

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Service Rules for the 698-746, 747-762)	
And 777-792 MHz Bands)	WT Docket No. 06-150
)	
Revision of the Commission's Rules to Ensure)	
Compatibility with Enhanced 911 Emergency)	WT Docket No. 94-102
Calling Systems)	
)	
Section 68.4(a) of the Commission's Rules)	WT Docket No. 01-309
Governing Hearing Aid-Compatible Telephones)	

COMMENTS OF TROPOS NETWORKS

Tropos Networks ("Tropos") submits these comments in response to the Federal Communications Commission's ("Commission") Notice of Proposed Rulemaking ("NPRM") in the above captioned proceeding.¹ The NPRM seeks public comment on a variety of licensing and service rules affecting both auctioned and unauctioned spectrum in the 698-746, 747-762, and 777-792 MHz bands ("700 MHz Band"). Tropos recommends that current Blocks A and B in the lower band of 700 MHz be designated for contention based unlicensed operations.

Tropos technology uses the radio spectrum to deliver broadband to individuals, businesses, and government agencies. Wi-Fi mesh technology, manufactured by Tropos and its competitors, uses unlicensed spectrum and has emerged as a model of facilities-based broadband competition to cities, suburbs, and rural areas. The technology is providing broadband to communities where incumbent providers do not make it available or where the service is

¹ In the Matter of Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones, *Notice of Proposed Rule Making, Fourth Further Notice of Proposed Rule Making, and Second Further Notice of Proposed Rule Making*, WT Docket No. 06-150, CC Docket No. 94-102, WT Docket No. 01-309, FCC 06-114 (rel. Aug. 10, 2006).

otherwise unaffordable. The technology is ideal for use in rural America, where the cost of wiring communities has often been prohibitive and where incumbent providers have consistently declined to provide broadband service. Tropos recommends that the Commission adopt rules that enable the 700 MHz Band to capture the ability of the unlicensed environment to provide affordable broadband networks expeditiously and within the President's goal of making affordable broadband available to all Americans by the end of 2007.²

I. INTRODUCTION

Tropos Networks, headquartered in Sunnyvale, California, provides wireless Wi-Fi technology that delivers broadband access using unlicensed spectrum. In more than 350 deployments, Tropos technology is providing wireless broadband (>1Mbps) over large geographic areas. Its MetroMesh architecture allows a network to be installed at substantial savings over legacy systems by eliminating costly backhaul and proprietary client devices. No large towers need to be constructed; no streets need to be excavated. The system's capacity is designed for advanced applications delivering voice and video. Portable wireless devices, now mass produced to operate in a Wi-Fi environment, contribute significantly to reducing cost and expanding consumer choice.

With its partners, Tropos has emerged as a facilities-based broadband provider in a market that desperately needs competition. Tropos is the technology provider to EarthLink in its Philadelphia and Anaheim projects, and in the Google/EarthLink San Francisco project. Tropos equipment in New Orleans, in place prior to Hurricane Katrina to support video surveillance, is

² President Bush stated in 2004, "I believe there ought to be broadband in every community and available to every house by the year 2007, in order to make sure America has lasting prosperity. And that's just the beginning. I think not only should broadband be accessible, but there ought to be ample providers available to every house and every community in America." *President Outlines Path for Lasting Prosperity in Wednesday Speech Remarks by the President at the Newspaper Association of America Annual Convention*, Omni Shoreham Hotel, Washington, D.C., Office of the Press Secretary (April 21, 2004) (available at <http://www.whitehouse.gov/news/releases/2004/04/20040421-5.html>).

being expanded in coverage and use. The innovation pervading Wi-Fi technology, the growing investment committed, and the expanding number of deployments is demonstrating how technology can lower cost and bring broadband to all Americans, especially those passed by in rural America.

A century ago, inexpensive electricity was available to only a small fraction of the U.S. population. Incumbent suppliers of electricity sought to limit who could offer electricity for many of the same reasons incumbent broadband providers now argue against community broadband deployment and services. Back then, incumbents sought to limit competition by arguing that local governments and affiliated interests did not have the expertise to offer something as complex as electricity. They argued that their own businesses would suffer if they faced competition from cities and towns. Local community leaders recognized that their economic survival and the health and welfare of their citizens depended on wiring their communities. They understood that it would take both private and public investment to bring electricity to all Americans. Fortunately, they prevailed. Just as municipal electric systems proved critical to making access to electric service universal in the 20th Century, municipal and similar networks can make broadband access universal in the 21st Century--as long as they have the freedom to do so.

