

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

In the Matter of Higher Ground LLC Application for Blanket Earth Station License
IBFS File No.: SES-LIC-20150616-00357
Call Sign: E150095

ORDER AND AUTHORIZATION

Adopted: January 18, 2017

Released: January 18, 2017

By the Chiefs, International Bureau, Wireless Telecommunications Bureau, Office of Engineering and Technology:

I. INTRODUCTION

1. With this Order, we grant the application of Higher Ground LLC (Higher Ground), with conditions, for a blanket earth station license to operate up to 50,000 earth stations, known as "SatPaqs," to communicate with the following U.S.-licensed satellites: Galaxy 3-C at the 95.05° W.L. orbital location, Galaxy 12 at the 129.0° W.L. orbital location, and Galaxy 19 at the 97.0° W.L. orbital location. In doing so, we waive the Table of Frequency Allocations to the extent necessary to permit Higher Ground to provide the services proposed in its application in the 5925-6425 MHz (Earth-to-space) and the 3700-4200 MHz (space-to-Earth) frequency bands on a non-interference basis, subject to the conditions listed below. The authorization will serve the public interest by allowing Higher Ground to provide new communications services to U.S. consumers, with safeguards designed to minimize the risk of harmful interference to primary users operating in these frequency bands. Accordingly, we deny the Petition to Deny filed by the Fixed Wireless Communications Coalition, Inc. (FWCC).

2. CenturyLink filed comments in opposition to Higher Ground's application, and the National Spectrum Management Association (NSMA) filed comments in response to Higher Ground's Consolidated Opposition. Frontier Communications, the State of Alaska's Office of Enterprise Technology Services, the Nebraska Public Power District, the Office of Enterprise Technology Services of the State of Hawaii, the Utilities Technology Council (UTC), the City of Mesa, the Regional Wireless

1 Higher Ground Application for a Blanket License to Operate C-band Mobile Earth Terminals, IBFS File No. SES-LIC-20150616-00357 (Application). We authorize these SatPaqs under Part 25 of the Commission's rules. See 47 CFR pt. 25.

2 Fixed Wireless Communications Coalition, Inc. (FWCC) Petition to Deny (filed Sept. 11, 2016) (FWCC Petition to Deny).

3 Comments of CenturyLink in Opposition to Application (CenturyLink Opposition Comments); Letter from David E. Meyer, President, National Spectrum Management Association (NSMA) (filed Oct. 6, 2015) (NSMA Ex Parte).

Cooperative, the TOPAZ Regional Wireless Cooperative (TRWC),<sup>4</sup> Southern Company Services, Inc., Cellular Network Partnership d/b/a Pioneer Cellular, the Cities of Garland, Mesquite, Rowlett, and Sachse, Texas, and the Association of American Railroads filed *ex parte* communications requesting that Higher Ground's application be dismissed and that Higher Ground's requests be addressed in a rulemaking proceeding instead.<sup>5</sup> We decline to do so for the reasons explained below.

## II. BACKGROUND

3. On June 16, 2015, Higher Ground submitted a request for a blanket authorization to operate up to 50,000 SatPaq terminals to provide consumer-based text messaging/light email and Internet of Things (IoT) communications in the United States, particularly in areas unserved by terrestrial CMRS networks.<sup>6</sup> The SatPaq terminals will be embedded in protective cases attached to ordinary smartphones. These SatPaq terminals will communicate with the following authorized satellites: Galaxy 3-C at the 95.05° W.L. orbital location, Galaxy 12 at the 129.0° W.L. orbital location, and Galaxy 19 at the 97.0° W.L. orbital location. In turn, these satellites will communicate with one of three authorized remote control facilities: one in Napa, California (Call Sign E970391) and two in Hagerstown, Maryland (E050048 and E050049).<sup>7</sup> The SatPaqs will operate on C-band frequencies in the 3700-4200 MHz

<sup>4</sup> TRWC filed a "Petition to Deny" on October 3, 2016, beyond the notice and comment period. As such, the comments of TRWC will be treated as an *ex parte* communication. Other pleadings filed beyond the comment period will similarly be treated as *ex parte* communications. *See infra* n.5.

<sup>5</sup> Letter from AJ Burton, Director of Federal Regulatory Affairs, Frontier Communications, to Marlene H. Dortch, Secretary, FCC (filed Aug. 22, 2016) (*Frontier Ex Parte*); Letter from Nebraska Public Power District, to Marlene H. Dortch, Secretary, FCC (filed Sept. 2, 2016) (*Nebraska PPD Ex Parte*); Letter from Vince Krog, State Radio Engineer, Office of Enterprise Technology Services (OETS), State of Hawaii to Marlene H. Dortch, Secretary, FCC (filed July 30, 2016) (*State of Hawaii Ex Parte*); Letter from Brett Kilbourne, Vice President and Deputy General Counsel, Utilities Technology Council (UTC), to Marlene H. Dortch, Secretary, FCC (filed Sept. 6, 2016) (*UTC Ex Parte*); Letter from Randy Thompson, Communications Administrator, City of Mesa Arizona, to Marlene H. Dortch, Secretary, FCC (filed Sept. 28, 2016) (*City of Mesa Ex Parte*); Letter from David A. Felix, Executive Director, Regional Wireless Cooperative, to Marlene H. Dortch, Secretary, FCC (filed Sept. 27, 2016) (*Regional Wireless Cooperative Ex Parte*); Letter from Dale Shaw, Executive Director, TOPAZ Regional Wireless Cooperative (TRWC), to Marlene H. Dortch, Secretary, FCC (filed Oct. 3, 2016) (*TRWC Ex Parte*); Letter from Jeffrey L. Sheldon, Attorney, Southern Company Services, Inc. to Marlene H. Dortch, Secretary, FCC (filed Sept. 30, 2016) (*Southern Company Services, Inc. Ex Parte*); Letter from Pamela Gist, Counsel to Pioneer Cellular, to Marlene H. Dortch, Secretary, FCC (filed Oct. 27, 2016); Petition to Deny of Cities of Garland, Mesquite, Rowlett, and Sachse, Texas (filed Nov. 17, 2016) (*Garland, Mesquite, Rowlett Ex Parte*); Letter from Elizabeth R. Sachs, Counsel, Enterprise Wireless Alliance (EWA), to Marlene H. Dortch, Secretary, FCC (filed Nov. 22, 2016) (*EWA Ex Parte*); Letter from Michele Farquhar, Counsel to Association of American Railroads, to Marlene H. Dortch, Secretary, FCC (filed Dec. 22, 2016) (*AAR Ex Parte*). Mimosa Networks, Inc. filed an *ex parte* letter taking no position on Higher Ground's application or waiver requests, but asking the Commission to make clear that mobile earth terminals operating in the 3700-4200 MHz band (space-to-Earth) would be secondary to terrestrial stations operating in this band. Letter from Robert S. Koppel, Mimosa Networks, Inc., to Marlene H. Dortch, Secretary, FCC (filed Oct. 26, 2016) (*Mimosa Ex Parte*). As discussed in more detail below, fixed services are primary in this band. *See infra* para. 12.

