

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

In the matter of

Modification of Parts 2 and 15 of the  
Commission's Rules for unlicensed devices  
and equipment approval.

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ET Docket No. 03-201

To: The Commission

**JOINT REPLY COMMENTS OF  
CELLNET TECHNOLOGY, INC. AND HUNT TECHNOLOGIES, LLC**

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## SUMMARY

Cellnet Technology, Inc. (“Cellnet”) and Hunt Technologies, LLC (collectively, “Cellnet + Hunt”) support the Commission’s adoption of the spectrum etiquette for unlicensed Part 15 products in the 902 – 928 MHz (“915 MHz”) band as proposed in the Further Notice of Proposed Rulemaking.

The proposed spectrum etiquette will not preclude any specialized use of the band, including wireless internet access. The spectrum etiquette establishes a trade-off between “quiet time” or amount of time in between transmissions and power output. Thus, there will be no technical bar to the use of the band for any particular unlicensed application, although the range of some applications may be reduced.

The proposed spectrum etiquette is intended to resolve the growing problems documented by commenters in this proceeding. Specifically, the current Part 15 rules permit the introduction of digitally modulated devices in the 915 MHz band that operate at maximum power levels in “always on” mode (*i.e.*, without a sufficient quiet time of transmission for other devices to access spectrum). Yet such devices do not allow for other Part 15 devices to operate within the same geographic area to pass data without interference. To document this, Cellnet provides specific data concerning an actual interference event. Adoption of the proposed spectrum etiquette will pave the way for the continued success of devices in the band used by both average consumers as well as many industry sectors including energy, medicine, transportation, and many others. Finally, just as importantly, the proposed spectrum etiquette will ensure that a growing community of users will have access to the 915 MHz band for their own diverse applications.

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Cellnet Technology, Inc. and Hunt Technologies, LLC (collectively, “Cellnet + Hunt”), hereby submit their joint reply to comments filed by other parties in this proceeding.<sup>1</sup> Cellnet + Hunt reiterate their strong support for the adoption of a spectrum etiquette for unlicensed operations in the 902-928 MHz band (“915 MHz Band”). The record clearly demonstrates that a spectrum etiquette should be adopted by the Commission so that significant portions of the band cannot be effectively taken over in large geographic areas by one or a few users employing unlicensed devices that utilize digital modulation (“DM”) techniques at maximum power and “always on” operation. By adopting a spectrum etiquette, the Commission will ensure that the 915 MHz Band

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<sup>1</sup> See *Modification of Parts 2 and 15 of the Commission’s Rules for Unlicensed Devices and Equipment Approval*, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 22 FCC Rcd 11383 (2007) (hereinafter “Part 15 FNPRM”).

remains a viable space for the numerous and varied commercial, consumer and public safety applications and services for which it was intended.<sup>2</sup>

Almost ten years ago, a coalition of unlicensed users, including Motorola, urged the Commission to update its “[r]egulations... to match technological and market evolutions, notwithstanding the somewhat extraordinary view of a few commenting parties that stability and certainty are more important than up-dating regulation, and that the Commission should refuse to “rock the boat” for fear of introducing uncertainty in the Part 15 marketplace.”<sup>3</sup> Today, the 915 MHz Band is faced with a similar situation: the Commission has rightly recognized that its regulations must be updated to reflect the preclusive effects of digitally modulated devices that exploit the flexibility of the Part 15 Rules to the detriment of all other unlicensed users. While introduction of a spectrum etiquette may have a short term “rock the boat” impact, the benefits for existing and potential users of the band over the long-term clearly justify such regulations. As the comments in this proceeding have demonstrated, a spectrum etiquette is the best means for coordinating and preserving the varied uses that exist today in the 915 MHz Band and that are certain to be developed in the future.<sup>4</sup> Equally as important, no

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<sup>2</sup> By way of clarification, Cellnet + Hunt supports a spectrum etiquette in the 902-928 MHz band based on changes to 47 C.F.R. § 15.247. Therefore, comments concerned with the 2.4 GHz and 5 GHz Bands as well as potential changes to 47 C.F.R. § 15.249 will not be addressed herein.