In recognition of the importance of these networks, both the House and the Senate are moving forward with legislation that would ensure that local governments can partner with the private sector or directly deploy municipal broadband networks. Both Title IV of H.R. 5252 and Title V of the companion Senate bill would effectively repeal those State laws that stand in the way of community broadband networks. Given the strong support in the Congress for these kinds of networks, the Commission should embrace policies that ensure that they will flourish.

Local governments, rural cellular and telephone companies, community-owned utilities, and other interests have the skill and the vision to deploy broadband networks. The development of government-owned electric facilities offers a profound parallel of the investment and effort that brought opportunity to all Americans where there otherwise would have been none. The Commission now has the same opportunity with regard to broadband.

II. THE COMMISSION'S FOURTH NOTICE OF PROPOSED RULEMAKING

In reexamining the 700 MHz band, the Commission recognizes this opportunity. The band is a critical resource in deploying broadband to all Americans. Its propagation character can do much to harness investment and technology so that economic growth and productivity will enhance opportunity for all Americans. It can be the source of competition that the broadband market desperately needs. Yet, if the 700 MHz band is captured by proprietary devices, closed technology and only those interests able to expend billions, the opportunity will be squandered.

The Commission notes the evolution of the Commercial Mobile Radio Service (CMRS) industry and how critical competition is to promoting broadband access. Competition, however, has not arrived for broadband. Broadband access in the United States lags considerably behind others services. The Commission's own data indicate exceedingly higher penetration rates for wireline and wireless telephone service but not so for broadband. Globally, the United States lags considerably behind 15 other countries in affordable broadband access. In the mobile telephone service, the pervasive cell phone has shown the benefits of competitive markets where several providers, in concentrated population areas as many as five, compete on both price and offerings.

In broadband, consumers have at most two providers; many have none. Prices are high and service indistinguishable.³

The NPRM outlines several areas of inquiry that underlie the objective of promoting broadband access. These include the character of the 700 MHz band, the technical advances capable of deploying advanced high speed service that have transpired in the four years since the Commission promulgated its 700 MHz rules, the recognition that transaction and other costs are often the inhibiting factor to deploying broadband, that the size of service areas and markets have a relationship to promoting access and how deployment to rural areas and tribal lands are integral elements to bringing advanced communications to all Americans.

In Wi-Fi mesh networks using unlicensed spectrum the Commission has a successful model that is delivering advanced services at substantially reduced costs over legacy systems of incumbent providers. These networks encompass large geographic areas in urban, suburban, and rural environments. The infrastructure, a small breadbox shaped router, is deployed throughout the country and needs only street lamps or light poles. This facilities-based provisioning brings broadband to where there was none. The contention-based protocols of Wi-Fi mesh allow the spectrum to be used effectively by several interests rather than one or a few, to the exclusion of others. This enormous innovation in technology since the Commission first established its policies for the 700 MHz band gives credence to the need to reexamine and revise its rules.

³ The importance of speeding deployment of broadband services throughout America has been a matter of national policy for some time. Congress adopted Section 706 of the Telecommunications Act of 1996 requiring that the Commission “encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans . . .” Telecommunications Act of 1996, P.L. 104-104, Title VII, § 706, 110 Stat. 153. Section 309(j) of the Communications Act of 1934, as amended, establishes similar objectives, such as “rapid deployment of new technologies, products, and services for the benefit of the public,” and “efficient and intensive use of the electromagnetic spectrum.” 47 U.S.C. § 309(j)(3)(A) and (D).

Tropos urges the Commission to structure its service rules, the size of the markets, and its competitive bidding format to promote contention based unlicensed use in the 700 MHz band.⁴

The 700 MHz Band

The quality and importance of the 700 MHz band is well established. The lower the frequency, the longer the wave length. Longer length waves hold their energy over longer distances and also bounce around physical objects such as buildings. These are ideal wave lengths for wireless broadband just as they were for broadcast television. Additionally, these waves can carry tremendous amounts of information, allowing wireless broadband to deliver very high bit rates at lower cost and greater equality. In contrast, broadband and other services delivered at higher frequencies require more infrastructure costs because more base stations are needed to retransmit signals. These costs reduce the return on capital and embed additional costs on consumers.

