

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

In the Matter of	)	
Amendment of Part 101 of the Commission's	)	
Rules to Facilitate the Use of Microwave for	)	WT Docket No. 10-153
Wireless Backhaul and Other Uses and to Provide	)	
Additional Flexibility to Broadcast Auxiliary	)	
Service and Operational Fixed Microwave	)	
Licenses	)	
	)	
Request for Interpretation of Section 101.141(a)(3)	)	WT Docket No. 09-106
of the Commission's Rules Filed by Alcatel-	)	
Lucent, Inc., <i>et al.</i>	)	
	)	
Petition for Declaratory Ruling Filed by Wireless	)	WT Docket No. 07-121
Strategies, Inc.	)	
	)	
Request for Temporary Waiver of Section	)	
101.141(a)(3) of the Commission's Rules Filed by	)	
Fixed Wireless Communications Coalition	)	

**COMMENTS OF CLEARWIRE CORPORATION**

Cathleen A. Massey  
Vice President, Regulatory Affairs  
& Public Policy  
Erin Boone  
Corporate Counsel, Regulatory Affairs  
Clearwire Corporation  
1250 I Street, N.W.  
Suite 901  
Washington, D.C. 20005  
(202) 351-5033

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**COMMENTS OF CLEARWIRE CORPORATION**

Clearwire Corporation ("Clearwire") hereby respectfully submits these comments in the above-captioned proceedings. Clearwire commends the Commission for initiating this proceeding to identify ways to increase efficient use of spectrum for backhaul and for providing more flexible use of microwave frequencies for backhaul. As the nation's first 4G mobile wireless broadband provider, Clearwire agrees with the Commission's determination that access to cost-efficient and effective backhaul solutions are critical to the deployment of 4G mobile broadband networks across America.<sup>1</sup>

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<sup>1</sup> In the Matter of Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licenses, *Notice of Proposed*

## I. SUMMARY

Clearwire supports the Commission's proposal to make an additional 750 MHz spectrum available for Fixed Service ("FS") use by maximizing the opportunity for FS to share existing bands reserved for Broadcast Auxiliary Service ("BAS") and Cable TV Relay Service ("CARS"). Further, Clearwire recommends that the Commission:

- Extend the more formalized frequency coordination procedures that exist today in the 6525-6875 MHz band to both of the two new allocations;
- Mandate identification of receive-only sites associated with TV pickup stations in the 6875-7125 MHz band;
- Assign a variety of overlapping bandwidths within each Part 101 FS band; and
- Examine its rules and consider changes to permit smaller diameter antennas in the Part 101 FS bands.

In addition, while Clearwire will not directly benefit from the proposal to permit adaptive modulation, Clearwire sees the benefit of the proposal to other carriers. Clearwire agrees with the Commission's tentative conclusion to amend Section 101.141 of its rules to state that the minimum payload capacity requirements must be met at all times, except during anomalous signal fading when lower capacities may be utilized.

Finally, Clearwire opposes Wireless Strategies, Inc.'s ("WSI") proposal to permit auxiliary stations. Clearwire is concerned that the proposal will increase the probability of interference in an already congested environment. It will also introduce time-division ("TDD")

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*Rulemaking and Notice of Inquiry*, WT Docket No. 10-153, WT Docket No. 09-106, WT Docket No. 07-121 (rel. August 5, 2010) ("NPRM" and "NOP").

operation into historically frequency-division duplexing (“FDD”) bands to the detriment of high capacity FDD systems, such as Clearwire’s.

## II. BACKGROUND

Clearwire operates open, Internet-Protocol (“IP”) 4G wireless broadband networks in markets across the United States and Europe. These networks provide communities with high-speed residential and mobile Internet and interconnected voice over Internet protocol (VoIP) services. As of October 2010, Clearwire has nearly two million wireless broadband subscribers and is rapidly deploying 4G broadband wireless service that utilizes the WiMAX technology standard in new markets and converting its pre-WiMAX markets to the 4G standard.<sup>2</sup> Clearwire has announced that by the end of 2010, its 4G WiMAX network is expected to be available in more than 80 markets covering up to 120 million people.<sup>3</sup>

