

Telecom Services & Towers

Spectrum Overview & Valuation Matrix - Carrier by Carrier Spectrum Value Across the Wireless Industry

Spectrum is the lifeblood of wireless companies. It is a finite resource that is difficult to obtain and held onto tightly once won. We look at the spectrum holdings of 11 companies and provide a valuation framework based upon the most recent large scale auctions, the 700 MHz (2008) and AWS (2006). In our view, spectrum valuation is more art than science with valuations swinging widely due to supply and demand and not around a stable, precise value, so think about this as a base-case valuation methodology. Additionally, in this report we show each carrier's spectrum by geography including a graphical representation that demonstrates channel width.

- Framework for spectrum valuations.** Our valuation framework for spectrum valuations is based upon the 700 MHz auction in 2008 and AWS auction in 2006. We assign a 30% premium to cellular spectrum over 700 MHz auction values due to its more attractive band quality. We add a 30% premium for top 100 markets vs. a 10% premium for the remaining markets. We estimate AWS auction values have increased from the 2006 auction with a 40% increase for top 100 markets and a flat valuation for non-top 100 markets. In less commonly used bands we estimate a 30% discount to current AWS prices for MMDS spectrum (DISH) and 50% for 2.5 GHz (CLWR).
- AT&T and Verizon have the largest and most valuable spectrum holdings.** We estimate AT&T's 90 MHz of mobile spectrum (excluding WCS) is worth about \$31b at average \$/MHz-pop prices of \$1.30. Verizon's 99 MHz of nationwide spectrum is worth almost \$36b driven by a substantial 700 MHz spectrum position. As of 3Q12, AT&T valued its spectrum at \$52b on its balance sheet and Verizon \$78b, well above our valuations.
- Sprint and T-Mobile spectrum positions valued at \$15b and \$13b respectively.** We calculate Sprint's spectrum value at \$15b with its 50 MHz of total spectrum of which 14 MHz is cellular and 36 MHz of PCS spectrum. T-Mobile USA's 58 MHz of PCS/AWS spectrum is worth \$13b at an average of \$0.77 MHz/pop. Sprint values its spectrum as of 3Q12 at \$21b and T-Mobile USA at \$14b.
- MetroPCS spectrum valued at \$2.4b and Leap at \$2.0b.** Our analysis of MetroPCS and Leap spectrum for its PCS and AWS holdings focused on licenses and prices paid on a per market basis. We value MetroPCS spectrum at \$2.4b and Leap at \$2.0b. The carrying value of each company's spectrum is \$2.6b for MetroPCS and \$1.8b for Leap.
- US Cellular has \$1.5b in spectrum value and nTelos ~\$109m.** We value US Cellular's spectrum at \$1.5b and nTelos's spectrum at \$109m. USM's spectrum carrying value is \$1.5b and \$132m for NTLs.
- We provide spectrum valuations for Clearwire and DISH Network as well as potential future auctions.** In the report below, we estimate values for the spectrum holdings for the potential alternative carriers. We estimate that, if sold, Dish's spectrum position could be worth \$7.1 billion at \$0.52/MHz-pop and Clearwire's \$11.9 billion at \$0.28/MHz-pop.

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Wireless Spectrum Overview

Spectrum is the lifeblood of wireless companies. It is a finite resource that is difficult to obtain and held onto tightly once it is won. We look at the spectrum holdings of 11 companies and provide a valuation framework based upon the most recent large scale auctions, the 700 MHz (2008) and AWS (2006) auctions. In our view, spectrum valuations are floor valuations, which can swing widely given technology, usage, carrier interest and capital availability. The overall value of AT&T's and Verizon's wireless businesses are substantially greater than spectrum value due to subscribers and networks, despite both having the largest and most highly valued spectrum positions. In our view, spectrum valuation is more art than science with valuations swinging widely due to supply and demand and not around a stable, precise value.

In the US there currently is roughly 200 MHz of spectrum allocated to the 2G and 3G technologies, while the 4G allocation is roughly 300 MHz depending on how one counts it.

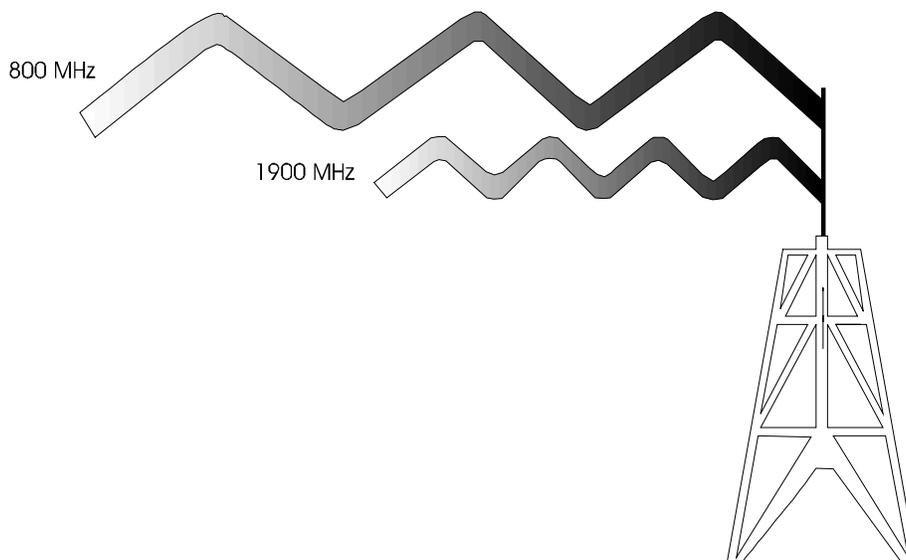
Figure 1: Wireless Spectrum Summary

Common Band Name	Frequency	Bandwidth	2G/3G/4G	Comments
Cellular	800/850 MHz	64 MHz	2G/3G	50 MHz given to industry in the 80's. 14MHz owned by Sprint through Nextel spectrum swap
PCS	1900 MHz	130 MHz	2G/3G/4G	120 MHz auctioned in mid-90's. Includes 10 MHz of G-Block spectrum owned by Sprint not in use
AWS	1.7/2.1 GHz	90 MHz	3G/4G	2006 Auction. T-Mobile and VZ own ~30 MHz for 4G. T owns ~20 MHz for 4G.
700	700 MHz	52 MHz	4G	2008 Auction. Mostly owned by AT&T, Verizon, DISH Network
2.5	2.5/2.6 GHz	150 MHz	4G	Owned by Clearwire, allocated to 4G
MMDS/AWS-4	2.0/2.2 GHz	40 MHz	4G	Owned by DISH Network, allocated to 4G
2G/3G total		~200 MHz		
4G total		~300 MHz		

Source: Company reports and J.P. Morgan estimates.

In general, the lower the frequency the farther a signal will travel and be useful (propagate) at a given power. Thus, lower frequencies like 700 MHz and 800 MHz bands are better for covering large distances and penetrating buildings than the PCS or AWS bands. More debatable is the value of high-frequency spectrum when trying to cover an urban area that needs high cell-site density anyway. How well Clearwire's 4G network loads and its economies over time will be interesting to watch against Verizon's lower-frequency 700 MHz build.

Figure 2: Illustration of Signal Propagation at 800 MHz and 1900 MHz



Source: J.P. Morgan.

Spectrum Positions

We have broken down the spectrum position for the major carriers into six major categories. Since all spectrum is not created equal, the specific band and depth in each band are key in evaluating a carriers spectrum position and its potential value. Generally, the lower the band the better propagation and higher value, and spectrum depth enables larger channels and greater capacity. For the national companies we use an average of spectrum holdings for the top 100 markets. For the unlimited and regional players we only averaged the spectrum using markets where each carrier had spectrum and not across the entire top 100.

Figure 3: Average Spectrum Holdings of Major Carriers in Top 100 Markets

	Cellular	PCS	AWS	700 MHz	MMDS /AWS-4	WCS	2.5 GHz	Total (weighted avg)
AT&T	24	34	5	27				89
Verizon	25	19	30	31				105
T-Mobile	-	27	35	-				62
Sprint*	14	36	-	-				50
MetroPCS	-	8	12	1				21
Leap	-	6	14	1				20
US Cellular*	4	9	8	3				23
NTELOS	-	22	4	-				25
Clearwire	-	-	-	-			150	150
Spectrum in bands in use today	54	130	90	52	-	-	150	476
LightSquared	-	-	-	-	20			20
DISH Network**	-	-	-	6	40			44
Broadcast***	-	-	-	84	-			84
Federal****	-	10	-	-	-			10
Spectrum with visibility to use	54	140	90	136	60	20	150	650

* Does not include sale of USM Midwest markets to Sprint

** Dish has 6 MHz of 700 MHz spectrum across 217m pops

*** Congress estimates 84 MHz could be auctioned nationwide

**** 10 MHz H-block

Source: J.P. Morgan estimates, FCC data.

Figure 4: Average Spectrum Holdings of Major Carriers Nationwide
Avg. Spectrum Holding (MHz)

	Cellular	PCS	AWS	700 MHz	MMDS /AWS-4	WCS	2.5 GHz	Total (weighted avg)
AT&T	22	34	4	23				90
Verizon	25	17	28	29				99
T-Mobile	0	26	33	-				58
Sprint*	14	36	-	-				50
MetroPCS	-	7	11	1				19
Leap	-	6	13	1				19
US Cellular*	7	7	7	5				25
NTELOS	-	23	3	-				26
Clearwire	-	-	-	-	-		135	135
Spectrum in bands in use today	54	130	90	52	-	-	150	476
LightSquared	-	-	-	-	20		-	20
DISH Network*	-	-	-	6	40		-	44
Broadcast**	-	-	-	84	-		-	84
Federal***	-	10	-	-	-		-	10
Spectrum with visibility to use	54	140	90	136	60	20	150	650

* Does not include sale of USM Midwest markets to Sprint

** Dish has 6 MHz of 700 MHz spectrum across 217m pops

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Source: J.P. Morgan estimates, FCC data.

Verizon at 105 MHz in top 100 markets has the largest spectrum position, for now

Verizon not only has the most spectrum (with the exception of Clearwire), but the most in lower bands. The company has 56 MHz of cellular/700 MHz spectrum with 25 MHz on average in cellular and 31 MHz in 700 MHz. Verizon has about 49 MHz of PCS/AWS spectrum with 19 MHz in PCS and 30 MHz in AWS for the top 100 markets.

Verizon’s 2G/3G CDMA is built on the company's 800 MHz and PCS spectrum frequencies, which are each nearly nationwide. Its 4G network however is being deployed on its nationwide 700 MHz C-Block spectrum as well as its nationwide AWS spectrum. By deploying on contiguous nationwide blocks Verizon should over time have a simpler and possibly less expensive network operation. The company paid nearly \$4 billion in 2012 for 20 MHz of nationwide AWS spectrum, and \$4.7 billion in 2008 for the 22 MHz 700 C-Block.

Additionally, as part of the AWS acquisition in 2012 Verizon offered to sell its 700 MHz A and B-Block spectrum licenses, which it paid \$4.6 billion for in 2008. The company has said that it doesn’t need the spectrum, and will sell it for the right price. We estimate that the spectrum is still worth the \$4.6 billion that Verizon paid - \$2.6 billion for 148m pops in the 12 MHz A-block and \$2.05 billion for 46m pops in the 12 MHz B-Block licenses. AT&T owns the rest of the B-Block nationwide and is the most likely buyer, while the A-Block is spread across a number of carriers. Verizon

has already agreed to sell some smaller markets to new entrants, and has said that we will get more information on the sale in January 2013.

AT&T has ~89 MHz in top 100 markets, and is likely to gain WCS, 700

AT&T has an average of ~89 MHz total including a combined 51 MHz in low frequency cellular/700 MHz bands – ~24 MHz of cellular and 27 MHz on average in 700 MHz for the top 100 markets. Note that including a number of smaller deals that it has pending AT&T estimates it has 94 MHz in the top 100 markets and 90 MHz nationwide.

While its 700 MHz spectrum holdings aren't as clean as Verizon's, AT&T does have 700 spectrum in essentially every market and 30 MHz of spectrum in many of the top 100 markets. By buying the remainder of Verizon's B-band spectrum and potentially some of the A-band AT&T could make its deployment of LTE far easier. AT&T has spent a total of \$9.1b for 700 MHz spectrum with \$6.6b in the 2008 auction and an additional \$2.5b for the Aloha spectrum. AT&T bought an additional 12 MHz of 70m pops and 6 MHz of 230m pops of 700 MHz spectrum from Qualcomm in 2011 for \$1.925b. All in, we estimate AT&T paid about \$1.65 MHz/pop for its 700 MHz spectrum.

Additionally AT&T has PCS spectrum essentially nationwide – an average of 34 MHz across the country. Its AWS spectrum position though was weakened after paying a break-up fee to T-Mobile USA and the company has 10 to 20 MHz in only 10 of the top 50 markets - mostly areas where it is weak in the 700 band. AT&T has noted it expects to use AWS for LTE services, but if it bought more 700 band spectrum from Verizon we would not be surprised to see AWS de-emphasized over time.

Interestingly though, AT&T is in the process of closing on acquisitions which will allow it to control the majority of the WCS spectrum band, a 30 MHz block in the 2.3 GHz range. This nearly nationwide 10x10 block of spectrum could be a big asset to AT&T's LTE rollout over time. AT&T currently has ~40% of the WCS spectrum nationwide and is buying another ~50% of the block from companies including NextWave, Comcast, and Horizon. We believe that the only remaining significant holder of WCS spectrum is Sprint which owns ~10% of the band, predominately in the southern US. See below for more information on WCS.

Sprint has ~50 MHz of spectrum in the 800 and PCS bands

Sprint has 14 MHz of cellular spectrum from Nextel and 36 MHz in the PCS band on average in both top 100 and all markets for 50 MHz total. Rather than being capacity constrained though given its smaller spectrum allocation than AT&T or Verizon, half of that spectrum is nearly empty today.