<sup>6</sup> IBFS File No. SES-LIC-20150616-00357. *See also* Letter from Adam D. Krinsky, Wilkinson Barker Knauer, LLP, Counsel, Higher Ground LLC, to Paul E. Blais, Chief, Systems Analysis Branch, FCC International Bureau (filed July 30, 2016) (supplementing Higher Ground's filing). The application was placed on Public Notice on Aug. 5, 2015. *See Satellite Communications Services re: Satellite Radio Applications Accepted for Filing*, Public Notice, Report No. SES-01771, at 1-2 (Aug. 5, 2015). The Application was initially dismissed in part as defective insofar as it requested points of communication other than the specific three satellites specified in the application. *See* Letter from Paul E. Blais, Chief, Systems Analysis Branch, FCC International Bureau, to Adam D. Krinsky, Wilkinson Barker Knauer, LLP, Counsel, Higher Ground LLC, 30 FCC Rcd 8158 (July 27, 2015).

<sup>7</sup> Application at 2.

(space-to-Earth) and 5925-6425 MHz (Earth-to-space) bands. The SatPaq terminals will operate in the continental United States, Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands.<sup>8</sup>

4. Higher Ground requests waivers of the Commission's coordination rules, Sections 25.130(b), 25.203(c), and 101.103, based on the low power operations of its transmitter and its automated frequency coordination analysis system.<sup>9</sup> Higher Ground also requests a waiver of the U.S. Table of Frequency Allocations, Section 2.106, and of Section 101.147(a), Note 6, to permit mobile earth station operations as an application of the Fixed-Satellite Service (FSS).<sup>10</sup> Higher Ground plans to protect terrestrial C-band operations from harmful interference by using a database-driven, permission-based, self-coordination authorization system it calls "Channel Master" that was developed to identify non-interfering frequencies for SatPaq terminal operations at any specific location.<sup>11</sup>

5. Specifically, Higher Ground asserts that its Channel Master software will engage in a rigorous, conservative assessment of the interference that the transmissions from a SatPaq at a given location would cause to any receiver of a C-band fixed service (FS) link. The Channel Master software will only authorize a SatPaq terminal to transmit if the interference level at all FS receiver inputs is 6 dB (or more) below receiver thermal noise (*i.e.*,  $I/N \leq -6$  dB).

6. Higher Ground's SatPaq Network Controller will maintain an updated database derived from the Commission's Universal Licensing System (ULS) with all authorizations for C-band, FS receive stations, which will be used to perform analysis of potential interference from SatPaq transmitters to FS receivers.<sup>12</sup> The SatPaq Network Controller will use the SatPaq terminal's geo-coordinates and the database information to determine whether transmission from that specific location on a given frequency and to a given satellite is allowable. According to Higher Ground, when transmission to a given satellite on a given frequency could exceed the specified interference threshold, the SatPaq Network Controller will use the database to explore the possibility of transmitting on another frequency and/or using a different satellite.<sup>13</sup> As described above, Higher Ground's Channel Master software identifies all transmit frequencies and satellite choices that ensure interference to any C-band FS receiver does not exceed the -6 dB I/N threshold. Higher Ground incorporated its Channel Master software into the SatPaq application, so that analysis of potential interference to FS receiving stations can be conducted both by the SatPaq terminal and the SatPaq Network Controller.<sup>14</sup> Higher Ground states that it will update daily the Channel Master database for C-band point-to-point operations, including the database embedded in the SatPaq, and will deliver these updates to the SatPaq application either via the smartphone's mobile data network

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<sup>8</sup> *Id.* Higher Ground has been operating on an experimental basis pursuant to an FCC experimental license since 2014. See ELS File Nos. 0443-EX-PL-2014, May 30, 2014, 0124-EX-ML-2015, June 15, 2015, 0036-EX-ML-2016, Mar. 3, 2016, 0233-EX-RR-2016, May 9, 2016, and 0093-EX-ML-2016, June 3, 2016, Call Sign WH2XHP.

<sup>9</sup> 47 CFR §§ 25.130(b), 25.203(c), and 101.103.

<sup>10</sup> 47 CFR §§ 2.106 and 101.147(a), Note 6.

<sup>11</sup> Application at 1.

<sup>12</sup> The database will include FS licensees and applicants, including the coordinate locations and orientations of the FS receiving antennas, the frequencies of the FS stations, and their antenna heights, heights above mean sea level, and receiving antenna polarizations. Letter from Adam D. Krinsky, Wilkinson Barker Knauer, LLP, Counsel, Higher Ground LLC, to Marlene H. Dortch, Secretary, FCC (filed May 23, 2016) (Higher Ground LLC May 23, 2016 *Ex Parte*).

<sup>13</sup> Application at 4.

