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

In the Matter of	)	
	)	CG Docket No. 09-158
Measurement of Mobile Broadband Network	)	CC Docket No. 98-170
Performance and Coverage	)	WC Docket No. 04-36
	)	

COMMENTS - MOBILE BROADBAND MEASUREMENT
OF BEST BUY CO., INC.

Introduction

Best Buy is pleased to provide these brief comments in response to the Commission's public notice asking whether and how to pursue a measurement program for mobile broadband services given the growing significance of mobile internet access. Additionally, you seek comment on how providers can improve voluntary self-reporting of network performance and coverage.[1]

Best Buy and Best Buy Mobile stores have become a destination of choice for purchasing a broad range of mobile devices and products, including mobile phones, smartphones, computers (desktops, laptops and netbooks), Internet-connected video consoles, portable music players, digital cameras, video devices, and modems. Consumers rely on Best Buy sales consultants' advice in choosing among devices and broadband Internet access services[2]. This experience in serving consumers gives Best Buy a distinct, and we think valuable, perspective on the promotion of broadband deployment and use including an understanding of information most

[1] *Comment Sought on Measurement of Broadband Network Performance and Coverage*, Public Notice, DA 10-988, (June 1, 2010).
[2] Best Buy and Best Buy Mobile stores feature non-commissioned sales staff offering informed, impartial advice on a broad selection of devices and networks from the leading brands and carriers.

useful to consumers in making informed purchase decisions of mobile broadband[3]. In addition, Best Buy Mobile has developed a technology solution ("mobile map tool") to measure mobile broadband performance based on user-generated data and believes its learnings and insights are particularly instructive and informative in this proceeding.

Specific Questions on Measurement Metrics for Mobile Broadband Services

1. What are the best measurement metrics for mobile broadband services?

a. What performance characteristics should be tracked for mobile broadband networks (e.g., typical data throughput, signal strength, accessibility, retainability, latency, other quality of service parameters)? At what level of temporal and geographic granularity?

Best Buy suggests signal strength, throughput, latency, and packet delay variation are the most important performance characteristics to track. In addition, our experience is that signal strength varies measurably at distances on the order of 10 meters. Throughput, latency, and packet delay variation vary measurably at distances on the order of 100 meters and thus should be measured at those approximant geographic granularities. Signal strength is approximately constant with time, but throughput, latency, and packet delay can vary over the course of a day, therefore the latter metrics should be measured many times per day.

b. What parts of the network should be measured? What starting and ending points (e.g., radio access network, middle mile) are most useful and actionable for consumers, regulators and providers?

Best Buy believes consumers care about the perceived speed of the network on the device they are using. However, the device does need to be factored in as some devices and the browsers on them are inherently faster than on other devices.

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[3] *See Ex Parte Comments* of Best Buy on National Broadband Plan, GN Dkt. No. 09-51, (January 27, 2010).

c. Should measurement processes and standards for mobile broadband services be different than those for fixed broadband connections?

Because mobile broadband performance fluctuates more than fixed broadband performance, more repeated measurements are required to get a statistically meaningful result.

Specific Questions on User-Generated and Other Data Gathering Methods

2. What are the best methods for collecting data on mobile broadband performance and coverage for end-users?

a. What are the best available tools in the market today for measuring mobile broadband performance and service coverage?

b. Are there current data sets already available that could be useful for facilitating better consumer disclosures on mobile broadband performance and coverage?

c. Are there existing technologies that can measure actual end-user experience on mobile broadband networks? If so where could the measurements take place (e.g., on the device, inside the network)?

Best Buy believes the current quality of service databases (more commonly known as "coverage maps") maintained by the carriers provide important and helpful information to consumers but have some limitations including:

- Each provides information about only one carrier;
- There is no standard quality of service measurement to compare carriers;
- None allow comparison of different phones;
- None show actual data network speed (e.g. bandwidth);
- Each has a different user interface and different nomenclature.

Best Buy believes data can be collected and presented to consumers in a way that is more informative, independent and represents mobile broadband performance based on user experience. Because these solutions were not readily available in the marketplace, Best Buy has developed its own mobile map tool to utilize the broad availability of GPS-enabled smartphones

in the U.S. marketplace to create a consumer-driven cell phone quality of service database that is independent of the major cell phone carriers. It is Best Buy's intent through the mobile map tool to fill the void for consumers by providing a quality of service database that provides the following:

- Data for all major U.S. carriers plus many others;
- Consumer collected and verified data;
- Accurate data measured directly from real-user experience on real phones;
- Standard measurements to compare carriers and phones;
- Radio signal strength and internet connection bandwidth data comparable across carriers and phones;
- A single user interface.

