



Spectrum Fights

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After a multi-year fight to retain untarnished use of C-band, the satellite industry continues to face challenges on that front as well as other spectrum bands. Why are other communications sectors seeking access to bands used by the satellite industry? Do satellite players still face the possibility of losing the use of certain spectrum globally or in certain regions of the world, and what does the industry plan to do to protect its use of spectrum?

During the 2006 World Cup, 30 percent of TV households in Bolivia missed some of the event due to interference to a satellite signal created by WiMax testing. In another incident on the other side of the globe, 300,000 households throughout Asia lost their TV service due to a satellite signal getting knocked off the air. What do these incidents have in common? Experts say they were caused by interference from WiMax systems that are starting to use portions of the extended C-band downlink frequency spectrum (3.4-3.7 GHz) traditionally used by satellite players. WiMax is based on the IEEE 802.16 standard (also called Broadband Wireless Access or BWA) for wireless transmission of data including point-to-multipoint links, portable, and mobile Internet access. WiMax plans on using 3.4-3.8 GHz, and International Telecommunications Union (ITU) is considering 3.8-4.2 GHz for future mobile phone networks (called IMT Advanced or 4G), but already, the number of incidents of reported WiMax interference with satellite services is growing, with reports of C-band broadcasts being disrupted from the Americas to Africa to Asia.

Dave Hartshorn, secretary general of the Global VSAT Forum (GVF), was involved in coordinating a global campaign to protect C-band satellite services from a re-allocation effort made by the terrestrial wireless industry at the ITU's World Administrative Radio Conference (WRC) in 2007, where international radio regulation standards are set. "We were getting reports from around the world that WiMax was not only generating interference in-band in extended C-band — but also out-of-band interference — in the entire range. In some cases it was severe enough to render [the] satellite totally inoperable. It also became clear that the terrestrial wireless industry was mounting an effort to identify a global range of frequencies including satellite

C-band for its use." Thanks to the campaign by satellite organizations, the terrestrial wireless industry was not successful getting a "global identification" of C-band spectrum, so there had been a sense in the industry coming out of WRC-07 that C-band spectrum would remain safe from WiMax interference.

Always Read the Fine Print

A provision, however, to the ITU decision allowed "opt-in footnotes" for designation of the bands 3.4-3.6 GHz for mobile telephony systems, allowing countries the right on an individual basis to permit some terrestrial services in C-band, subject to extremely stringent technical specifications that have to be adhered to in order to prevent cross-border interference. The European Union, Korea, Japan and more than five dozen other countries footnoted as 'opt-ins,' and some began acting on it. This has led to interference reports, says Hartshorn. "By early 2008, it became apparent there are still serious problems of reported interference incidents and continued efforts by the terrestrial wireless industry to convince regulators to identify C-band for IMT operations regardless of the ITU decision."

The satellite industry's response has been to re-launch the global campaign that had been organized before WRC-07. Called the Spectrum Security Initiative, it is the central point of coordination for efforts to ensure continued access to all satellite spectrum worldwide. "As a central component of the campaign, we have begun coordinating with the terrestrial-wireless industry through the WiMax Forum. We have begun working together on joint activities designed to enable satellite and WiMax services to more effectively coexist," says Hartshorn.

WiMax is being deployed around the world for delivery of last mile wireless broadband access as an alternative to cable and DSL. According to the WiMax Forum, an industry trade and standards-certification body, WiMax network deployments are approaching 460 in more than 135 countries for fixed, portable and mobile services. WiMax service providers now offer networks covering 430 million people globally, and this number is expected to double in the next 24 months, says the WiMAX Forum.

How many of these networks are using C-band frequencies also used by FSS satellite? "Our count is there are 455 networks in deployment, and between 50 to 60 percent of today's WiMax networks are in the 3.4-3.6 gigahertz spectrum," says Tim Hewitt, director of regulatory and spectrum policy, and chairman of the WiMax Forum's regulatory working group. Hewitt acknowledges the potential for interference. "What has happened in some countries is that deployment has been done without, I think, a full

understanding of the issues partly because the locations of earth stations aren't known," he says. "Some or all of receive-only stations are non-licensed, so there's no formal record of their locations. So if the satellite systems and terrestrial systems are not fully understood and the Earth station locations aren't known, then there's a potential for some interference."

