The 700 MHZ Spectrum;
The Auction
And
Usage

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The history of the 700 MHz Spectrum

The 700 MHz spectrum is a broadcasting spectrum that is part of the Ultra High Frequency (UHF) band which transmits analog television signals. The 700 MHz spectrum is broken up into two parts. The spectrum consists of an upper 700 MHz band and a lower 700 MHz band. The lower band consists of a 48 MHz spread whereas the upper band is a 60 MHz spread. The lower band includes frequencies from 698 MHz to 746 MHz while the upper band includes frequencies from 746 MHz to 806 MHz, which, for the lower band is channels is 52-59 and 60-69 for the upper band (Malik).

Currently, the 700 MHz spectrum is used for broadcasting analog television signals; however, the government has ordered all television broadcasters to switch to digital television signals by February 19, 2009 as mandated by the Digital Television Transition and Public Safety Act of 2005 (Mullin). Since TV broadcasters will be making the switch to digital signals and vacating the 700 MHz spectrum, the FCC has decided to auction the free space to the general public. This auction has generated much attention from big telecommunications companies like AT&T and Verizon. One of the reasons the auction is generating so much attention is because the physical properties of this particular spectrum is very much sought after by telecommunications giants like AT&T and Verizon. The 700 MHz is very much sought after because its signal can propagate through walls (Malik). This
kind of signal opens the door for many wireless applications including mobile WiMAX (Barthold).

In 2002 and 2003, the FCC reallocated the 700 MHz spectrum which freed up the lower 700 MHz band. This reallocation was necessary as the FCC pushes for all broadcasters to make the switch to digital television (Malik). As a result, the lower 700 MHz band was freed up and sold to the general public. Some of the largest bidders for the lower 700 MHz band included Aloha Partners, Qualcomm, Vulcan Spectrum and Cavalier Group, LLC (FCC).

Currently, the largest owners of the lower 700 MHz band include Qualcomm and AT&T. In 2007, Aloha Partners sold their portion of the lower 700 MHz spectrum, a total of 12 MHz, to AT&T for a whopping US$2.5 billion (Gross).

In February of 2006, The Digital Television Transition and Public Safety Act of 2005 was signed into law by President George W. Bush. This act gave all television broadcasters an absolute deadline to stop broadcasting analog television signals and makes the switch to digital television (Mullin). Television broadcasters currently use up a total of 60 MHz which is the upper 700 MHz band. Of that 60 MHz, the FCC has guaranteed to allocate 24 MHz to Public Safety once television broadcasters vacate the spectrum (Malik). The figure below shows the different blocks that were auctioned off in the January 2008 auction for the 700 MHz spectrum.
The FCC has held auctions for the 700 MHz spectrum a total of six times. Each time the FCC holds any type of auction, they use a numbering system to identify the different auctions. The auction numbers for the 700 MHz spectrum are auctions 33, 38, 44, 49, 60, and 73. Auctions 33 and 38 were for the upper 700 MHz guard bands and auctions 44, 49, and 60 were for the lower 700 MHz band while auction 73 was for the upper 700 MHz band (FCC).

**The FCC**

Established by the Communications Act of 1934, the Federal Communications Commission (FCC) is an independent United States government agency that regulates all interstate and national communications. The FCC regulates communications through satellite, radio, cable, television and wire. The FCC is the regulatory agency that oversees the 700 MHz spectrum. The FCC’s main responsibilities with the 700 MHz spectrum are to create the band’s service rules for efficient commercial
wireless use and to intensify these services as well. The band’s service rules will also apply to certain broadcast services that meet the technical rules for efficient use of the spectrum.

The FCC will be shutting down analog television broadcasting by February of 2009. The switch that will take place will be to digital TV. This will free up space that is now occupied by the Ultra High Frequency (UHF) channels 59 to 69. The FCC has the responsibility to create the guidance regarding the voluntary band clearing. The FCC will make sure that this voluntary clearing will be in the best interest of the public. As discussed earlier, it will. It will implement advanced wireless services and broadcast stations will be switching to DTV. People might be asking themselves, what is going to happen to my local channels? Well the FCC will obligate cable systems to carry local broadcasters’ digital signals. The FCC is looking for ways to accelerate the transition to DTV. The FCC is looking into a possible three way voluntary relocation agreement that involve the broadcasters in channels 59-69, broadcasters with operations on lower channels and the new 700 MHz licensees. The FCC is also looking into the possibility of allowing the broadcasters in channels 59-69 and the new 700 MHz service providers to share the spectrum in time and/or in bits. Another question is if the broadcasters should be allowed to share DTV facilities and spectrum during the DTV transition? The FCC will also allow base and mobile
transmissions in the lower and upper 700 MHz bands. This will allow for Time Division Duplex (TDD) technologies to be used in these bands.

