FCC Narrative Statement
File Number: 0335-EX-CN-2022
License Type: Conventional Experimental License
Authorized person filing application: Arpad G. Kovesdy (FRN: 0026721944) on behalf of Beamlink Inc.
Date of Submission: April 1st, 2022

Reason for Request for License: Beamlink, Inc. requests a conventional experimental license to complete a National Science Foundation SBIR Grant (Phase I) with a start date of March 15th, 2022. Additional information about the grant is available at: https://www.nsf.gov/awardsearch/showAward?AWD_ID=2136602&HistoricalAwards=false

Proposed Program Description: This program of experimentation is proposed in order to develop, test, and verify the operation of a new "temporary cellular base station" that is specifically used after natural disaster or in emergency circumstances. The cellular base station consists of radio hardware, a computing system, power supply, and other supporting systems such as a display and GPS module. The hardware is designed to be portable enough for a single person to carry and use extremely minimal power. The base station can create an "ad-hoc" cellular network, where new telephone numbers may be assigned to mobile stations to allow calling, texting, and data services to be provided with minimal reliance on outside systems. Alternatively, the base station can connect to the existing systems of cellular carriers to augment emergency systems in emergencies. The base station will also feature WiFi capability that is outside of the purview of this license filing.

Description of Radio Equipment
1. Software defined radio: The bladeRF series SDRs (bladeRF 2.0 micro ax5) are capable of independent RX/TX on frequency range of 70 MHz to 6 Ghz. These modules are the sole radiators and receivers of radio energy in the system on the frequencies described in this filing application. Their purpose is to receive instructions from the computing system and communicate through LTE/5G-NR protocols with cellular mobile devices. Their frequency range is limited through software to very specific ARFCN(s) within a given frequency band of operation for cellular devices.

2. Antennas: SMA, omni-directional antennas, one for TX and one for RX per SDR module. Includes:
a. Part No: RFDPA161500SMMB801 with gain 0.93 dBi at the requested 900 MHz band and 4.37 dBi at the requested 5.2 GHz band.
Quantity: 4 per cellular base station

3. Amplifiers (note: will be enabled to verify compatibility, good signal integrity, and power draw but transmitting amplifiers will be limited by lowering input signal through software in the SDR)
a. Power amplifier (TX): Nuand BT-100 Power Amplifier based on the Mini-Circuits PHA-1H+ MMIC Amplifier capable of transmitting from 50MHz to 6GHz
b. Low noise amplifier (RX): Nuand BT-200 Low Noise Amplifier based on the Mini-Circuits TSS-53LNB+ MMIC Low Noise Amplifier

4. Other electronic equipment, including power supply, single board computer, GPS module, and display do not fall under the purview of this application.

Theory of Operation:
The base station communicates via one or multiple test “devices”, or mobile stations on an unused frequency by other cellular providers. The base station will utilize SIM cards with known encryption keys that are inserted into each test device only for the purposes of testing OR utilizing e-SIMs that are loaded onto each test phone.

Specific Objectives 1. Test and debug connectivity between the temporary base stations and our test mobile devices in a short range to: a. Verify the self-registration procedure of the mobile device with the standalone tower. b. Verify the call handover process between two temporary base stations. c. Verify routing table configuration changes by the proprietary automatic algorithms in a real world test environment with physical mobile devices. d. Test the maximum load each base station is capable of handling by loading the stations with calls and other data services from physical devices. e. Verify SMS and MMS function normally. f. Verify Internet connectivity through the provided data service. g. Test the radio hardware to verify its continued operation even under adverse conditions, including but not limited to water contact and submersion and extreme temperatures.

Mitigation of Interference 1. A closed, independent test network will be created for each test. The test will limit connections of phones based on phones which have specific SIM cards that will be manufactured for Beamlink, Inc. by a third party vendor. The Beamlink base stations will not interfere with normal carrier operation as other cellular devices on other carriers will not be able to connect to the Beamlink test network without the appropriate test SIM cards 2. The radio devices are attenuated to limit the effective radiated power. This attenuation is done through software, which reduces the power sent from the SDR modules to the amplifiers and thereafter to the antennas. The attenuation will reduce the range of base station testing to at most 40-50 feet (power sent to transmitting antennas will be less than 6 mW) during normal test periods except for specialized power tests which will occur infrequently to verify that the base stations have an acceptable range of operation.

The frequency bands utilized are either not used for cellular coverage in the United States (Band 8, LTE, Source: https://www.phonearena.com/news/Cheat-sheet-which-4G-LTE-bands-do-AT-T-Verizon-T-Mobile-and-Sprint-use-in-the-USA_id77933) or unlicensed LTE bands (Band 46). The use of two bands for testing is to test FDD and TDD so that hypothetically any LTE band could be supported if the base station were utilized in any country or territory that had different licensing requirements.

Background:
Beamlink, Inc. is a social enterprise founded at the University of Southern California in 2018 with the goal of reconnecting individuals in disaster zones, refugee camps, and rural areas through providing quality Internet service that can be setup in a matter of hours instead of months. It is now based in Pasadena, California. Beamlink has twice been granted Conventional Experimental Licenses for developing cutting edge technologies related to cellular connectivity in emergency and temporary circumstances and has filed a utility patent in relation to its research and development.

Arpad Kovesdy is the Cofounder and Chief Technical Officer at Beamlink, and graduate of the Aerospace Engineering program at USC. He currently also works at Boeing Satellite Systems in the Product Design organization, designing satellite digital and power electronics. Arpad has a General Class Ham Radio License.