Sprint historically has offered CDMA service using the PCS band and Nextel service in the 800 MHz band. As Nextel goes away though Sprint has been rolling out CDMA voice service in the 800 band and over time we expect to see 800 MHz data as well as LTE voice/data in this band as well. Additionally Sprint has a clean 10 MHz slice of spectrum that it is currently using for LTE in the PCS G-Block. Over time we expect Sprint to use more PCS for data as voice moves to 800 MHz.

T-Mobile has 58 MHz of spectrum nationwide and MetroPCS 19 MHz in its markets

T-Mobile USA has 26 MHz of PCS spectrum and 33 MHz of AWS for a total of 58 MHz. The company has contracted to merge with MetroPCS, and when combined with Metro's PCS and AWS spectrum the resulting company will have on average 77 MHz of spectrum in areas where they both operate today.

In its top 20 markets with coverage MetroPCS has on average 21 MHz of spectrum, with 10 MHz dedicated to LTE in essentially every market. In the individual bands and markets, MetroPCS has on average 15 MHz in PCS across 53m pops, 13 MHz in AWS across 85m pops and 12 MHz in 700MHz across 7m pops in the top 100 markets.

T-Mobile is in the process of adjusting its network to balance traffic load and match AT&T's 3G/4G band plan. The company is moving its 3G/HSPA network to the PCS band (similar to AT&T), clearing its AWS spectrum for 4G/LTE technology. Thus far T-Mobile has 15 markets with HSPA+ in the 1900 band, and expects to be essentially nationwide by mid-2013. Further, the company expects to start launching LTE into its markets in the second half of 2013 and be completely rolled out with LTE by the end of that year.

Leap is balancing CDMA and LTE in ~20 MHz of spectrum

In its top 20 markets with coverage Leap Wireless has on average 20 MHz of spectrum. Its spectrum holdings are split between 12 MHz across 53m pops in the PCS band and 14 MHz across 91m pops in the AWS band. Leap has said that it is using only a minority of its spectrum today for 2G/3G services, and has at least 3x3channels ready for LTE in most/all of its markets. The company today offers LTE service in 11 markets that covers ~21 million pops and expects to roll out LTE to about 2/3 of covered pops in the next year or two.

US Cellular has 25 MHz of cellular spectrum in most markets as well as PCS remaining in key areas, but is in the process of selling its non-core PCS markets to Sprint

US Cellular has a 25 MHz cellular license in eight of the top 100 markets. Additionally, it has 19 MHz of PCS across 30m pops, 15 MHz of AWS across 15m pops, and 12 MHz of 700 MHz across 6m pops.

US Cellular recently inked an agreement with Sprint to sell its Chicago, St. Louis, Central Illinois, and parts of the Indiana/Michigan/Ohio markets where it does not have cellular licenses for \$480m. The deal includes the customer base (585k) and most of the PCS licenses in these markets but does not include the network infrastructure. We estimate the value of the PCS licenses to be ~\$285m of the transaction value, or \$1.23/MHz-Pop.

Clearwire has the largest spectrum position, but 2.5 GHz has propagation and ownership issues

Clearwire has the largest holdings of any carrier with 42 billion MHz-pops in the 2.5 GHz band, including 150 MHz in the top 100 markets. While much of the spectrum is leased and licenses cannot be transferred, we believe that Clearwire's leases are sufficiently long term that they can be treated as owned for this analysis. Clearwire is ~51% owned by Sprint.

150 MHz is a tremendous amount of spectrum, and we believe in the long term could have substantial value. While the propagation is not impressive compared to 800 MHz or even PCS band spectrum, we believe that the band is fine to be used for outdoor hotspot spectrum, or indoor in DAS or small cell implementations to create a lot of capacity in a small environment. This spectrum band is a standard global band for TD-LTE service, which is becoming prevalent in Japan and China as well as other places.

Figure 5: Major Carrier Spectrum Holdings - Top 100 Markets

Market	Pops	T-Mobile	Cingular	Verizon	Sprint	Leap	MetroPCS	US Cellular	NTELOS Inc.
New York, NY	18,878	50	91	139	54			20	
Los Angeles, CA	16,811	60	109	111	54			20	
Chicago, IL	8,886	60	83	119	44	22			20
San Francisco, CA	7,484	70	111	89	44		30		
Philadelphia, PA	5,995	60	101	109	54	20		10	
Dallas, TX	5,409	70	110	84	54			30	
Detroit, MI	4,986	70	95	99	54	10		20	
Houston, TX	4,975	70	95	109	44	30			
Washington, DC	4,686	60	95	119	54	20			
Boston, MA	4,311	60	101	117	54		22		
Atlanta, GA	4,266	80	95	109	44		20		
Miami, FL	3,844	60	86	116	44		30		
Phoenix, AZ	3,387	70	80	102	54	30			
Seattle, WA	3,245	70	83	117	54				
Minneapolis, MN	3,212	80	63	119	54	10		10	
San Diego, CA	2,959	65	100	97	54	20			
Cleveland, OH	2,956	70	80	124	44	10			
St Louis, MO	2,862	50	95	77	54	20			52
Denver, CO	2,629	70	85	89	54	20			
Baltimore, MD	2,578	60	95	129	44	20			
Tampa, FL	2,576	65	95	129	39		20		
Pittsburgh, PA	2,446	60	85	97	54	20			
San Jose, PR	2,421	55	73	10	44				
Cincinnati, OH	2,180	40	73	111	44	20			
Portland, OR	2,098	70	73	77	54	20	10		
Kansas City, MO	2,056	60	85	109	54	30			10
Charlotte, NC	2,034	60	56	124	44	20			10
Sacramento, CA	1,982	65	90	89	54		30		
San Antonio, TX	1,861	70	90	84	54	20			
Milwaukee, WI	1,851	60	73	72	44	20			77
Norfolk, VA	1,751	60	70	132	44	10			20
Nashville, TN	1,727	40	100	87	54	25			10
Orlando, FL	1,670	80	88	104	44		20		
Columbus, OH	1,657	80	85	87	54	10			
Salt Lake City, UT	1,593	70	88	97	44	25			
Las Vegas, NV	1,558	60	105	77	54	20			10
Memphis, TN	1,516	50	93	99	44	25			10
Providence, RI	1,512	70	91	107	54		22		
Indianapolis, IN	1,503	40	95	109	44	10			10
Louisville, KY	1,472	40	95	97	54	20			10
Mayaguez, PR	1,462	45	73	35	44				
Raleigh, NC	1,424	60	56	104	44	10			12
Oklahoma City, OK	1,411	60	73	101	54	20			20
Greensboro, NC	1,405	60	56	114	54	20			10
New Orleans, LA	1,404	25	100	117	54	20			10
Jacksonville, FL	1,385	90	78	92	34		10		
Birmingham, AL	1,319	70	78	87	54	15			10
Austin, TX	1,241	80	100	84	54	20			
Richmond, VA	1,233	70	70	102	44	20			20
Dayton, OH	1,211	50	75	107	44	20			
Buffalo, NY	1,184	60	105	77	54	20			10
Rochester, NY	1,143	90	83	69	54	20			10
West Palm Beach, FL	1,119	70	75	116	44				30
Hartford, CT	1,116	50	121	109	54	20			
Knoxville, TN	1,097	35	90	87	34	25			35
Grand Rapids, MI	1,061	85	60	104	54	25			10
Albany, NY	1,041	80	103	67	54	10			
Omaha, NE	983	70	38	102	54	20			40
New Haven, CT	981	60	71	119	54		20		
Tulsa, OK	954	55	85	52	54	25			45
Fresno, CA	943	70	95	99	54	20			
Little Rock, AR	942	30	85	97	54	40			10
Lexington, KY	917	40	93	107	54	20			10
Greenville, SC	898	80	58	92	34	20			
Honolulu, HI	871	80	75	87	64				
Tucson, AZ	855	60	75	122	54	25			
Albuquerque, NM	803	60	75	102	44	45			
El Paso, TX	796	70	80	92	44	40			
Des Moines, IA	788	50	46	97	54	10			79
Toledo, OH	780	20	60	109	54	15			
Syracuse, NY	776	60	100	77	54	35	10		
Worcester, MA	745	70	79	107	54		22		
Spokane, WA	743	45	83	87	54	25			
Savannah, GA	737	90	63	92	34	20			
Allentown, PA	722	60	111	119	54		20		
Fl Wayne, IN	697	70	85	77	34	20			12
Harrisburg, PA	695	70	95	97	54		10		
Kingsport, TN	693	55	70	127	44				10
Charleston, SC	687	80	58	102	34	10			
Baton Rouge, LA	686	40	85	117	54	20			10
Wichita, KS	682	60	93	67	54	25			
Bakersfield, CA	671	60	91	109	44		10		
Mobile, AL	668	60	63	117	54				10
Madison, WI	668	20	63	82	44	10			77
Jackson, MS	668	60	85	87	34	10			10
Macon, GA	663	80	73	77	34	30			
Springfield, MA	658	70	91	99	54		20		
Columbia, SC	657	80	70	112	34	20			
Scranton, PA	657	60	91	119	54		20		
Roanoke, VA	648	50	46	77	34				50
Springfield, MO	646	40	73	97	54				30
Fayetteville, NC	637	60	66	102	66				12
Saginaw, MI	634	50	78	124	54	10			
McAllen, TX	623	80	65	77	64	20			
Stockton, CA	616	70	91	59	54		40		
Sarasota, FL	614	80	73	117	34		10		
Fl Myers, FL	608	50	73	117	44		30		
Manchester, NH	599	70	64	107	54	20			25
Reno, NV	591	50	88	77	54	35	10		
Asheville, NC	589	70	48	87	34				59

Source: J.P. Morgan estimates, FCC data.

Spectrum Valuation Framework

Our valuation framework for spectrum is based upon the 700 MHz auction (for low-band spectrum) in 2008 and AWS auction (for higher-band spectrum) in 2006. One important point is that rather than averaging the sale prices of each auction and applying it to current carrier spectrum holdings, we use market by market sale prices and then add a standard premium to more accurately estimate current value. Thus the average per-pop for Leap’s PCS spectrum could be significantly different than the average for Metro’s due to their current markets.

For low frequency spectrum we estimate that 700 MHz spectrum today is worth about what it sold for in 2008, with a few exceptions where licenses in some markets sold at egregious prices. We assign a 10-30% premium to cellular spectrum over 700 MHz auction values due to the fact that it is already in wide use and is a standard handset band. Finally we put a discount on E-band spectrum owned by AT&T and Dish due to its unpaired nature.

In high band we estimate AWS and PCS spectrum values are up 26% from the 2006 AWS auction average with a 40% increase for top 100 markets and a flat valuation for non-top 100 markets. We estimate a 30% discount in value to AWS spectrum for Dish’s AWS-4 spectrum (formerly MMDS), a 40% discount for WCS spectrum (non-standard but paired), and a 50% discount for 2.5 GHz spectrum (unpaired, and a lot of supply).

Figure 6: Spectrum Valuation Based Upon 700 MHz and AWS Auctions

Discount/Premium from original auction weighted average price	Avg. \$/MHz-Pop	
	Top 100	Rest
700MHz	0%	0% vs. 700MHz auction average
700MHz E-Block	-40%	-45% vs. 700MHz auction average
700MHz Broadcast	-40%	-40% vs. 700MHz auction average
Cellular	30%	10% vs. 700MHz auction average
AWS	40%	0% vs. AWS auction
PCS	40%	0% vs. AWS auction
PCS H-Block	-10%	-10% vs. PCS today
MMDS-Dish	-30%	-30% vs. AWS today
MMDS-Lightsquared	-75%	-75% vs. AWS today
WCS	-40%	-40% vs. AWS today
2.5GHz	-50%	-75% vs. AWS today

	Avg. \$/MHz-Pop		
	Top 100	Rest	All
700MHz	\$1.70	\$0.73	\$1.32
700MHz E-Block	\$1.02	\$0.40	\$0.77
700MHz Broadcast	\$1.02	\$0.44	\$0.79
Cellular	\$2.20	\$0.80	\$1.62
AWS	\$0.88	\$0.40	\$0.68
PCS	\$0.88	\$0.40	\$0.68
PCS H-Block	\$0.80	\$0.36	\$0.62
MMDS-Dish	\$0.62	\$0.28	\$0.48
MMDS-Lightsquared	\$0.22	\$0.10	\$0.17
WCS	\$0.53	\$0.24	\$0.41
2.5GHz	\$0.44	\$0.10	\$0.28

Source: J.P. Morgan estimates, FCC.

National Carriers Spectrum Valuations

AT&T and Verizon have the largest and most valuable spectrum holdings

We estimate AT&T’s 90 MHz of spectrum is worth about \$31b at average \$/MHz-pop prices of \$1.91 for cellular \$1.59 for 700 MHz and \$0.77 for PCS. Verizon’s 99 MHz of nationwide spectrum is worth almost \$36b driven by substantial cellular and 700 MHz spectrum positions. We calculate an average \$/MHz-pop valuation of \$1.30 for AT&T and \$1.29 for Verizon.

As of 3Q12, AT&T valued its spectrum at \$52b on its balance sheet and Verizon \$78b, well above our valuations. Note that much of the carrying value of this spectrum was allocated from acquisitions like Alltel and AT&T Wireless. Since we

do not expect AT&T or Verizon to ever sell their spectrum the valuation disparity is not very important.

Note that while we don't include AT&T's ownership of 40% of the nationwide WCS spectrum today the value is essentially a rounding error on AT&T's total spectrum value. After AT&T's deals close and it owns 90% of that band we estimate it to be worth ~\$2.5 billion.