<sup>3</sup> See Reply Comments of the Committee for Unlicensed Broadband Enablement (“CUBE”) (Intel, Micrilor, Motorola, Proxim and Siemens), ET Docket No. 99-231, at 45 (filed Nov. 19, 1999).

<sup>4</sup> A small sample of devices and applications which rely on the availability of unlicensed spectrum in the 902-928 MHz Band include: Supervisory Control and Data Acquisition (“SCADA”) systems for oil and gas operations; Automatic Meter Reading (“AMR”) and Advanced Metering Infrastructure (“AMI”) systems; IP radios for mobile computing; RFID tracking of freight containers; wireless broadband access; baby monitors; video cameras; data transfer from locomotive event recorders; cardiac devices with radio

commenter has provided a convincing explanation as to why a spectrum etiquette would present a technical bar to the provision of any service or application that is currently utilizing the 915 MHz Band or that may be developed for use in this band in the future.

**I. THE PROPOSED SPECTRUM ETIQUETTE WILL NOT PRECLUDE ANY PARTICULAR USE OF THE 915 MHZ BAND**

**A. The Proposed Spectrum Etiquette Will Not Preclude the Provision of Wireless Internet Service, Although it May Reduce its Range**

Although Cellnet made clear that the imposition of a spectrum etiquette should not serve as a technical bar to the deployment of any particular application or service utilizing devices in the 915 MHz band, most of the opposition to a spectrum etiquette is based on the view that it will be particularly harmful to systems designed to provide last-mile Internet connectivity. This is simply not true. It may well be that for devices designed to operate under the proposed spectrum etiquette, the geographic range that unlicensed devices offering significant throughput can cover may be more limited than that of digitally modulated devices that operate today at maximum, “always on” power on very high towers – surely well less than the 40 mile radius that Motorola seeks to achieve with its Canopy system.<sup>5</sup> But the impact on Wireless Internet Service Providers

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telemetry; and patient monitoring devices. *See* Comments of American Petroleum Institute and the Utilities Telecom Council, ET Docket No. 03-201, at 3-4 (filed Oct. 15, 2007) (“API Comments”); Comments of Itron, Inc., ET Docket No. 03-201, at 2 (filed Oct. 15, 2007); Comments of the Medical Device Manufacturing Association, ET Docket No. 03-201 at 1 (filed Oct. 15, 2007); Comments of American Association of Railroads, ET Docket No. 03-201, at 3-4 (filed Oct. 15, 2007); Comments of PECO Energy, ET Docket No. 03-201, at 1 (filed Oct. 15, 2007); Comments of WE Energies, ET Docket No. 03-201, at 1 (filed Oct. 15, 2007) (“WE Energies Comments”); Comments of Consumer Electronics Association, ET Docket No. 03-201, at 3-4 (filed Oct. 15, 2007) (“CEA Comments”).

<sup>5</sup> The 40 mile range that Motorola seeks to achieve from a single unlicensed transmitter – and the potential area in which other unlicensed device operations would be disrupted – is more consistent with a licensed product than that of the overwhelming majority of

(“WISPs”) will be commercial, not technical; WISPs may simply be required to use more sites or they may be capable of offering service to a fewer number of subscribers from any given site. But by requiring such devices to trade “quiet time” for power increases, the Commission will assure that many multiples of 915 MHz Band devices will gain access to this spectrum over a wide geographic area that would otherwise be effectively denied its use. Indeed, the very admission that WISP devices are designed to effectively occupy large parts of this band over such a huge geographic range alone demonstrates the need for further controls over such devices if the band is to have any use by other unlicensed products.

Polycom opposes the Cellnet + Hunt proposal because, Polycom suggests, WISP devices that would be particularly adversely affected by the etiquette are generally used in remote areas where other Part 15 devices are not prevalent.<sup>6</sup> This premise is inaccurate on two counts. First, Part 15 DM devices using maximum power and little quiet time are being deployed in urban, ex-urban and rural settings, and the record in this proceeding demonstrates that Motorola Canopy devices have, in fact, been deployed for wireless internet and video surveillance in urban areas.<sup>7</sup> Second, as AMR networks are being deployed by large utility companies across their entire service area and RFID devices are being deployed in all areas of the country, Part 15 products that could not access the 915 MHz band in large geographic areas without harmful interference from DM devices are equally prevalent in rural and ex urban areas of the country as well as in urban

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devices operating on an unlicensed basis. *See* Comments of Motorola, Inc., ET Docket No. 03-201, at 7 n.16 (filed Oct. 15, 2007) (“Motorola Comments”).