As the nation’s first, greenfield 4G wireless broadband provider, Clearwire was able to develop and deploy a backhaul strategy specifically designed for the demands of 4G mobile broadband. A key component of that strategy is the use of cost-effective microwave backhaul that is simple to install and manage, yet delivers the capacity and reliability needed for the

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<sup>2</sup> CLEAR 4G service is currently available in 56 markets across the United States, including: Minneapolis/St. Paul, Minn.; Nashville, Tenn.; Boston, Mass.; Orlando, Daytona Beach and Jacksonville, Fla.; Providence, R.I.; Wilmington, Del.; Grand Rapids, Mich.; Syracuse and Rochester, N.Y.; Atlanta and Milledgeville, Ga.; Baltimore, Md.; Boise, Idaho; Chicago, Ill.; Las Vegas, Nev.; St. Louis and Kansas City, Mo.; Pittsburgh, Philadelphia, Harrisburg, Reading, Lancaster and York, Pa.; Charlotte, Raleigh, and Greensboro, N.C.; Honolulu and Maui, Hawaii; Seattle, Tri-Cities, Yakima and Bellingham, Wash.; Salem, Portland and Eugene, Ore.; Merced, Visalia, Modesto and Stockton, Calif.; Dallas/Ft. Worth, Houston, San Antonio, Austin, Abilene, Amarillo, Corpus Christi, Killeen/Temple, Lubbock, Midland/Odessa, Waco and Wichita Falls, Texas; central Washington, D.C.; Richmond, Va.; and Salt Lake City, Utah.

<sup>3</sup> By the end of 2010, CLEAR 4G will also be available in major metropolitan areas such as New York City, Los Angeles, the San Francisco Bay area, Denver, Miami, Cincinnati and Cleveland.

explosive demand of broadband customers. Clearwire designed its microwave backhaul network around the following key requirements:

- Packet-based, all IP solution to ensure greater efficiency and compatibility with next generation applications and services;
- High capacity and scalability;
- Low latency supporting real-time applications, including voice and video over IP;
- Rapid deployment; and
- Carrier-grade reliability utilizing an advanced ring architecture.

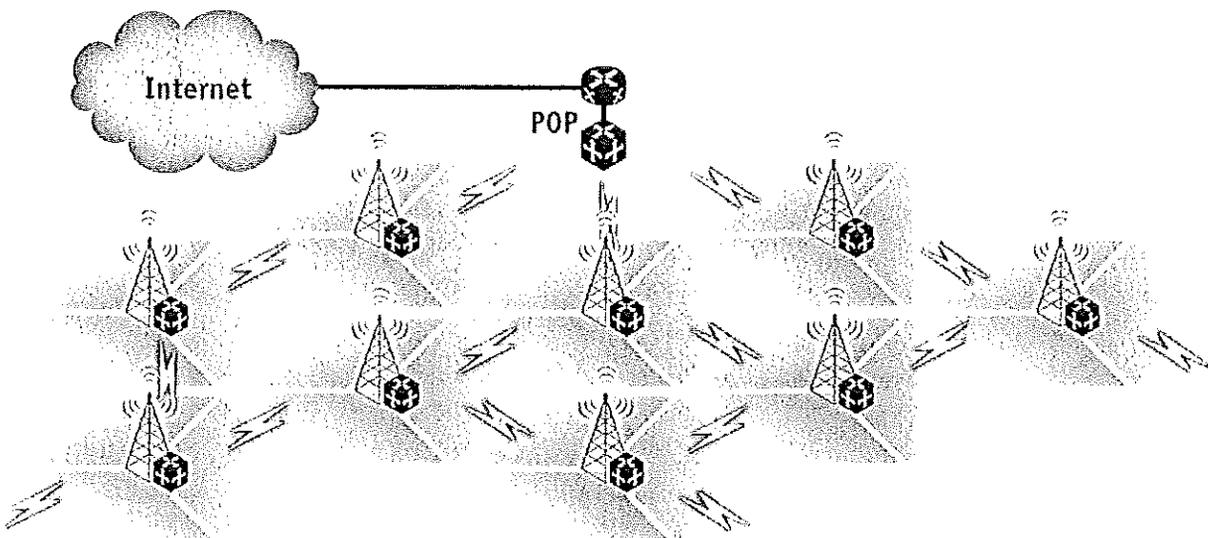
Today, Clearwire operates the largest wireless backhaul network in the United States and uses microwave backhaul for more than 90 percent of its cell sites. It has employed microwave to break what the company calls internally the “backhaul bottleneck.” Traditional cellular networks rely on copper based TDM circuits at more than 80 percent of their cell sites. TDM backhaul can account for more than 30 percent of a wireless carriers’ operating expense, is notoriously slow to deploy and is not well suited for the high-capacity demands of 4G. For example, Clearwire’s WiMAX network is carrying significantly higher payloads than 2G/3G networks (approximately 30-60 Mbps per site) that would require more than 20 T1s per site using a traditional TDM backhaul solution. As a result, Clearwire estimates that by relying on microwave, its backhaul deployment costs are approximately 50 percent less—both in terms of capital expenditure and time—relative to traditional cellular implementations.<sup>4</sup>