Sprint and T-Mobile spectrum positions valued at \$15b and \$13b respectively

We calculate Sprint's spectrum value at \$15b with its 50 MHz of total spectrum of which 14 MHz is cellular and 36 MHz of PCS spectrum. We calculate an average \$/MHz-Pop valuation of \$1.07 for Sprint. T-Mobile USA's 58 MHz of spectrum is \$13b due to the average value of PCS/AWS spectrum at \$0.77 MHz/pop. Sprint values its spectrum as of 3Q12 at \$21b, substantially higher than our valuations, and T-Mobile USA at \$14b.

Much of T-Mobile USA's spectrum (the PCS) came in the acquisition of Voicestream by DT, which marked the peak of the wireless industry valuation in the last decade. Similarly, Sprint allocated \$14 billion in value to Nextel's spectrum when it bought that company in 2005, which we believe is significantly overstated.

Figure 7: National Carrier Spectrum Valuations

Spectrum Value (\$ in '000s)

	Cellular	PCS	AWS	700 MHz	MMDS /AWS-4	WCS	2.5 GHz	Total	Avg. \$/ MHz- Pop	3Q12 Wireless Balance Sheet Carrying Value
AT&T	12,087,949	7,353,818	875,196	10,205,999				30,522,963	\$1.30	\$ 52,082,000
Verizon	12,571,894	4,298,520	6,556,202	12,349,771				35,776,386	\$1.29	\$ 77,591,000
T-Mobile	3,898	5,477,683	7,236,960	-				12,718,542	\$0.77	\$ 14,360,000
Sprint*	7,128,752	7,806,293	-	-				14,935,045	\$1.07	\$ 20,631,000

Source: J.P. Morgan estimates, FCC, Company data.

Unlimited and Regional Carriers

MetroPCS spectrum valued at \$2.4b and Leap at \$2.0b on a bottoms-up basis

Our bottom up analysis of MetroPCS and Leap PCS and AWS holdings focused on licenses and prices paid on a per market basis. We value MetroPCS spectrum at \$2.4b and Leap at \$2.0b. The carrying value of each company's spectrum is \$2.6b for MetroPCS and \$1.8b for Leap, slightly lower than our valuations. We calculate an average \$/MHz/pop valuation of \$0.66 for Leap and \$0.99 for MetroPCS.

As we think about spectrum value of Leap and MetroPCS in the context of share value, the spectrum value of each company comes close to the net debt of Leap at \$2.6 billion and \$2.5 billion for MetroPCS, thus is significant as a backer of the debt but not much support to equity value.

US Cellular has \$1.5b in spectrum value and nTelos ~\$109m

We value US Cellular's spectrum holdings at \$1.5b before the Sprint sale, after which we estimate the remainder will be worth ~\$1.3 billion. USM's spectrum carrying value is \$1.5b and \$132m for NTLN. Of all the numbers in this note the value for US Cellular's cellular spectrum we believe is the most uncertain. Given USM's strong cellular position and high roaming revenue that spectrum could be worth substantially more to a potential acquirer than we estimate above based on 700

MHz. We would say, however, that as Verizon and AT&T build out 700 MHz networks with LTE their need for roaming in USM markets could decline and the spectrum move back to a more normal value.

Similar to Leap and MetroPCS above, the spectrum value of US Cellular compares favorably to its net debt. US Cellular has net debt of only \$320 million today so the spectrum should be worth an implied \$14/share over and above debt.

We value nTelos's spectrum holdings at \$109m vs. the \$132 million carrying value. nTelos also has some WCS spectrum, but we don't consider it in the valuation.

Figure 8: Regional and Unlimited Carrier Spectrum Valuations

Spectrum Value (\$ in '000s)

	Cellular	PCS	AWS	700 MHz	MMDS /AWS-4	WCS	2.5 GHz	Total	Avg. \$/ MHz- Pop	3Q12 Wireless Balance Sheet Carrying Value
MetroPCS	-	653,882	1,503,630	206,043				2,363,555	\$0.99 \$	2,562,000
Leap	-	445,113	1,306,703	217,828				1,969,644	\$0.66 \$	1,788,363
US Cellular*	569,312	427,238	222,294	326,723				1,545,566	\$0.79 \$	1,531,873
NTELOS	-	101,138	7,884	-				109,022	\$0.50 \$	132,326

Source: J.P. Morgan estimates, FCC, Company data.

Alternative Carriers and Spectrum Bands

Below we estimate spectrum valuations for Clearwire, DISH Network, and AT&T's WCS band, as well as look at Lightsquared.

Clearwire still looking to fulfill its potential

Clearwire has said that it has 42 billion MHz-pops, as well as an average of 150 MHz of spectrum across the top 100 markets in the US. While so far the spectrum has failed to live up to its potential, the 2.5 GHz band is quickly becoming a global standard for TD-LTE technology. New Sprint investor Softbank is a big proponent of TD-LTE in this band in Japan, and we believe over time could see the same potential for the service in the US. Additionally, the TD-LTE ecosystem is growing and in 2013 we expect standard chipsets from Qualcomm to come with TD-LTE enabled in this band, though most carriers around the world will not choose the band plans necessary to activate it.

As with any spectrum, value is a question of supply and demand, and thus far Clearwire has far more supply than there has been demand. Assuming that Clearwire burns all of its cash the company currently trades at \$0.23/MHz-Pop including \$1.8 billion in NPV of lease expense. We estimate that over time Clearwire's 2.5 GHz spectrum could be valued at more like \$11.9b, or about \$0.28/MHz-pop – the equivalent of \$4 per share - vs. the balance sheet wireless license value of \$4.3b as of 3Q12.

Dish – S-Band Should be Authorized Soon for Terrestrial

Dish has 6 MHz of 700 MHz E-Block spectrum across 217 million pops. Additionally, Dish Network has acquired 40 MHz of spectrum from bankrupt MMDS carriers Terrestar and DBSD, and has applied to the FCC for a license transfer and then waiver to allow this spectrum to be used for terrestrial-only applications as well as satellite/terrestrial hybrid. Dish Network has discussed using this for LTE-Advanced service which could launch in 2014 or 2015.

Dish has offered to restrict power on 5 MHz of its upload spectrum to create a guard band for the PCS H-block if the FCC otherwise approves Dish's spectrum for terrestrial use. This deal or something like it is in-line with our recent thinking. While long term technology changes may make power reduction a minor issue, near-term it restricts Dish to a symmetrical 15x15 LTE network vs. the planned 20x20, and creates some delay at 3GPP. Assuming a structure similar to Dish's proposal we expect approval by the end of 2012.

We estimate DISH Network's 6 MHz of 700 MHz spectrum to be worth \$872 million or \$0.71/MHz-Pop. While this is less than some have estimated, we believe it is important to look at what markets Dish has (and doesn't have), and the company is missing the biggest markets on the east and west coasts. We believe AT&T (which owns those large markets) is the only likely buyer for the spectrum, limiting its value but still a premium vs the \$712 million that Dish paid for it.

Next we estimate that Dish's 40 MHz of MMDS spectrum to have a \$6.2b value, much higher than the total purchase price of \$2.8b but below what we estimated its worth to be a year ago. The 5 MHz restriction is not likely to reduce the long-term usability of the spectrum, but near-term it makes it somewhat less attractive to a buyer. We calculate a \$/MHz-Pop value of \$0.50 for DISH's MMDS/AWS-4 spectrum based on a 30% discount to our value for standard AWS today.

WCS band is being cleaned up by AT&T

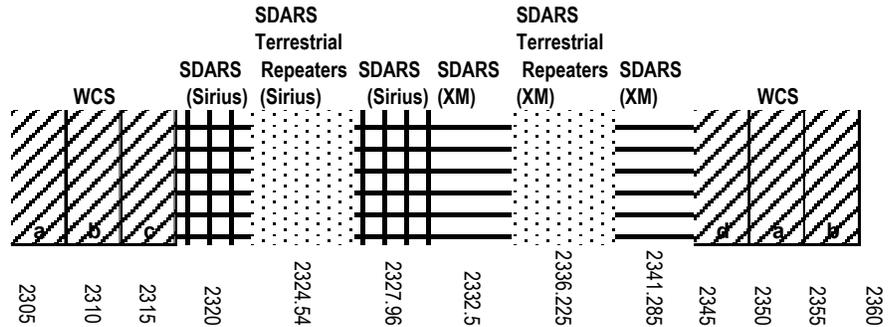
Historically the WCS band, a 30 MHz block (15x15 paired) in the 2.3 GHz range was intended to be for wireless broadband services, but it never went anywhere due to potential interference issues with the adjacent Satellite Digital Audio Radio Service (SDARS) band. The bands C and D blocks are adjacent to the spectrum used by Sirius and XM for satellite radio, and could never be used for mobile services in order to protect that weak satellite signal. The fact that ownership was across a variety of companies that each wanted to protect their interest kept a deal from coming for far too long.

Now however, AT&T is in the process of closing on acquisitions which will allow it to control the majority of the WCS spectrum band. AT&T currently has ~40% of the WCS spectrum nationwide and is buying another ~50% of the block from companies including NextWave, Comcast, and Horizon. We believe that the only remaining significant holder of WCS spectrum is Sprint, which owns ~10% of the band, predominately in the southern US. With AT&T's control, the company has been able to strike a deal with Sirius to use the C and D bands as guard bands with point to point applications only, freeing it to use the A and B bands as a 10x10 MHz pair. The FCC has blessed this pact, and we expect AT&T to close on its acquisitions very soon.

Assuming that the WCS band deal closes we estimate that the 20 MHz of spectrum is worth \$2.5 billion or \$0.41/MHz-pop, a 40% discount to our estimate of AWS band value today. To get the spectrum in use AT&T will need to get it into the 3GPP process and we do not expect this to be a global standard any time soon.

Figure 9: WCS Band Map

Wireless Communications Service (WCS)



Source: FCC

L-Band Satellite Spectrum Looks Delayed Indefinitely

Two years ago it looked like Lightsquared was on track to be the next wireless carrier, with 59 MHz of spectrum and a waiver from the FCC to begin its buildout. At this point, however, the FCC has essentially halted all of Lightsquared’s momentum, and the 20 MHz of spectrum that Lightsquared owns that was intended for downlink are too close to GPS to use in the foreseeable future. At this point the company’s hopes rest on it convincing the FCC to swap 10 MHz that it has which is entangled with GPS for the 1675-1680 MHz block which could otherwise be auctioned. However, we believe that the FCC looks at the 10 MHz to be swapped as essentially worthless, and is reluctant to approve the swap.

At this point for Lightsquared we estimate a ~\$0.18 MHz/pop valuation for its 20 MHz of spectrum essentially on optionality, a 75% discount to AWS spectrum for a spectrum valuation of \$1.1b. We do not put a value on Lightsquared’s other spectrum which may be even more impaired at this point.

Figure 10: Alternative Carrier Spectrum Valuations

	Spectrum Value (\$ in '000s)						Total	Avg. \$/ MHz- Pop	3Q12 Wireless Balance Sheet Carrying Value	
	Cellular	PCS	AWS	700 MHz	MMDS /AWS-4	WCS				2.5 GHz
Clearwire							11,885,232	11,885,232	\$0.28	\$ 4,263,367
LightSquared					1,115,505			1,115,505	\$0.18	NA
DISH Network				872,378	6,246,826			7,119,205	\$0.52	NA

Source: J.P. Morgan estimates, Company data.

Spectrum Auctions Will Come Eventually

The national broadband plan was delivered to Congress in March 2010. It recommended finding 500 MHz of new spectrum for broadband services – 300 MHz in the next five years and another 200 MHz in the five years after that. Thus far we believe the FCC would count the 40 MHz of MMDS spectrum that it is turning into terrestrial for Dish against the goal, as well as hoping that ~80 MHz of broadcast spectrum can be turned into wireless. We are somewhat skeptical on the broadcast

spectrum process, and think that finding 300 MHz by 2015 will be a real challenge for the FCC.

AWS bands seem like soonest available source.

The seemingly easiest source could be additional AWS spectrum. AWS-2 is two 5 MHz pairs (H-block is 1915-1920/1995-2000 and J-block is 2020-2025/2175-2180) that are close to Sprint's PCS spectrum and weren't auctioned in the 2006 AWS-1 auction. AWS-3 is an unpaired 20 MHz that could be paired with lower-band military spectrum to make it more attractive. The FCC is working to protect the H-block by forcing Dish to reduce power in the 5 MHz adjacent to it. We believe the H-block could be sold as early as 2013 and that Sprint or Dish is likely to buy it for about \$2 billion based on an assumed average of \$0.68/MHz/pop.

Lower 700 MHz band could be a disappointment

One source of very good spectrum could be to repurpose more spectrum from the TV broadcasters in the 700 MHz band. Channels 52-69 were the sources for the 2008 700 MHz auction (6 MHz per channel), and channels 31-51 could yield another 120 MHz.

In February of 2012 Congress passed the "Middle Class Tax Relief and Job Creation Act" which includes authorization for the FCC to conduct incentive auctions including that of broadcast spectrum. Ideally, local broadcasters in cities will turn their spectrum in to the FCC in exchange for part of the proceeds from the auction. However, many of the big broadcasters have pushed back against this, and we believe that the Congressional Budget Office's estimate that an average of 84 MHz of spectrum will be turned in is very optimistic. Were that 84 MHz of spectrum be auctioned we estimate a value of as high as \$20 billion or \$0.79/MHz/pop - far less than the \$1.32 average in the 700 MHz auction in 2008 due to lower demand from carriers and potential new entrants.