<sup>6</sup> *See* Comments of Polycom, Inc., ET Docket No. 03-201, at 4 (filed Oct. 15, 2007) (“Polycom Comments”).

<sup>7</sup> *See* WE Energies Comments at 3.

environments. WISPs, alone, would make the Commission choose between particular services or applications by demanding complete control over all or large parts of the band to serve one public interest goal in rural or urban areas; those parties supporting a spectrum etiquette join Cellnet + Hunt in seeking to provide opportunities for any application or service to survive in an environment in which no single user can “dominate” the band over large areas to the exclusion of all others.

Cellnet’s proposed etiquette is designed to facilitate sharing without denying use of the spectrum to any unlicensed user of the 915 MHz Band. Contrary to the suggestions of many of those who oppose the etiquette, no high throughput application would be denied use of the band, as long as it was achieved with reduced power. Thus, for example, contrary to the allegations by Polycom, Voice over Internet Protocol (VoIP) applications will not be technically precluded from being used in the band.<sup>8</sup> Similarly, the trade-off between quiet time and power would not render the band “useless” for other high throughput applications and devices;<sup>9</sup> the limitation would simply be on the range at which such devices would be able to operate effectively. For indoor devices which do not operate at maximum power, the etiquette is unlikely to result in any perceivable reduction in quality of service; real-time devices like baby-monitors and cordless phones would be largely unaffected by the changes presented by the etiquette, since they do not typically require maximum authorized power in order to provide quality service.<sup>10</sup>

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<sup>8</sup> See e.g., Polycom Comments at 5.

<sup>9</sup> See *id.*

<sup>10</sup> See Comments of Shure, Inc., ET Docket No. 03-201, at 4-6 (filed Oct. 15, 2007) (“Shure Comments”) (Expressing concern that an etiquette would render the 915 MHz band unusable.)

## II. A SPECTRUM ETIQUETTE FOR THE 902-928 MHZ BAND IS IN THE PUBLIC INTEREST

Numerous commenters have recognized that in order to continue the successful use of the 915 MHz Band by a wide range of devices providing an enormous variety of commercial and consumer benefits, it is necessary that the Commission adopt a spectrum etiquette. As Cellnet + Hunt and other commenters have documented,<sup>11</sup> the 915 MHz Band has been a fountainhead for innovation in unlicensed applications. As a result, today, hundreds of millions of Part 15 devices have been deployed<sup>12</sup> – including millions of devices deployed by Cellnet + Hunt alone -- generally without creating destructive interference to each other. Indeed, it is one of the Commission’s great accomplishments that, prior to the introduction of DM devices, the 915 MHz band was a proving ground for an enormous number of commercial and consumer applications with an extremely low number of irreconcilable interference issues.

One of the primary drivers in this proliferation of devices has been the Commission’s requirement that Part 15 devices be “constructed in accordance with good engineering and manufacturing practice” and suppress emanations “as much as practicable.”<sup>13</sup> In keeping with this spirit, the proposed spectrum etiquette will simply re-confirm in technical rules affecting the 915 MHz Band that new digitally modulated devices may not operate in such a way as to effectively convert unlicensed bandwidth to their exclusive use and effectively bar other valuable unlicensed users from the band.

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<sup>11</sup> See Comments of Cellnet + Hunt, ET Docket No. 03-201, at 2-5 (filed Oct. 15, 2007) (“Cellnet + Hunt Comments”); Comments of S5 Wireless Inc., ET Docket No. 03-201, at 4-5 (filed Oct. 15, 2007) (“S5 Wireless Comments”); CEA Comments at 2-3.

<sup>12</sup> See *Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems*, Second Report and Order and Second Memorandum Opinion and Order, 19 FCC Rcd 24558, 24591 n.183 (2004).