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<sup>4</sup> Traditional 2G/3G wireless carriers had little choice but to build their existing and expansive backhaul networks on TDM circuits since the sophisticated microwave technology employed by Clearwire was not available until recently. These TDM based networks were built on a wholly different architecture from Clearwire’s network and cannot be quickly or easily retrofitted with Ethernet microwave mesh. Consequently, Clearwire’s construction of a greenfield microwave backhaul system should not be cited as a solution for the deep dysfunction

Clearwire's backhaul network architecture departs radically from the "hub and spoke" or "tree and branch" designs that were typical before the advent of 4G. In fact, the equipment needed to support an Ethernet-based microwave mesh such as Clearwire's backhaul network has only been available for a few years. Consequently, Clearwire is the first mobile broadband provider to incorporate a microwave backhaul system into its network from its inception. As shown in Figure 1 below, Clearwire relies on a ring topology that provides 99.999 percent network availability by providing redundant link diversity from every cell site location.

Figure 1. Clearwire Microwave Backhaul Network



Design Criteria:

- 99.995% availability per PTP link
- Ring topology provides 99.999% network availability
- Diverse path using PBT (PBB-TE) from every site

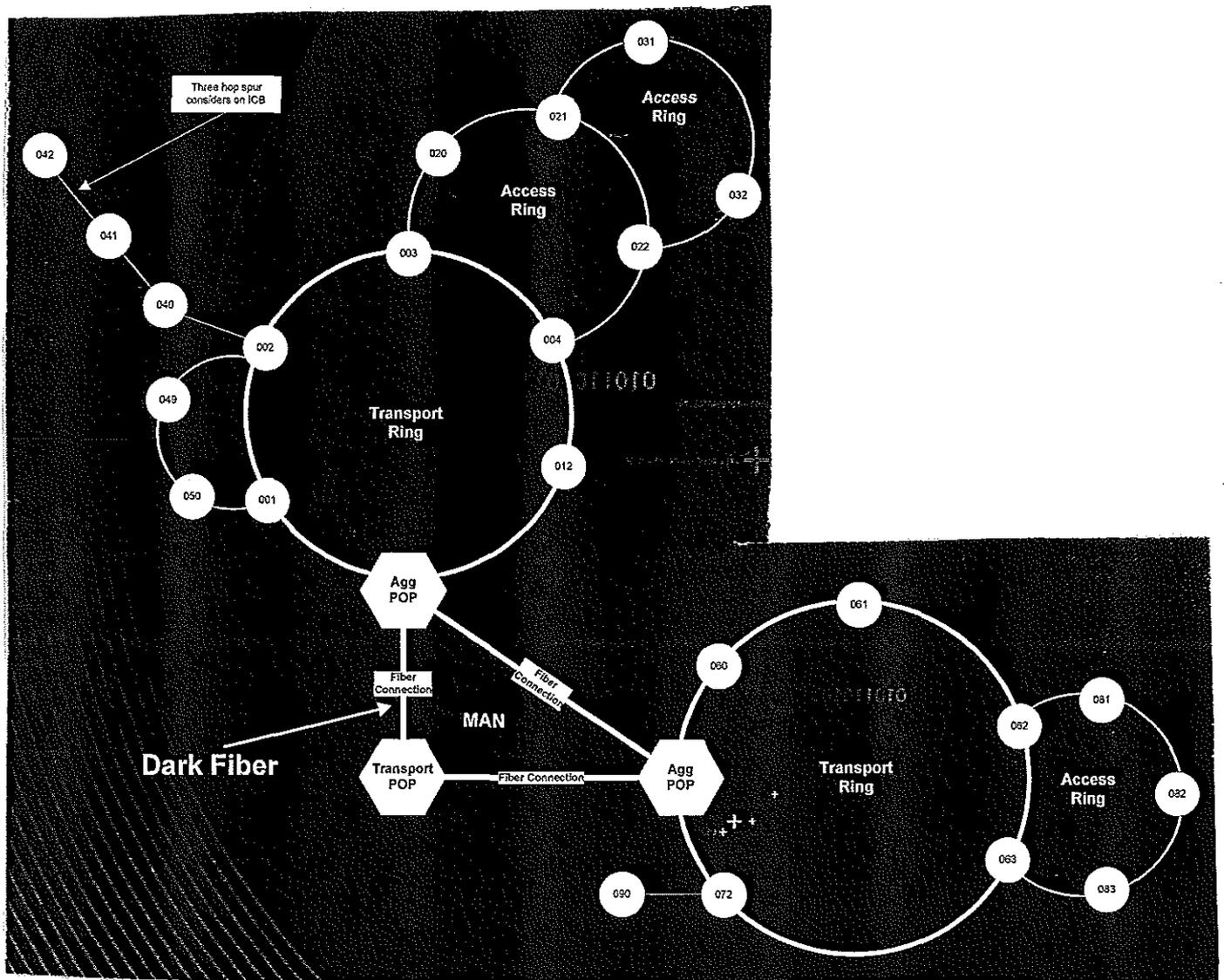
While there is a wide range of microwave frequencies that can be deployed within Clearwire's backhaul network, the most commonly utilized microwave bands within the system are licensed 11 GHz links with 40 MHz channels, and 18 and 23 GHz links with 50 MHz channels. Clearwire also uses a substantial amount of unlicensed spectrum at 5.4 and 5.8 GHz in

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that permeates the special access marketplace. Clearwire fully supports efforts by the "No Choke Points" Coalition and others seeking reform.

