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.	)	ET Docket No. 03-201
	)	

To: The Commission

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

CELLNET TECHNOLOGIES, INC
HUNT TECHNOLOGIES, LLC
Ellie A. Doyle
General Counsel
30000 Mill Creek Avenue
Suite 100
Alpharetta, GA 30022

October 15, 2007

TABLE OF CONTENTS

SUMMARY ii

BACKGROUND 2

DISCUSSION 9

I. To avoid exploitation of the rules to the exclusion of other unlicensed devices, a Spectrum Etiquette is necessary in the 902-928 MHz Band 9

II. Devices that are always on at maximum power create the problem 12

III. Cellnet's spectrum etiquette proposal is an effective way to achieve spectrum efficiency in the 902-928 MHz band. 13

IV. Given the significant use of the 902-928 MHz band, the public interest would be adversely affected by the failure to adopt a spectrum etiquette. 16

CONCLUSION 18

SUMMARY

Cellnet Technology, Inc. ("Cellnet") and Hunt Technologies, LLC (collectively, "Cellnet + Hunt") urge the Commission to adopt a spectrum etiquette for unlicensed Part 15 products in the 902 – 928 MHz ("915 MHz") band. This band is utilized by thousands of different types of unlicensed products, ranging from consumer products like cordless telephones, baby monitors, wireless audio and video equipment, and home security systems, to medical implant products, to automatic meter reading ("AMR") devices utilized by the energy, transportation and utility critical infrastructure industries. In adopting a spectrum etiquette, the Commission will reaffirm a policy supporting responsible engineering and manufacturing practices that will facilitate the coexistence of a wide range of 915 MHz products in the same geographic area.

Recently, Cellnet + Hunt have observed that some users can exploit the current rules permitting the introduction of digitally modulated devices in the 915 MHz band to deploy devices 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). Unfortunately, digitally modulated systems that function in this matter do not allow for other Part 15 devices operating within the same geographic area to pass data without interference.

Cellnet's proposed spectrum etiquette seeks to accommodate a wide range of designs by allowing manufacturers to trade an increase in quiet time for higher power. This etiquette is consistent with the Commission's long-standing policy, codified in its rules, that Part 15 devices must be "constructed in accordance with sound engineering and manufacturing practices" and suppress emanations "as much as practicable." By the adoption of a spectrum etiquette of this nature in the 902-928 MHz band, the Commission can encourage all stakeholders to maximize efficiency in the band and continue to provide new and innovative devices and services.

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.	)	ET Docket No. 03-201
	)	

To: The Commission

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

Cellnet Technology, Inc. ("Cellnet") and Hunt Technologies, LLC ("Hunt" or "Hunt Technologies") (collectively, "Cellnet + Hunt")[1], pursuant to 47 C.F.R. § 1.415 of the Federal Communications Commission's ("FCC" or "Commission") rules, hereby submit these joint comments in response to the Commission's *Further Notice of Proposed Rulemaking*[2] in the above-referenced proceeding. For the reasons discussed below, Cellnet + Hunt urge the Commission to adopt a spectrum etiquette for the 902-928 MHz band that will assure that no one

[1] Cellnet is a leading provider of real-time automated meter reading ("AMR") and automation solutions to the utility industry. Based in Atlanta, Georgia, Cellnet supplies gas, water, and electric utilities with highly reliable, field-proven products that enable them to communicate with residential and commercial and industrial (C&I) meters using wireless and IP network communications. Using a combination of Part 101 Multiple Address System licenses and spread spectrum Part 15 devices, Cellnet has created a low-cost, private internal telemetry services network which allows it to transmit and receive data for the remote monitoring and control of devices, primarily utility meters. Cellnet utilizes the 902-928 MHz band for its unlicensed local area network connecting the endpoint (meter) devices to the MAS network. Cellnet has installed over 10 million end points in its network of AMR services. This wireless solution has represented a leap-forward for the nation's energy utilities that are able to increase their efficiency and effectiveness at a savings to all consumers. Hunt Technologies[1] has been a provider of innovative AMR and automated meter infrastructure ("AMI") for electric, water, and gas utilities since the mid-1980's. Hunt Technologies provides wireless solutions like its StatSignal and Airpoint™ radio frequency technologies for many powerline utilities. For Hunt, the freedom to operate in the 915 MHz band is of fundamental importance. Cellnet + Hunt thus bring a wealth of first-hand experience in the successful shared operation of devices in this spectrum band.

unlicensed device is able to exploit the technical flexibility available in this band and occupy significant amounts of spectrum at very high powers on a virtually "always on" basis to the exclusion of virtually all other unlicensed devices operating in a wide geographic area. Without a spectrum etiquette, there is a real potential that certain unlicensed users each will seek to effectively gain exclusive use of all or portions of the 902-928 MHz band, eviscerating the concept behind Part 15 that certain spectrum should accommodate a multitude of unlicensed users sharing the band.[3] By contrast, an appropriate spectrum etiquette can provide an environment in which numerous users may operate in the same geographic area simultaneously, using only the minimum power and bandwidth they need for their particular application. Such an approach protects current users in the band and ensures that the band will continue to be available to future innovation.

