

**BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, DC 20554**

In the Matter of	)	
	)	
PCS Partners, L.P.	)	WT Docket No. 16-149
	)	
Petition For Waiver of 47 C.F.R. § 90.353(b)	)	File Nos. 0007232430 et al.
and Request for Extension of Time and	)	
for Expedited Treatment	)	

**REPLY COMMENTS OF PCS PARTNERS, L.P.**

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June 3, 2016

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**ATTACHMENT 1: DECLARATION OF NAT NATARAJAN, Ph.D.**

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**REPLY COMMENTS OF PCS PARTNERS, L.P.**

PCS Partners, L.P. (“PCSP”), by its attorneys, hereby replies to comments filed in response to the Wireless Telecommunications Bureau’s Public Notice requesting comment on PCSP’s Petition for Waiver of 47 C.F.R. § 90.353(b) and Request for Extension of Time and for Expedited Treatment (“Petition”) in the above-captioned proceeding.<sup>1</sup>

**I. INTRODUCTION AND SUMMARY**

Six parties filed comments opposing various aspects of the Petition: Inovonics Wireless Corporation (“Inovonics”); Itron, Inc. (“Itron”); Landis+Gyr Technology, Inc. (“L+G”); Public Knowledge, Consumer Federation of America, and the Open Technology Institute (“PK/CFA/OTI”); Starkey Hearing Technologies (“Starkey”); and the Wireless Internet Service Providers Association (“WISPA”). These parties are motivated by their vested interests in

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<sup>1</sup> *Wireless Telecommunications Bureau Seeks Comment on PCS Partners Requests for Multilateration Location and Monitoring Service Waiver and Construction Extension*, Public Notice, DA 16-491 (May 4, 2016) (“Public Notice”).

maximizing use of the 902-928 MHz band for their own equipment and customers.<sup>2</sup>

Consequently, they oppose PCSP's efforts to make efficient and effective use of its spectrum.<sup>3</sup>

PCSP addresses below and in the attached Declaration of Dr. Nat Natarajan, of Roberson and Associates LLC, the handful of substantive technical issues raised in response to the Petition. PCSP questions whether any commenter has a valid basis to object to grant of the Petition, because not one stated that its equipment, customers, or members use any portion of the Multilateration Location and Monitoring Service ("M-LMS") A Block frequencies in any of the geographic areas that are the subject of the request, or if so, the extent of such operations. Tellingly, although commenters express concerns about possible interference from PCSP's proposed M-LMS and narrowband IoT operations, which would utilize just 1.4 MHz of its

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<sup>2</sup> See Itron Comments (filed May 24, 2016) at n.1 (Itron is a manufacturer and supplier of RF-based automatic meter reading and advanced metering infrastructure technologies, serving U.S. utility companies, "[m]any of [which] operate in the 902-928 MHz band"); Inovonics Comments (filed May 24, 2016) at n.1 (Inovonics manufactures radio devices for the unlicensed 902-928 MHz band); L+G Comments (filed May 24, 2016) at n.1 (L+G has deployed a private internal telemetry services network utilizing Part 15 devices in the 902-928 MHz band, along with licensed Part 101 spectrum; Starkey Comments (filed May 24, 2016) at 2 (Starkey "has sold wireless hearing aids using the 902-928 MHz band in the United States since 2010"); WISPA Comments (filed May 24, 2016) at 2 (the 902-928 MHz band "is a primary band used by" its members, who "rely[] principally on unlicensed frequencies," to provide fixed wireless broadband Internet access services). The PK/CFA/OTI Comments (filed May 24, 2016) do not state their interest in this matter, but their advocacy of unlicensed operations, supported by companies with similar interests, is a matter of record before the Commission.

<sup>3</sup> Many of the commenters have a history of opposing such efforts. In substance and tone, the comments echo the opposition of Itron, L+G, WISPA, and others to the proposed implementation of new technology in M-LMS spectrum by Progeny LMS, LLC ("Progeny"). See, e.g., WT Docket No. 12-202, Joint Comments of Itron, WISPA and L+G (Aug. 16, 2012); WT Docket No. 11-49, Reply Comments of WISPA (Jan. 11, 2013), Comments of Itron (Dec. 21, 2012), Comments of L+G (Dec. 21, 2012), Comments of New America Foundation and Public Knowledge (Dec. 21, 2012), Comments of Starkey (Dec. 21, 2012), Comments of WISPA (Dec. 21, 2012), Comments of Inovonics (Dec. 20, 2012), Reply Comments of Itron (Mar. 29, 2012), Comments of Itron (Mar. 15, 2012), Comments of WISPA (Mar. 15, 2012), Comments of Itron (Mar. 25, 2011); WT Docket No. 06-49, Comments of Itron (May 30, 2006).

licensed spectrum per cell cite, it is clear that their arguments would be identical even if PCSP proposed to provide only M-LMS within any portion of its licensed bandwidth.