partially blocked line-of-site (nLOS) applications and high interference environments. As shown in Figure 2 below, Clearwire uses a multi-layered ring topology that is both redundant and scalable to accommodate increases in capacity demand. As noted below, Clearwire links its microwave aggregation points with dark fiber transport that is also connected by redundant pathways.

Figure 2. Ring Topology



### III. DISCUSSION

#### A. Clearwire Supports the Commission's Proposal to Make Additional Spectrum Available for Part 101 FS Operations

Clearwire supports the Commission's proposal to make an additional 750 MHz of spectrum available for FS uses by maximizing the opportunity for FS to share existing bands reserved for BAS and CARS. As the Commission notes, the amount of mobile data traffic in North America is expected to increase by a factor of 20 to over 40 times the level of data traffic in 2009.<sup>5</sup> This explosion of mobile broadband demand can only be met if carriers increase their backhaul capacity, including microwave backhaul, to accommodate that traffic. As the Commission notes, there is already a well-documented history demonstrating that FS, BAS and CARS operations can co-exist, assuming that frequency coordination procedures are adhered to the help minimize interference concerns among the services. Clearwire, therefore, recommends that the Commission move ahead with its proposal to permit FS operations in the 6875-7125 MHz band, but that it extend the more formalized frequency coordination procedures that exist today in the 6525-6875 MHz band to both allocations. As part of the establishment of more formalized frequency coordination, the Commission should make the identification of receive-only sites associated with TV pickup stations mandatory in the 6875-7125MHz band. Otherwise, a key component to successful coordination may be missing.

Clearwire also supports the Commission's proposal to introduce FS systems into the 12700-13200 MHz band. This band has been underutilized for some time, and as the Commission notes, is well suited for short to medium length backhaul microwave links.<sup>6</sup> As with the 6875-7125 MHz band, Clearwire recommends that the Commission use its existing,

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<sup>5</sup> See *NPRM* at ¶ 3, citing National Broadband Plan at Section 5.1 p. 77, Exhibit 5-A.