BACKGROUND

The 902-928 MHz band has been a fertile proving ground for thousands – if not tens of thousands -- of different types of products, ranging in nature from hugely successful consumer products like cordless telephones, baby monitors, wireless audio and video equipment, and home security systems, to medical implant products, to devices that have been integrated into critical infrastructure operations involved in the nation's energy, transportation and utility industries. More recently, this band has been used as a proving ground for RFID products and for the provision of wireless broadband connectivity.

---

[2] *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 (hereinafter "Part 15 FNPRM").

[3] For those entities that wish to have spectrum exclusivity, it has been long-accepted FCC policy that such rights are to be acquired in licensed bands through auction.

As long ago as 1995, when the FCC was considering rules for the use of this band by licensed automatic vehicle monitoring systems, the FCC estimated the number of unlicensed devices operating pursuant to Part 15 then to be in excess of 4 Million.[4] Since that time, a number of changes have been made in the rules governing the use of this band[5] in order to further encourage the use of advanced technologies and the development of unique and innovative devices and uses. It is estimated that the number of Part 15 devices operating in the band today likely are in the hundreds of millions.[6] Despite this widespread use, however, until very recently there have been relatively few incidents of harmful interference among unlicensed devices operating in this band.

The success of the technology operating in the 915 MHz unlicensed band is due, in part, to the FCC's approach (embodied in Sections 15.247 and 15.249) to spectrum management. Until 2002, the FCC generally compelled the user of a Part 15 device operating under these particular regulations to occupy a specific channel or frequency just long enough to communicate and then effectively release the channel for others to use. This spectrum sharing has been accomplished either through frequency hopping, with FCC specified "dwell times," or by spreading the transmitted energy across a wide portion of the spectrum, thereby minimizing the power spectral density applied to any one channel.[7] Both methods have been, and continue to be, utilized successfully by millions of devices in an environment in which harmful

---

[4] *See Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems*, Report and Order, 10 FCC Rcd 4695, 4712 (1995).

[5] *See e.g.*, *Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices*, Second Report and Order, 17 FCC Rcd 10755 (2002);

[6] *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 (2004).

[7] In very simple terms, in the pre-digital modulation Part 15 regime, unlicensed users coexisted because all parties would "pop up, send a quick signal, and go down." By going quiet, one device allowed one or more other devices also to "pop up, send a quick signal, and then go down." However, when certain digitally modulated devices are used, they are always up and so everyone else is blocked from going up.

interference among devices has been a very rare occurrence.[8] This approach to spectrum sharing has been extremely effective, as evidenced by the enormous number of devices operating in the 902-928 MHz (and in other so-called ISM bands as well) without widespread harmful interference.

That environment changed, however, when the FCC expanded the use of digital modulation in these bands. Indeed, the genesis of the instant proceeding can be traced back to a May, 2001 *Notice of Proposed Rule Making* in a Docket initially started several years earlier to liberalize the rules governing spread spectrum devices.[9] As part of its continuing effort to improve technological flexibility in the 902-928 MHz band, as well as other so-called ISM bands, the FCC proposed for the first time to allow alternative digital technologies to operate in bands formerly reserved for frequency hopping and direct sequence spread spectrum systems. The Commission stated its belief that such a change in the rules would

> [a]llow more and more diverse products to utilize those bands and thereby increase consumer choice… [and] provide the flexibility and certainty needed to promote the introduction of new, *non-interfering* products into the band, without the need for frequent rule changes to address each specific new technology that may be developed.[10]

Significantly, the Commission also believed that "digital systems may exhibit no more potential to cause interference to other devices than direct sequence systems"[11] and asked for comment on

---

[8] Indeed, the Commission has regularly reviewed the rules governing spread spectrum technology, liberalizing the frequency hopping and spreading requirements without increasing the incidents of interference among unlicensed products. *See, e.g.*, *Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices*, First Report and Order, 15 FCC Rcd 16244 (2000); *Amendment of Amateur Radio Service Rules to Allow Greater Use of Spread Spectrum Communication Technologies*, Report and Order, 15 FCC Rcd 1481 (1999); *Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters*, Report and Order, 12 FCC Rcd 7488 (1997).

[9] *See Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices, Further Notice of Proposed Rule Making and Order*, 16 FCC Rcd 10036 (2001).