As shown below and in Dr. Natarajan's Declaration, concerns about potential interference are largely theoretical, and the few specific technical points raised in the comments do not alter PCSP's view that its proposed solution is highly unlikely to cause interference to other band users. PCSP also addresses certain commenters' misunderstanding of, or failure to acknowledge, important aspects of the Petition, such as the specific spectrum covered and PCSP's intent to offer M-LMS. Proposed conditions on grant of the requested waiver, such as responsibility for all costs of field testing, are unwarranted, as they would impose undue burdens on PCSP and go beyond what is appropriate under the rules and prior decisions. Finally, PCSP responds to commenters' opposition to an extension of construction deadlines applicable to PCSP's licenses. These commenters ignore the significant public interest benefits of granting the requested relief, and the rationale for an extension, which is fully consistent with Commission rule, policies, and treatment of similarly situated licensees.

## **II. OPPOSITION TO THE REQUESTED WAIVER IS PREMISED ON UNFOUNDED AND THEORETICAL TECHNICAL CONCERNS**

In its Petition, PCSP requested a waiver of Section 90.353(b) in order to deploy technology that would permit short, infrequent packet transmissions in its licensed A Block sub-band (904.0-909.75 MHz) at scheduled times utilizing equipment that incorporates the 3GPP LTE standard, deploying an LTE system capable of supporting both a trilateration-based M-LMS and machine type communication ("MTC") for narrowband applications and services, without any change in protections afforded other users.<sup>4</sup> As noted, the commenters' specific technical

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<sup>4</sup> See, e.g., Petition at 2-3, 7-8.

concerns are few. Dr. Natarajan has provided a response to these issues.<sup>5</sup> Among other issues he addresses, Dr. Natarajan explains that:

- The duty cycle factor<sup>6</sup> must be considered in conjunction with the bandwidth used. Footnote 22 of the Petition showed that PCSP's proposed solution is intended to utilize 1.4 MHz per cell site, demonstrating that the potential to cause interference, if any, is much less than the system which the Commission has approved for Progeny, and that PCSP's solution has flexibility to operate at a much lower duty cycle, if warranted by low traffic demand and/or any demonstration of unacceptable levels of interference to Part 15 users.<sup>7</sup>
- PCSP's solution is based on the global standard, 3GPP LTE Release 13,<sup>8</sup> which, as noted in the Petition, has defined a new low complexity UE category that supports reduced bandwidth, reduced transmit power, reduced support for downlink transmission modes, ultra-long battery life via power consumption reduction techniques and extended coverage operation. However, as 3GPP continues to evolve, PCSP should not be locked in to a particular version of the standard, but should be able to use the most advanced commercially available version.<sup>9</sup>
- The Petition observed that proposed operations are highly unlikely to cause interference to other band users. This includes M-LMS A Block users.<sup>10</sup> While PCSP does not anticipate material impact to co-channel Block A users, it was careful not to pre-judge this matter, because it will conduct co-existence testing with incumbent Part 15 users (such as WISPs) in the A Block.<sup>11</sup>
- WISPA's concern about the ability of LTE to coexist with Wi-Fi and other unlicensed devices<sup>12</sup> is general and does not cite any specific area of concern with respect to PCSP proposal. Most of the debate with respect to LTE and Wi-Fi is in the context of an entirely different set of assumptions than apply here. As a

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<sup>5</sup> Attachment 1, Declaration of Nat Natarajan, Ph.D. ("Declaration").

<sup>6</sup> See Inovonics Comments at 3; L+G Comments at 3.

<sup>7</sup> See Declaration at ¶ 6.

<sup>8</sup> See Inovonics Comments at n.12.

<sup>9</sup> See Declaration at ¶¶ 7, 8.

<sup>10</sup> Cf. WISPA Comments at 5.

<sup>11</sup> See Declaration at ¶¶ 11.