The importance of access to the 700 MHz band for expanding broadband access cannot be overstated. Higher costs means higher prices to consumers. The Commission's policies should be based on lowering costs for the technologies capable of delivering advanced services. This is particularly true in rural America and in the Tribal Lands where costs are higher due to reduced density of customers. The lower the frequencies assigned to wireless broadband, the

⁴ In examining unlicensed operations in its TV white space proceeding, the Commission determined in 2004 not to consider unlicensed operations within channels 52-69 as the services rules for the Upper and Low 700 MHz Band had been established. In the Matter of Unlicensed Operations in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, FCC 04-113, ET Docket No. 04-186, ET Docket No. 02-380, *Notice of Proposed Rulemaking*, 19 FCC Rcd 10018, ¶¶ 33-34 (2004). Since that time, with the intervening Congressional actions and the technological advances, the Commission has asked for updated information to reconsider the structure and service rules for the 700 MHz Band. Tropos urges the Commission to reexamine its decision in view of the demonstrated capability of unlicensed spectrum to deliver affordable broadband.

more millions of people throughout America, including rural areas and Tribal Lands will be able to afford broadband access.

Wi-Fi mesh technology enables coverage of large areas with shorter-range transmissions. Tropos customers routinely operate unlicensed links in urban, suburban, and rural areas that use Listen before Talk (LBT) formats at the street level outside the home. The links are up to ½ mile in urban areas and 1 or more miles in flat, treeless areas. Mesh networks encompass uniform coverage across a city using the LBT based radios in unlicensed bands. Customers include ISPs with thousands of subscribers on these networks at the same time. There are no proprietary devices; consumers select from an array of choices offered by a highly competitive market. The result is quality broadband choice at lower cost. Contention-based protocols have proven to be a reasonable, cost effective method for ensuring the ability of any user to access the spectrum and are embodied in products that are available in the market today.⁵ These efficiencies combined with the propagation character of the 700 MHz Band will translate directly into affordable broadband.

The Commission's inquiry regarding the benefits due to the propagation characteristics of the 700 MHz Band spectrum over small areas and whether the 700 MHz Band spectrum has unique spectral advantages that would help lower deployment costs to rural or high-cost areas is

⁵ Systems using a contention protocol are common for both licensed and unlicensed systems. In unlicensed Wi-Fi devices under the IEEE 802.11 standard the contention based protocol known as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) uses a listen before talk scheme. This means that a station wishing to transmit first senses the radio channel to determine if another station is transmitting. If the channel is not busy, the transmission may proceed. The CSMA/CA protocol avoids collisions among stations sharing the medium by using a random back off time if the station senses a busy channel. This process is repeated until the station is allowed to transmit. Such a scheme ensures channel sharing while avoiding collisions. In the Matter of Wireless Operations in the 3650-3700 MHz Band, ET Docket No. 04-151, Rules for Wireless Broadband Services in the 3650-3700 MHz, WT Docket No. 05-96, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, ET Docket No. 02-380, Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Government Transfer Band, ET Docket No. 98-237, *Report and Order and Memorandum Opinion and Order*, FCC 05-56, 20 FCC Rcd. 6502, 20 FCC Rcd. 10,692 (2005).

well founded.⁶ The Commission's examination and decision should comprehend how the location and propagation character of the 700 MHz Band reduces costs but also that the spectrum must be accessible. Enormous entry costs, such as needed to purchase 700 MHz spectrum covering large geographic areas, will choke broadband deployment. The 700 MHz Band's ability to use technology to promote broadband depends on how accessible it is to those interests that will build the networks.

Shared Spectrum will Lower Transaction and Other Costs

The Commission's pronounced objective to lower transaction costs for providers and ultimately consumers of the spectrum relates to how the spectrum is used and how it is made available. These matters fit squarely within the Commission's authority to manage the spectrum; it is here where the Commission's ability to expand broadband access is most significant.

In the period since the Commission promulgated the original 700 MHz auction and services rules, the contention based shared spectrum environment and its deregulatory structure have made broadband more affordable and accessible. In shared spectrum, no exclusive usage right and interference protection imposes on technology the responsibility to ensure adequate interference management. Instead of being ensured of freedom from interference that pervades the historic spectrum management model, shared spectrum technology must confront it. Investment is directed toward compatibility with other users and interference management.

In contrast to the licensed and wireline environments, Wi-Fi mesh requires no enormous capital to build towers or excavate the streets. Routers are mounted to the street lamp or light pole in minutes. Additionally, capital expenditures are reduced because each router is not connected to the backhaul facilities. Networks need not be completed throughout the coverage

⁶ NPRM at Para 31.

area to commence service nor does expanding coverage disrupt the network. The inherent redundancy of the technology's architecture reduces default potential and the capital dedicated to address such circumstances. All these efficiencies contribute to enormous cost differences when compared to legacy systems and results in affordable broadband to the consumer.