<sup>13</sup> 47 C.F.R. § 15.15(a).

**A. Interference Concerns Threaten a Wide Community of 902-928 MHz Uses**

The 915 MHz Band is currently home to a large variety of devices with critical uses for the American citizenry.<sup>14</sup> Yet, significantly, the opponents to spectrum etiquette in the 915 MHz Band generally coalesce in favor of just a single use for the band – wireless broadband access.<sup>15</sup> Cellnet + Hunt certainly recognize the vital importance of broadband deployment, but the public interest demands that all types of wireless devices can and should be able to coexist in the 915 MHz Band with other users.<sup>16</sup>

As one commenter has recognized, if a spectrum etiquette is not adopted, the varied uses and devices in the 915 MHz Band will be threatened by a “race for the bottom”; in such circumstances, a number of spectrally inefficient devices cause levels of interference that effectively block others from use of the band without any adverse consequences except the possibility that another device will come along that knocks the initial “offender” out of service as well.<sup>17</sup> Ironically, those WISPs who oppose a spectrum etiquette fail to recognize this likely consequence; their systems are no less susceptible to interference from a competing service provider who also operates at

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<sup>14</sup> *See, e.g.*, footnote 4, *supra*.

<sup>15</sup> *See e.g.*, Motorola Comments at 9; Comments of Kansas Broadband, Inc., ET Docket No. 03-201, at 1 (filed Oct. 15, 2007); Comments of SmarterBroadband, ET Docket No. 03-201, at 1 (filed Oct. 15, 2007).

<sup>16</sup> Cellnet + Hunt commend the efforts of Commission and industry to pursue the laudable goal of broadband deployment throughout the country, including in rural areas. It is important to note, however, that such broadband deployment efforts also enjoy access to licensed spectrum opportunities including 700 MHz, and 2.5 GHz that may not be available for other uses. *See e.g.*, Remarks of Hon. Kevin J. Martin, Chairman, FCC, Before the Committee on Small Business, U.S. House of Representatives, at 2 (Oct. 10, 2007), available at: [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-277217A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-277217A1.pdf).

<sup>17</sup> *See* Comments of GE MDS, LLC, Freewave Technologies, Inc. and Dataradio, Inc., ET Docket No. 03-201, at 4 (filed Oct. 15, 2007) (“GE MDS et al. Comments”).

maximum power in an “always on” mode. That is simply not the policy that has, for decades, allowed unlicensed use of the 915 MHz band to flourish. Indeed, while the proposed etiquette will not prohibit or limit the viability of the band for any particular use, the lack of an etiquette clearly threatens the viability of the band for a large number and wide variety of uses.

