Bloomberg BNA

Telecom Law Report™

Spectrum Allocation

For TV 'White Spaces,' the Global Outlook Is Hopeful but Cautious

BY PAUL BARBAGALLO

Ten years ago, when the first of the world's TV stations began switching over to all-digital broadcasts, freeing up hundreds of megahertz of spectrum in the process, U.S. technology giants saw a rare opportunity.

They could use whatever was left after the transition—the ''white space''—to transmit broadband signals more cheaply and easily everywhere in the world, especially in places like rural America and sub-Saharan Africa, where even the most basic Internet service is not widely available, if it is available at all.

In little time, a coalition led by Google Inc., Microsoft Inc., Intel Corp., Dell Inc., and Hewlett-Packard successfully lobbied both the Federal Communications Commission and Ofcom, the British communications regulator, to green-light the idea.

Since those early victories, however, their campaign has grown far more difficult.

Opposition from incumbent spectrum license holders like 3G and 4G wireless service providers and TV broadcasters has either halted or greatly slowed the regulatory processes in scores of countries across Europe, Asia, and Africa, which in turn has discouraged manufacturers from building new white-spaces devices, chipsets, and infrastructure.

In the United States, the FCC's coming auction of broadcast TV spectrum to mobile carriers has added another layer of complexity and uncertainty, with reverberations being felt not just in Silicon Valley but down the entire global supply chain.

And yet, despite all this unsettledness, white spaces are starting to find a place in the spectrum policies of developed and emerging economies alike. Slowly and methodically, regulators in a growing number of countries are laying the groundwork to leave at least some white space *unlicensed*—and useable for broadband.

But by any measure, success is still in the future.

''The regulators and incumbents aren't completely satisfied that white spaces are going to work,'' said Rich Kennedy, the chairman of the working group of the Institute of Electrical and Electronics Engineers that developed the new wireless networking standard 802.11af—also known as ''White-Fi'' and ''Super Wi-Fi''—which will enable wireless local-area networking in TV white spaces in the VHF and UHF bands between 54 and 790 megahertz.

''The complexity is always with regulation,'' Kennedy told Bloomberg BNA in an interview. ''Any country that wants to adopt this has to first adopt regulations that allow it.''

''Over time, once it's well-proven, we'll start to see more use of it, including in metropolitan areas,'' said Kennedy, who works as a consultant to Microsoft and Taiwan-based MediaTek Inc., which is planning to build a baseband-processing chip including the 802.11af standard. ''Regulators worldwide know that they have a spectrum crunch. They know that clearing spectrum is a long-term problem and that this is a good form of relief for them on a fairly immediate basis.''

First Singapore, Next Africa? Just last month, Singapore's Infocomm Development Authority unveiled the regulatory framework that will ultimately guide the use of TV white spaces in Singapore. Effective in November, some 180 MHz of spectrum will be made available for high-speed Internet access and new wireless devices, with a few caveats. In a nod to the regulatory approach taken by the FCC in 2008, the IDA's regulations stipulate that all devices must connect with a geolocation database to determine whether TV channels are protected for use by incumbent broadcasts; what the permissible power limits are; and how long (hours? days?) they can operate in certain channels. There will also be ''guard channels'' to prevent interference to TV signals or wireless microphones used in live music performances and sporting events.

''Globally, the industry is agreeable that the database method is the way forward in the implementation of TV White Spaces technologies,'' an authority spokesperson told Bloomberg BNA in June. ''The other method, spectrum sensing, is still nascent. However, the IDA encourages the industry to continue their work to further develop spectrum sensing to complement the database approach. That would lead to even greater efficiency in the use and allocation of spectrum.''

On a trial basis, uses of TV white spaces in Singapore have included Wi-Fi (for backhaul); smart metering; and machine-to-machine communications.

''But there are many possible applications for TV white spaces,'' the spokesperson noted. ''[We] welcome companies to create innovative solutions. . .''

Over in Africa, meanwhile, Malawi may be poised to become the first country on the continent to allow commercial uses of TV white spaces.

In 2013, the University of Malawi, the International Centre for Theoretical Physics, and the Malawi Communications Regulatory Authority launched a TV white-spaces pilot project with the goal of providing a low-cost, high-speed Internet access service in rural parts of the country. Though still ongoing, the early results are

 ISSN 1933-4370

believed to be promising: Speaking at a Google-sponsored forum on TV white spaces in Africa last year, a Malawi official said the country could be ready to issue final regulations sometime in 2014.

South Africa may be next. The South African Independent Communications Authority is reportedly considering a regulatory approach whereby some white spaces would remain license-exempt while some would be quasi-licensed to prevent interference to ''protected mode'' users, like broadcasters. Those regulations could be finalized by late 2015 or early 2016, according to reports. In South Africa, Google and Carlson Wireless Technologies Inc. have been conducting a white-spaces trial with 10 schools in and around Cape Town, and regulators appear to be convinced that white spaces can in fact be used to provide affordable Internet services without causing interference to broadcasts.