<sup>14</sup> See Application, Technical Appendix at 12 ("The look-up table, or a portion of it, may be off-loaded to the SatPaq, enabling the SatPaq to identify and select a suitable frequency to request transmission with SatPaq Network Control."). These dual points of analysis were designed to make SatPaq operations more efficient and enable mobility. *Id.*

or Wi-Fi, or via the satellite when the SatPaq is out of mobile network range.<sup>15</sup>

7. On August 5, 2015, the International Bureau placed Higher Ground's application on public notice.<sup>16</sup> In response, the Fixed Wireless Communications Coalition, Inc. (FWCC) filed a Petition to Deny the application.<sup>17</sup> FWCC has concerns about interference in the 6 GHz frequency band. FWCC asserts that Higher Ground's proposed unilateral interference protection mechanism is insufficient.<sup>18</sup> FWCC argues that Higher Ground's request for waiver of the Table of Frequency Allocations for the operation of mobile earth stations in the 5925-6425 MHz frequency band is not appropriate and should be subject to a notice and comment rulemaking.<sup>19</sup> Specifically, FWCC states that Higher Ground's waiver request does not meet the Commission's waiver standards, and that grant of the waiver would increase the potential for harmful interference to FS stations.<sup>20</sup> CenturyLink also filed opposition comments asserting similar concerns regarding the potential for harmful interference.<sup>21</sup> Nebraska Public Power District, Frontier, UTC, the State of Hawaii, NSMA, the City of Mesa, the Regional Wireless Cooperative, the TOPAZ Regional Wireless Cooperative, and Southern Company Services, Inc. filed *ex partes* echoing the interference concerns articulated by FWCC and CenturyLink.<sup>22</sup> The *ex parte* filings also emphasized the importance of the 6 GHz band (or 5925-6425 MHz band) to critical infrastructure.<sup>23</sup> Finally, the *ex parte* filings expressed concern about the ability of the terrestrial operators to detect and identify the source of interference.<sup>24</sup> Intelsat filed comments in support of Higher Ground's application.<sup>25</sup>

### III. DISCUSSION

8. As explained below, we grant Higher Ground's application, and waive the Table of Frequency Allocations and the applicable coordination rules to the extent necessary to permit SatPaq operations as described in Higher Ground's application, with certain conditions. In doing so, we first review the public interest benefits and unique circumstances posed by Higher Ground's application. We then address the concerns raised by existing users in the uplink frequency band about the potential for harmful interference. We also consider questions about the ability of other C-band users to identify the source of potential interference, if it occurs, and available recourse. Additionally, we discuss the issue raised regarding the potential for adjacent channel interference. Finally, we weigh the issues raised by the introduction of a new approach to frequency coordination analysis that uses an automated system.

9. *Public Interest Benefits.* Under Section 309(a) of the Communications Act, the Commission must determine whether the public interest is served by the grant of an application. In

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<sup>15</sup> Higher Ground May 23, 2016 *Ex Parte* at 2-3. The satellites will constantly broadcast the current Channel Master database version number and information about recent changes. *Id.* at 2-3.

<sup>16</sup> See *Satellite Communications Services re: Satellite Radio Applications Accepted for Filing*, Public Notice, Report No. SES-01771 (Aug. 5, 2015).

<sup>17</sup> See *infra* n.2.

<sup>18</sup> See FWCC Petition to Deny.

<sup>19</sup> See *id.* at 1, n.3.

<sup>20</sup> *Id.* at 4.

<sup>21</sup> CenturyLink Opposition Comments.

<sup>22</sup> See generally Nebraska PPD *Ex Parte*; Frontier *Ex Parte*; UTC *Ex Parte*; State of Hawaii *Ex Parte*; NSMA *Ex Parte*.

<sup>23</sup> See, e.g., Frontier *Ex Parte* at 1; Nebraska *Ex Parte* at 1; UTC *Ex Parte* at 1.

<sup>24</sup> See, e.g., Frontier *Ex Parte*; UTC *Ex Parte* at 5.

<sup>25</sup> See generally Intelsat Comments.

pertinent part, Section 309(a) states: “[t]he Commission shall determine . . . whether the public interest, convenience, and necessity will be served by the granting of such application, and if the Commission, upon examination of such application and upon consideration of other matters as the Commission may officially notice, shall find that the public interest, convenience, and necessity would be served by the granting thereof, it shall grant such application.”<sup>26</sup> In making this determination, we first turn to the public interest benefits that Higher Ground claims its proposed operation will produce.

10. Higher Ground asserts that grant of its application will allow the introduction of a new consumer service and make more intensive and efficient use of C-band spectrum through a sharing regime.<sup>27</sup> Higher Ground further notes in its application that the Commission encourages the shared use of spectrum, as it proposes, where the behavior of other users – in this case, FS stations – is well understood and predictable.<sup>28</sup> Intelsat argues that Higher Ground’s service offerings will help satisfy consumer demand for affordable, ubiquitous messaging services offering universal connectivity across the United States.<sup>29</sup>

11. We agree that Higher Ground’s proposed operations would provide public interest benefits by making available to consumers a unique service in areas that may lack coverage. Higher Ground has explained that one of the primary purposes of its service is to enable hikers and others travelling into areas that have no cell phone coverage to be able to keep in touch – *e.g.*, short text messages to friends or relatives to let them know they are alright. Or message for help if they are in trouble. The Commission has found that the public interest is best served when consumers have access to a diverse array of communications services and facilities, including robust satellite networks that can reach remote areas of the United States that are not well served by existing terrestrial networks.<sup>30</sup> Higher Ground seeks to use a customized automated frequency coordination analysis system (discussed below) to permit its proposed use of C-band spectrum while mitigating the risk of harmful interference to point-to-point microwave receivers. We thus find that Higher Ground’s proposed system and operations, under certain conditions, would further the Commission’s interest in ensuring the highest public benefit is derived from this finite spectrum resource.<sup>31</sup>

12. *Interference Analysis.* We turn to the technical details of Higher Ground’s system. Higher Ground proposes to operate in the 5925-6425 MHz (Earth-to-space) and the 3700-4200 MHz (space-to-Earth) frequency bands. In the United States, these bands are allocated to the FS and the FSS for primary use.<sup>32</sup>

13. Higher Ground’s use of the 6 GHz band is opposed by various C-band FS users.<sup>33</sup> As an

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<sup>26</sup> 47 U.S.C. § 309.

<sup>27</sup> Application at 1. *See also* Intelsat Comments at 1.

<sup>28</sup> FCC, *Connecting America: The National Broadband Plan*, at 96 (2010).

<sup>29</sup> Intelsat Comments at 2. Intelsat also agrees that Higher Ground’s service will promote the more efficient use of C-band satellite spectrum and capacity. *Id.*

<sup>30</sup> *See* FCC, *Connecting America: The National Broadband Plan*, at 95. *See also* Intelsat Comments at 1.