According to Robert Ames, president of the Satellite Users Interference Reduction Group (SUIRG), an international non-profit formed to reduce interference into satellite services, "The problem for the satellite industry is the WRC put out a recommendation to protect FSS (fixed satellite services) antenna services, yet we still have many WiMax systems being implemented in the band without proper protections. Nothing is preventing them from doing it.... One of the problems is WiMax has hubs and transportables," he says.

Indeed, the WiMax Forum has issued certifications of Mobile WiMax products for the 3.5 GHz C-band. WiMax Forum President Ron Resnick says the certifications give more operators access to equipment needed to deliver mobile broadband services. But implementation of mobile products in the C-band poses an even greater risk of harm to satellite services — since it is extremely difficult as a practical matter to preempt, pinpoint and police radio interference from mobile devices. Hewitt disputes the notion of laying all the blame on WiMax. "SUIRG put out some statistics in the fourth quarter of 2008. We saw out of all the RFI cases they had, and less than one percent were attributed by them to terrestrial services. So this is not a widespread problem, and if things are deployed carefully then the problems can be avoided," he says.

Ames says the statistics were from an incomplete database established prior to WiMax implementation, and the reporting capability has been removed from SUIRG's Web site until realistic data is collected. SUIRG also has performed field testing with the U.S. Navy to prove the interference problem exist. "The results conclusively show that the criteria where FSS antennas cannot coexist with WiMax systems within ranges from 50 to over 200 kilometers depending upon the local terrain and WiMAX power levels. In a 50-mile radius you exceed the - 10 dB interference-to-noise ratio. That is a threshold which WiMax has agreed it will not exceed and agrees is incompatible with FSS services." According to SUIRG's report, "Calculations based solely on line of sight for defining the distance required between FSS and WiMax systems indicate an exclusion zone of 280 kilometers, which is greater than the direct line-of-sight Earth curvature distance and assumed no terrestrial interference," Ames says.

Widespread Issues

Satellite C-band is the primary distribution system for delivering TV programming to North America's cable and broadcast systems, making it a critical infrastructure supporting a multibillion-dollar value chain. Are these services at risk too? Not according to Hewitt. "In the case of the United States, it doesn't allow WiMax in 3.4-3.6 gigahertz because of radar frequencies, so there's no possibility of in-band interference from WiMax," he says. The U.S. Federal Communications Commission (FCC), however, does allow WiMax in the 3650-3700 band, and this caused an outage at the CBS-owned KYW TV station in Philadelphia in December 2008. According to TV Newsday, Rich Paleski, KYW's chief engineer, traced the interference to a WiMax service provider testing equipment in the 3.65-3.7 GHz band the FCC authorized for WiMax and other wireless services. The upper end of the band abuts the lower end of satellite C-band downlink frequencies.

The situation differs in Latin America, Africa and Asia. A report issued in October 2008 by the Cable & Satellite Broadcast Association of Asia (CASBAA) on current and planned WiMax deployments in the 3.4-4.2 GHz band presents an alarming message. The report, "Transmission Troubles: A Threat to Satellite TV Services in Asia," identifies six countries as "having a high risk of encountering highly destructive interference with satellite communications from wireless systems." Potential problems exist in Australia, India, Indonesia, Pakistan, the Philippines and New Zealand. "This is no false alarm. Rising incidents of reported interference also show the problem is very real," says Gregg Daffner, chairman of CASBAA's Wireless Action Group and one of the report's authors. "Unchecked, the growth of BWA systems in C-band and the rising incidence of radio interference that comes with that threaten to wreck infrastructure supporting television and financial transaction networks."

