

Tropos Networks – Position Paper

FCC Adoption of Rules for Unlicensed Use of Television White Spaces

Background

On November 4, 2008, the FCC adopted a ruling¹ allowing the operation of unlicensed wireless devices in television whitespaces. This is an exciting and welcome development that will spur innovation and result in new wireless technologies and products that can take advantage of this valuable spectrum to deliver the benefits of wireless broadband to consumers and municipal governments alike.

The FCC ruling will allow for unlicensed operation in broadcast TV spectrum, subject to numerous safeguards put into place to protect incumbent services including TV stations and wireless microphones. The technologies proposed to protect incumbent operators include geolocation capabilities assisted by databases of incumbent services, as well as spectrum-sensing “cognitive radio” techniques.

Wi-Fi standards developed within the IEEE and commercialized by a broad ecosystem of vendors have demonstrated the workability of unlicensed-band cognitive radios through techniques such as listen-before-talk (CSMA/CA) and radar detection and avoidance (5 GHz DFS). The IEEE is expected to soon consider a motion for the formation of a new Study Group within 802.11 to create a standard aimed at satisfying the technical requirements laid out by the FCC for operation in the TV whitespaces.

Implications of Unlicensed Spectrum

The historical experience with the opening-up of wireless spectrum for unlicensed uses has been a success, as the history of Wi-Fi amply illustrates, with an estimated 1 billion Wi-Fi chips being produced and shipped this year. As the experience with 900 MHz, 2.4 GHz and 5 GHz unlicensed operation shows us, unlicensed spectrum has time-and-again lowered the bar to market entry, stimulated technology innovation, spurred the creation of broad and competitive ecosystems of vendors and delivered low-cost high-performance products to consumers.

To date, most spectrum that has been available for unlicensed operation has been limited to frequency bands that result in very small cell sizes and coverage footprints, as has been the case with 2.4 GHz and 5 GHz. The release of unlicensed spectrum in television whitespaces (under 700 MHz) opens up possibilities for the creation of a wide-area wireless footprint. This is likely to benefit public safety agencies as well as municipalities that have unmet wide-area wireless broadband needs and do not own spectrum licenses.

Municipalities and local governments, as well as public safety agencies, have wireless broadband needs that often go well beyond those serviced by public wireless carriers including cellular operators. These include such applications as easy access to wireless broadband for municipal field workers, mobile broadband access for public safety officers and wide-area video surveillance in high-crime areas. Local governments also frequently have a mandate to promote social aims and goals such as broader economic development, bridging the digital divide, efficient e-government initiatives, and community education programs.

These entities typically do not own wireless spectrum licenses and have employed unlicensed technologies and solutions, leveraging the 2.4 GHz and 5 GHz bands, to operate municipally-owned wireless broadband networks. The opening-up of television whitespaces for unlicensed use creates the possibility of expanding the unlicensed coverage footprint at a low overall cost, leveraging the favorable propagation characteristics of low-frequency spectrum. The use of TV whitespace spectrum to achieve broad coverage footprints is very complementary with the use of higher-frequency (2.4 and 5 GHz) spectrum to provide the high speed and capacity required by municipal and public safety applications.

Spectrum Characteristics and System Performance

Broadcast TV spectrum has a number of very attractive RF propagation characteristics that hold out promise for wide-area wireless broadband applications. In particular, the much lower frequencies occupied by TV spectrum (under 700 MHz, compared to Wi-Fi operating at 2.4 GHz or above 5 GHz) imply that signals can carry over much longer distances and propagate much better through obstructions such as foliage and building walls. This is expected to translate to a significantly lowered cost-of-coverage, as fewer base stations will be required to establish a wide-area coverage footprint.

Since propagation in urban canyons and indoor penetration have been historical challenges to wireless broadband, the opening up of lower frequency spectrum has been greeted with considerable excitement. Much less attention has been devoted to explaining the implications of this spectrum for system capacity. As the radius covered by a base station is expanded, the capacity available over the airwaves at that base station is effectively spread out over a larger area, resulting in a lower system capacity per square mile or per capita. This tradeoff between larger cell sizes and lower cell capacities is illustrated by the move by the industry over time to smaller cells to increase the carrying capacity of cellular networks.

From the viewpoint of wireless system design, the most valuable use of the whitespace spectrum will be in expanding coverage, rather than expanding network capacity. It offers the possibility of cost-effectively creating a broad-area coverage underlay using TV spectrum, employed in conjunction with higher-frequency shorter-range higher-capacity unlicensed wireless spectrum. The use of whitespaces to expand coverage is thus complementary to the use of higher-frequency unlicensed spectrum to create the higher-capacity dense cells needed by mobile broadband applications.

Tropos Position

The recent FCC ruling is an exciting new development that is likely to stimulate innovation in wireless broadband delivery that will eventually deliver significant value to both consumers and municipal governments.

Tropos continues to be an active participant in the IEEE and we plan to contribute to the development of the technical specifications for a standard that will enable wireless devices to be able to effectively use this spectrum. The creation of a standard for devices from multiple vendors to interoperate is a critical first step before infrastructure equipment vendors and embedded client device manufacturers can begin to undertake product development to develop compatible products. As standards emerge and garner industry and ecosystem support (a process that we expect to see play out over the next 3+ years), we will integrate standards-based radio technology supporting these new unlicensed frequencies into our products. Even at this early stage in the development of standards, it is our expectation that use of this spectrum to expand coverage will be complementary to the use of higher-frequency unlicensed spectrum in use today to support high bandwidth applications.

¹ FCC adopted a Rule and Order (FCC 08-260) “to allow new, sophisticated wireless devices to operate in broadcast television spectrum on a secondary basis at locations where that spectrum is open” – see http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-286566A1.pdf