



The Market for Mobile Broadband

February 16, 2009

A quick introduction to Signals Research Group, LLC.

- Signals Research Group, LLC offers thought-leading field research and proprietary consulting services on the wireless telecommunications industry.
- Our flagship research product, a research newsletter entitled “Signals Ahead,” includes more than 70 corporate subscribers on five continents across the entire wireless ecosystem.

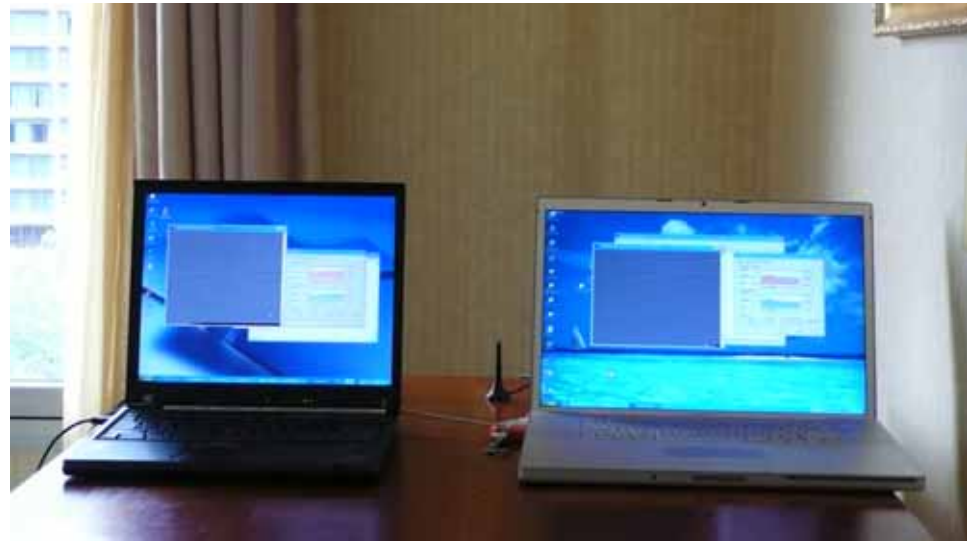


Understanding today's HSPA capabilities

- In November 2008 and January 2009 we conducted independent performance benchmark tests of several leading HSPA platforms.
- The tests leveraged Telstra's Next G HSPA network in Melbourne, Australia.
- Telstra provided access to an in-network server but otherwise did not participate in our benchmark tests.



Source: Telstra Website



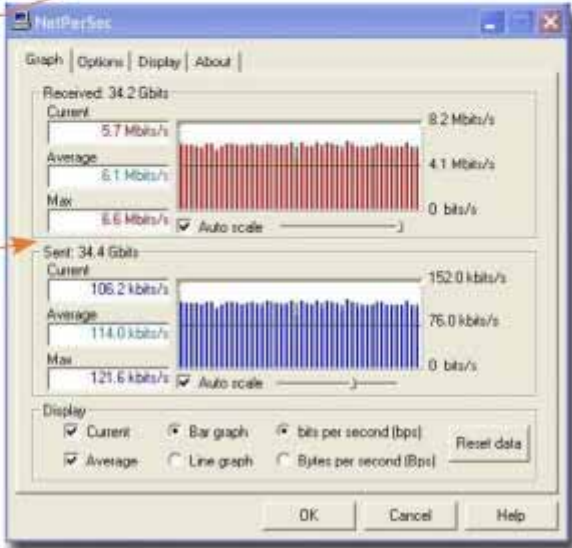
HSPA Throughput under Ideal Conditions

A screenshot of a Windows Command Prompt window. The title bar says "Command Prompt". The main area contains the text: "226 Transfer complete.", "ftp: 52428800 bytes received in 74.178seconds: 706.85kbytes/sec.", and "ftp>".