[10] *Id*. at 10041 (emphasis added).

[11] *Id*. at 10042.

whether "digitally modulated systems should be allowed to operate at the same power levels as direct sequence spread spectrum systems."[12]

In May 2002, the Commission generally adopted its 2001 proposals and amended the Part 15 Rules to allow new digital transmission technologies and spread spectrum systems to operate in the 902-928 MHz band.[13] The Commission acknowledged that some commenters had suggested that alternative operating conditions, such as lower output power or lower power spectral density, should be imposed on devices using digital modulation techniques because of expressed concerns that "because digital systems are less immune to interference, they will tend to operate at higher powers and thus cause interference to existing devices."[14] Nevertheless, based on its analysis of the record, the Commission decided that systems using digital modulation techniques can operate under the same rules as direct sequence spread spectrum devices in the 902-928 MHz band without posing additional risk of interference. The Commission therefore removed all regulatory distinctions between direct sequence spread spectrum systems and systems using other forms of digital modulation. In doing so, the Commission noted that "there is no evidence that new digital systems are more likely to operate in a fashion to cause interference to incumbent technologies."[15]

Separate from, and contemporaneous with, its consideration of allowing digital modulation techniques in the 902-928 MHz band, the FCC was independently updating Parts 2

---

[12] *Id*. Cellnet did not comment on these proposals because, having long employed devices operating in the 902-928 MHz band – over 8 million endpoints installed as of 2001, with very few incidents of interference at that time -- Cellnet accepted the Commission's characterization of the interference potential of new digitally modulated devices. Simply stated, at that time Cellnet had virtually no experience in the field with unlicensed devices from other manufacturers utilizing digital modulation in the band and therefore no basis on which to challenge the Commission's own analysis. Cellnet also had every reason to believe that the cooperative, efficient sharing among unlicensed users that had historically characterized the use of this band would continue.

[13] *See Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices*, Second Report and Order, 17 FCC Rcd 10755 (2002).

[14] *Id*. at 10759.

and 15 of the Commission's rules.[16] Among other issues, the Commission sought comment on "methods to ensure efficient spectrum usage by unlicensed devices;"[17] and it asked whether a "spectrum sharing etiquette should be considered" for other "devices that operate on an unlicensed basis."[18] In a 2004 Report and Order,[19] the Commission declined to adopt a spectrum etiquette for the Part 15 bands because it "appears that the existing regulations have resulted in very efficient use of available unlicensed spectrum."[20] Nevertheless, the Commission did recognize that "some form of spectrum sharing requirements" have "merit and should be taken under consideration."[21]

Unfortunately, and contrary to the expectations of the Commission when it (a) allowed the use of digital modulation techniques with characteristics similar to those of direct sequence devices and (b) declined to impose any type of spectrum sharing etiquette on the already heavily utilized 902-928 MHz band, Cellnet noticed an increasing number of instances of harmful interference to its incumbent wireless meter reading networks from devices utilizing digital modulation techniques. In many of those cases, the digitally modulated devices were operating

---

[15] *Id.* at 10760.

[16] *See Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval*, Notice of Proposed Rulemaking, 18 FCC Rcd 18910 (2003).

[17] *Id*. at 18923

[18] *Id*.

[19] *See Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval*, Report and Order, 19 FCC Rcd 13539 (2004).

[20] *Id*. at 13552.

[21] *Id*. Specifically, the Commission recognized proposals of Microsoft Corporation including "ceas[ing] transmissions if there is no information to be sent, allowing unlicensed devices to transmit [if] only they can do so without causing interference to other devices already using the channel, and requiring unlicensed devices to incorporate dynamic range control which would force a device to use the minimum transmit power necessary to complete a communications link." *Id*.

at the maximum available power without a meaningful "quiet period" when the spectrum was not being occupied by the device.[22]

To date, in many cases, the users of these interfering devices have been willing to work with Cellnet to accomplish a mutually satisfactory resolution that allows both parties to operate within this band.[23] However, in other cases a resolution has not been achieved, and Cellnet's utility customer has been compelled to implement higher cost and less efficient meter reading or SCADA functionalities in parts of its service territory. In almost every such case, the problem has been traced to a digitally modulated device that has been set to operate at the maximum authorized power, on a 24-hour "always on" basis, located at relatively high locations with a signal that radiates over very large geographic areas – significantly larger than the typical low-power Part 15 device.