**B. Cellnet + Hunt Have First-hand Experience with Interference from Digitally Modulated Devices in the Band**

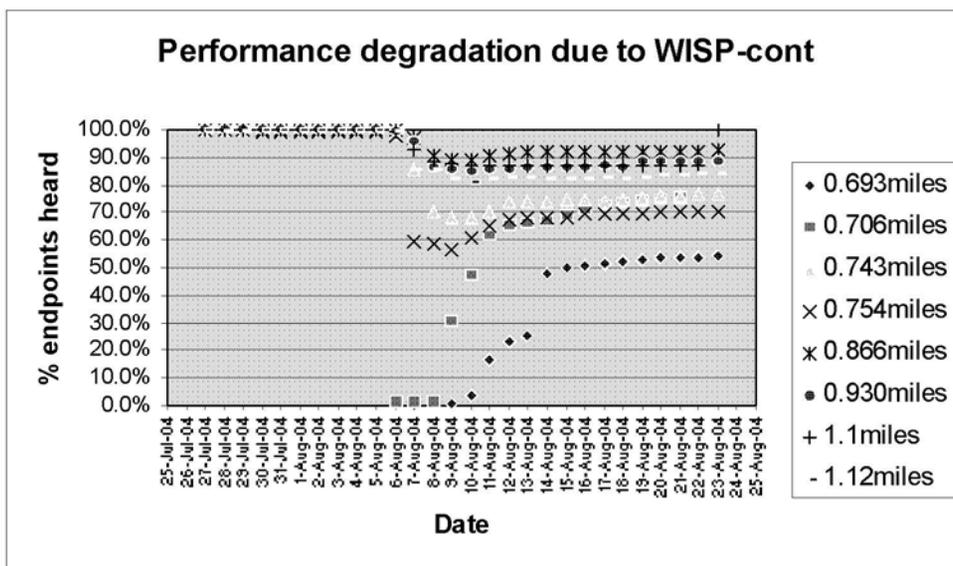
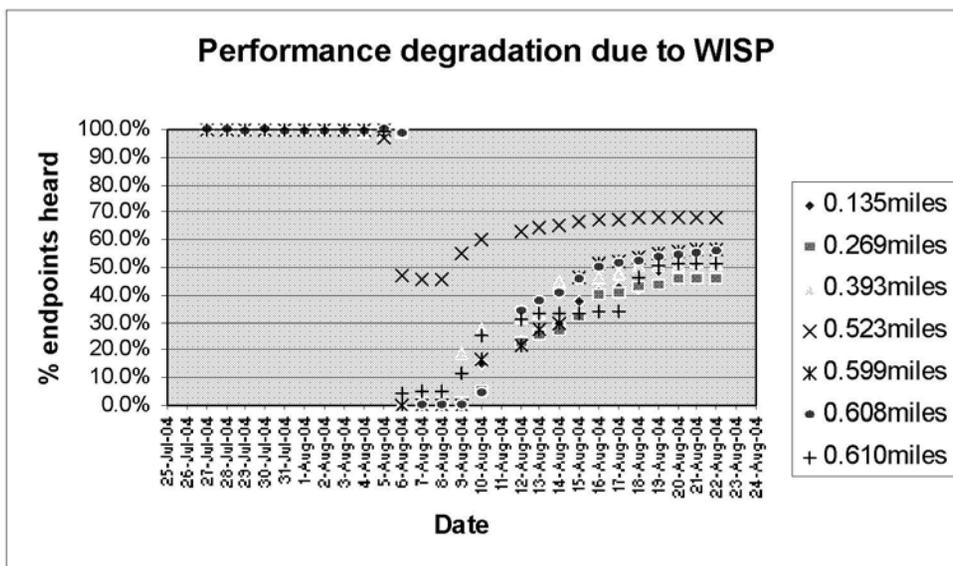
As noted in their initial Comments, Cellnet + Hunt have been stakeholders in this cooperative, successful band for years. They did not oppose the Commission proposals to permit DM technologies to operate in the 915 MHz Band because they accepted the Commission’s characterization at the time of the limited interference potential. Cellnet + Hunt first raised the issue of a spectrum etiquette *after* it experienced interference in the field.<sup>18</sup>

For example, in one the better documented instances of interference with a digitally modulated system, on August 6, 2004, a Cellnet utility customer experienced 100% performance degradation of its micro cell controllers’ (“concentrators”) ability to hear from end points when the concentrators are located at a distance of 0.61 miles or less from the digitally modulated system (see first chart below). Similar effects were measured for over a mile (see second chart) and, although not represented in the chart, extended even further. This degradation was due to the deployment of a digitally modulated system by a WISP. After being contacted, on August 9, 2004, the WISP reduced the power on its system with the result that approximately 15% of Cellnet’s

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<sup>18</sup> See Cellnet + Hunt Comments at 5 n.12.

endpoints at distances within 0.6 miles could be heard by the concentrators. Functional operation of Cellnet's AMR system was, however, only restored when, 5 days later, the WISP changed its frequency channel to an adjacent one. Even then, however, the information recovery performance reached only approximately 60-70% of its pre-WISP level (performance varied not only by distance but also depended upon line of sight). This sequence is displayed graphically below.



