

HAPPY BIRTHDAY, NATIONAL BROADBAND PLAN!

Blow out the candles, already! The recent auction of Advanced Wireless Spectrum raised \$41 Big Ones (that's \$41E9) for the US Treasury. Now, spectrum is a little like real estate and as Will Rogers once said: "I had been putting what little money I had in Ocean Frontage [because] they wasn't making any more..." If there were spectrum futures, I'd recommend placing a buy. AT&T, apparently, thinks the same way, having dropped nearly one-half of the record bids.



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By Mike Violette

Part of this haymaking for the Feds is the result of the FCC's "National Broadband Plan" or "The Omnibus Broadband Initiative." In 2010 the FCC released a plan to increase the availability of spectrum for broadband deployment in the United States. Some of the initiatives have had an immediate impact. Others have languished or have been overtaken by events. What has happened since is that the Commission has made hundreds of MHz of spectrum available for all kinds of mobile, IoT and M2M uses. This has caused some difficulties for incumbent users and created opportunities for innovators.

This article will provide an update of how the plan is being implemented.

FCC SAUSAGE-MAKING

First, a quick word about how the Rules are made.

In the case of the Commission's Broadband Plan, congressional prodding, such as what happened in 1996 with *The Telecommunications Act of 1996*¹, directed the FCC to generate a "Notice of Inquiry" to query the nation on the future of broadband. The Commission initiated a series of workshops across the US, which generated "10,000 in-person or online attendees, provided the framework for the ideas contained within the plan. These ideas were then refined based on

replies to 31 public notices, which generated some 23,000 comments totaling about 74,000 pages from more than 700 parties."W²

The internet provided a superhighway for discussion and dissemination of ideas. At the release of the plan, the FCC's Twitter feed was the third-most followed in the Federal Government behind the White House and the Center for Disease Control.

Once the plan was set out, a series of "Notices of Proposed Rule Making" issued forth from Southwest Washington DC (the little piece of DC that did not get ceded to Virginia in 1849). The Rule Makings continue and this is where the rubber meets the road. NPRMs form the genesis for future frequency uses and regulations.

Another flurry of Public Comments may then ensue, refinement of the Rules follows and a Report and Order (R&O) get published in the Federal Register. That is the short-form version of an often complicated and sometimes litigious discourse and debate. Consider that there are many eager entrepreneurs, large corporate interests, amateurs and public entities interested in the use of a precious national resource. Plus, throw a couple of engineers together with a couple of lawyers and it can get pretty ugly.

TV WHITE SPACES

The changeover to HDTV a few years ago left a dangling piece of juicy spectrum in the 700 MHz range of the TV band. (Actual gaps are available here and there below 700 MHz, but the biggest, and most tantalizing continuous piece is above 700 MHz).

What's nice about this frequency band is that the propagation is pretty decent (city and county-wide) using reasonably-sized antennas with a half-wavelength just shy of half-a-meter. The availability of 100 MHz of spectrum is appealing for both fixed and mobile applications. With a mix of existing licensed users and otherwise empty spots, the commission has developed procedures for getting the most out of this (relatively) newly-released resource.

In recent action, the FCC has come up with a plan to allow up to four channels in the 700 MHz band. The availability of this spectrum spurred the development of a database-supported system that would allow users to operate on unused spectrum, using a coordinated approach to minimize interference. This is not unlike the long-standing licensing that has existed for broadcasters, public safety and land mobile operators. It does, however, make it possible to provide a mechanism for "listening" to the spectrum to report

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use back to a central database. This becomes an interesting paradigm for maximizing the use of many parts of the spectrum.

As an aside, Google is taking the action to develop a database that users can determine who is where and at what frequencies. <https://www.google.com/get/spectrumdatabase/> to "...to enable dynamic spectrum sharing." The dynamic sharing part of this effort takes traditional licensing to another level. These principals are being discussed beyond the TVWS re-use and sits squarely with the long-held vision of dynamically agile software-defined radios.

Other entities are involved in the spectrum management and information services. Key Bridge Global, located in Virginia, provide TVWS database services.

Currently, eight TVWS devices are Certified by the FCC at the time of this writing. Most of these devices, as understood by the author are provisional operations and not widely deployed for commercial uses.