<sup>31</sup> *See generally* Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959 (2015) (3.5 GHz R&O) (noting the importance of spectrum sharing in all bands).

<sup>32</sup> 47 CFR § 2.106.

<sup>33</sup> FWCC notes that an applicant who seeks a waiver to introduce a non-allocated service into an established band has the burden of establishing it will not cause harmful interference to the incumbent. *See* Letter from Cheng-yi Liu and Mitchell Lazarus, Counsel to FWCC, to Marlene H. Dortch, Secretary, FCC, at 2, fn. 2 (filed July 29, 2016)

(continued....)

initial matter, FWCC, CenturyLink, and UTC point out that the 6 GHz band is crucially important to FS operations.<sup>34</sup> For example, the 6 GHz band routinely carries applications critical to safety of life and property such as pipeline control, operation of the electric grid, synchronizing the movement of railroad trains, real-time financial and market data, and public safety communications, among others.<sup>35</sup> They stress that reliability is therefore an important factor, noting that many applications have typical availabilities of better than 99.999 percent.<sup>36</sup>

14. FWCC, CenturyLink, Frontier, and UTC also assert that SatPaq terminals will cause interference to FS operations in the 6 GHz frequency band.<sup>37</sup> FWCC claims that Higher Ground's assumptions about the performance level and off-axis gain of the FS antennas that would be subject to interference from Higher Ground are incorrect, and therefore the separation distance it calculates is not nearly large enough to satisfy its interference objective.<sup>38</sup> Similarly, CenturyLink asserts that the 9 dBW (39 dBm) e.i.r.p. level at which the SatPaq terminals would transmit in the C-band may cause interference in some scenarios.<sup>39</sup> Further, FWCC is concerned about the SatPaq terminals' use of a directional antenna and sensors in the attached consumer cell handset to turn off the device if the antenna is pointed in the wrong direction. They assert that the wide beam width of the transmit antenna could easily encompass both the satellite and a victim FS receiver, particularly at higher latitudes where satellite look angles are closer to the horizon.<sup>40</sup> Therefore, CenturyLink asserts that under certain circumstances, such interference could result in a major network outage.<sup>41</sup>

15. Higher Ground opposes the petitions, and argues that its service can operate without causing interference to C-band FS point-to-point licensees. Higher Ground details several approaches that it has incorporated into its system to prevent or minimize the risk of harmful interference. Specifically, Higher Ground will use its Channel Master software to identify non-interfering frequencies for SatPaq terminal operation, taking into account all relevant ULS-derived data for individual C-band point-to-point receivers as well as the SatPaq terminal's location and orientation, and the use of frequency diversity and satellite choice.<sup>42</sup> A SatPaq terminal will not transmit other than on the non-interfering "hailing frequency" if its database does not contain current information, absent frequency assignment from the SatPaq Network Controller.<sup>43</sup> The SatPaq terminal can use the hailing frequency to request

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(FWCC July 29 *Ex Parte*) (citing *Ms. Laura Stefani*, 30 FCC Rcd 137 at 5 (WTB 2015) *rev'd in part on additional factual showings*, 30 FCC Rcd. 10164 (WTB 2015)).

<sup>34</sup> See, e.g., CenturyLink Opposition Comments at 5.

<sup>35</sup> *Id.* at 3. The State of Hawaii also objects to Higher Ground's application based on the state of Hawaii's use of these frequency bands for public safety purposes. See *State of Hawaii Ex Parte*.

<sup>36</sup> Letter from Cheng-yi Liu, Counsel to FWCC, to Marlene H. Dortch, Secretary, FCC, at 4 (filed July 15, 2016) (FWCC July 15 *Ex Parte*).

<sup>37</sup> Letter from Cheng-yi Liu and Mitchell Lazarus, Counsel to FWCC, to Marlene H. Dortch, Secretary, FCC, at 2 (filed June 8, 2016) (FWCC June 8 *Ex Parte*); CenturyLink Opposition Comments at 1.

<sup>38</sup> FWCC Petition to Deny at 11.

<sup>39</sup> CenturyLink Opposition Comments at 4.

<sup>40</sup> FWCC June 8 *Ex Parte* at 5.

<sup>41</sup> *Id.* See also Tiffany West Smink, Counsel, CenturyLink, to Marlene H. Dortch, Secretary, FCC, at 2 (filed Feb. 1, 2016) (CenturyLink Feb. 1 *Ex Parte*) (discussing the "response cascade" of trouble-shooting and re-routing traffic).

<sup>42</sup> Higher Ground May 23, 2016 *Ex Parte* at 2.

<sup>43</sup> Higher Ground has chosen 5927.5 MHz as its primary hailing frequency because it is a low-bandwidth, lightly used channel with few active point-to-point links. See Application, Technical Appendix at 14.

relevant updates, and the satellite will deliver “new” C-band FS receiver information to allow it to select a non-interfering frequency.<sup>44</sup>

16. Additionally, Higher Ground underscores that SatPaq terminal transmissions in the 5925-6425 MHz frequency band will be such that the interference level to any C-band FS receiver will be 6 dB or more below the thermal noise floor at the receiver. Whenever this condition is not met the SatPaq will search for another frequency, or use satellite diversity, to avoid exceeding the -6 dB I/N threshold to any FS receiver.

17. Finally, Higher Ground provides additional assurance regarding interference mitigation. Specifically, the SatPaq Network Controller will maintain supervisory control of all operations at all times. Thus, the SatPaq Network Controller can override the frequency selection of the software on the SatPaq application and assign a different frequency or satellite for a SatPaq terminal transmission, shut off the entire SatPaq terminal operation by muting the forward path from a satellite necessary for the communication “handshake,” or direct a specific SatPaq terminal to suspend or delay its transmission.<sup>45</sup>

18. In support of Higher Ground’s application, Intelsat points out that the SatPaq terminal use of spread spectrum techniques will ensure compliance with the Commission’s off-axis power spectral density limits, thus protecting adjacent satellite systems.<sup>46</sup> Intelsat also notes transmissions from its satellites to the SatPaq terminal will comply with FCC and ITU power flux density limits, thereby protecting FS receivers from downlink interference in the 3700-4200 MHz frequency band.<sup>47</sup>

19. We find that Higher Ground has demonstrated that its proposed system should prevent or minimize the risk of harmful interference to FS operators in the 5925-6425 MHz frequency band. In designing its proposed system, Higher Ground has incorporated interference avoidance techniques, including a detailed analysis of potential interference to FS stations, taking into account the characteristics of the SatPaq transmitting station, the FS receiving stations, and the propagation environment between the stations,<sup>48</sup> frequency agility, and satellite diversity. We clarify that, because FS stations in the 5925-6425 MHz band are permitted to operate under conditional authority immediately upon the filing of an application,<sup>49</sup> Higher Ground’s system must protect terrestrial FS receivers that are operating under conditional authority, in addition to receivers operating under licenses.