Because Cellnet's experience in the field contradicted the Commission's expectation that interference would not increase if devices operating with digital modulation technology (with technical characteristics like those of direct sequence spread spectrum devices) had proven to be incorrect, Cellnet filed a Petition for Reconsideration in this proceeding. Cellnet requested adoption of a spectrum etiquette that would achieve the Commission's objective of expanding

---

[22] Because Cellnet has millions of unlicensed low power devices deployed in various regions across the country, it is often one of the first to identify trends and effects in the 902-928 MHz band. Unlike a consumer who may simply return or discard a cordless telephone or baby monitor that suddenly does not seem to work because of interference from a digitally modulated device in the area, if the wireless infrastructure Cellnet has deployed in a particular area to serve an electric, gas or water utility is being adversely affected by newly created interference from a recently installed digitally modulated device, Cellnet will both realize it, be able to identify it, and have to deal with it.

[23] It must be noted the identification and resolution of an interfering source is *not* an easy process. Typically, the problem will be recognized when data from a large number of Cellnet + Hunt meters is not being received. At that point, Cellnet + Hunt must send a technical crew to determine the source of the interference; identify the nature of the device that is interfering (which may require obtaining approval of the device owner or at times the landlord to the device owner on whose property the device is located), determine (often by contacting the manufacturer of the device) the nature of the transmission, including the channels being occupied, the power level being used, and other technical characteristics) and then, hopefully, cooperatively attempt to find a technical "work-around" to the problem. Clearly, this is not the type of process that consumers would take, even when one or more consumer products are suddenly, but regularly, no longer working (by reason of the interference).

the flexibility and use of this unlicensed band, while also assuring that all devices operating lawfully in the band would have a reasonable chance to operate without harmful interference from other higher-powered uses of the band.

The Commission initiated this phase of the proceeding to determine "whether there is a need to require unlicensed transmitters operating in the 902-928 MHz band under Sections 15.247 and 15.249 of the rules to comply with a spectrum etiquette requirement, and the impact that requiring an etiquette would have on the development and operation of unlicensed 915 MHz devices operating under those rule sections."[24] As the Commission noted,

> [t]here appears to be a potential for a digitally modulated device or a group of digitally modulated devices to essentially occupy the entire 915 MHz band, leaving little or no opportunity for other devices to gain access to the spectrum. We believe that this has not been a problem in the past because the majority of spread spectrum devices operate at less than the maximum output power permitted in the rules to conserve battery power or because higher power is not necessary in many applications. Also, most spread spectrum devices that have been on the market in this band do not occupy the entire band simultaneously. However, as Cellnet and Itron observe, recently there has been increased use of the unlicensed 915 MHz band by parties providing wireless broadband services. These applications require operation at higher power and greater bandwidth than other unlicensed devices to provide service to users. While we encourage the provision of wireless broadband service to all Americans, we recognize that there is the potential under our rules for some unlicensed devices to preclude the operation of other unlicensed devices.[25]

The Commission noted further that:

> in considering the need for an etiquette, our intent is not to establish interference protection rights for unlicensed devices or to ensure that unlicensed devices are always able to operate without

[24] Part 15 FNPRM at 11389.

[25] *Id*. at 11390. It is important to recognize that the majority of spread spectrum devices using the 902-928 MHz band operate by centralizing information (down-up flow) while all WISPs distribute information (up-down flow). This difference in directional flow is the reason WISPs tend to deploy a higher power downlink with higher potential to cause interference.

> interference. *Rather, our goal is to ensure that the different types of unlicensed devices that operate in a band have an opportunity for spectrum access.* [26]

DISCUSSION

I. To avoid exploitation of the rules to the exclusion of other unlicensed devices, a spectrum etiquette is necessary in the 902-928 MHz Band.

As a threshold matter, it is critical to note that Cellnet + Hunt are *not* asking the Commission to modify its longstanding policy that unlicensed devices are not entitled to operate free from interference; nor does adoption of a spectrum etiquette establish new interference protection rights for unlicensed devices. Rather, by adopting a spectrum etiquette, as Cellnet suggests, which trades higher power for increased "quiet time" [27] the Commission will simply be reaffirming its long-standing policy, codified in its rules, that Part 15 devices must be "constructed in accordance with sound engineering and manufacturing practices" and suppress emanations "as much as practicable."[28] These standards have been in Part 15 since the 1980s so that a myriad of unlicensed devices can generally co-exist in the same spectrum utilizing a variety of different modulation techniques.

For years before the FCC modified its rules to allow digital modulation, this design ethic was adequate to encourage the development of an incredible flow of new products, innovative designs and significant public benefits from devices operating in this band, on a highly economical basis. With the more recent introduction of digitally modulated devices operating at

---

[26] *Id*. at 11390-91. The Commission also sought comment on Cellnet's contention that digitally modulated devices in the 915 MHz band that transmit continuously at maximum power and occupy wide bandwidths are creating emissions at levels that can cause interference to incumbent devices, irrespective of how well the incumbent devices may have been designed to operate in the presence of other users; on the tolerance of currently operating devices to emissions from other devices in the same frequency band; on how effective an etiquette would be in improving spectrum sharing between unlicensed devices in the 915 MHz band; and about the potential for a spectrum etiquette to limit design flexibility and stifle unlicensed product innovation. *Id*. at 11391-92.

