Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC

In the Matters of	)	
	)	
International Comparison and Survey Requirements in the Broadband Data Improvement Act	)	**GN Docket No. 09-47**
	)	
A National Broadband Plan for Our Future	)	**GN Docket No. 09-51**
	)	
Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act	)	**GN Docket No. 09-137**

REPLY COMMENTS OF THE FIBER-TO-THE-HOME COUNCIL
NBP PUBLIC NOTICE #1

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SUMMARY

In its initial comments, the Fiber-to-the-Home Council ("FTTH Council") proposed broadband to be defined as:

- Broadband is a relative term of information-carrying capacity of a transmission on any media expressed in analog or digital format. In analog format, it is measured in terms of bandwidth, the range of frequencies used for a particular transmission. In digital format it is measured primarily in terms of actual available throughput, bits transmitted per second measured at peak usage periods, and secondarily in terms of other quality of service factors, such as latency, jitter, and contention.
- Broadband performance should be: (1) measured by tiers of capability to more precisely direct government policy and increase user understanding; (2) measured separately for fixed and mobile services because of material differences in the access infrastructure over which such services are provided; and (3) measured annually based on actual usage during peak usage periods to reflect the rapid evolution of the technology and market demand and supply.
- For the purposes of the National Broadband Plan in 2010, fixed broadband should be defined as throughput currently used by Internet subscribers based on advertised offerings at: (1) a minimum speed of 768 Kbps downstream and 384 Kbps upstream; (2) an average speed of 9.1 Mbps downstream and 1.7 Mbps upstream; and (3) a maximum speed of 101 Mbps downstream and 20 Mbps upstream. The future fixed broadband tier should be defined as throughput at 1 Gbps downstream and 100 Mbps upstream.

In these reply comments, the FTTH Council provides further support for this definition by addressing three issues. First, the Council demonstrates that the statute directs the Commission, in writing the National Broadband Plan, to fashion policies that achieve numerous national purposes, including: providing service to unserved areas; upgrading service in underserved areas; and, ensuring service to public safety agencies, ensuring broadband infrastructure and services advance "consumer welfare, civic participation, public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, worker training, private sector investment, entrepreneurial activity, job creation and economic growth, and other national purposes and any definition of broadband should serve these aims."

Second, the FTTH Council links these objectives with its multi-tier definition of broadband. Specifically, the minimum current generation tier could be used to bring first-time service to users in areas with very high-costs. The average tier could serve to encourage in the short-term upgrades in the quality of existing broadband service so that users could take advantage of important applications (*e.g.* telemedicine, distance learning, and telework). The maximum tier would serve as a basis for more intermediate-term upgrades, and the future generation tier provides our longer-term goals.

Finally, the FTTH Council provides evidence to support the benchmarks in its proposed Future Generation tier by examining application in development, international standards, and activities in other countries.

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The Fiber-to-the-Home Council ("FTTH Council"),[1] through its undersigned counsel, hereby respectfully submits its reply comments to the Federal Communications Commission

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[1] The FTTH Council is a non-profit organization established in 2001. Its mission is to educate the public and government officials about fiber-to-the-home ("FTTH") and to promote and accelerate FTTH deployment and the resulting quality of life enhancements FTTH networks make possible. The FTTH Council's members represent all areas of the broadband access industry, including telecommunications, computing, networking, system integration, engineering, and content-provider companies, as well as traditional service providers, utilities, and municipalities. As of today, the FTTH Council has more than 210 entities as members. A complete list of FTTH Council members can be found on the organization's website: http://www.ftthcouncil.org.