20. We are authorizing this system with a number of conditions designed to allow the service to rollout in a controlled manner in order to minimize any potential negative impact on primary users (current and future) in the unlikely event of interference. Notably, Higher Ground’s system must accept interference from and avoid causing interference to all current and future users of the band operating under an existing allocation. In addition, the SatPaq Network Controller must maintain supervisory control of all operations at all times. The SatPaq Network Controller must maintain the ability to override the frequency selection of the software on the SatPaq application and assign a different frequency or satellite for a SatPaq terminal transmission, shut off the entire SatPaq terminal operation by muting the forward path from a satellite necessary for the communication “handshake,” or direct a specific SatPaq terminal to suspend or delay its transmission. Finally, we note that we retain the right to add or change

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<sup>44</sup> *Id.*

<sup>45</sup> Higher Ground May 23, 2016 *Ex Parte* at 3.

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

<sup>47</sup> *Id.*

<sup>48</sup> Letter from Adam D. Krinsky, Wilkinson Barker Knauer, LLP, Counsel, Higher Ground LLC, to Marlene H. Dortch, Secretary, FCC, Attach. B at 4-5 (filed Dec. 17, 2015).

<sup>49</sup> 47 C.F.R §101.31(b).

allocations in the band, and Higher Ground must protect users operating under these new or modified allocations in these bands.

21. *Adjacent Channel Interference.* FWCC is concerned that Higher Ground does not offer protection against adjacent channel operations. FWCC points out that like all receivers, those in the FS are vulnerable to interference sources in adjacent channels, and under some conditions, in second-adjacent channels as well (as where the interfering mobile is close to the victim FS receiver). In response, Higher Ground asserts that its SatPaq terminal operations will comply with applicable out-of-band emission limits, including those specified in Section 25.202(f) of the FCC's rules, which are designed to protect against adjacent-channel interference.

22. We find that, given the low signal strength at which the SatPaq terminals transmit and the small likelihood of having a SatPaq close to an FS station operating in the adjacent channel, the risk of interference is minimal. In any event, Higher Ground is obligated to comply with Section 25.202(f) of the Commission's rules in order to protect against adjacent-channel interference.

23. *Automated Frequency Coordination.* FWCC, CenturyLink, and others oppose Higher Ground's use of an automated frequency coordination analysis system rather than traditional coordination methods. FWCC argues that Higher Ground's coordination system is wholly unilateral, lacks transparency, and is not subject to review by independent validation.<sup>50</sup> FWCC notes that White Space and Citizens Broadband Radio Service's protection of incumbents involved highly public processes, and that Higher Ground's proposal is unacceptably opaque in comparison.<sup>51</sup> FWCC also asserts that Higher Ground's presumptions about FS stations' operational parameters are incorrect.<sup>52</sup> Specifically, FWCC is concerned that the ULS -- the FS license database on which Higher Ground proposes to rely -- includes errors, particularly in tower locations.<sup>53</sup> FWCC, however, acknowledges that most of the errors are likely to be small, and that the FS licensees have the responsibility to keep the database accurate.<sup>54</sup> Finally, FWCC asserts that there is no way for an authorized user to protest interference.<sup>55</sup>

24. In response, Higher Ground notes that the Commission has found that other parties may reasonably rely upon ULS licensing data, even if "attributable to an 'error in the Commission's data base.'"<sup>56</sup> In any event, Higher Ground asserts that whenever it has found errors of omission in the ULS licensing data, Higher Ground inserts replacement data with a significant safety factor.<sup>57</sup> Higher Ground also notes that it has thoroughly explained and demonstrated its coordination process both to the Commission and interested parties. The application and underlying technical information have been on public notice and available for comment, and Higher Ground argues that it has provided sufficient answers and explanations for any issues raised.

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<sup>50</sup> FWCC June 8 *Ex Parte* at 5 (noting its concerns regarding Higher Ground's resistance to providing the algorithm for, and notification of changes to, its interference calculation model).

<sup>51</sup> FWCC June 8 *Ex Parte* at 3-4.

<sup>52</sup> FWCC Petition to Deny at 8-9; FWCC June 8 *Ex Parte* at 7-8; FWCC July 15 *Ex Parte* at 11.

<sup>53</sup> FWCC June 8 *Ex Parte* at 4.

<sup>54</sup> *Id.*

<sup>55</sup> FWCC June 8 *Ex Parte* at 2; FWCC July 13 *Ex Parte* at 8, 10; State of Hawaii *Ex Parte*.

<sup>56</sup> Letter from Adam D. Krinsky, Wilkinson Barker Knauer, LLP, Counsel, Higher Ground LLC, to Marlene H. Dortch, Secretary, FCC, at 5 (filed July 21, 2016) (Higher Ground July 21 *Ex Parte*) (citing *Liberty Commc'ns., Inc. and Sprint Nextel Corp.*, 25 FCC Rcd 9197, 9203, paras. 1617 (PSHSB 2010)).

<sup>57</sup> Higher Ground July 21, 2016 *Ex Parte* at 5 ("for example, if antenna height is omitted from the ULS database, Higher Ground submits an overly conservative level of 100 meters for the missing data").