Cellnet + Hunt's experience and concerns are not unique. As reported by other commenters, unrestrained DM devices have become a hazard to many unlicensed users. For example, after deploying its AMR system in December 2001, We Energies stated that it began to experience interference from a WISP deploying a DM device in January 2003.<sup>19</sup> We Energies also reported that it has experienced still unresolved interference to its automatic meter reading from a Motorola Canopy device deployed to relay video surveillance of a nearby parking lot. In addition, We Energies indicated that it has conducted testing with its AMR devices in the presence of DM devices and concluded that "digitally modulated devices that operate with virtually no quiet time and a very high power level will overwhelm the lower power We Energies AMR receiving devices, regardless of which set of frequencies the digital modulated devices utilize[] within the 915 MHz Band."<sup>20</sup> This conclusion comports with the experience of the members of the American Petroleum Institute and of the Utilities Telecom Council, which stated in joint comments that the energy "industry has learned that these devices tend to dominate the band to the exclusion of other devices."<sup>21</sup>

Meanwhile, it is extremely significant that no commenter opposing imposition of a spectrum etiquette disputed Cellnet+ Hunt's observation that unlicensed DM devices that take maximum advantage of the Part 15 rules to operate at maximum power, at high elevation above terrain, and without quiet time are likely to cause interference to all other

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<sup>19</sup> See WE Energies Comments at 2-3.

<sup>20</sup> See *id.* at 3.

<sup>21</sup> API Comments at 5.

lower power unlicensed users of the band over a wide geographic area.<sup>22</sup> The lack of analysis of this real problem by those who oppose a spectrum etiquette is telling. Indeed, at most, commenters questioned why there had not been more documented cases of interference. It is clear from the broad base of support for the etiquette that commercial users of this band are, indeed, suffering from interference already. As DM devices continue to proliferate, the problem continues to grow; so it is incumbent upon the FCC to anticipate these problems by adopting an etiquette now, rather than waiting until the proverbial “horse has left the barn.”

Simply put, the past success and “high density of use” in the 915 MHz Band would not be possible if every device operated at “maximum power, bandwidth and [no quiet time].”<sup>23</sup> Instead, commenters “agree with Cellnets’ [sic] observation that there are new devices entering the marketplace that are not necessarily designed nor deployed with adequate regard to coexist[] in the unlicensed bands.”<sup>24</sup> Because it is clear that the current FCC rules do not preclude a single unlicensed user from dominating a large portion or even the entirety of the band and because actual interference incidents from DM devices have been documented, the Commission must now act to preserve the 915 MHz Band for potential use by multiple unlicensed devices.

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<sup>22</sup> Rather, the Wireless ISP Association (“WISPA”) has recognized that “[t]he rapid growth of wireless applications and networks that use the unlicensed 902-928 MHz band has resulted in an increase in noise and interference that has lowered network reliability.” Comments of WISPA, ET Docket No. 03-201, at § II(1) (filed Sept. 13, 2007) (“WISPA Comments”).

<sup>23</sup> See S5 Wireless Comments at 5.

<sup>24</sup> Comments of Vecima Networks, Inc., ET Docket No. 03-201, at 3 (filed Oct. 15, 2007) (“Vecima Comments”); See also Comments of Lectrosonics, Inc., ET Docket No. 03-201, at 1 (filed Oct. 15, 2007) (“Lectrosonics recognizes the concerns expressed by the Commission regarding the potential for maximum power, maximum duty cycle spread spectrum transmitters to be disruptive.”).

**C. A Spectrum Etiquette is Necessary to Promote Spectrum Efficiency in the 915 MHz Band**

In its comments, the Wireless Internet Service Provider Association noted that a spectrum etiquette may promote more efficient spectrum utilization.<sup>25</sup> In the view of Cellnet + Hunt, its proposed spectrum etiquette linking increased power levels with more quiet time will best ensure that a large portion of the 915 MHz Band is not dominated by a single DM device to the exclusion of unlicensed users.<sup>26</sup> To the extent that there are additional aspects of a spectrum etiquette that would improve the results achieved, Cellnet + Hunt are willing to work with other interested parties to develop alternative approaches that will ensure that the 915 MHz Band is available to multiple unlicensed users. To date, however, few opponents have suggested realistic alternatives to the spectrum etiquette proposed by Cellnet + Hunt.

Other proposals elicited in the comments generally fall short of the mark. Proposals that seek to cap the amount of bandwidth that a device occupies are problematic for two reasons.<sup>27</sup> First, such proposals fail to recognize the purpose of the Commission's creation of unlicensed bands, because they assume that an unlicensed user should be entitled to design a device that occupies even part of the band over large areas for long periods of time on an exclusive basis. Such an approach, while helpful in theory, is equivalent to the virtual grant of a license for segments of the band in certain areas.