Max Data Rates up to 6.8Mbps

Average DL =
706.85KB/s =
5,655kbps

Maximum DL = 6.6Mbps

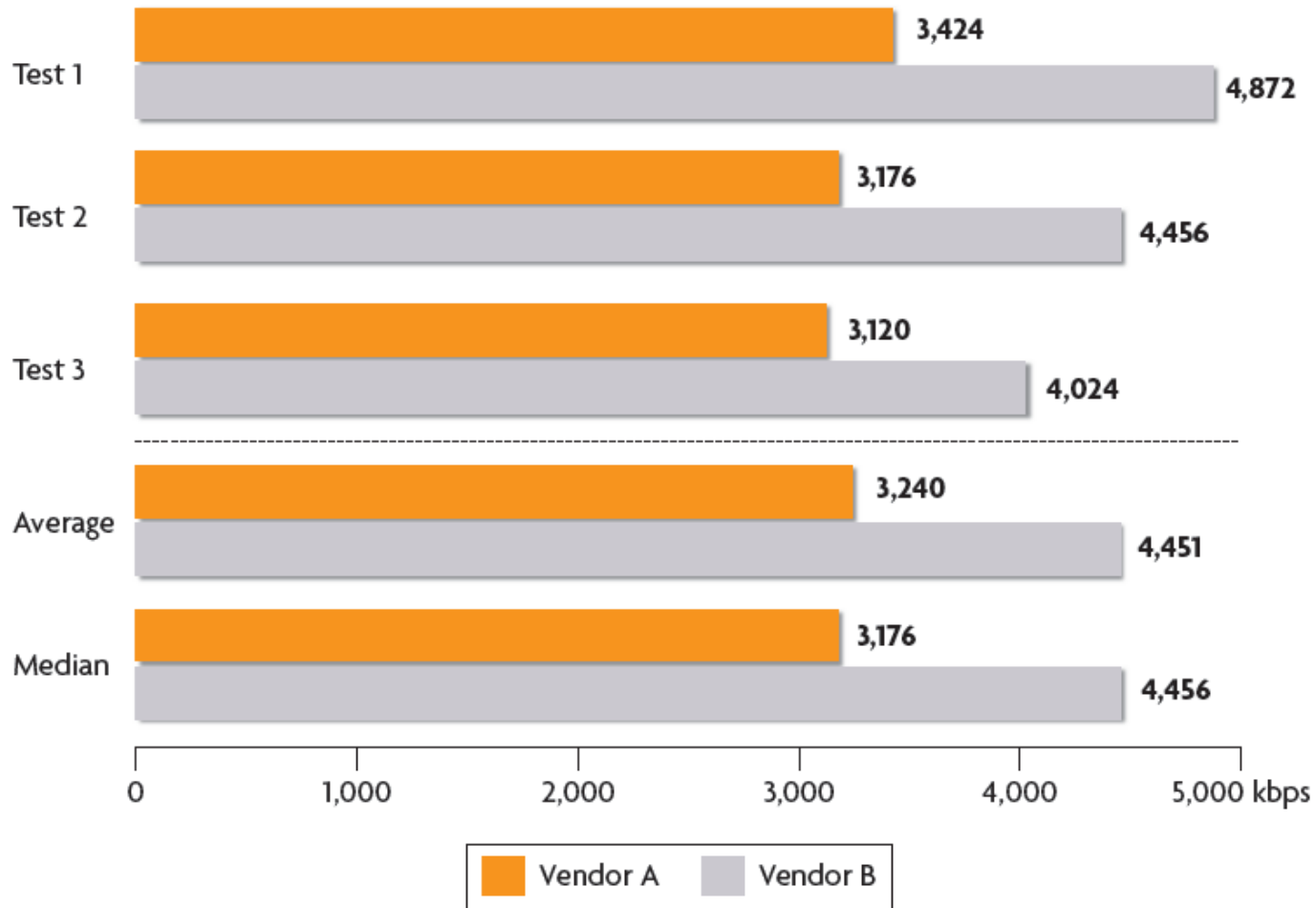


Up to 6Mbps Sustained Throughput (50MB files)