Because the mobile map tool data is collected by consumers for consumers using consumer's phones, Best Buy believes it will be an accurate representation of anticipated and expected performance and thus be more valuable information for the consumer and complementary to existing coverage maps in the marketplace.[4]

3. How can user generated data (i.e., 'crowdsourcing') on mobile broadband network performance and coverage be utilized to assist in collecting data and improving transparency?

Best Buy agrees the popularity of GPS-enabled smartphones in the marketplace has made crowdsourcing mobile network performance feasible.

a. What efforts and technologies currently exist that can enable device level data collection on performance and coverage of mobile broadband networks? What metrics could a device level software application collect that could measure mobile broadband performance and

[4] All data would be provided on a voluntary, opt-in basis by consumers.

coverage (e.g., signal strength, data throughput rate)? What other data points would be valuable to collect in association with that data (e.g.,location, tower ID, handset type)?

Best Buy believes signal strength, throughput, latency, and packet delay variation are currently existing efforts and technologies, and in addition, suggests location, location accuracy, date-time, cell ID, handset type, network type, and home carrier ID as valuable data points.

b. For collecting device level data, what impact does the type of device (e.g., smartphone, feature phones, laptop, wireless modem) itself have on end-user experienced network performance? How, if at all, could a measurement methodology take variations resulting from device type into consideration?

The device certainly has an impact as does the software on the device. Best Buy recommends that the measurement should be browser agnostic in order to give raw speeds for that type of hardware and it should be possible to see how different hardware performs on the same network at the same points (maybe there is a set of reference locations where different phones can be compared against each other). There also needs to be an easy to digest way of showing the difference between browsers, both in terms of raw speed and also the impact the browser has on the amount of data downloaded.

c. How could measurement methodology account for variations in performance due to the location (e.g., basement of house vs. above ground) or movement (e.g., user on a train) of the end-user? How can we account for differences in location determination methods (e.g., GPS) across handsets and providers, if any? How should buildings, topography, weather, continued network build-outs, and other service availability variables be accounted for in the methodology?

GPS allows for accurate location determination when outdoors, but does not work reliably indoors.

d. Can a statistically robust sampling method correct for the variables described above, such as the impact on performance and coverage measurements of movement, device and location variability?

Given enough data the 'noise' from irregularities will diminish compared to the amount of overall data to give a good level of confidence in the measurements.

e. How can we measure performance with minimal impact on the network itself? For example, how can active measurement techniques that generate additional network traffic mitigate potential increases in congestion?

Rather than continuously sample, the measurement tool should adjust the frequency of data collection based on the speed that the user is traveling. In addition, the tool could also adjust its frequency in places where there is already a lot of recent data.

4. What are the benefits and costs of measurement for providers, regulators, customers and others?

a. What are the benefits (e.g., transparency, better data, network and international comparability, benefits for researchers, verification of National Broadband Map grantee data)?

See comments at 2.c.

b. What are the costs (e.g., hardware costs, usage of the network, consumer hassle, accurate information already exists)?

In crowdsourcing situations, customers may incur data bandwidth charges during measurement.

c. Are there any legal, security, privacy or data sensitivity issues with collecting device level data? If so, how can these issues be addressed?

The user's location is sensitive. This risk can be mitigated by not collecting other information that can be used to identify the user.

<u>Specific Questions on Publication and Communication</u>

5. How could information on mobile broadband performance and coverage be better communicated to consumers?

a. What are the current best practices for displaying or communicating mobile broadband performance and coverage to consumers today?

The coverage maps vary significantly by carrier. The quality of service information published by the wireless operators and manufacturers could be standardized to be more useful for consumers.

b. Are consumers currently being provided with enough accurate and detailed information about performance and service coverage to make informed choices between different mobile broadband network providers?

We do not believe so. In particular the "up to X mbps" claims made by the wireless operators and manufacturers do not appear to always be in-line with the real performance experienced by consumers in our experience.

Specific Questions on Current Mobile Broadband Network Performance and Coverage Disclosures

6. What measurements are typically performed by service providers today to track mobile broadband network performance and service availability?

a. What tools are currently available for consumers to check coverage and performance at a specific geographic location by mobile broadband network (e.g., coverage maps), and how accurate are the data for typical outdoor and indoor consumer use?

In regards to Best Buy's mobile map tool, it is ideal for outdoor data collection. Indoor usage is a more significant issue than outdoors where the GPS on the phone can give a precise location. If the user's location cannot be determined, then only spot data can be collected and is reliant on the knowledge of the individual and accuracy of their information provided.

Respectfully submitted,
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