[27] "Quiet time" refers to when a device is not transmitting.

[28] 47 C.F.R. § 15.15(a).

the maximum technical criteria available under the rules, however, this Part 15 policy has *not* been enough to stem the recent rise of devices that do not merely increase the potential for interference to existing users by reason of their numbers, but rather that effectively preclude over relatively wide geographic areas other unlicensed uses of the 902-928 MHz band. To the extent that certain types of devices or uses of this band have been developed in response to newly offered technical flexibility and operate under Part 15 in a manner that essentially precludes virtually any other use, there *is* a problem that must be addressed. In Cellnet's view, it is not necessary to address the issue by changing the technical rules or prohibiting a particular modulation. Rather, the *least* obtrusive approach is to adopt a spectrum etiquette that allows the designer of each device to make the "power for quiet time" trade off in determining how to develop its products and applications.

It cannot be denied that, as an unintended consequence of the rules changes adopted in 2002, digitally modulated, non-spread spectrum devices can legally function at power levels and duty cycles that cause disruptive interference over large geographic areas to other devices operating in the 915 MHz unlicensed band. Unlike most pre-2002 Part 15 devices that are operating at very low power or with meaningful quiet times, these offending devices, most often using digital modulation to provide a wide area, high baud rate internet access service, feature the following criteria:

- "Always on" – i.e., their quiet time of no transmission is so short that lower power devices cannot access the spectrum
- "Always maximum power" – i.e., they operate continuously at a power level of 1 watt
- Tallest possible locations to extend their geographic reach.

The combination of a device being "always on" plus "always maximum power" plus "tallest locations" over virtually the entire band without the use of spread spectrum techniques

creates an environment in which no other unlicensed device can operate in the same geographic area without suffering harmful interference. Simply stated, a digitally modulated system[29] ("DM") functioning in the same band at peak power levels as another digitally modulated system or a direct sequence[30] ("DS") system will generally need to overpower the other devices in order to function properly.[31]

It has been Cellnet's experience when harmful interference has been suffered and traced to a digitally modulated device, that the manufacturers, vendors and users of such devices will claim that the characteristics of maximum power, always-on and tallest locations are necessary for them to achieve the maximum throughput over the widest range to the largest number of possible subscribers of their wireless broadband internet access services at the lowest cost to the

---

[29] In digital modulation, a signal is modulated by a digital bit stream. Digital modulation works because the transmitter-receiver pair shares knowledge of how the data will be encoded and represented in the system.

[30] In direct sequence systems, a signal structure is used in which the sequence of chips produced by the transmitter is known a priori by the receiver. Direct-sequence spread-spectrum transmissions multiply the data being transmitted by a "noise" signal. For de-spreading to work correctly, transmit and receive sequences must be synchronized. This requires the receiver to synchronize its sequence with the transmitter's sequence through a timing search process.

[31] For example, if two DM devices operating in a similar band create the same power density at a receiving distance, each receiver will be unable to distinguish and find the correct message from either of the two DM sources; thus, two digitally modulated WISP devices cannot coexist in the same area if they use the same band. On the other hand, if two DS devices operating in the same band create the same power density at a receiving distance, each receiver will find the correct information from either, and indeed both, of the two sources; thus two DS devices can coexist in the same area. This is why the rules governing DS devices have successfully allowed for the operation of a multitude of Part 15 devices in any defined geographic area, and demonstrate the Commission's general approach to "regulating" unlicensed devices in the past.

However, if a DM transmitter and a DS transmitter operate in the same band, use the same bandwidth and produce the same power density at a receiving distance, and this power density is above the sensitivity threshold of both systems, a DS receiver will recover its data while the Digital Modulation receiver will not recover its data; thus, if these devices operate at the same power density, the direct sequence system will be able to coexist with the Digital Modulation System, but the DM will not function properly in such environment.