<sup>6</sup> See *NPRM* at ¶ 16.

more formal, frequency coordination process in the 12700-13200 MHz band. Establishing the same frequency coordination process for all of the shared bands is likely to lead to the greatest success with regard to interference free operations for all parties in the bands. It also has the benefit of establishing uniformity across shared spectrum.

With regard to channelization schemes for the new shared bands, Clearwire endorses the Commission's recent decision to assign a variety of overlapping bandwidths within each Part 101 FS band so that applications can choose a channel width appropriate for their needs.<sup>7</sup> In addition, Clearwire supports the Commission's proposal to apply the same technical parameters that currently apply to the Upper 6 GHz band to the adjacent 6875-7125 MHz band with one important exception. Clearwire urges the Commission to examine its rules and consider changes to Category A (also known as Standard A) and Category B (also known as Standard B) that would accommodate the deployment of smaller antennas. Currently, the smallest diameter antenna permitted in the Upper 6 GHz band is six feet. As the Commission has done with regard to the 11 GHz band, the Commission should update its rules to account for technology advancements and more sophisticated band sharing techniques, and permit the deployment of different antenna geometries and smaller diameter antennas. Clearwire urges the Commission to foster the development of different antenna geometries in addition to developing radio pattern envelope (RPE) standards for smaller diameter antennas using current parabolic geometries. The gain of an antenna is determined by the intended area of coverage. The gain at a given wavelength is achieved by appropriately choosing the size of the antenna. Developing different antenna geometries provides the most deployment flexibility while promoting higher performance, lower profile antennas.

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<sup>7</sup> See *NPRM* at ¶ 18.

**B. Clearwire Does Not Oppose the Proposal to Allow FS Licensees to Use Adaptive Modulation**

Because Clearwire's microwave ring topology is designed to operate its microwave links at the maximum capacity that the link can support under the design conditions (rain zone, path length, antenna diameter etc.), Clearwire would not directly benefit from the proposal to permit adaptive modulation. Clearwire does, however, see the benefit of the adaptive modulation proposal for other microwave backhaul systems and does not object to or oppose the proposal to permit adaptive modulation. Clearwire does, however, agree that the Commission needs to ensure that scarce spectrum resources are efficiently and effectively put to use. It therefore agrees with the Commission's tentative conclusion to amend Section 101.141 of its rules to state that the minimum payload capacity requirements must be met at all times, except during anomalous signal fading, when lower capacities may be utilized in order to maintain communications.<sup>8</sup>

**C. Clearwire Opposes Wireless Strategies, Inc.'s Proposal to Permit Auxiliary Stations**

Clearwire agrees with the comments filed by Comsearch and others that the Commission should reject the proposal of WSI to permit the deployment of additional auxiliary links designed to reuse the same frequency near the coordinated/licensed transmitter. As is explained more in the comments of Comsearch and others in the coordination community, Clearwire is concerned that the proposal will increase the probability of interference in an already congested environment. Clearwire is also concerned that the proposal promotes the introduction of TDD operation into historically FDD bands. This change would have a deleterious impact on the existing and future use of high capacity FDD systems, such as Clearwire's, without any obvious

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<sup>8</sup> See *NPRM* at ¶ 39.

countervailing benefit. In addition, Clearwire is concerned that the WSI proposal is overbroad, appears to be highly theoretical, is devoid of field testing data and is not supported by a broad swath of the FS industry.

#### **IV. CONCLUSION**

For the foregoing reasons, Clearwire largely supports the Commission's proposals to promote the efficient use of spectrum for backhaul and for providing more flexible use of microwave frequencies for backhaul.

Respectfully submitted,

By: /s/ Cathleen A. Massey

Cathleen A. Massey  
Vice President, Regulatory Affairs  
& Public Policy  
Erin Boone  
Corporate Counsel, Regulatory Affairs  
Clearwire Corporation  
1250 I Street, N.W.  
Suite 901  
Washington, D.C. 20005  
(202) 351-5033

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