Source: Signals Research Group, LLC

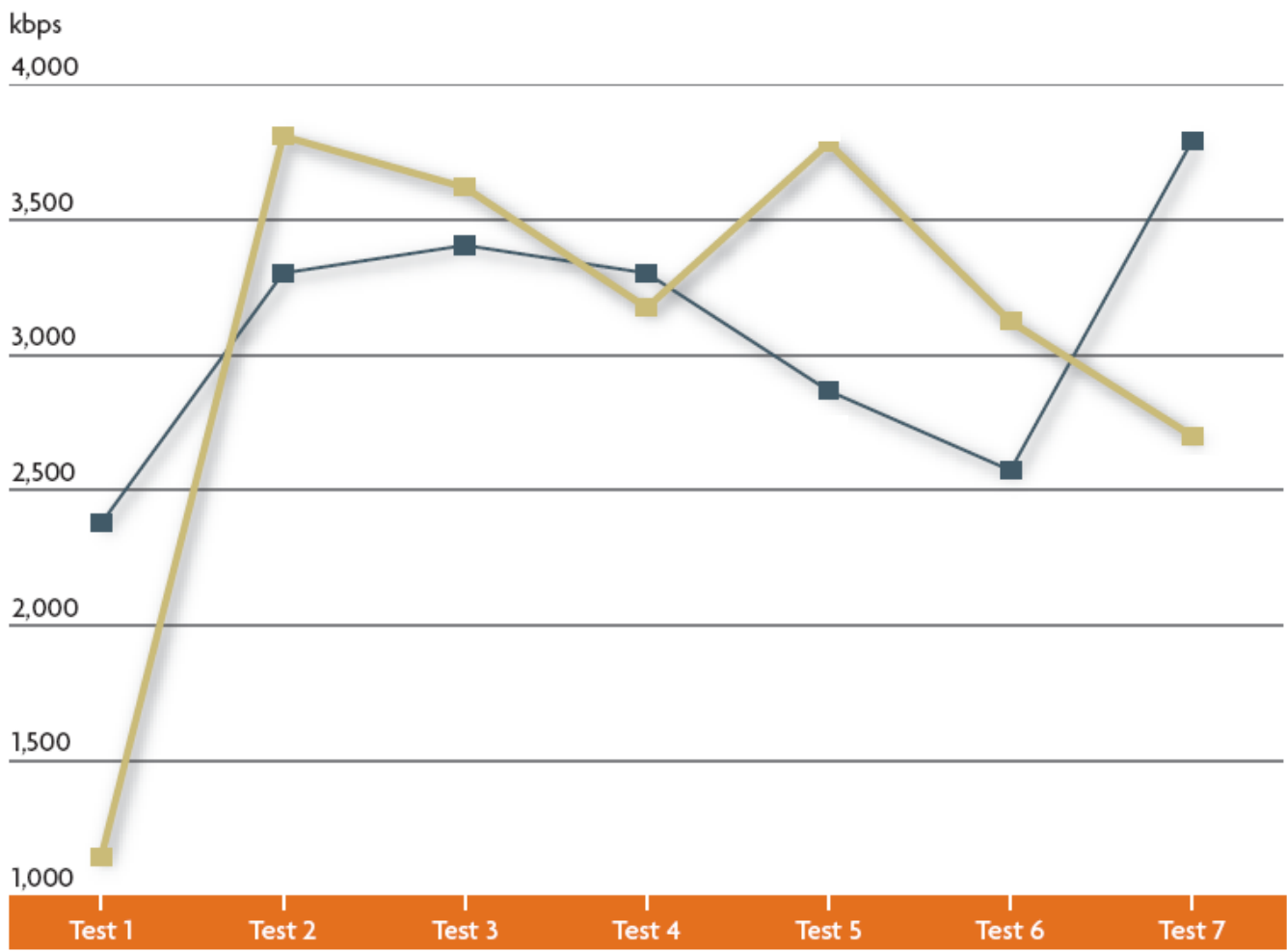


HSPA Throughput under Somewhat Ideal Conditions



**Individual Throughput 3.1 to 4.8Mbps
Combined Throughput >8Mbps**

HSPA Throughput under Challenging Conditions – Pedestrian

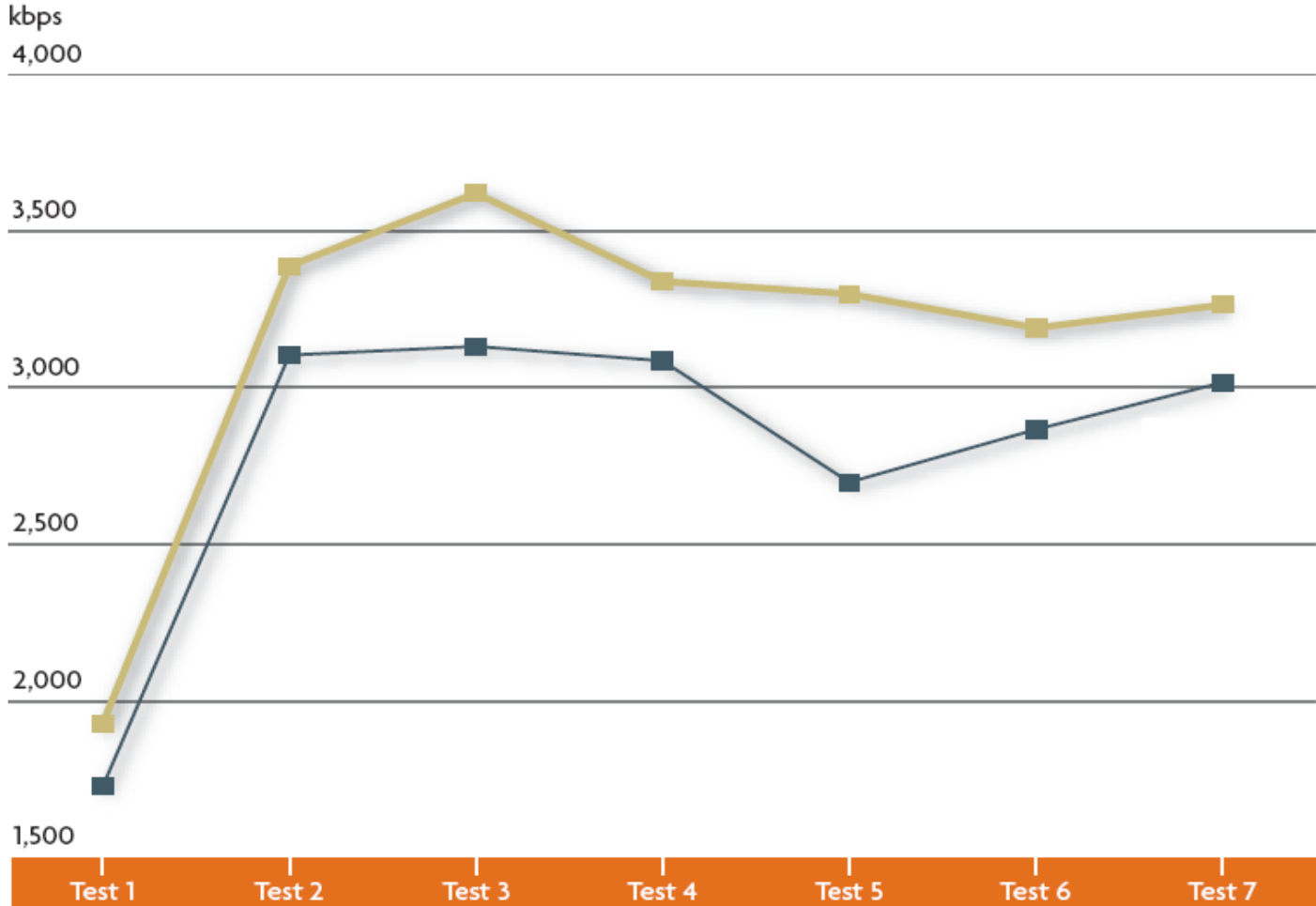


Source: Signals Research Group, LLC

Individual Average Throughput > 3Mbps
Combined Throughput > 6Mbps



HSPA Throughput under More Challenging Conditions – Driving

