecessary delays and other stonewalling tactics that are underway in many current data roaming negotiations do not allow for such predictability.³⁵ The Commission

³⁰ *Id.*.

³¹ *See Id.* at ¶ 33.

³² *See In the Matter of Implementation of Section 224 of the Act; A National Broadband Plan for Our Future*, in WC Docket No. 07-245, GN Docket No. 09-51, Report and Order and Order on Reconsideration, FCC No. 11-50 (rel. April 7, 2011) (“*Pole Attachment Order*”).

³³ *Id.* at ¶ 24.

³⁴ *Id.* at ¶ 21.

³⁵ Indeed, one can argue that the effect of not having one site on competition is considerably less than the effect of *no customers* of a carrier having the ability to use these services when they roam.

should follow its past precedent and take action to limit the opportunity for the largest carriers to stonewall or delay negotiations.

The Commenters join BTC in urging the Commission to impose a reasonable deadline for a Host Carrier to make its best and final offer in response to a request for a data roaming agreement. The Commenters submit that 60 days for the initial roaming request would make a suitable deadline for such an offer. The Commission then should act promptly to resolve any issues upon which the parties have not agreed by the end of that term.³⁶ With the imposition of such a deadline, along with an indication that fines and forfeitures could apply for failure to comply, carriers being asked to provide data roaming services will have the missing incentive to come to terms with wireless carriers requesting data roaming. A discernible deadline also will increase the prospect that the negotiating parties will have made their best and final offers before needing to complain before the FCC. As BTC correctly explains, with a shot clock, “the incentive to delay and stonewall” would be transformed “into an incentive to negotiate and reach agreement (rather than risk an adverse Commission decision).”³⁷

V. CONCLUSION

The Commenters respectfully urge the Commission to grant BTC’s Petition For Reconsideration and adopt a time limit for negotiations. Since the adoption of the *Second Report and Order*, small, rural and mid-sized carriers have continued to struggle to obtain adequate data roaming from the largest nationwide carriers in a reasonable time. Carriers on which the Commenters desire to roam have no incentive to engage in prompt negotiations, as they are aware that the small, rural and mid-sized carriers have little or no recourse since the admonitions

³⁶ See *BTC Petition*, at 8.

³⁷ *Id.*

for prompt action are not embodied in any enforceable rule. The imposition of a shot clock will provide the necessary incentive for large, nationwide carriers to properly engage in data roaming negotiations to enhance the prospect that all carriers may provide nationwide data coverage to their customers. Without such incentive, negotiations will continue to be unduly delayed, resulting in less overall coverage provided by small, rural and mid-sized carriers.

Respectfully submitted,



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December 16, 2011

CERTIFICATE OF SERVICE

I, Jessica DeSimone, do hereby certify that on this 16th day of December, 2011, I caused a copy of the foregoing **COMMENTS IN SUPPORT OF THE BLANCA TELEPHONE COMPANY PETITION FOR RECONSIDERATION** to be served on the following via First-Class Mail, postage pre-paid:

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Opposition To AT&T/T-Mobile Deal Grows

May 21, 2011 [Print Page](#) [RSS Feeds](#)



After [last week's Congressional hearing](#) on the proposed [AT&T purchase of T-Mobile](#) it was clear that even partisan lines weren't stopping a laundry list of concerns from being presented. A rising number of states are already expressing concerns over the proposed deal, most recently [California who has just signed SB 600](#) in favor of investigating possible implications. Analysts are backtracking on their bets that the deal will be approved with many stating that AT&T's "orchestrated launch" and "corn of the story" is gone with many questioning just how good the deal is for the wireless market.

Analyst experts continue to believe the deal will not be approved because it will substantially less competition in the wireless industry. While AT&T aspects will have to direct some assets the question remains can AT&T do enough to persuade the Justice Department that the deal should move forward. In order to face the continued question as to what his deal means for industry price AT&T has brought on economic consultants including Navigant Economics. Navigant has found that AT&T and T-Mobile have two very different classes of customer that really serving. T-Mobile aggressively courted value seeking clients looking for cheap phones and no-frills service, and on had relatively few handsets that could compete with AT&T's highest offerings such as the iPhone.

There is some hope in the notion that the Justice Department has showed it's willingness to block deals likely that would integrate the market horizontally. Examples of the blockage of H&R Block buying 2nd Story Software maker of H&R Block competitor TaxACT and Verifone from purchasing Hypercom leaving one major supplier of point-of-sale units.

It's by no means a done deal for AT&T and they still have a large and uphill battle to fight as more states continue to prepare their own investigations and with members of Congress moving beyond party lines to question the necessity of this proposed arrangement. Let's hope that the Justice Department and the FCC find plenty more reason to believe that AT&T isn't deserving of Magenta.

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About David Barton: David is the founder and Editor-in-Chief of TmoNews.com. He considers himself a Jack Wagner, capable of leading tall buildings in a single bound and a compasser of the cell phone. He has been involved in the wireless industry since 2003 and has been known to show up for too many times in any given year. Should you wish to contact him, you can do so at david@tmoNews.com.

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Mobile Wireless Performance in the EU & the US

Friday, May 31, 2013

Navigant Economics released a new report in conjunction with GSMA. The report, “Mobile Wireless Performance in the EU & the US,” concludes that the EU is lagging well behind the U.S. in deployment of next generation wireless infrastructures and the advanced services they make possible, and that EU consumers are worse off as a result.

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AT&T Innovation Space Blog *connect, engage and create*



Wireless Data Volume on Our Network Continues to Double Annually

John Donovan

February 14, 2012

Running year-end numbers that show the same result as previous years is typically a sign of stability.

But when the year-end numbers show a doubling of wireless data traffic from 2010 to 2011 – and you’ve seen at least a doubling every year since 2007 – the implications are profound.

Over the past five years, AT&T’s wireless data traffic has grown 20,000%.

The growth is now driven primarily by smartphones. Add to that new customer additions and the continuing trend of upgrades from feature phones to smartphones, and you have a wireless data tsunami.

It’s a global phenomenon, as also detailed by Cisco today with the release of their annual [Visual Network Index](#) forecast.

At AT&T, we’re addressing the challenge by investing to drive service improvements. AT&T has invested more than \$95 billion in its wireless and wireline networks over the past five years. In 2011, we invested \$20 billion in our networks, and completed more than 150,000 wireless network improvements. And we expect to invest about \$20 billion again in 2012 with a focus on wireless, including more 4G LTE deployment, the roll-out of distributed antenna systems in key venues across the U.S. and adding even more AT&T Wi-Fi Hot Spots to the nation’s largest Wi-Fi network.

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VNI Mobile Forecast Highlights, 2013 – 2018

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Global - 2018 Forecast Highlights

2018 Forecast

Globally, mobile data traffic will grow 11-fold from 2013 to 2018, a compound annual growth rate of 61%.

Globally, mobile data traffic will reach 15.9 Exabytes per month by 2018, the equivalent of 3,965 million DVDs each month or 43,709 million text messages each second.

Globally, mobile data traffic will reach an annual run rate of 190.3 Exabytes by 2018.

Global mobile data traffic will grow 3 times faster than global fixed IP traffic from 2013 to 2018.

Globally, mobile data traffic will account for 12% of global fixed and mobile data traffic by 2018, up from 3% in 2013.

Globally, mobile data traffic by 2018 will be equivalent to 417x the volume of global mobile traffic ten years earlier (in 2008).

Globally, 54% of mobile connections will be 'smart' connections by 2018, up from 21% in 2013.

Globally, 96% of mobile data traffic will be 'smart' traffic by 2018, up from 88%

in 2013.

Globally, mobile traffic per mobile-connected device (excluding M2M) will reach 1,820 megabytes per month by 2018, up from 220 megabytes per month in 2013, a CAGR of 53%.

Globally, mobile traffic per mobile connection (including M2M) will reach 1,550 megabytes per month by 2018, up from 212 megabytes per month in 2013, a CAGR of 49%.

Globally, mobile traffic per user will reach 3,049 megabytes per month by 2018, up from 356 megabytes per month in 2013, a CAGR of 54%.

Globally, mobile traffic per capita will reach 2,098 megabytes per month by 2018, up from 208 megabytes per month in 2013, a CAGR of 59%.

Globally, mobile busy hour traffic will be 83% higher than average hour traffic by 2018, compared to 66% in 2013.

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**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)
)
Reexamination of Roaming Obligations of) WT Docket No. 05-265
Commercial Mobile Radio Service Providers and)
Other Providers of Mobile Data Services)

To: The Commission

COMMENTS OF LIMITLESS MOBILE, LLC

Limitless Mobile, LLC (“Limitless”)¹, by its attorneys, respectfully submits these Comments in response to the Federal Communications Commission’s (“FCC” or “Commission”) *Public Notice*² seeking comments on the petition for expedited declaratory ruling filed by T-Mobile USA, Inc. (“T-Mobile”).³ Limitless strongly supports the spirit of T-Mobile’s *Petition*, but, as outlined below, urges the Commission to take additional steps to promote transparency and clarity in the roaming marketplace.

I. BACKGROUND

Limitless, together with its predecessor companies, has served the mobile voice and mobile data needs of Central Pennsylvania residents for over 15 years. Indeed, Limitless was the first carrier to offer digital PCS services in several Pennsylvania towns and cities and along

¹ Limitless Mobile, LLC (formerly known as Keystone Wireless LLC) is a small, rural mobile wireless carrier located in central Pennsylvania. Limitless holds PCS licenses covering 10 counties. Limitless, which currently operates a 2G (GSM/EDGE) network, is in the process of building-out a 3G (UMTS/HSPA) and 4G (LTE) network across much of its licensed market.

² *Wireless Telecommunications Bureau Seeks Comment on Petition for Expedited Declaratory Ruling Filed by T-Mobile USA, Inc. Regarding Data Roaming Obligations*, DA 14-798, Public Notice (rel. June 10, 2014) (“*Public Notice*”).

³ *In the Matter of Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, WT Docket No. 05-265, Petition for Expedited Declaratory Ruling of T-Mobile USA, Inc. (filed May 27, 2014) (“*Petition*”).

crucial highways and rural roads. However, over this same time period, as the wireless infrastructure of the country matured, American consumers have come to expect that *all* retail wireless carriers offer voice and data rate plans with nationwide coverage. For a facilities-based carrier like Limitless, this expectation means that its own nationwide, retail service offering must consist of some combination of local coverage (provided on-network) and roaming partner coverage.⁴ Because Limitless is a local mobile wireless service provider with a modest licensed footprint in just one state, it relies upon AT&T and T-Mobile (which operate similar GSM-based networks) as absolutely crucial nationwide roaming partners. Limitless depends upon these two carriers to supplement its local coverage so that Limitless may offer truly nationwide retail plans that are even remotely competitive with the retail rates and plans offered by the nationwide carriers.

The Commission, in 2011, adopted rules requiring “all facilities-based providers of commercial mobile data services to offer data roaming arrangements to other such providers on commercially reasonable terms and conditions.”⁵ However, the Commission failed to define what constitutes “commercially reasonable” rates, terms and conditions. This lack of clarity and direction by the Commission, combined with the coverage needs of small and rural service providers, has allowed certain “must-have”⁶ carriers to strong-arm small, facilities-based carriers

⁴ For retail mobile virtual network operators (“MVNOs”), especially those that rely on the expansive underlying networks of AT&T and Verizon Wireless (*e.g.*, Cricket, NET10, and Tracfone), there is no need to rely on roaming partner coverage.

⁵ *In the Matter of Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, WT Docket No. 05-265, Second Report & Order, WT Docket No. 05-265, FCC 11-52 (released April 7, 2011) (“*Data Roaming Order*”) at ¶42; *aff’d sub nom. Cellco P’ship v. FCC*, 700 F.3d 534 (D.C. Cir. 2012).

⁶ While T-Mobile does not define a “must have” carrier, Limitless considers a must-have carrier to be the only wireless carrier that is able to provide the requesting carrier with wireless data roaming services in a market that has significant “map value” to the requesting carrier. “Map value” is used in the wireless industry to describe a service area that adds significant value to a carrier’s network by satisfying the demand of the carrier’s customers. Examples of areas with map value include major Interstates; areas covering hundreds of square miles; markets that fill-in a

like Limitless into entering data roaming agreements containing commercially unreasonable roaming rates. This imbalance in the marketplace ultimately hurts competition and drastically reduces consumer choice. Accordingly, and pursuant to Section 1.2 of the Commission's rules, Limitless urges the Commission to act on the T-Mobile *Petition* and clarify what it means for data roaming rates to be "commercially reasonable".⁷ If a nationwide carrier like T-Mobile -- with tens of millions of customers, valuable spectrum across the United States and a facilities-based GSM/LTE network stretching from coast-to-coast -- is unable to offer compelling retail plans because of high data roaming costs, then a small, rural carrier like Limitless is all but doomed in large part because a large percentage of its subscribers are regularly dependent upon *adjacent* local roaming with AT&T.

Within the last year, Limitless found itself with the pressing need to re-negotiate its domestic roaming agreements with both AT&T and T-Mobile in order to secure access to nationwide GSM/LTE coverage in urban, suburban and rural markets across the United States. While Limitless was able to enter into a data roaming agreement with T-Mobile consisting of rates, terms and conditions that it objectively believes are "commercially reasonable", it was not able to achieve the same result with AT&T. Nonetheless, Limitless entered into a new data roaming agreement with AT&T. Because AT&T offers wireless data coverage in nearby Pennsylvania markets that even T-Mobile does not cover, Limitless felt pressured to enter into a data roaming deal with AT&T. Without the ability to offer its existing and prospective customers roaming coverage on the adjacent AT&T network, Limitless would be at an

carrier's doughnut hole-shaped service territory; and rural markets that are immediately adjacent to a carrier's service territory.

⁷ See 47 C.F.R. § 1.2. See also *Petition* at ¶ 82 ("We note that the Wireless Telecommunications Bureau has delegated authority to resolve other disputes with respect to the data roaming rule adopted herein. We also note that whether or not the appropriate procedural vehicle is a complaint under Section 20.12(e) or a petition for declaratory ruling under Section 1.2 may vary depending on the circumstances of each case.")

immediate disadvantage in the eyes of many consumers, regardless of the retail price attached to the wireless data service offering. However, after several months of roaming on AT&T under the new rates, Limitless made the unilateral decision to severely “restrict” its customers from accessing the AT&T network for the sole reason that AT&T’s data roaming rates are too high and by continuing roaming access, Limitless could not maintain a commercially competitive retail wireless data offering to the general public.

II. THE COMMISSION SHOULD RULE THAT DOMESTIC, WHOLESALE, INTER-CARRIER DATA ROAMING RATES THAT EXCEED SPECIFIC BENCHMARKS ARE *DE FACTO* COMMERCIALY UNREASONABLE.

When the Commission promulgated its data roaming rules, it concluded that it was in the public interest to ensure that “providers of commercial mobile data services [] offer data roaming arrangements on commercially reasonable terms and conditions.”⁸ However, the ambiguity surrounding the definition of “commercially reasonable”, which has lingered since the release of the *Data Roaming Order* in 2011, has created two completely divergent viewpoints on what exactly constitutes “commercially reasonable”, with “must-have” carriers like AT&T and Verizon Wireless on one side and public interest groups, consumers, and small, rural carriers (and now even T-Mobile) on the other side.

T-Mobile proposes in its *Petition* that the Commission adopt four benchmarks for assessing the commercial reasonableness of data roaming agreements. These benchmarks include:

- (1) whether a wholesale roaming rate offered to a retail competitor substantially exceeds the relevant retail rate;
- (2) whether a wholesale roaming rate substantially exceeds roaming rates charged to foreign carriers when their customers roam in the U.S.;
- (3) whether a wholesale roaming rate substantially exceeds the price for wholesale data service that a seller charges to MVNO customers; and

⁸ *Data Roaming Order* at ¶13.

(4) how the proposed wholesale roaming rate compares to other competitively negotiated wholesale roaming rates.⁹

Limitless supports the general intent underlying the benchmark “concept” introduced by T-Mobile. Limitless also supports T-Mobile’s request for clarification that the inclusion of the “extent and nature of providers’ ‘build-out’” in the Data Roaming Order, as one of a number of non-exclusive factors intended to inform determinations of commercial reasonableness, “was not intended to allow a host carrier to deny roaming, or to charge commercially unreasonable rates for roaming, in a particular area where the otherwise built-out requesting provider has not built-out.”¹⁰ While Limitless supports T-Mobile’s request that the Commission clarify that the rates, terms and conditions of already-executed agreements should not be presumed commercially reasonable for future negotiations and agreements, Limitless urges the Commission to reconsider its original determination that the rates, terms and conditions of already-executed agreements are presumed to be commercially reasonable. Limitless, and likely other requesting carriers, have signed data roaming agreements under duress. With no competition in the provision of data roaming services, carriers like Limitless find themselves attempting to negotiate “take-it or leave-it” contract provisions, which they have no choice but to take.

While the four benchmarks proposed by T-Mobile are a good start, they do not provide the clarity needed by carriers to determine whether a particular rate is commercially reasonable. To provide such clarity, the Commission should draw definitive lines-in-the-sand that clearly separate rates, terms, and conditions that qualify as commercially reasonable from rates, terms and conditions that are commercially unreasonable. Limitless strongly urges the Commission to create three new benchmarks that allow for direct comparison and an easier determination as to

⁹ *Petition* at p. ii-iii.

¹⁰ *Petition* at p. 22.

whether a roaming rate is commercially reasonable. Specifically, the Commission should find that a domestic, inter-carrier, wholesale data roaming rate is commercially unreasonable:

- (1) if it exceeds the relevant retail rate¹¹; or
- (2) if it exceeds roaming rates charged to foreign carriers when their customers roam in the U.S.; or
- (3) if it exceeds the price for wholesale data service that a seller charges to MVNO customers.

The Commission should make clear that if inter-carrier, wholesale data roaming rates are higher than any of those three benchmarks, then they are commercially unreasonable.

As discussed below, confidentiality provisions which govern most, if not all, domestic roaming agreements prevent open and honest public debate about commercial reasonableness. Indeed, these same confidentiality provisions prevent Limitless from explaining here in detail just how divergent are the various data roaming rates it has been forced to agree to. To facilitate such a discussion, Limitless proposes in Section III below that the Commission require that all such agreements be filed with the Commission. Given Limitless' restrictions on what it can discuss publicly with respect to its current roaming agreements and the rates it pays for the data services acquired under those agreements, it is forced to restrict its discussion here to roaming rates in the abstract.

Limitless, due to its rural location and reliance upon adjacent "must-have" roaming coverage by AT&T, has been forced to choose between paying for that roaming coverage at rates which it considers commercially unreasonable and blocking the ability of its own subscribers to access that AT&T roaming coverage and thus reduce the coverage area available through its wireless retail offerings. Limitless first chose to allow roaming on AT&T at commercially unreasonable rates. However, after several months, this decision proved to be too expensive for Limitless and it did not want to pass along these higher costs to its subscribers in the retail

¹¹ The relevant retail rates are the rates that the wholesale carrier offers to its own data customers.

marketplace. Limitless then decided to severely restrict the size of its coverage footprint by blocking subscriber roaming on AT&T, and in the process reduce the overall attractiveness of its retail offering to both existing and prospective subscribers.

It is well documented that data consumption by mobile users is skyrocketing.¹² Unlike in a “home” market where high data usage can be offset by reliance on WiFi hotspots in the home or school or workplace, there are no realistic alternatives when a consumer is mobile and roaming. Therefore, companies like Limitless routinely expect that a certain percentage of their subscribers’ usage will fall onto must-have roaming partners. Indeed, Limitless is much more reliant upon off-network roaming compared to its other facilities-based retail competitors in Central Pennsylvania: AT&T, Sprint, T-Mobile and Verizon Wireless. The dependency of smaller carriers on the roaming coverage provided by larger, must-have roaming partners and the cost structure associated with that reliance reveals that small and rural carriers are often in a no-win situation.

If Limitless, solely because of its reliance upon must-have data roaming, continues to pay excessive data roaming rates, it will be forced to do one of two things. First, it could maintain a competitive retail price just like the four nationwide carriers and attract customers, but be forced on a per-customer basis to pay excessive roaming costs, which makes offering a robust roaming footprint absolutely unprofitable. Second, Limitless could pass along that increase in wholesale roaming costs and offer the comparable retail offering to the consumer for a much higher retail price in order to sustain revenue and offset costs. By maintaining such a retail rate, Limitless would gradually lose money and be forced to go out of business. If

¹² See, e.g., *Policies Regarding Mobile Spectrum Holdings, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, WT Docket Nos. 12-269, 12-268, Report and Order, FCC 14-63 (rel. Jun 2, 2014) (Noting that “skyrocketing” consumer demand for high speed data is increasing providers’ need for spectrum and that today’s consumers expect mobile broadband at home, at work, and while “on the go.”).