<sup>12</sup> WISPA Comments at 5-6.

result, lessons learned about LTE/Wi-Fi coexistence are not relevant to PCSP's proposed system.<sup>13</sup>

More generally, commenters broadly oppose the Petition because of the *potential* for interference to unlicensed Part 15 operations. Inovonics states that “PCSP’s proposed use of 3GPP LTE, especially operating at a 56 percent duty cycle, *may likely cause* unacceptable interference to Part 15 devices operating on the same frequencies.”<sup>14</sup> Similarly, L+G states that “PCSP is seeking ... to compete with (and *potentially* create interference to) lower power unlicensed devices,”<sup>15</sup> while Itron expresses concern about the “*potential* impact on other users of the band.”<sup>16</sup> None of these commenters provided any data about their own use of the M-LMS A Block spectrum.<sup>17</sup> As Dr. Natarajan notes, these parties base their general concerns on the *a priori* assumption that any use of the M-LMS A Block by PCSP will cause unacceptable interference.<sup>18</sup> Similar concerns were raised with respect to Progeny’s use of the M-LMS B and C Blocks. However, co-existence testing by Progeny with Part 15 vendors showed no unacceptable interference.<sup>19</sup> Consequently, it is appropriate to respond to WISPA’s assertion that “any claim about the absence of unacceptable levels of interference is speculative and premature”<sup>20</sup> by observing that claims about the *presence* of unacceptable levels of interference

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<sup>13</sup> See Declaration at ¶ 13.

<sup>14</sup> Inovonics Comments at 3 (emphasis added).

<sup>15</sup> L+G Comments at 4 (emphasis added).

<sup>16</sup> Itron Comments at 2 (emphasis added).

<sup>17</sup> See also Starkey Comments at 2 (asserting that “the proposed request by PCSP would have a detrimental effect on disabled Americans....”).

<sup>18</sup> See Declaration at ¶ 9.

<sup>19</sup> *Id.* at ¶ 10.

<sup>20</sup> WISPA Comments at 6.

must be equally speculative and premature – except that PCSP (1) made no categorical claims, but rather stated that its belief that its proposed operations are “highly unlikely to cause interference to other band users”;<sup>21</sup> (2) explained the basis for that statement;<sup>22</sup> and (3) reiterated that the field testing safety net and other protections embodied in the rules will apply.<sup>23</sup>

Some commenters misunderstand or fail to acknowledge important aspects of the Petition and applicable rules. Starkey vaguely expresses concern about PCSP’s proposed use of the M-LMS A Block spectrum, but is “even more concerned about the use of this proposed MTC in the M-LMS B and C blocks since such use would interfere with access to our two discovery channels....”<sup>24</sup> However, PCSP’s request expressly covers only its M-LMS A Block frequencies for the PCSP licenses that are the subject of the Petition.<sup>25</sup> L+G claims that the Petition does not include “a sufficient level of technical detail from which to determine the potential impacts of the PCSP proposals on other users of the 902-928 MHz band.”<sup>26</sup> Of course, the rules do not require M-LMS licensees to limit “potential impacts” of their operations to all 902-928 MHz users. To the contrary, the Commission has “expressly recognized that M-LMS *potentially would cause* interference to some of the various types of unlicensed operations in the band, and it modified the Part 15 rules to enable certain spread spectrum devices to avoid using M-LMS

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<sup>21</sup> Petition at 7.

<sup>22</sup> *Id.* at 7-8.

<sup>23</sup> *Id.* at 8.

<sup>24</sup> Starkey Comments at 2. Starkey offered no information regarding the technical characteristics of its use.

<sup>25</sup> Those licenses are listed in the Attachment to the Public Notice.

<sup>26</sup> L+G Comments at 3. Like Starkey, L+G also provided no data regarding its unlicensed operations.

channels.”<sup>27</sup> Thus, the rules require that PCSP demonstrate through field tests that its system does not cause “unacceptable levels of interference” to Part 15 devices that operate on a secondary basis in its licensed spectrum.<sup>28</sup> PCSP expressly stated its intention to comply with the field testing condition<sup>29</sup> (a fact that only WISPA acknowledged<sup>30</sup>). As the Commission has stated, “the purpose of the field test is to promote the coexistence of M-LMS and unlicensed operations in the band by ‘minimizing’ – not eliminating – the potential for M-LMS interference to Part 15 operations overall so that the band can continue to be used for unlicensed operations without significant detrimental impact, consistent with their Part 15 status.”<sup>31</sup> The commenters’ overbroad, theoretical, and unsupported concerns about presumed interference to all users should not preclude grant of a waiver.

PK/CFA/OTI make several claims that are based not on overstatement of what the rules require, but an apparent failure to read the Petition. They wrongly assert that PCSP does not intend to offer a competitive M-LMS service,<sup>32</sup> or to provide M-LMS at all.<sup>33</sup> In fact, the Petition states PCSP’s intent to do so.<sup>34</sup> They also claim that the Petition asks for a waiver to

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<sup>27</sup> *Request from Progeny LMS, LLC for Waiver of Certain Multilateration Location and Monitoring Service Rules, Progeny LMS, LLC Demonstration of Compliance with Section 90.353(d) of the Commission’s Rules*, Order, 28 FCC Rcd 8555, ¶ 19 (2013) (“*Progeny Field Test Order*”) (emphasis added).

<sup>28</sup> 47 C.F.R. §§ 90.353(a), (d).

