

SkyWerx Industries, LLC
Application for Renewal of Experimental Authorization W12XTF
Narrative Statement

Pursuant to Section 5.63(c)(1) of the Commission's Rules, SkyWerx Industries, LLC ("SkyWerx") hereby provides this narrative statement in support of its application for short-term renewal of its experimental license issued under call sign W12XTF to conduct a market trial, as defined in Sections 5.5 and 5.602, using spectrum in the 3550-3650 MHz in La Plata and Archuleta counties in Colorado. SkyWerx requests a renewal of its experimental license for an additional license term of the shorter of (a) six (6) months from grant of this renewal application, or (b) SkyWerx's grant of authority from a Spectrum Access System ("SAS") and Environmental Sensing Capability ("ESC") to operate the authorized equipment and facilities on a General Authorized Access ("GAA") basis.

As the accompanying Form 405 shows, SkyWerx is reducing the scope of its trial from the 16 locations authorized under the experimental authorization to 10 of those locations. SkyWerx has determined that it can narrow the scope of its trial and still accomplish the purposes explained herein.

Overview

SkyWerx is a fixed wireless broadband provider that holds a nationwide non-exclusive 3650-3700 MHz service license (Call Sign WQIS540). SkyWerx delivers service to approximately 3,000 residential and business subscribers in Colorado, including portions of La Plata and Archuleta counties, with a focus on rural and previously underserved locations. SkyWerx uses a wide array of unlicensed spectrum, licensed spectrum in the 2.5 GHz band and "lightly licensed" spectrum in the 3650-3700 MHz band.

On February 22, 2017, SkyWerx submitted an application for an experimental license to use spectrum in the 3550-3650 MHz band to conduct a market trial experiment in La Plata and Archuleta counties in Colorado to determine the financial and technical viability of the CBRS band and assess consumer acceptance at various speeds and price points. These counties are extremely rural, and coverage and deployment are severely restricted by rugged terrain and dense foliage that makes line-of-sight propagation impossible over the distances from existing towers. SkyWerx's market trial would use Telrad LTE equipment on an experimental basis to determine whether and to what extent such deployment could resolve the line-of-sight propagation issues. In addition, SkyWerx planned to incorporate SAS/ESC integration of equipment into the trial once SAS and ESC alpha and beta testing became viable with at least one party, which would enable SkyWerx to evaluate the integration of its service and equipment with the SAS and ESC.

On April 28, 2017, the Commission granted an experimental license to SkyWerx under call sign W12XTF, which will expire on May 1, 2019. Following the grant of this license, SkyWerx began its market trial experiment by deploying the experimental frequencies on tower locations that have substantial foliage between the test customer and the tower locations.

As discussed below, although SkyWerx has been able to learn a significant amount of information about equipment capabilities and limitations through its existing market trial experiment, it has not been able to assess integration with the SAS and ESC because, as of the date of this renewal application, SAS and ESC alpha and beta testing are still unavailable. In addition, new software has recently become available that will enable multi-user, multiple input, multiple output (“MU-MIMO”) on the fixed LTE platform that SkyWerx has been utilizing, and SkyWerx needs to test this new MU-MIMO technology to determine its performance in comparison to the LTE configuration that SkyWerx has been testing in this experiment. SkyWerx plans to conduct this testing at only ten of the sixteen station locations currently listed on its experimental license, thus significantly reducing the scope of its trial.

In sum, the completion of this experiment will inform SkyWerx’s business, investment, technology and deployment decisions as it plans for expansion and densification of its broadband networks.

Accordingly, SkyWerx respectfully requests the renewal of its experimental license issued under call sign WI2XTF for an additional license term of the shorter of (a) six (6) months from grant of this renewal application, or (b) SkyWerx’s grant of authority from a SAS and ESC to operate the authorized equipment and facilities on a GAA basis.

