



Spektrum Metrics

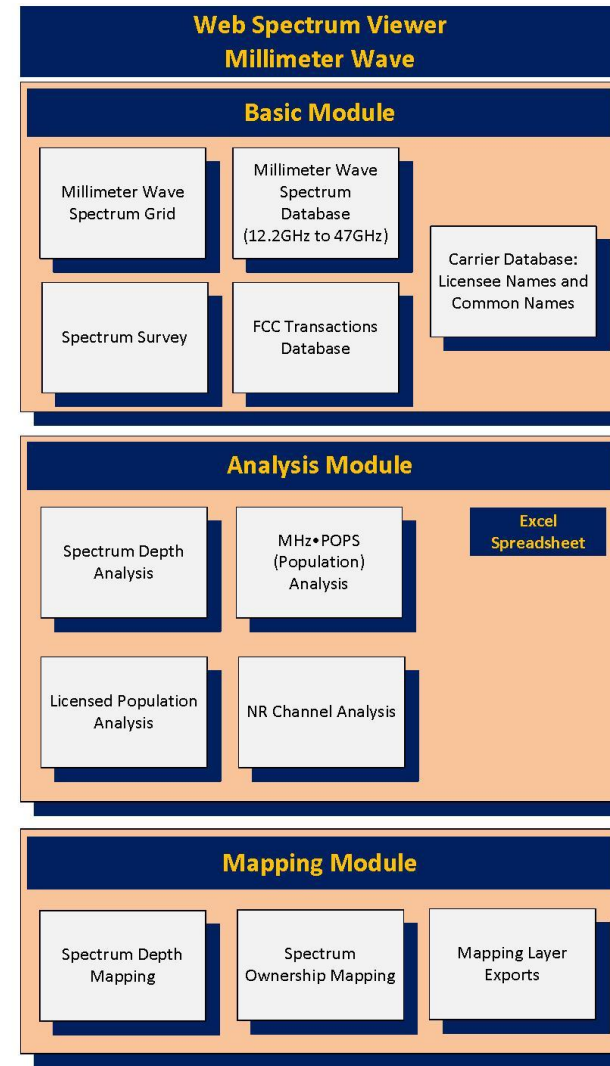
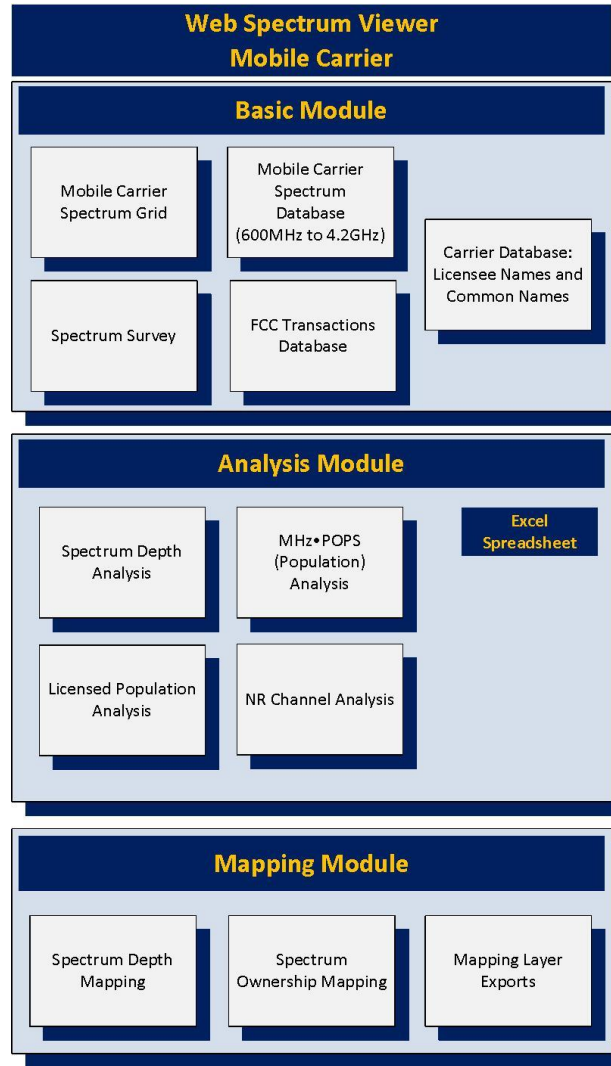
Global Spectrum Ownership Insights & Analytics

Spectrum Ownership Analysis Tool

The Spectrum Ownership Analysis Tool is an Excel product which allows users to visualize and analyze the current spectrum ownership for all of the mobile carrier and millimeter wave frequency bands at a county-level for all 50 states and US territories. The Spectrum Ownership Analysis Tool provides analysis for nearly 2,400 US carriers and spectrum licensees that own or lease these frequencies.



Modules



Spectrum Database

The Spectrum Ownership Analysis Tool includes **4 sources of data for analysis:**

Source	Description
License Holdings (FCC)	Represents the current licensee for each block of spectrum.
Lease Holdings (Lease)	Reflects the carrier that is leasing a block of spectrum. Includes the Lease ID.
Current Holdings (Current)	Represents the current operator of each spectrum block including spectrum leases.
Future Holdings (Future)	Represents the proposed ownership or leasing changes that have been filed with the FCC.



The Spectrum Ownership Analysis Tool Database is updated monthly based upon filed FCC transactions.

Spectrum Bands

Mobile Carrier:

Bands	Frequency	Details
600 MHz	600 MHz	600MHz
700 MHz	700 MHz	700MHz
Cellular/SMR	850 MHz	Cellular/SMR
PCS	1900 MHz	Personal Communication Service
AWS 1/2/3/4	1700 MHz	Advanced Wireless Services
WCS	2.3 GHz	Wireless Communication Service
EBS/BRS	2.5 GHz	Educational Broadcast Service / Broadband Radio Service
3.45 GHz	3.45 GHz	3.45GHz Service
CBRS	3.5 GHz	Citizens Band Radio Service
C-Band	3.7 GHz	C-Band Satellite Service

Millimeter Wave:

Bands	Frequency	Details
12.2 GHz	12.2 - 12.7 GHz	Multichannel Video Distribution and Data Service
24 GHz	24.25 - 25.25 GHz	24 GHz
28 GHz	27.5 - 28.35 GHz	28 GHz - (LMDS A1)
28-31 GHz	28-31 GHz	LMDS (A2, B1, B2)
Lower 37 GHz	37 - 37.6 GHz	Lower 37 GHz
Upper 37 GHz	37.6 - 38.6 GHz	Upper 37 GHz
39 GHz	38.6 - 40 GHz	39 GHz
47 GHz	47.2 - 48.2 GHz	47 GHz



Spectrum Grid Details

- The Spectrum Grid displays the primary spectrum holder for each block of spectrum at a county-level.
- Pull-down menu to select licensing data to display: FCC, Lease, Current, Future or Call Signs and Reserved Spectrum
- Includes the following reference information:
 - Alignment with LTE band classifications
 - Uplink/downlink spectrum allocation
 - Frequency start/stop, bandwidth
- Color-coded to carriers branding colors



Geographic Auto-Filters

Auto-Filters provide the selection of counties that are contained by individual geographic markets. The geographic markets included are:

- MTA # / MTA Name (Metropolitan Trading Area)
- BTA # / BTA Name (Base Trading Area)
- CMA # / CMA Name (Cellular Market Area)
- State / County
- PEA # / PEA Name (Partial Economic Area)
- BEA # / BEA Name (Base Economic Area)



Spectrum Depth NR Band - Details

- Displays how much spectrum a selected carrier controls for each LTE Band Classification e.g. NR Band Class 4, 41, 66
- Geographic Auto-filters



Spectrum Depth Channel Block - Details

- Displays the amount of spectrum a carrier controls for an individual channel block at a county-level
- Geographic Auto-Filters