In short, for a Digital Modulation system to survive in an environment in which other DS and DM devices are also operating, it *must* produce enough additional power above the direct sequence system to guarantee its minimum Signal-to-Interference ratio, which typically compares to the minimum process gain that the DS system was required to have by the FCC. Unfortunately when the DM system increases its power, the DS system will no longer be able to recover its data. In the presence of the two systems, one using Digital Modulation and one using DS, whenever the Digitally Modulation system survives and recovers its information the DS system is overwhelmed and cannot operate. The proposed spectrum etiquette essentially accepts this environment, but provides for a quiet time from the DM system during which the DS devices can transmit and be received. By assuring that both types of devices can operate in all circumstances, the proposed spectrum etiquette provides the very environment that the FCC seeks to create in its Part 15 regulatory scheme.

service provider. That an alternative, less intrusive approach would also work to create a viable, commercial product (albeit potentially at more cost to the provider) is simply not explored. In such an opportunistic environment, a spectrum etiquette that assures all unlicensed devices in this band a reasonable opportunity to transmit and receive signals is essential. Otherwise, one or a few devices operating to take maximum advantage of the current Part 15 technical regulations (while ignoring the policy requirements of Section 15.15(a) to suppress emanations as much as possible) will simply overwhelm and restrict all other devices from equally important operations.

II. Devices that are always on at maximum power create the problem.

A digitally modulated system that operates with a virtually no quiet time does not allow for other devices operating within the same geographic area to pass data without interference. A device operating at maximum power must allow for a quiet time sufficient to allow other devices operating in the area to access the spectrum and transmit with a reasonable chance that a channel will be available.[32] Cellnet's proposed spectrum etiquette, even at levels where the digitally modulated device is operating at full power, allows a sufficient "off time" for other equally innovative, and technically flexible, devices to operate for some period without overwhelming interference.

Obviously, the area in which a digitally modulated device will have the potential to interfere with other unlicensed devices will be significantly impacted by the power output of the

[32] For example, the Motorola Canopy claims to use a 50% duty cycle from the Access Point; however, the cycle is only 5 milliseconds in duration. As a result, the Access Point is always "on" transmitting for 2.5 milliseconds then "off" for 2.5 milliseconds in receive-only mode. For even the most efficient Part 15 device operating in close proximity to the Canopy, 2.5 milliseconds is not enough time for information to be transmitted to, or received at, the destination before another interfering signal occurs from the on-again Canopy device. Cellnet's packets, for example, have lengths between 10ms and 25ms; and the transmissions cannot be completed in the 2.5 milliseconds that a Canopy device is not transmitting. Thus, for Cellnet's devices, the effect is that Canopy is "always on" and always disruptive within the geographic area in which the Canopy signal is being heard. It should be noted that Cellnet has worked with at least one other manufacturer of WISP devices in this band who has designed its devices to operate in stand-by mode that does not inhibit other unlicensed systems. These devices allow sharing because they are not "always on," but rather, just "always ready."

digitally modulated device. Cellnet's spectrum etiquette does not seek to restrict power unnecessarily. It simply recognizes that those devices operating with very little quiet time will have the greatest potential for limiting access to the spectrum for other devices. Such devices should be required to operate over a much shorter range by reducing their allowable power, than those whose operation is sufficiently quiet for longer periods of time so that even over a greater range, the likelihood of dominating the band is small.

III. Cellnet's spectrum etiquette proposal is an effective way to achieve spectrum efficiency in the 902-928 MHz band.

Cellnet is sensitive to the Commission's desire to encourage technical innovation by allowing significant flexibility in the regulations. Cellnet's proposed spectrum etiquette seeks to accommodate a wide range of designs by simply allowing manufacturers to trade an increase in quiet time for higher power. Indeed, by the adoption of a spectrum etiquette of this nature in the 902-928 MHz band, the Commission can encourage all stakeholders to maximize efficiency in the band and continue to provide new and innovative devices and services.

Specifically, the Cellnet spectrum etiquette limits unlicensed devices that operate with minimal quiet time to lower power, while allowing unlicensed devices with more quiet time to operate at higher power.[33] In other words, a device that stays "off" for a longer period of time can have a wider geographic range (affected by power and altitude) than a device that is virtually always on, and thus dominating the spectrum, and which will be limited to a much smaller geographic range of impact.

For example, a digitally modulated 915 MHz device that remains in a continuous non-transmitting mode for at least 0.36 seconds or more in the 0.4 second time period following the initiation of a transmission should be allowed to operate at 1 watt (30dBm). This power level is

consistent with the current rule, and also consistent with the rules governing systems that use digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz bands. Because these systems operate with silent intervals 90% or more of the time, no power density reduction is necessary. In contrast, for a digitally modulated 915 MHz device that operates with a continuous silent interval of less than 90% within a 0.4 second window (0.36 seconds), operation should be restricted to less than the maximum power level (1 Watt) currently permitted under the rules. Instead, the maximum peak conducted output power should be reduced based on the non-transmit interval, based on the longest continuous non-transmit interval within such 0.4 second time period following the initiation of the transmission.[34] A simple equation can, in Cellnet's view, ensure that digital modulation systems which are designed to operate – or whose operators choose to operate -- at the highest power levels in the 915 MHz band will not occupy large swaths of spectrum over wide geographic areas to the exclusion of all other devices.