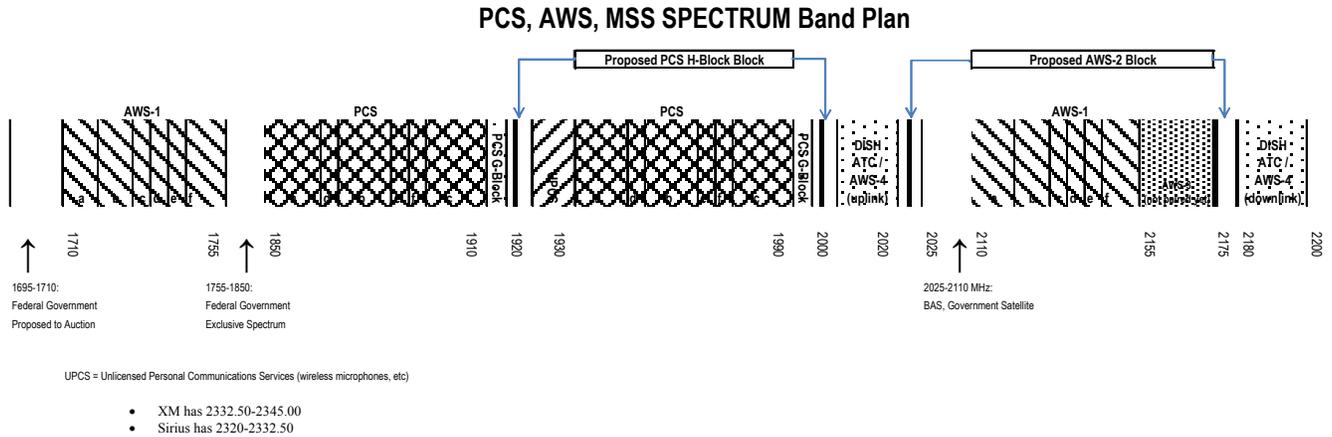
Microwave?

Additional commercial microwave could also be sourced, pushing the microwave broadcasters further up the bands. This, however, is not seen as very attractive spectrum by the carriers but could become more so if it was paired with something in a lower band.

Government bands.

Finally, there is a lot of spectrum that currently is being used (or at least allocated to) the Federal government. Congress has instructed the FCC to auction the 1675-1710 MHz spectrum by 2015, and there is far more that is not allocated but is being tested for shared use between industry and government. However, entities like the FBI, the Department of Defense, and others are likely to lobby heavily against sharing or being moved from their current bands and it would take congressional action to move most of this into the FCC's domain.

Figure 11: PCS, AWS Band Plan



Source: FCC

Spectrum Spending History

Spectrum expense is mostly behind us

Since 2005 the US wireless carriers spent roughly \$42 billion in major sales of spectrum in the PCS, AWS, and 700 MHz bands. Spectrum spending is almost always a contra to valuation in our models. While there has been speculation about more spectrum coming to market, we estimate it could be 2013 or later before substantial blocks of spectrum come to market.

Table 1: Major Wireless Spectrum License Spending by Carrier, 2005-Present

Company	Auction 58	AWS	700 MHz	Aloha (700)	QCOM (700)	SpectrumCo	Cox	Total
AT&T	184	1400	6637	2500	1925			12646
Verizon Wireless	697	2809	9363			3600	315	16784
T-Mobile USA	252	4182						4434
Spectrum Co LLC (Cable co's)**		2378						2378
Sprint	194							194
Echostar			712					712
Qualcomm*			558					558
MetroPCS		1391	313					1704
Leap Wireless	235	1076						1311
Cox Wireless			305					305
US Cellular	152	170	300					622
Cellular South			192					192
CenturyLink			149					149
	1714	13406	18529	2500	1925	3600	315	41989

* Later sold to AT&T
 ** Later sold to Verizon

Source: Company reports and FCC.

Table 2: History of Spectrum Prices in Major Transactions, 2001-2010

	Date	Frequency	Amount (\$m)	\$/MHz-Pop
Verizon/Cox	2012	AWS	315 \$	0.61
Verizon/SpectrumCo.	2012	AWS	3600 \$	0.69
AT&T/Qualcomm sale	2010	700 MHz	1925 \$	0.86
Auction 73 (700 MHz)	2008	700 MHz	14827 \$	1.29
AT&T/Aloha	2007	700 MHz	2500 \$	1.06
Auction 66 (AWS)	2006	1.7/2.1 GHz	13879 \$	0.54
Auction 58 (PCS)	2005	1900 MHz	2250 \$	1.06
Auction 35 (PCS, cancelled)	2001	1900 MHz	16300 \$	2.11

Source: Company reports and FCC.

Table 3: MHz POP Prices by License Type Comparison for Auction 73, 66, 58 and 35

AUCTION 73 DATA

MHz/pop price by license type	Total \$/MHz/Pop	\$	1.29
Price	\$/MHz/Pop	MHz/pop	Bid
CMA-B Band	2.68	3,416,968,344	\$9,143,993,000
BEA - A, E Band	1.02	5,132,740,758	\$5,228,066,000
REA - C Band	0.76	6,277,460,816	\$4,747,769,000
Total	1.29	14,827,169,918	\$19,119,828,000

AUCTION 66 DATA

MHz/pop price by size of spectrum licenses	Total \$/MHz/Pop					\$0.54
	0-99k	100k-249k	250-499k	500-999k	1-2.9m	3-60m
	\$0.12	\$0.12	\$0.13	\$0.18	\$0.36	\$0.67

MHz/pop price by license type

Price	\$/MHz/Pop	MH/pop	Bid
CMA	0.40	5,712,408,900	\$2,268,029,200
BEA	0.46	8,568,613,350	\$3,938,533,000
REA	0.67	11,424,817,800	\$7,672,548,000
Total	0.54	25,705,840,050	\$13,879,110,200

AUCTION 58 DATA

Category	Total \$/MHz/pop						\$1.06
	A	B	C	D	E	F	
Min pops	0	100,000	250,000	500,000	1,000,000	3,000,000	
Max pops	99,999	249,999	499,999	999,999	2,999,999	20,000,000	
Auction 58 Markets	45	52	34	35	67	9	
Average pops (mm)	0.064	0.171	0.357	0.659	1.768	5.118	
No bid markets	14	5	3	3	0	0	
Avg. \$ Bid	0.19	0.51	0.95	2.88	20.35	82.08	
Avg. \$/MHz/Pop	\$0.37	\$0.31	\$0.26	\$0.41	\$1.07	\$1.26	

AUCTION 35 DATA

Auction 35	Total \$/MHz/pop						\$2.11
Avg. \$/MHz/Pop	\$0.90	\$1.20	\$1.35	\$2.20	\$3.57	\$6.19	
% of Auct. 35 Price	41%	26%	19%	19%	30%	20%	

Auction 35

Min pops	Max Pops	Category	\$/MHz/Pop
0	99,999	A	\$0.90
100,000	249,999	B	\$1.20
250,000	499,999	C	\$1.35
500,000	999,999	D	\$2.20
1,000,000	2,999,999	E	\$3.57
3,000,000	20,000,000	F	\$6.19

Source: FCC and J.P. Morgan estimates.

700 MHz auction Recap: Incumbents Dominated Auction 73

The 700 MHz auction was completed in the spring of 2008, and carriers collectively spent \$19b or ~\$1.30/MHz-Pop. We believe this was the auction that cemented

AT&T and Verizon as the leaders of the US wireless industry for the next decade at least.

Verizon and AT&T were the two largest winners, composing nearly \$16b or 82% of the total auction proceeds. Verizon spent \$9.3b, winning not only the nationwide C-block, but also 195mm pops in the A and B-block. AT&T spent \$6.6b, winning 175mm pops of B-block. T's strategy seems to have been to fill in around its existing assets rather than using the auction to acquire a national footprint. T also bought 196mm pops from Aloha Partners, contiguous to the B-Block, in October for \$2.5b.

The biggest new entrant was EchoStar, buying 217mm pops in the E-block for \$712mm. Despite significant hype at the time, we believe Google bid the minimum it could.

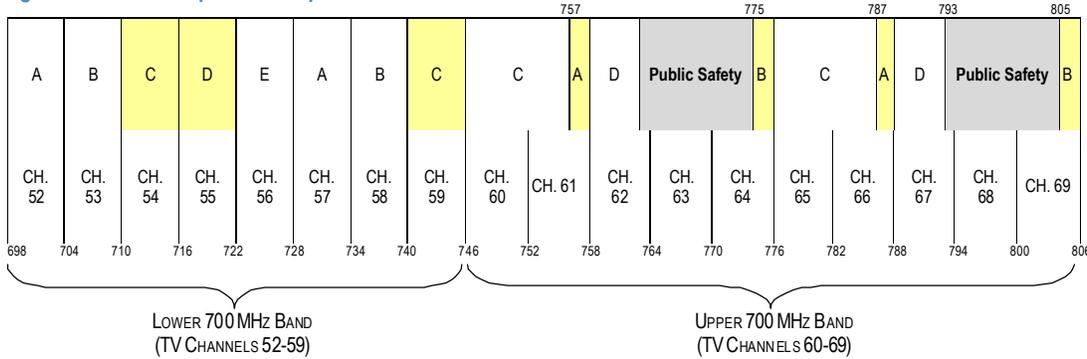
MetroPCS spent \$313mm on 8mm pops, most of it on another 12 MHz in Boston. This was the high-end of what we expected Metro to spend, but not over. Leap stayed out. US Cellular spent \$305mm on A and B-block licenses, mostly in the Midwest or small markets.

Table 4: Auction 73: Top 20 Bidders

Bidding Entity Name	Bidder	Bid Subtotal	Pops Subtotal	MHz-Pops Subtotal	\$/MHz/Pop
Cellco Partnership d/b/a Verizon Wireless	Verizon Wireless	9,363,160,000	475,029,030	8,508,298,100	\$ 1.10
AT&T Mobility Spectrum, LLC	AT&T	6,636,658,000	175,826,532	2,109,918,384	\$ 3.15
Frontier Wireless LLC	EchoStar	711,871,000	217,246,979	1,303,481,874	\$ 0.55
QUALCOMM Incorporated	QUALCOMM Incorporated	558,142,000	68,495,648	413,394,882	\$ 1.35
MetroPCS 700 MHz, LLC	MetroPCS	313,267,000	7,954,554	95,454,648	\$ 3.28
Cox Wireless, Inc.	Cox Wireless, Inc.	304,633,000	20,666,971	248,003,652	\$ 1.23
King Street Wireless, L.P.	US Cellular	300,478,500	40,570,096	486,841,152	\$ 0.62
Cellular South Licenses, Inc.	Cellular South	191,533,000	14,997,052	179,964,624	\$ 1.06
CenturyTel Broadband Wireless LLC	CenturyTel	148,964,000	17,651,509	211,818,108	\$ 0.70
Vulcan Spectrum LLC	Vulcan (Paul Allen)	112,793,000	7,019,028	84,228,336	\$ 1.34
Continuum 700 LLC	Continuum 700 LLC	66,134,250	11,976,880	143,722,560	\$ 0.46
Cavalier Wireless, LLC	Cavalier Wireless, LLC	46,352,250	26,808,514	321,702,168	\$ 0.14
Puerto Rico Telephone Company, Inc.	Puerto Rico Telephone Company, Inc.	31,402,000	6,093,357	73,120,284	\$ 0.43
Triad 700, LLC	Triad 700, LLC	17,020,500	11,754,402	186,494,364	\$ 0.09
Horry Telephone Cooperative, Inc.	Horry Telephone Cooperative, Inc.	8,469,000	878,267	10,539,204	\$ 0.80
Central Texas Telephone Investments, LP	Central Texas Telephone Investments, LP	6,347,000	1,253,210	15,038,520	\$ 0.42
I-700, LLC	I-700, LLC	5,960,000	1,985,504	23,826,048	\$ 0.25
Iowa Telecommunications Services, Inc.	Iowa Telecommunications Services, Inc.	5,894,000	286,530	3,438,360	\$ 1.71
Redwood Wireless Corp.	Redwood Wireless Corp.	5,883,750	828,466	9,941,592	\$ 0.59
Miller, David	Miller, David	5,859,000	3,311,017	39,732,204	\$ 0.15
Total		18,840,821,250	1,110,633,546	14,468,959,064	\$ 1.30

Source: FCC and J.P. Morgan estimates.

Figure 12: 700 MHz Spectrum Map.



The blocks highlighted above (Lower 700 MHz Band C and D Blocks and Upper 700 MHz Band A and B Blocks) have previously been auctioned.

Block	Frequencies (MHz)	Bandwidth	Pairing	Area Type	Licenses
A	698-704, 728-734	12 MHz	2 x 6 MHz	EA	176
B	704-710, 734-740	12 MHz	2 x 6 MHz	CMA	734
E	722-728	6 MHz	unpaired	EA	176
C	746-757, 776-787	22 MHz	2 x 11 MHz	REAG	12
D	758-763, 788-793	10 MHz	2 x 5 MHz	Nationwide	1*

* Subject to conditions respecting a public/private partnership license.

Source: FCC, J.P. Morgan estimates

Table 5: Build Requirement Schedule by Band

Band	Build Requirement Schedule (From Feb. 2009)	Type of Requirement (Geography/Pops)
Lower A, B, E	35% in 4 years; 70% in 10 years	Geography
Upper C	40% in 4 years, 75% in 10 years	Population
Upper D	75% in 4 years, 95% in 7 years, 99.3% in 10 years (Also public safety requirement)	Population

Source: FCC and J.P. Morgan estimates.

AWS Auction Recap

Auction 66, the AWS band auction ended in September of 2006, net bid amount of \$13.7 billion. We estimate the REAs averaged \$0.67 MHz/pop vs \$0.46 for BEAs and \$0.40 CMAs.

High bidders on the REAs ended up being the usual suspects; T-Mobile, Verizon, Cingular (AT&T), US Cellular, LEAP, and MetroPCS. T-Mobile ended as the high bidder on 120 licenses, totaling \$4,182mm and Verizon closed out with 4 REAs and a total of 13 high bids for a total of \$2,809mm. Cingular ended up having 48 high bids totaling \$1,335mm. SpectrumCo closed with 137 markets totaling \$2,378mm. Note the JV's winning bids are mainly comprised of B blocks in many BEA markets, achieving 20 MHz of spectrum in those areas

Among regional carriers, LEAP ended with high bids on 100 licenses including the Great Lakes & Central REAs, totaling \$1,075mm (\$984mm net bid). MetroPCS

ended with high bids on 8 licenses, totaling \$1,391mm. USM had 17 high bids, totaling \$170mm (\$127mm net bid) and Dobson (now owned by AT&T) had 85 high bids, totaling \$66mm.