<sup>29</sup> *See* Petition at 7.

<sup>30</sup> *See* WISPA Comments at 5.

<sup>31</sup> *Field Test Order*, ¶ 19.

<sup>32</sup> PK/CFA/OTI Comments at 4.

<sup>33</sup> *Id.*

<sup>34</sup> *See* Petition at 4, 5-6 (the proposed solution will permit the provision of M-LMS in a more spectrally efficient manner than the configuration mandated by current rules, and provide a competitive alternative to the location service authorized to be offered by Progeny).

provide voice service,<sup>35</sup> when the Petition makes no such request. (The rules expressly permit both voice and data transmissions related to location and monitoring functions.<sup>36</sup>) Their hyperbole is no substitute for fact. Like other parties promoting the interests of unlicensed Part 15 interests,<sup>37</sup> PK/CFA/OTI's intent is to limit competition by cutting off operations in the licensed M-LMS bands before they have a chance to take root.

In sum, as Dr. Natarajan concludes, PCSP's proposed solution "not only fulfills the intent of the Commission's rules requiring delivery of location and monitoring services but also enables the provision of a variety of narrow bandwidth Internet of Things applications in a manner that has very little potential for causing unacceptable interference to other users of the 902-928 MHz band. It has the potential to introduce innovative and cost effective use of spectrum in an area of rapid anticipated growth."<sup>38</sup>

### **III. PROPOSED CONDITIONS TO GRANT OF A WAIVER ARE NOT JUSTIFIED**

L+G and WISPA ask the Division to impose conditions on a grant of rule waiver. Such conditions, which focus primarily on field testing, would be unduly burdensome and go beyond what is required under Section 90.353(d) and prior decisions regarding the field test obligations, and are unwarranted.<sup>39</sup>

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<sup>35</sup> PK/CFA/OTI Comments at 4, 5.

<sup>36</sup> 47 C.F.R. § 90.353(b).

<sup>37</sup> Inovonics states that PCSP "proffers no reason why it cannot deploy any currently-available technologies," Inovonics Comments at 2, apparently overlooking PCSP's explanation that there currently is no M-LMS equipment commercially available for deployment in its licensed spectrum. *See* Petition at 11.

<sup>38</sup> Declaration at ¶ 14.

<sup>39</sup> WISPA concedes that PCSP has acknowledged its field testing obligation while complaining that it "attempts to pre-judge the outcome" merely by stating that there is little possibility of interference. WISPA Comments at 5. Obviously, PCSP's statements are not contradictory.

L+G argues that the Bureau should require that PCSP's field testing be "conducted at the sole expense of PCSP, including reimbursement of the reasonable expenses incurred by Part 15 users who are participating in such cooperative testing."<sup>40</sup> This request, which is offered without support or justification, is contrary to precedent and should be rejected. When developing the field testing requirement, the Commission stated its expectation that testing would be accomplished through cooperation between M-LMS providers and operators of Part 15 systems, and offered examples of the types of "fine tuning" that could contribute to this cooperation.<sup>41</sup> The Commission did not require the testing party exclusively to bear the costs of "cooperation."<sup>42</sup> As Inovonics understands, field testing costs are to be borne by both participating Part 15 users and the M-LMS licensee.<sup>43</sup> This is consistent with the Bureau's grant of waiver to Progeny, which was not conditioned on Progeny having sole financial responsibility for testing.<sup>44</sup>

L+G also argues that "[u]nilateral testing by PCSP without the cooperation of a wide group of manufacturers of Part 15 devices should not be considered satisfactory,"<sup>45</sup> while Starkey raises a broad concern about "consumer devices."<sup>46</sup> Again, these commenters overreach. In the *Progeny Waiver Order*, the Bureau conditioned its waiver grant on compliance with the

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<sup>40</sup> L+G Comments at 6-7.

<sup>41</sup> *Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems*, Report and Order, 10 FCC Rcd 4695, 4737 ¶ 82 (1995).

<sup>42</sup> *See id.*

<sup>43</sup> Inovonics Comments at 4.

<sup>44</sup> *See In the Matter of Request by Progeny LMS, LLC for Waiver of Certain Multilateration Location and Monitoring Service Rules*, WT Docket No. 11-49, Order, 26 FCC Rcd 16878 (WTB & OET 2011), *recon. pending* ("*Progeny Waiver Order*").

<sup>45</sup> L+G Comments at 6.