**How the FCC implemented the first spectrum auction?**

In August 1993, President Clinton signed a historical law that granted the United States Federal Communications Commission (FCC) the authority to auction radio frequency or spectrum. Winning the auction meant the owner was able to use the frequencies in accordance with the license. The FCC started the first auction on July 25, 1994. In order to run an auction, the FCC needed to choose an auction design. The auction design needed to be simple to understand because the spectrum auctions were conducted for the first time with inexperienced bidders. After designing the spectrum auctions, the FCC implemented it, relying on outside contractors to develop auction software. Timely implementation was particularly challenging given that the Commission decided on a novel auction method, the electronic simultaneous multiple round bidding auction, base on the economic advice.

**Why is the FCC 700 MHz spectrum so special?**

The auction for the 700 MHz is being compared to beach front property as well as being referred to as the last great wireless auction (Clark). The auction for the 700 MHz spectrum will allow its owners to build cheap and reliable wireless networks. Also it is able to travel long distances and even penetrate walls. One of the great advantages to building a network on 700
MHz is the fact that the broadcast towers are already established, from their previous usage to broadcast TV signals, which means that owners can use the existing towers rather than have to build new ones. The fact that the broadcasting towers are already established means that telecommunications giants like AT&T and Verizon can build nationwide networks at a much lower cost with the 700 MHz spectrum than with other frequencies like 1900 MHz or 2400 MHz. Also, broadcasting at the 700 MHz frequency means that signals can cover at least twice as many square miles than 1900 MHz and 2400 MHz. That means that owners broadcasting at 700 MHz would need fewer towers and that would also bring down the cost of building a network on the 700 MHz spectrum. The figure below shows how much it would cost to set up a network using the 700, 1900, and 2400 MHz to cover a total of 1000 Sq. Miles (Malik).

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<thead>
<tr>
<th></th>
<th>700 MHz Propagation</th>
<th>1900 MHz Propagation</th>
<th>2400 MHz Propagation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Network cost per Customer</td>
<td>$150,000</td>
<td>$600,000</td>
<td>$1,500,000</td>
</tr>
<tr>
<td># Mos. to Network Cost Breakeven</td>
<td>9 Months</td>
<td>36 Months</td>
<td>91 Months</td>
</tr>
</tbody>
</table>

Mobile operator companies, public safety companies and even Google view the spectrum as an excellent opportunity to increase the availability of
mobile broadband services. Believe it or not, the Internet is still not available in many places. Broadband services are still restricted in some geographical areas. If these services are available, they are still very expensive for many people. The 700 MHz spectrum; therefore, will change the way people access the Internet because it will create broadband services at the lowest price possible and it will reach the broadest number of people. (Reardon, Marguerite: Google’s battle for wireless spectrum. 2007).

The Auction that began in January 2008 was for the upper 700 MHz band which is a total of 60 MHz, broken up into five blocks, A-E. Each block contains its own set of rules and regulations as well as a certain amount of licenses (Malik). Block C has generated the most controversy in the auction for the upper 700 MHz band. This is because the FCC has stipulated that this block will require open access. Open access on block C was fought for by a group of companies led by Google. This means that whoever owns and operates the C block, or any part of that block, must allow its customers and users to use any device or software on that network with certain restrictions (Buchanan).

**What are the past auctions of 700 MHz spectrum?**

The Federal Communications Commission conducts auctions of licenses for radio frequencies. The initial C block licenses were awarded through two auctions, Auction No. 5, which ended on May 6, 1996, and Auction No. 10, which concluded on July 16, 1996. Auction No. 11, the initial F block auction,
ended on January 14, 1997. It also included D and E block licenses. Auction No. 22, which concluded on April 15, 1999, made available C, E and F block licenses that had been returned to, or reclaimed by the Commission.