Licensed Population

		Data Source										Cellular/SMR				Low Band		
		ATT																
		AT&T																
		% US Population Licensed Population																
C#	CMA Name	County	A	B	C	D	E	UPPER C	UPPER A	PSBB	PSNB	UPPER B	Total	SMR	CELL A	CELL B	Total	Total
			0.0%	89.0%	94.0%	100.0%	23.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	65.9%	25.1%	83.5%	100.0%
			-	287,360,392	303,282,820	322,792,146	74,295,151	-	-	322,792,146	-	-	322,792,146	-	212,703,443	81,081,490	269,427,897	322,792,146
			322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146	322,792,146
1	New York, NY-NJ/Nassau-	NJ Bergen County	-	933,572	933,572	933,572	933,572	-	-	933,572	-	-	933,572	-	933,572	-	933,572	933,572
1	New York, NY-NJ/Nassau-	NJ Essex County	-	795,723	795,723	795,723	795,723	-	-	795,723	-	-	795,723	-	795,723	-	795,723	795,723
1	New York, NY-NJ/Nassau-	NJ Hudson County	-	669,115	669,115	669,115	669,115	-	-	669,115	-	-	669,115	-	669,115	-	669,115	669,115
1	New York, NY-NJ/Nassau-	NJ Morris County	-	499,727	499,727	499,727	499,727	-	-	499,727	-	-	499,727	-	499,727	-	499,727	499,727
1	New York, NY-NJ/Nassau-	NJ Passaic County	-	508,856	508,856	508,856	508,856	-	-	508,856	-	-	508,856	-	508,856	-	508,856	508,856
1	New York, NY-NJ/Nassau-	NJ Somerset County	-	332,568	332,568	332,568	332,568	-	-	332,568	-	-	332,568	-	332,568	-	332,568	332,568
1	New York, NY-NJ/Nassau-	NJ Union County	-	552,939	552,939	552,939	552,939	-	-	552,939	-	-	552,939	-	552,939	-	552,939	552,939
1	New York, NY-NJ/Nassau-	NY Bronx County	-	1,438,159	1,438,159	1,438,159	1,438,159	-	-	1,438,159	-	-	1,438,159	-	1,438,159	-	1,438,159	1,438,159
1	New York, NY-NJ/Nassau-	NY Kings County	-	2,621,793	2,621,793	2,621,793	2,621,793	-	-	2,621,793	-	-	2,621,793	-	2,621,793	-	2,621,793	2,621,793
1	New York, NY-NJ/Nassau-	NY Nassau County	-	1,358,627	1,358,627	1,358,627	1,358,627	-	-	1,358,627	-	-	1,358,627	-	1,358,627	-	1,358,627	1,358,627
1	New York, NY-NJ/Nassau-	NY New York County	-	1,636,268	1,636,268	1,636,268	1,636,268	-	-	1,636,268	-	-	1,636,268	-	1,636,268	-	1,636,268	1,636,268
1	New York, NY-NJ/Nassau-	NY Putnam County	-	99,487	99,487	99,487	99,487	-	-	99,487	-	-	99,487	-	99,487	-	99,487	99,487
1	New York, NY-NJ/Nassau-	NY Queens County	-	2,321,580	2,321,580	2,321,580	2,321,580	-	-	2,321,580	-	-	2,321,580	-	2,321,580	-	2,321,580	2,321,580
1	New York, NY-NJ/Nassau-	NY Richmond County	-	473,279	473,279	473,279	473,279	-	-	473,279	-	-	473,279	-	473,279	-	473,279	473,279
1	New York, NY-NJ/Nassau-	NY Rockland County	-	323,866	323,866	323,866	323,866	-	-	323,866	-	-	323,866	-	323,866	-	323,866	323,866
1	New York, NY-NJ/Nassau-	NY Suffolk County	-	1,502,968	1,502,968	1,502,968	1,502,968	-	-	1,502,968	-	-	1,502,968	-	1,502,968	-	1,502,968	1,502,968
1	New York, NY-NJ/Nassau-	NY Westchester County	-	972,634	972,634	972,634	972,634	-	-	972,634	-	-	972,634	-	972,634	-	972,634	972,634
2	Los Angeles-Long Beach/A	CA Los Angeles County	-	10,116,705	10,116,705	10,116,705	10,116,705	-	-	10,116,705	-	-	10,116,705	-	10,116,705	-	10,116,705	10,116,705
2	Los Angeles-Long Beach/A	CA Orange County	-	3,145,515	3,145,515	3,145,515	3,145,515	-	-	3,145,515	-	-	3,145,515	-	3,145,515	-	3,145,515	3,145,515
2	Los Angeles-Long Beach/A	CA Riverside County	-	2,329,271	2,329,271	2,329,271	2,329,271	-	-	2,329,271	-	-	2,329,271	-	2,329,271	-	2,329,271	2,329,271
2	Los Angeles-Long Beach/A	CA San Bernardino County	-	2,112,619	2,112,619	2,112,619	2,112,619	-	-	2,112,619	-	-	2,112,619	-	2,112,619	-	2,112,619	2,112,619
3	Chicago, IL	IL Cook County	-	5,246,456	5,246,456	5,246,456	-	-	5,246,456	-	-	5,246,456	-	5,246,456	-	5,246,456	-	5,246,456
3	Chicago, IL	IL DuPage County	-	932,708	932,708	932,708	-	-	932,708	-	-	932,708	-	932,708	-	932,708	-	932,708
3	Chicago, IL	IL Kane County	-	527,306	527,306	527,306	-	-	527,306	-	-	527,306	-	527,306	-	527,306	-	527,306
3	Chicago, IL	IL Lake County	-	705,186	705,186	705,186	-	-	705,186	-	-	705,186	-	705,186	-	705,186	-	705,186
3	Chicago, IL	IL McHenry County	-	307,283	307,283	307,283	-	-	307,283	-	-	307,283	-	307,283	-	307,283	-	307,283
3	Chicago, IL	IL Will County	-	685,419	685,419	685,419	-	-	685,419	-	-	685,419	-	685,419	-	685,419	-	685,419
4	Philadelphia, PA	NJ Burlington County	-	449,722	449,722	449,722	449,722	-	-	449,722	-	-	449,722	-	449,722	-	449,722	449,722
4	Philadelphia, PA	NJ Camden County	-	511,038	511,038	511,038	511,038	-	-	511,038	-	-	511,038	-	511,038	-	511,038	511,038
4	Philadelphia, PA	NJ Gloucester County	-	290,951	290,951	290,951	290,951	-	-	290,951	-	-	290,951	-	290,951	-	290,951	290,951
4	Philadelphia, PA	PA Bucks County	-	626,685	626,685	626,685	626,685	-	-	626,685	-	-	626,685	-	626,685	-	626,685	626,685
4	Philadelphia, PA	PA Chester County	-	512,784	512,784	512,784	512,784	-	-	512,784	-	-	512,784	-	512,784	-	512,784	512,784



Licensed Population Details

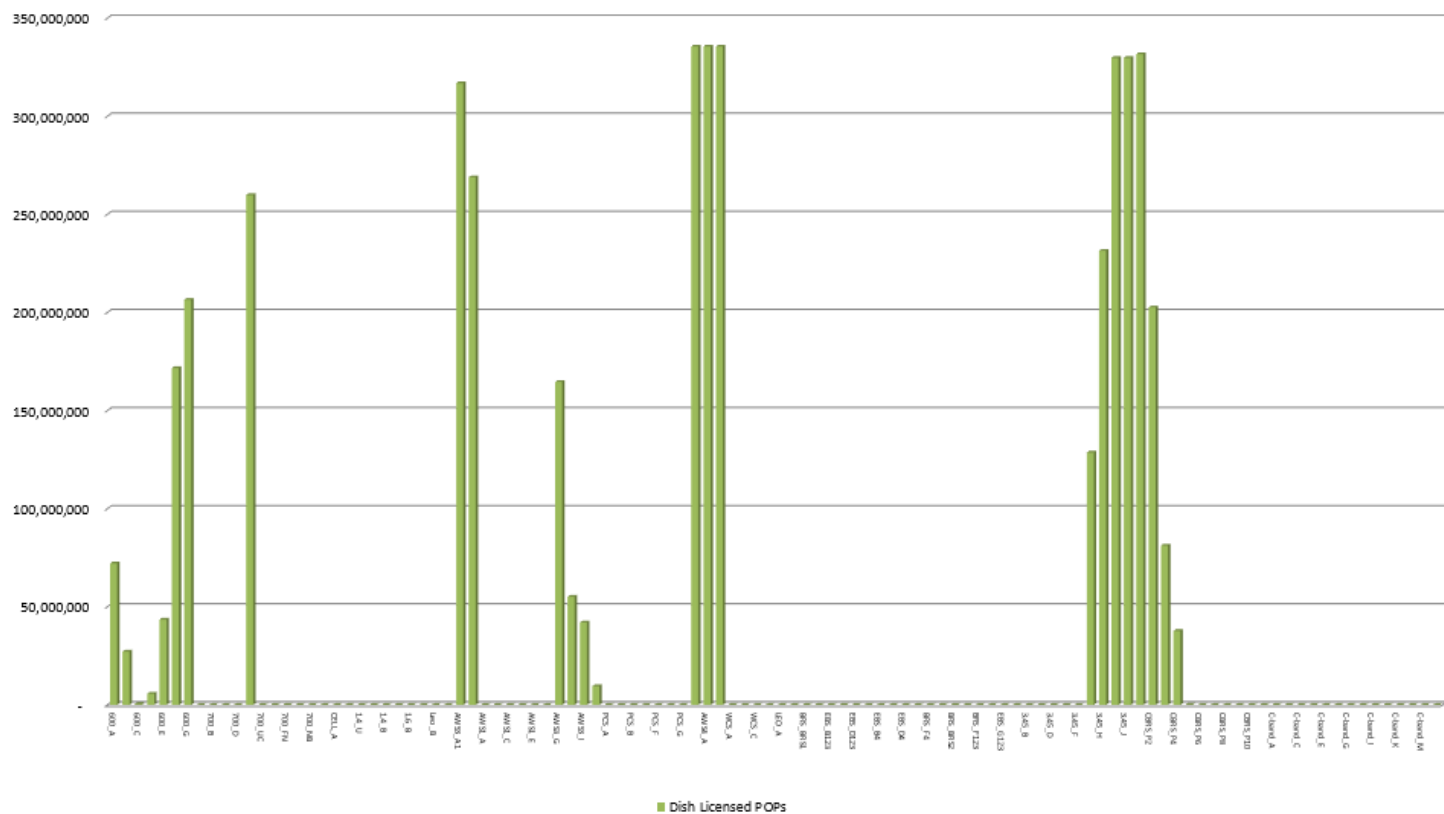
- Displays the estimated licensed population that a carrier can serve with a specific channel (700-A), frequency band (700MHz), and band classification (low, lower mid, or upper mid).
- Display the estimated licensed population at a county-level or at the national-level.
- Geographic Auto-Filters