<sup>46</sup> Starkey Comments at 2.

field testing requirement, but only to the extent of requiring that certain testing attributes be addressed or included.<sup>47</sup> Moreover, the Commission has made clear that “[t]he field test requirement does not create an obligation that M-LMS licensees protect particular unlicensed devices or models from interference, and it does not require an M-LMS licensee to avoid causing interference to particular unlicensed systems or to particular circumstances of their operation. To require this would elevate the status of Part 15 operations in the band and undermine the established relationship between licensed and unlicensed operations.”<sup>48</sup>

#### **IV. THE STANDARD FOR GRANT OF AN EXTENSION OF TIME IS SATISFIED**

With the exception of one commenter, responses to PCSP’s request for extension of time to implement its proposed solution make no attempt to address the substantial public interest benefits of granting the requested relief – including innovative and efficient use of spectrum; the introduction of a competitive provider of M-LMS with the ability to produce location information in deep indoor environments; the offering of additional applications and services to consumers; and serving the underlying purpose of the rule.<sup>49</sup> Nor do they address the clear rationale for the requested extension, which is consistent with the Commission’s rules, policies, and prior decisions.<sup>50</sup>

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<sup>47</sup> See *Progeny Waiver Order* at ¶ 29.

<sup>48</sup> *Field Testing Order* at ¶ 19. “Elevating the status of Part 15 operations” is precisely what commenters hope to achieve by arguing that “Part 15 users deserve a level of certainty” that M-LMS operations will not “‘change the game’ at the expense of the unlicensed systems.” L+G Comments at 5. No Part 15 technology should be provided “certainty” by prohibiting the use of newer, more efficient competing technologies.

<sup>49</sup> See Petition at 4-9.

<sup>50</sup> See Petition at 12-14. WISPA states that “PCSP flatly admits that it meets ‘none of the[] circumstances’ necessary for grant” of an extension. WISPA Comments at 3. In fact, PCSP stated (and, to the extent not clear from the Petition, clarifies) that it is *not* relying on

(continued...)

Rather than acknowledge the benefits of competition, innovation, and efficient and productive use of PCSP's M-LMS A Block spectrum, or address in any substantive manner the specifics of PCSP's request, the commenters simply raise straw man arguments. For example, Inovonics asserts that PCSP is seeking an extension "in perpetuity,"<sup>51</sup> ignoring the fact that PCSP's request is expressly time-limited, with specific milestones.<sup>52</sup> Similarly, commenters accuse PCSP of "warehousing" spectrum.<sup>53</sup> As the Commission has explained, warehousing entails acquisition and holding of spectrum without the intent to use it, while preventing its use by competitors.<sup>54</sup> Notwithstanding their use of the term, commenters offer no facts to support it. Nor could they, because PCSP plainly has demonstrated its intent to use its spectrum – which, because it is shared with federal government and other users, it would be impossible for PCSP to prevent its use by third parties. Indeed, "by participating in the auction, [PCSP] ... showed that [it is] genuinely interested in acquiring spectrum to utilize and not warehouse."<sup>55</sup>

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(...continued)

circumstances (lack of financing; lack of site availability; assignment or transfer of control; failure to timely order equipment) which, pursuant to Section 90.155(g), do *not* justify an extension.

<sup>51</sup> Inovonics Comments at 2-3. *See also* PK/CFA/OTI Comments at 3.

<sup>52</sup> Petition at 12-13. *See also* WEBSTER'S NEW COLLEGE DICTIONARY 840 (3d ed. 2008) (defining "perpetuity" as "time without end; eternity").

<sup>53</sup> *See, e.g.*, Inovonics Comments at 2-3; WISPA Comments at 4.

<sup>54</sup> *See, e.g.*, *In the Matter of Applications of Cellco Partnership d/b/a Verizon Wireless and SpectrumCo LLC and Cox TMI, LLC For Consent to Assign AWS-1 Licenses et al.*, Memorandum Opinion and Order and Declaratory Ruling, 27 FCC Rcd 10698, ¶¶ 68, 118 (2012).

<sup>55</sup> *In the Matter of Amendment of Part 90 of the Commission's Rules to Facilitate Future Development of SMR Systems in the 800 MHz Frequency Band et al.*, Second Report and Order, 12 FCC Rcd 19079, ¶ 34 (2007).

Commenters’ also assert that they oppose extension because of their purported desire to see the spectrum put to commercial use earlier than proposed by PCSP.<sup>56</sup> But it is transparent that they do not want any licensed use – even if, as is the case here, they have ample time and opportunity to work cooperatively to address interference concerns, as the rules contemplate. Commenters’ rhetorical shedding of crocodile tears about PCSP’s A Block spectrum lying “fallow”<sup>57</sup> rings hollow, given their simultaneous assertions that their own operations in the M-LMS A Block must be protected from “potential” interference from PCSP’s proposed operations. In any event, PCSP’s A Block spectrum does not lie fallow because it is shared with federal government, ISM, and Part 15 users.