Limitless offers a retail rate plan that is intended to cover excessive roaming costs, no right-minded consumer would be willing to pay more each month for Limitless when there are less expensive and comparable services on other carriers. This is true even if Limitless were somehow to distinguish itself through other means such as stellar customer service, a varied portfolio of data-capable devices, or some other distinguishing characteristic.

Limitless has reason to believe that inter-carrier data roaming rates in the mobile industry are five-times or perhaps even ten-times the prevailing retail rates for comparable data services. Such rates are clearly commercially unreasonable. At the end of the day, the choice a consumer makes is heavily dictated by coverage and price, and Limitless loses on both accounts. This is a no-win predicament, and it can only be remedied by the FCC taking action to prevent roaming partners from charging commercially unreasonable rates as mandated by the *Data Roaming Order*.

III. TO ENSURE THAT INTER-CARRIER, WHOLESALE DATA ROAMING RATES, TERMS AND CONDITIONS ARE COMMERCIALY REASONABLE, THE FCC SHOULD REQUIRE ALL DOMESTIC CARRIERS TO CONFIDENTIALLY FILE THEIR ROAMING AGREEMENTS WITH THE COMMISSION.

Limitless maintains dozens of data roaming agreements, including agreements with similarly-situated small and rural GSM/LTE carriers in the United States, large GSM/LTE nationwide carriers like AT&T and T-Mobile, and international GSM/LTE carriers. What distinguishes all existing and/or potential GSM/LTE roaming partners is their relative importance to Limitless as an aid to achieving its goal of cobbling together a compelling mobile wireless service offering to consumers in Central Pennsylvania. For example, a data roaming partner covering just a small portion of a domestic market like northern Alaska or an international market like Ecuador is not a “must-have” carrier, whereas, a data roaming partner

like AT&T with its expansive domestic coverage is absolutely crucial to Limitless. The reasons for the varying importance to Limitless of particular roaming partners are not that complex. For example, the aggregate amount of traffic on that sole, rural Alaskan carrier may be insignificant and there may be more than one mobile operator to choose from as roaming partners in Ecuador. These differences affect the ability of Limitless to remain competitive. For example, if the Alaskan or Ecuadorian carrier has excessively high data roaming rates, Limitless could make changes to its retail offerings (*i.e.*, add a reasonable retail surcharge for roaming in Alaska or prefer a less expensive roaming partner in Ecuador) and still be competitive. But the same is not true when it comes to AT&T. AT&T is a must-have carrier for Limitless because not only does it cover vast, non-urban markets throughout the United States that no other carrier covers, but much more importantly, it covers immediately adjacent cities, towns, and rural roads in other parts of Central Pennsylvania that no other GSM/LTE carrier covers, not even T-Mobile. It is precisely those must-have markets in nearby areas that distinguish AT&T from every other roaming partner. For at least three years, there has been no transparency in the domestic roaming marketplace to allow the FCC to determine what constitutes a commercially reasonable data roaming rate and what constitutes a commercially unreasonable data roaming rate. Therefore, Limitless strongly believes that the *only* effective way to educate the Commission on just how chaotic the domestic roaming marketplace has become, and more to the point, spotlight just how commercially unreasonable must-have carriers have been acting, is to require that *all* domestic, inter-carrier data roaming agreements be filed with the Commission.

IV. CONCLUSION

Limitless agrees with the T-Mobile *Petition* that there is ambiguity in the meaning of “commercially reasonable” inter-carrier, domestic data roaming rates and that this confusion is detrimental to the public interest. However, unlike T-Mobile, Limitless strongly believes that the

proposed benchmarks should be modified and serve as an absolute ceiling for what constitutes commercially reasonable roaming rates. The FCC should require all domestic carriers to file their data roaming agreements with the Commission so that it has all the relevant information to make an informed decision.

Respectfully submitted,

LIMITLESS MOBILE, LLC

By: */s/ Daryl A. Zakov*

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Its Attorney

July 10, 2014

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 114**

December 5, 2011

VIA ELECTRONIC DELIVERY

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

**Re: Notice of *Ex Parte* Presentations
WT Docket Nos. 06-150, 11-18; RM-11592**

Dear Ms. Dortch:

On December 1, 2011, Vulcan Wireless LLC (“Vulcan”) representatives Scott Wills, Paul Nagle, Paul Kolodzy, and Michele Farquhar met with Renata Hesse, Senior Counsel to the Chairman for Transactions; and Tom Peters, Paul D’Ari, Kathy Harris, Aleks Yankelevich, and Saurbh Chhabra from the Wireless Telecommunications Bureau (“WTB”) to discuss the critical need for a condition on the AT&T-Qualcomm acquisition that would help restore a consolidated Lower 700 MHz band class. Dave Saylor, representing Vulcan; Ben Moncrief, Public Policy Manager for C Spire Wireless; and Nicole McGinnis from WTB also joined the meeting by telephone.

The group discussed the results of a “real world” study, funded by a consortium of several Lower 700 MHz A Block licensees,¹ to test the underlying assumptions originally put forth regarding the need for a separate Band Class 17 in the Lower 700 MHz band. The study also set out to test a series of unsubstantiated claims put forth by AT&T and Qualcomm regarding the technical feasibility and cost impact of possible conditions on the pending AT&T-Qualcomm acquisition. The study included a combination of in-market field environmental measurements in Atlanta along with lab bench testing of AT&T 4G LTE devices.

The study found that the anticipated interference circumstances were unfounded and the underlying assumptions put forth for a separate Lower 700 MHz Band Class 17 were overstated. The real world data confirms that the use of Band Class 12 would not lead to degraded service for Lower 700 MHz B & C Block users. The data demonstrates that different operators’ systems in the Lower B and C Blocks actually pose a threat of interference to each other that is greater than any threat that would be introduced from a unified Lower 700 MHz band class that includes the A Block. Moreover, the AT&T devices tested proved that the device designs successfully handled these

¹ The consortium members include: Vulcan Wireless, King Street Wireless, Cavalier Wireless, Continuum 700, Cox Wireless, C Spire and MetroPCS.

differences in signal levels. Thus, neither high power E Block transmissions nor Channel 51 transmissions present an interference threat. Specifically, AT&T LTE devices currently receive and successfully manage greater disparities in signal levels from within their B and C Blocks than need to be accounted for by incorporating the A Block. In addition, concerns and claims made about reverse intermodulation distortion interference were shown to be unfounded, as the commercially deployed AT&T devices did not experience such interference. Finally, vague, alarmist, and unsubstantiated concerns and claims about the potential increase in cost and/or size of devices are inaccurate and misstated, as the current bill of materials costs will remain virtually unchanged. Therefore, the parties urged the Commission to impose a condition on the AT&T-Qualcomm acquisition that would help restore the original, unified Lower 700 MHz band plan, which would reconsolidate the fragmented Lower 700 MHz A, B, and C Blocks.

The attached materials were provided by Vulcan to Bureau staff during the discussion. Ms. Farquhar also met with Louis Peraertz, Legal Advisor to Commissioner Clyburn, on the same day and discussed the same issues described above and in the attached presentation.

Messrs. Wills, Nagle, and Kolodzy, along with Ms. Farquhar, also met with Tom Peters, John Leibovitz, Jim Schlichting, Paul Murray, Peter Trachtenberg, and Lloyd Coward from WTB on the same day. The Vulcan representatives discussed the circumstances that are dramatically hindering A Block broadband deployment, as described in the attached presentation. Specifically, they noted that AT&T's dominance in the Lower 700 MHz band and its influence over vendors has significantly impacted the availability of handsets to Lower 700 MHz band licensees and is a major impediment to deployment in the band. In addition, Vulcan noted that the FCC could clarify its rules regarding the level of protection that 700 MHz A Block licensees must afford to Channel 51 broadcasters.

Pursuant to Section 1.1206(b) of the Commission's rules, I am filing this notice electronically in the above-referenced docket. Please contact me directly with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar

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John Leibovitz
Jim Schlichting
Paul Murray
Peter Trachtenberg
Lloyd Coward

Why it is Imperative for the FCC to Help Restore a Consolidated Lower 700 MHz Band Class to Prevent Harm From the AT&T-Qualcomm Transaction

Vulcan Wireless

December 1, 2011

The AT&T-Qualcomm Transaction Gives AT&T Far Too Much Influence Over Band Class 12 Licensees

- AT&T has demonstrated misuse of the standards process and failure to disclose critical facts in the creation of Band Plan 17
- AT&T unfairly used its influence and monopsony power over the Lower 700 MHz vendor community to “carve up” the existing unified band plan, orphaning A Block licensees
- Owning D Block nationwide, which neighbors Band Class 12, gives too much power and influence to AT&T over Lower 700 MHz licensees
 - % ATT POPs Controlled Before: 35%
 - % ATT POPs Controlled After: 52%*

* does not include other pending AT&T 700 MHz acquisitions

AT&T's Planned Acquisition of the D & E Blocks Has Already Negatively Impacted Band Class 12 Licensees

- As recent as two weeks ago at 3GPP, AT&T spoke in favor of a proposal regarding base station operations that would require Band 12 licensees to set aside 1 MHz of their spectrum as guard band to support AT&T's D Block operations, rather than requiring AT&T to solely provide their own guard band
- AT&T's declaration to the FCC on January 12, 2011 stated: "AT&T's deployment of D & E block base station should have little effect on future deployments of A, B, and C-Block base stations by AT&T or any other licensee."

The AT&T-Qualcomm License Transfer Would Exacerbate the Interference and Deployment Problems Experienced by A Block

Licensees in Band Class 12

- The AT&T-Qualcomm acquisition, if approved, would magnify AT&T's market power in the Lower 700 MHz band and increase its ability to exert undue influence within the 3GPP process to the detriment of other Lower 700 MHz band licensees.
- The acquisition would specifically threaten interoperability by increasing the potential for significant interference across the Lower 700 MHz band.
 - For example, AT&T has argued that adjacent and other transmissions in or around 700 MHz caused interference concerns and required the creation of Band Class 17. But these concerns apparently do not apply to AT&T itself, which is now suggesting that it does not and will not cause interference to others, including by using the adjacent D & E Blocks.
 - **Nonetheless, there has already been a request at 3GPP to reduce the usable bandwidth for Band Class 12 licensees. This AT&T influenced request comes even before their acquisition is completed**
 - **AT&T's public submissions to the FCC never revealed that its use of the D Block spectrum would require other licensees to reduce their use of spectrum to create guard band for AT&T's purposes**
 - Without a requirement to help restore a unified Lower 700 MHz band class, AT&T at any time would be able to introduce new system requirements that cause interference to, preclude interoperability with, and introduce additional costs for, other Lower 700 MHz band licensees.
- Moreover, if the acquisition is approved, AT&T will have no incentive to cooperate with Lower Band licensees on *any* issues that may arise in the Lower 700 MHz Band, as it will function as a separate ecosystem. This will further threaten interoperability.
- Without interoperability, there will be no roaming across the Lower 700 MHz band and there will be a greater risk of exclusive handset arrangements, both of which will hinder competition and create islands of incompatibility – especially in the Lower 700 MHz A Block.
- The FCC should not approve the proposed license transfer without a single transaction-specific condition to reconsolidate the Lower 700 MHz band classes.

Recommended FCC Action: The FCC should adopt only a single condition on the AT&T-Qualcomm transaction that will help reconsolidate and unify the paired spectrum in the Lower 700 MHz band while allowing AT&T to proceed with its current deployment plans

- *After the transaction closes, any mobile device offered by AT&T that operates on paired Lower 700 MHz band spectrum must operate on all Lower 700 MHz band paired spectrum. This condition only applies to new devices, beginning as early as 6 months after the transaction closes, and should be fully implemented two years following the close of the transaction*

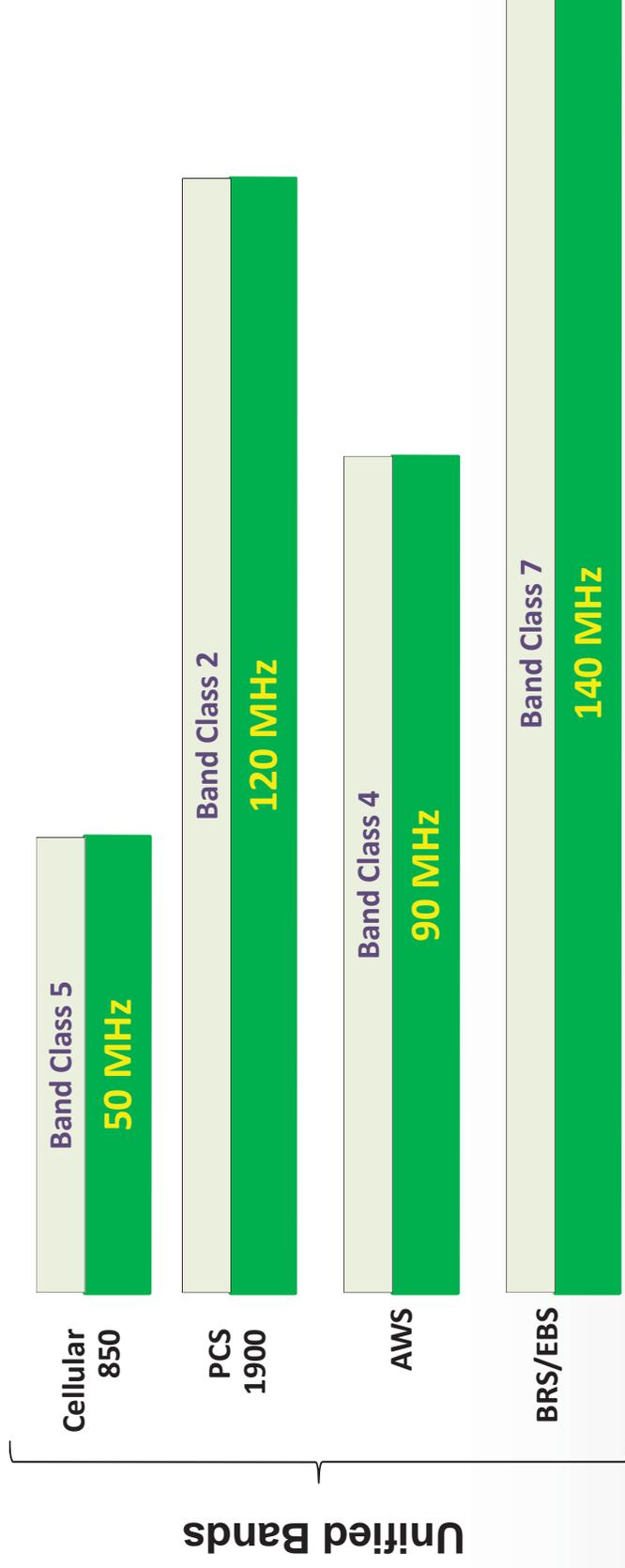
FCC Must Take Action Now

- AT&T's dominance in the Lower 700 MHz band and its influence over vendors has significantly impacted the availability of handsets to Lower 700 MHz band licensees and is a major impediment to deployment in the band
- The FCC can, and must, take action immediately to solve this problem
 - The transaction creates new interference obstacles for lower A Block licensees, threatens their ability to achieve interoperability, and could enable AT&T to circumvent the FCC's roaming decisions
- There are no technical- or cost-based impediments to imposing a condition on this transaction, as demonstrated by a recent technical study
- A single condition to help restore a consolidated Lower 700 MHz band class is most appropriate at this time to quickly restore a competitive environment and reduce the threat of impediments to A Block deployment at the lowest possible cost

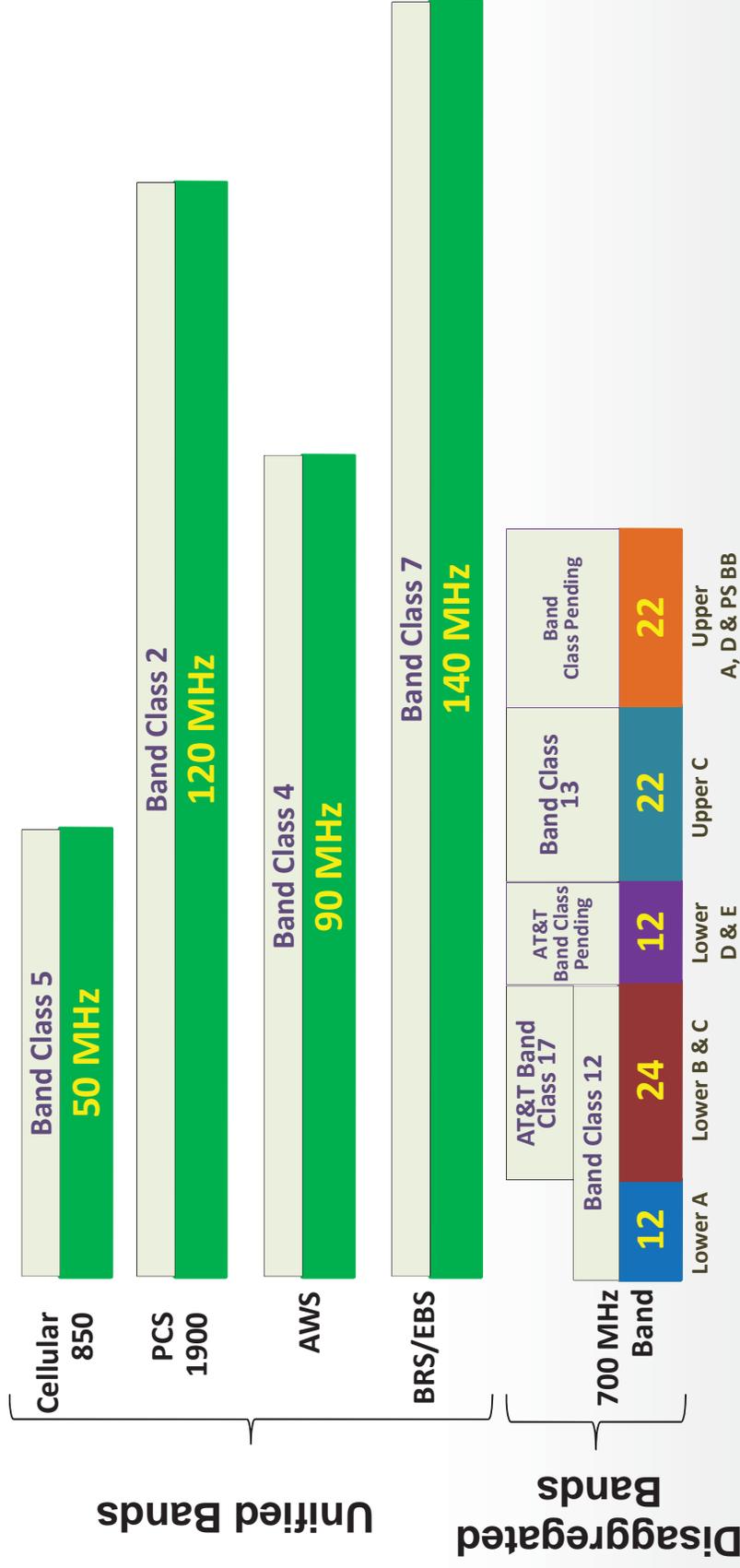
The FCC Needs to Require a Simple Condition to Curtail Further Manipulation and Compensate for the Absence of the Traditional

Balance of Market Forces in the Band Plan Process

- For standards bodies to work, multiple wireless carriers need to be present to allow for the creation of interoperable band classes and provide the necessary economies of scale and access to technology
- Neither standards bodies nor markets work when there is only one wireless carrier in the market influencing the band plan process
- The 3GPP process is predicated on market force collaboration, but the unanticipated problem is that only one wireless carrier dominated the Lower 700 MHz band plan process
- Predatory tactics were allowed to influence the band class creation in the standards body process leading to unprecedented and unanticipated marketplace manipulation
- AT&T's dominance of the band plan process thwarts efficiencies that benefit consumers, vendors, and licensees
- A reconsolidated Lower 700 MHz band class will compensate for AT&T's dominance and control over the Lower 700 MHz band



- **Every historical mobile wireless band class in the US has a unified band plan.** Traditionally, vendors came together in 3GPP to establish a single band class across individual spectrum allocations as a common technical foundation for all service providers within the band, driving economies of scale and interoperability.
- **Unified Band Plans have contributed significantly to ecosystem development, industry growth and consumer choice.** Without a common band plan, consumers can never switch carriers with a phone and data roaming is not possible.