Description of Program Conducted Under Call Sign WI2XTF

Because the Commission has not yet certified Category B Part 96 equipment for use with the SAS or the ESC in the CBRS band, SkyWerx is using Telrad equipment certified by the FCC for Part 90 use in the 3650-3700 MHz band that is re-tuned to the 3550-3650 MHz band. Power limits and out-of-band emission limits conform to the Part 96 rules for Category B CBSDs that the Commission adopted in the *CBRS Order* and the Order on Reconsideration and Second Report and Order.¹

SkyWerx identified La Plata and Archuleta counties in Colorado as the optimum place to conduct the market trial experiment. SkyWerx has access to and is transmitting on other frequencies from existing towers and operation in these counties with personnel on site to monitor construction and operation, to ensure that there will be no harmful interference to Incumbent Access users and to remedy harmful interference in the unlikely event it occurs. Further, there appears to be no ground-based radar within 130 miles of the planned trial area that would require ESC or coordination with incumbents, and the proposed areas of operation are outside the coastal protection zone. Commission records also show that there are no Fixed Satellite earth stations in the 3600-3650 MHz band operating anywhere in the vicinity of the trial

¹ See *Amendment of the Commission’s Rules with Regard to the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959 (2015) (“*CBRS Order*”); *Amendment of the Commission’s Rules with Regard to the 3550-3650 MHz Band*, Order on Reconsideration and Second Report and Order, GN Docket No. 12-354, FCC 16-55 (rel. May 2, 2016).

location.² SkyWerx has not received any reports of harmful interference from any incumbent users during its market trial experiment.

Pursuant to this market trial, SkyWerx has been testing different broadband speeds and price points to determine the utility and value of the CBRS as it relates to consumer take rates and network performance. Consistent with the market trial requirements of Section 5.602(d), SkyWerx owns the CBSD and End User Device equipment, and will not transfer ownership to trial participants.

As required by Section 5.602(e), all end users were advised upon service installation that service is being provided on a trial basis, that any non-approved devices are for testing only and that all equipment must be returned at the end of the trial period. SkyWerx further acknowledges that it will need to retrieve the devices from the users at the end of the trial. In particular, all users have been notified that the service they are receiving is being provided in part or in whole under experimental authority, and that as a condition of the experimental license, SkyWerx may be required at any time, without prior notice, to cease operations in the spectrum between 3550 and 3650 MHz. In addition, SkyWerx acknowledges and has notified users that all customer premise equipment authorized under the experimental license remains the property of SkyWerx, and must be collected or rendered inoperable at the conclusion of the trial. At the end of the trial, SkyWerx will either: (1) shut off the service immediately, stop billing users for the service and post a public notice at www.skywerx.com, and collect or render all customer premise equipment inoperable, or (2) change the frequency and operating parameters of some or all of the customer premise equipment that is part of the trial to parameters authorized under Part 90, Subpart Z of the FCC rules (which may materially impact network capacity, performance, and quality of service), post a public notice to www.skywerx.com, and allow users to opt out of the modified service offering with no further obligation to pay for the service.

SkyWerx planned to conduct its trial in two phases. In the first phase, SkyWerx deployed with equipment certified for use in the 3650-3700 MHz band, and operating in 3550-3650 MHz band at various architectures and speeds. In the second phase, which was planned to begin when SAS and ESC alpha and beta testing became viable with at least one party, SkyWerx would incorporate experimental SAS/ESC integration of equipment into the trial.

Objectives of Experimental Program

During the trial, and prior to the certification of a SAS and ESC, SkyWerx has complied and will continue to comply with the power levels in Section 96.41 as they apply to End User Devices and Category B CBSDs. At the conclusion of the requested additional experimental license term, SkyWerx will either transition to Part 96 GAA if equipment is certified and authorized under GAA rules or, if not, cease operation in 3550-3650 MHz.

² See *Amendment of the Commission's Rules with Regard to the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, GB Docket No. 12-354, 27 FCC Rcd 15594 (2012), at Appendix A.

In addition to the technical objectives, the objective of determining the value and utility of PALs exists, which necessitates charging for the service at varying price points and performance levels.

The experiment will examine the impact of the following rules on potential future commercial deployments:

Section 96.15 - Validate ability to comply through dynamic frequency changes across a geographically clustered collection of CBSDs, planned and executed within 300 seconds of a simulated command to vacate an occupied channel.

Section 96.17 – Validate propagation models ability to predict co-channel interference, blocking, and OOBE to comply with protections of existing FSS Earth Stations.

Section 96.21 - Validate propagation models ability to predict co-channel interference, blocking, and OOBE to comply with protections of Grandfathered Wireless Broadband Licensees.

Section 96.25 – Validate propagation model’s ability to predict compliance with PAL Protection Areas.