Finally, PCSP notes that the Division’s 2014 Order<sup>58</sup> did not and could not pre-judge all possible future requests for relief, and PCSP is not relying solely on current availability of equipment as the basis of its extension request, as some assert.<sup>59</sup>

In sum, PCSP’s Petition demonstrated that the standard for extension under Section 90.155(g) of the rules is satisfied, and that grant of the request is consistent with the Commission’s treatment of similarly situated licensees. As PCSP also showed, waiver of the deadline also is warranted under Section 90.125 of the rules, because application of the

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<sup>56</sup> See, e.g., Inovonics Comments at 2.

<sup>57</sup> See, e.g., L+G Comments at 5; PK/CFA/OTI Comments at 3.

<sup>58</sup> *Requests by Progeny LMS, LLC, FCR, Inc., Helen Wong-Armijo, and PCS Partners, L.P. for Waiver and Extension of Time to Construct 900 MHz M-LMS Licenses*, WT Docket No. 12-202, Order, 29 FCC Rcd 10361 (WTB MD 2014), *recon. pending*.

<sup>59</sup> PK/CFA/OTI Comments at 3; WISPA Comments at 4; Inovonics Comments at 2-3. The assertion of a purported “windfall” for PCSP if its request is granted (PK/CFA/OTI Comments at 3) is misguided. PCSP, a small business, has invested substantially in license acquisition and technology development, and stands ready to make further substantial investments to implement a technology solution that will deliver competitive services – with no guarantee of success and assuming all risks of failure.

September 2016 deadline would not promote timely use of PCSP's M-LMS spectrum, would not serve the public interest, and would impose inequitable and unduly burdensome obligations, while extension of the deadline will result in increased spectrum use, advance Commission policies regarding deployment of efficient and innovative technologies, and promote competition.<sup>60</sup>

## V. CONCLUSION

WHEREFORE, PCSP respectfully requests that the Division grant PCSP's request for waiver of Section 90.353(b) and for extension of time, as set forth in the Petition, on an expedited basis.

Respectfully submitted,

**PCS PARTNERS, L.P.**

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June 3, 2016

Its Attorneys

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<sup>60</sup> See *In the Matter of New York State Electric & Gas Corporation Request for Extension and Consolidation of Construction Deadlines*, 22 FCC Rcd 1787, ¶¶ 11-12 (WTB MD 2007). In addition, construction requirements may be waived on a case-by-case basis where, as here, the circumstances are unique and the public interest would be served. *Id.* at n.36.

# **ATTACHMENT 1**

## **DECLARATION OF NAT NATARAJAN, Ph.D.**

1. My name is Nat Natarajan. I received a Bachelor of Technology (First Class) in Electrical Engineering from the Indian Institute of Technology, Madras; Master of Engineering (with Distinction) in Computer and Control Sciences from the School of Automation, Indian Institute of Science, Bangalore; and M.S. and Ph.D. in Computer and Information Sciences from the Ohio State University at Columbus, Ohio. I have over 25 years of experience in design, analysis and simulation, measurement and testing, and standardization of communication networks and wireless systems in lab and operating environments.

2. I am currently a senior Principal Engineer at the engineering and management consulting company Roberson and Associates LLC. Prior to joining Roberson and Associates, I worked at Cisco, Motorola, IBM, and Network Analysis Corporation. At Cisco, I served as a Network Consulting Engineer for mobile systems and was engaged in design, testing and validation prior to commercial deployment of UMTS Femto and Macro Long Term Evolution (LTE) systems. Prior to Cisco, I was a Fellow of the Technical Staff at Motorola Networks (Arlington Heights, IL). At Motorola, I developed adaptive routing algorithms for the Iridium satellite communication system; led the early research and prototype development and customer trials of 4G All-IP mobile networks; research, standardization and pre-commercial implementations of WiMAX and LTE (Frequency Division Duplex as well as Time Division Duplex) systems. Prior to Motorola, I was a Research Staff Member in the Computer Science Department at the IBM Thomas J. Watson Research Center (Yorktown Heights, New York). At IBM, I contributed to research and development and commercialization of a frequency-hopping spread spectrum-based Wireless Local Area Network (WLAN). I made fundamental contributions to WLAN architecture concepts and specifications of the baseline 802.11 standard.

I have been acknowledged as a major contributor to the standard by the Institute of Electrical and Electronics Engineers. The 802.11 standard has evolved and become the dominant, globally deployed wireless network standard based on unlicensed spectrum and subject to the Federal Communications Commission's rules in 47 C.F.R. Part 15. Prior to IBM, I served as a Senior Member of Technical Staff at Network Analysis Corporation (Great Neck, NY) and contributed to the design and analysis of algorithms and software tools for survivable communication networks and systems.