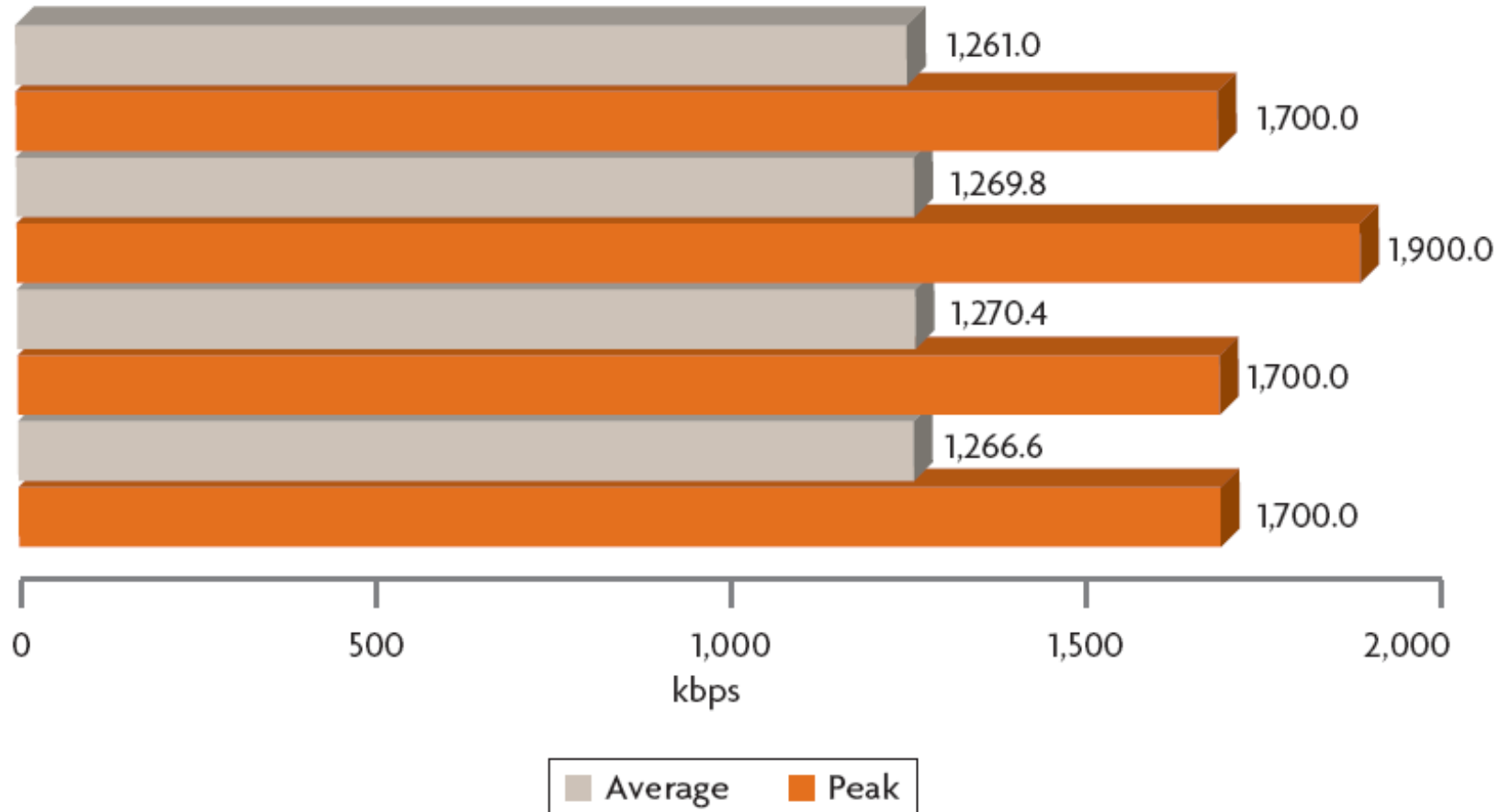


Source: Signals Research Group, LLC

**Combined Throughput >6Mbps
Downloaded 140MB in 3.5 Minutes**



HSPA Throughput in the Uplink



Source: Signals Research Group, LLC

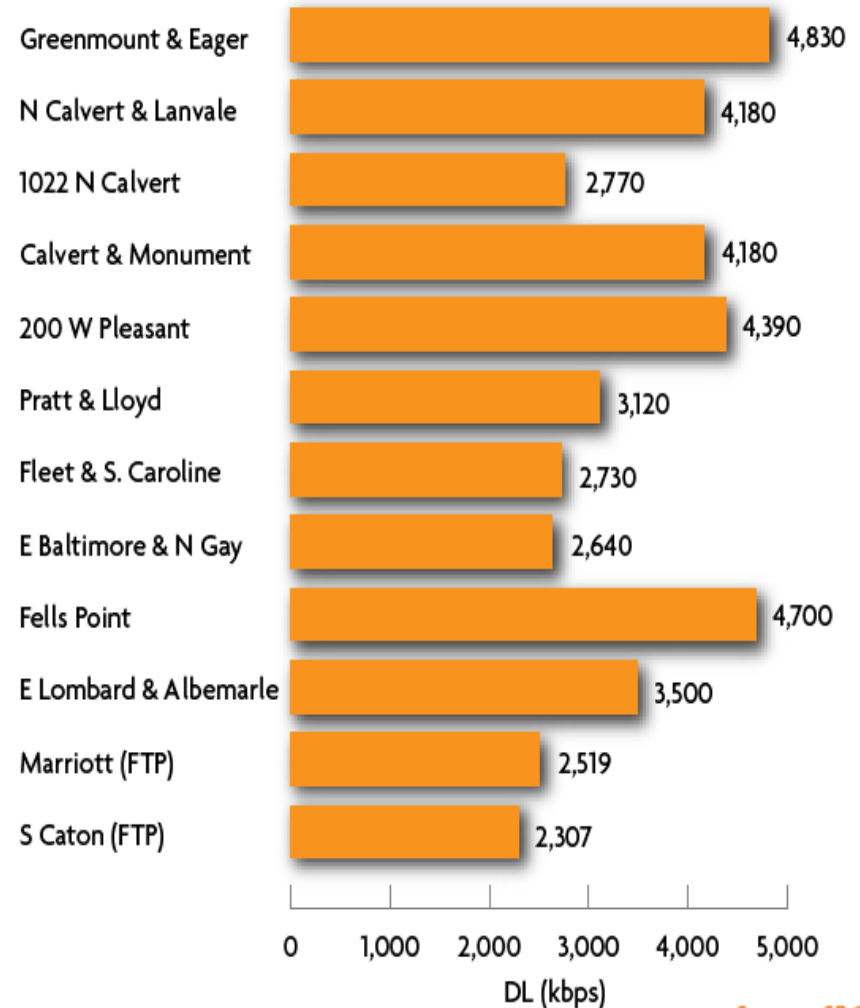
Average Uplink Throughput > 1.2Mbps

Mobile WiMAX in a Best in Class Network - Stationary

**Individual Throughput
2.3 to 4.8Mbps**

- Lightly loaded Network
- Spectrum Differences
- Stationary
- FTP versus UDP

Around Baltimore (UDP)



View of the World – Sites Required for Coverage

Relative Site Count

Service Concept	450 MHz	700 MHz	900 MHz	2100 MHz	2500 MHz	3500 MHz
Full Mobility	30%	43%	53%	148%	183%	320%
Nomadic	10%	13%	13%	21%	23%	40%
	18%	24%	24%	37%	41%	71%
	18%	24%	24%	37%	41%	71%
Semi-Fixed	5%	6%	6%	9%	10%	16%
	8%	11%	11%	15%	16%	27%
	8%	11%	11%	15%	16%	27%
Fixed	3%	3%	3%	4%	5%	6%
	5%	6%	6%	9%	9%	12%
	5%	6%	6%	9%	9%	12%
Full Mobility	30%	43%	53%	148%	183%	320%

