

## Sizing Up Wireless Spectrum

BY MICHAEL HARRIS

When you pick up your cell phone to make a call, you know the number you are calling and the strength of the available signal by “counting the bars.” But what about the wireless spectrum frequency carrying the signal for that call?

While we can see the importance of cell towers and mobile phones, the invisible link between them – radio frequency spectrum – is as vital. It carries the energy, in the form of radio waves, that enable you to talk, text, email, web surf, download an application or watch a movie on your favorite mobile device.

In the U.S., wireless carriers are licensed by the Federal Communications Commission (FCC) to operate services in specific frequencies and geographies. A cell phone functions similarly to other radio devices, like the stereo in your car. When you tune to your favorite station – say 98.7 FM – your car radio is receiving a signal at the frequency 98.7 megahertz (MHz) in your local area. Cell phone and data services simply operate higher in the spectrum, using frequencies in the 700 MHz to 2,500 MHz range.

Generally speaking, all of the frequencies used for wireless services offer equal capacity or bandwidth. However, frequencies in the lower ranges, such as those in the 700 MHz and 800 MHz spectrum bands, offer better coverage (see Figure 1). Signals in the higher frequencies have greater attenuation, meaning they lose strength more quickly. As a result, cell sites supporting services in higher frequencies must be installed closer together. Additionally, cell phone users in the upper frequencies are more likely to have indoor reception problems.

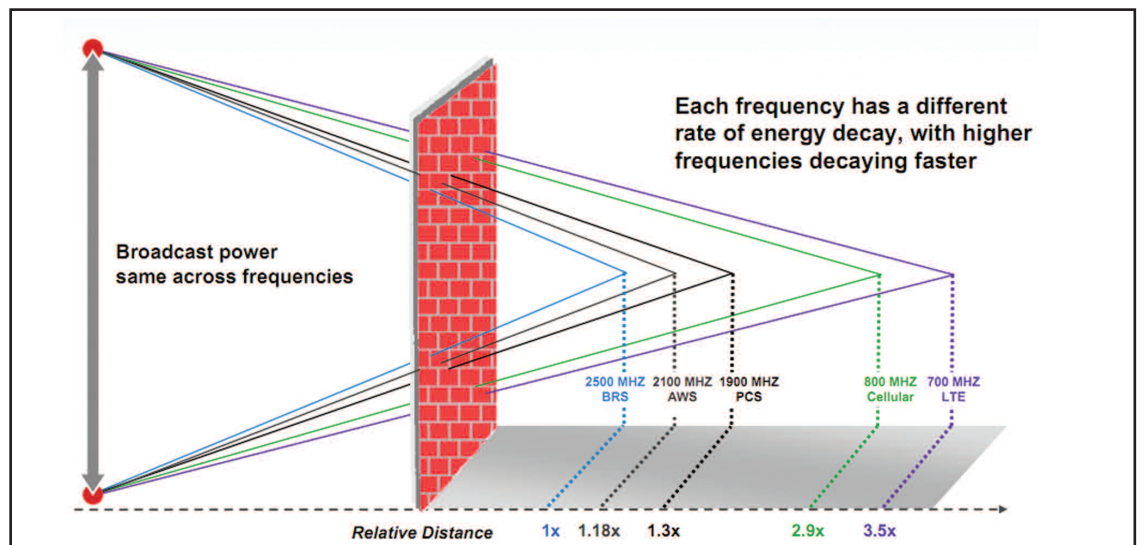


FIGURE 1: Frequencies Used for Wireless Services

*“Verizon spent billions in the [700 MHz] spectrum auction... Verizon’s LTE network will work continuously on that 700 MHz band, and in actuality, you will get better coverage than your current 3G phone using the same base tower.”*

Lowell McAdam, President & CEO, Verizon Wireless



For this reason, AT&T and Verizon – which together control more than 60% of the U.S. wireless market – are betting big on 700 MHz spectrum. In the FCC’s 2008 auction, Verizon paid \$9.6 billion for prime 700 MHz spectrum, while AT&T spent \$6.6 billion. AT&T purchased additional 700 MHz spectrum from Aloha Partners for \$2.5 billion and Qualcomm for \$1.9 billion. Both AT&T and Verizon are rolling out next-generation networks in this spectrum with 4G LTE technology.

The “**700 MHz**” band, which covers the 698-806 MHz frequency range, is the newest wireless spectrum block (see [Table 1](#)). Previously used for UHF television, the spectrum became available for wireless after the federally mandated broadcast digital TV transition.