Above and beyond the interference threat, growth of terrestrial mobile and wireless services is straining spectrum capacity to the hilt. It is prompting initiatives to take away spectrum used for satellite services and open more traditional satellite spectrum for sharing. CASBAA reported that the government of Pakistan awarded C-band slots to WiMax providers and was considering plans to ban satellite receivers in C-band in some instances.

Eyes on Ku-band?

In May 2008, the Utilities Telecom Council (UTC) and Winchester Cator LLC, a private wireless venture, petitioned the FCC for secondary access on a non-interfering basis to Ku-band spectrum (14.0-14.5 GHz). UTC is an international trade association and lobbying arm for the telecommunications

interests of electric, gas, water, and power utilities. Backed by companies such as Pacific Gas & Electric, The Southern Companies, Sempra Energy, PSE&G as well as other not-for-profit entities such as state or municipally-owned corporations, UTC claims it needs more utility-only wireless bandwidth to support its members' future infrastructure such as smart grids and more intrastate power sharing. The petition also seeks access for "critical infrastructure industries" such as railroad transit industries, private ambulances and volunteer fire departments.

According to satellite industry representatives, if left unchecked, this request for terrestrial access to Ku-band satellite spectrum poses a threat to live TV and events, corporate data, and DTH services via satellite. The Satellite Industry Association, the GVF and the European Satellite Operators Association, among others, have filed opposing arguments, dubbing UTC's proposal to permit shared, secondary terrestrial fixed service use of the band "ill-conceived, technically flawed and glaringly unjustified," and have asked the FCC to dismiss the request as incompatible with existing and future Ku-band services. The proposal would not protect present and future fixed satellite service operations from harmful interference and likely would result in harmful interference even at modest deployment levels, say the satellite representatives. Ames says, "The FCC could simply dismiss UTC's petition," but according to Jill Lyon, vice president and general counsel for UTC, "We have been given to understand the commission is in favor of moving forward with the proceeding. In other words, they're not going to stop it here. There probably will be [a Notice of Proposed Rulemaking (NPRM)], allowing all interested parties to go through another round."

Lobbying Lessons Learned

To protect their spectrum, satellite players must continue to lobby governments, educate all parties and seek cooperation from other communications technologies. CASBAA sees a lesson learned from the industry's past experience in the U.S. protecting C-band spectrum from encroachment attempts by wireless users. "Satellite's primary rights to these frequencies were saved in large part by focusing the regulators on the millions of citizens whose direct and indirect satellite reception of popular television programming would be disrupted," the organization said in its report "Transmission Troubles." CASBAA has taken this approach in its communications efforts, and the strategy may be working, as regulators in some Asian countries are starting to recognize the risk to satellite services and take actions to change policy directions. Hong Kong changed its policy after seeing the impact of interference on C-band and now is pointing towards the 2.3 GHz band for BWA. Malaysia has taken more steps to protect satellite

signals, imposing restrictions on its BWA licensees. Indonesia's policy seems to be shifting towards moving BWA licenses from 3.5 GHz to 3.3 GHz in the hope of reducing inference, says the report.

"It is in both the WiMax and satellite industries' best interests to see it resolved so that the natural marriage of these two technology tools can be fully drawn on," says Hartshorn. "To address this issue with WiMax organizations, we need to heighten awareness that satellite and wireless go together." Hewitt also see the benefits of collaboration. "We don't want any problem to build up, so that's why we're keen to work with the satellite community," he says. "We want to advise the operators, the vendors and, in some cases, the regulators on how the problems can be avoided."

The two organizations have signed a collaboration agreement to seek a joint solution for the issue, "and there are concrete steps being taken that have global implications," says Hartshorn. In addition, GVF has launched an initiative to facilitate financially sustainable wireless/satellite deployments in developing countries, including WiMax-VSAT architectures. "The fact that there is a mutual, commercial motivation for the satellite and WiMAX industries to work together is key," he says.

The organizations have agreed to work together, but the satellite industry has a lot of regulatory outreach work ahead of it in view of the new dynamics in the world of terrestrial microwave.

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