("Commission") in response to NBP Public Notice #1 ("*Commission Notice*")[2] issued in the above-captioned proceedings.[3] In these replies, the FTTH Council focuses on three issues joined by commenters in the initial comments: (1) the objectives the Commission is to use in developing its definition of broadband; (2) how the Commission is to use these objectives to fashion a definition of broadband; and (3) the need for the Commission to adopt a long-term vision of broadband. Most importantly, for purposes of these comments is the FTTH Council's proposed multi-tier and evolving definition of broadband, which is keyed to the multiple objectives of the law and which the Council discussed in its initial comments and upon which it elaborates here. The Council's proposed definition of broadband is as follows:

> Broadband is a relative term of information-carrying capacity of a transmission on any media expressed in analog or digital format. In analog format, it is measured in terms of bandwidth, the range of frequencies used for a particular transmission. In digital format it is measured primarily in terms of actual available throughput, bits transmitted per second measured at peak usage periods, and secondarily in terms of other quality of service factors, such as latency, jitter, and contention.
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> Broadband performance should be: (1) measured by tiers of capability to more precisely direct government policy and increase user understanding; (2) measured separately for fixed and mobile services because of material differences in the access infrastructure over which such services are provided; and (3) measured annually based on actual usage during peak usage periods to reflect the rapid evolution of the technology and market demand and supply.
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> For the purposes of the National Broadband Plan to be submitted in 2010, fixed broadband should be defined as a throughput currently used by Internet subscribers based

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2 *Public Notice, Comment Sought on Defining "Broadband" NBP Public Notice #1*, Rel. Aug. 20, 2009.

3 *In the Matters of International Comparison and Survey Requirements in the Broadband Data Improvement Act*, GN Docket No. 09-47, Rel. Mar. 31, 2009, *A National Broadband Plan for Our Future*, GN Docket No. 09-51, Rel. Apr. 8, 2009 ("*NBP Notice of Inquiry*"), and *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 09-137, Rel. Aug. 7, 2009.

on advertised offerings[4] at: (1) a minimum speed of 768 Kbps downstream and 384 Kbps upstream; (2) an average speed of 9.1 Mbps downstream and 1.7 Mbps upstream; and (3) a maximum speed of 101 Mbps downstream and 20 Mbps upstream. The future wireline broadband should be defined as throughput at 1 Gbps downstream and 100 Mbps upstream.

1. Multiple Objectives Drive the Definition of Broadband

While some commenters seek to restrict the aims of the National Broadband Plan to a single goal -- ensuring that all people have access to some minimal level of broadband service -- the law is not so limited. The statute is framed in terms of ensuring all people "have access to broadband capability,"[5] and directs the Commission to draft a plan that sets forth specific policies to both widen the reach ("access") and enhance the quality ("capability") of broadband service Americans should receive. This wider interpretation is buttressed by the statute's direction that the Commission create a plan "for use of broadband infrastructure and services in advancing" an array of national purposes.[6] Chairman Genachowski recognized the breadth and import of the law's objectives in his July 2, 2009 remarks at the FCC's Open Meeting:

> "The statute is clear about what our goals must be. We must find ways to ensure that all people of the United States have access to broadband...**And we must ensure that our broadband infrastructure and services advance national purposes, including job creation and economic growth...education, health care, energy, public safety, civic participation and many others.**"[7] (emphasis added)

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4 The performance benchmarks proposed for use in the National Broadband Plan are based on advertised speeds because those data are most readily available. As the Commission updates the benchmarks, it should rely on actual usage data.

5 American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115, Div. B, Tit. VI, Sec. 6001(k)(2), Feb. 17, 2009. ("*ARRA*")

6 *Id.*, Sec. 6001(k)(2)(D).

7 Chairman Julius Genachowski, Prepared Remarks on National Broadband Plan Process, FCC Open Meeting, Washington, D.C., July 2, 2009, available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291884A1.pdf.

The Chairman reiterated these thoughts later in the month when he stated that the Commission "needs to develop a National Broadband Plan that will spur innovation, promote competition, create jobs, and bring the powerful benefits of broadband to all Americans."[8] Commissioner Copps too has stated that the plan needs to have an expansive vision: "What the FCC has been charged to do...is to complete a forward-looking, strategic, data-driven, accessible, living, breathing plan that can guide us to affordable, value-laden broadband in every corner of our country and restore our preeminence as the world's technology leader."[9]