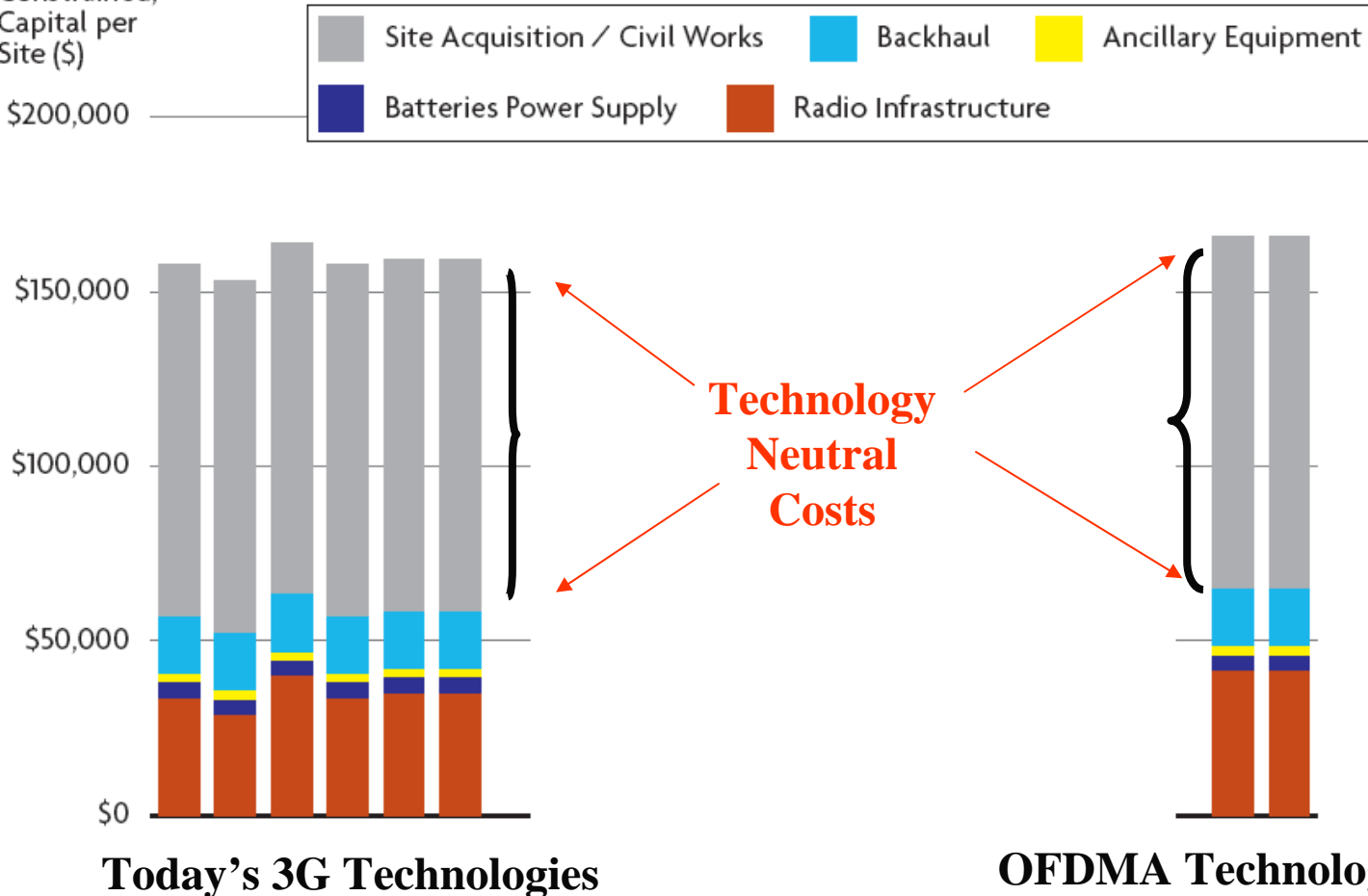
Source: Signals Research Group, LLC

- Higher Frequencies = Higher Cell Count
- Higher Degrees of Mobility = Higher Cell Count