Watching and Learning. ''They are now beginning to learn from themselves,'' Dr. Hyacinth ''H'' Nwana, executive director of the Dynamic Spectrum Alliance, a global policy advocacy group whose members include Google, Microsoft, and Facebook Inc., told Bloomberg BNA in an interview. ''There are a lot of countries watching very, very carefully.''

''Regulators are very cautious people,'' said Nwana, who formerly served as partner of the Spectrum Policy Group at Ofcom, where he oversaw Britain's 3G and 4G auctions. ''Spectrum regulations in particular do not move that quickly. Spectrum regulations actually tend to move at a glacial pace. So [regulators'] general thinking is, 'why should we start moving quickly now?' There's a natural inertia in all spectrum policy. So we're seeing some of that.''

Incumbents Still Playing Spoiler? Nwana was quick to acknowledge, however, that one of the reasons for the uncertain regulatory environment is the mounting pressure from mobile carriers.

From the moment that Google first lobbied the FCC to set aside TV white spaces for unlicensed use, the U.S. carriers cried foul. Google's creation of a brand-new, lower-cost, and yet still-high-speed Internet service, relying on *free* spectrum, skews competition in the wireless sector, they argued. How could Google and others use this very valuable public resource for free when the carriers paid billions of dollars for exclusive licenses to use the same airwaves?

''The Facebooks, Microsofts, Amazons, and Googles—they want more access to consumers who use broadband to do more searching and online shopping and Facebooking,'' Nwana said. ''The [mobile] industry is quite concerned about that. At the same time, we really need to find a way to close the digital divide. Three to four billion [people] are unconnected, and in emerging market economies. In the end, the 3G and 4G networks will not extend beyond the cities. Are you going to wait until this trickles down in 20 years? From a citizen's and consumer's perspective, the answer is very clear: We need to inject more competition in the mobile industry.''

Digital TV Transition Still Ongoing, Clouding Picture. But while most of the world has already completed the transition from analog to digital TV delivery, Africa has not. (Neither has India, Hong Kong, Mexico, Philippines, Chile, Brazil, China, and Russia, for that matter.) And Africa's regulators are not expected to finalize exactly *how much* of this newly vacated spectrum—what is known as ''digital dividend'' spectrum, the 700 MHz and 800 MHz bands—will be available for unlicensed use until at least the World Radiocommunication Conference in 2015 (WRC-15). At 2012's World Radiocommunication Conference, countries in ''Region 1,'' which includes Europe, Russia, the Middle East, and Africa, had left open the possibility of allocating the 694-790 MHz frequency band for mobile broadband service.

In the meantime, the world's mobile network operators are lobbying aggressively for as much sub-1 gigahertz spectrum to be licensed to them as possible.

''We think that we can easily compete and secure good coverage across Africa,'' Wladimir Bocquet, senior director of spectrum policy for GSMA, an industry group based in Britain representing 800 such operators, told Bloomberg BNA in an interview. ''But we need to have the right regulatory framework. It will be quite important.''

''The same types of wireless services and applications need to have the same types of regulations,'' he added.

The world's UHF and VHF bands are desirable to both the mobile carriers and high-tech companies for the same reason: Signals travel far distances and penetrate walls and windows better than those in any other available spectrum bands. For the carriers, this means wide-area outdoor wireless coverage with fewer cell sites. For the tech companies, this means the same kind of coverage with fewer costs.

Really 'Wi-Fi on Steroids?' But whether white spaces can enable a new generation of mobile devices that use the public's airwaves more opportunistically than ever before, providing cheaper Internet services to a world of exploding populations and rising emerging-market middle classes—what Google co-founder Larry Page once referred to as ''Wi-Fi on steroids''—is still an open question.

''Traditional Wi-Fi operates in the 2.4 GHz and 5 GHz bands. If you want to take that local area network model and apply it to TV white spaces, I think it can be a viable business, but a much smaller one,'' Steve Crowley, a wireless engineer and consultant, told Bloomberg BNA in an interview. ''White-space channels are narrower, limiting data rates per channel, though channels can be aggregated where available.''

''Unfortunately, you'll have the least white space in the densest urban areas where you want capacity the most,'' added Crowley, who owns two patents for wireless communications technologies. The simple reason for that, Crowley explained, is that there are more TV stations in cities. ''Then there's the added complexity of protecting TV stations using the database,'' he said. In the United States, that database is managed by Google. ''The same physics that makes coverage good also makes interference propagate farther, which can limit the density of base stations in a local area network.''