Licensed Population Channel



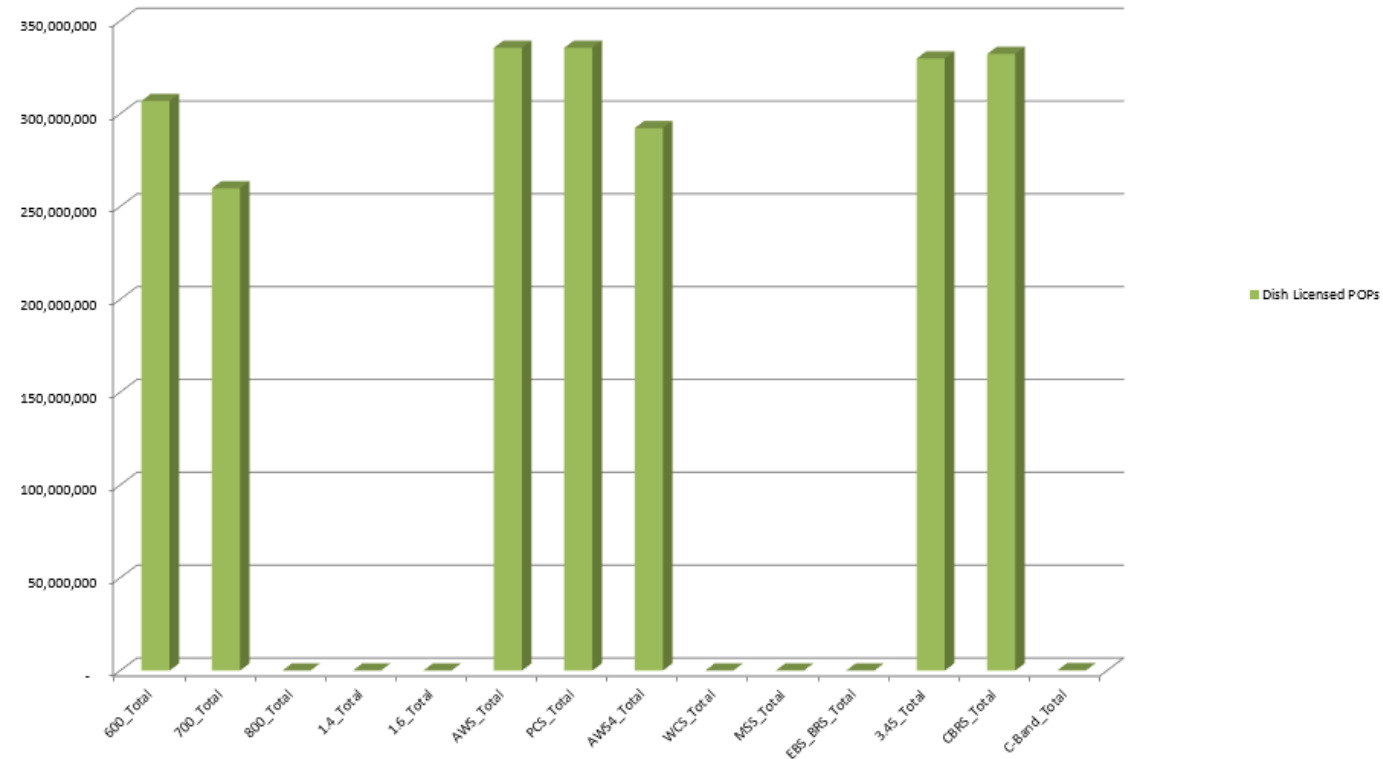
Licensed POPs
by Channel Block



Licensed Population Frequency Band



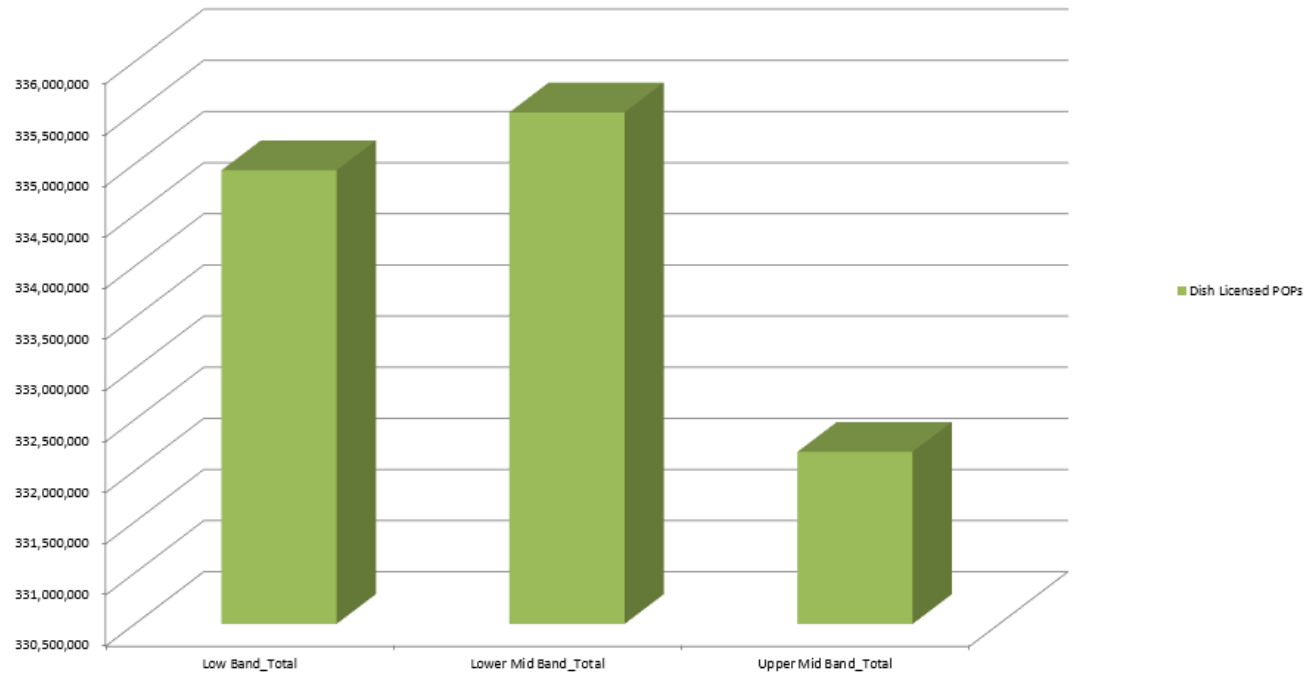
Licensed POPs
by Frequency Band



Licensed Population Band Classification



Licensed POPs by
Band Classification



Spectrum Depth

County Comparison - Details

- Compare county-level spectrum depth between 8 selected carriers.
- Included breakdowns:
 - Total Spectrum Depth
 - Low Band, Lower Mid-band, and Upper Mid-band Spectrum Depth
 - Frequency Band Spectrum Depth (700MHz, Cellular/SMR, AWS3..)
- Geographic Auto-Filters



Spectrum Depth Company Profile - Details

- This analysis module provides a complete picture of a carrier's spectrum assets at a county-level.
- Included breakdowns:
 - Total Spectrum Depth
 - Low Band, Lower Mid-band, and Upper Mid-band Spectrum Depth
 - Frequency Band Spectrum Depth (700MHz, Cellular/SMR, AWS3..)
- Spectrum profiles for 8 selected carriers are displayed.
- Geographic Auto-Filters

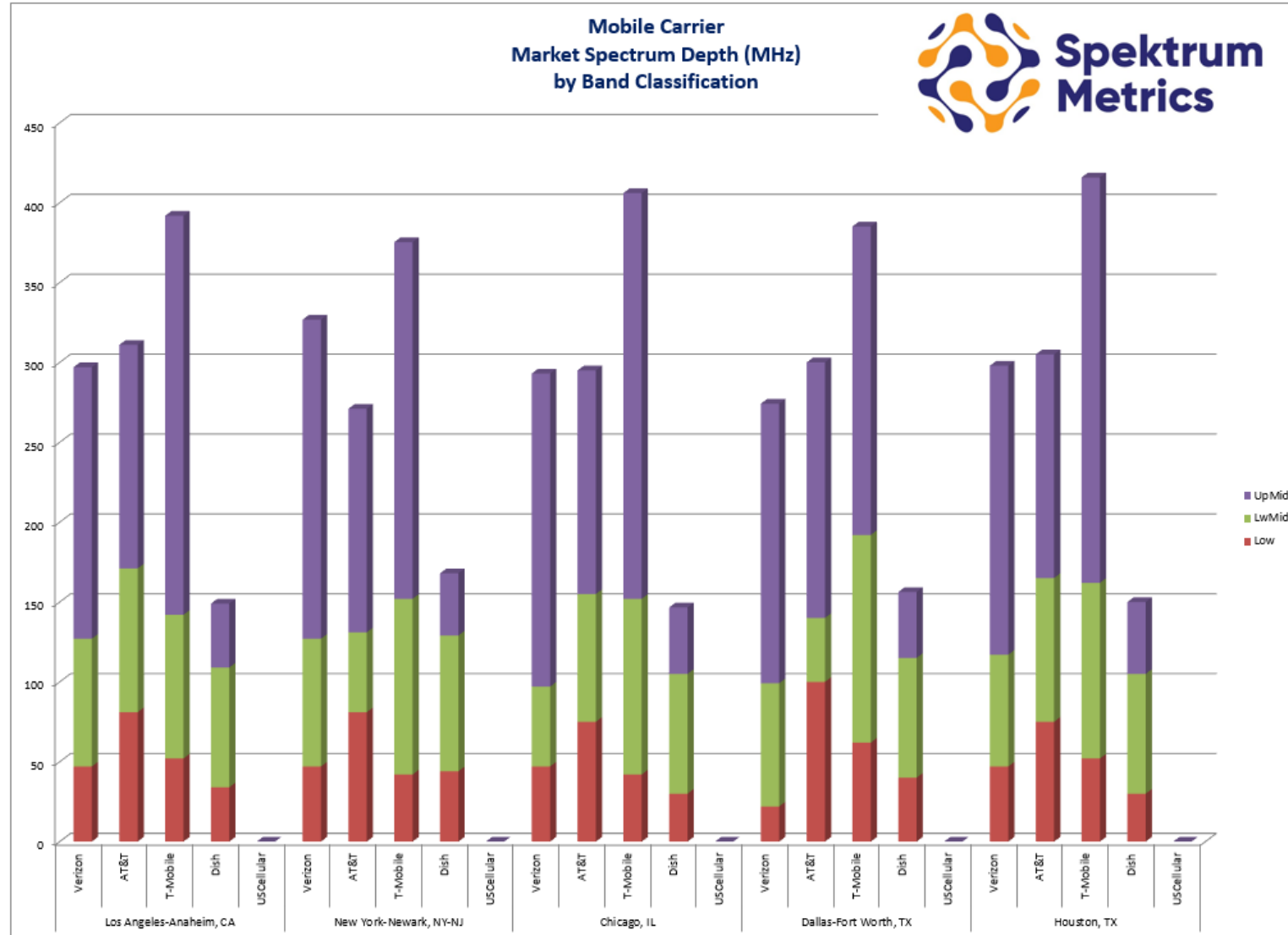


Spectrum Depth Market Reports – Details

- Available Market Reports
 - Cellular Market Areas (CMA)
 - Economic Areas (EA)
 - Partial Economic Areas (PEA)
- Included Breakdowns
 - Total Spectrum Depth
 - Low Band, Mid Band, and High Band Spectrum Depth
 - Frequency Band Spectrum Depth