The Commission also should recognize that the National Broadband Plan is part and parcel of Title VI, the Broadband Technologies Opportunities Program ("BTOP"), and the ARRA, and it should view the aims of the plan within this larger context. The BTOP and its linked Broadband Initiatives Program ("BIP") overseen by the Rural Utilities Service seek to fund broadband projects for both unserved and underserved areas,[10] and the BTOP's goals also include improving access to "broadband service for public safety agencies"[11] and stimulating "economic growth and job creation."[12] Further, both BTOP and BIP require the agencies to consider broadband performance in awarding funds —"greatest broadband speed" for the BTOP and "high-speed" for the BIP.[13] As for the *ARRA*, its purposes include "to preserve and create

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8 *FCC News, Chairman Genachowski Announces Topics to Focus Discussion at Workshops for National Broadband Plan, July 30, 2009*, available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292455A1.pdf.

9 *Bench Remarks of Commissioner Michael J. Copps on Presentation of National Broadband Plan Process, FCC's Open Meeting, Washington, DC, July 2, 2009*, available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291882A1.pdf.

10 *ARRA*, Sec. 6001(b)(1), (2) and Div. A, Tit. I, "Rural Utilities Service."

11 *Id.*, Sec. 6001(b)(4).

12 *Id.*, Sec. 6001(b)(5).

13 *Id.*, Sec. 6001(h)(2)(B) and Div. A, Tit. I, "Rural Utilities Service."

jobs" and "to invest in...infrastructure that will provide long-term economic benefits."[14] Finally, it is important to note the statement of the *ARRA* Conferees stating: "[T]he construction of broadband facilities capable of delivering next-generation broadband speeds is likely to result in greater job creation and job preservation than projects centered on current-generation speeds."[15]

When all of the *ARRA's* statutory language and Congressional direction are taken together, it is evident that the Commission, in writing the National Broadband Plan, is directed to fashion policies that achieve numerous national purposes, including:

- Providing service to unserved areas;
- Upgrading service in underserved areas;
- Ensuring service to public safety agencies, ensuring broadband infrastructure and services advance "consumer welfare, civic participation, public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, worker training, private sector investment, entrepreneurial activity, job creation and economic growth, and other national purposes and any definition of broadband should serve these aims."[16]

The Commission thus must eschew the views of those commenters that seek a more constricted reading of the law, limiting the National Broadband Plan to the pursuit of the sole, albeit worthy, objective of seeking to bring first-time broadband service to unserved areas.

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14 *Id.*, Sec. 3(a)(1), (4).

15 Conference Report on H.R. 1, American Recovery and Reinvestment Act of 2009, Div. B, Tit. VI, Broadband Technology Opportunities Program, Conference Agreement.

16 *ARRA*, Sec. 6001(k)(2)(D).

2. A Tiered and Evolving Definition of Broadband Best Serves Policymakers and Users

Just as the Commission should reject any view that the aims of the National Broadband Plan are restricted solely to ensuring that broadband service is brought to unserved areas, it also needs to reject a definition of broadband that serves only to meet that much too limited goal. Rather, broadband should be defined in a way that enables the Commission, Congress, and other policymakers to use it, in the National Broadband Plan and in establishing future policies, to achieve the many national purposes discussed above. More specifically, a definition of broadband that is limited to minimal performance levels – in effect, the lowest two tiers in Form 477 (below 768 Kbps) – at best is potentially of use only in assisting policymakers to help bring service to unserved areas. While a worthwhile objective, such a limited definition provides no instruction to policymakers on how to achieve other crucial aims, and it provides no benchmarks for users in assessing various broadband offerings. Further, as noted by commenters,[17] even users in unserved areas deserve the same broadband performance of users elsewhere in the country. So, a definition with minimal performance does not provide much benefit even to achieve that aim.

To enable the achievement of the multiple aims of the National Broadband Plan, numerous commenters supported a tiered approach incorporating various levels of broadband performance, both current and future.[18] The FTTH Council sought to link the aims of the statute

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17 *See, e.g.,* Comments of the Organization for the Promotion and Advancement of Small Telecommunications Companies, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 3.

18 A variety of comments supported some variant of a tiered approach, often based on the Commission's current Form 477. *See, e.g.,* Comments of the Organization for the Promotion and Advancement of Small Telecommunications Companies, GN Docket Nos.