➤ **With 700 MHz, the 3GPP process has been unduly influenced to force disaggregation**
 The unique use of 700 MHz frequencies exclusively in the US has given AT&T (a dominant 700 MHz spectrum holder) excessive influence, as there are no large international carriers using the same spectrum. This has led to unprecedented band class fragmentation and delays, slower ecosystem development and less consumer choice.

Activity Timeline for 700 MHz Band Class Pre- and Post- Auction 73

Dec 2007 (prior to auction) Only Band Class 12 is before 3GPP. Heading into Auction 73, there was no indication that the Lower 700 MHz band class would become fragmented. Prior to the auction, the focus had been on Band Class 12.

March 2008 Auction closes

April 2008 Motorola submits paper to 3GPP proposing Band Class 17 – eliminates a unified Lower 700 MHz band class and covers B and C Blocks predominantly owned by AT&T

June 2008 Ericsson questions reason for fracturing the band into separate band classes; Ericsson removes objections after AT&T supports Band Class 17 “which goes against economies of scale and may lead to market fragmentation”

September 2008 3GPP ratifies Band Class 17 – Ericsson objections silenced

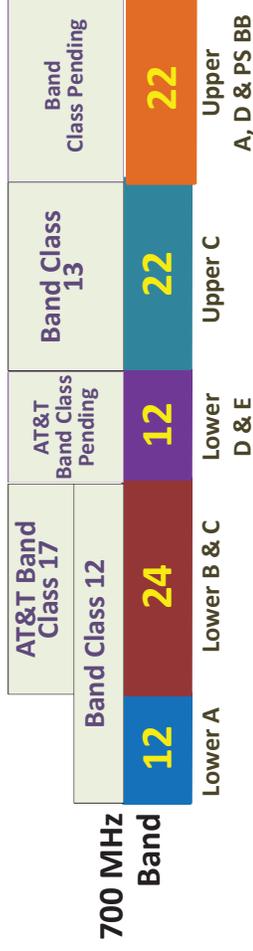
December 2010 3GPP ratifies Band Class 12 with 1 MHz guard band - It has taken a long time for the marginalized A Block licensees to get vendors to develop devices for its stand-alone band class. By the end of this year, both VZW and AT&T will have deployed 700 MHz spectrum to their customers, while the A Block licensees are still waiting for a workable prototype.

November 2011 AT&T requests that an additional 1 MHz of guard band be provided by Band Class 12 to protect spectrum being acquired from Qualcomm

700 MHz Band Class Manipulation Benefited AT&T but Derailed and Corrupted Lower 700 MHz Interoperability Efforts, Created Global Backlash, and Thwarted A Block 4G Deployments

ITU & 3GPP Mission: “Adopting international standards to ensure seamless global communications and interoperability for next-generation networks (NGN)” – **this was not done**

- Normally major global wireless carriers such as Orange, Vodafone, China Mobile, among others, are involved at the outset in standard-setting for key spectrum bands – **this was not done**
- Carriers always make the necessary technical compromises to ensure ecosystem interoperability – **this was not done**
- Since the US led in awarding 700 MHz licenses, AT&T, with its captive vendor community found itself in an unusual position to drive standards only for the AT&T-owned spectrum bands, often without even providing traditional and necessary technical data to support asserted needs – **this needs to be corrected**
- Global analysts and global wireless carriers alike cite the lack of 700 MHz interoperability standards as a key issue and new non-US global standards are being developed as a result [e.g., Asia-Pacific Telecommunity (namely, the APT band plan)] – **this needs to be corrected**



The Problem: The unique nature of the 700 MHz band (with no matching international allocation) and market consolidation have led to a skewed 3GPP process, which has resulted in:

- 1: Fractured and disaggregated spectrum
- 2: A captive vendor community
- 3: Isolated/orphaned spectrum holders
- 4: Harm to competition and consumers

After acquiring the Qualcomm spectrum, AT&T will be the exclusive owner of the D Block spectrum that neighbors Band Class 12. This will give AT&T significant influence and control over Band Class 12 licensees.

Pro-Consumer and Pro-Competition FCC Policies Have Been Circumvented and the Recent FCC Roaming Order Rendered Useless

- The April 2011 FCC Workshop on Interoperability revealed that primarily business reasons, more so than technical reasons, drove 700 MHz band plan fragmentation
- The acquisition of D & E Block licenses by AT&T removes a key part of the technical reasons used in 3GPP to originally rationalize the need to develop its own separate Band Class 17
- If AT&T is allowed to hide behind the claim that its mobile devices do not interoperate with other 700 MHz spectrum, then FCC policy goals will continue to be circumvented and the roaming order will be eviscerated
- Without FCC action now, before the network is built and deployed, the opportunity to correct the situation may become forever lost

The Solution

Recommended FCC Action: The FCC should adopt only a single condition on the AT&T-Qualcomm transaction that will help consolidate and unify the paired spectrum in the Lower 700 MHz band while allowing AT&T to proceed with its current deployment plans

- AT&T's dominance in the Lower 700 MHz band and its influence over vendors has significantly impacted the availability of handsets to Lower 700 MHz band licensees and is a major impediment to deployment in the band
- The FCC can, and must, take action immediately to solve this problem
 - The transaction creates new interference obstacles for lower A Block licensees, threatens their ability to achieve interoperability, and could enable AT&T to circumvent the FCC's roaming decisions
- There are no technical- or cost-based impediments to imposing a condition on this transaction, as demonstrated by a recent technical study
- A condition to reconsolidate the Lower 700 MHz band classes is most appropriate at this time to quickly restore a competitive environment and reduce the threat of impediments to A Block deployment at the lowest possible cost

After the transaction closes, any mobile device offered by AT&T that operates on paired Lower 700 MHz band spectrum must operate on all Lower 700 MHz band paired spectrum. This condition only applies to new devices, beginning as early as 6 months after the transaction closes and fully implemented two years following the close of the transaction

FCC Action Will Help to Accelerate Other US 4G Deployments and Address Global Backlash

- **Mike Byrne, Chair of the European Commission's Radio Spectrum Policy Group and a Commissioner at the Commission for Communications Regulation (ComReg) said:** "Cooperation between Europe and the Americas is increasingly important to ensure that spectrum is being used wisely and countries are able to recover from the economic slump. An inward-looking approach results in increased fragmentation and higher prices for products and services that have to be tailored to each region."
- **Sebastian Cabello, Director of GSMA's regional office in Latin America, said:** "GSMA members want harmonized frequencies, which drive scale and adoption of wireless services. Mr. Cabello noted that one drawback of the U.S. plan is the difficulty in device interoperability between sub-bands."

Benefits of the Proposed Condition

Not onerous

- Allows AT&T to transition to this solution over time
- No stranded investment because no impact on current handset sales
- New phones are constantly developed and deployed

A solution that will evolve as mobile wireless services evolve

- Does not force AT&T into a single configuration, but imposes a service condition
- Allows AT&T to innovate and develop new handsets just as in other mobile bands (which all have a uniform band class)
- Ensures that Band Class 12 licensees can get devices, and that roaming is technically possible across the Lower 700 MHz band

Interference is not an impediment to interoperability

- The FCC workshop demonstrated that there is no technical barrier to interoperability – only business decisions prevent it
- Post-transaction there are no significant technical differences between Band Class 12 (Lower A, B, & C Blocks) vs. Band Class 17 (Lower B & C)
- Band Class 12 could be substituted for Band Class 17 without impacting the number of bands on a chip

Extensive Study Demonstrates that There Are No Technical Impediments to Lower 700 MHz Interoperability

- A consortium of several 700 MHz A Block license holders* funded a “real world” study by conducting a variety of tests and collaborative engineering analyses/evaluations regarding the underlying assumptions originally put forth regarding the need for a separate Band Class 17 in the Lower 700 MHz band that has precluded interoperability
- The study included a combination of in-market field environmental measurements along with device lab bench testing of AT&T4G devices
- The study included field measurements in Atlanta, a market with a high power E Block system (50 kW), AT&T Lower B and C Block LTE system, Verizon Upper C Block LTE system, a high power Channel 51 broadcaster and an LPTV broadcaster. Also included in the test were AT&T LTE 4G devices.

*The consortium members include: Vulcan Wireless, King Street Wireless, Cavalier Wireless, Continuum 700, Cox Wireless, C Spire and MetroPCS.

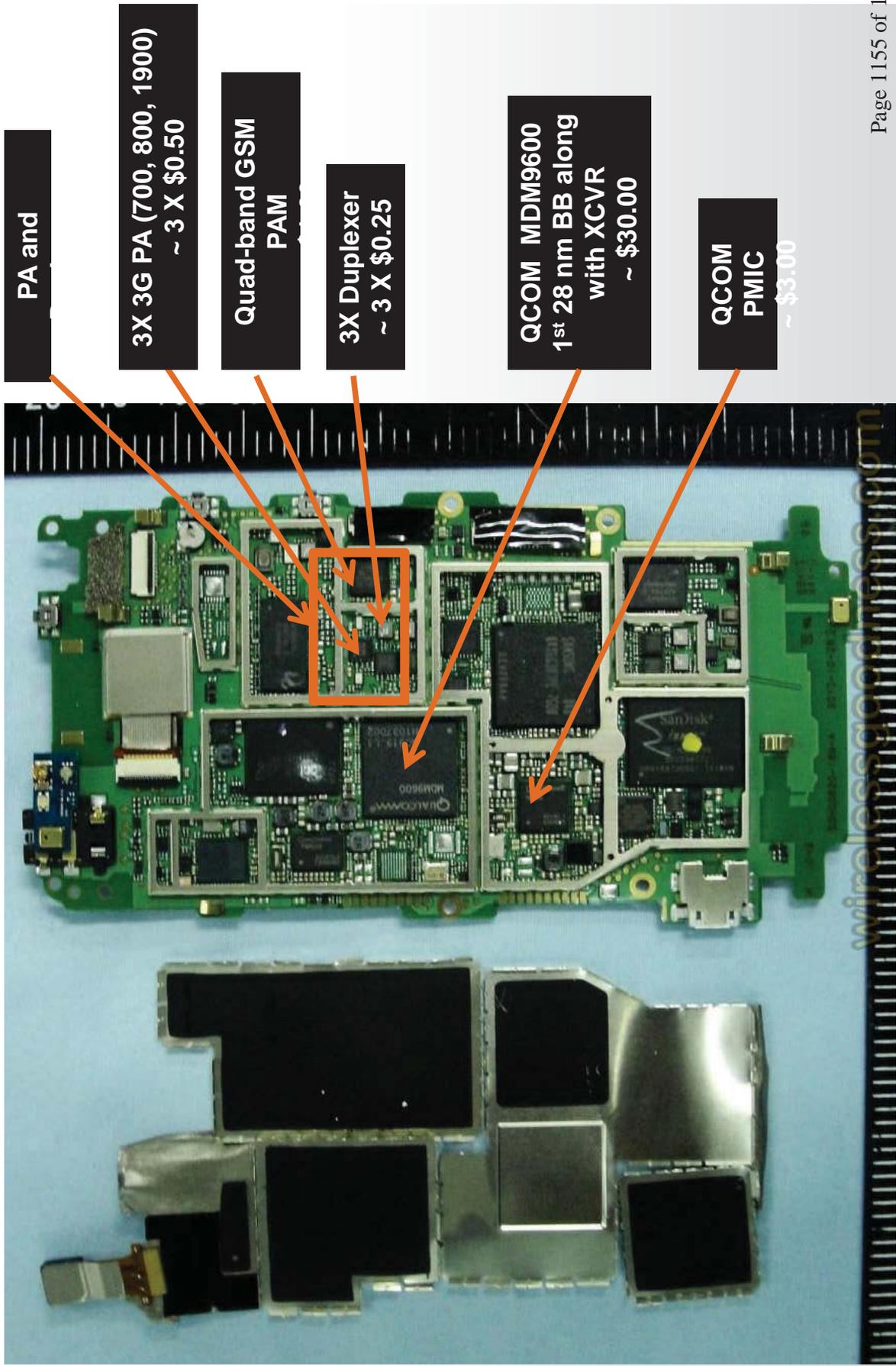
700 MHz Study Objectives

- Provide “Real World” hard engineering data that specifically addresses and quantifies previously submitted general claims that has led to confusion regarding the impact of interference in the lower 700 MHz band
- Quantify answers to questions: If AT&T were to use Band Class 12 versus Band Class 17, would AT&T experience any:
 - Increased levels of interference?
 - Degraded service?
 - Increases in handset costs?
- Are the fundamental assumptions used to support AT&T’s adoption/creation of a separate Band Class 17 technically necessary or marketplace motivated?
- How does the AT&T acquisition of D and E Block licenses affect the need for Band Class 17 ?
 - Has the main rationale originally used to rationalize the creation of Band Class 17 been technically eliminated with this acquisition?
 - Could the acquisition of these licenses impact interoperability among other license holders in the lower 700 MHz band?

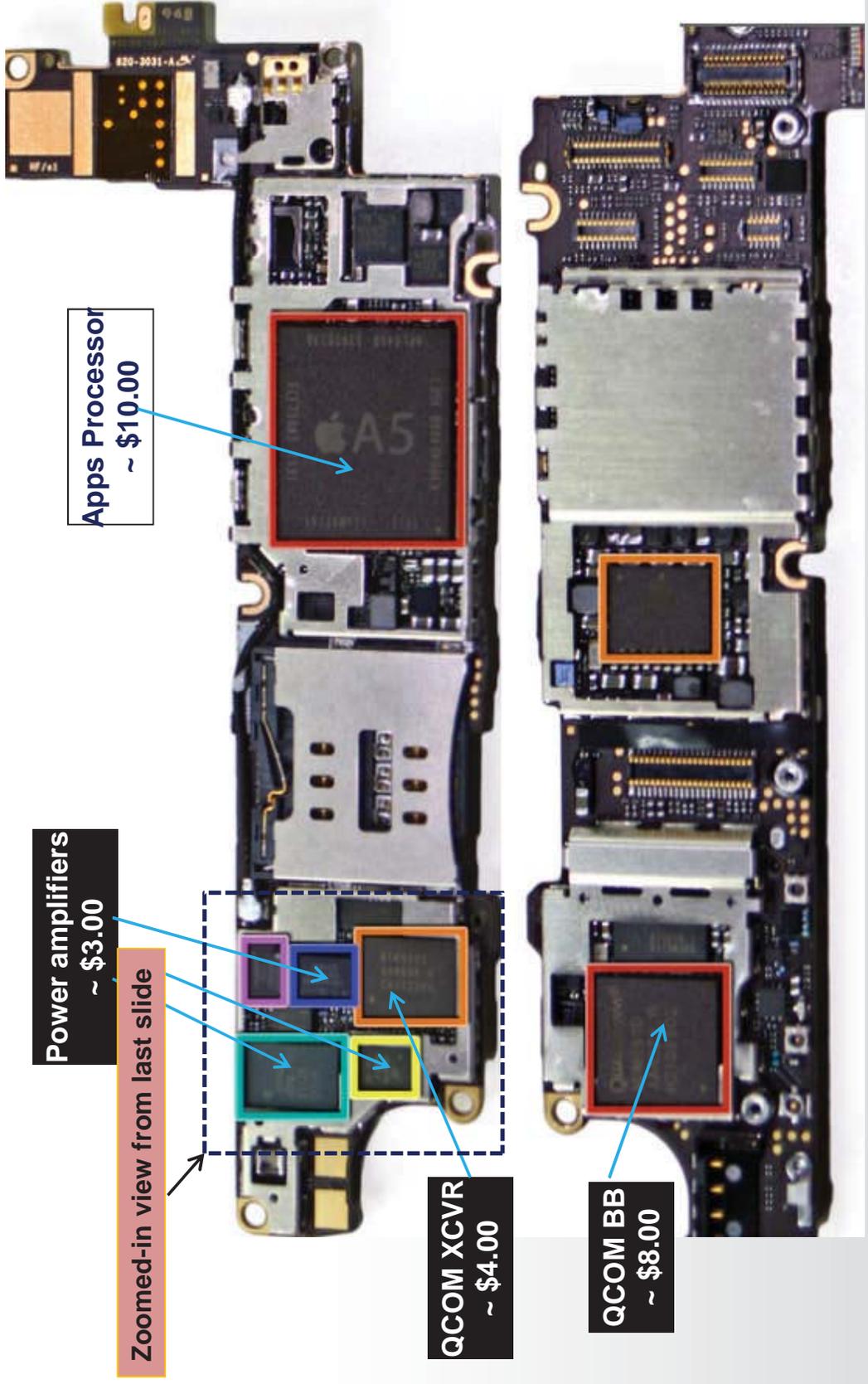
Summary of 700 MHz Study Findings

- Band Class 17 B and C Blocks already suffer greater interference threats from each other than what would be introduced from a unified Lower 700 MHz Band Class that includes the Lower A Block. Neither high power E Block transmissions nor Channel 51 transmissions create an increased interference threat; in fact, the interference threat is lower.
 - AT&T LTE devices currently receive and successfully manage greater levels of interference from within the B and C Blocks than need to be accounted for by unifying the Lower 700 MHz paired bands
 - Concerns and claims made about reverse intermodulation distortion interference are unfounded
- Unsubstantiated concerns and claims about the potential increase in cost or size of devices are inaccurate and misstated as testing shows the BOM costs will remain virtually unchanged.

Device Component Bill of Materials for HTC Thunderbolt



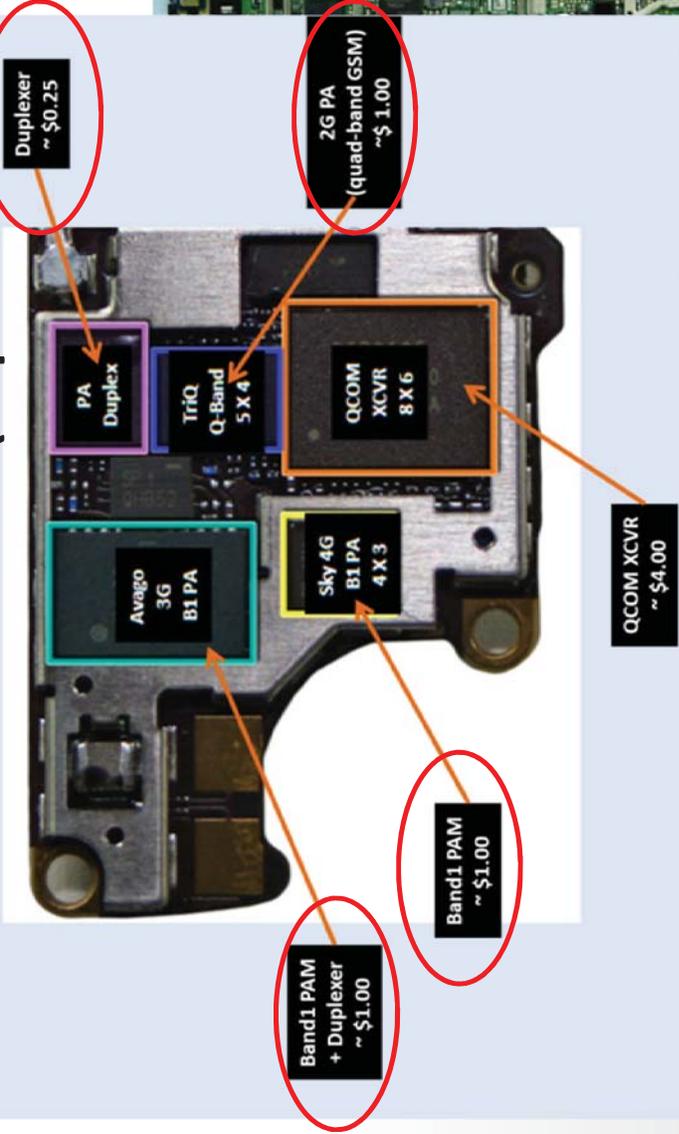
Device Component Bill of Materials for iPhone 4S



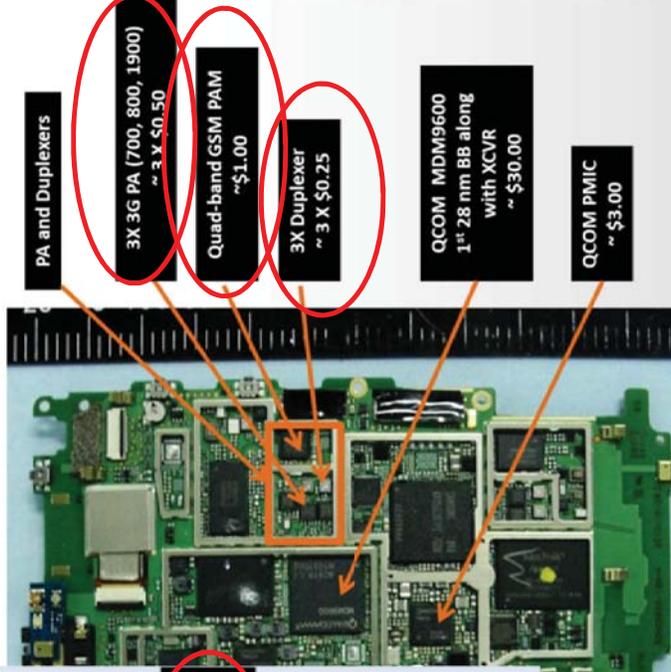
No Cost Increases Anticipated in Either Apple or Android Bill of Materials

iPhone 4S

(Impact of Band Class 12)



HTC Thunderbolt



Device Performance indicates that no changes are required except to simply broaden the duplexer to cover Lower A, B and C Blocks. However, if new filter (and potentially new Power Amplifier Module) components are required, similar BOMs component prices are all < \$1 and, in quantity, have no cost impact.