25. We find that Higher Ground's automated coordination process, while unconventional and proprietary, provides necessary safeguards against harmful interference to users in the band. Higher Ground's interference analysis is a unilateral coordination process that is different from the previously established coordination process under Section 25.203(c) of the Commission's rules.<sup>58</sup> However, the Commission supports new, innovative and increasingly efficient ways of achieving spectrum sharing without harmful interference to other users.<sup>59</sup> Although the details of Higher Ground's algorithms are proprietary, Higher Ground has provided sufficient technical and operational parameters for its automated coordination system to support its application. For example, Higher Ground's reliance on the ULS to identify FS stations is reasonable, and Higher Ground states that it has endeavored to correct any errors that it has identified with conservative assumptions designed to avoid any harmful interference.<sup>60</sup>

26. *Attributing Harmful Interference.* Higher Ground asserts that its billing logs will be able to confirm or deny that a SatPaq terminal caused a particular interference event.<sup>61</sup> FWCC counters that even if Higher Ground's operations were to seriously degrade FS operations, the affected FS operators would have no way to connect the interference to Higher Ground.<sup>62</sup> FWCC states that they are sensitive to this problem after incidents of interference from earth stations on vessels proved very difficult to identify.<sup>63</sup> Even if interference events were properly attributable retroactively, argues FWCC, the damage would have been done and there would be no way for an FS operator to address the root cause of the problem.<sup>64</sup>

27. CenturyLink is also concerned about the intermittent nature of the SatPaq terminal transmissions, and thus the difficulty in isolating the source of any interference.<sup>65</sup> CenturyLink requests that grant of Higher Ground's application include a condition that Higher Ground accept responsibility and liability for any operational hardship associated with service degradation and liability for any fines, penalties, or legal complications resulting from service disruption or outage.<sup>66</sup>

28. In response, Higher Ground points out that SatPaq terminal operations will be network-controlled, and Higher Ground will log all SatPaq terminal transmissions.<sup>67</sup> The Higher Ground log will contain each SatPaq terminal's transmitting location, and the date, time, and duration of each transmission, and thus can be used to identify whether SatPaq terminal operations occurred in the vicinity of any reported interference.<sup>68</sup> The log and all of its details will be made available to the Commission upon request.<sup>69</sup> Higher Ground notes that the Commission supports the use of dynamic coordination

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<sup>58</sup> 47 CFR 25.203(c).

<sup>59</sup> See, e.g., *3.5 GHz R&O*, 30 FCC Rcd at 3964, para. 13.

<sup>60</sup> *Id.*

<sup>61</sup> Higher Ground July 21, 2016 *Ex Parte* at 4.

<sup>62</sup> FWCC July 29 *Ex Parte* at 4-5. See also *State of Hawaii Ex Parte* (arguing that there would be no way for a "victim" of interference to predict or avoid interference).

<sup>63</sup> FWCC Petition to Deny at 7.

<sup>64</sup> *Id.* See also *State of Hawaii Ex Parte* (asserting that recourse for confirmed interference would be uncertain).

<sup>65</sup> CenturyLink Opposition Comments at 2-3. See also *State of Hawaii Ex Parte* (arguing that sporadic interference is hard to identify and ascribe to a mobile device).

<sup>66</sup> CenturyLink Feb. 1 *Ex Parte* at 5-6.

<sup>67</sup> See Higher Ground July 21, 2016 *Ex Parte* at 4.

<sup>68</sup> *Id.*

<sup>69</sup> *Id.*

frameworks for other services, such as Citizens Broadband Radio Service, to maximize spectrum's potential use. The sharing regime in that case involves a three-tiered framework, prioritizing use across multiple users in commercial and government environments, with potentially multiple administrators.<sup>70</sup> In contrast, Higher Ground argues that the SatPaq terminal interference regime is unlike the framework required for other services, such as the Citizens Broadband Radio Service, in that it is much simpler to implement using a single database that authorizes and manages a limited number of devices operated within the same network.

29. As previously noted, the Commission supports innovative ways to share spectrum without interfering with other users.<sup>71</sup> In this case, the use of a single database that authorizes and manages the devices within a single network is relatively simple. Nonetheless, we agree that Higher Ground's authorization should be conditioned on the tracking of SatPaq terminal transmissions as described above, and that such tracking requirements, along with operational requirements like those requested by CenturyLink, are critical interference management measures for accurately assessing and addressing any interference that may occur. Specifically, CenturyLink requested that Higher Ground maintain logs of all activity, cease activity in the event of a database outage, provide written notice of changes in interference algorithms, provide a direct point of contact for shutdown requests, and provide a competent and responsive contact to work jointly towards resolution of any harmful interference.<sup>72</sup> We agree that for Higher Ground's proposed SatPaq terminal operations, these are reasonable conditions for sharing spectrum in this band, and, accordingly, we conclude that Higher Ground's application should not be granted without including those conditions in the license.

30. We decline, however, to require Higher Ground to accept responsibility and liability for any reported interference. Such a requirement would be unprecedented and is unnecessary given the conditions placed on Higher Ground's operations and the Commission's other enforcement tools. We do require Higher Ground to comply with requests from the Commission or FS operators for information to investigate or resolve reported interference, and to otherwise cooperate in good faith with such investigations and remedial efforts.

31. *Differential Fading.* FWCC asserts that differential fading in microwave signals means that FS receivers are more vulnerable to interference by SatPaq terminals when the FS signal is weakened by atmospheric conditions. Modern FS systems use a "fade margin" to preserve communications during fading events. FWCC argues that if SatPaq transmissions near a receiving FS station do not fade during an atmospheric event that affects the FS link, the FS station received signal will become more vulnerable to interference.<sup>73</sup> In response, Higher Ground asserts that any of 50,000 SatPaqs being close to a FS station receiver and causing such interference is statistically unlikely to occur.<sup>74</sup> Given the safeguards incorporated as conditions to its license, we agree with Higher Ground that the likelihood of interference from SatPaqs during differential fading is very small.

32. *Incentives to Avoid Harmful Interference.* FWCC points out that Higher Ground's primary responsibilities are to its customers and shareholders, not to other authorized users in the band. As FWCC itself notes, however, the tension between profit and adherence to the parameters of a license are inherent for any provider. There is nothing unique about Higher Ground that indicates that it is any

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<sup>70</sup> *Id.*

<sup>71</sup> *Infra.* para. 25, n.61.

<sup>72</sup> Letter from Tiffany West Smink, Counsel, CenturyLink, to Marlene H. Dortch, Secretary, FCC, at 3 (filed Mar. 4, 2016) (CenturyLink Mar. 4, 2016 *Ex Parte*).