Market Spectrum Depth Band Classification

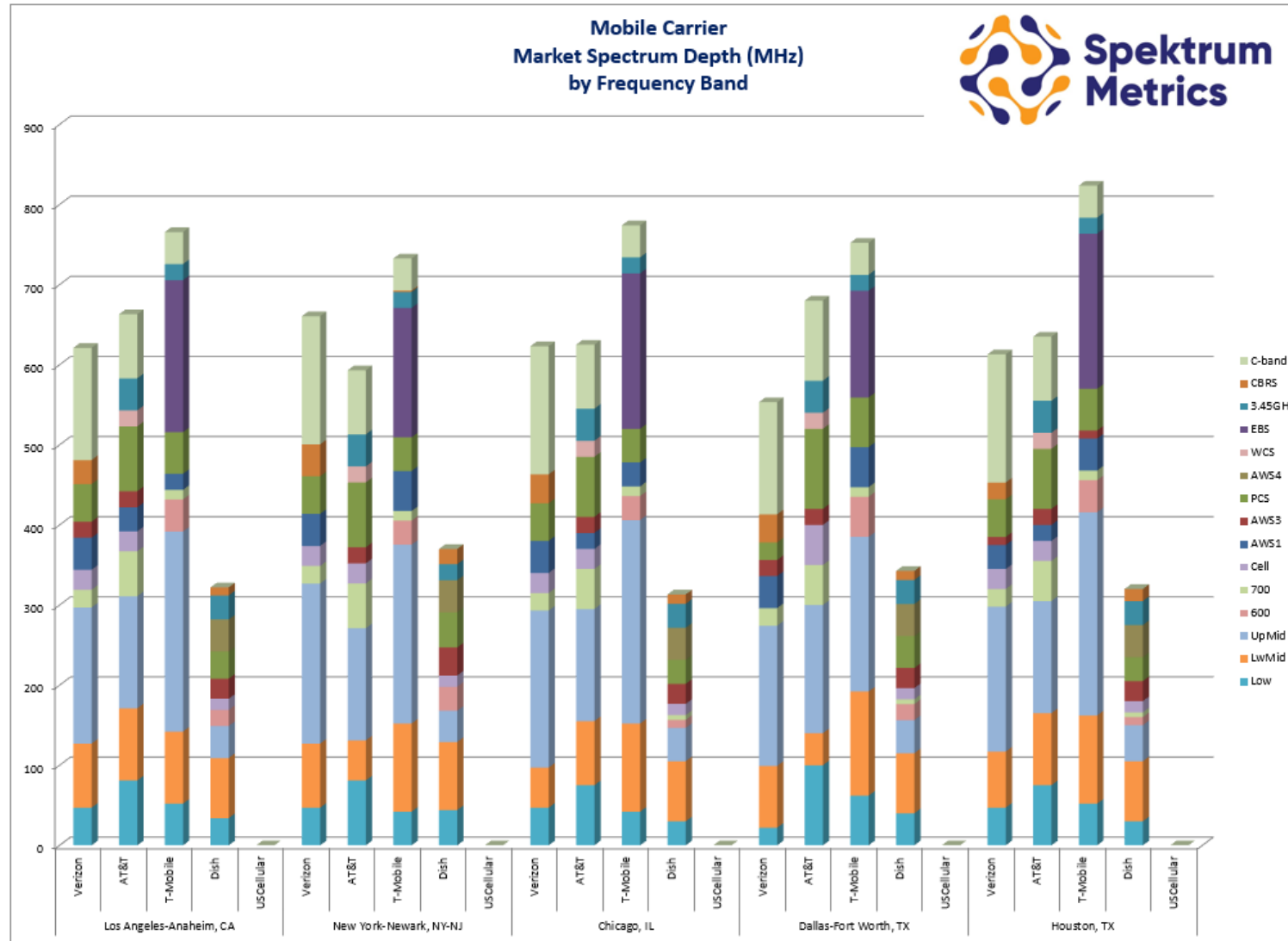


Market Spectrum Depth Charts Details

- 5 Markets (CMA) are displayed
- 5 Selected Carriers are displayed
- Visually highlight the market spectrum depth differences between carriers
 - By Band Classification
 - By Frequency Band



Market Spectrum Depth Frequency Band



Spectrum Depth

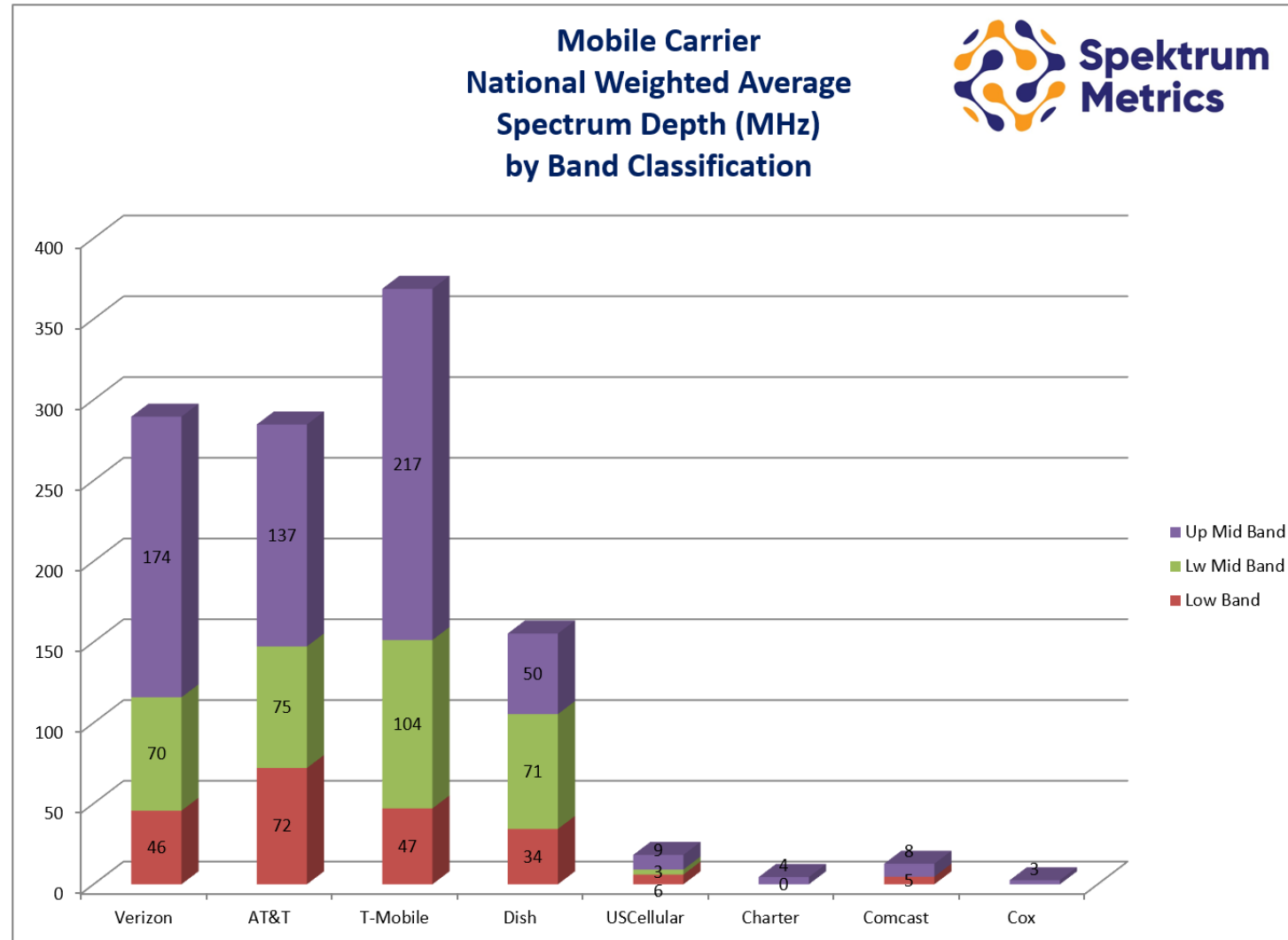
State and National - Details

- Included Breakdowns
 - Total Spectrum Depth
 - Low Band, Lower Mid-band, and Upper Mid-band Spectrum Depth
 - Frequency Band Spectrum Depth

National Population Weighted Average (MHz)	Verizon	AT&T	T-Mobile	Dish	USCellular	Charter	Comcast	Cox
Total	290	285	369	155	18	4	13	3
600MHz	0	0	36	16	2	0	5	0
700MHz	21	50	10	5	2	0	0	0
Cellular/SMR	24	22	0	14	2	0	0	0
AWS-1	37	17	35	0	1	0	0	0
AWS-3	12	21	3	21	1	0	0	0
PCS	22	38	66	10	1	0	0	0
AWS 4 / L Band	0	0	0	40	0	0	0	0
WCS	0	20	0	0	0	0	0	0
EBS/BRS	0	0	179	0	0	0	0	0
3.45GHz	0	39	12	30	4	0	0	0
CBRS	16	0	0	19	0	4	8	3
C-Band	158	79	27	0	5	0	0	0
<hr/>								
National Population Weighted Average (MHz)	Verizon	AT&T	T-Mobile	Dish	USCellular	Charter	Comcast	Cox
Total	290	285	369	155	18	4	13	3
<i>Low Band</i>	46	72	47	34	6	0	5	0
<i>Lw Mid Band</i>	70	75	104	71	3	0	0	0
<i>Up Mid Band</i>	174	137	217	50	9	4	8	3