On August 29, 2000, the Commission released the C/F Block Sixth Report and Order, revising the service and auction rules for auction of C and F block PCS licenses. The Commission decided to reconfigure each 30 MHz C block license available in Auction No. 35 and other future broadband PCS auctions into three 10 MHz C block licenses. The Commission also divided Basic Trading Areas (“BTAs”) into two tiers according to the population size, with Tier 1 comprising markets with population at or above 2.5 million, based on 1990 census figures, and Tier 2 comprising the remaining markets. The Commission decided that some licenses would be available to all bidders in “open” bidding, while other licenses would be available only to entrepreneurs in “closed” bidding. The Commission established open bidding for all C and F block licenses available but unsold in Auction No. 22 or any subsequent auction. The Commission also established open bidding for the following licenses: two of the three reconfigured 10 MHz C block licenses in Tier 1, one of the three reconfigured 10 MHz C block licenses in Tier 2, the 15 MHz C block licenses in Tier 1, and all F block licenses (Tier 1 and Tier 2). The Commission established small and very small business bidding credits of 15 percent and 25 percent, respectively, for licenses won in open bidding and eliminated bidding credits for licenses won in closed bidding.
Additionally, the Commission removed from its rules the Section 24.710 license cap, which had prohibited an applicant from winning more than 98 of the licenses available in the C and F blocks. Finally, the Commission decided that the Commercial Mobile Radio Services spectrum cap would continue to apply to C and F block licenses, including those won in Auction No. 35.

**Who won on the 700 MHz spectrum and how much did they pay?**

The “A” block was not dominated by a single company, but Verizon Wireless and U.S. Cellular Corporation each picked up 25 licenses each. Verizon Wireless’ are mostly centered around densely populated urban areas. On the other hand, U.S. Cellular obtained licenses around its current markets, which are in the Midwest, Northeast, and Northwest. MetroPCS obtained one license for the Boston area and Chevron obtained a license covering the Gulf of Mexico. Other companies that won licenses in the “A” block are Century Tel, who obtained 21 licenses, Cavalier Wireless, Cox Communications, and King Street Wireless.

Mobile power house, AT&T took control of the “B” block by purchasing approximately 227 region licenses, one-third of the available licenses within this block. With the licenses AT&T purchased, they now cover 100% of the top 200 markets. 127 licenses were purchased by U.S. Cellular. Once again, U.S. Cellular’s licenses cover their market area in the Midwest, Northeast, and Northwest. Other companies to purchase within the “B”
block are Verizon Wireless, purchasing 77 licenses, Qualcomm, Chevron, Cavalier Wireless, Cox Communications, and Cellular South.

The much anticipated “C” block was the most sought after section of the whole 700 MHz spectrum because of the open access ability it has. The “C” block received an initial bid of $1.24 billion, but unfortunately for that bidder, the U.S. Federal Communications Commission’s set a reserve price of $4.6 billion. Google made the initial bid to satisfy the reserve price with a bid of $4.64 billion to ensure that open access would be available at auction ends. Verizon Wireless was the big winner in the 22 MHz block coming away with seven of the ten regional licenses, which cover the contiguous 48 states, as well as a Hawaii. Triad 700, took the two licenses covering Alaska and Puerto Rico/Virgin Islands and Small Ventures U.S.A. L.P. took the final license covering the Gulf of Mexico.

At the end of the auction, the “D” block was officially de-linked from the 700 MHz auction for not meeting its $1.3 billion reserve price. The “D” block deals with public safety and was designed to allow first responders to communicate with each other in times of emergency. This block came as a response into the actions of 9/11. The single bidder for a license within the block was $472 million by Qualcomm. The FCC has considered additional options for the block, such as lowering the reserve price and re-auctioning the block because of the importance it has.
The final block of the spectrum, the “E” block was dominated by EchoStar who purchased 168 of the available 176 licenses. Others who purchased within the block were Qualcomm, who purchased 5 licenses and Chevron, who once again took the license covering the Gulf of Mexico. The “E” block is an unpaired spectrum from the rest which is best suited for broadcasting services instead of mobile communications.

Of the 214 applicants granted to bid in the 700 MHz auction, only 101 walked away with licenses. However, these approved bidders came out and purchased 1,090 of the available 1,099 licenses. The bidders raised a record breaking $19.592 billion. Of all the bidders, Verizon Wireless and AT&T combined to spend the most on the 700 MHz. They spent a combined $16.2 billion, with Verizon Wireless spending $9.6 billion and AT&T spending $6.6 billion on licenses throughout the spectrum. Other big spenders in this auction were such companies such as EchoStar who spent $711 million, Qualcomm who spent $500 million, U.S. Cellular’s $401 million, MetroPCS who spent $313 million, Cox Communications’ $304 million, and others who spent millions to obtain licenses throughout the 700 MHz spectrum.