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<sup>25</sup> WISPA Comments at § II(1) (“The implementation of reasonable spectrum etiquette techniques could result in a lowering of th[e] noise and interference level... [which] is more beneficial than simply doing nothing and allowing the 900 MHz noise and interference levels to continue to increase without limit.”).

<sup>26</sup> Again, the proposed spectrum etiquette is designed to minimize interference with digitally modulated and not frequency hopping systems.

<sup>27</sup> See e.g., WISPA Comments at § II(2); Shure Comments at 6-7.

Even assuming *arguendo*, that such an outcome is acceptable, it is simply not sustainable where multiple devices each may seek to monopolize a portion of the 915 MHz Band.

Second, such bandwidth caps fail to account for the significant interference caused by DM devices outside of the channels that they purport to occupy. For instance, Cellnet + Hunt have noticed that emissions from DM devices that operate in the center channel of the 915 MHz Band are not subject to a “cliff effect” but instead have caused significant interference to AMR devices operating on frequencies outside of that channel.

Other commenters suggest that unlicensed devices employ listen-before-talk, meshed technologies, dynamic frequency selection, manual frequency selection or simply leave the band entirely; but these proposals are all reactive solutions to interference caused by DM devices operating at maximum power and without quiet time.<sup>28</sup> Such proposals should be recognized as attempts to shift the burden to devices that do not cause widespread interference. By failing to account for the fundamental problems presented by “always on, always maximum power” DM devices, these alternatives leave the DM transmitters free to operate, to the detriment of all other users, without regard to the admonition of Section 15.15(a) of the Commission’s rules to suppress emanations as much as practicable.

Contrary to the suggestion of some WISP commenters, the spectrum etiquette under consideration is not “tailor-made” for Cellnet’s own uses.<sup>29</sup> Rather, the spectrum etiquette proposal of Cellnet + Hunt is an effort to develop the simplest, most effective

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<sup>28</sup> See Motorola Comments at 8; Comments of IEEE 802.18, ET Docket No. 03-201, at 5 (filed Oct. 15, 2007). Commenters have been generally critical of any listen-before-talk etiquette requirement in the band. See S5 Wireless Comments at 8; GE MDS et al. Comments, at 7-8; Vecima Comments at 5; Polycom Comments at 2.

<sup>29</sup> See *e.g.*, Motorola Comments at 8.

and least intrusive regulation possible considering the millions of devices already deployed in the 915 MHz Band. We note that the imposition of a quiet time requirement is not unprecedented. The European ETSI EN 302 208 technical requirements include a period of quiet time (“the maximum period of continuous transmission and the period between consecutive transmissions on the same sub-band are specified in order to ensure most efficient use of available sub-bands for the general benefit of all users.”).<sup>30</sup> Nevertheless, if, for example, the etiquette would be more acceptable if the time period over which the percentage of quiet time was measured was increased, for example, up to 5 minutes (but no shorter than 400 ms), or similar improvements, Cellnet +Hunt would welcome such improvements – as long as they did not have the effect of allowing any particular user to “hog” the band over long periods of time and large geographic areas.

### **III. INNOVATION IN THE 915 MHZ BAND WILL CONTINUE TO FLOURISH IF AN ETIQUETTE IS ADOPTED**

Both proponents and opponents of spectrum etiquette in the 915 MHz Band have argued about the likely impact of an etiquette on innovation and the deployment of new devices. In no small part, the reason that innovation has flourished to date in the 915 MHz Band has been because the prior FCC rules have forced the industry to avoid using “always-on” or “channel allocation” techniques to achieve spectrum sharing; these rules encouraged users to co-exist by sharing time, space (frequency), or both. The spectrum etiquette is a relatively simple proposal that mandates power limits for devices that are “always on.” The etiquette itself does not prohibit any given application or device.

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<sup>30</sup> See ETSI EN 302 208-1 V1.1.1, Electromagnetic compatibility and Radio spectrum Matters (ERM), § 8.6.1 (2004).