. . .*Continued*

with the definition of broadband by proposing an evolving, multi-tier approach to defining broadband. The Council's proposed definition included three tiers for current generation service -- minimum, average, and maximum -- and then an additional tier for future generation service.[19] These multiple tiers give the Commission a basis upon which it can adopt policies to simultaneously seek a number of objectives. The minimum current generation tier could be used to bring first-time service to users in areas with very high-costs.[20] The average tier could serve to encourage in the short-term upgrades in the quality of existing broadband service so that users could take advantage of important applications (*e.g.* telemedicine, distance learning, and telework). The maximum tier would serve as a basis for more intermediate-term upgrades, and the future generation tier provides our longer-term goals.

Not only would these multiple tiers provide a basis for actions by policymakers, they would provide an immediate benefit for users. The definition in effect would become the standard upon which users across the country could judge where their broadband service ranks among the competition. With such knowledge, users who find their service falls short of the average or who want access to service with even greater performance can notify their providers

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09-47, 09-51, 09-137, Aug. 31, 2009 at 3; Comments of IEEE 802.18, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 3-4; Comments of Comcast Corporation – NBP Public Notice #1, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 7-8.

19 The FTTH Council proposed that for each tier broadband performance be measured by throughput, and, where appropriate, other performance characteristics, such as latency and jitter, and by actual usage at peak periods.

20 As noted earlier, while the tiers proposed by the FTTH Council includes a minimum, it does not support Commission policies that would support deployments at those "backward-looking" performance levels. The Council strongly endorses the statement of OPASTCO that users in rural and high-cost areas should "have access to advanced services that are reasonably comparable in price and quality to those that are available in urban areas." (*See*, the Comments of the Organization for the Promotion and

. . .*Continued*

that they wish to receive improved service. This same information also would benefit applications providers, who now could develop their offerings based upon a more precise indication of the status of broadband performance and where the market and policymakers were headed.

Once it constructed its multi-tier definition, the FTTH Council provided the Commission with current broadband performance data that could be used in developing the policies in the National Broadband Plan. It contracted with the consulting firm, CSMG, to sample existing market information about the advertised performance of fixed broadband offerings, and, based on that sample, CSMG produced the following chart of the current generation tiers:

Advancement of Small Telecommunications Companies, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 3.)

CURRENT GENERATION BROADBAND TIER	UPLOAD SPEED[21]	DOWNLOAD SPEED
MINIMUM	384 Kbps[22]	768 Kbps[23]
AVERAGE	1.7 Mbps[24]	9.1 Mbps[25]
MAXIMUM	20 Mbps	101 Mbps

The FTTH Council wishes to emphasize a number of points about its multi-tier paradigm and the chart. First, currently available actual performance data supports the benchmarks in the chart and argues against "dumbing-down" the thresholds to a single low-end service. Akamai's recent report, for instance, found that 26% of the broadband connections in the United States (and at least 38% in the top ten states) were at speeds above 5 Mbps. The FTTH Council's own research shows that FTTH subscriber downstream access speeds in 2009 have increased to an

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21 While the chart defines performance only in terms of throughput, the FTTH Council, as noted in these comments, expects that future charts would include other QoS metrics.

22 Minimum and Maximum tier advertised upload speeds are from the lowest and highest offers currently available in the top 10 U.S. cities (by population). The highest advertised Maximum tier upload speed (20 Mbps) is currently offered by Verizon FiOS in multiple U.S. markets. The lowest upload speed (384 Kbps) is offered by AT&T and Verizon in 9 of the top 10 U.S. markets.

23 Minimum and Maximum tier advertised download speeds are from the lowest and highest offers currently available in the top 10 U.S. cities (by population). The highest advertised Maximum tier download speed (101 Mbps) is currently offered by Cablevision in New York City. It is estimated that other cable companies will match or exceed this offer in the near future. Verizon FiOS is expected to generally exceed highest cable speeds. The lowest download speed (768 Kbps) is offered by AT&T in 6 of the top 10 U.S. markets.