National Spectrum Depth Chart Band Classification



National Spectrum Depth Charts Details

- 8 Selected Carriers are displayed
- Visually highlight the National Population Weighted Average spectrum depth differences between carriers
 - By Band Classification
 - By Frequency Band



Contiguous Spectrum Analysis Details

- Determines the size of each of the contiguous blocks of spectrum for a selected carrier in each NR band
- Supplemental Uplink and Downlink channels are included
- Geographic Auto-Filters



NR Band Channel Analysis

Carrier Selection - Contiguous Spectrum Analysis Tab		NR Channels																																																			
AT&T		FDD - Downlink										Time Division Duplex						FDD - Uplink																																			
Data Source:		600MHz	700MHz (ABC)	700MHz (DE)	700MHz (UC)	700MHz (UD)	Cellular	PCS	AWS-4	AWS	WCS	EBS/BRS		3.45GHz/CBRS/C-Band				600MHz	700MHz (ABC)	700MHz (UC)	700MHz (UD)	Cellular	PCS	AWS-4	AWS	WCS																											
Future Holdings		n71	n12	n29	n13	n14	n26	n25	n70	n66	n30	n41		n77				n71	n12	n13	n14	n26	n25	n70	n66	n30																											
Channel Bandwidth (MHz)	Max (MHz)	20	15	10	5	15	10	5	10	10	5	20	15	10	5	20	15	10	5	100	90	80	60	50	40	20	15	10	5	20	15	10	5	15	10	5	10	10	5	20	15	10	5	20	15	10	5						
County																																																					
NY Kings County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0									
NY Queens County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0									
NY New York County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Suffolk County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Nassau County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Bronx County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Westchester County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Bergen County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Essex County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Hudson County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Union County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Passaic County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Morris County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Richmond County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NJ Somerset County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Rockland County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
NY Putnam County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	2	0	10	1	0										
CA Los Angeles County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	20	1	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	0	3	1	10	1	0				
CA Orange County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	20	1	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	0	3	1	10	1	0				
CA Riverside County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	20	1	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	0	3	1	10	1	0				
CA San Bernardino County	0	0	0	0	0	10	0	10	0	0	0	10	1	10	0	0	0	0	1	1	0	0	0	0	20	1	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	0	3	1	10	1	0				



NR Band Channel Analysis Details

- Determines the NR channels by size that are available to a selected carrier in each NR band
- Supplemental Uplink and Downlink channels are included
- Geographic Auto-Filters



Throughput Analysis Details

- Associates an estimate throughput (data speed) value with each NR channel
- Estimates are based on:
 - 4x4 MIMO Antennas
 - 256 QAM
- Supplemental Uplink and Downlink channels are included
- Geographic Auto-Filters



Throughput Summary

Carrier Selection - Contiguous Spectrum Analysis Tab		Throughput by NR Band																												
AT&T		FDD - Throughput																TDD - Throughput												
Data Source:	Future Holdings	600MHz	700MHz(ABC)	700MHz(DE)	700MHz(LC)	700MHz(LD)	Cellular	PCS	AWS4	AWS1/3	WCS	FDD Downlink Total (Mbps)	600MHz	700MHz(ABC)	700MHz(LC)	700MHz(LD)	Cellular	PCS	AWS4	AWS1/3	WCS	FDD Uplink Total (Mbps)	EBIS/BRS	3.45GHz/CBRS/C-Band	FDD Downlink Total (Mbps)	EBIS/BRS	3.45GHz/CBRS/C-Band	FDD Downlink Total (Mbps)		
Channel Bandwidth (MHz)		n71	n12	n29	n13	n14	n26	n25	n70	n66	n80		n71	n12	n13	n14	n26	n25	n70	n66	n80		n41	n77		n41	n77			
County	County																													
NY Kings County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Queens County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY New York County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Suffolk County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Nassau County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Bronx County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Westchester County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Bergen County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Essex County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Hudson County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Union County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Passaic County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Morris County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Richmond County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NJ Somerset County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Rockland County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
NY Putnam County		-	205	205	-	205	205	300	-	651	205	1,977	-	220	-	220	220	321	-	696	220	1,896	-	2,054	2,054	-	676	676		
CA Los Angeles County		-	205	205	-	205	205	437	-	1,181	205	2,645	-	220	-	220	220	467	-	1,264	220	2,610	-	2,054	2,054	-	676	676		
CA Orange County		-	205	205	-	205	205	437	-	1,181	205	2,645	-	220	-	220	220	467	-	1,264	220	2,610	-	2,054	2,054	-	676	676		
CA Riverside County		-	205	205	-	205	205	437	-	1,181	205	2,645	-	220	-	220	220	467	-	1,264	220	2,610	-	2,054	2,054	-	676	676		
CA San Bernardino County		-	205	205	-	205	205	437	-	1,181	205	2,645	-	220	-	220	220	467	-	1,264	220	2,610	-	2,054	2,054	-	676	676		
IL Cook County		-	205	94	-	205	205	437	-	976	205	2,328	-	220	-	220	220	467	-	1,044	220	2,390	-	2,054	2,054	-	676	676		
IL DuPage County		-	205	94	-	205	205	437	-	976	205	2,328	-	220	-	220	220	467	-	1,044	220	2,390	-	2,054	2,054	-	676	676		
IL Lake County		-	205	94	-	205	205	437	-	976	205	2,328	-	220	-	220	220	467	-	1,044	220	2,390	-	2,054	2,054	-	676	676		
IL Will County		-	205	94	-	205	205	437	-	976	205	2,328	-	220	-	220	220	467	-	1,044	220	2,390	-	2,054	2,054	-	676	676		
IL Kane County		-	205	94	-	205	205	437	-	976	205	2,328	-	220	-	220	220	467	-	1,044	220	2,390	-	2,054	2,054	-	676	676		



Throughput Summary Details

- Provides Throughput Totals by NR band along with FDD and TDD downlink and uplink totals
- Estimates are based on:
 - 4x4 MIMO Antennas
 - 256 QAM
- Supplemental Uplink and Downlink channels are included
- Geographic Auto-Filters



Uplink and Downlink Spectrum Depth

Future Holdings		Downlink													Time Division Duplex				Uplink																	
Channel Bandwidth (MHz)		Total	Low Band	Lw Mid Band	Up Mid Band	n71	n12	n29	n13	n14	n26	n25	n70	n66	n30	Total	Low Band	Lw Mid Band	Up Mid Band	n41	n77	Total	Low Band	Lw Mid Band	Up Mid Band	n71	n12	n13	n14	n26	n25	n70	n66	n30		
ST	County																																			
NY	Kings County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	210	0	0	210	150	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Queens County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	215	0	0	215	155	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	New York County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	210	0	0	210	150	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Suffolk County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	250	0	0	250	190	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Bronx County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	190	0	0	190	120	70	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Nassau County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	215	0	0	215	155	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Westchester County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	185	0	0	185	125	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Bergen County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	180	0	0	180	120	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Essex County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	220	0	0	220	150	70	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Hudson County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	220	0	0	220	150	70	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Union County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	180	0	0	180	120	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Passaic County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	215	0	0	215	155	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Morris County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	185	0	0	185	125	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Richmond County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	180	0	0	180	120	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NJ	Somerset County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	190	0	0	190	130	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Rockland County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	175	0	0	175	115	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
NY	Putnam County	90	20	70	0	15	5	0	0	0	0	25	0	45	0	190	0	0	190	130	60	115	40	75	0	15	5	0	0	20	30	0	45	0		
CA	Los Angeles County	50	25	25	0	20	5	0	0	0	0	15	0	10	0	250	0	0	250	190	60	90	45	45	0	20	5	0	0	20	35	0	10	0		
CA	Orange County	50	25	25	0	20	5	0	0	0	0	15	0	10	0	220	0	0	220	160	60	90	45	45	0	20	5	0	0	20	35	0	10	0		
CA	Riverside County	50	25	25	0	20	5	0	0	0	0	15	0	10	0	250	0	0	250	190	60	90	45	45	0	20	5	0	0	20	35	0	10	0		
CA	San Bernardino County	50	25	25	0	20	5	0	0	0	0	15	0	10	0	250	0	0	250	190	60	90	45	45	0	20	5	0	0	20	35	0	10	0		
IL	Cook County	65	20	45	0	15	5	0	0	0	0	10	20	15	0	250	0	0	250	190	60	95	40	55	0	15	5	0	0	20	40	0	15	0		
IL	DuPage County	65	20	45	0	15	5	0	0	0	0	10	20	15	0	250	0	0	250	190	60	95	40	55	0	15	5	0	0	20	40	0	15	0		
IL	Lake County	65	20	45	0	15	5	0	0	0	0	10	20	15	0	250	0	0	250	190	60	95	40	55	0	15	5	0	0	20	40	0	15	0		
IL	Will County	65	20	45	0	15	5	0	0	0	0	10	20	15	0	250	0	0	250	190	60	95	40	55	0	15	5	0	0	20	40	0	15	0		
IL	Kane County	65	20	45	0	15	5	0	0	0	0	10	20	15	0	250	0	0	250	190	60	95	40	55	0	15	5	0	0	20	40	0	15	0		
IL	McHenry County	65	20	45	0	15	5	0	0	0	0	10	20	15	0	250	0	0	250	190	60	95	40	55	0	15	5	0	0	20	40	0	15	0		
PA	Philadelphia County	80	25	55	0	20	5	0	0	0	0	15	0	40	0	240	0	0	240	180	60	120	45	75	0	20	5	0	0	20	35	0	40	0		
PA	Montgomery County	80	25	55	0	20	5	0	0	0	0	15	0	40	0	240	0	0	240	180	60	120	45	75	0	20	5	0	0	20	35	0	40	0		
PA	Bucks County	80	25	55	0	20	5	0	0	0	0	15	0	40	0	240	0	0	240	180	60	120	45	75	0	20	5	0	0	20	35	0	40	0		