Solving the Backhaul Problem. There is also the problem of backhaul, which involves the matter of connecting a cell site to the service provider's (Google's or Microsoft's) core network. These connections are typically made using wholesale Ethernet-over-fiber infrastructure, which is either nonexistent or of insufficient capacity in sparsely populated places like Africa, parts of South America and Asia, and rural America. (It's worth noting that in the lead-up to the FCC's vote in 2008, Sprint Corp. and T-Mobile US Inc. had urged the com-

  TELR ISSN 1933-4370

mission to license TV white spaces—channels 52 to 69, from 698 to 806 MHz in the United States—for fixed backhaul use. They said they needed a cheaper alternative to the fixed ''special-access'' line service provided by Verizon Communications Inc. and AT&T Inc. through the Verizon- and AT&T-incumbent local exchange carrier subsidiaries. Of course, those arguments fell flat.)

For now at least, white spaces may be the only backhaul solution in these rural areas. And with fewer television stations in operation and largely one-way (downstream) traffic, that should prove satisfactory. But as data traffic increases, and more traffic begins moving upstream in the network, companies will need to shift to fiber or satellite backhaul. If they fail to plan for such a transition, they could face setbacks in rolling out new services.

But those issues aside, two other recent developments—the IEEE's approval of the ''White-Fi'' and ''Super Wi-Fi'' 802.11af standard, in February; and the FCC's adoption of broadcast spectrum auction rules, in March—are seen as possibly forcing policy changes.

802.11af Could Create 'Big Market.' Reduced to its essence, 802.11af means Wi-Fi that operates in white spaces for the first time using a wireless local area network—WLAN—standard designed for ranges up to a few miles. As a point of reference, it is remarkably similar to all other 802.11 Wi-Fi standards, except that it relies on cognitive-radio technology to locate available frequencies over which to send and receive data, a crucial feature for TV white spaces.

''It's going to be a big market in five years,'' Jim Carlson, president, CEO, and chief engineer of Arcata, Calif.-based Carlson Wireless, told Bloomberg BNA in an interview, commenting on 802.11af.

As a company, Carlson designs products primarily for IEEE 802.22 standard-compliant wireless regional area networks—WRAN—which also operate in TV white spaces but extend up to 60 miles and are meant for fixed locations such as a home or office. But in the company's ''Generation 3'' product line, Carlson said the company plans to add an integrated Wi-Fi radio to serve as either a hotspot or backhaul for the customer.

''If you look at the Wi-Fi innovation now, it's everywhere. It's quite ubiquitous,'' Carlson said. ''And if you were to say, 'well, a mobile device can go three to five times farther, let's add this TV frequency band in.' Wow. That's what 802.11af does.''

On MediaTek's decision to make a baseband-processing chip with the 802.11af standard integrated into it, Carlson said: ''That's what the industry's been waiting for for quite a while.''

FCC Action Also Seen as Encouraging. In the United States, the future of white spaces will depend on how much spectrum the FCC reclaims from TV stations and then auctions off to mobile carriers—and where the stations who choose to continue broadcasting are relocated (what the agency and industry refers to as being ''repacked'').

In March, FCC commissioners approved a lengthy set of rules for the agency's auction, now set for 2015, which commit to setting aside as much as 28 MHz of spectrum in the UHF and VHF bands nationwide as white space.

''This is a strong enough case for people to come and start building white-spaces products,'' Dr. Apurva Moody, founding chairman of the industry association the WhiteSpace Alliance and working group chairman of the IEEE's 802.22, told Bloomberg BNA in an interview. ''If the FCC's incentive auctions go smoothly, a lot will happen, not only in the U.S. market but internationally.''

''The 28 MHz that the FCC is proposing is really most important to the mobile silicon ASIC [application-specific integrated circuit] vendors, those companies that are trying to build a chip that is a global, multiband chip,'' said Peter Flynn, business development manager for communications infrastructure products at Texas Instruments, a WhiteSpace Alliance member. ''Low-cost ASICs need two things to be successful in the market: They need spectrum. And they need to have sufficient motivation to build. . . . The FCC has really given them the motivation . . .''

Increasingly, Flynn added, global regulators are realizing the importance of a ''balanced'' approach to spectrum policy—some licensed spectrum; some license-exempt spectrum; and some shared-use spectrum.

''In order to get device manufacturers on board, you have to have a fairly consistent policy of what spectrum is going to be accessible to them and what protocols they could use in that spectrum band,'' he told Bloomberg BNA. ''When you restrict all your spectrum to certain protocols—3G, 4G, LTE, then that gives a clear message of economic value.''

With assistance from Tim McElgunn in Cherry Hill, N.J. and Michael Mackey in Bangkok

To contact the reporter on this story: Paul Barbagallo in Washington at pbarbagallo@bna.com

To contact the editor responsible for this story: Bob Emeritz at bemeritz@bna.com