In the contention based unlicensed environment, expeditious deployment and commencing service is critical as shared spectrum providers must compete with wireline and other unlicensed providers. There are no moratoriums of service as in a licensed regime build out period. Investment earns its return by providing better service. The likely presence of competition is immediate, motivating innovations and resulting in expanded consumer choice. As infrastructure costs are nominal, with no proprietary devices needed to access the network, costs are reduced enormously. When combined with these attributes, the 700 MHz band can make broadband access by all Americans a reality.

THE COMMISSION'S AUCTION AND SERVICE RULES IN THE 700 MHZ SPECTRUM BAND SHOULD EMBRACE A CONTENTION BASED UNLICENSED ENVIRONMENT

The proven experience of municipal Wi-Fi mesh networks using unlicensed spectrum, where private investment has joined with government-owned assets, presents a proven model where advanced broadband services are being delivered at enormous cost efficiencies, generating competition and resistance from incumbent providers. The experience demonstrates the Commission's need to promote a contention based unlicensed environment and its ability to deploy broadband expeditiously in its auction and service rules for the 700 MHz spectrum Band.

The auction and service rules should recognize the position of the Rural Cellular Association that the use of smaller license areas will accelerate the delivery of broadband

services.⁷ The rules should also recognize that the goal is broadband deployment, leveraging the innovation associated with the unlicensed environment. By combining smaller service areas with a bidding credit tied to promoting immediate investment in advanced services, rural cellular and telephone companies, municipalities, community owned utilities and the private interests that have invested in these entities, will have an ability and incentive to participate in the auction.

The bidding credit would be contingent on the rapid deployment of advanced services. The standard to be met would be clear as would be the timeframe to complete deployment. The entity awarded a license would administer a contention based unlicensed spectrum environment. It could provide service itself and allow other entities, in exchange for a user fee, to provide advanced services. The user fee would recoup the auction investment and the bidding credit.

The Commission's rules addressing the obligation to provide substantial service would be revised to bring clarity to the goal pursued--universal access to broadband. The current requirement "substantially above the level of mediocre service" would be replaced by a standard embracing the delivery of advanced services within an established yet limited time frame. A licensee would be evaluated on the number of entities providing services and/or the number of users that have gained broadband access.

Tropos recommends that current Blocks A and B in the lower band of 700 MHz be designated for contention based unlicensed operations. Now known as TV broadcast channels 52-53 and 57-58, these four six megahertz segments will allow the unlicensed environment to provide robust advanced services while protecting adjacent users. The contention based technology and the size of the segments will allow multiple providers to use the network. It will

⁷ *Petition to Institute Review and Modification of the Size of Service Areas for Geographic Licensing for the Lower and Upper Bands of 700 MHz Not Yet Auctioned, Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 53-59), GN Docket No. 01-74, Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, by the Rural Cellular Association (filed July 29, 2005).*

make real broadband available at substantial cost efficiencies and more expeditiously compared to the licensed and proprietary technology historically associated with auctioned spectrum. With smaller services areas, the character of the 700 MHz spectrum and these efficiencies, opportunity to participate in the auction will be expanded considerably. This structure also accommodates the Commission's concern regarding Blocks C& D of the lower 700 MHz Band that have already been auctioned and that any reconfiguration not be detrimental to these licenses.

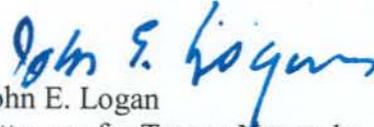
In the NPRM, the Commission notes the possibility of allocating smaller band segments to accommodate particular technologies. Various technologies can operate at smaller or larger individual channels. Delivering real broadband will not be accomplished by 1.25 MHz or 1.75 MHz channels; it is the entire channel capacity that is relevant. Tropos believes it important that the objective of deploying advanced services expeditiously is paramount. The question evolves around what capacity is needed. Wi-Fi mesh technology can meet this goal within the currently designated A and B Blocks segment in the lower 700 MHz band.

III. CONCLUSION

With the 700 MHz Band, the Commission is on the verge of being able to unleash revolutionary broadband technology. The Commission has a chance to take action that will deliver enormous cost savings to these emerging wireless broadband technologies. It can save billions of dollars in cost and make wireless broadband available to millions more people, without a significant expenditure of public funds. The Commission needs to allocate the optimal spectrum to the future of communications instead of its past to connect everyone to each other and to the knowledge of the world.

Respectfully submitted,

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