Uplink and Downlink Spectrum Depth - Details

- Displays the amount of spectrum that can be deployed by county based upon the NR Band Channel Analysis. Spectrum that is used as guard band or undeployable is not included in this spectrum depth analysis.
- Details and Uplink / Downlink imbalances
- Included Breakdowns
 - Total Spectrum Depth
 - Low Band, Lower Mid-band, and Upper Mid-band Spectrum Depth
 - Frequency Band Spectrum Depth
- Geographic Auto-Filters



MHz-POPs Analysis

		Total	Low Band	Lower Mid Band	Upper Mid Band	600MHz	700MHz	Cellular/SMR	AMS-1	AMS-3	PCS	AMS 4 / L Band	WCS	3.45GHz	CBRS	C-Band
NY	Kings County	863,624,004	124,129,444	211,284,160	528,210,400	-	58,103,144	66,026,300	105,642,080	-	105,642,080	-	-	-	105,642,080	422,568,320
NY	Queens County	762,283,761	109,563,721	186,491,440	466,228,600	-	51,285,146	58,278,575	93,245,720	-	93,245,720	-	-	-	93,245,720	372,982,880
NY	New York County	515,638,452	74,113,172	126,150,080	315,375,200	-	34,691,272	39,421,900	63,075,040	-	63,075,040	-	-	-	63,075,040	252,300,160
NY	Suffolk County	499,114,488	71,738,168	122,107,520	305,268,800	-	33,579,568	38,158,600	61,053,760	-	61,053,760	-	-	-	61,053,760	244,215,040
NY	Bronx County	465,957,996	66,972,556	113,995,840	284,989,600	-	31,348,856	35,623,700	56,997,920	-	56,997,920	-	-	-	56,997,920	227,991,680
NY	Nassau County	454,826,589	65,372,629	111,272,560	278,181,400	-	30,599,954	34,772,675	55,636,280	-	55,636,280	-	-	-	55,636,280	222,545,120
NY	Westchester County	326,311,665	46,901,065	79,831,600	199,579,000	-	21,953,690	24,947,375	39,915,800	-	39,915,800	-	-	-	39,915,800	159,663,200
NJ	Bergen County	311,898,813	44,829,493	76,305,520	190,763,800	-	20,984,018	23,845,475	38,152,760	-	38,152,760	-	-	-	38,152,760	152,611,040
NJ	Essex County	279,557,859	40,181,099	68,393,360	170,983,400	-	18,808,174	21,372,925	34,196,680	-	34,196,680	-	-	-	34,196,680	136,786,720
NJ	Hudson County	229,705,401	33,015,761	56,197,040	140,492,600	-	15,454,186	17,561,575	28,098,520	-	28,098,520	-	-	-	28,098,520	112,394,080
NJ	Union County	187,081,278	26,889,358	45,769,120	114,422,800	-	12,586,508	14,302,850	22,884,560	-	22,884,560	-	-	-	22,884,560	91,538,240
NJ	Passaic County	169,424,259	24,351,499	41,449,360	103,623,400	-	11,398,574	12,952,925	20,724,680	-	20,724,680	-	-	-	20,724,680	82,898,720
NJ	Morris County	167,090,787	24,016,107	40,878,480	102,196,200	-	11,241,582	12,774,525	20,439,240	-	20,439,240	-	-	-	20,439,240	81,756,960
NY	Richmond County	161,372,538	23,194,218	39,479,520	98,698,800	-	10,856,868	12,337,350	19,739,760	-	19,739,760	-	-	-	19,739,760	78,959,040
NJ	Somerset County	113,026,569	16,245,409	27,651,760	69,129,400	-	7,604,234	8,641,175	13,825,880	-	13,825,880	-	-	-	13,825,880	55,303,520
NY	Rockland County	110,927,229	15,943,669	27,138,160	67,845,400	-	7,462,994	8,480,675	13,569,080	-	13,569,080	-	-	-	13,569,080	54,276,320
NY	Putnam County	28,107,632	4,602,992	7,834,880	15,669,760	-	2,154,592	2,448,400	3,917,440	-	3,917,440	-	-	-	-	15,669,760
CA	Los Angeles County	2,919,374,568	461,988,568	786,363,520	1,671,022,480	-	216,249,968	245,738,600	393,181,760	196,590,880	196,590,880	-	-	-	294,886,320	1,376,136,160
CA	Orange County	940,839,273	148,887,023	253,424,720	538,527,530	-	69,691,798	79,195,225	126,712,360	63,356,180	63,356,180	-	-	-	95,034,270	443,493,260
CA	Riverside County	730,143,315	115,544,565	196,671,600	417,927,150	-	54,084,990	61,459,875	98,335,800	49,167,900	49,167,900	-	-	-	73,751,850	344,175,300
CA	San Bernardino County	651,828,870	103,151,370	175,576,800	373,100,700	-	48,283,620	54,867,750	87,788,400	43,894,200	43,894,200	-	-	-	65,841,300	307,259,400
IL	Cook County	1,536,424,362	243,137,862	258,657,300	1,034,629,200	-	113,809,212	129,328,650	206,925,840	-	51,731,460	-	-	-	206,925,840	827,703,360
IL	DuPage County	274,690,845	43,469,595	46,244,250	184,977,000	-	20,347,470	23,122,125	36,995,400	-	9,248,850	-	-	-	36,995,400	147,981,600
IL	Lake County	211,237,983	33,428,233	35,561,950	142,247,800	-	15,647,258	17,780,975	28,449,560	-	7,112,390	-	-	-	28,449,560	113,798,240
IL	Will County	207,083,844	32,770,844	34,862,600	139,450,400	-	15,339,544	17,431,300	27,890,080	-	6,972,520	-	-	-	27,890,080	111,560,320
IL	Kane County	132,506,116	24,232,636	25,779,400	82,494,080	-	11,342,936	12,889,700	20,623,520	-	5,155,880	-	-	-	82,494,080	-
IL	McHenry County	79,958,354	14,622,734	15,556,100	49,779,520	-	6,844,684	7,778,050	12,444,880	-	3,111,220	-	-	-	49,779,520	-
PA	Philadelphia County	483,909,057	74,083,797	110,337,570	299,487,690	-	34,677,522	39,406,275	47,287,530	31,525,020	31,525,020	-	-	-	47,287,530	252,200,160
PA	Montgomery County	264,197,446	40,447,166	60,240,460	163,509,820	-	18,932,716	21,514,450	25,817,340	17,211,560	17,211,560	-	-	-	25,817,340	137,692,480
PA	Bucks County	198,352,086	30,366,606	45,226,860	122,758,620	-	14,214,156	16,152,450	19,382,940	12,921,960	12,921,960	-	-	-	19,382,940	103,375,680
PA	Delaware County	176,171,643	26,970,903	40,169,430	109,031,310	-	12,624,678	14,346,225	17,215,470	11,476,980	11,476,980	-	-	-	17,215,470	91,815,840
PA	Chester County	149,205,773	25,316,503	37,705,430	86,183,840	-	11,850,278	13,466,225	16,159,470	10,772,980	10,772,980	-	-	-	-	86,183,840
NJ	Camden County	160,797,697	24,617,237	36,663,970	99,516,490	-	11,522,962	13,094,275	15,713,130	10,475,420	10,475,420	-	-	-	15,713,130	83,803,360
NJ	Burlington County	128,602,513	21,820,643	32,498,830	74,283,040	-	10,213,918	11,606,725	13,928,070	9,285,380	9,285,380	-	-	-	74,283,040	78,203,600
NJ	Gloucester County	84,340,129	14,310,419	21,313,390	48,716,320	-	6,698,494	7,611,925	9,134,310	6,089,540	6,089,540	-	-	-	48,716,320	-
MI	Wayne County	562,616,672	83,416,352	141,985,280	337,215,040	-	39,045,952	44,370,400	70,992,640	35,496,320	35,496,320	-	-	-	53,244,480	283,970,560
MI	Oakland County	402,595,389	59,690,799	101,601,360	241,303,230	-	27,940,374	31,750,425	50,800,680	25,400,340	25,400,340	-	-	-	38,100,510	203,202,720
MI	Macomb County	277,943,064	41,209,224	70,143,360	166,590,480	-	19,289,424	21,919,800	35,071,680	17,535,840	17,535,840	-	-	-	26,303,760	140,286,720



MHz-POPs Details

- Provides estimated MHz-POPs for 8 selected carriers
 - By County
 - By Nation
- Included Breakdowns
 - Total Spectrum Depth
 - Low Band, Mid Band, and High Band Spectrum Depth
 - Frequency Band Spectrum Depth
- Geographic Auto-Filters