<sup>73</sup> TWCC June 8 *Ex Parte* at 5.

<sup>74</sup> Higher Ground July 21, 2016 *Ex Parte* at 6.

more likely to act outside its license when cases arise in which Higher Ground must block its own communication in order to protect a FS link. Like any license holder, Higher Ground must comply with all conditions of its license or be subject to enforcement action by the Commission.

33. *Waiver Versus Rulemaking Analysis.* FWCC argues that Higher Ground's application should be considered in the context of a rulemaking proceeding of general applicability. Higher Ground responds that grant of its application would be consistent with Commission precedent granting similar technical waivers.

34. The rulemaking process is particularly appropriate for establishing a new category of spectrum use that is not tailored for one individual's operations, while the adjudicative process, like a waiver proceeding, generally functions as a more effective vehicle for addressing more individualized circumstances. In this case, Higher Ground proposes a specific, unique application of the C-band that does not warrant a rulemaking proceeding of general applicability. Additionally, Higher Ground has adequately demonstrated an alternative methodology to protect other users of this spectrum, and we condition this grant to minimize further the potential for harmful interference. For these reasons, we have decided to exercise our considerable discretion on the choice of procedural vehicle for responding to Higher Ground's request by resolving this case through the adjudicative process.<sup>75</sup>

35. *Waiver Analysis.* Generally, the Commission may waive any rule for good cause.<sup>76</sup> Waiver is appropriate if special circumstances warrant a deviation from the general rule, and the deviation will serve the public interest.<sup>77</sup> FWCC and NSMA assert that waiver of spectrum management rules is inappropriate in this case, and that a full notice and comment rulemaking is required in order to permit Higher Ground's proposed services to operate in the C-band.<sup>78</sup> We find good cause for waiver of the Table of Frequency Allocations and the applicable coordination rules is warranted in this case to the extent necessary for Higher Ground to provide services as specified in its application. The record in the proceeding indicates that there is little risk of harmful interference given the low power transmissions proposed and the comprehensive self-coordination safeguards developed by Higher Ground.<sup>79</sup> Nor do we believe that a grant of this waiver will undermine the rule, given that it is limited to a specific, unique type of operation and, as discussed in detail below, is being authorized under a carefully drawn set of conditions designed to minimize any risk of interference due to operations under the waiver.

36. As indicated above, we have determined that a cautious approach is warranted, considering that a self-coordination system like Higher Ground's does not have a track record of wide-scale, generalized deployment. Accordingly, we impose specific conditions to safeguard against

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<sup>75</sup> See, e.g., *SEC v. Chenery Corp.*, 332 U.S. 194, 203 (1947) (stating that "the choice made between proceeding by general rule or by individual, ad hoc litigation is one that lies primarily in the informed discretion of the administrative agency"); *SBC Communications, Inc. v. FCC*, 138 F.3d 410, 421 (D.C. Cir. 1998) (stating that "[i]nherent in an agency's ability to choose adjudication rather than rulemaking . . . is the option to make policy choices in small steps, and only as a case obliges it to") (citation omitted).

<sup>76</sup> 47 C.F.R. § 1.3.

<sup>77</sup> See *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969); *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

<sup>78</sup> FWCC June 8 *Ex Parte* at 6; FWCC July 29 *Ex Parte* at 2-3. CenturyLink also argues that waiver of Note 6 to 47 CFR § 101.147 would be necessary to allow mobile services in the FS environment. See CenturyLink Opposition Comments at 3. FWCC states that they have heard from non-members who belatedly learned about the application and would have participated had they known earlier or had a rulemaking proceeding been initiated.

<sup>79</sup> Higher Ground transmitters operate at a peak power of 9 dBW and a power spectral density of -21 dBW/4 kHz or less, and based on Higher Ground's self-coordination methods, would not produce any interference level to FS operations in excess of 6 dB below the thermal noise level.

unintended consequences if Higher Ground's system, for any reason, does not perform as promised, and to provide additional transparency. First, we condition this grant on a phased roll out of a maximum 50,000 authorized SatPaq terminals. Specifically, Higher Ground may deploy up to 5,000 new terminals each quarter during the first year following authorization. Thereafter, Higher Ground may deploy additional terminals up to the 50,000 total authorized number, but is required to notify the Commission when it has deployed: (1) 30,000 terminals, (2) 40,000 terminals, and (3) 50,000 terminals. Second, Higher Ground's automated coordination system must log the date, time, location, frequency, and satellite point of communication of each SatPaq terminal transmission. Third, Higher Ground must make this coordination data available to any FS operator, FSS operator, or the Commission, upon request. Additionally, as noted above, Higher Ground must cease activity in the event of a database outage, provide written notice of changes in interference algorithms, provide a direct point of contact for shutdown requests, and provide a competent and responsive contact to work jointly towards resolution of any harmful interference. The Commission may suspend or terminate deployment and operational authority at any time if it finds that the Higher Ground system causes unresolved harmful interference to protected users of the band. We note that to the extent that Higher Ground expands operations beyond the 50,000 terminals authorized or that we receive additional similar waiver requests, we will consider the possibility of conducting a rulemaking to formally establish a new service.

37. *Section 25.218(d) Compliance.* Section 25.218(d) of the Commission's rules provides limits on earth station off-axis e.i.r.p. density levels in the plane tangent to and the plane perpendicular to the geostationary arc.<sup>80</sup> Based on the antenna gain pattern characteristics of the SatPaq antenna and the transmitted e.i.r.p. density characteristics of the SatPaq terminal transmissions, no more than 100 SatPaq terminals should simultaneously transmit on the same frequency using an 8 megahertz bandwidth emission, and no more than 50 SatPaq terminals should simultaneously transmit on the same frequency using a 4 megahertz bandwidth emission, in order for the aggregate e.i.r.p. density of all concurrently-transmitting co-frequency SatPaq terminals to stay below the Section 25.218(d) limits.<sup>81</sup>

#### IV. CONCLUSION AND ORDERING CLAUSES

38. In sum, we find that Higher Ground's service will provide significant public interest benefits to consumers that are not currently served. Further, we find that Higher Ground has committed to following an interference management plan and that should prove highly effective, and that this plan, coupled with the conditions we impose herein, ensure that the waiver granted for Higher Ground's specific, unique operations will not undermine the Commission's rules. Accordingly, good cause has been shown for waiving the rules to the extent described in this Order and Authorization, and we conclude that grant of Higher Ground's application for a blanket license to operate up to 50,000 SatPaq terminals operating with three specific satellites in the 5925-6425 MHz (Earth-to-space) and 3700-4200 MHz (space-to-Earth) frequency bands, as conditioned herein, will serve the public interest, convenience, and necessity.