While those who argue against a spectrum etiquette that requires higher power to be accompanied by increased quiet time may seek, for political reasons, to characterize the issue as one by which the Commission will be choosing between the benefits of one type of Part 15 use over another, e.g., the benefits of wireless AMR to the nation's utilities over the benefits of wireless internet access to rural America – that is simply *not* the case. To the contrary, the spectrum etiquette proposed by Cellnet takes the Commission out of the position of choosing one use over another, and instead gives the device designer the ability to optimize the balance

---

[33] For suggested rule changes, *see* Attachment A (Cellnet Proposed Revision to 15.247(b)(3)).

[34] Under Cellnet's proposal, the maximum peak conducted output power during this 0.4 second time period must be reduced to the level determined using the following equation:

Power in dBm = 30 x (the longest continuous non-transmit interval within every 0.4 second period / 0.4 seconds) / 0.9.

If the system is continuously transmitting longer than such a 0.4 second time period at 0 dBm pursuant to the foregoing, then during each subsequent 0.4 second time period during such transmission, the maximum peak conducted output power must be limited to the level determined using the equation.

between power and quiet time. No uses – AMR or internet access – are foreclosed, only the commercial costs of implementing them are affected.[35] Instead, the Commission will be able to assure that all of the significant public benefits that are being obtained from the millions of other Part 15 devices operating in the band – uses which the Commission has regularly recognized[36] -- will also be available to the public in those areas being served by WISPs. The proposed etiquette does not restrict the band for any innovation; it simply assures that no one innovation locks out all others.

Cellnet + Hunt's spectrum etiquette offers advantages over other possibilities that have been suggested in this and other dockets. For instance, some have suggested that the listen-before talk etiquette employed in PCS bands might be effective in the 902-928 MHz band. This is simply not the case. Because most Part 15 devices operate at very low power and often in crowded environments – and indeed are not designed to be "heard" over long distances -- there will always be a number of different types of devices that will not be detectable by the "listen" feature of the potentially offending device. In such cases, a "listen-before-talk" etiquette may result in situations where devices that do not "hear" these low-power transmitters will be misled, and will begin transmitting stronger signals that will create destructive interference to these

[35] It may well be, as some WISPs have argued, that such a spectrum etiquette will impact the commercial expense associated with the provision of services which are available today;, but the proposed etiquette will not restrict the ability of devices operating in this band to provide any services currently available. Thus, devices offering high-throughput data rates for internet access will still be able to do so with minimal quiet time – but they may be limited in the range at which they can operate. Indeed, it may be that some WISP business plans will need to be adjusted to require more transmitters to cover the same area (or even to require repeaters or other network designs to provide the same coverage).

[36] *See Amendment of the Commission's Part 90 Rules in the 904-909.75 and 919.75-928 MHz Bands*, Notice of Proposed Rulemaking 21 FCC Rcd 2809, 2811-12 (2006); *Modifications of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval*, Second Report and Order, 22 FCC Rcd 8028 (2007); *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Devices*, Second Report and Order and Second memorandum Opinion and Order, 19 FCC Rcd 24558, 24591 n.183 (2004).

lower-powered Part 15 devices. "Listen-before-talk" also dictates how technology is implemented and therefore may unintentionally limit useful applications or technologies.[37]

Likewise, Cellnet does not believe that a spectrum etiquette that limits frequency range will be effective. For example, in a regime where spectrum etiquette would apply only to devices that utilize more than 10% of the spectrum, high powered, continuous operation even in a relatively small part of the band could still cause interference to other systems that are also operating in any part of that spectrum slice.[38]

IV. Given the significant use of the 902-928 MHz band, the public interest would be adversely affected by the failure to adopt a spectrum etiquette.

The Commission is well aware of the enormous number of devices that currently use the 902-928 MHz band. The record in any number of proceedings before the FCC over the last decade contains substantial evidence of the breadth and depth of use of this band for medical, public safety, infrastructure, utility and consumer use.[39] As noted previously, because Cellnet has millions of unlicensed low power devices deployed in various regions across the country, it is often one of the first to identify interference trends and effects in the 902-928 MHz band. The fact that AMR companies like Cellnet are identifying interference more than others does not evidence that the problem is not serious. It simply evidences the nature of the Part 15 device community, and the likelihood that a commercial user like Cellnet is most likely to be affected.

---

[37] In adopting the spectrum etiquette, the Commission also must prohibit synchronization of transmissions from multiple devices that occupy the silent intervals between transmissions. In other words, parties should be prohibited from synchronizing transmissions during silent intervals to effectively operate continuously. Thus, during the silent interval, no other similar device should be allowed to create energy in that same time period in the territory defined as coverage for the first device.