3. I am currently a Senior Member of the IEEE and its Communication Society. To date, I have been awarded 38 U.S. issued patents, including many implemented in commercial wireless systems, and several international patents. I have published over 30 refereed technical publications and am the recipient of three Cisco Achievement Awards, the Motorola Science Advisory Board Associate recognition, the Motorola Global Standards Outstanding Performance awards, and five IBM Invention Achievement Awards. In my career, I have delivered several invited tutorials and lectures on wireless systems around the globe.

4. At the request of PCS Partners, L.P. (PCSP), I conducted a comprehensive review of the Multilateration Location and Monitoring Service (M-LMS) spectrum, its purpose, and current FCC rules (Part 90) applicable to its use. Based on my analysis of such rules and recognition of the realities of the wireless communication services market, I assisted PCSP in developing a technical proposal that can not only meet the primary original purpose of M-LMS (location determination and monitoring using a trilateration technique) but also utilize PCSP's spectrum efficiently and productively by offering additional services for support of narrowband Internet of Things applications. The main concepts of such technical proposal were an integral

part of the PCSP Petition for Waiver of Section 90.353(b) and Request for Extension of Time and for Expedited Treatment (Petition), submitted to the FCC on April 15, 2016.

5. In response to the Petition, PCSP received comments from incumbent parties currently using the 902-928 MHz band that sought technical details or responses to specific questions. I am providing this Declaration in response to such comments. As context before addressing the commenters' technical points in detail, I note that the Part 15 rules (Section 15.247) for frequency hopping systems operating in the 902-928 MHz band provide that the maximum peak conducted output power of an intentional radiator shall not exceed (i) 1 Watt for systems employing at least 50 hopping channels, and (ii) 0.25 Watts for systems employing less than 50 hopping channels, but at least 25 hopping channels. It is my assumption that the commenters that raise concerns about interference are, like Inovonics Wireless Corporation, operating under these limits.

6. Duty Cycle. Inovonics commented (at page 3) that "PCSP's proposed use of 3GPP LTE, especially operating at a 56% duty cycle, may likely cause unacceptable interference to Part 15 devices operating on the same frequencies." Landis+Gyr Technology, Inc. also commented (at page 3) that "PCSP's proposed duty cycle of 56% is almost three times the duty cycle sought by Progeny." I note that the duty cycle factor must be considered in conjunction with the bandwidth used by the system. Footnote 22 of the Petition explained that PCSP's proposed solution is intended to utilize 1.4 MHz per cell site, demonstrating that the potential to cause interference, if any, is much less than the system which the Commission has approved for Progeny LMS, LLC. As indicated by footnote 22, the PCSP solution has flexibility to operate at a much lower duty cycle, if warranted by low traffic demand and/or any legitimate and proven demonstration of unacceptable levels of interference to Part 15 users.

7. 3GPP LTE Standard. Inovonics commented (at footnote 12) that “the Waiver Request is not particularly clear about which version of the 3GPP LTE standard it will employ, or the technical characteristics of the technology, so the potential for unacceptable interference is unknown.” PCSP’s proposed solution will be based on the global standard, 3GPP LTE Release 13, and will include UE support for Cat-M1 devices (1 Mbps peak uplink as well as downlink, 1 antenna, half-duplex, 1.4 MHz UE receive bandwidth and UE peak transmit power 20 dBm). A detailed description of the standard documents, though out of scope of this Declaration, can be found at <http://www.3gpp.org>. Release 13, as was noted in the Petition, has defined a new low complexity UE category that supports reduced bandwidth, reduced transmit power, reduced support for downlink transmission modes, ultra-long battery life via power consumption reduction techniques, and extended coverage operation. 3GPP has specified 1.4 MHz operation at the terminal, and improved by 15dB the coverage of delay-tolerant Machine Type Communication (MTC) devices. This enables operators to reach MTC devices in poor coverage conditions, including an assortment of M-LMS-based location-aware sensor devices in building as well as meters located in basements. PCSP anticipates full utilization of its A Block spectrum by having up to four channels (each 1.4 MHz) in each license area and applying principles of frequency reuse to provide load balancing across multiple LTE cells, thereby further minimizing any potential co-channel impact on non-M-LMS A Block users.

8. As 3GPP continues to develop standards specifications (Release 14 and beyond) that target potential improvements for even lower power devices, PCSP will be prudent to leverage the global ecosystem of suppliers and use the most advanced version of the LTE standard commercially available for implementation of M-LMS and IoT solutions. Part 15 users’ existing radio products based on 25-channel frequency hopping can employ adaptive

frequency hopping and advanced coding schemes to mitigate against any potential narrowband interference.