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 115**

December 14, 2011

VIA ELECTRONIC DELIVERY

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

**Re: Notice of *Ex Parte* Presentations
WT Docket No. 11-18; RM-11592**

Dear Ms. Dortch:

On December 12, Vulcan Wireless LLC (“Vulcan”) representatives Michele Farquhar and Dave Saylor spoke by telephone with Louis Peraertz, Legal Advisor to Commissioner Clyburn, to discuss the critical need for a condition on the AT&T-Qualcomm acquisition that would help restore a consolidated Lower 700 MHz band class.

During the call, the Vulcan representatives discussed the nexus between the transaction and the proposed condition, as described in the attached antitrust and competitive harm analysis provided to Mr. Peraertz yesterday. They also indicated that Vulcan would be responding to several new technical claims made recently by AT&T in this proceeding.

Ms. Farquhar also spoke by telephone with Rick Kaplan, Chief of the Wireless Telecommunications Bureau, on December 12. The parties reviewed the technical and timing issues associated with a condition to reconsolidate the Lower 700 MHz band classes, as discussed in Vulcan’s prior *ex parte* filings in this proceeding.¹

Pursuant to Section 1.1206(b) of the Commission’s rules, I am filing this notice electronically in the above-referenced docket. Please contact me directly with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar

Michele C. Farquhar
Counsel to Vulcan Wireless LLC

Partner
michele.farquhar@hoganlovells.com
D 1+ 202 637 5663

cc: Rick Kaplan
Louis Peraertz

¹ See *Ex Parte* Filing by Vulcan Wireless LLC, WT Docket No. 11-18, RM-11592 (filed Dec. 6, 2011).

**Overview of the Nexus between the AT&T-Qualcomm Transaction
and the Competitive Harm Requiring a Remedy**

Vulcan Wireless LLC

WT Docket No. 11-18

As explained below, there is a compelling factual and legal nexus to justify conditioning any Commission approval of this transaction upon a requirement that all AT&T 700 MHz devices work on all Lower 700 MHz paired blocks, including the A block. AT&T's prior 700 MHz spectrum purchases (which were large relative to other wireless operators) accorded AT&T a significant level of market power as a buyer of 700 MHz equipment. Through predatory market leverage, AT&T has used that market power to elicit private standards body (3GPP) decisions on 700 MHz-specific interference and interoperability issues that, in turn, have raised barriers to market entry by others (namely A block licensees).

AT&T's acquisition of additional 700 MHz spectrum from Qualcomm will broaden and further entrench AT&T's power to perpetuate its influence over 700 MHz equipment manufacturers and the 700 MHz standards-setting and interference-resolving processes, thereby blockading or delaying entry and raising prospective rivals' costs. Indeed, in anticipation of owning the Qualcomm 700 MHz D and E block spectrum, AT&T has already begun trying to manipulate the 3GPP standards body on interference issues relating to those blocks and to the specific detriment of its potential A block competitors. ^{1/}

To justify comprehensive Commission remedial intervention now, there is no requirement in logic or Commission precedent that the instant transaction cause the entirety of the competitive problem, as opposed to measurably deepening and worsening the existing problem. Nor is this the classic case for industry wide rulemaking, namely where numerous industry participants are engaging in common widespread practices long considered proper and legal and suddenly the Commission wants to prohibit or limit those practices prospectively. **The focus here is on one company (i.e., AT&T) which has been accumulating market power with respect to the Lower 700 MHz Band and engaging in coercive and potentially deceptive practices in the industry's standards body (3GPP) for several years.**

In a December 9, 2011 *ex parte* filing, AT&T brazenly threatened to terminate the Qualcomm transaction (despite the potential positive attributes of the transaction) rather than consider a modest condition that would limit AT&T's future ability to dominate the 700 MHz market sector and misuse the associated standards-setting and interference-resolving processes. ^{2/} This unvarnished threat speaks loudly about the need for Commission intervention now – rather than awaiting some future general inquiry – to rein in AT&T's hubris.

An antitrust court would always consider the full marketplace context and past market-shaping behavior of the proposed acquiring firm when deciding if a challenged transaction is

^{1/} See, e.g., *Ex Parte* Filing by Vulcan Wireless LLC, WT Docket No. 11-18, RM-11592 (filed Dec. 6, 2011) (attached hereto as **Attachment A**); *Ex Parte* Filing by Vulcan Wireless LLC, WT Docket No. 11-18, RM-11592 (filed Nov. 30, 2011).

^{2/} *Ex Parte* filing by AT&T Services, Inc., WT Docket No. 11-18 (filed Dec. 9, 2011).

unlawful and, if so, whether it can be made lawful by imposing certain remedial conditions. ^{3/} So the Commission, in exercising its public interest responsibilities to protect competition and consumers, must evaluate the proposed transaction in light of the 700 MHz market structure and history and AT&T's past behavior in that market sector.

By virtue of its actions to date, AT&T already possesses the incentive and the ability to coerce the 700 MHz equipment manufacturers and the private industry standards body to defeat or delay competition from A block licensees. The instant transaction, by providing AT&T an even larger 700 MHz platform, moreover, enhances that AT&T purchasing power in the eyes of 700 MHz manufacturers and expands AT&T's incentive and ability to cause further mischief through the 3GPP industry standards processes and to prevent reform of those processes. Arresting the anticompetitive consequences of ever-increasing monopsony power to which a pending acquisition would contribute is precisely what Commission approval conditions should address.

Notably, the Commission staff recently found that enhancing AT&T's already significant equipment purchasing power through the proposed T-Mobile acquisition may be contrary to the public interest when the exercise of that purchasing power may have the effect of hindering or preventing the design and manufacture of interoperable equipment to the detriment of consumers and rivals. ^{4/} A Commission majority was poised to place that AT&T-specific purchasing power/interoperability issue into hearing until AT&T withdrew its T-Mobile application.

AT&T's Conduct

For the Commission to conclude that AT&T's enhancement of its 700 MHz monopsony power through the Qualcomm acquisition cannot be approved absent a reasonable condition ensuring Lower 700 MHz band paired spectrum interoperability going forward, it is not necessary to find that AT&T's past exercise of that power has violated Commission rules or the antitrust laws.

^{3/} For example, in *United States v. Grinnell Corp.*, 384 U.S. 563 (1966), the Supreme Court affirmed a fully litigated antitrust decision that the defendant had illegally gained monopoly power through a string of acquisitions and various other behavior. In affirming the antitrust liability finding but requiring further relief, the Court accepted the notion that the defendant could keep some of its accumulated businesses while divesting others. *Id.* at 577-78. Importantly for present purposes, the Court also held that the government was correct in insisting upon a decree that would prohibit particular commercial practices that had contributed to the monopoly power and would otherwise continue to act as "substantial barriers to competition" going forward. *Id.* at 576, 578.

Although unusual, the antitrust enforcement agencies have sometimes concluded after litigation that a merger or acquisition found illegal need not be prohibited or unwound but rather should be subject to behavioral conditions so as to preserve the beneficial aspects of the transaction. See, e.g., *Evanston Northwest Healthcare Corp.*, Dkt. No. 9315, slip op. (FTC April 28, 2008) (opinion on remedy) available at <http://www.ftc.gov/os/adjpro/d9315/080428commopiniononremedy.pdf>. The Justice Department considers "conduct remedies" "a valuable tool for the [Antitrust] Division" because "[t]hey can preserve a merger's efficiencies and, at the same time, remedy the competitive harm." U.S. Department of Justice, *Antitrust Division Policy Guide to Merger Remedies* at 6 (June 2011) available at <http://www.justice.gov/atr/public/guidelines/272350.pdf>. Indeed, conduct relief can apply to practices that may not themselves be unlawful and were regularly engaged in prior to the transaction being challenged. See, e.g., Competitive Impact Statement, *United States et al. v. Comcast Corp. et al.*, <http://www.justice.gov/atr/cases/f266100/266158.pdf> (consent decree allowing the acquisition but, inter alia, prohibiting exclusivity practices otherwise common in the industry and lawful).

^{4/} *Applications of AT&T and Deutsche Telekom*, WT Dkt. No. 11-65, page 59 at paras. 120-122.

Nonetheless, the fact that AT&T's 3GPP conduct does raise antitrust concerns is an additional public interest reason to require such a condition in lieu of a time-consuming investigation and hearing.

Applicable Antitrust Law and Precedents

The 3GPP body of which AT&T is a very active member is a private standards-setting body. As the Supreme Court observed, "Private standard-setting associations have traditionally been objects of antitrust scrutiny." *Allied Tube & Conduit Corp. v. Indian Head, Inc.*, 486 U.S. 492, 500 (1988) (*Allied Tube*). This is because "a private standard-setting organization can be rife with opportunities for anticompetitive activity." *American Soc'y of Mech. Eng'rs v. Hydrolevel Corp.*, 456 U.S. 556, 571 (1982). "Collaborative standard-setting is inconsistent with the antitrust laws, for example, if the standard-setting process is biased by members with economic interests in stifling . . . competition." *Allied Tube*, 486 U.S. at 501.

Anticompetitive misuse of the standards-setting process can constitute, depending on the circumstances, a violation of Section 1 of the Sherman Act (concerted conduct in unreasonable restraint of trade), Section 2 of the Sherman Act (illegal acquisition or maintenance of a monopoly; conspiracy or attempt to monopolize), and Section 5 of the Federal Trade Commission Act (unfair or deceptive act or practice, unfair method of competition). See, e.g., *Coalition for ICANN Transparency v. VeriSign, Inc.*, 611 F.3d 495, 506-08 (9th Cir. 2010)(*ICANN*); *Broadcom Corp. v. Qualcomm Inc.*, 501 F.3d 297, 308-20 (3d Cir. 2007); *Rambus, Inc. v. Infineon Technologies AG*, 330 F. Supp. 679, 694-99 (E.D. Va. 2004)(*Rambus v. Infineon*); *In the Matter of Dell Computer Corp.*, 121 F.T.C. 616, 618 (1996).

"[T]he subversion of a [standards setting organization] by a single industry player . . . can result in anticompetitive outcomes. Thus, antitrust law historically has been concerned with the risk of one or a small number of participants . . . turning the [organization] into a source of exclusionary power." *Rambus v. Infineon*, 330 F. Supp. at 696. Coercing a private standards body through threats of legal or economic consequences, unethical and deceptive practices, or more subtle predatory means such as working behind the scenes through ostensibly independent but actually economically rewarded standards body participants, may violate the antitrust laws. *Allied Tube*, 486 U.S. at 495-97; *ICANN*, 611 F.3d at 505-08.

An important line of FTC precedents makes clear that misrepresentation and/or the failure to disclose critical information in the standards-setting process, as well as the failure to abide by commitments to be open and fully forthcoming with the standards body on critical competition issues, can be an illegal abuse or misuse of market power and improper under the antitrust laws. See, e.g., *Dell Computer Corp. supra*; Complaint and Analysis of Proposed Consent Order, *Negotiated Data Solutions LLC*, Dkt. No. C-4234 (FTC 2008) available at <http://www.ftc.gov/os/caselist/0510094/080122complaint.pdf> and <http://www.ftc.gov/os/caselist/0510094/080122analysis.pdf>; see also *Rambus Inc. v. FTC*, 522 F.3d 456 (D.C. Cir. 2008) (overturning FTC on facts and holdings of particular case but not rejecting the notion that deceptive failure to disclose critical facts to a private standards body may constitute an antitrust violation in certain circumstances).

One reason why the antitrust laws permit certain collaborative standards-setting practices is to respond in certain industries (like telecommunications) to a genuine "need for interoperability," *i.e.*, "the ability of one manufacturer's product to interface with another manufacturer's product. *Rambus*

v. Infineon, 330 F. Supp. 2d at 696 and n. 26. However, if at the instigation of a dominant competitor the result of the standards-setting process is to diminish or eliminate interoperability and thereby raise insuperable barriers to effective competition, that dominant competitor's conduct in the standards-setting venue may well be subject to antitrust liability and a comprehensive remedy that reinstates interoperability.

AT&T's Conduct in the 3GPP Process to Foreclose Interoperability

As the Commission knows, the preparation for the 700 MHz auction (Auction 73) proceeded throughout 2007, with finalization of the spectrum blocks to be auctioned and the completion of technical rules. Auction 73 began January 24, 2008 and concluded March 18, 2008. Actual license grants occurred later that year, but use of the licenses was delayed due to a postponement of the deadline for the digital TV transition out of that spectrum until June 2009. Certainly AT&T knew in mid-2008 that it had won considerable spectrum in the B and C blocks and that numerous small, new competitors were being licensed in the A block. Prior to the bidding, the industry standards process had left every indication that the Lower A, B, and C blocks would be grouped in Band 12 and that winners of the A block licenses would be in an economically and technically viable ecosystem in which devices (at that point using 3G UMTS technology) would work on all three spectrum blocks.

By early 2008 technology was advancing and carriers as well as manufacturers began to focus on standards for using the 700 MHz spectrum to provide 4G LTE service. In February 2008, Ericsson proposed and the 3GPP body agreed to consider defining the base station specifications for LTE as Band 12, i.e., encompassing the A, B, and C blocks in a single band. (Meanwhile Band 12 was formally approved for UMTS the following month.) Then Auction 73 was concluded and it was clear AT&T had a strong position in Blocks B and C and was going to face competition from A Block licensees.

Conveniently for AT&T in May 2008, one of AT&T's major equipment suppliers, Motorola, asserted to the standards body that the A block might experience interference from sources outside Band 12 and that therefore it would be desirable to create a smaller sub-band (originally called Band 15 but later Band 17) consisting of blocks B and C. ^{5/} If adopted, this meant that equipment suppliers could design and manufacture equipment for their major customer AT&T that would not interoperate with the A block.

In June 2008, Ericsson refuted Motorola's interference concerns making clear that the stated concerns were very manageable. Ericsson argued that Band 15 (later 17) was not only unnecessary to protect B and C block operators but that creating the new band would fragment the market. ^{6/} AT&T in its June and August 2008 submissions to the standards body made several technically incorrect or exaggerated assertions about the interference issues and possible technical

^{5/} 3GPP TSG RAN WG4 (Radio) Meeting #47, Kansas, USA (April 5-9, 2008), R4-081108 (attached hereto as **Attachment B**).

^{6/} TSG-RAN Working Group 4 (Radio) Meeting #47bis, Munich, Germany (June 16-20, 2008), R4-081356 (attached hereto as **Attachment C**).

remedies. 7/ Moreover, AT&T made clear that it only planned operations on blocks B and C and wanted its own band (Band 17) for those two blocks. 8/

As AT&T well knew, the comparatively small and new entrants into the wireless industry who had acquired A block licenses were not yet involved in 3GPP and were not present in the standards discussions. They were not invited to explain their business plans or how a failure to fully examine the supposed interference issues and to rush to judgment on the creation of a basically AT&T-only Band 17 would erect a major economic barrier to their being able to build a business out of A Block licenses. AT&T used its long-standing economic power as an equipment purchaser to push the manufacturers who were significant 3GPP participants to quickly approve the creation of Band 17. 9/

The reports of the June and August 2008 3GPP meetings which indicate who spoke on the Band 17 subject make clear that the effect of creating Band 17 on A block licensees in the United States was effectively hidden by AT&T and its loyal supporters. 10/ Most of the 3GPP attendees from other parts of the world were not familiar with the particular 700 MHz licensing situation in the U.S. and were not really in a position to care about the effect of Band 17 on the U.S. A block licensees. Although there are a few references to Ericsson's concern about market fragmentation, there was no explanation or acknowledgement that the creation of Band 17 would have a major detrimental impact on Lower 700 MHz interoperability between the A block and the B and C blocks.

AT&T (as paraphrased in the 3GPP minutes) affirmatively played down Ericsson's concern over market fragmentation by saying "one subband more may not make a big difference in the market fragmentation" and the creation of this "subband" (Band 17) was "the simplest and the quickest way to solve the [supposed interference] problem." 11/ Conveniently, Qualcomm (licensee of the D and some E blocks) was there to vocally support AT&T, as did Motorola. 12/ Plainly, the 3GPP as a body was misled into thinking that the creation of Band 17 as a "subset" would ameliorate technical interference concerns rather than eliminate as a practical matter any chance of interoperability with the B and C blocks for the A block licensees and thus seriously handicap A block licensees from ever using their spectrum.

Conclusion

It is plain that AT&T used its market power as the major U.S. customer for 700 MHz equipment suppliers and potentially deceptive argumentation rife with critical omissions to coerce and mislead the 3GPP body into adopting a very economically significant Band change without any acknowledgment or analysis of the major economic consequences of that change. AT&T could not

7/ 3GPP TSG RAN WG4 (Radio) Meeting #47bis, Munich, Germany (June 16-21, 2008), R4-081324 (attached hereto as **Attachment D**); Change Request, 3GPP TSG RAN WG4 Meeting #48, Jeju, Korea (August 18-22, 2008), R4-082179 (attached hereto as **Attachment E**).

8/ *Id.*

9/ *Id.*

10/ Report of the 3GPP TSG RAN WG4 meeting #47bis, Munich, Germany (June 16-20, 2008) (excerpts attached hereto as **Attachment F**); Report of the 3GPP TSG RAN WG4 meeting #47bis, Jeju, Korea (August 18-23, 2008) (excerpts attached hereto as **Attachment G**).

11/ See Attachment F.

12/ See Attachment F at p. 29.

have accomplished that anticompetitive result without the overwhelming equipment purchasing power it maintains for the 700 MHz spectrum. AT&T's actions had the purpose and effect of maintaining and expanding that market power. AT&T's strategy of enhancing its own market power and erecting a major barrier to the entry of A block rivals raises serious questions under the antitrust laws and precedents discussed above and under Commission public interest principles that incorporate antitrust concerns.

Moreover, the actions of AT&T's vendors last month reinforce concerns about AT&T's ability to harm other Lower 700 MHz spectrum holders if the FCC approves the AT&T-Qualcomm transaction. AT&T's proposed acquisition of Qualcomm's 700 MHz spectrum will further enhance AT&T's purchasing power and its consequent ability to use that power in the 3GPP processes to preserve and perpetuate its unfair advantage – an advantage that may have been deceptively obtained.

The Qualcomm deal will further exacerbate the situation in a seriously anticompetitive way unless the Commission insists upon mandatory Lower 700 MHz band interoperability across all three blocks (A as well as B and C) as a condition for approving the Qualcomm transaction. Such a remedy will address a serious competitive and public interest harm enhanced and exacerbated by the Qualcomm transaction. The proposed remedy is more than adequately "specific" to that transaction so as to satisfy the Commission's understandable desire to adopt only those approval conditions that are "specific" to cognizable transaction-based harms.

Attachment A

December 6, 2011

VIA ELECTRONIC DELIVERY

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

**Re: Notice of *Ex Parte* Presentation
WT Docket No. 11-18; RM-11592**

Dear Ms. Dortch:

On December 2, 2011, Vulcan Wireless LLC (“Vulcan”) representatives Scott Wills, Paul Nagle, Paul Kolodzy, and Michele Farquhar met with Commissioner McDowell and Angela Giancarlo, his Chief of Staff and Senior Legal Advisor, to discuss the critical need for a condition on the AT&T-Qualcomm acquisition that would help restore a consolidated Lower 700 MHz band class.