The two biggest winners of the 700 MHz spectrum have announced their plans on what they plan to do with their licenses. Verizon Wireless and AT&T both announced plans to use the spectrums they won from the 700 MHz auction for a future 4G long term evolution (LTE) based network. Verizon plans on releasing theirs in 2010, while AT&T says that their current
3G network will be okay till its 4G network is released in 2012. Another big winner, Qualcomm, has announced plans to on how they will use the licenses they purchased in the “E” block. They plan on expanding their FLO TV services to more areas in the country. Areas under which their licenses cover are Boston, Los Angeles, New York and Philadelphia.

**Was there open access in past auctions?**

Open access in this auction was a first; there was no open access in these past spectrum auctions. Customers were restricted to use their devices on their carriers’ network, and they could not use the same device in other wireless company network spectrum. However, in the 700 MHz spectrum, the FCC has established a standard that mandate wireless services using the spectrum to be opened to any handset a customer chooses. Verizon and AT&T agreed they will open their entire networks to any devices or application that meets their standards.

**Terms of use and auction structure**

Some rules that the FCC put forth on the spectrum include the open-access rule, network neutrality/right to attach, fair bidding, “use it or lose it,” and a pro-competitive band plan. The open-access rule applies to 1/3 of the spectrum and basically states that operators are required to allow customers to use any device they want. Customers can also download and use any applications they like. This will provide access for third parties on
that 1/3 of the spectrum at wholesale prices. This will permit any number of competitors on this part of the spectrum. The FCC is hoping that this will lead competitive broadband services in terms of speed and prices.

Network neutrality/right to attach would protect the consumer to use any equipment, content or application they like on the 700 MHz licensees network without being discriminated against. This prevents the licensees from giving better services such as faster speeds, better quality of content and applications to those customers that it has financial interests. Fair bidding is another issue that the FCC wants to incorporate. The purpose of fair bidding is to prevent large companies from locking out new potential entrants and keeping prices low. Anonymous bidding is the best way to go to prevent anticompetitive behavior. In this fashion, bidders will not identify one another and will be more difficult for signaling and blocking behavior.

The quote “use it or lose it” means that winning bidders should not let their part of the spectrum unused. This could be a strategy by incumbents who do not want to compete with their own wire line broadband service. Unused spectrum will be used to make it available to others who are unlicensed to use the spectrum. The pro-competitive band plan is structured so that broadband providers can achieve desired economies of scale. In order to make this happen, the spectrum needs to be auctioned off with the maximum number of large blocks in the upper 700 MHz band.
Technologies that could be used on the 700 MHz spectrum

Technologies that will be able to be used on the 700 MHz spectrum are all existing technologies. There are some special technologies that the spectrum will be able to take advantage of such as the Time Division Duplex (TDD) technology. TDD is best suited for asymmetric traffic like for the Internet or other data services. It can also support symmetrical communication services such as voice. TDD is perfect for use in the spectrum because it is the most efficient duplexing scheme for wireless networks. It allows for the performance required for high bandwidth demands that must deliver voice, video, data and Internet efficiently. TDD only uses one frequency to transmit signals in both upstream and downstream. Both the receiver and transmitter operate on this frequency but at different times. This technology will take less “space” in the spectrum. Older duplexing technologies such as Frequency Division Duplex (FDD) require one frequency for the upstream and one frequency for the downstream. Using TDD will allow for the reuse of filters, mixers, frequency sources and synthesizers. This will make things much easier and cost effective because there is no need to isolate a transmit antenna and the receive antenna as with other schemes like FDD. System operators will be happier with their investment in spectrum and telecom equipment by using TDD technology and they will also meet the customer’s needs.
Another technology that will be featured in the spectrum is the Commercial Mobile Alert System (CMAS). With this system customers must subscribe to participating wireless service in order to receive emergency alerts. The emergency alerts will feature presidential alerts (national emergencies), imminent danger alerts (lives or well being at risk) and child abduction/amber alerts. At this point messages from participating wireless carrier will be in the form of a text message notifying the customer of the emergency. This service may eventually carry audio and video emergency alerts as well.