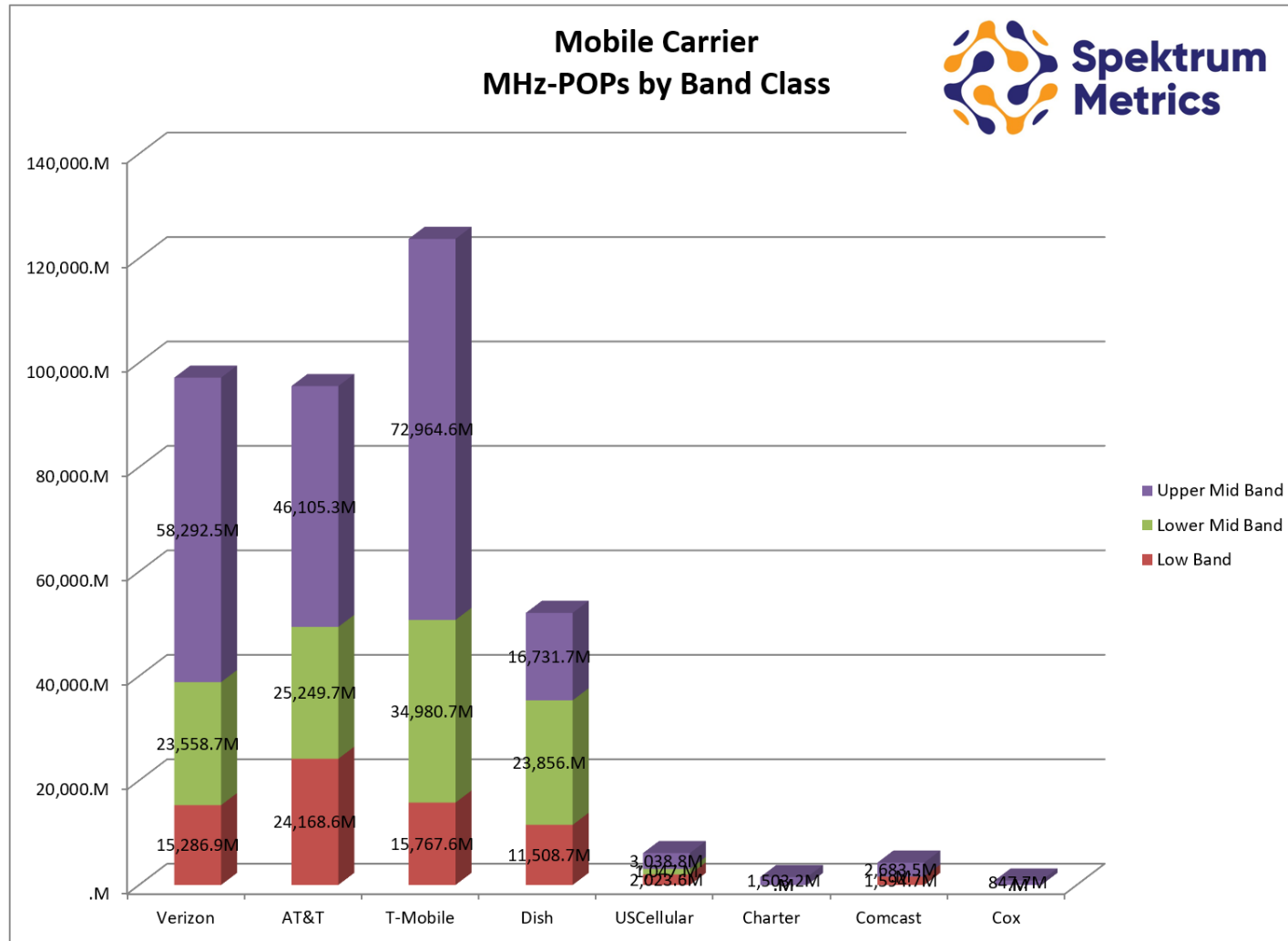


National MHz-POPs

(MHz-POPs)	Verizon	AT&T	T-Mobile	Dish	USCellular	Charter	Comcast	Cox	Other	Total Allocation
Total	97,138M	95,524M	123,713M	52,096M	6,109M	1,503M	4,278M	848M	32,464M	413,674M
<i>Low Band</i>	<i>15,287M</i>	<i>24,169M</i>	<i>15,768M</i>	<i>11,509M</i>	<i>2,024M</i>	<i>M</i>	<i>1,595M</i>	<i>M</i>	<i>4,802M</i>	<i>75,152M</i>
600MHz	16M	2M	12,238M	5,270M	585M	M	1,595M	M	3,779M	23,485M
700MHz	7,170M	16,618M	3,518M	1,559M	775M	M	M	M	556M	30,195M
Cellular/SMR	8,101M	7,548M	11M	4,680M	664M	M	M	M	468M	21,472M
<i>Lower Mid Band</i>	<i>23,559M</i>	<i>25,250M</i>	<i>34,981M</i>	<i>23,856M</i>	<i>1,047M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>3,701M</i>	<i>112,393M</i>
AWS-1	12,324M	5,582M	11,605M	M	231M	M	M	M	453M	30,195M
AWS-3	4,002M	6,910M	1,105M	7,081M	359M	M	M	M	2,350M	21,808M
PCS	7,232M	12,757M	22,270M	3,355M	458M	M	M	M	898M	46,970M
AWS-4	M	M	M	13,420M	M	M	M	M	M	13,420M
<i>Upper Mid Band</i>	<i>58,292M</i>	<i>46,105M</i>	<i>72,965M</i>	<i>16,732M</i>	<i>3,039M</i>	<i>1,503M</i>	<i>2,684M</i>	<i>848M</i>	<i>23,961M</i>	<i>226,128M</i>
WCS	M	6,559M	M	M	M	M	M	M	3,506M	10,065M
EBS/BRS	2M	M	59,964M	M	73M	M	M	M	5,049M	65,087M
EBS	2M	M	36,301M	M	47M	M	M	M	2,735M	39,086M
BRS	M	M	23,662M	M	26M	M	M	M	2,314M	26,001M
3.45GHz	M	13,189M	3,947M	10,195M	1,249M	M	M	M	4,970M	33,550M
CBRS	5,287M	M	51M	6,532M	78M	1,503M	2,684M	848M	6,502M	23,485M
C-Band	53,003M	26,357M	9,003M	4M	1,639M	M	M	M	3,935M	93,941M



MHz-POPs Band Classification



MHz-POPs Charts Details

- Provides estimated MHz-POPs for 8 selected carriers
 - By County
 - By Nation
- Included Breakdowns
 - Total Spectrum Depth
 - Low Band, Mid Band, and High Band Spectrum Depth
 - Frequency Band Spectrum Depth
- Geographic Auto-Filters

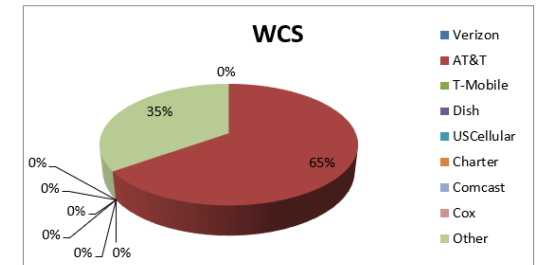
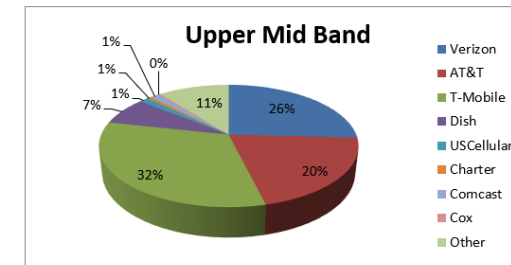
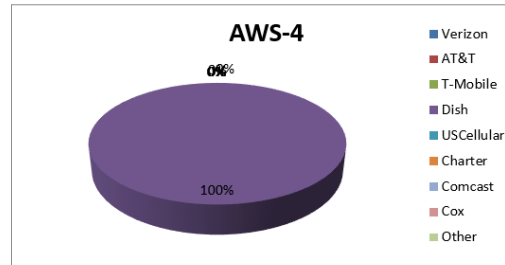
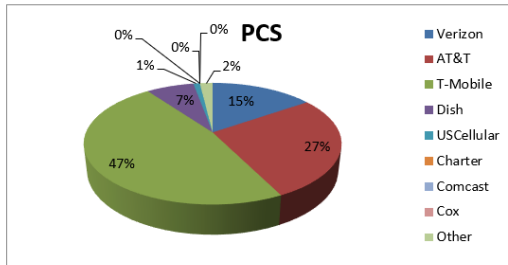
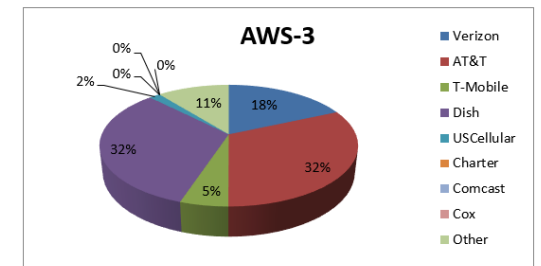
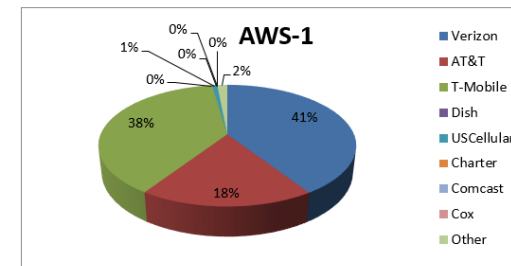
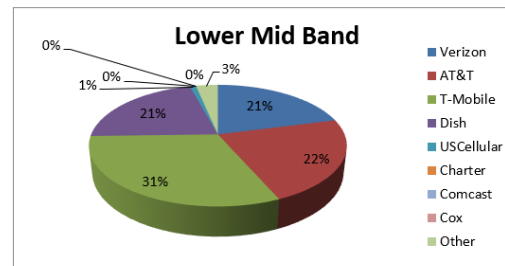
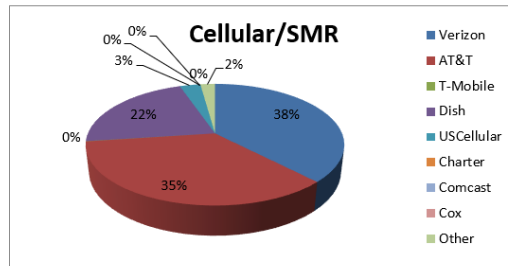
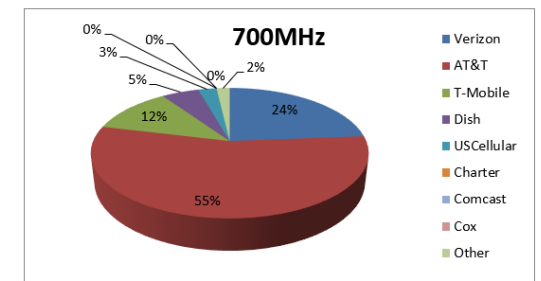
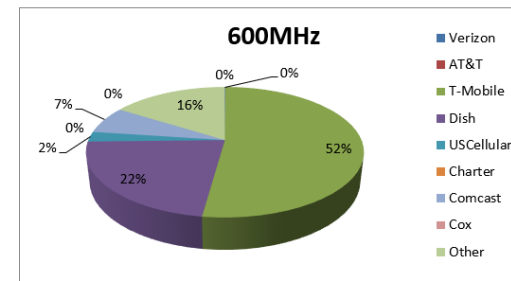
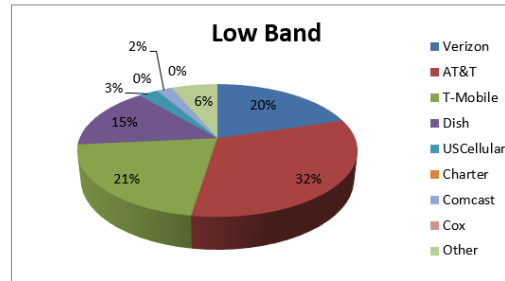