TABLE 1: Wireless Spectrum at a Glance

BAND	FREQUENCY (MHZ)
<b>700 MHz</b>	698-806
<b>iDEN</b>	806-824 and 851-869
<b>Cellular</b>	824-894
<b>PCS</b>	1850-1910 and 1930-1990
<b>AWS</b>	1710-1755 and 2110-2170
<b>BRS/EBS</b>	2500-2690

Source: Wikipedia

Let’s take a closer look at how this new slice of spectrum compares to the other radio frequencies used in the U.S. to offer wireless services.

The frequencies now used for **iDEN** (those in the 806-824 MHz and 851-869 MHz frequency bands) were originally employed for vehicle fleet dispatching. Wireless entrepreneurs repurposed the spectrum to deliver cellular services with Integrated Digital Enhanced Network (iDEN) technology developed by Motorola. Nextel rolled out the service nationwide, including its Direct Connect “push-to-talk” capability.

Sprint acquired Nextel and is in the process of shutting down its iDEN network so it can use this prime 800 MHz spectrum to offer CDMA-based mobile services.

As the name implies, **Cellular** spectrum was used for the nation’s original launch of cell phone services. Operating in the 824-894 MHz frequency range, the spectrum was made available by assignment and then lotteries in the 1980s. Carriers rolled out analog cell phone services nationwide in these frequencies. By 2008, analog services were retired in favor of digital GSM and CDMA-based mobile services.

The first FCC spectrum auctions were held from 1994 to 1996 and included **PCS** (Personal Communications Service) frequencies. All major wireless carriers offer digital mobile services in

the PCS band, which covers frequencies in the 1850-1910 MHz and 1930-1990 MHz range.

The FCC auction for **AWS** spectrum in 2006 netted nearly \$14 billion for the U.S. treasury. T-Mobile was the biggest bidder for this Advanced Wireless Service (AWS) spectrum, operating in the 1710-1755 MHz and 2110-2155 MHz frequencies. AWS spectrum offers performance comparable to the widely used PCS band. Indeed, the similarities between PCS and AWS have accelerated the availability of cost-competitive AWS wireless equipment. The research firm Global View Partners expects that within two years, half of T-Mobile's subscriber base will use AWS-based services, with that total climbing to 90% within five years.

The **BRS/EBS** spectrum block includes microwave frequencies in the 2500-2690 MHz range (also called 2.5 GHz) that were originally allocated to offer "wireless cable" TV services. Today, Broadband Radio Service (BRS) and Educational Broadband Service (EBS) spectrum is being used by Sprint partner Clearwire to deliver 4G mobile services with WiMAX technology. While a bigger base station investment is required to offer service with 2.5 GHz spectrum compared to lower frequencies, the cost can be balanced out due to the much lower cost of acquiring the spectrum. Additionally, the characteristics of 2.5 GHz are a good match for providing fast data rates in dense urban areas.

Because most carriers offer services in several different frequency ranges (see [Table 2](#)), most mobile devices sold today have "multi-mode" capabilities. This allows them to operate in many different spectrum bands.

The largest wireless carriers – AT&T and Verizon – have cornered the market for 700 MHz spectrum for 4G services. Other carriers are hoping to keep pace using the spectrum they have available at higher frequencies. Time will tell which solutions will get the best reception among wireless consumers.

**TABLE 2:** Major U.S. Wireless Carrier Spectrum Holdings

SPECTRUM MHz	700	800	1900	2100	2500
DESCRIPTION		CELLULAR	PCS	AWS	BRS
<b>AT&amp;T</b>	☑	☑	☑	☑	
<b>Clearwire</b>					☑
<b>Sprint</b>		☑	☑	☑	
<b>T-Mobile</b>			☑	☑	
<b>Verizon</b>	☑	☑	☑	☑	

### About the Author

Michael Harris is principal consultant at Phoenix, Ariz.-based Kinetic Strategies, Inc. Applying more than 15 years of experience as a strategist, research analyst, journalist, public speaker and entrepreneur, Michael consults with select clients in the networking, Internet and telecommunications industries.

### About Unison Site Management

Unison Site Management is the largest independently owned cell site management company in the United States, managing thousands of wireless leases. As wireless lease consultants, Unison helps cell site owners protect against uncertainty, maximize return and provide peace of mind.

340 Madison Avenue  
New York, NY 10173  
Phone: 1-866-434-8495

© Copyright 2011.  
All rights reserved.  
Unison Site Management.