GIGAHERTZ GOINGS-ON

Recent activity in industry includes the test demonstration of a Terrestrial Low Power Service (TLPS) operating at the upper end of the traditional 2.4 GHz ISM/DSS/Bluetooth band. TLPS is proposed for the 2473-2495MHz band, which just touches the upper channels of the traditional ISM

band (2400-2483.5). A report on potential interference to existing devices was prepared, after extensive trials with FCC and Industry, dated March 27, 2015 and issued by the FCC OET staff. No analysis has been performed and only indoor operation was assessed.³

Recent action has started the opening of the 3550-3650 MHz band. Currently, this is Federal Government spectrum used for Naval radar operation. Following a little on the TVWS coordination activity the so-called "Spectrum Assignment System" is envisioned as a way to maximize the use of these frequencies. Primary protection will be to the Federal Government, secondary protection will be offered to protected-access licensees with the third allowance offered to the "rest of us" (for general authorization). There is current work to extend this band to 3700 MHz.

Further developments at cm-waves include liberalization of the 5150-5250 band, which was exclusively limited to indoor operation. At the time of this writing, this process was in-process. A major satellite data provider is a principal petitioner. The migration of devices in these otherwise sensitive radar bands has demonstrated that the testing and operation of these designs that must comply with Dynamic Frequency Selection (DFS) requirements has been largely successful.

Medical applications continue to spring up "all over the spectrum," according to our sources at the FCC.*

Higher yet, but in the same "5 GHz Band" is the spectrum between 5350-5470 MHz. This, too, is the subject of some interest and a Report and Order has been issued to allow operation in this band (not yet acted on, as of this writing). Again, this is more Federal government spectrum (the guys at the NTIA and military have had some sleepless nights). If this spectrum gets adopted, it will allow space for additional operation under 802.11ac with channel bandwidths up to 160 MHz. Remarkable.

HIGHER STILL

More activity is happening in the 10s of GHz bands, notably various actions at 24 GHz, 27-31 GHz, 39, 37, 60, 70, 80...GHz. The various uses include very high bandwidth short range data communications, on-airport use (debris detection), vehicle radar, sensing and other uses, some which will certainly be part of 5G Communications, whatever that will be.

CHOOSE YOUR PARTNER WISELY

If you can cough up a few billion bucks for spectrum, you're probably in a good place to choose partners (or not). One of the impacts of the aforementioned "Advanced Wireless Services" or AWS-3 Auction that raised \$41B for the Feds was how the winners are shaping policy towards sharing. Network operators that now can control segments that have dual-use licensed and unlicensed operation can yield a particularly heavy-hand. Further, unlicensed LTE use may well "kill" 802.11 networks in the same frequency band. Apparently, LTE is just not as "nice" as 802.11 and just doesn't share as well.

One success story is the use of the 2360-2400 MHz band. This chunk

is useful for medical telemetry, but is currently the domain of the aeronautical guys. A plan to share these frequencies is being developed that would, again, rely on a database to manage interference. This seems to be a bit of trend, with a philosophical shift--discussions anyway--towards controlling the unlicensed spectrum.

LIKE AN LA FREEWAY: CLOGS FAST

In 2014, the number of wireless mobile devices surpassed the population of the human race, according to CISCO Systems.⁴ The world is getting crowded with devices and so, too, is the spectrum. If the user experience is to match expectations, more efficient use of the existing spectrum is paramount.

Incumbents and the owners of "new" spectrum--obtained through auction--need to figure out a way to share this limited space. It will only get more critical in the next 20 years as device complexities grow and competition for usable spectrum gets more keen.

Just like an LA freeway, as soon as a new communication channel opens up, it's not too long before gridlock. When we wish the National Broadband Plan a Happy Tenth Birthday, we may be well into an entirely new generation of communications modes.

Let's hope we make it to the party. 

**The core of this material was derived from conversations with FCC OET*

staff on March 24, 2015. However, the information, and any errors, contained in this article are wholly the responsibility of the author.

NOTES

1. <http://transition.fcc.gov/telecom.html>
2. The Omnibus Broadband Plan, <http://www.fcc.gov/national-broadband-plan>
3. http://www.globalstar.com/en/ir/docs/FCC_OET_Report-040115.pdf
4. http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.pdf