National Band Ownership Charts

Mobile Carrier Frequency Band Ownership
Based on National MHz-POPs



Mobile Carrier - Spectrum Ownership Analysis Tool - October 2023



National Band Ownership Details

- Displays the percentage of Spectrum Held by any eight selected carriers in each Mobile Carrier frequency band and band classification along with the remaining spectrum in an Others category
- Percentages based upon each carriers MHz-POPs in each frequency band compared to the total allocated MHz-POPs



Carrier Spectrum Distribution Charts

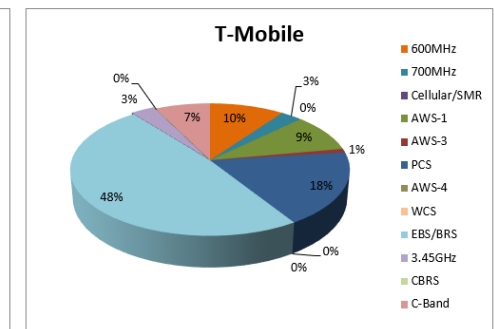
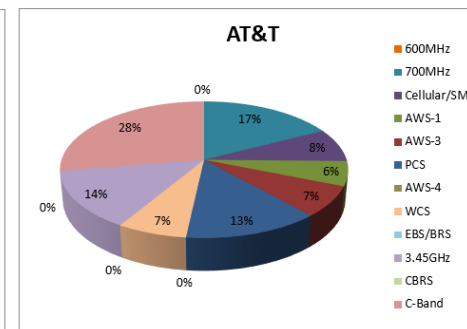
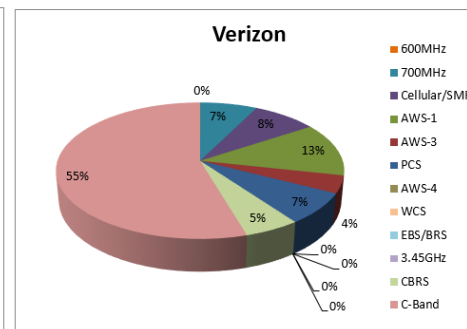
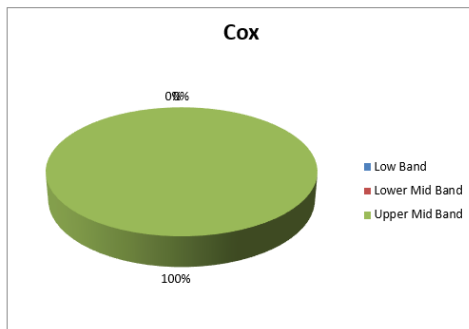
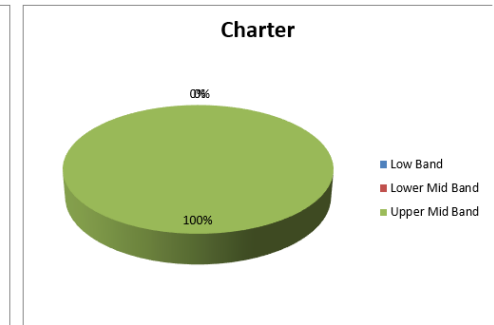
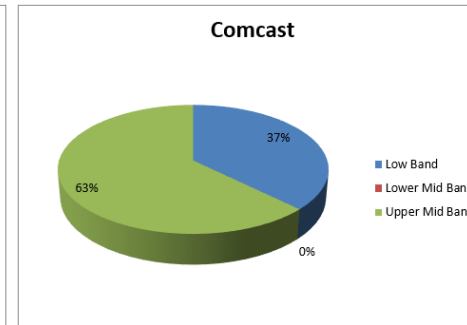
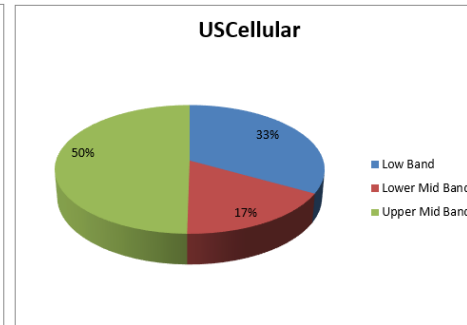
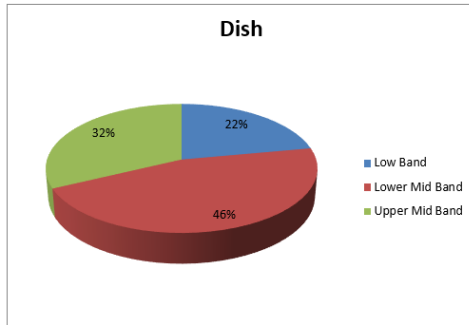
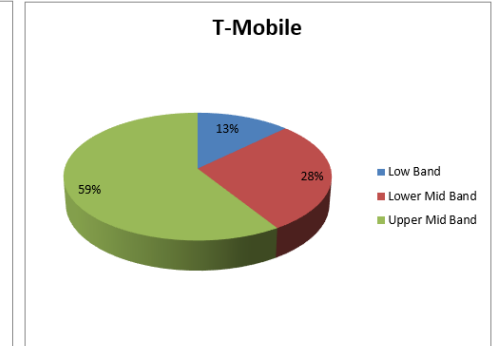
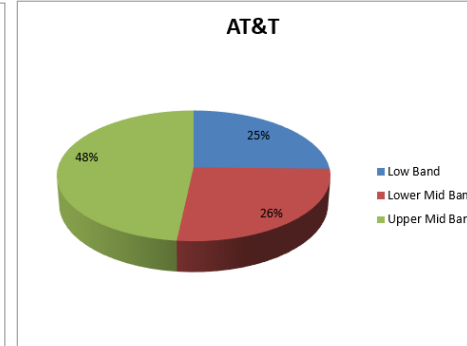
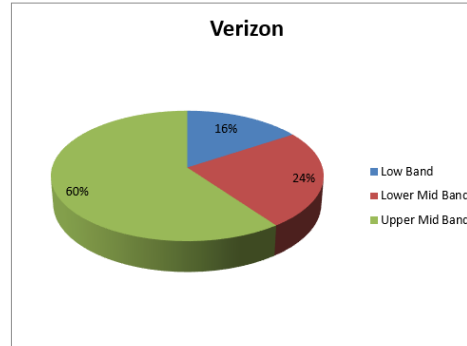
Mobile Carrier Spectrum Distribution By Carrier

Based on MHz-POPs



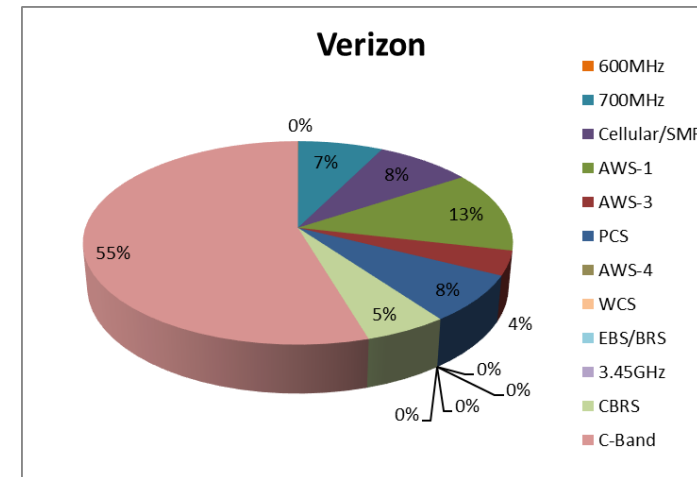
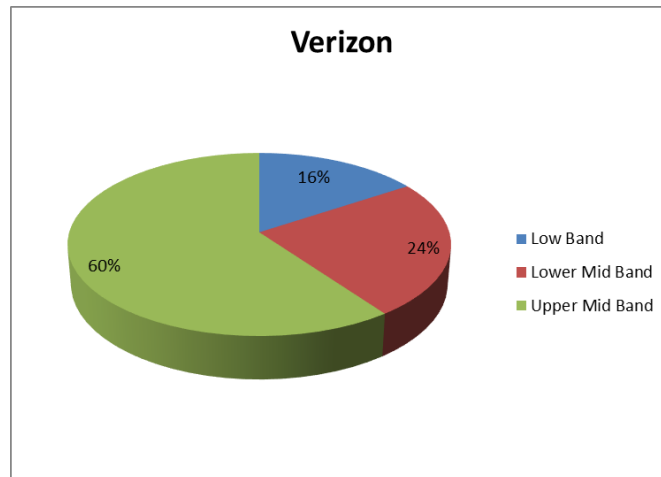
Spektrum Metrics

Mobile Carrier - Spectrum Ownership Analysis Tool - October 2023



Carrier Spectrum Distribution Details

- Displays the breakdown of spectrum held by each of the selected wireless carriers
- Detailed by band classification (low, lower mid, upper mid) or frequency band



Email: brian.Goemmer@spektrummetrics.com

Web: <https://www.spektrummetrics.com>

Phone: +1 (425) 522-2142



**Spektrum
Metrics**