Figure 13: Auction 66 Bidding Entities and Significant Investors

Rank	Bidder Name	Significant Investors	Upfront Payment (\$MM)	Maximum Eligibility, MM (Bidding Units)	Footprint Eligibility (10MHz)	Est. POPs Eligibility, MM (10MHz)
1	Wireless DBS LLC	Echostar/DirectTV	972.5	648.4	5.00	1,480
2	SpectrumCo LLC	Comcast/Bresnan/Time Warner Cable/Cox/Bright House/Sprint	637.7	637.7	4.92	1,456
3	T-Mobile License LLC	T-Mobile	583.5	583.5	4.50	1,332
4	Cingular AWS, LLC	Cingular (AT&T)	500.0	333.3	2.57	761
5	Cellco Partnership d/b/a Verizon Wireless	Verizon Wireless	383.3	255.6	1.97	583
6	Cricket Licensee (Reaution), Inc.	Leap Wireless / Cricket Communications	255.0	255.0	1.97	582
7	MetroPCS AWS, LLC	MetroPCS	200.0	200.0	1.54	457
8	Dolan Family Holdings, LLC	Charles Dolan (Cablevision)	150.0	150.0	1.16	342
9	AWS Wireless Inc.	NextWave	142.8	142.8	1.10	326
10	Barat Wireless, L.P.	US Cellular	80.0	80.0	0.62	183
11	CenturyTel Broadband Wireless LLC	CenturyTel	59.1	59.1	0.46	135
12	Atlantic Wireless, L.P.	Atlantic Wireless Mgmt Co. / Fortress Investment Group	52.0	52.0	0.40	119
13	Denali Spectrum License, LLC	Leap Wireless / Cricket Communications	50.0	50.0	0.39	114
14	Triad AWS, Inc.	Triad AWS / M.C Venture Partners (Cavalier Telco, Cleveland Un'td, Coral Wireless)	40.0	40.0	0.31	91
15	Antares Holdings, LLC	John Dolan (Northcoast Communications)	21.0	21.0	0.16	48
16	Cavalier Wireless, LLC	Wirt A Targer III	18.8	18.8	0.14	43
17	American Cellular Corporation	American Cellular / Dobson Cellular	17.0	17.0	0.13	39
18	Daredevil Communications LLC	Shawn Capistrano / Gregory Smith	8.9	8.9	0.07	20
19	Cellular South Licenses, Inc.	Cellular South / Telapex	7.0	7.0	0.05	16
20	Cincinnati Bell Wireless LLC	Cincinnati Bell	7.0	7.0	0.05	16
21	Carolina West Wireless, Inc.	Skyline Telephone / Surry Telephone / Wilkes Telephone	6.0	6.0	0.05	14
22	Red Rock Spectrum Holdings, LLC	George Evans	6.0	6.0	0.05	14
23	Centennial Michiana License Company LLC	Centennial, Welsh Carson, Blackstone	5.0	5.0	0.04	11
24	Shenandoah Mobile Company	Shenandoah Telecommunications Co	4.7	4.7	0.04	11
25	Public Service Wireless Services, Inc.	Public Service Communications	4.5	4.5	0.03	10
26	Cable One, Inc.	The Washington Post Co. / Berkshire Hathaway Inc.	3.5	3.5	0.03	8
27	Command Connect, LLC	William and Lena Henning (Command Connect, LLC / Cameron Comm, LLC)	3.3	3.3	0.03	8
28	Iowa Telecommunications Services, Inc.	-	3.1	3.1	0.02	7
29	PCS Partners, L.P.	PCSGP, Inc. / David Behenna	3.0	3.0	0.02	7
30	Plateau Telecommunications, Inc.	E.N.M.R. Telephone Cooperative	3.0	3.0	0.02	7
31	Central Texas Telephone Investments, LP	Central Texas Telephone Management Co.	2.6	2.6	0.02	6
32	LL License Holdings II, LLC	Long Lines Wireless	2.5	2.5	0.02	6
33	Hawaiian Telcom Communications, Inc.	Hawaiian Telcom Holco, Inc / Carlyle Partners / TC Group	2.2	2.2	0.02	5
34	AGRI-VALLEY COMMUNICATIONS, INC.	Agri-Valley Communications / Pigeon Telephone Co.	2.0	2.0	0.02	5
35	Iowa Intelegra Consortium, LLC	Schaller Telephone Co. / Niagra Telephone Co. / Hawkeye Telephone Co.	2.0	2.0	0.02	5
36	MTPCS License Co., LLC	AAA Entertainment Licensing / Alta Communications	2.0	2.0	0.02	5
37	NSIGHTTEL WIRELESS, LLC	Brown County CLEC	1.8	1.8	0.01	4
38	Lynch AWS Corporation	Brighton Communications / Lynch Telephone Corp	1.5	1.5	0.01	3
39	Telephone Electronics Coporation	Joseph Fail (Bay Springs Communications) / Walter Frank (Signature Telecom)	1.3	1.3	0.01	3

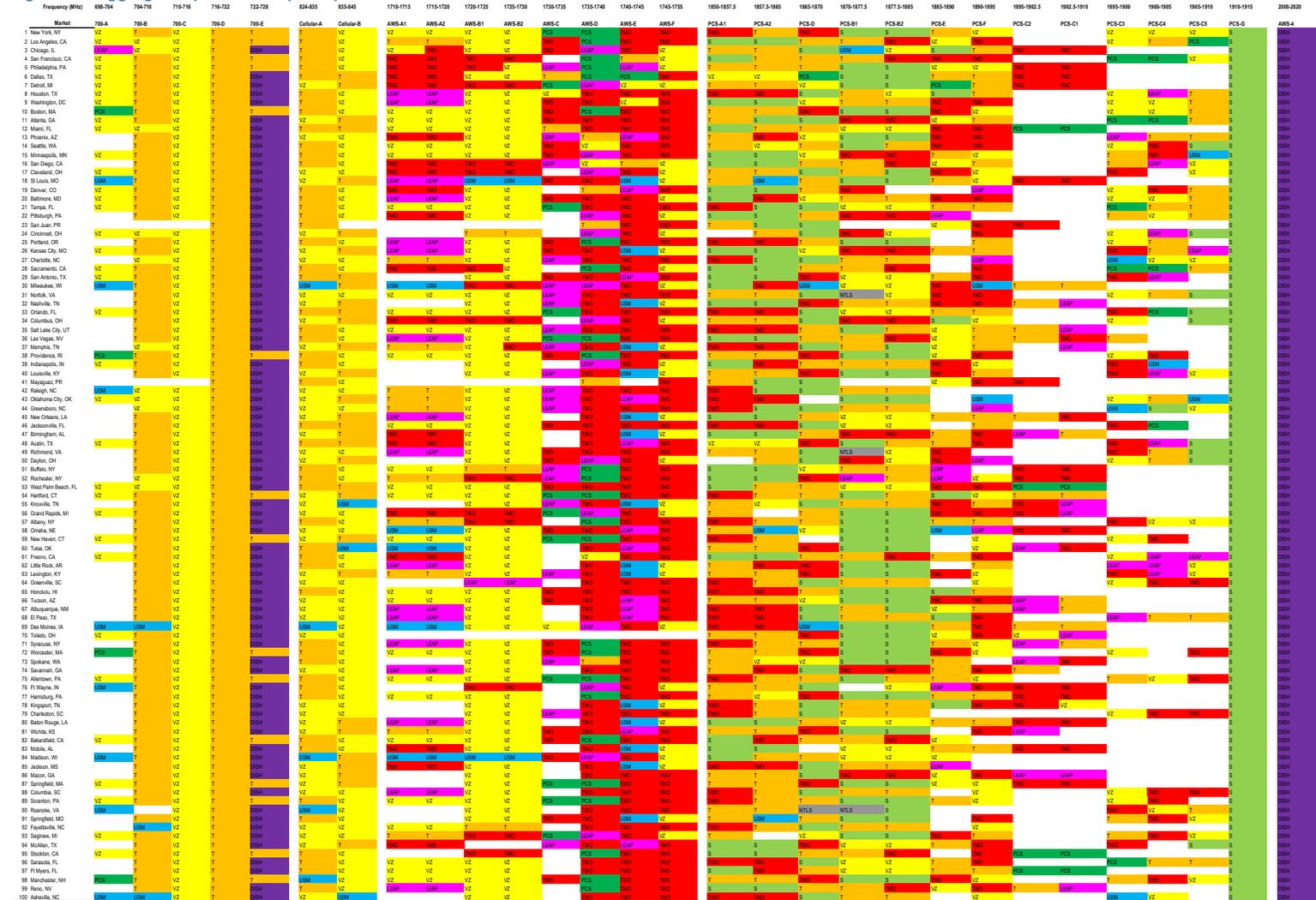
Source: FCC and J.P. Morgan estimates.

Figure 14: Auction 66 (AWS) License Descriptions

Block	Frequency Bands (MHz)	Total Bandwidth	Geographic Area Type	No. of Licenses Nationwide
A	1710-1720 / 2110-2120	20 MHz	CMA	734
B	1720-1730 / 2120-2130	20 MHz	EA	176
C	1730-1735 / 2130-2135	10 MHz	EA	176
D	1735-1740 / 2135-2140	10 MHz	REAG	12
E	1740-1745 / 2140-2145	10 MHz	REAG	12
F	1745-1755 / 2145-2155	20 MHz	REAG	12

Source: FCC and J.P. Morgan estimates.

Figure 15: Aggregate Spectrum Map - Top 100 Markets



Source: FCC and J.P. Morgan estimates.

Figure 16: AT&T Spectrum Holdings - Top 100 Markets

Market	Pops	AT&T (Cellular)	AT&T (PCS)	AT&T (AWS)	AT&T (700)	AT&T (Total Spectrum)	Market	Pops	AT&T (Cellular)	AT&T (PCS)	AT&T (AWS)	AT&T (700)	AT&T (Total Spectrum)
1 New York, NY	18,878	25	30			36	91 51 Buffalo, NY	1,184	25	30	20	30	105
2 Los Angeles, CA	16,811	25	40	20		24	109 52 Rochester, NY	1,143	25	20	20	18	83
3 Chicago, IL	8,886	25	40			18	83 53 West Palm Beach, FL	1,119	50	20		6	76
4 San Francisco, CA	7,484	25	40	10		36	111 54 Hartford, CT	1,116	25	60		36	121
5 Philadelphia, PA	5,995	25	40			36	101 55 Knoxville, TN	1,097		60		30	90
6 Dallas, TX	5,409	50	20	10		30	110 56 Grand Rapids, MI	1,061		30		30	60
7 Detroit, MI	4,996	25	40			30	95 57 Albany, NY	1,041	25	40	20	18	103
8 Houston, TX	4,975	25	40			30	95 58 Omaha, NE	983		20		18	38
9 Washington, DC	4,686	25	40			30	95 59 New Haven, CT	981	25	10		36	71
10 Boston, MA	4,311	25	40			36	101 60 Tulsa, OK	954	25	30		30	85
11 Atlanta, GA	4,266	25	40			30	95 61 Fresno, CA	943	25	40		30	95
12 Miami, FL	3,844	50	20	10		6	86 62 Little Rock, AR	942	25	30		30	85
13 Phoenix, AZ	3,387	40	10	10		30	80 63 Lexington, KY	917	25	30	20	18	93
14 Seattle, WA	3,245	25	40			18	83 64 Greenville, SC	898		40		18	58
15 Minneapolis, MN	3,212	25	20			18	63 65 Honolulu, HI	871	25	20		30	75
16 San Diego, CA	2,959	25	35	10		30	100 66 Tucson, AZ	855		45		30	75
17 Cleveland, OH	2,956		50			30	80 67 Albuquerque, NM	803		45		30	75
18 St Louis, MO	2,862	25	40			30	95 68 El Paso, TX	796		50		30	80
19 Denver, CO	2,629	25	20	10		30	85 69 Des Moines, IA	788		40		6	46
20 Baltimore, MD	2,578	25	40			30	95 70 Toledo, OH	780		30		30	60
21 Tampa, FL	2,576	25	40			30	95 71 Syracuse, NY	776	25	45		30	100
22 Pittsburgh, PA	2,446	25	30			30	85 72 Worcester, MA	745	25	30		24	79
23 San Juan, PR	2,421	25	20	10		18	73 73 Spokane, WA	743	25	30	10	18	83
24 Cincinnati, OH	2,180	25	10	20		18	73 74 Savannah, GA	737		45		18	63
25 Portland, OR	2,098	25	30			18	73 75 Allentown, PA	722	25	50		36	111
26 Kansas City, MO	2,056	25	30			30	85 76 Ft Wayne, IN	697	25	30		30	85
27 Charlotte, NC	2,034		30	20		6	56 77 Harrisburg, PA	695	25	40		30	95
28 Sacramento, CA	1,982	25	35			30	90 78 Kingsport, TN	693		40		30	70
29 San Antonio, TX	1,861	50	10			30	90 79 Charleston, SC	687		40		18	58
30 Milwaukee, WI	1,851	25	30			18	73 80 Baton Rouge, LA	686	25	30		30	85
31 Norfolk, VA	1,751		40			30	70 81 Wichita, KS	682	25	30	20	18	93
32 Nashville, TN	1,727	25	45			30	100 82 Bakersfield, CA	671	25	30		36	91
33 Orlando, FL	1,670	50	20			18	88 83 Mobile, AL	668	25	20		18	63
34 Columbus, OH	1,657	25	30			30	85 84 Madison, WI	668	25	20		18	63
35 Salt Lake City, UT	1,593	25	45			18	88 85 Jackson, MS	668	25	30		30	85
36 Las Vegas, NV	1,558	25	50			30	105 86 Macon, GA	663	25	30		18	73
37 Memphis, TN	1,516	25	30	20		18	93 87 Springfield, MA	658	25	30		36	91
38 Providence, RI	1,512	25	30			36	91 88 Columbia, SC	657		40		30	70
39 Indianapolis, IN	1,503	25	40			30	95 89 Scranton, PA	657	25	30		36	91
40 Louisville, KY	1,472	25	40			30	95 90 Roanoke, VA	648		40		6	46
41 Mayaguez, PR	1,462	25	20	10		18	73 91 Springfield, MO	646	25	30		18	73
42 Raleigh, NC	1,424		30	20		6	56 92 Fayetteville, NC	637		40	20	6	66
43 Oklahoma City, OK	1,411	25	10	20		18	73 93 Saginaw, MI	634		40	20	18	78
44 Greensboro, NC	1,405		30	20		6	56 94 McAllen, TX	623	25	10		30	65
45 New Orleans, LA	1,404	25	45			30	100 95 Stockton, CA	616	25	30		36	91
46 Jacksonville, FL	1,385	50	10			18	78 96 Sarasota, FL	614	25	30		18	73
47 Birmingham, AL	1,319	25	35			18	78 97 Ft Myers, FL	608	25	30		18	73
48 Austin, TX	1,241	50	20			30	100 98 Manchester, NH	599		40		24	64
49 Richmond, VA	1,233		40			30	70 99 Reno, NV	591	25	45		18	88
50 Dayton, OH	1,211	25	20			30	75 100 Asheville, NC	589		30		18	48

Source: FCC and J.P. Morgan estimates.