During the meeting, the Vulcan representatives discussed the concerns that are dramatically impeding A Block broadband deployment (as described in the attached presentation distributed at the meeting). They discussed a key condition that the Commission must impose before allowing the transfer of Qualcomm’s 700 MHz spectrum to AT&T, or the transaction will further subvert FCC policy, decrease market competitiveness, and further delay the deployment of 4G networks.

They also discussed the following points:

- The Commission should only impose a single condition that restores the original Lower 700 MHz band plan, which would reconsolidate and unify the paired spectrum in the Lower 700 MHz band (*i.e.*, the A, B, and C Blocks);
- The Commission should promptly grant the transfer with this condition, as a reunified band will speed network deployment. Conversely, failure to address the fragmentation of the Lower 700 MHz band now will cause additional delay in network deployments and discourage participation by smaller operators in future spectrum auctions, thereby reducing the value of spectrum, discouraging competition, and subsequently driving up costs to consumers; and
- The Commission should provide AT&T with a sufficient amount time to comply with the condition by affording AT&T up to two years to fully comply with any such condition and ensure that all of its 700 MHz mobile handsets operate on the unified Lower 700 MHz band plan.

The representatives also discussed the results of a “real world” study, funded by a consortium of several Lower 700 MHz A Block licensees,¹ intended to prove or disprove the unsubstantiated claims previously submitted to the FCC and 3GPP by AT&T and Qualcomm, among others, regarding the need for establishing two separate band classes to govern only three spectrum blocks. As described in more detail in the attached presentation and in Vulcan’s November 25 *ex parte* in this proceeding, the findings of the study were as follows:

- The underlying assumptions and claims put forth in 3GPP proceedings rationalizing a separate Band Class 17 were incorrect or overstated;
- Different operators’ systems in the Lower 700 MHz B and C Blocks actually pose a threat of interference to each other that is greater than any threat that would be introduced from a unified Lower 700 MHz band class that includes the A Block;
- Neither the high power E Block transmissions nor Channel 51 transmissions present an interference threat to AT&T’s LTE devices, which currently receive and manage signal level disparities from within the B and C Blocks that are greater than those which would need to be accounted for by restoring the original Lower 700 MHz band plan;
- Concerns about reverse intermodulation distortion interference are unfounded, as commercially deployed AT&T devices did not experience any such interference; and
- The vague and exaggerated concerns regarding the potential increase in cost and/or size of devices necessary to operate on a reunified Lower 700 MHz band plan are without merit, as the cost of devices with such a condition will be virtually unchanged.

Finally, Vulcan explained how the proposed transaction has already negatively impacted other Lower 700 MHz spectrum. Within the last two weeks, a leading AT&T 4G network vendor submitted a proposal to the 3GPP (seemingly endorsed by AT&T) to have other non-AT&T 700 MHz spectrum holders reduce the amount of their usable bandwidth to compensate for AT&T’s anticipated use of the D Block. This proposal was not revealed to the FCC in any filings by AT&T, Qualcomm, or any vendors supporting this proposed transaction. Designed solely to accommodate AT&T’s use of the D Block spectrum, this proposal would force non-AT&T spectrum holders to forfeit their valuable spectrum rather than require AT&T to bear the full responsibility of setting aside its own guard band to accommodate its operations on the D Block.

¹ The consortium members include: Vulcan Wireless, King Street Wireless, Cavalier Wireless, Continuum 700, Cox Wireless, C Spire and MetroPCS.

Pursuant to Section 1.1206(b) of the Commission's rules, I am filing this notice electronically in the above-referenced docket. Please contact me directly with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar

Michele C. Farquhar
Counsel to Vulcan Wireless LLC

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cc: Commissioner McDowell
Angela Giancarlo

Attachment B

Source:	Motorola
Title:	TS36.101: Lower 700 MHz Band 15
Agenda Item:	6.1.2
Document for:	Discussion

1 Introduction

This document is presented as a discussion paper to evaluate the need for a new operating band to support block B and block C in the lower 700MHz band. This new operating band would be in addition to that in [1], for UTRA Band XII which supports Block A, Block B and Block C. The rationale for this new band is to address possible co-existence issues with High power TV broadcast transmission in Channel 51 and other broadcast transmission in channel 55 (Block D) and channel 56 (Block E).

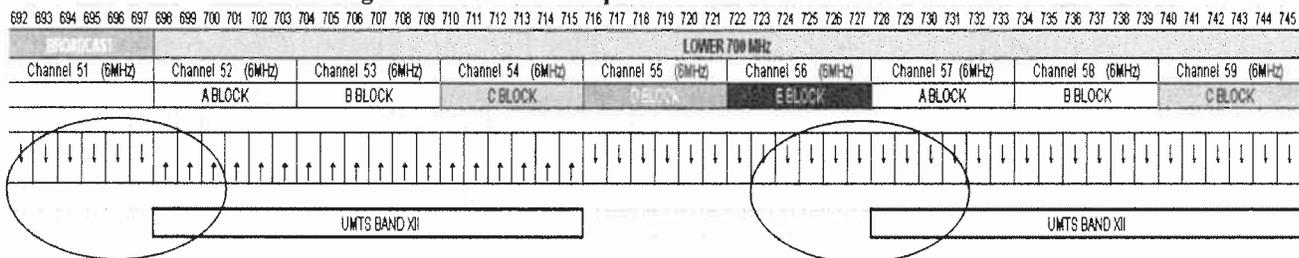
This document provides some of the rationale for this new band and a draft TP for discussion. These discussions should also encompass the future role of Band 12 in terms of either; following the same approach as UTRA in supporting Bands A, B and C, or be limited to Block A and B, in order to complement the proposed new band. In this case, inputs from the relevant spectrum stake holders, would be useful before a final decision can be made

A draft TP is provided for TS36.101 for this new band 15. This is in order to show how this could be implemented in the specification

2 Background

The FCC channel plan and 3GPP UTRA plan [1] is provided below;

Figure 2-1 FCC channel plan and UMTS Band X11



Band XII includes both A block (2x6MHz), B block (2x6MHz) and C block (2x6MHz). Using the FCC channel plan as a base line we note;

- a) Per FCC, ERP for channel 51 can be between 500 KW (87 dBm) and 5MW (97 dBm). According to the FCC site (using the stringent mask) emissions must be attenuated 47 dB at the channel edge and no less than 76dB at a 3MHz offset.
 - As A block (Channel 52) is adjacent to Digital TV (channel 51) this would result in a high level of out of band emission into channel 51 (A block) and would place stringent requirements on the adjacent Rx and ACLR performance for a eNodeB operating in the same geographical area. In this case deployment of channel 52 (A block) site would need to be conditioned on the site location of a high power channel 51 transmitter.
- b) For a UE operating in a Band 12 configuration (A+ B+ C), this would result in a significant in-band power when roaming near a channel 51 broadcast transmitter since limited RF filtering would be available for the adjacent Channel 51 if A block is part of the operating bandwidth. This large in band power would intermod with an existing UE transmission in block A, B and C to generate spurious emission ($2F_1-F_2$) in other parts of

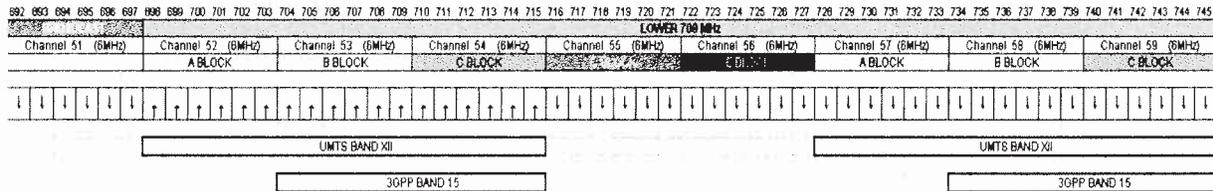
the 700 MHz spectrum. The key issue for Tx IM is the level of the DTV Channel 51 wideband signal that would be present at the UE antenna port based on a reasonable deployment scenario

- c) As shown in figure 2-1, there may be some impact performance from high broadcast transmission for channel 55/56 for UE supporting Band 12 (A+ B+ C) as since limited RF filtering would be available to provide adequate UE Rx out of band blocking rejection if A block part of the operating band. Again, the magnitude of this problem is a function of the operator's deployment scenario.

3 Proposal for discussion

In order to address the co-existence issues highlighted in section 2 an additional EUTRA band [15] could be created as shown in figure 2.1-1 below

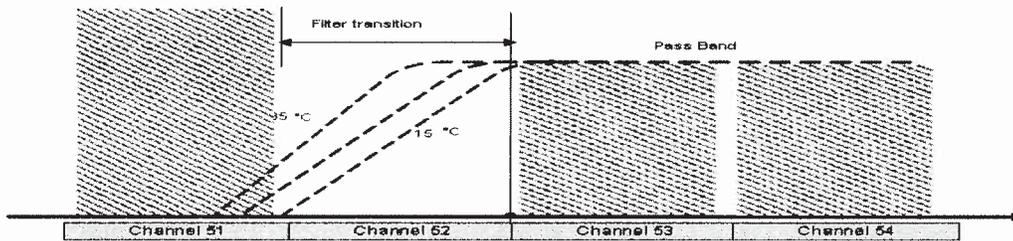
Figure 3-1 Band 15 proposal for Lower 700 MHz



3.1 Impact on Tx IMD and Rx blocking

Based on the operating band in Figure 2.1-1 additional front end RF filtering would be provided by the duplex filter in lieu of block A as shown in figure 3.1-1 below for both TX IMD and Rx out of band blocker performance

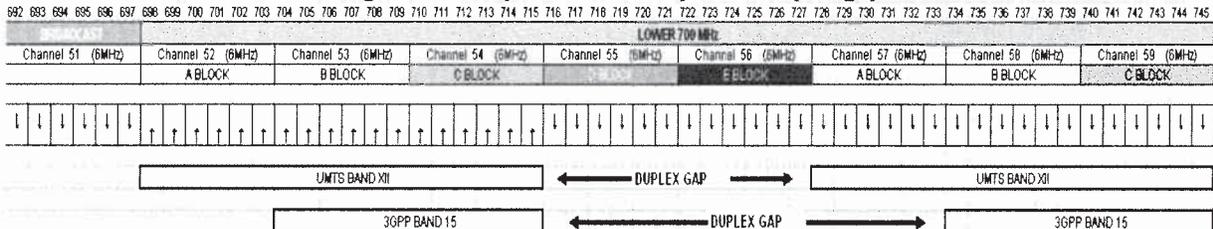
Figure 3.1-1 Channel 52 and 57 used as filter transition



3.2 Impact of duplex performance

The duplex distance for both band 12 (A+ B+ C) and Band 15 (B+C) is shown below in figure 3.2-1. In this case the duplex gap would increase from 12MHz for Band 12 to 18MHz and Band 15 would start to resemble Band V in terms of duplex gap, so we would expect an improvement in terms of Rx sensitivity and Tx output power for Band 15.

Figure 3.2-1 impact on channel plan on duplex gap



3.3 Impact of channel bandwidth / self interference

Self interference is a function of, Tx – Rx spacing, duplex filter performance, Tx power and transmitted RB(s). For a fixed duplex gap the self interference increases with channel bandwidth, transmit power and RB allocation. However, as the same TX-RX spacing is maintained, we would not expect a significant difference in desense performance for either band 12 or band [15].

3.4 Implementation aspects of adding a new operating band

All though there appears to be merit in terms of co-existence performance for the addition of a new operating, the number of operating bands a UE terminal would need to support would increase and some practical limitations may be necessary to reduce implementation complexity. In this scenario roaming between band 12, 13, 14 and 15 could be impacted depending on the number of E-UTRA support bands a UE could support.

4 Proposal / Conclusions

This document provides some of the rationale for this new band 15], and how this could be formulated in the specification for the Lower 700 MHz. A TP draft proposal for E-UTRA operating band is provided

As part of the discussions for band 15 we would welcome further discussion on E-UTRA band 12. In this case it is not clear if Band 12 should be aligned with UTRA Band XII to include Blocks A, B and C or just be limited to Block A and B.. Therefore, we propose to maintain the TBD status until this aspect is clarified.

----- Start of draft TP for TS36.101 -----

5.1 General

The channel arrangements presented in this clause are based on the frequency bands and channel bandwidths defined in the present release of specifications.

NOTE: Other frequency bands and channel bandwidths may be considered in future releases.

5.2 Frequency bands

E-UTRA is designed to operate in the frequency bands defined in Table 5.2-1.

Table 5.2-1 E-UTRA frequency bands

E-UTRA Band	Uplink (UL) eNode B receive UE transmit	Downlink (DL) eNode B transmit UE receive	UL-DL Band separation	Duplex Mode
	F _{UL_low} – F _{UL_high}	F _{DL_low} – F _{DL_high}	F _{DL_low} - F _{UL_high}	
1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	130 MHz	FDD
2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	20 MHz	FDD
3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	20 MHz	FDD
4	1710 MHz – 1755 MHz	2110 MHz – 2155 MHz	355 MHz	FDD
5	824 MHz – 849 MHz	869 MHz – 894MHz	20 MHz	FDD
6	830 MHz – 840 MHz	875 MHz – 885 MHz	35 MHz	FDD
7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	50 MHz	FDD
8	880 MHz – 915 MHz	925 MHz – 960 MHz	10 MHz	FDD
9	1749.9 MHz – 1784.9 MHz	1844.9 MHz – 1879.9 MHz	60 MHz	FDD
10	1710 MHz – 1770 MHz	2110 MHz – 2170 MHz	340 MHz	FDD
11	1427.9 MHz – 1452.9 MHz	1475.9 MHz – 1500.9 MHz	23 MHz	FDD
12	[TBD] – [TBD]	[TBD] – [TBD]	[TBD]	FDD
13	777 – 787	746 – 756	21	FDD
14	788 – 798	758 – 768	20	FDD
[15]	[704] - [716]	[734] - [746]	[18]	[FDD]
...				
33	1900 MHz – 1920 MHz	1900 MHz – 1920 MHz	N/A	TDD
34	2010 MHz – 2025 MHz	2010 MHz – 2025 MHz	N/A	TDD
35	1850 MHz – 1910 MHz	1850 MHz – 1910 MHz	N/A	TDD
36	1930 MHz – 1990 MHz	1930 MHz – 1990 MHz	N/A	TDD
37	1910 MHz – 1930 MHz	1910 MHz – 1930 MHz	N/A	TDD
38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	N/A	TDD

5.3 TX–RX frequency separation

5 References

- [1] 3GPP TR25.822 v1.0.0 UMTS 700 MHz Work Item Technical Report

Attachment C

Source: Ericsson
Title: On the introduction of Band 15
Agenda item: 6.1.2.2
Document for: Discussion

1 Background

It has been proposed to introduce Band 15 as a subset of the current Band 12 to resolve certain co-existence issues [1]. The current Band 12 covers Blocks A+B+C in the lower 700 MHz band in Region 2, Band 15 would cover B+C (see Figure 1).

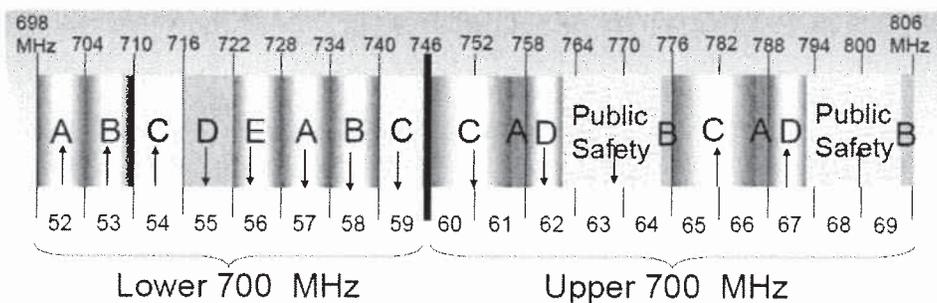


Figure 1 Band plan for Region2.

There are indeed some technical benefits of introducing Band 15, but there are also drawbacks. There would be two duplexers covering part of the lower 700 MHz (it has also been proposed to limit Band 12 to A+B), which goes against economies of scales and may lead to market fragmentation.

In this contribution, some of the co-existence issues are addressed to assess the merits of Band 15.

2 Discussion

2.1 Digital TV in Channel 51 and MediaFLO into eNB

DTV interference into eNB RX is the most difficult of the interference scenarios considered.

For DTV in Ch51 (and MediaFLO in Ch55, Block D/E) there are two interfering mechanisms

- Out-of-band emission (OOBE) from the TV transmitter falling into the LTE RX passband
- eNB RX blocking by an adjacent TV signal. Blocks A and C then the most prone

see Figure 2. The OOBE cannot be mitigated by filtering at the eNB, it must be done at the TV transmitter. Duplex- and additional filter can mitigate the RX blocking.

OOBE is thus not relevant for the Band 15 issue, we only note that for DTV (5 MW eirp) Block A will be significantly degraded in the neighbourhood of the TV transmitter unless 25 dB extra attenuation of a power reduction is supplied at the DTV transmitter, Blocks B and C are not impacted by Ch51.

When analysing the blocking we consider a DTV transmitter with 5 MW eirp (largest transmitters typically mounted in high TV masts) and a MediaFLO at 50 kW eirp. Clearly, a Band 15 duplexer would reduce the DTV blocker level but leave the MediaFLO unaffected.

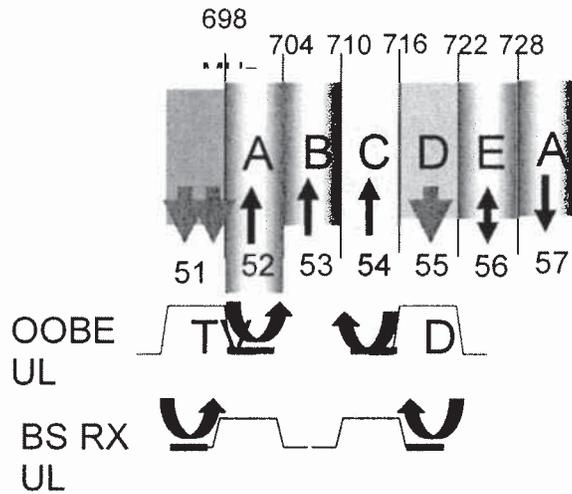


Figure 2 Interference from DTV in Ch51 and MediaFLO in Ch55.

The coupling between the broadcast transmitter and the eNB RX is highly dependent on the relative difference in height (see Figure 3) and the inter-site distance. Examples provided here represent worst case scenarios, in real deployments analysis must be made on a case-by-case basis. Clearly, additional filtering or different duplex arrangements in the eNB is only needed in the vicinity of the broadcast transmitter.

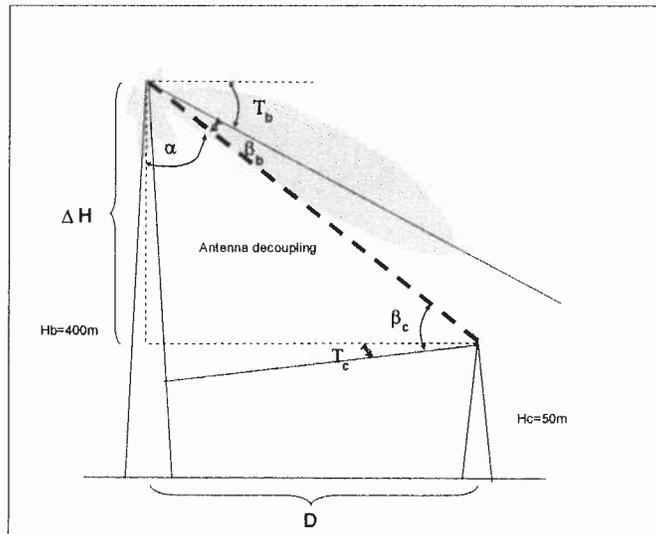


Figure 3

Considering a DTV 6 MHz interference in Ch51 the A block at 6 MHz offset from the broadcast signal will be the most impacted, an additional 35 dB of eNB filtering is needed at 698 MHz, which can be implemented at moderate loss in the RX passband. Block B will be less impacted and it suffices with a 15-20 dB additional attenuation is needed at 698 MHz. However, this can easily be achieved with an external filter for LTE sites close to the broadcast tower and is not a major reason for introducing a Band 15 duplexer.

For MediaFLO at 50 kW eirp the C block will be most impacted, but with some 20 dB extra external attenuation at 716 MHz the blocking can be mitigated with less than 1% degradation. Band 15 instead of Band 12 would have a very limited effect here.

To sum up: the interference from DTV at Ch51 does not in itself motivate the introduction of Band 15, for block B+C licence holders additional attenuation can be provided at the eNBs located in the vicinity of the broadcast tower.