9. Part 15 Users. Starkey Hearing Technologies expressed concern (at page 2) that PCSP's proposed solution would negatively impact their two discovery channels in the M-LMS B and C Blocks. However, this is not a valid concern since the PCSP waiver request is specific to only its A Block licenses. Furthermore, Starkey and other vendors have based their general concerns on the *a priori* assumption that any use of the M-LMS A Block by PCSP will cause harmful interference.<sup>1</sup> Starkey did not state whether it has any discovery channels or other operations in the M-LMS A Block.

10. Concerns similar to those raised by Starkey and other Part 15 vendors were expressed a few years ago with respect to Progeny's use of the M-LMS B and C Blocks. However, co-existence testing by Progeny with Part 15 vendors showed no unacceptable interference. In its Petition, PCSP has acknowledged the condition to demonstrate through field tests that its system does not cause unacceptable levels of interference to Part 15 devices.

11. Unlicensed A Block Users. According to the Wireless Internet Service Providers Association (at page 5), "PCSP claims that no user outside the A Block will be materially impacted. But it makes no claim about unlicensed users that are co-channel with the Block A frequencies." In fact, the Petition observed that the proposal is highly unlikely to cause

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<sup>1</sup> A single eNodeB capable of 1 Mbps uplink speed can support about 10.8 million devices transmitting 1 Kbytes a day (or 108K devices at 1% utilization). If a Part 15 device utilizing the 902-928 MHz band is surrounded by 108 IoT devices, it is likely to encounter co-channel effect approximately .000056% of the time, a very small amount of potential interference. Even if one cannot predict the exact growth of IoT devices and traffic patterns, it is a reasonably safe hypothesis that the potential for interference to Part 15 devices is very small, to be verified by field testing at a future date. The hypothetical model above is for illustrative purposes only and not to be taken literally as a prediction of future traffic patterns.

interference to other band users, including without limitation A Block users. While PCSP does not anticipate material impact to co-channel Block A users, it was careful not to pre-judge this matter, because, as noted, it will conduct co-existence testing with incumbent Part 15 users (such as WISPs) in the A Block.

12. Part 15 Technical Rules. Landis+Gyr commented (at footnote 8) that “at the very least if PCSP wants to utilize its licensed spectrum for non-M-LMS IoT, PCSP should be required in the waiver grant to operate under the same power levels (one watt) and other technical constraints as Part 15 users.” However, PCSP has chosen a solution to comply with all but one of the existing Part 90 rules. Adding additional rules to comply with all the technical constraints of Part 15 users would require multiple rule changes that are unnecessary. And, as illustrated above, even prior to testing, it is not unreasonable to assume that the likelihood of interference is very small and does not require changes in Part 90 power limits.

13. LTE/Wi-Fi Coexistence. WISPA stated (at pages 5-6) that “substantial questions have been raised about the ability of LTE to coexist with Wi-Fi and other unlicensed devices, and testing among LTE and other technologies has not been completed.” This is a general statement that does not cite any specific area of concern with respect to the proposed PCSP solution. Most of the debate with respect to LTE and Wi-Fi is in the context of an entirely different set of assumptions: frequency bands used (2.4 and 5 GHz), power levels used (LTE operating at higher power levels), use of LTE Carrier Aggregation (3GPP Release 10 feature) for increasing bandwidth with a supplemental downlink (3GPP Release 13 feature) for consumer Internet broadband data intensive access, and persistent traffic patterns. While PCSP proposes to use particular features of Release 13 suited for narrowband IoT applications, its focus is entirely different: frequencies in the 900 MHz band, lower power levels suited for IoT (including UE

features for advanced power saving and discontinuous operation modes to conserve battery power), focus on mainly small amount (e.g. 1 Kbytes) of uplink traffic from devices on a sporadic, non-persistent basis (once a day or once an hour, etc.) and more. The learnings from LTE/Wi-Fi coexistence are not relevant to the PCSP solution and its impact on Part 15 (not just Wi-Fi or 802.11ah) users. Only the development of PCSP's solution and testing for coexistence will provide valid learning and insight useful to PCSP/Part 15 coexistence.

14. In conclusion, PCSP has proposed a solution for effective use of its M-LMS A Block licenses. The proposal not only fulfills the intent of the Commission's rules requiring delivery of location and monitoring services but also enables the provision of a variety of narrow bandwidth Internet of Things applications in a manner that has very little potential for causing unacceptable interference to other users of the 902-928 MHz band. It has the potential to introduce innovative and cost effective use of spectrum in an area of rapid anticipated growth.

15. I declare under penalty of perjury of the laws of the United States that the foregoing is true and correct to the best of my knowledge, information, and belief.

Signed: /s/ Nat Natarajan  
Nat Natarajan, Ph.D.  
Roberson and Associates LLC

Date: June 3, 2016