Figure 17: Verizon Spectrum Holdings - Top 100 Markets

Market	Pops	Verizon (Cellular)	Verizon (PCS)	Verizon (AWS)	Verizon (700)	Verizon (Total Spectrum)	Market	Pops	Verizon (Cellular)	Verizon (PCS)	Verizon (AWS)	Verizon (700)	Verizon (Total Spectrum)
1 New York, NY	18,878	25	40	40	34	139	51 Buffalo, NY	1,184	25	10	20	22	77
2 Los Angeles, CA	16,811	25	20	20	46	111	52 Rochester, NY	1,143	25	10		34	69
3 Chicago, IL	8,886	25	10	50	34	119	53 West Palm Beach, FL	1,119		30	40	46	116
4 San Francisco, CA	7,484	25	10	20	34	89	54 Hartford, CT	1,116	25	10	40	34	109
5 Philadelphia, PA	5,995	25	20	30	34	109	55 Knoxville, TN	1,097	25		40	22	87
6 Dallas, TX	5,409		30	20	34	84	56 Grand Rapids, MI	1,061	50		20	34	104
7 Detroit, MI	4,996	25	10	30	34	99	57 Albany, NY	1,041	25	20		22	67
8 Houston, TX	4,975	25	20	30	34	109	58 Omaha, NE	983	50	10	20	22	102
9 Washington, DC	4,686	25	30	30	34	119	59 New Haven, CT	981	25	20	40	34	119
10 Boston, MA	4,311	25	30	40	22	117	60 Tulsa, OK	954		10	20	22	52
11 Atlanta, GA	4,266	25	10	40	34	109	61 Fresno, CA	943	25	10	30	34	99
12 Miami, FL	3,844		30	40	46	116	62 Little Rock, AR	942	25	10	40	22	97
13 Phoenix, AZ	3,387	50	10	20	22	102	63 Lexington, KY	917	25	20	40	22	107
14 Seattle, WA	3,245	25	20	50	22	117	64 Greenville, SC	898	50	20		22	92
15 Minneapolis, MN	3,212	25	20	40	34	119	65 Honolulu, HI	871	25		40	22	87
16 San Diego, CA	2,959	25	20	30	22	97	66 Tucson, AZ	855	50	10	40	22	122
17 Cleveland, OH	2,956	50	20	20	34	124	67 Albuquerque, NM	803	50	10	20	22	102
18 St Louis, MO	2,862	25	10	20	22	77	68 El Paso, TX	796	50		20	22	92
19 Denver, CO	2,629	25	10	20	34	89	69 Des Moines, IA	788	25		50	22	97
20 Baltimore, MD	2,578	25	30	40	34	129	70 Toledo, OH	780	50	25		34	109
21 Tampa, FL	2,576	25	30	40	34	129	71 Syracuse, NY	776	25	10	20	22	77
22 Pittsburgh, PA	2,446	25	10	40	22	97	72 Worcester, MA	745	25	20	40	22	107
23 San Juan, PR	2,421		10			10	73 Spokane, WA	743	25	20	20	22	87
24 Cincinnati, OH	2,180	25	20	20	46	111	74 Savannah, GA	737	50		20	22	92
25 Portland, OR	2,098	25	10	20	22	77	75 Allentown, PA	722	25	20	40	34	119
26 Kansas City, MO	2,056	25	10	40	34	109	76 Ft Wayne, IN	697	25	10	20	22	77
27 Charlotte, NC	2,034	50	20	20	34	124	77 Harrisburg, PA	695	25	10	40	22	97
28 Sacramento, CA	1,982	25		30	34	89	78 Kingsport, TN	693	50	15	40	22	127
29 San Antonio, TX	1,861		30	20	34	84	79 Charleston, SC	687	50	10	20	22	102
30 Milwaukee, WI	1,851		30	20	22	72	80 Baton Rouge, LA	686	25	30	40	22	117
31 Norfolk, VA	1,751	50	20	40	22	132	81 Wichita, KS	682	25		20	22	67
32 Nashville, TN	1,727	25		40	22	87	82 Bakersfield, CA	671	25	10	40	34	109
33 Orlando, FL	1,670		30	40	34	104	83 Mobile, AL	668	25	30	40	22	117
34 Columbus, OH	1,657	25	20	20	22	87	84 Madison, WI	668		40	20	22	82
35 Salt Lake City, UT	1,593	25	10	40	22	97	85 Jackson, MS	668	25		40	22	87
36 Las Vegas, NV	1,558	25	10	20	22	77	86 Macon, GA	663	25	10	20	22	77
37 Memphis, TN	1,516	25	10	30	34	99	87 Springfield, MA	658	25	20	20	34	99
38 Providence, RI	1,512	25	20	40	22	107	88 Columbia, SC	657	50	20	20	22	112
39 Indianapolis, IN	1,503	25	10	40	34	109	89 Scranton, PA	657	25	20	40	34	119
40 Louisville, KY	1,472	25	10	40	22	97	90 Roanoke, VA	648	25	10	20	22	77
41 Mayaguez, PR	1,462	25	10			35	91 Springfield, MO	646	25	10	40	22	97
42 Raleigh, NC	1,424	50		20	34	104	92 Fayetteville, NC	637	50	10	20	22	102
43 Oklahoma City, OK	1,411	25	10	20	46	101	93 Saginaw, MI	634	50	20	20	34	124
44 Greensboro, NC	1,405	50	10	20	34	114	94 McAllen, TX	623	25	30		22	77
45 New Orleans, LA	1,404	25	30	40	22	117	95 Stockton, CA	616	25			34	59
46 Jacksonville, FL	1,385		30	40	22	92	96 Sarasota, FL	614	25	30	40	22	117
47 Birmingham, AL	1,319	25		40	22	87	97 Ft Myers, FL	608	25	30	40	22	117
48 Austin, TX	1,241		30	20	34	84	98 Manchester, NH	599	25	20	40	22	107
49 Richmond, VA	1,233	50	10	20	22	102	99 Reno, NV	591	25	10	20	22	77
50 Dayton, OH	1,211	25	20	40	22	107	100 Asheville, NC	589	25	20	20	22	87

Source: FCC and J.P. Morgan estimates.

Figure 18: Sprint Spectrum Holdings - Top 100 Markets

Market	Pops	Sprint (Cellular)	Sprint (PCS)	Sprint (AWS)	Sprint (700)	Sprint (Total Spectrum)	Market	Pops	Sprint (Cellular)	Sprint (PCS)	Sprint (AWS)	Sprint (700)	Sprint (Total Spectrum)
1 New York, NY	18,878	14	40			54	51 Buffalo, NY	1,184	14	40			54
2 Los Angeles, CA	16,811	14	40			54	52 Rochester, NY	1,143	14	40			54
3 Chicago, IL	8,886	14	30			44	53 West Palm Beach, FL	1,119	14	30			44
4 San Francisco, CA	7,484	14	30			44	54 Hartford, CT	1,116	14	40			54
5 Philadelphia, PA	5,995	14	40			54	55 Knoxville, TN	1,097	14	20			34
6 Dallas, TX	5,409	14	40			54	56 Grand Rapids, MI	1,061	14	40			54
7 Detroit, MI	4,996	14	40			54	57 Albany, NY	1,041	14	40			54
8 Houston, TX	4,975	14	30			44	58 Omaha, NE	983	14	40			54
9 Washington, DC	4,686	14	40			54	59 New Haven, CT	981	14	40			54
10 Boston, MA	4,311	14	40			54	60 Tulsa, OK	954	14	40			54
11 Atlanta, GA	4,266	14	30			44	61 Fresno, CA	943	14	40			54
12 Miami, FL	3,844	14	30			44	62 Little Rock, AR	942	14	40			54
13 Phoenix, AZ	3,387	14	40			54	63 Lexington, KY	917	14	40			54
14 Seattle, WA	3,245	14	40			54	64 Greenville, SC	898	14	20			34
15 Minneapolis, MN	3,212	14	40			54	65 Honolulu, HI	871	14	50			64
16 San Diego, CA	2,959	14	40			54	66 Tucson, AZ	855	14	40			54
17 Cleveland, OH	2,956	14	30			44	67 Albuquerque, NM	803	14	30			44
18 St Louis, MO	2,862	14	40			54	68 El Paso, TX	796	14	30			44
19 Denver, CO	2,629	14	40			54	69 Des Moines, IA	788	14	40			54
20 Baltimore, MD	2,578	14	30			44	70 Toledo, OH	780	14	40			54
21 Tampa, FL	2,576	14	25			39	71 Syracuse, NY	776	14	40			54
22 Pittsburgh, PA	2,446	14	40			54	72 Worcester, MA	745	14	40			54
23 San Juan, PR	2,421	14	30			44	73 Spokane, WA	743	14	40			54
24 Cincinnati, OH	2,180	14	30			44	74 Savannah, GA	737	14	20			34
25 Portland, OR	2,098	14	40			54	75 Allentown, PA	722	14	40			54
26 Kansas City, MO	2,056	14	40			54	76 Ft Wayne, IN	697	14	20			34
27 Charlotte, NC	2,034	14	30			44	77 Harrisburg, PA	695	14	40			54
28 Sacramento, CA	1,982	14	40			54	78 Kingsport, TN	693	14	30			44
29 San Antonio, TX	1,861	14	40			54	79 Charleston, SC	687	14	20			34
30 Milwaukee, WI	1,851	14	30			44	80 Baton Rouge, LA	686	14	40			54
31 Norfolk, VA	1,751	14	30			44	81 Wichita, KS	682	14	40			54
32 Nashville, TN	1,727	14	40			54	82 Bakersfield, CA	671	14	30			44
33 Orlando, FL	1,670	14	30			44	83 Mobile, AL	668	14	40			54
34 Columbus, OH	1,657	14	40			54	84 Madison, WI	668	14	30			44
35 Salt Lake City, UT	1,593	14	30			44	85 Jackson, MS	668	14	20			34
36 Las Vegas, NV	1,558	14	40			54	86 Macon, GA	663	14	20			34
37 Memphis, TN	1,516	14	30			44	87 Springfield, MA	658	14	40			54
38 Providence, RI	1,512	14	40			54	88 Columbia, SC	657	14	20			34
39 Indianapolis, IN	1,503	14	30			44	89 Scranton, PA	657	14	40			54
40 Louisville, KY	1,472	14	40			54	90 Roanoke, VA	648	14	20			34
41 Mayaguez, PR	1,462	14	30			44	91 Springfield, MO	646	14	40			54
42 Raleigh, NC	1,424	14	30			44	92 Fayetteville, NC	637	14	20			34
43 Oklahoma City, OK	1,411	14	40			54	93 Saginaw, MI	634	14	40			54
44 Greensboro, NC	1,405	14	40			54	94 McAllen, TX	623	14	50			64
45 New Orleans, LA	1,404	14	40			54	95 Stockton, CA	616	14	40			54
46 Jacksonville, FL	1,385	14	20			34	96 Sarasota, FL	614	14	20			34
47 Birmingham, AL	1,319	14	40			54	97 Ft Myers, FL	608	14	30			44
48 Austin, TX	1,241	14	40			54	98 Manchester, NH	599	14	40			54
49 Richmond, VA	1,233	14	30			44	99 Reno, NV	591	14	40			54
50 Dayton, OH	1,211	14	30			44	100 Asheville, NC	589	14	20			34

Source: FCC and J.P. Morgan estimates.