- ~2x more Cell Sites at 2500MHz versus initial 3G rollouts

Some Economic Fact Checking – Part I

Capital per Coverage Site

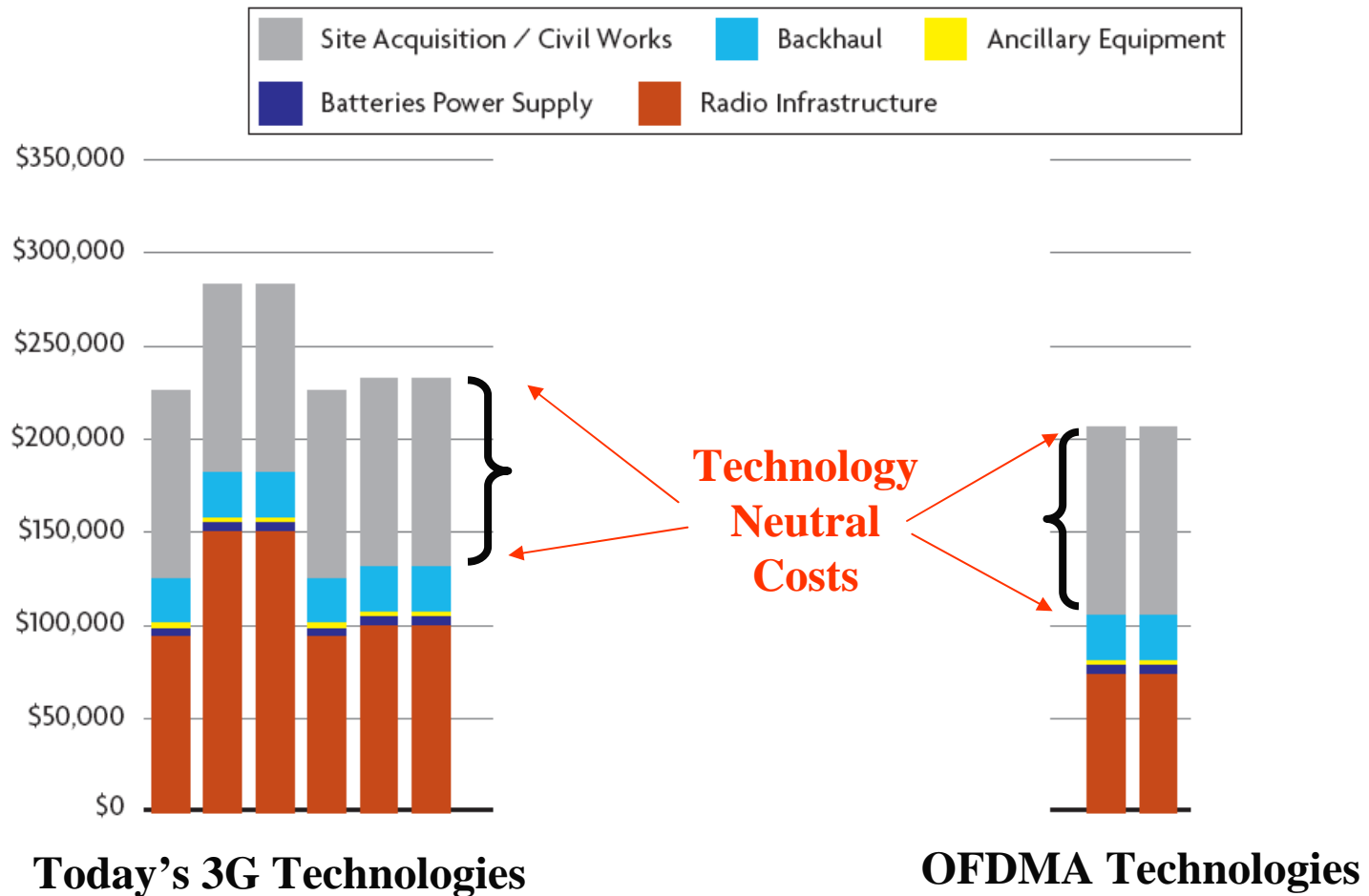
Coverage-
Constrained,
Capital per
Site (\$)