24 Average tier upload speeds are estimated using the most prevalent upload speeds accompanying download speed offers of ~9 Mbps (*see* n. 12) in currently marketed offers in the top 10 U.S. markets.

average of 12.2 Mbps (with an average peak demand of 27.6 Mbps), which is a 134% increase over the past two years. Upstream access speed growth was even greater – 263%.[26] In addition, an increasing number of FTTH subscribers have access to symmetrical 100 Mbps service.[27] In fact, it is important to note that speeds that many thought would not be available for years are rapidly coming to the market by various broadband providers. In other words, the goal proposed by Senator Rockefeller and Representative Eshoo to bring 100 Mbps symmetrical service throughout the country by 2015 is becoming an increasing reality.[28] Second, while the throughput data in the chart is based on advertised offerings, the definition and subsequent gathered data should evolve to define and measure actual performance to more accurately reflect

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25 Average tier download speeds are calculated by taking a weighted average of the current (2009) distribution of U.S. broadband subscribers by speed tiers, as estimated in the SNL Kagan Report (*see*, SNL Kagan website, *Economics of the Internet Media 2009*).

26 *A Study of U.S. FTTH and Broadband Consumers, FTTH Performance and Subscriber Satisfaction, For the FTTH Council*, RVA LLC, July, 2009 at 6-7 available at: http://www.ftthcouncil.org/sites/default/files/RVA%20FTTH%20Performance%20FINAL_0.pdf. ("*FTTH Performance and Subscriber Satisfaction*")

27 *FTTH Provider Study*, RVA LLC, April 1, 2009

28 S. Res. 191, 110th Congress, which provides: "That the Senate--
(1) establishes a national next-generation broadband network goal to bring, by 2015, universal and affordable access to networks with the capability of transmitting data at 100 megabits per second, bidirectionally, so that households, businesses, and government offices in the United States can access the Internet and, via direct connections, access other households, businesses, and government offices."
H. Res. 1292, 110th Congress, which provides: "That the House of Representatives--
(1) establishes a national next-generation broadband network goal to bring, by 2010, universal and affordable access to networks with the capability of transmitting data at 10 megabits per second, bidirectionally, and by 2015, universal and affordable access to networks with the capability of transmitting data at 100 megabits per second, bidirectionally, so that households, businesses, and government offices in the United States can freely access the Internet and, via direct connections, access other households, businesses, and government offices."

network performance.[29] Again, the Form 477 process provides a mechanism for this to occur, and the Commission should work with the industry to establish measurement methodologies that reflect actual performance. Third, the Council expects the Commission to update the chart annually. Commenters[30] were divided about how frequently to update the definition, but the simple fact is that the broadband service market is dynamic and offerings change throughout the year. If the Commission's definition is to be relevant, it needs to use the Form 477 process and the annual Section 706 proceeding to amend the definition annually. Doing so will not be detrimental to network planning since the chart is based on actual market activity.

3. A Long-Term Broadband Vision is an Inherent Part of the National Broadband Plan and Should be Reflected in the Definition of Broadband

As part of its multi-tier broadband proposal, the FTTH Council urged the adoption of an "aspirational" Future Generation tier to drive long-range policymaking. This tier would be based upon observed trends in bandwidth provision and use, general growth in traffic, and anticipated demands from applications and users, especially to access video, telework, and healthcare services. Other commenters echoed a similar viewpoint. Verizon and Verizon Wireless, for instance, called on the Commission to "set aggressive, long-term targets" with a 50 Mbps target for fixed services and 5 Mbps for mobile.[31] OPASTCO urged the Commission to establish a

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29 Other commenters supported the use of actual performance data, including Windstream. *See,* e.g. Comments of Windstream Communications, Inc. – NBP Public Notice #1, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 2, which argues for a transition to actual "average throughput speeds available to an end user during the most common utilization periods" to better assess the market.

30 For commenters supporting an annual review, *see, e.g.*, Comments of the Organization for the Promotion and Advancement of Small Telecommunications Companies, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 4.