[38] For example, 10% of 26 MHz is 2.6 MHz – if a digital modulation system were operating continuously using 2.6 MHz, it will affect any other system in the same bandwidth.

[39] *See supra*, note 36.

Unless the Commission adopts and quickly implements a spectrum etiquette, severe negative effects will result for devices that operate in the 902-928 MHz band.[40] Despite all the good engineering practices that it could employ for its AMR and SCADA devices, it is impossible for Cellnet + Hunt to design around the interference of "always on, always maximum power" devices within their vicinity. As discussed above, where the signal from the digitally modulated device has been designed to be stronger than the signal from Cellnet + Hunt Cellnet + Hunt's device, the receiver simply cannot hear the Cellnet + Hunt transmitter, no matter how well the receiver is designed.

The undesirable effects of such interference cannot be disputed and should not be understated. For its automatic meter reading operations, electric utilities may be positioned to suffer periods where key operational and load control data cannot be received. [41] SCADA operations may also be impacted, and depending on the type of interruption, important public safety functions may be affected (for example, if a maximum power, "always-on" device is sufficiently proximate to a water treatment plant or a power grid such that SCADA and load management functions that have otherwise functioned well in the unlicensed environment were to be suddenly and regularly disrupted).

---

[40] Cellnet recognizes that manufacturers of digitally modulated devices currently in production will require some time to design the spectrum etiquette into their products, and some additional time to market existing inventory. While Cellnet believes that no more than 12 months should be needed for the redesign and retooling of new product, and some additional time for clearing of existing inventory, the threat from high-powered, "always on" digitally modulated devices is significant and Cellnet urges the Commission to impose the shortest time that is commercially reasonable. To extend the existing problem by permitting product makers to continue to manufacture and sell product that does not include the spectrum etiquette is to exacerbate, rather than cure, the problem.

[41] Under the Federal Energy Policy Act of 2005, Congress made clear that it is the policy of the United States of America that "time-based pricing and other forms of demand response [via AMR] shall be encouraged… and facilitated." 16 U.S.C. § 2642(f). To that end, over 30 million electric meters are read by 902-928 MHz Band radios. Further, an additional 30 million water and gas meters are read by radios that use the 902-928 MHz band. The success of this large-scale deployment thus depends on usable spectrum in the frequency.

CONCLUSION

The introduction of digital modulation techniques and other regulatory flexibility has enhanced the potential use of the 902-928 MHz, but with severe unintended consequences. Devices designed to exploit the flexibility of these bands have overlooked their charge to maintain good engineering and design practices to facilitate sharing. As a result, such devices make it impossible for other unlicensed users to avoid harmful interference and thus have the additional potential to create material adverse effects on the millions of consumer and commercial devices that utilize the 902-928 MHz band.

Cellnet + Hunt urge the Commission to confirm the critical importance of cooperative sharing of the 915 MHz unlicensed band by adopting the spectrum etiquette proposed by Cellnet.

Respectfully Submitted
CELLNET TECHNOLOGIES, INC
HUNT TECHNOLOGIES, LLC

___/s/_____

Ellie A. Doyle
General Counsel
30000 Mill Creek Avenue
Suite 100
Alpharetta, GA 30022

October 15, 2007

ATTACHMENT A

CELLNET PROPOSED REVISION TO 15.247(b)(3)

Part 15
***

15.247 **Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz**

. . .

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

. . .

(3)

(i) For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz bands: 1 watt (30 dBm)

(ii) For systems using digital modulation in the 902-928 MHz band that remain in a continuous non-transmitting mode for at least 0.36 seconds or more in the 0.4 second time period following the initiation of a transmission: 1 watt (30 dBm).

(iii) For systems using digital modulation in the 902-928 MHz band that remain in a continuous non-transmitting mode of less than 0.36 seconds in the 0.4 second time period following the initiation of a transmission, the maximum peak conducted output power shall be based on the longest continuous non-transmit interval within such 0.4 second time period following the initiation of the transmission. In such case, the maximum peak conducted output power during such 0.4 second time period shall be reduced to the level determined using the following equation:

Power in dBm = 30 x (the longest continuous non-transmit interval within every 0.4 second period ÷ 0.4 seconds) ÷ 0.9.

Provided however, that if the system is continuously transmitting longer than such 0.4 second time period at 0 dBm pursuant to the foregoing equation, then during each subsequent 0.4 second time period during such transmission the maximum peak conducted output power shall be limited to the level determined using the foregoing equation.

(iv) For example, if the longest continuous non-transmit period during a 0.4 second period is .2 seconds, then the power would be 16.67 dBm, i.e., 30 x 0.2 ÷ 0.4÷ 0.9.