Before the
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, DC 20554

In the Matter of	)	
	)	
Higher Ground LLC	)	File No. SES-LIC-20150615- _____
	)	
Application for a Blanket License to Operate C-band Mobile Earth Terminals	)	

DECLARATION

I. Introduction

1. The purpose of this declaration is to provide an independent review of the foregoing Technical Annex prepared by Higher Ground LLC (HG) with regard to the above-captioned application, verify the accuracy of the technical analyses and calculations contained therein, and assess the technical feasibility of HG's proposed SatPaq system, particularly with respect to interference protection to other authorized satellite and terrestrial point-to-point (PtP) microwave systems.

II. Declarant

2. Dr. Jeffrey H. Reed is the President of Reed Engineering, the Willis G. Worcester Professor of Electrical and Computer Engineering at Virginia Tech, and the founding director of Wireless @ Virginia Tech, one of the largest and most comprehensive university wireless research groups in the United States. Dr. Reed is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and has served as co-chair for the IEEE Dynamic Spectrum Access Network conference. In 2013, he received the International Achievement Award from the Wireless Innovations Forum for the impact of his accumulated research. Dr. Reed is a member of the Commerce Spectrum Management Advisory Council (CSMAC), the advisory group on spectrum issues for NTIA. He also served on the President's Council of Advisors in Science and Technology (PCAST) Working Group on how to transition federal spectrum for commercial economic benefits.

3. Dr. Reed is also a cofounder of several commercial companies, including (i) Cognitive Radio Technologies, a company commercializing the cognitive radio technologies produced at Virginia Tech for commercial and military applications; (ii) Federated Wireless, a company commercializing 5G wireless systems; and (iii) PFP Cybersecurity, a company specializing in security for embedded systems such as Android platforms.

III. Review and Verification of the HG Technical Annex

4. Dr. Reed (as the President of Reed Engineering) is familiar with Parts 25 and 101 of the Commission's rules, has reviewed the foregoing Technical Annex, and concludes the following:

a. *SatPaq Proposal.* HG seeks to provide a novel, satellite-based two-way messaging service, through a small transceiver called a SatPaq, that offers ubiquitous connectivity, particularly in areas where no terrestrial networks operate, for the consumer/Internet of Things market segments. These SatPaq devices communicate with geosynchronous satellites in the C band and utilize self-coordination techniques to enable substantial frequency re-use without causing harmful interference to incumbent spectrum users.

b. *Overall Feasibility.* HG's SatPaq proposal is technically feasible, particularly with respect to interference protection to other authorized satellite and terrestrial systems.

i. First, the availability of global satellite communications systems and the delay-tolerant and low data rate nature of the messaging applications at issue here imply that the HG bi-directional system is relatively easy to design.

ii. With regard to interference protection, this technical feasibility is largely attributable to: (a) the ability of a centralized controller to communicate with SatPaqs via satellites; (b) the ability of that controller to shut down the operations of any SatPaq, if necessary; and (c) the ability of the SatPaq system to develop a look-up table that identifies non-interfering frequencies for all locations across the United States using the technical parameters of C band PtP microwave systems derived from the FCC's Universal Licensing System (ULS) database (regularly updated); (d) the ability of the SatPaq system to apply the geolocation coordinates of the requesting SatPaq to the look-up table and for the SatPaq to transmit on non-interfering frequencies.

iii. These factors enable HG to establish operational parameters for SatPaqs to successfully provide messaging services without causing harmful interference.

c. *SatPaq Self-Coordination and Interference Protection for PtP Microwave Systems.* The traditional coordination procedures required under Parts 101 and 25 of the Commission's rules typically involve a 30-day notice period to establish

a regular transmitter site. This static process is costly in terms of spectral and economic efficiency, and unnecessary particularly with respect to itinerant, low-power, bursty (*i.e.*, durations of 1 to 2 seconds) transmissions. By contrast, the SatPaq's self-coordination technique utilizes a combination of ULS database, Global Positioning System, and software-defined radio technologies to enable a ubiquitous messaging service that permits substantial re-use of spectrum while achieving the same level of interference protection afforded under traditional Part 101 coordination procedures.

i. The technical information, calculations, and simplified analysis contained in the foregoing Technical Annex demonstrate that the SatPaq system is highly unlikely to cause harmful interference to PtP receivers.

ii. The SatPaq system's interference avoidance techniques, such as Protection Zones, frequency agility, and satellite diversity are more than sufficient to avoid causing harmful interference to PtP receivers.

iii. Based upon our review and analysis, HG's proposed protection zones are at least 25 times larger than the areas that would be sufficient to avoid harmful interference to PtP receivers. The line-of-sight distance for a PtP receive antenna 1000 feet above sea level [an unusually high height] to a hand-held is 47 miles based on the curvature of the earth. The typical line of sight distance for most PtP links is 30 miles. The suggested 50 mile protective zone will easily cover most cases, and HG's protocol will account for those few cases that could extend beyond the 50 mile zone.

iv. Within a Protective Zone, the HG controller will identify a non-interfering frequency via frequency agility or satellite diversity. In the rare event that a SatPaq cannot identify an available operating channel, the device will not transmit and will instruct the user to change the location and/or orientation of the device until an available operating channel is identified.

v. Based on our review and analysis of HG's statistical modeling, we concur that even if HG operated without the self-coordination techniques it proposes (i.e. no coordination), the probability of SatPaq operations overlapping with a PtP receiver is extremely low – only once, lasting approximately 2 seconds, every 13 months – that it would not rise to the level of harmful interference (applying HG's assumed characteristics of one million SatPaqs and an average monthly use of 5 messages per SatPaq).

d. *Interference Protection for Other Satellite Systems.* The technical information and analysis contained in the Technical Annex also demonstrate that the SatPaq's spread spectrum uplink transmissions are within the spectral emission mask required under the FCC's rules, and thus will not cause harmful interference to other authorized satellites.

5. Dr. Reed, as the President of Reed Engineering, is responsible for this declaration.

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

Executed on June 12, 2015:

Jeffrey H. Reed
President, Reed Engineering