39. Accordingly, IT IS ORDERED that, pursuant to authority in Sections 0.31, 0.131, 0.241, 0.331, and 1.3 of the Commission's rules, 47 C.F.R. §§ 0.31, 0.51, 0.131, 0.241, 0.261, 0.331, and 1.3, and Sections 4(i), 301, 302, 303(r), 308, 310, and 405 of the Communications Act, as amended, 47 U.S.C. §§ 154(i), 301, 302, 303(r), 308, 309, 310, and of the Commission's rules, the application of Higher Ground LLC, IBFS File No. SES-LIC-20150616-00357 (E150095) for a blanket license to operate up to 50,000 SatPaq terminals communicating with the Galaxy 3-C (Call Sign S2381) at 95.05° W.L., Galaxy 12 (Call Sign S2422) at 129.0° W.L., and Galaxy 19 (Call Sign S2647) at 97.0° W.L., using the antenna specified in Higher Grounds' application, is GRANTED, subject to the conditions specified in paragraph

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<sup>80</sup> 47 CFR § 25.218(d).

<sup>81</sup> See Application, Technical Appendix at 7-8.

40 below, and subject to the following parameters for emissions in the Earth-to-space direction:

Emission: 8M00G1D

Max EIRP/Carrier: 9 dBW

Max EIRP Density/Carrier: -24 dBW/4 kHz

No more than 100 SatPaq terminals may transmit concurrently within any 8 MHz band, consistent with 47 CFR § 25.218(d.)

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Emission: 4M00G1D

Max EIRP/Carrier: 9 dBW

Max EIRP Density/Carrier: -21 dBW/4 kHz

No more than 50 SatPaq terminals may transmit concurrently within any 4 MHz band, consistent with 47 CFR § 25.218(d).

40. IT IS FURTHER ORDERED that Higher Ground's authorization IS CONDITIONED on the following requirements:

- a. Higher Ground may only deploy a maximum of 5,000 new SatPaq terminals each quarter during the first year following authorization. Thereafter, Higher Ground may deploy additional terminals up to the 50,000 total authorized number, but is required to notify the Commission when it has deployed: (1) 30,000 terminals, (2) 40,000 terminals, and (3) 50,000 terminals.
- b. Higher Ground operations must not cause harmful interference to any current or future authorized station operating in compliance with the Table of Frequency Allocations in the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz band (Earth-to-space) bands (*see* 47 CFR § 2.106), and must accept interference caused by current and future authorized stations in these bands. Higher Ground must immediately cease operation of its SatPaq terminals upon notification of such harmful interference from its operations.
- c. Higher Ground must maintain a 24/7 point-of-contact with capability to remotely control and shut down SatPaq terminal operations, and remedy any interference problems or terminate operations. The Commission may suspend or terminate deployment authority at any time if it finds that the Higher Ground system causes unresolved harmful interference to protected users of the band.
- d. Higher Ground must respond promptly to requests for information, coordination and interference resolution by the Commission and other authorized operators in these bands, and must cooperate in good faith with efforts to identify and resolve interference.
- e. Higher Ground's automated coordination system must log the date, time, location, frequency, and satellite point of communication of each SatPaq terminal transmission. This log of each transmission must be maintained for a period of not less than one year. Higher Ground must make this coordination data available to any FS operator, FSS operator, or the Commission, upon request.
- f. Higher Ground SatPaq terminals must request reauthorization from the automated coordination system upon a change in coordinates of more than 1 second in latitude or longitude.
- g. Higher Ground must maintain a log recording all incidents of alleged harmful radio interference. The log must document the nature of each incident, the parties involved, and

the outcome. The log must be maintained for a five year period after each incident, and must be made available to the Commission upon request.

- h. Higher Ground must submit to the Commission an annual report indicating the number of SatPaq terminals actually brought into service under its blanket licensing authority. The first of these reports is due one year after the date of grant and these reports are required upon deployment of 30,000, 40,000 and 50,000 SatPaqs, or annually until the 50,000 authorized SatPaqs have been deployed.
- i. Higher Ground must continue to update daily its Channel Master database of C-band FS operations, including the database embedded in the SatPaq terminals, from the Commission's Universal Licensing System (ULS) database. In the event of an outage of the ULS database, Higher Ground must update its database promptly once the ULS database is back on-line. If Higher Ground's Channel Master database is not updated accordingly, the devices may not transmit except on the non-interfering hailing frequency.
- j. Higher Ground must promptly report to the Commission any changes in its Channel Master automated coordination system software algorithm or assumptions that impact the interference threshold or calculated interference level to FS systems.
- k. Higher Ground's automated coordination methods must adapt to any changes in configuration to the Commission's current ULS database or any future applicable database adopted by the Commission. Higher Ground's automated coordination methods must also comply with any applicable future automated coordination system best practices and any applicable rules adopted by the Commission.

41. IT IS FURTHER ORDERED that Higher Ground's request for a waiver of the Table of Frequency Allocations, 47 CFR § 2.106, and of 47 CFR § 101.147(a), Note 6, and of the applicable coordination rules, 47 CFR §§ 25.130(b), 25.203(c), and 101.103, IS GRANTED.

42. IT IS FURTHER ORDERED that Higher Ground's request for a waiver IS GRANTED, subject to the conditions adopted in this Order and Authorization.

43. IT IS FURTHER ORDERED, that FWCC's Petition to Deny and CenturyLink's Comments in Opposition ARE HEREBY DENIED.

FEDERAL COMMUNICATIONS COMMISSION

Mindel De La Torre  
Chief  
International Bureau

Julius Knapp  
Chief  
Office of Engineering and Technology

Jon Wilkins  
Chief  
Wireless Telecommunications Bureau