2.2 MediaFLO into UE

The next scenario is interference from broadcast transmitting on Ch 55 (Block E) into LTE downlink Blocks A, B and C, see Figure 1. A Band 15 duplexer would then provide extra attenuation for Blocks B and C, but A is the most critical. The broadcast transmitter power is 50 kW eirp. Blocking is the worst case interference here as compared to that of OOBE.

The assumptions for the coexistence simulation are

- one broadcast system at 50 kW from a 138 m mast with a 12 dBi antenna
- a cellular system with a cell grid of 1000 m

The UE will be subject to a performance degradation close to the broadcast site. Figure 4 shows the degradation as a function of distance from the broadcast site for a 5 MHz channel in Blocks A, B and C at 6, 12 and 18 MHz separation, respectively. Block A is the most sensitive with a 1.3% performance degradation in the downlink. Block B is at 0.2%, a Band 15 duplexer would have reduced this further.

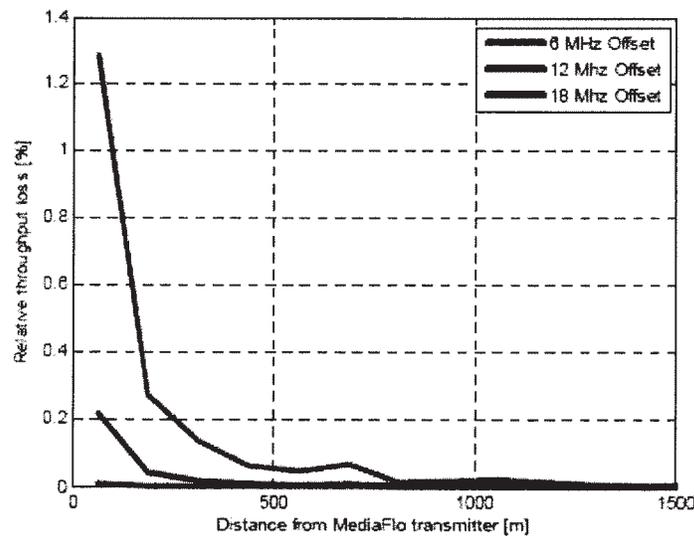


Figure 4 Interference from MediaFLO into downlink Blocks A, B and C.

A 500 m high broadcast tower would also have given a 0.2% degradation for Block B. Summarizing: it is questionable if a Band 15 duplexer should be introduced based on the coexistence results considered above.

2.3 TX IM due to DTV

The last issue considered is UE TX intermodulation of a lower 700 MHz LTE signal with a powerful DTV signal. The latter is a 6 MHz DVB-T signal in Ch 51 centred at 695 MHz transmitted at 5 MW eirp. The intermodulation occurs in the UE TX chain and may produce products falling in the UE transmit and receive bands. For UTRA, TX IM is specified as IM with a CW interferer, which will produce IM products of up to 10 MHz bandwidth. Now we have IM between two wideband signals which will produce a IM product that will interfere over a larger bandwidth but a lower PSD.

We assume that the DTV signal is centered at f_i with the LTE transmitted signal at $f_0 = f_i + \Delta f$ (centered at Blocks A, B and C or combinations). The IM product is produced from the sum of the DTV and LTE signals

$$u = A \cos 2\pi f_i t + B \cos 2\pi f_0 t$$

where A and B are bandpass signals of bandwidths equal to the DTV and LTE signals, respectively. The TX nonlinearity is modelled as

$$g(x) = \sum_{j=1} k_j x^j$$

Now, the 3rd order intermodulation product will appear at the following frequencies with amplitudes

$$f_i \quad k_1 A + \frac{3}{4} k_3 (A^3 + 2AB^2)$$

$$f_0 \quad k_1 B + \frac{3}{4} k_3 (2A^2 B + B^3)$$

$$2f_0 - f_i = f_0 + \Delta f \quad \frac{3}{4} k_3 AB^2.$$

The IM product at $2f_i - f_0$ falls into the broadcast band. The product at $f_0 + \Delta f$ may fall into the receive band, considering its amplitude and using the supports of convolution in the spectral domain, it follows that it's located at

$$f_0 + \Delta f \pm \frac{1}{2} (BW_A + 2BW_B)$$

with regard to the LTE transmitted signal. Table 1 shows the frequency of this IM3 product in relation to the UE receive bands for various scenarios and LTE bandwidths

Table 1. IM3 in relation to the LTE receive band for a 6 MHz DTV interferer in Ch 51.

LTE Block	Interferer separation Δf MHz	IM3 frequency MHz	LTE receive band MHz
A (5 MHz)	6	699-715	728-734
B (5 MHz)	12	711-727	734-740
C (5 MHz)	18	723-739	740-746
A+B (10 MHz)	9	700-726	728-740
B+C (10 MHz)	15	712-738	734-746

For the 5 MHz LTE cases the IM3 will not overlap with the receive bands and the TX duplexer will provide more than 40 dB of attenuation outside the transmit band, so these products will likely not be blocking the UE receiver. The level depends on the linearity of the TX, the intermodulation requirements and required linearity is still TBD in TS 36.101.

There may be a problem for 10 MHz channels in B+C where part of the IM product will fall into the receive band (a problem even if the duplexer provides attenuation). The TX filter of a Band 15 duplexer could then decrease the DTV signal, but the reduction as compared to a Band 12 duplexer is still TBD as there are few 700 MHz filters available at present (ongoing work).

Looking at the frequencies of the IM3 products it appears that the only scenario that motivates a Band 15 duplexer is the 10 MHz LTE allocation in B+C for terminals used in the vicinity of broadcast transmitters. TX IM problems would of course also be alleviated for Block B channels.

3 Proposal

Collecting the results

- starting with the most difficult case, DTV and MediaFLO interference into eNB, we note that this requires additional filtering in the eNB in the vicinity of the broadcast tower for duplexers involving Block A (i.e also for the current Band 12), for Block B the filter requirements are less stringent
- MediaFLO interference into the LTE downlink will be most severe for Block E broadcast into Block A downlink, but it appears that the degradation does not translate into more than a percent of performance loss for LTE

- TX IM could be a problem for B+C licence holders when 10 MHz channels are deployed near big 5 MW eirp DTV transmitters

The first item above can be solved by external filters at the eNB close to the broadcast site and does not motivate a Band 15 duplexer in all eNB since the requirements on the external filter for Block B+C would not be difficult (Block A provides a guard). MediaFLO interference into Blocks B and C is a smaller problem than A assuming a Band 12 duplexer.

The TX IM in the vicinity of high-power broadcast transmitter will be alleviated for Block B, but the extra attenuation of the TX duplexer is still uncertain. The isolation has to be provided on the “wrong” side of the TX duplexer filter that needs to provide high attenuation in the RX band on the other side of the passband.

Unless there is a severe problem with TX IM and difficult MediaFLO into LTE UE interference scenarios can be identified, Band 15 should not be introduced considering the risk of market fragmentation. However, the interference issues will remain for Block A holders regardless of Band 15 and still needs to be resolved. Nevertheless, the risk of interference will always be higher for Block A holders.

References

- [1] R4-081108, “TS36.101: Lower 700 MHz Band 15”, Motorola

Attachment D

Source: AT&T
Title: Performance and coexistence issues in the Lower 700 MHz band.
Agenda Item: 6.1.2.1
Document for: Discussion
Contact: David Shively, david.shively@att.com, Marc Grant marc.grant@att.com

1. Introduction

This document is provided as discussion related to prior contributions on the 700 MHz bands to be used in the US and also the proposal for a new band (Band 15) to include only a portion of the Lower 700 MHz band [1].

2. Background

The band plan for the Lower 700 MHz band and the allowed power limits (ERP) are shown in Figure 1 below. Currently, AT&T has acquired spectrum licenses in only the B and C Blocks as indicated in the shaded blocks in the figure. The digital TV (DTV) broadcast stations on channels 51 and below are permitted to transmit up to 1 MW ERP. The unpaired D and E Blocks are permitted to transmit up to 50 kW and some of these stations are already in service on D Block with MediaFLO broadcast service for mobile devices. It is expected that similar transmitters and power levels will be used in E Block. The transmit power limits for the paired blocks (A, B, and C) are given in terms of power spectral density as 1 kW/MHz and this is approximated as 6 kW although the expected power levels for 2-way services are expected to be much lower than the maximum limit (expected to be 500 to 1000 W ERP, similar to cellular service at 850 MHz). The paired C Block is also allowed to transmit up to 50 kW for broadcast services but it is assumed that the C Block will be used for 2-way services in combination with B Block and will be limited by the 1 kW/MHz level. Note that the limit for the Upper 700 MHz blocks is also 1 kW/MHz and this means the 11 MHz block is allowed up to 11 kW. However, it is assumed that that block will also be used for 2-way services and will have power levels similar to B and C Blocks in the Lower 700 band.

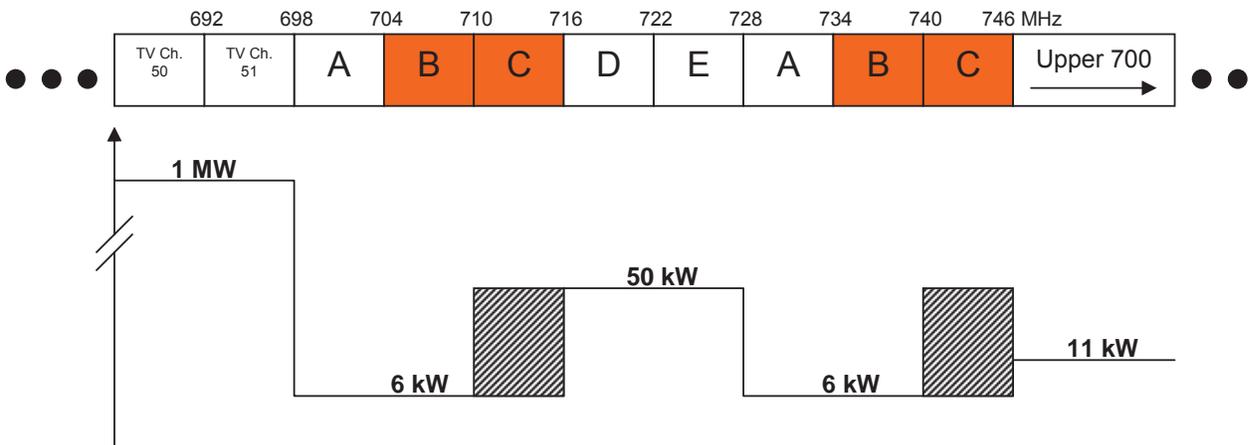


Figure 1. Band plan and power (ERP) limits for the Lower 700 MHz band.

As mentioned above, it is expected that the E Block will be used for broadcast type services such as MediaFLO, DVB-H, etc., and will transmit at 50 kW ERP. As shown in Figure 2 below, during the recent 700 MHz auction MediaFLO (Qualcomm) won licenses in California, New York, etc., shown in white with the remaining licenses won by Frontier (Echostar) shown in red. While it is not completely clear what technology will be deployed by Frontier it is likely that many large metropolitan markets will have broadcast services on E Block at high power (i.e. 50 kW ERP).

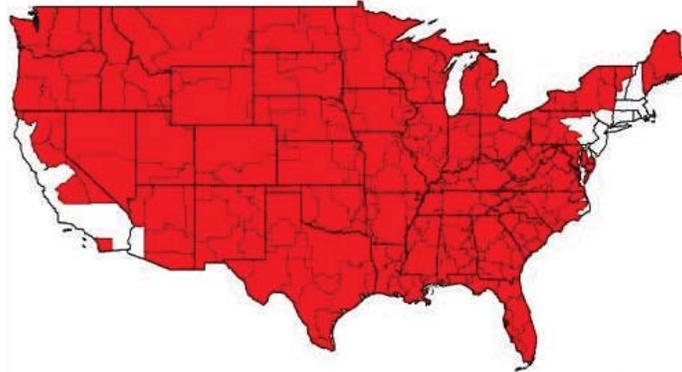


Figure 2. E Block licenses (6 MHz channel, unpaired).
(MediaFLO white, Frontier red)

The 700 MHz band plan and the allowed power limits introduce scenarios that have never occurred up to now and have not been addressed in the past in the 3GPP specifications. In particular, the band plan includes a narrow duplex gap (12 MHz), a relatively small duplex distance (Rx-Tx = 30 MHz), and the presence of strong interfering signals that fall directly into the duplex gap needed for two-way services. These issues, and in particular the strong interferers, will require some issues to be resolved in the specifications.

3. Technical Issues

UE Receiver Performance

In the present analysis the following points are assumed:

- For two-way services on A, B, and C Blocks the UE must be able to operate at a level close to the reference sensitivity with strong signals present on the D and E Blocks. As explained above, AT&T is primarily concerned with two-way operation on the B and C Blocks only.
- Typical duplex filters must account for tolerances due to temp. variations (approx. 2 MHz), manufacturing process (approx. 1.5 MHz, etc. It also takes a few MHz of spectrum to achieve a significant level of attenuation in the filter. Thus, it is unlikely that a typical filter can reject signals in the first 5-6 MHz outside of the intended receive pass band (i.e. very little rejection in the first adjacent channel block)

- Several values are used from the UE specifications (TS 25.101) and it is assumed that the values for LTE will be similar.

As noted above, high power broadcast services have already been deployed on the D Block and are also expected to be deployed on the E Block. These systems are allowed to operate at 50 kW ERP with some additional limits on their emissions. From Part 27.55, the power flux density at ground level is limited to 3000 $\mu\text{W}/\text{m}^2$ within 1 km of the transmitter location. Assuming an isotropic receive antenna this is equivalent to a received power of -13.8 dBm. However, since these transmitters are generally located on high towers (200m-500m) with little antenna downtilt, the actual signal power at ground level may be somewhat lower due to the reduced antenna gain in the direction toward the ground (e.g. Rx power of -25 to -30 dBm w/ 0 dBi UE receive antenna). A sample link budget is shown in the table below.

		<u>Units</u>	<u>Notes</u>
E Block Tx Power (ERP) =	50	kW ERP	725 MHz, E Block
Tx power (EIRP) =	79.13	dBm EIRP	Convert to EIRP
Tx tower height =	200	m	
Distance to Victim UE =	500	m	Distance from base of tower
Antenna gain reduction =	-10	dB	Due to Tx ant. pattern in direction of UE
Path loss =	-84.27	dB	< 1 km so free space loss is assumed
Other losses =	-10	dB	Blockage, body loss, etc.
UE antenna gain =	0	dBi	Assumed isotropic Rx antenna
UE Rx power =	-25.14	dBm	Blocking signal level in E Block

Table 1. Sample link budget for E Block signal into UE receiver.

As noted in the table, the broadcast transmitter antenna height is assumed to be 200 meters and the UE is at 500 m distance from the base of the tower. In this case, free space loss is assumed since the Hata model is valid only for distances > 1 km. Note that the peak ERP is reduced by 10 dB due to the elevation pattern of the transmit antenna and an additional loss of 10 dB is also included to account for blockages in the signal path, body loss, etc. In this case, the azimuth pattern of the antenna is assumed isotropic and so there would little variation in azimuth. For reference, antenna pattern data for typical broadcast antennas can be found at [2]. While the UE may have an antenna gain somewhat below 0 dBi this can be easily included and would reduce the received power by a few dB. With the same assumptions as above but with a 1 km spacing, the Rx power at the mobile is estimated as -30.7 dBm. Note that this is also similar to the value predicted at 1 km by the urban Hata model (Rx power = -33.4 dBm, pathloss = $112.57+29.13\log(d)$) and the suburban Hata model (Rx power = -24.0 dBm, pathloss = $103.17+29.13\log(d)$). From these estimates it is assumed that the UE will be subjected to strong signals (approx. -25 to -30 dBm) within 1 km of D and E Block transmitters.

Assuming that the UE is operating on A Block, it must have sufficient selectivity to reject the interfering signal in E Block. In the current UMTS specifications the ACS is given for two cases. In Case 1 the desired signal is at REFSSENS+14 dB and the interferer is at -52 dBm leading to an ACS value of 33 dB. In Case 2 the desired signal is at REFSSENS+41 dB and the interferer is at -25 dBm, also leading to an ACS value of 33 dB. However, neither of these two cases addresses the

case of a UE operating at a point close to the reference sensitivity while in the presence of a strong signal due to MediaFLO or other high power transmitters which is a scenario that may occur depending on the location of the E Block transmitters and cell towers. In this case, the desired signal would be similar to Case 1 REFSENS+14 dB (or even lower) and the adjacent channel interference could be as high as -25 to -30 dBm . If the duplex filter could provide attenuation for the interfering signal it would help to mitigate this problem. However, as mentioned above, little or no attenuation is provided by the duplex filter in the block adjacent to the desired pass band. In this case, operation on A Block may be problematic.

A similar situation exists for a UE operating on B Block with a strong interfering signal on E (or D) Block. In this case, the in-band blocking specifications are used and for a UE operating on B Block at REFSENS+3 dB, a signal on E Block can be as high as -56 dBm (assumed at 10 MHz offset although in the case of the 700 MHz band this offset would be approx. 12 MHz). In this case, with an interfering signal at -30 dBm, an additional attenuation of 26 dB is needed. This could be accomplished with the duplex filter provided that a Band 15 approach is used so that the duplexer passband includes only the B and C Blocks. In this case, the desired filter attenuation can be achieved at 6 MHz outside the edge of the intended passband. **Without this attenuation provided by the duplexer the UE would be impacted at a distance of 8.7 km from the E Block transmitter** (assuming suburban Hata model w/ 10 dB additional loss for blockage, body loss, etc.). In addition, in some markets it is probable that both E Block and D Block will be on the air with high transmit power. AT&T currently believes that the Band 15 approach will provide performance for the UE that is consistent with the performance on other bands that do not have the more extreme operating conditions.

In addition, as noted in [1], the broadcast signals on Channel 51 and the D and E Blocks may mix with the UE's own transmit signal to produce intermodulation (IM) products that may fall into the UE receive band (and could affect the UE's own receiver or another nearby UE if the IM signal is re-radiated). The table below shows the possible IM components and the resulting signals (center frequency). Of particular concern are the products that fall into the B and C Block UE receiver. In addition, the bandwidth of IM products will be wider than the signals themselves and would affect multiple blocks. Furthermore, AT&T has the option to use a 10 MHz LTE carrier that spans both the B and C Blocks and these signals could mix with an E Block signal and fall into the 10 MHz receive band.

<u>Broadcast Signal (F1)</u>	<u>UE Transmit Signal (F2)</u>	<u>IM Center Freq. (2xF2-F1)</u>
Channel 51	B Block	719 MHz (D Block)
Channel 51	C Block	731 MHz (A Block)
D Block	B Block	731 MHz (A Block)
D Block	C Block	725 MHz (E Block)
E Block	B Block	743 MHz (C Block)
E Block	C Block	737 MHz (B Block)

Table 2. IM Products due to Broadcast signals and UE transmitter.

In terms of the specification, the IM response is evaluated at REFSENS+3 dB and the receiver must meet the performance target with interfering signals at -46 dBm at offsets of 10 MHz and 20 MHz.

In this case, the duplex filter must attenuate an external signal by at least 16 dB to meet the current specification. In the case of a Band 12 duplexer this would not be possible if the external signal is in the E Block but this would be mitigated in the case of Band 15. **Without this attenuation the UE would be affected by IM at a distance of 6 km from the E Block transmitter.**

Previous contributions on the 700 MHz band have also identified the possibility of interference to a UE receiver due to the out of band emissions from the MediaFLO, or other, transmitters operating on D and E Blocks. In this case, the interference cannot be reduced through filtering in the UE. However, it is generally expected that the out of band emissions from these types of UHF transmitters will be significantly lower than the general FCC limit (although this cannot be guaranteed through regulatory rules). For example, for transmitters operating in the Lower 700 MHz band the out of band emission limit is -13dBm / 100 kHz. However, as can be seen in a regulatory compliance report by Harris Broadcast Corp. [3], the actual level of the OOB emission after the transmit filter is approx. -47 dBm / 100 kHz. Using this transmit power for the OOB emission, a link budget is shown in Table 3 below to estimate the impact on the UE receiver. In this case, at a distance of 500 m the OOB emission is well below the noise floor of the victim UE. **Thus, it can be assumed that the other interference aspect analyzed above will be the main sources of interference in the Lower 700 MHz band.**

		<u>Units</u>	<u>Notes</u>
Tx power =	-47	dBm/100kHz	D or E Block OOB emission level
Tx power =	-30.5	dBm/4.5 MHz	Convert to 4.5 MHz
Tx line loss =	2	dB	
Tx antenna gain =	14.1	dBi	= 12 dBd
Tx tower height =	200	m	
Distance to Victim UE =	500	m	Distance from base of tower
Antenna gain reduction =	-10	dB	Due to ant. pattern in direction of UE
Path loss =	-84.27	dB	< 1 km so free space loss is assumed
Other losses =	-10	dB	Blockage, body loss, etc.
UE antenna gain =	0	dBi	Assumed isotropic Rx antenna
UE Rx power =	-122.67	dBm/4.5 MHz	OOB level in UE receive block

Table 3. Sample link budget for OOB from D or E Block transmitter to UE receiver.