➤ Site related costs are the biggest cost driver

Some Economic Fact Checking – Part II

Capital per Capacity Site



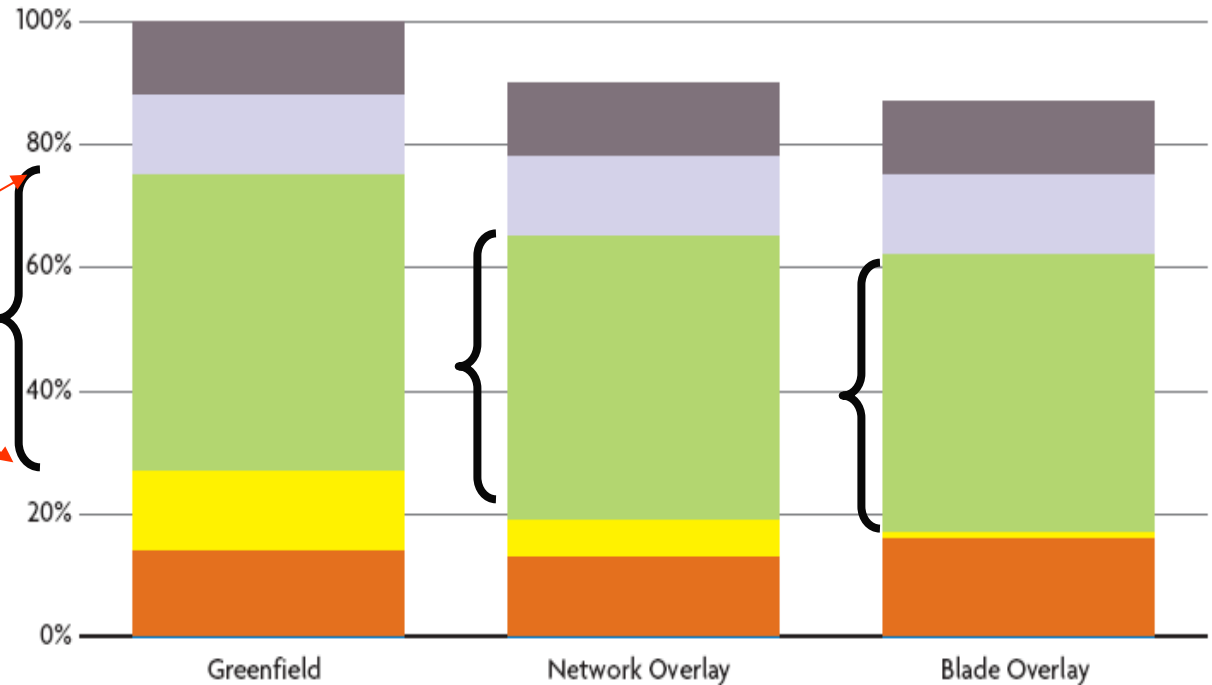
➤ Some technology advantages begin to appear

Some Economic Fact Checking – Part III

Deployment Options – Data (Full Capacity)

Total Allocated Cost (%)

Backhaul Costs



➤ **Backhaul costs in next-gen networks is the single biggest cost driver**

Source: Signals Research Group, LLC

Conclusions

➤ **Today's HSPA technology can provide the most compelling user experience**

➤ **Operators need to carefully consider the cost implications of a next-generation network that supports full mobility**

➤ **LTE is a very attractive technology that will remain on all mobile operators road maps**

➤ **HSPA/HSPA+ provides a critical bridge until LTE**

- **Continued role for voice + data services**
- **wide area coverage**

The logo features a stylized signal icon consisting of four concentric, curved lines in orange, positioned above the letter 'i' in the word 'SIGNALS'.

SiGNAALS
Research Group

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