Section 96.39(a) – Develop a method for determining CBSD locations with sufficient accuracy to comply with this section.

Section 96.39(d), (e) – Develop methods for collecting Signal Level and Frequency information from the CBSD so it can be reported to the SAS.

Section 96.41 – Determine the appropriate power levels for CBSD and End User Devices to both comply with this section and achieve desired coverage and performance. The aggregate RMS power level RSS and PAPR requires measurement validations in a real world environment where CBSD and End User Device density is consistent with intended long term use of the band. Propagation models must be tuned and validated to accurately predict compliance. Power level control of the equipment must be tuned so that the CBSD and End User Device transmit at the lowest power levels possible to meet performance objectives, while complying with the prescribed limits.

Section 96.53 – Develop methods to detect interference at the CBDS and End User Device from other GAA and PAL users so it can be reported to the SAS.

Preliminary Results and Need to Complete the Experiment

As described above, SkyWerx deployed LTE equipment using the experimental frequencies at existing tower locations in La Plata and Archuleta counties in Colorado that have substantial foliage between the customer and the tower locations in order to determine whether and to what extent such deployment could resolve the line-of-sight propagation issues. During

this experiment, SkyWerx observed that this fixed LTE configuration achieved sufficient penetration and propagation to allow SkyWerx to achieve broadband service speeds of 25/3 Mbps to rural parts of Colorado that otherwise would not be able to receive service. This experiment has therefore allowed SkyWerx to validate the performance and capabilities of the fixed LTE platform in extremely rural areas with rugged terrain and dense foliage.

Nevertheless, SkyWerx requires additional time to complete this experiment in order to test and evaluate how this LTE platform will perform with new beta software from the equipment manufacturer that will enable MU-MIMO. Specifically, SkyWerx needs to test and evaluate the differences in capability and performance between (i) a single Evolved Node B (“eNB”) with MU-MIMO, and (ii) a single 2x2 LTE deployment that does not utilize MU-MIMO, particularly with respect to foliage penetration, throughput, and the maximum number of CPEs that can be served. This new MU-MIMO technology was not available when SkyWerx began conducting its market trial experiment, and SkyWerx must have the opportunity to evaluate it in order to complete its experiment, as this will be essential to informing SkyWerx’s business, investment, technology and deployment decisions as it plans for expansion and densification of its broadband networks.

Because the completion of this experiment will focus primarily on the performance of MU-MIMO in areas of dense foliage, SkyWerx plans to conduct this testing at only ten of the sixteen station locations currently listed on its experimental license, thus significantly reducing the scope of its trial. Specifically, SkyWerx plans to test the MU-MIMO technology at station locations 1, 4, 6 – 8, 10, 11, 13, 14 and 16, and SkyWerx will remove station locations 2, 3, 5, 9, 12 and 15 from the scope of the trial.

In addition to testing new technology, SkyWerx requires additional time to complete its experiment with respect to the integration of its service and equipment with the SAS and ESC. When SkyWerx submitted its initial application for an experimental license in February 2017, it was generally expected that SAS and ESC certification and the availability of SAS/ESC systems for alpha and beta testing would occur before the end of 2018. For a variety of reasons, however, the SAS/ESC process has been delayed, and SAS/ESC testing is now expected to become available after the current May 1, 2019 expiration date of SkyWerx’s experimental license.

For these reasons, SkyWerx requests the renewal of its experimental license issued under call sign WI2XTF for an additional license term of the shorter of (a) six (6) months from grant of this renewal application, or (b) SkyWerx’s grant of authority from a SAS and ESC to operate the authorized equipment and facilities on a GAA basis.

Contribution to the Radio Art

In accordance with Section 5.63(c)(1), SkyWerx expects that the continuation and completion of its market trial will contribute greatly to the radio art. The CBRS is a new service in which commercial and Federal uses will share a spectrum band, with use governed by an SAS and ESC. It has been characterized as a test-bed for innovation and as a paradigm shift in spectrum management. In connection with its market trial, SkyWerx expects to learn a

significant amount of information about equipment capabilities and limitations, customer acceptance at various speeds and price points, and integration of its service and equipment with the SAS and ESC. To the extent permitted by SAS and ESC administrators and equipment providers, SkyWerx will share the results of its market trial with the Commission.