UE Transmitter Performance

Earlier contributions have examined the self-desense issues related to LTE transmissions when the signal bandwidth is 5 MHz, or greater. Since the total amount of isolation that can be achieved in a Band 15 duplexer is approximately the same as in a Band 12 device the self-desense issue may not be improved. However, there are other advantages to using a Band 15 approach for the UE transmitter. Since the filter passband is smaller, the insertion loss may be slightly less than a Band 12 duplexer. Also, to avoid interference to mobile devices receiving signals on the D and E Blocks the out of band emissions from the UE should be reduced as much as possible. With a smaller passband, a Band 15 UE may exhibit lower out of band emissions. Similarly, a mobile device transmitting on the A, B, or C Blocks could cause interference to a DTV receiver operating on

Channel 51. Since AT&T plans operations on only the B and C Blocks, the Band 15 approach offers the possibility that emissions into Channel 51 could be reduced through the duplex filter.

eNode-B Performance

As for the UE receiver, the eNode-B receiver must work in the presence of in-band noise due to OOB from D and E Blocks and also the presence of strong signals on the adjacent blocks including 1 MW transmitters on Channel 51. In general, much better filtering can be applied at the Node-B and some amount of additional isolation can be achieved through site engineering during deployment. AT&T recommends no specific changes to the eNode-B/Node-B specifications at this time.

4. Conclusions

Due to the disparity of wireless services that are deployed and envisioned for the Lower 700 MHz band in the US there will be additional requirements on the UE and the eNode-B to ensure acceptable performance for two-way voice and data services in the band. As proposed in previous RAN4 meetings some of these issues can be addressed through the introduction of an additional band in the specifications (Band 15) that includes only the B and C Blocks which are currently planned for service by AT&T. In addition, as has been presented in this contribution, the expected signal levels due to high-powered systems in neighboring blocks may be mitigated to some degree by front-end filtering and this alleviate some of the blocking and intermodulation problems in the UE receiver. This approach may be the preferred solution rather than impose more stringent requirements on the baseband components within the UE. Currently, AT&T believes that this offers the best way forward and that Band 15 should be adopted in the specifications.

References

- [1] R4-081108, TS 36.101: Lower 700 MHz Band 15, Motorola, RAN WG4 #47, Kansas City, MO, April 5-9, 2008.
- [2] See, for example, Model TLP-12A at www.dielectric.com
- [3] Harris Broadcast Corp., Certification of Compliance for Digital TV Transmitter, March 2007, available at www.fcc.gov

Attachment E

CR-Form-v9.4
CHANGE REQUEST

36.101 CR 48 # 3 # Current 8.2.0 #
 version:
 rev

For **HELP** on using this form look at the pop-up text over the # symbols. Comprehensive instructions on how to use this form can be found at <http://www.3gpp.org/specs/CR.htm>.

Proposed change UICC apps# ME Radio Network Access Core Network
affects: #

Title: # Addition of Band 17

Source to WG: AT&T
 #

Source to TSG: R4
 #

Work item code: LTE-RF **Date:** # 18/08/2008
 #

Category: # **B** **Release:** # Rel-8
 Use one of the following categories: Use one of the following
F (correction) releases:
A (corresponds to a correction in an earlier R99 (Release 1999)
 release) Rel-4 (Release 4)
B (addition of feature), Rel-5 (Release 5)
C (functional modification of feature) Rel-6 (Release 6)
D (editorial modification) Rel-7 (Release 7)
 Detailed explanations of the above categories Rel-8 (Release 8)
 can Rel-9 (Release 9)
 be found in 3GPP TR 21.900.

Reason for change: # Due to the disparity of wireless services that are deployed and envisioned for the Lower 700 MHz band in the US there will be additional requirements on the UE and the eNode-B to ensure acceptable performance for two-way voice and data services in the band. As proposed in previous RAN4 meetings some of these issues can be addressed through the introduction of an additional band in the specifications (Band 17) that includes only the B and C Blocks. The expected signal levels due to high-powered systems in neighboring blocks may be mitigated to some degree by front-end filtering and this alleviate some of the blocking and intermodulation problems in the UE receiver.

Summary of change: # Added Band 17 (704-716/734-746 MHz) to table 5.2-1
 #

Consequences ⌘ *if* There is a potential for more stringent requirements to be imposed on the UE
⌘
not approved:

Clauses ⌘ *affected:* 5.2
⌘

	Y	N	
Other specs ⌘			Other core specifications ⌘
affected:	Y		Test specifications
			O&M Specifications

Other ⌘ **comments:**
⌘

5.1 General

The channel arrangements presented in this clause are based on the frequency bands and channel bandwidths defined in the present release of specifications.

NOTE: Other frequency bands and channel bandwidths may be considered in future releases.

5.2 Frequency bands

E-UTRA is designed to operate in the frequency bands defined in Table 5.2-1.

Table 5.2-1 E-UTRA frequency bands

E-UTRA Band	Uplink (UL) eNode B receive UE transmit		Downlink (DL) eNode B transmit UE receive		Duplex Mode
	F _{UL_low}	F _{UL_high}	F _{DL_low}	F _{DL_high}	
1	1920 MHz	1980 MHz	2110 MHz	2170 MHz	FDD
2	1850 MHz	1910 MHz	1930 MHz	1990 MHz	FDD
3	1710 MHz	1785 MHz	1805 MHz	1880 MHz	FDD
4	1710 MHz	1755 MHz	2110 MHz	2155 MHz	FDD
5	824 MHz	849 MHz	869 MHz	894 MHz	FDD
6	830 MHz	840 MHz	875 MHz	885 MHz	FDD
7	2500 MHz	2570 MHz	2620 MHz	2690 MHz	FDD
8	880 MHz	915 MHz	925 MHz	960 MHz	FDD
9	1749.9 MHz	1784.9 MHz	1844.9 MHz	1879.9 MHz	FDD
10	1710 MHz	1770 MHz	2110 MHz	2170 MHz	FDD
11	1427.9 MHz	1452.9 MHz	1475.9 MHz	1500.9 MHz	FDD
12	[TBD]	[TBD]	[TBD]	[TBD]	FDD
13	777 MHz	787 MHz	746 MHz	756 MHz	FDD
14	788 MHz	798 MHz	758 MHz	768 MHz	FDD
...					
17	704 MHz	716 MHz	734 MHz	746 MHz	FDD
...					
33	1900 MHz	1920 MHz	1900 MHz	1920 MHz	TDD
34	2010 MHz	2025 MHz	2010 MHz	2025 MHz	TDD
35	1850 MHz	1910 MHz	1850 MHz	1910 MHz	TDD
36	1930 MHz	1990 MHz	1930 MHz	1990 MHz	TDD
37	1910 MHz	1930 MHz	1910 MHz	1930 MHz	TDD
38	2570 MHz	2620 MHz	2570 MHz	2620 MHz	TDD
39	1880 MHz	1920 MHz	1880 MHz	1920 MHz	TDD
40	2300 MHz	2400 MHz	2300 MHz	2400 MHz	TDD

5.3 TX–RX frequency separation

Attachment F

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Executive Summary

- **Letters to other groups:** Need further discussions on Physical Cell Identities, Measurement gaps, Radio problem detection
- **Maintenance:** Treated: Inner loop power control, UE power classes, EDCH phase issues, CQI tests and New cell identification time
- **E-UTRA/E-UTRAN:**
 - Use nominal/additional bandwidth?
 - **UE Requirements:** Band 15 introduced as a subset of band 12. Public Safety related to band 13 has been discussed.
 - **UE Transmitter:** Min output power, Transmit OFF power, EVM windowing is reduced for 1.4 and 3MHz, Power control (conf call), ACLR (not removed requirements for 1.4 and 3MHz), Tx Modulation (spectrum flatness need more discussion)
 - **UE Receiver:** Agreed retests for 1.4 and 3MHz, UE ACS Test time alignment, FRC definition, In-band Blocking Requirement correction for band 13
 - **UE Performance Requirement:** High speed train need more results, Testing points accepted, PBCH scenarios agreed, Extra margin discussion (treat it case by case). MIMO correlation matrices defined.
 - **BS Requirements:** mask for the transmitter time dynamic behavior is added and clarification on the time duration during which the requirement applies. Output power, Output power dynamics Transmit on off power (applicable to TDD), TX signal quality, Unwanted emissions, Transmitter intermodulation for the transmitter and Receiver spurious emission for the receiver are affected. Unwanted emission requirements for multi-carrier BS agreed
 - **BS Performance Requirements:** remove the intra and inter frequency hopping currently in the simulation assumptions. Call for results for PUCCH format 2 (with impairments) and PRACH format 4 (ideal). Uplink timing adjustment (modifications according to ran 1), MU pucch simulation assumption agreed.
 - **BS Conformance Testing:** Good progress for 36.141
 - **RRM: Discussions on**
 - IDLE state mobility requirements
 - Handover
 - Monitoring Layers of multiple IF/RATs
 - Uplink timing issues
 - Intra-LTE RRC Re-establishment Requirements
 - Intra-frequency cell Search requirement
 - Inter-frequency Monitoring using measurement gaps
 - Inter rat monitoring using measurement gaps
 - Measurement accuracy requirements
 - Mobility UTRA->E-UTRA
 - **Dual-cell HSDPA operation on adjacent carriers: New reference measurement channel defined.**
 - **LTE FDD Repeaters:** Agreed requirements for definitions, Frequency stability, Operating band unwanted emissions, ACRR, spurious emissions, Input Intermodulation co-existence and co-location
 - **FDD Home NodeB RF Requirement:** Frequency error 0.25ppm, ACLR -45dB is agreed
 - **64QAM for 1.28 Mcps TDD HSDPA:** Simulation assumptions endorsed in 1273.
 - **UE Antenna Performance Evaluation Method and Requirements:** accepted the proposal of test tolerances and measurement uncertainties.

Extended Summary

- **Letter to other Groups:**
 - Ran 1 asks feasibility of introducing without impact to the Rel-8 timeline, a set of new Physical Cell Identities (PCIs) to be used for CSG cells. More discussions in meeting 48.
 - LS from Ran 1: Measurement gaps duration (6ms, 10ms periodicity), UE behaviour for transmissions overlapping with the measurement gap (no tx on PUSCH in a subframe containing measurement, UE shall drop UL transmissions overlapping with the measurement gap).
 - LS from Ran 1: Radio problem detection → Ran 4 to define the tests → need more discussions: Propose that cell specific or the so-called common reference symbols (CRS) SIR is solely used as a criteria to determine radio link problem since received quality of reference symbol is fundamental to the decoding of control (e.g. PDCCH, PHICH) and shared channel (PDSCH). This will also simplify UE implementation compared to earlier discussions in which combination of channels for radio problem detection has been proposed. Nokia suggests the use of PC-FICH as a mapping function but this would mandate the UE to use PC-FICH, that is not necessary to decode PDCCH. PC-FICH may be used in case it is received. Questions arise on to measure the PC-FICH error rate.
- **Maintenance**
 - Inner loop power control: insufficient testing of ILPC accuracy (can affect system tput). Meeting 48, more discussions and more simulation results
 - UE power classes: 23dBm power class is supported also for WCDMA, no impact in other part of the spec (3bis, same PA.)
 - EDCH phase issues: (link level run with a particular specific power vs. phase shift profiles. Performance loss is related to the number of transitions passing the PA switch points → need more analysis to define the worst case, best case and maybe a typical case implementation.
 - CQI: 3 catheteries: CQI-bias testing in static conditions, Fading CQI test cases, Varying Ior/Ioc CQI test cases (some tests will be agreed in next meeting).
 - New cell identification time (intra-frequency) when UE DRX is enabled: <800 ms when UE DRX cycle < 10 subframes and 1.5s when the UE DRX cycle ≥ 10 subframes. (this is because in DRX the T_identify_intra can be up to 6s).
- **E-UTRA/E-UTRAN**
 - Discussion on the use of nominal and additional bandwidth. It can be misleading to have these two tables. What are the differences between the applicability of the relaxations to these 2 tables? More discussion in the next meeting.
 - RF Scenarios: Seameat presentation. Discuss how to proceed with that.
 - **UE Requirements:**
 - Band 15 as a subset of band 12 which includes only the B and C Blocks of the lowe 700MHz band (currently planned for service by AT&T)
 - In Region 2 there is a Public Safety (PS) downlink band in the duplex gap of Band 13 → backoff power or network signal value to protect?
 - Band 13 REFSENS specified.
 - **UE Transmitter:**
 - Specify the min output power = -40dBm
 - Transmit OFF power is specified as -50 dBm in the associated channel bandwidth
 - EVM windowing is reduced for 1.4 and 3MHz otherwise the emission mask would be difficult to meet
 - Power control: discussion on power tolerance, position and amount of the transient period, scenarios, criteria for open loop. Conf call before meeting 48.
 - ACLR:

Agilent: formalizing a move towards subframe measurements (instead of slot based).

Motorola: most of the work has been done on subframe measurement, only a R&S contribution was based on a slot basis.

Freescall: extreme conditions added in table.

Motorola: it can be added when a proposal will be presented..

Agilent: we would need to give RAN 1 information about the flatness of the signal.

Motorola: let's finish the work on power control before sending the information to ran 1.

Status: Agreed

6.1.2.1 General [For section 1 to 5 in TS36.101]

R4-081575 Discussion TS36.101: Normal and additional channel bandwidth Motorola

Status: Withdrawn

Introduction of Band 15 as a subset of the current Band 12 to resolve certain co-existence issues

R4-081324 Decision Performance and coexistence issues in the Lower 700 MHz band AT&T

Comments:

As proposed in previous RAN4 meetings some of these issues can be addressed through the introduction of an additional band in the specifications (Band 15) that includes only the B and C Blocks which are currently planned for service by AT&T. In addition, as has been presented in this contribution, the expected signal levels due to high-powered systems in neighboring blocks may be mitigated to some degree by front-end filtering and this alleviates some of the blocking and intermodulation problems in the UE receiver.

Nortel: for the eNodeB filtering can be improved.

Qualcomm: analyze the interference situation and they come to conclusions similar to AT&T for the UE, they understand that for the BS the problem can be solved without introducing the 15 band.

AT&T: propose the band 15 as opposed to the best we can do with what it is available so far. Band 15 should be adopted.

Status: Noted

R4-081356 Discussion On the introduction of Band 15 Ericsson

There is a benefit in using Band 15 but there is a risk of market fragmentation.

AT&T: 1000m is it inter site distance?

Ericsson: yes.

Qualcomm: fig 4, tput loss, are these averaged across all the users.

Ericsson: averaged in a circle around the BS.

Qualcomm: 2.2, are the UE randomly distributed and the Mediaflo is transmitted at the center of the cell? It does not raise the blocking issue as in At&T doc.

Ericsson: they do address the blocking as well. If all the users are very close to the site, as in AT&T the degradation could be much higher. The difference between the assumptions, AT&T is close to the worst case scenario, why here it is more typical scenario that is used for average system analysis.

Ericsson: analysis in 2.2, 35dB of attenuation is at the BS. Intermodulation issue: this is not specified yet, looking at different attenuation there are different number circulating there.

AT&T: fragmenting the market, in 36.101, 13 and 14 FDD and TDD band, one subband more may not make a big difference in the market fragmentation. They believe that the simplest and the quickest way to solve the problem

Motorola: we have band 12 for A+B+C that is not applicable for US, now there is the proposal to have band 15 which consider only the combination B+C. The other possible combinations need to be considered.

Status: Noted

R4-081357 Discussion Band 13 and spurious emission in Public Safety

In Region 2 there is a Public Safety (PS) downlink band in the duplex gap of Band 13. It consists of a broadband part in 763-768 MHz and a narrowband in 769-775 MHz (Figure 1). The latter is the most critical in terms of Band 13 emission and must be sufficiently protected. There is a regulatory limit that for a 23 dBm UE implies a spurious emission limit of -35 dBm/6.25 kHz, and this has been introduced into the spec. In this contribution we look at the emission levels produced by a LTE 10 MHz signal. It has been proposed to standardize scheduling restrictions in terms of RB allocations and power to resolve the problems. However, it turns out that this would not guarantee that the FCC limit is satisfied in all cases if 23 dBm output power is used. Moreover, scheduling behaviour is normally not standardized. proposed to allow some back-off for Power Class 3 in order to provide some margin to the FCC requirements whilst still allowing allocation of wide LTE uplink transmissions. We sum up by noting that a deterministic interference analysis based on worst case would imply spurious limits > 25 dB below the required regulatory limit. This would imply severe restrictions on the LTE UE uplink in Block C

They are not proposing to standardize any scheduling, they would like to propose a reduction in the output power that can be standardized.

Motorola: they are proposing a 2dB backoff. In ue to ue coexistence, protection for wireless is -67/100KHz

Ericsson: we are using the actual FCC spurious emission . By backing off 2dB, in table 1.

Qualcomm: would it be possible to use a network signalled value? Using 2dB overall, in many cases it may not be necessary.

Ericsson: that's could be a feasible option.

Conclusion: Not to specify the backoff but using a network signalled value, we can achieve the same protection for PS system. The proposal is agreed in principle, the CR will be presented.

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Attachment G

Title: Report of the 3GPP TSG RAN WG4 meeting # 47bis
Jeju Island, South Korea , 18-23 August 2008

Status: Draft

Source: Stefania Sesia, MCC



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Summary: The concepts of nominal and additional bandwidths are removed. Tables 5.4.2.1-1 and 5.4.2.2-1 are merged onto one single table. Footnotes are used to indicate that a particular bandwidth in an operating band does have an allowed receiver relaxation, e.g. reference sensitivity. Transmitter relaxations like MPR and A-MPR are not addressed since these are allowed for all bandwidths. For additional bands (a part from band 1), there is note for which bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (Clause 7.3) is allowed.

Band 1 there are spurious emissions. Possible that later we will have to add an other footnote to cover the spurious emissions

Freescale: a footnote with [] what does it mean?

Ericsson: It is FFS.

Status: Agreed.

R4-081823 CRTXRX frequency separation Fujitsu

Summary: TX-RX frequency separations for each E-UTRA band are defined based on the separations in UTRA FDD. For E-UTRA TDD bands, the separation is inherently inapplicable and defined as N/A (Not Applicable) accordingly.

Ericsson: Not sure if the text below the table on the fixed duplex or variable duplex is appropriate. Need more discussion.

Motorola: Should be stated in the proposal how to define the separation.

Status: Noted

R4-082001 Discussion Improved Reference Power Amplifier Model for UE Transmitter Simulations Freescale

Summary: This contribution presents a modifiable model for a Power Amplifier (PA) that can be used as a baseline for contributions examining issues such as de-sense, coexistence and ACLR and out of band performance.

The model is used in order to show that there are effects due to imbalance that is particular important for coexistence. The document provide a script to change the test methodology. They provide how to derive the model.

Chairman: All the companies may have different implementation of the PA.

Status: Noted

R4-082068 Addition of Band 15 (CR 48 to 36.101) (AT&T)

T-Mobile: Band should be 'Band 17' to avoid problem spreading the specifications (overlapping)

Ericsson: ask to discuss this CR in the next meeting together with the band 12.

Expect a revised CR in this meeting or in the next meeting. (Come back to check the status).

Status: Revised in 2133

R4-082133 Addition of Band 15 (CR 48r1 to 36.101)(AT&T)

The band is called 17.

Status: Revised in 2168

R4-082168 Addition of Band 17 (CR 48r2 to 36.101)(AT&T)

Status: Revised in 2179

R4-082179 Addition of Band 17 (CR 48r3 to 36.101)(AT&T)

Status: Agreed

R4-082164 Frequency range for Band 12 (CR 52 to 36.101)(Ericsson)

Status: Revised in 2196

R4-082196 Frequency range for Band 12 (CR 52r1 to 36.101)(Ericsson)

Status: Agreed

R4-082169 Update of symbol and definitions (CR 53 to 36.101 Rel-8)(Ericsson, Alcatel-Lucent)

Comments: E_{RS} and \hat{E}_s is modified. I_{o} is defined with the 2 alternatives (with power averages), I_{or}, \hat{I}_{or} and I_{ot} + some definitions.