31 Comments of Verizon and Verizon Wireless on Defining Broadband Capabilities, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 1.

definition for broadband that anticipates "the needs of consumers in rural service areas" and accounts "for bandwidth-intensive applications, including those that incorporate video, that are most efficiently delivered via fiber."[32] The Commission, of course, is familiar with establishing such long-term objectives. In its recent rural broadband strategy report, Acting Chairman Copps stated that the report's recommendations should "facilitate the rapid and widespread buildout of state-of-the-art broadband access facilities" to all Americans.[33]

The FTTH Council believes there is more than ample evidence to establish a Future Generation tier through a variety of indicia, including use of trends in research and equipment development, known applications in development, work on international standards, and activities in other countries. In its initial comments, the Council proposed that the Commission establish a process to establish benchmarks for that tier. As with the benchmarks proposed above for the current generation tiers, for purposes of drafting the National Broadband Plan, the Council believes the Commission has access to sufficient information upon which it can construct a Future Generation tier. The following are some examples:

- In its comments, OPASTCO cited research that the typical user will need 90 Mbps as early as 2013, which would translate into almost 1 Gbps for a "maximum" user.[34]

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32 Comments of the Organization for the Promotion and Advancement of Small Telecommunications Companies, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 13.

33 *Bringing Broadband to Rural America: Report on a Rural Broadband Strategy*, GN Docket No. 09-29, May 22, 2009, at ¶ 12, available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291012A1.pdf.

34 Comments of the Organization for the Promotion and Advancement of Small Telecommunications Companies, GN Docket Nos. 09-47, 09-51, 09-137, Aug. 31, 2009 at 8. The RVA LLC *FTTH Performance and Subscriber Satisfaction* report (at 8) forecasts that the average peak bandwidth downstream load in 2013 will approach 100 Mbps.

- As just reported in *Communications Daily*, Corning researchers determined that even at speeds of 12 Mbps an image of dynamic HDTV programming is "unacceptable" on large 1080p sets, which are increasing in use.[35] As a result, the Commission's and the video industry's goal of ubiquitous, high-quality HDTV will suffer if broadband performance does not improve dramatically – to at least 24 Mbps per signal. (For a "3-set" household, this would translate into 72 Mbps.) This is especially the case as the industry moves to more bandwidth-intensive video applications, such as 3-D TV, Quad-HD, and Web-enabled sets.[36]

- As for equipment development, while today's FTTH electronics generally are capable of providing 100 Mbps bidirectionally to each end user, in just a few years, these speeds will increase by ten times – to 1 Gbps per user – and further growth is already being planned.[37]

- Regarding international standards, the International Telecommunications Union already has approved standards (ITU J.601) for receiving a single Super video signal -- 50 Mbps required for a single channel -- and a single Ultra video signal -- 200 Mbps required for a single channel.[38]

- In leading broadband countries, including Korea and Japan, service providers have begun offering users 1 Gbps symmetrical broadband service, and both Korea and Singapore have national plans to increase broadband speeds to 1 Gbps in several years.[39]

Based on these and other data, the FTTH Council believes the Future Generation tier should be set at 1 Gbps downstream and 100 Mbps upstream.

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35 *Communications Daily*, September 3, 2009 at 10. Compression methods may be used to lessen the bandwidth requirements, but the trade-off is that they are expensive.

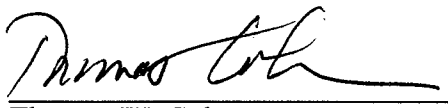
36 Also, *see*, *Perspectives: WW Optical Fiber Market*, B. Boersen, 2009 OFC Conference, March 24, 2009, available at: http://www.ofcnfoec.org/conference_program/2009/images/09-Boerson.pdf.

37 The IEEE and International Telecommunications Union are both expected to publish 10G standards within the next year.

38 *Broadband Home Area Networks -- Meeting the Needs of Today and Tomorrow*, K.D. Langer, Heinrich-Hertz-Institut, Feb. 2009, at 3, available at: http://www.slideshare.net/ceobroadband/ftth-conference-2009-heinrich-hertz-institut.

39 *See, e.g., Fiber for the Future*, David Boothroyd, July 9, 2009, available at: http://www.newelectronics.co.uk/article/19756/Fibre-for-the-future-%E2%80%93-COVER-STORY.aspx.

Respectfully submitted,



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