Figure 19: T-Mobile USA Spectrum Holdings - Top 100 Markets

Market	Pops	T-Mobile (Cellular)	T-Mobile (PCS)	T-Mobile (AWS)	T-Mobile (700)	T-Mobile (Total Spectrum)	Market	Pops	T-Mobile (Cellular)	T-Mobile (PCS)	T-Mobile (AWS)	T-Mobile (700)	T-Mobile (Total Spectrum)
1 New York, NY	18,878		20	30		50	51 Buffalo, NY	1,184		30	30		60
2 Los Angeles, CA	16,811		20	40		60	52 Rochester, NY	1,143		40	50		90
3 Chicago, IL	8,886		30	30		60	53 West Palm Beach, FL	1,119		20	50		70
4 San Francisco, CA	7,484		30	40		70	54 Hartford, CT	1,116		20	30		50
5 Philadelphia, PA	5,995		30	30		60	55 Knoxville, TN	1,097		25	10		35
6 Dallas, TX	5,409		30	40		70	56 Grand Rapids, MI	1,061		35	50		85
7 Detroit, MI	4,996		30	40		70	57 Albany, NY	1,041		30	50		80
8 Houston, TX	4,975		30	40		70	58 Omaha, NE	983		30	40		70
9 Washington, DC	4,686		20	40		60	59 New Haven, CT	981		30	30		60
10 Boston, MA	4,311		20	40		60	60 Tulsa, OK	954		25	30		55
11 Atlanta, GA	4,266		30	50		80	61 Fresno, CA	943		20	50		70
12 Miami, FL	3,844		20	40		60	62 Little Rock, AR	942		20	10		30
13 Phoenix, AZ	3,387		30	40		70	63 Lexington, KY	917		30	10		40
14 Seattle, WA	3,245		30	40		70	64 Greenville, SC	898		40	40		80
15 Minneapolis, MN	3,212		40	40		80	65 Honolulu, HI	871		30	50		80
16 San Diego, CA	2,959		25	40		65	66 Tucson, AZ	855		20	40		60
17 Cleveland, OH	2,956		20	50		70	67 Albuquerque, NM	803		30	30		60
18 St Louis, MO	2,862		30	20		50	68 El Paso, TX	796		40	30		70
19 Denver, CO	2,629		30	40		70	69 Des Moines, IA	788		40	10		50
20 Baltimore, MD	2,578		30	30		60	70 Toledo, OH	780		20			20
21 Tampa, FL	2,576		25	40		65	71 Syracuse, NY	776		20	40		60
22 Pittsburgh, PA	2,446		30	30		60	72 Worcester, MA	745		30	40		70
23 San Juan, PR	2,421		25	30		55	73 Spokane, WA	743		15	30		45
24 Cincinnati, OH	2,180		30	10		40	74 Savannah, GA	737		50	40		90
25 Portland, OR	2,098		30	40		70	75 Allentown, PA	722		30	30		60
26 Kansas City, MO	2,056		40	20		60	76 Ft Wayne, IN	697		40	30		70
27 Charlotte, NC	2,034		20	40		60	77 Harrisburg, PA	695		40	30		70
28 Sacramento, CA	1,982		25	40		65	78 Kingsport, TN	693		45	10		55
29 San Antonio, TX	1,861		30	40		70	79 Charleston, SC	687		40	40		80
30 Milwaukee, WI	1,851		20	30		50	80 Baton Rouge, LA	686		30	10		40
31 Norfolk, VA	1,751		20	40		60	81 Wichita, KS	682		20	40		60
32 Nashville, TN	1,727		30	10		40	82 Bakersfield, CA	671		20	40		60
33 Orlando, FL	1,670		40	40		80	83 Mobile, AL	668		30	30		60
34 Columbus, OH	1,657		30	50		80	84 Madison, WI	668			20		20
35 Salt Lake City, UT	1,593		30	40		70	85 Jackson, MS	668		30	30		60
36 Las Vegas, NV	1,558		30	30		60	86 Macon, GA	663		40	40		80
37 Memphis, TN	1,516		30	20		50	87 Springfield, MA	658		40	30		70
38 Providence, RI	1,512		30	40		70	88 Columbia, SC	657		40	40		80
39 Indianapolis, IN	1,503		30	10		40	89 Scranton, PA	657		30	30		60
40 Louisville, KY	1,472		30	10		40	90 Roanoke, VA	648		10	40		50
41 Mayaguez, PR	1,462		25	20		45	91 Springfield, MO	646		20	20		40
42 Raleigh, NC	1,424		20	40		60	92 Fayetteville, NC	637		20	40		60
43 Oklahoma City, OK	1,411		30	30		60	93 Saginaw, MI	634		20	30		50
44 Greensboro, NC	1,405		20	40		60	94 McAllen, TX	623		30	50		80
45 New Orleans, LA	1,404		15	10		25	95 Stockton, CA	616		20	50		70
46 Jacksonville, FL	1,385		40	50		90	96 Sarasota, FL	614		40	40		80
47 Birmingham, AL	1,319		40	30		70	97 Ft Myers, FL	608		10	40		50
48 Austin, TX	1,241		30	50		80	98 Manchester, NH	599		30	40		70
49 Richmond, VA	1,233		20	50		70	99 Reno, NV	591		20	30		50
50 Dayton, OH	1,211		30	20		50	100 Asheville, NC	589		30	40		70

Source: FCC and J.P. Morgan estimates.

Figure 20: MetroPCS Spectrum Holdings - Top 100 Markets

Market	Pops	MetroPCS (Cellular)	MetroPCS (PCS)	MetroPCS (AWS)	MetroPCS (700)	MetroPCS (Total Spectrum)	Market	Pops	MetroPCS (Cellular)	MetroPCS (PCS)	MetroPCS (AWS)	MetroPCS (700)	MetroPCS (Total Spectrum)
1 New York, NY	18,878			20		20	51 Buffalo, NY	1,184					10
2 Los Angeles, CA	16,811		10	10		20	52 Rochester, NY	1,143				10	10
3 Chicago, IL	8,886						53 West Palm Beach, FL	1,119		30			30
4 San Francisco, CA	7,484		20	10		30	54 Hartford, CT	1,116			20		20
5 Philadelphia, PA	5,995			10		10	55 Knoxville, TN	1,097					0
6 Dallas, TX	5,409		10	20		30	56 Grand Rapids, MI	1,061			10		10
7 Detroit, MI	4,996		10	10		20	57 Albany, NY	1,041			10		10
8 Houston, TX	4,975					0	58 Omaha, NE	983					0
9 Washington, DC	4,886					0	59 New Haven, CT	981			20		20
10 Boston, MA	4,311			10	12	22	60 Tulsa, OK	954					0
11 Atlanta, GA	4,266		20			20	61 Fresno, CA	943					0
12 Miami, FL	3,844		30			30	62 Little Rock, AR	942					0
13 Phoenix, AZ	3,387					0	63 Lexington, KY	917					0
14 Seattle, WA	3,245					0	64 Greenville, SC	898					0
15 Minneapolis, MN	3,212					0	65 Honolulu, HI	871					0
16 San Diego, CA	2,989					0	66 Tucson, AZ	855					0
17 Cleveland, OH	2,966					0	67 Albuquerque, NM	803					0
18 St Louis, MO	2,862					0	68 El Paso, TX	796					0
19 Denver, CO	2,629					0	69 Des Moines, IA	788					0
20 Baltimore, MD	2,578					0	70 Toledo, OH	780					0
21 Tampa, FL	2,576		10	10		20	71 Syracuse, NY	776			10		10
22 Pittsburgh, PA	2,446					0	72 Worcester, MA	745			10	12	22
23 San Juan, PR	2,421					0	73 Spokane, WA	743					0
24 Cincinnati, OH	2,180					0	74 Savannah, GA	737					0
25 Portland, OR	2,098			10		10	75 Allentown, PA	722			20		20
26 Kansas City, MO	2,066					0	76 Ft Wayne, IN	697					0
27 Charlotte, NC	2,034					0	77 Harrisburg, PA	695			10		10
28 Sacramento, CA	1,982		20	10		30	78 Kingsport, TN	693					0
29 San Antonio, TX	1,861					0	79 Charleston, SC	687					0
30 Milwaukee, WI	1,851					0	80 Baton Rouge, LA	686					0
31 Norfolk, VA	1,751					0	81 Wichita, KS	682					0
32 Nashville, TN	1,727					0	82 Bakersfield, CA	671			10		10
33 Orlando, FL	1,670		10	10		20	83 Mobile, AL	668					0
34 Columbus, OH	1,657					0	84 Madison, WI	668					0
35 Salt Lake City, UT	1,593					0	85 Jackson, MS	668					0
36 Las Vegas, NV	1,568			20		20	86 Macon, GA	663					0
37 Memphis, TN	1,516					0	87 Springfield, MA	658			20		20
38 Providence, RI	1,512			10	12	22	88 Columbia, SC	657					0
39 Indianapolis, IN	1,503					0	89 Scranton, PA	657			20		20
40 Louisville, KY	1,472					0	90 Roanoke, VA	648					0
41 Mayaguez, PR	1,462					0	91 Springfield, MO	646					0
42 Raleigh, NC	1,424					0	92 Fayetteville, NC	637					0
43 Oklahoma City, OK	1,411					0	93 Saginaw, MI	634			10		10
44 Greensboro, NC	1,405					0	94 McAllen, TX	623					0
45 New Orleans, LA	1,404					0	95 Stockton, CA	616		30	10		40
46 Jacksonville, FL	1,385		10			10	96 Sarasota, FL	614		10			10
47 Birmingham, AL	1,319					0	97 Ft Myers, FL	608		30			30
48 Austin, TX	1,241					0	98 Manchester, NH	599			10	12	22
49 Richmond, VA	1,233					0	99 Reno, NV	591			10		10
50 Dayton, OH	1,211					0	100 Asheville, NC	589					0

Source: FCC and J.P. Morgan estimates.

Figure 21: Leap Wireless Spectrum Holdings - Top 100 Markets

Market	Pops	Leap (Cellular)	Leap (PCS)	Leap (AWS)	Leap (700)	Leap (Total Spectrum)	Market	Pops	Leap (Cellular)	Leap (PCS)	Leap (AWS)	Leap (700)	Leap (Total Spectrum)
1 New York, NY	18,878					0	51 Buffalo, NY	1,184			10	10	20
2 Los Angeles, CA	16,811					0	52 Rochester, NY	1,143			10	10	20
3 Chicago, IL	8,886			10	12	22	53 West Palm Beach, FL	1,119					0
4 San Francisco, CA	7,484					0	54 Hartford, CT	1,116					0
5 Philadelphia, PA	5,995			20		20	55 Knoxville, TN	1,097		15	10		25
6 Dallas, TX	5,409					0	56 Grand Rapids, MI	1,061		15	10		25
7 Detroit, MI	4,996			10		10	57 Albany, NY	1,041					0
8 Houston, TX	4,975		10	20		30	58 Omaha, NE	983		10	10		20
9 Washington, DC	4,686			20		20	59 New Haven, CT	981					0
10 Boston, MA	4,311					0	60 Tulsa, OK	954		15	10		25
11 Atlanta, GA	4,266					0	61 Fresno, CA	943					20
12 Miami, FL	3,844					0	62 Little Rock, AR	942		20	20		40
13 Phoenix, AZ	3,387		10	20		30	63 Lexington, KY	917		10	10		20
14 Seattle, WA	3,245					0	64 Greenville, SC	898			20		20
15 Minneapolis, MN	3,212			10		10	65 Honolulu, HI	871					0
16 San Diego, CA	2,959		10	10		20	66 Tucson, AZ	855		15	10		25
17 Cleveland, OH	2,956			10		10	67 Albuquerque, NM	803		15	30		45
18 St Louis, MO	2,862			20		20	68 El Paso, TX	796		10	30		40
19 Denver, CO	2,629		10	10		20	69 Des Moines, IA	788			10		10
20 Baltimore, MD	2,578			20		20	70 Toledo, OH	780		15			15
21 Tampa, FL	2,576					0	71 Syracuse, NY	776		15	20		35
22 Pittsburgh, PA	2,446		10	10		20	72 Worcester, MA	745					0
23 San Juan, PR	2,421					0	73 Spokane, WA	743		15	10		25
24 Cincinnati, OH	2,180		10	10		20	74 Savannah, GA	737			20		20
25 Portland, OR	2,098			20		20	75 Allentown, PA	722					0
26 Kansas City, MO	2,056		10	20		30	76 Ft Wayne, IN	697		10	10		20
27 Charlotte, NC	2,034		10	10		20	77 Harrisburg, PA	695					0
28 Sacramento, CA	1,982					0	78 Kingsport, TN	693					0
29 San Antonio, TX	1,861		10	10		20	79 Charleston, SC	687			10		10
30 Milwaukee, WI	1,851			20		20	80 Baton Rouge, LA	686			20		20
31 Norfolk, VA	1,751			10		10	81 Wichita, KS	682		15	10		25
32 Nashville, TN	1,727		15	10		25	82 Bakersfield, CA	671					0
33 Orlando, FL	1,670					0	83 Mobile, AL	668					0
34 Columbus, OH	1,657			10		10	84 Madison, WI	668			10		10
35 Salt Lake City, UT	1,593		15	10		25	85 Jackson, MS	668		10			10
36 Las Vegas, NV	1,558			20		20	86 Macon, GA	663		30			30
37 Memphis, TN	1,516		15	10		25	87 Springfield, MA	658					0
38 Providence, RI	1,512					0	88 Columbia, SC	657			20		20
39 Indianapolis, IN	1,503			10		10	89 Scranton, PA	657					0
40 Louisville, KY	1,472		10	10		20	90 Roanoke, VA	648					0
41 Mayaguez, PR	1,462					0	91 Springfield, MO	646					0
42 Raleigh, NC	1,424			10		10	92 Fayetteville, NC	637					0
43 Oklahoma City, OK	1,411			20		20	93 Saginaw, MI	634			10		10
44 Greensboro, NC	1,405		10	10		20	94 McAllen, TX	623			20		20
45 New Orleans, LA	1,404			20		20	95 Stockton, CA	616					0
46 Jacksonville, FL	1,385					0	96 Sarasota, FL	614					0
47 Birmingham, AL	1,319		15			15	97 Ft Myers, FL	608					0
48 Austin, TX	1,241		10	10		20	98 Manchester, NH	599					0
49 Richmond, VA	1,233			20		20	99 Reno, NV	591		15	20		35
50 Dayton, OH	1,211		10	10		20	100 Asheville, NC	589					0

Source: FCC and J.P. Morgan estimates.