Status: Agreed

6.1.2.2 Transmitter requirement

[For section 6 in TS36.101]

R4-081777 Discussion Discussion of RF and baseband frequency alignment Qualcomm Europe

Comments:

R&S: in wcdma they depend on each other and we have only one requirement. We can say that in the test environment the timing should not be changed. Or we can avoid having this as a requirement and we can state in the test procedure in ran 5 that the test assume that the 2 are coupled.

Status: Noted

POWER CONTROL

R4-081930 Information Summary of Telco on LTE UL Power Control (2008-08-07)Ericsson

6.1.4 BS requirements

6.1.4.1 General [For section 1 to 5 in TS36.104]

R4-081951_CRLTE Abbreviations update_Ericsson_36.104.16.F

Status: Revised in 2083

R4-082083_LTE Abbreviations update (CR 16r1 to 36.104 Rel-8) (Ericsson)

Collect the abbreviations that are widely used in the LTE area and propose a CR for the document that it is generally used for abbreviations.

Status: Agreed

R4-082193_Additional band 17 (CR 23 to 36.104 Rel-8) (AT&T)

Status: Agreed

6.1.4.2 Transmitter requirement [For section 6 in TS36.104]

R4-081870_CRLTE BS ON-OFF Mask Alcate! Lucent_Ericsson_36.104.Tr22_B

Comments by last meeting: Make further modification in the next meeting. AL made further correction of the CR agreed in the 1637 in the last meeting.

CATT: in sec 3 there is a error in the applicatio

Status: Agreed

R4-081927_CRUnwanted emission requirements for multi-carrier BS NTT DOCOMO_Ericsson_Nokia Siemens Networks_36.104.14_B

Status: revised 2069

R4-082069_Unwanted emission requirements for multi-carrier BS (CR 14r1 to 36.104 Rel-8) (NTT DOCOMO_Ericsson_Nokia Siemens Networks_T-mobile)

The multi carrier area this area should be discussed in a separate Work Item... But some conclusions can be done without WI Changes are based on the agreed R4-081638 for TR36.942.

Status: Agreed

R4-081950_CRClearification of emission requirements for co-existence_Ericsson_36.104_15_B

Changes:

- Regional requirements can be mandatory.

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PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 116**

Additionally, we are expanding our accessory compatibility across all brands of wireless handsets and Bluetooth-enabled devices.

We are investing in next-generation technologies, such as WiMAX, HSDPA and Long Term Evolution (“LTE”). We believe a strong intellectual property portfolio is critical to our long-term success and to ensuring that we maintain a favorable strategic position in these technologies. We will continue to identify opportunities to generate licensing revenue from these investments. We also believe that innovation is critical to offering devices that demonstrate unique experiences and value propositions for consumers. As an example, in 2007 we began shipping our flagship RAZR2 devices with Crystal Talk, a proprietary technology that automatically adjusts audio quality based on ambient noise conditions to provide the optimal conversational experience. In application services, we continue to work with third parties to improve upon and develop our services and applications, which will deliver rich experiences to the customer. Motorola is committed to investing in evolving technologies to ensure that we continue to deliver enhanced and differentiated wireless handset experiences to consumers.

In January 2008, we announced that we are evaluating alternatives for the structural and strategic realignment of our Mobile Devices business to better equip it to recapture global market leadership and to enhance shareholder value. This may include the separation of the Mobile Devices business from Motorola’s other businesses to permit each to grow and better serve their customers.

Customers

We continue to focus on strengthening our relationships with our customers. The segment has several large customers worldwide, the loss of one or more of which could have a material adverse effect on the segment’s business. The largest of the segment’s end customers (including sales through distributors) are Sprint Nextel, AT&T, Verizon, China Mobile and America Movil. In 2007, aggregate net sales to these five customers represented approximately 42% of the segment’s net sales.

In addition to selling directly to carriers and operators, our Mobile Devices business also sells products through a variety of third-party distributors and retailers, which account for approximately 33% of the segment’s net sales. The largest of these distributors is Brightstar Corporation.

The U.S. market continued to be the segment’s largest individual market, accounting for approximately 46% of the segment’s net sales in 2007, compared to approximately 35% of the segment’s net sales in 2006. Approximately 54% of the segment’s net sales in 2007 were to markets outside the U.S., the largest of which were Brazil, China and Mexico. Compared to 2006, the segment experienced sales declines in each of its four major sales regions: Asia, the Europe, Middle East and Africa region (“EMEA”), North America and Latin America.

Competition

The segment believes its overall market share for the full year 2007 was approximately 14%, making it the third-largest worldwide supplier of wireless handsets. The segment experiences intense competition in worldwide markets from numerous global competitors, including some of the world’s largest companies, such as Nokia, Samsung, Sony-Ericsson and LG. In 2007, consolidation in the wireless handset industry slowed compared to previous years, and the five largest vendors together held an aggregate market share of approximately 83%, compared to 84% at the end of 2006. During 2007, regulatory changes in China precipitated a substantial increase in the number of manufacturers producing handsets in that market. The increased competition, primarily in the very low tier of the Mass Market product segment, has impacted shipment volumes in China for global vendors, as local vendors gained market share in the fourth quarter of 2007.

Major competitors in the industry are moving to applications and services as key sources of value and are increasing their focus and investments in these areas. In response, Motorola has created a global applications and services team within the Mobile Devices segment to focus on building the applications and services business.

General competitive factors in the market for the segment’s products include: design; time-to-market; brand awareness; technology offered; price; product proposition, performance, quality, delivery and warranty; the quality and availability of service; and relationships with key customers.

PUBLIC VERSION

**EXHIBIT 1 TO ROETTER REPLY DECLARATION
DOCUMENT 117**

2014-11-21

3GPP Meeting Registration

Version 1.3

**Meeting:** 3GPPRAN4#47-bis**Identifier:** 27235

LIST OF REGISTERED ATTENDEES

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97 registered participants / 79 attended participants

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T-Mobile scores more 700 MHz A-Block spectrum from CenturyLink unit

August 12, 2014 | By Phil Goldstein

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The details of T-Mobile US' (NYSE:TMUS) \$50 million expansion into 700 MHz spectrum continue to become clearer as FCC documents revealed the carrier purchased 700 MHz A Block licenses from Actel, a wholly-owned subsidiary of wireline telco CenturyLink.



T-Mobile revealed the deal in a filing with the FCC in which it asked to gain control of the spectrum licenses. The companies did not reveal financial terms of the deal.

TOOLS

According to the filing, the 13 spectrum licenses T-Mobile wants to buy from Actel include markets in parts of Alabama, Arkansas, Colorado, Florida, Georgia, Louisiana, Michigan, Missouri, Montana, New Mexico and Oklahoma. Most of the markets covered are small cities, with Little Rock, Ark., being perhaps the largest. T-Mobile spokeswoman Stephenie Hanschka confirmed to *FierceWireless* that the deal covers 6.5 million POPs.

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As it did in a recent filing to acquire 700 MHz A Block spectrum from I-700 A Block LLC for licenses in the Evansville-Henderson area in Indiana and Kentucky and the Paducah area in Kentucky, T-Mobile said the deal will yield clear public interest benefits" by allowing T-Mobile to expand its 700 MHz footprint "and thus offer improved services to its customers."

Reprint

Further, T-Mobile noted that there "will be no loss of an existing service provider in any of the market areas subject to the transaction at issue" and that Actel is not using the spectrum "to provide service to end-user customers."

T-Mobile paid a total of \$50.5 million for its recent A-Block purchases. The I-700 deal covered 1.1 million POPs, according to Hanschka. "We have recently entered into agreements to acquire A-Block spectrum in additional markets for multiple parties covering 8.7 million POPs for approximately \$50.5 million," T-Mobile CEO John Legere said last week during the company's second-quarter earnings conference call, [according to a Seeking Alpha transcript](#). "That translates into an average MHz-per-POP price of approximately \$0.48 compared to \$1.85 per MHz-POP price we pay in the Verizon A-Block transaction."

Between its two deals with Actel and I-700, T-Mobile is buying spectrum covering 7.6 million POPs, leaving just 900,000 POPs remaining to be covered in any

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other deals that may soon come to light.

The general value of 700 MHz A Block spectrum scored a boost last year when AT&T Mobility (NYSE: T) said it would support 700 MHz interoperability by adding A Block, Band 12-capable devices to its portfolio. The move essentially will help lower the cost of A Block devices by broadening the number of carriers using the band.

In April, T-Mobile completed its \$2.4 billion deal to buy Verizon Wireless' (NYSE: VZ) MHz A Block spectrum but has been on the hunt for more. T-Mobile said last week it will start rolling out its 700 MHz A Block spectrum it acquired from Verizon beginning in the third quarter. The spectrum covers 150 million POPs, including nine of the top 10 and 21 of top 30 metro areas. The company said its first 700 MHz sites are on air and its first handsets are being tested and should be in the market in the fourth quarter. T-Mobile said it has already cleared encumbered A-Block metro areas in five markets covering more than 13 million POPs on top of many markets already free and clear. The A-Block spectrum T-Mobile got from Verizon covers the markets of Atlanta, Dallas, Detroit, Houston, Los Angeles, New York City, Philadelphia and Washington, D.C.

For more:

- see this [FCC filing](#)
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Correction, Sept. 29, 2014: This article incorrectly stated the number of covered POPs involved in T-Mobile's 700 MHz A Block purchase from Verizon. It was for 150 million covered POPs, not 158 million.

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Rulemaking

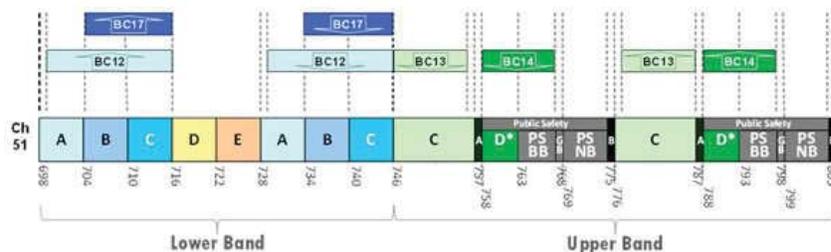
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Promoting Interoperability in the 700 MHz Band

12-69

This Notice of Proposed Rulemaking involves interoperability issues in the Lower 700 MHz spectrum band. Currently, there are two distinct sets of technical specifications for devices operating in the Lower 700 MHz band, resulting in a lack of interoperability in the Lower 700 MHz band. In 2009, an alliance comprised of four Lower 700 MHz A Block licensees filed a petition for rulemaking requesting the Commission to require that all mobile devices for the 700 MHz band be capable of operating over all frequencies in the band.

700 MHz Band Plan & 3GPP Band Classes



*"BCxx" indicates Band Classes proposed as part of the international 3GPP industry LTE technical standards processes.
 *The D Block will be reallocated for use by public safety entities as directed by recent Congressional mandate.

The 700 MHz Band is comprised of 108 MHz of spectrum:

- 70 MHz of commercial, non-guard band spectrum;
- 24 MHz of public safety spectrum;
- 10 MHz of spectrum that will be reallocated for public safety use consistent with the Middle Class Tax Relief and Job Creation Act of 2012;
- and 4 MHz of guard band spectrum

The Lower 700 MHz spectrum band consists of 48 MHz of spectrum, divided into five spectrum blocks:

- Lower A Block = 12 MHz of paired spectrum
- Lower B Block = 12 MHz of paired spectrum
- Lower C Block = 12 MHz of paired spectrum
- Lower D Block = 6 MHz of unpaired spectrum
- Lower E Block = 6 MHz of unpaired spectrum

The 3rd Generation Partnership Project (3GPP) is a consensus-driven international partnership of industry-based telecommunications standards bodies. 3GPP developed standards for Long-Term Evolution (LTE) wireless broadband technology. There are two different 3GPP operating bands in the Lower 700 MHz band: 1) Band Class 12, which covers operations in the Lower A, B, and C Blocks; and 2) Band Class 17, which covers operations in the Lower B and C Blocks only. Entities involved in the creation of Band Class 17 during the 3GPP proceedings assert that it was necessary to create a separate band class for Lower 700 MHz B and C Blocks in order to avoid interference issues from digital television (DTV) Channel 51 and high power operations in the Lower E Block.

The group that filed the petition for rulemaking make essentially two arguments: 1) Equipment vendors currently first serve the needs of Band Class 17, which covers the Lower B and C Blocks only, and is dominated by AT&T; and 2) Equipment manufacturers have little incentive

to innovate and provide compatible devices for smaller markets, particularly when providing interoperable devices would run contrary to their largest customers' desires.

Supporters of an interoperability requirement assert that Band Class 17 devices preclude supporting operation on Lower A Block spectrum and that this is contrary to the public interest. Supporters argue that small providers that acquired 700 MHz Lower A Block licenses are left without viable and widely usable equipment options. They contend that interoperability is necessary for Lower A Block licensees to obtain devices with competitive economies of scale. The group also contends that full support of Band Class 12 will maximize roaming opportunities.

On the other hand, others argue that the distinct band classes are necessary, and that without Band Class 17 filtering, Lower 700 MHz B and C licensees will face greater levels of harmful interference. They contend that the existing 3GPP band classes were crafted through an open process and are responsive to the realities of the engineering and manufacturing constraints of the Commission-defined spectrum blocks.

The Notice of Proposed Rulemaking addresses numerous issues and requests comment on, among other things:

- Challenges to Achieving Interoperability
- Potential for Harmful Interference
- Promoting Interoperability

The Notice of Proposed Rulemaking seeks to resolve whether a single, unified band class for devices in the Lower 700 MHz band would result in harmful interference to the operations of Lower 700 MHz B and C Block licensees, and whether, if harmful interference exists, it reasonably can be mitigated. The Notice of Proposed Rulemaking explores various options to help achieve the ultimate goal of interoperability.

Related Information

- Notice of Proposed Rulemaking: Word | PDF
- News Release: Word | PDF
- Genachowski Statement: Word | PDF
- McDowell Statement: Word | PDF
- Clyburn Statement: Word | PDF
- 700 MHz Interoperability Workshop
- Petition for Rulemaking

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LTE rollout for AT&T in the US

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- AT&T to build LTE network
- Ericsson named as key supplier for LTE equipment
- Commercial launch scheduled to begin 2011

LTE is the latest step in a wireless evolution that Ericsson (NASDAQ: ERIC) began with AT&T over two decades ago and is part of AT&T's ongoing efforts to innovate and invest in mobile broadband.

AT&T serves more than 85.1 million customers and has seen mobile broadband growth of more than 5,000 percent over the past three years. Smartphones are just one example of innovation made possible by investment in mobile broadband.

After extensive testing of equipment from multiple suppliers in lab and field environments, AT&T chose to extend its existing relationship with Ericsson for LTE deployment. The agreement also complements AT&T's strategy to continue to boost the speed and performance of 3G mobile broadband to deliver the best, most advanced customer experience for customers throughout the evolution toward LTE.

As part of this multi-year agreement, Ericsson expands its key supplier role with AT&T by delivering LTE network equipment as well as a full suite of services to design, deploy and optimize the LTE network.

AT&T plans field trials of LTE technology later this year, and commercial deployment is scheduled to begin in 2011.

"The announcement is an important step forward in our ongoing mobile broadband strategy, which is focused on delivering the best possible combination of speed, performance and available devices for

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customers at every level of technology deployment," said John Stankey, president and CEO, AT&T Operations. "AT&T has a key advantage in that LTE is an evolution of the existing GSM family of technologies that powers our network and the vast majority of the world's global wireless infrastructure today."

Hans Vestberg, president and CEO, Ericsson said: "Our ability to work together to meet the demands of a rapidly changing market has been a crucial element in gaining AT&T's continued confidence. We will work just as hard to secure a smooth rollout of LTE and support AT&T in introducing new consumer and business services moving forward."

AT&T previously named Ericsson as a [key supplier for wireline access](http://www.ericsson.com/thecompany/press/releases/2009/09/1339721) (<http://www.ericsson.com/thecompany/press/releases/2009/09/1339721>) products and services. Ericsson can offer wireline solutions to accelerate AT&T's ability to bring new broadband-based products and services to market.

To date, Ericsson has signed commercial LTE contracts with four other major global operators, two of which are in the United States, the world's fastest growing LTE market.

LTE, the next generation of mobile communication technology, enables the fast transfer of huge amounts of data in an efficient and cost-effective way, optimizing the use of the frequency spectrum. With increased speed and decreased latency, consumers can enjoy a wide range of applications (real-time web, online gaming, social media collaboration and video conferencing) effortlessly and while on the move. LTE will meet the demands of new and enhanced mobile internet applications of the future.

Ericsson has been driving open standards and has had the highest impact on the released LTE specifications. Ericsson expects to hold 25 percent of all essential patents for LTE, making it the largest patent holder in the industry.

Notes to editors:

[Ericsson LTE Achievement List](http://www.ericsson.com/ericsson/press/facts_figures/lte_achievement.shtml) (http://www.ericsson.com/ericsson/press/facts_figures/lte_achievement.shtml)

[YouTube: LTE site launched in Stockholm](http://www.youtube.com/watch?v=Q6eSZvLT3nM&feature=related) (<http://www.youtube.com/watch?v=Q6eSZvLT3nM&feature=related>)

[LTE White paper](http://www.ericsson.com/technology/whitepapers/index.shtml) (<http://www.ericsson.com/technology/whitepapers/index.shtml>)

[Photo of products: RBS6000 and Evolved Packet Core](http://www.ericsson.com/ericsson/press/photos/network_products.shtml) (http://www.ericsson.com/ericsson/press/photos/network_products.shtml)

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telecom operators. Ericsson is the leader in 2G, 3G and 4G mobile technologies, and provides support for networks with over 2 billion subscribers and has the leading position in managed services. The company's portfolio comprises mobile and fixed network infrastructure, telecom services, software, broadband and multimedia solutions for operators, enterprises and the media industry. The Sony Ericsson and ST-Ericsson joint ventures provide consumers with feature-rich personal mobile devices.

Ericsson is advancing its vision of being the "prime driver in an all-communicating world" through innovation, technology, and sustainable business solutions. Working in 175 countries, more than 80,000 employees generated revenue of SEK 206.5 billion (USD 27.1 billion) in 2009. Founded in 1876 with the headquarters in Stockholm, Sweden, Ericsson is listed on OMX NASDAQ, Stockholm and NASDAQ New York.

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[Mobile World Congress \(http://www.ericsson.com/ericsson/press/events/2010/invit_2010.shtml\)](http://www.ericsson.com/ericsson/press/events/2010/invit_2010.shtml), Barcelona, Spain, February 15- 18
Ericsson's Capital Markets Day, Stockholm, Sweden, May 5-6
Ericsson Business Innovation Forum, Shanghai, China, May 17-18

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AT&T to Upgrade Network to LTE from 2011

Published on: 10th Feb 2010

Note -- this news article is more than a year old.

AT T has awarded contracts to Alcatel Lucent and Ericsson as equipment suppliers for its planned deployment an LTE upgrade to its network. The selection of the two suppliers paves the way for AT T's planned field trials of LTE technology later this year with commercial deployment scheduled to begin in 2011.

As part of the supplier agreements, 3G equipment delivered to AT&T by the suppliers starting this year will also be convertible to LTE

As part of the agreements, AT&T has designated Alcatel-Lucent and [Ericsson](#) as the domain suppliers for its Radio Access Network Domain. The multi-year agreement covers radio access network equipment needed to deliver [LTE](#) service. This equipment will be deployed at cell sites across AT&T's network to enable LTE speeds and functionality. Financial terms of the supplier agreements were not disclosed.

AT&T in January announced total 2010 capital expenditures are expected to be between \$18 billion and \$19 billion. These plans include an increase of approximately \$2 billion in wireless network and backhaul investment, which will help ensure continued strong results in 3G network performance as well as preparation for planned deployment of LTE.

Earlier this year, AT&T upgraded 3G cell sites to HSPA 7.2 technology. Over the course of 2010 and 2011, AT&T plans to combine this upgrade with enhanced [fiber-optic](#) backhaul connectivity, which will support a considerable boost in 3G speeds as well as future LTE service.

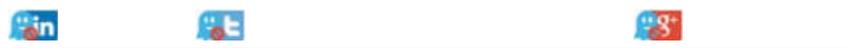
AT&T wireless network investment plans for 2010 also include construction of about 2,000 new cell sites and adding new radio controllers and carriers at a pace that doubles deployment in 2009.

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