Figure 22: US Cellular Spectrum Holdings - Top 100 Markets

Market	Pops	US Cellular (Cellular)	US Cellular (PCS)	US Cellular (AWS)	US Cellular (700)	US Cellular (Total Spectrum)	Market	Pops	US Cellular (Cellular)	US Cellular (PCS)	US Cellular (AWS)	US Cellular (700)	US Cellular (Total Spectrum)
1 New York, NY	18,878					0	51 Buffalo, NY	1,184					0
2 Los Angeles, CA	16,811					0	52 Rochester, NY	1,143					0
3 Chicago, IL	8,886		20			20	53 West Palm Beach, FL	1,119					0
4 San Francisco, CA	7,484					0	54 Hartford, CT	1,116					0
5 Philadelphia, PA	5,995					0	55 Knoxville, TN	1,097	25		10		35
6 Dallas, TX	5,409					0	56 Grand Rapids, MI	1,061					0
7 Detroit, MI	4,996					0	57 Albany, NY	1,041					0
8 Houston, TX	4,975					0	58 Omaha, NE	983		20	20		40
9 Washington, DC	4,686					0	59 New Haven, CT	981					0
10 Boston, MA	4,311					0	60 Tulsa, OK	954	25		20		45
11 Atlanta, GA	4,266					0	61 Fresno, CA	943					0
12 Miami, FL	3,844					0	62 Little Rock, AR	942			10		10
13 Phoenix, AZ	3,387					0	63 Lexington, KY	917			10		10
14 Seattle, WA	3,245					0	64 Greenville, SC	898					0
15 Minneapolis, MN	3,212	10				10	65 Honolulu, HI	871					0
16 San Diego, CA	2,959					0	66 Tucson, AZ	855					0
17 Cleveland, OH	2,956					0	67 Albuquerque, NM	803					0
18 St Louis, MO	2,862		10	30	12	52	68 El Paso, TX	796					0
19 Denver, CO	2,629					0	69 Des Moines, IA	788	25	10	20	24	79
20 Baltimore, MD	2,578					0	70 Toledo, OH	780					0
21 Tampa, FL	2,576					0	71 Syracuse, NY	776					0
22 Pittsburgh, PA	2,446					0	72 Worcester, MA	745					0
23 San Juan, PR	2,421					0	73 Spokane, WA	743					0
24 Cincinnati, OH	2,180					0	74 Savannah, GA	737					0
25 Portland, OR	2,098					0	75 Allentown, PA	722					0
26 Kansas City, MO	2,056			10		10	76 Ft Wayne, IN	697				12	12
27 Charlotte, NC	2,034	10				10	77 Harrisburg, PA	695					0
28 Sacramento, CA	1,982					0	78 Kingsport, TN	693			10		10
29 San Antonio, TX	1,861					0	79 Charleston, SC	687					0
30 Milwaukee, WI	1,851	25	20	20	12	77	80 Baton Rouge, LA	686			10		10
31 Norfolk, VA	1,751					0	81 Wichita, KS	682					0
32 Nashville, TN	1,727			10		10	82 Bakersfield, CA	671					0
33 Orlando, FL	1,670					0	83 Mobile, AL	668			10		10
34 Columbus, OH	1,657					0	84 Madison, WI	668	25		40	12	77
35 Salt Lake City, UT	1,593					0	85 Jackson, MS	668			10		10
36 Las Vegas, NV	1,558					0	86 Macon, GA	663					0
37 Memphis, TN	1,516			10		10	87 Springfield, MA	658					0
38 Providence, RI	1,512					0	88 Columbia, SC	657					0
39 Indianapolis, IN	1,503		10			10	89 Scranton, PA	657					0
40 Louisville, KY	1,472			10		10	90 Roanoke, VA	648	25			12	37
41 Mayaguez, PR	1,462					0	91 Springfield, MO	646		20	10		30
42 Raleigh, NC	1,424				12	12	92 Fayetteville, NC	637				12	12
43 Oklahoma City, OK	1,411	20				20	93 Saginaw, MI	634					0
44 Greensboro, NC	1,405	10				10	94 McAllen, TX	623					0
45 New Orleans, LA	1,404			10		10	95 Stockton, CA	616					0
46 Jacksonville, FL	1,385					0	96 Sarasota, FL	614					0
47 Birmingham, AL	1,319			10		10	97 Ft Myers, FL	608					0
48 Austin, TX	1,241					0	98 Manchester, NH	599	25				25
49 Richmond, VA	1,233					0	99 Reno, NV	591					0
50 Dayton, OH	1,211					0	100 Asheville, NC	589	25	10		24	59

Source: FCC and J.P. Morgan estimates.

Figure 23: nTelos Spectrum Holdings - Top 100 Markets

Market	Pops	NTELOS (Cellular)	NTELOS (PCS)	NTELOS (AWS)	NTELOS (700)	NTELOS (Total Spectrum)	Market	Pops	NTELOS (Cellular)	NTELOS (PCS)	NTELOS (AWS)	NTELOS (700)	NTELOS (Total Spectrum)
1 New York, NY	18,878					0	51 Buffalo, NY	1,184					0
2 Los Angeles, CA	16,811					0	52 Rochester, NY	1,143					0
3 Chicago, IL	8,886					0	53 West Palm Beach, FL	1,119					0
4 San Francisco, CA	7,484					0	54 Hartford, CT	1,116					0
5 Philadelphia, PA	5,995					0	55 Knoxville, TN	1,097					0
6 Dallas, TX	5,409					0	56 Grand Rapids, MI	1,061					0
7 Detroit, MI	4,996					0	57 Albany, NY	1,041					0
8 Houston, TX	4,975					0	58 Omaha, NE	983					0
9 Washington, DC	4,686					0	59 New Haven, CT	981					0
10 Boston, MA	4,311					0	60 Tulsa, OK	964					0
11 Atlanta, GA	4,266					0	61 Fresno, CA	943					0
12 Miami, FL	3,844					0	62 Little Rock, AR	942					0
13 Phoenix, AZ	3,387					0	63 Lexington, KY	917					0
14 Seattle, WA	3,245					0	64 Greenville, SC	898					0
15 Minneapolis, MN	3,212					0	65 Honolulu, HI	871					0
16 San Diego, CA	2,959					0	66 Tucson, AZ	855					0
17 Cleveland, OH	2,956					0	67 Albuquerque, NM	803					0
18 St Louis, MO	2,862					0	68 El Paso, TX	796					0
19 Denver, CO	2,629					0	69 Des Moines, IA	788					0
20 Baltimore, MD	2,578					0	70 Toledo, OH	780					0
21 Tampa, FL	2,576					0	71 Syracuse, NY	776					0
22 Pittsburgh, PA	2,446					0	72 Worcester, MA	745					0
23 San Juan, PR	2,421					0	73 Spokane, WA	743					0
24 Cincinnati, OH	2,180					0	74 Savannah, GA	737					0
25 Portland, OR	2,098					0	75 Allentown, PA	722					0
26 Kansas City, MO	2,056					0	76 Ft Wayne, IN	697					0
27 Charlotte, NC	2,034					0	77 Harrisburg, PA	695					0
28 Sacramento, CA	1,982					0	78 Kingsport, TN	693					0
29 San Antonio, TX	1,861					0	79 Charleston, SC	687					0
30 Milwaukee, WI	1,851					0	80 Baton Rouge, LA	686					0
31 Norfolk, VA	1,751		20			20	81 Wichita, KS	682					0
32 Nashville, TN	1,727					0	82 Bakersfield, CA	671					0
33 Orlando, FL	1,670					0	83 Mobile, AL	668					0
34 Columbus, OH	1,657					0	84 Madison, WI	668					0
35 Salt Lake City, UT	1,593					0	85 Jackson, MS	668					0
36 Las Vegas, NV	1,558					0	86 Macon, GA	663					0
37 Memphis, TN	1,516					0	87 Springfield, MA	658					0
38 Providence, RI	1,512					0	88 Columbia, SC	657					0
39 Indianapolis, IN	1,503					0	89 Scranton, PA	657					0
40 Louisville, KY	1,472					0	90 Roanoke, VA	648		30	20		50
41 Mayaguez, PR	1,462					0	91 Springfield, MO	646					0
42 Raleigh, NC	1,424					0	92 Fayetteville, NC	637					0
43 Oklahoma City, OK	1,411					0	93 Saginaw, MI	634					0
44 Greensboro, NC	1,405					0	94 McAllen, TX	623					0
45 New Orleans, LA	1,404					0	95 Stockton, CA	616					0
46 Jacksonville, FL	1,385					0	96 Sarasota, FL	614					0
47 Birmingham, AL	1,319					0	97 Ft Myers, FL	608					0
48 Austin, TX	1,241					0	98 Manchester, NH	599					0
49 Richmond, VA	1,233		20			20	99 Reno, NV	591					0
50 Dayton, OH	1,211					0	100 Asheville, NC	589					0

Source: FCC and J.P. Morgan estimates.

Figure 24: DISH Spectrum Holdings - Top 100 Markets

Market	Pops	DISH (700)	DISH (MMDS)	DISH (Total Spectrum)	Market	Pops	DISH (700)	DISH (MMDS)	DISH (Total Spectrum)
1 New York, NY	18,878		40	40	51 Buffalo, NY	1,184	6	40	46
2 Los Angeles, CA	16,811		40	40	52 Rochester, NY	1,143	6	40	46
3 Chicago, IL	8,886	6	40	46	53 West Palm Beach, FL	1,119	6	40	46
4 San Francisco, CA	7,484		40	40	54 Hartford, CT	1,116		40	40
5 Philadelphia, PA	5,995		40	40	55 Knoxville, TN	1,097	6	40	46
6 Dallas, TX	5,409	6	40	46	56 Grand Rapids, MI	1,061	6	40	46
7 Detroit, MI	4,996	6	40	46	57 Albany, NY	1,041	6	40	46
8 Houston, TX	4,975	6	40	46	58 Omaha, NE	983	6	40	46
9 Washington, DC	4,686	6	40	46	59 New Haven, CT	981		40	40
10 Boston, MA	4,311		40	40	60 Tulsa, OK	954	6	40	46
11 Atlanta, GA	4,266	6	40	46	61 Fresno, CA	943	6	40	46
12 Miami, FL	3,844	6	40	46	62 Little Rock, AR	942	6	40	46
13 Phoenix, AZ	3,387	6	40	46	63 Lexington, KY	917	6	40	46
14 Seattle, WA	3,245	6	40	46	64 Greenville, SC	898	6	40	46
15 Minneapolis, MN	3,212	6	40	46	65 Honolulu, HI	871	6	40	46
16 San Diego, CA	2,959	6	40	46	66 Tucson, AZ	855	6	40	46
17 Cleveland, OH	2,956	6	40	46	67 Albuquerque, NM	803	6	40	46
18 St Louis, MO	2,862	6	40	46	68 El Paso, TX	796	6	40	46
19 Denver, CO	2,629	6	40	46	69 Des Moines, IA	788	6	40	46
20 Baltimore, MD	2,578	6	40	46	70 Toledo, OH	780	6	40	46
21 Tampa, FL	2,576	6	40	46	71 Syracuse, NY	776	6	40	46
22 Pittsburgh, PA	2,446	6	40	46	72 Worcester, MA	745		40	40
23 San Juan, PR	2,421	6	40	46	73 Spokane, WA	743	6	40	46
24 Cincinnati, OH	2,180	6	40	46	74 Savannah, GA	737	6	40	46
25 Portland, OR	2,098	6	40	46	75 Allentown, PA	722		40	40
26 Kansas City, MO	2,056	6	40	46	76 Ft Wayne, IN	697	6	40	46
27 Charlotte, NC	2,034	6	40	46	77 Harrisburg, PA	695	6	40	46
28 Sacramento, CA	1,982	6	40	46	78 Kingsport, TN	693	6	40	46
29 San Antonio, TX	1,861	6	40	46	79 Charleston, SC	687	6	40	46
30 Milwaukee, WI	1,851	6	40	46	80 Baton Rouge, LA	686	6	40	46
31 Norfolk, VA	1,751	6	40	46	81 Wichita, KS	682	6	40	46
32 Nashville, TN	1,727	6	40	46	82 Bakersfield, CA	671		40	40
33 Orlando, FL	1,670	6	40	46	83 Mobile, AL	668	6	40	46
34 Columbus, OH	1,657	6	40	46	84 Madison, WI	668	6	40	46
35 Salt Lake City, UT	1,593	6	40	46	85 Jackson, MS	668	6	40	46
36 Las Vegas, NV	1,558	6	40	46	86 Macon, GA	663	6	40	46
37 Memphis, TN	1,516	6	40	46	87 Springfield, MA	658		40	40
38 Providence, RI	1,512		40	40	88 Columbia, SC	657	6	40	46
39 Indianapolis, IN	1,503	6	40	46	89 Scranton, PA	657		40	40
40 Louisville, KY	1,472	6	40	46	90 Roanoke, VA	648	6	40	46
41 Mayaguez, PR	1,462	6	40	46	91 Springfield, MO	646	6	40	46
42 Raleigh, NC	1,424	6	40	46	92 Fayetteville, NC	637	6	40	46
43 Oklahoma City, OK	1,411	6	40	46	93 Saginaw, MI	634	6	40	46
44 Greensboro, NC	1,405	6	40	46	94 McAllen, TX	623	6	40	46
45 New Orleans, LA	1,404	6	40	46	95 Stockton, CA	616		40	40
46 Jacksonville, FL	1,385	6	40	46	96 Sarasota, FL	614	6	40	46
47 Birmingham, AL	1,319	6	40	46	97 Ft Myers, FL	608	6	40	46
48 Austin, TX	1,241	6	40	46	98 Manchester, NH	599		40	40
49 Richmond, VA	1,233	6	40	46	99 Reno, NV	591	6	40	46
50 Dayton, OH	1,211	6	40	46	100 Asheville, NC	589	6	40	46

Source: FCC and J.P. Morgan estimates.

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