

DESCRIPTION OF RESEARCH PROJECT

Pursuant to Sections 5.3(j) and Section 5.61 of the Federal Communications Commission's rules, 47 C.F.R. §§ 5.3(j) and 5.61, CCO Fiberlink, LLC ("Charter"), a limited liability company and subsidiary of Charter Communications, Inc., seeks Special Temporary Authority ("STA") for 180 days, beginning December 6, 2018, to test and evaluate coverage, capacity, and propagation characteristics in the 3550-3700 MHz band. The proposed operations will advance Charter's understanding of technology and network potential in the 3550-3700 MHz band and will advance the potential deployment of fixed and mobile wireless services.

For the testing, Charter will use multiple models of fixed equipment and several models of mobile End User Equipment. The technical information below describes the greatest bandwidth and power levels to be used for each piece of prototype equipment, in most cases, implemented bandwidth and power levels implemented will be lower.

Location of Testing

Charter will conduct outdoor and indoor fixed and mobile testing within 10 miles (16.1 km) of the provided fixed location of 39° 35' 17.50" N, 104° 50' 46.09" W in Centennial, Colorado.

Description of Testing

Charter will deploy both experimental fixed and mobile equipment in various configurations in support of several wireless initiatives in mobile and fixed service models. Depending on the testing scenario, devices will be deployed on existing structures or poles, in both indoor and outdoor environments.

Specifically, Charter will use the following base station deployment approaches:

1. Outdoor:
 - a. Building deployment with Category A or B radios.¹ Up to 50 m height AGL, either rooftop or wall mounted, with no device extending more than 2 m above the existing structure.
 - b. Pole mount: Category A or B radios, up to 15 m AGL, with no device extending more than 2 m above the existing structure.
2. Indoors (Category A radios): Up to 50 m AGL in height (up to 12th floor indoor).
3. In our wireless laboratory environment.

Charter will use other equipment to interact with the base station devices, in both receiving and transmitting modes ("End User Devices" or "EUDs"). These devices will conform to the Part 96 limits for End User Devices, and will evaluate propagation characteristics, conduct connectivity and throughput testing, and include assessment of inter-cell interference, mobility characteristics, Spectrum Access System ("SAS") compatibility and individual performance of multiple vendors' devices.

¹ Category A and B radios are defined in Sections 96.3 and 96.41 of the FCC's rules. See 47 C.F.R. §§ 96.3 and 96.41.

Charter intends to install approximately 100 fixed transmitters and employ approximately 500 fixed and mobile EUDs during the testing. The number of devices is largely driven by the operational environment Charter intends to trial, that of an Enterprise Campus deployment of private LTE. As such, much like Enterprise WiFi, the 100 base stations will be overwhelmingly (95%) comprised of indoor Category A devices, deployed in Charter occupied buildings, whose already low emissions should barely penetrate the building exteriors, and therefore contribute nearly nothing to the aggregate noise floor outdoors. Additionally, the End User Devices, also already limited on power, while mobile, will also be primarily operated indoors, and only at limited specific deliberate test periods will be operated concurrently in an attempt to evaluate the network's response to loading. Normally, as in a real world deployment, each End User Device will transfer data in bursts, versus streams, further limiting aggregate noise. These End User Devices will be operated by Charter employees during working hours, so Charter will be monitoring all use and any interference concerns at all times during the testing. In this carefully controlled environment, Charter seeks to test how these devices will operate under real world situations.

Radio Equipment Description

Base Station Equipment (fixed - multiple models):

Equipment	Category	Tx Power (mW)	EIRP (dBm)	ERP (watts)	Mean or Peak	Emission Designator	Frequency Tolerance	Modulation
Indoor prototypes	A	1000	33.0	1.26	Peak	20M0W7D	0.0005%	256/64/16 QAM; QPSK; BPSK
Outdoor prototypes	B	6777	54.8	184.1	Peak	60M0W7D	0.00001%	256/64/16 QAM; QPSK; BPSK

End User Devices (fixed and mobile - multiple models):

Equipment	Category	Tx Power (mW)	EIRP (dBm)	ERP (Watts)	Mean or Peak	Emission Designator	Frequency Tolerance	Modulation
Mobile prototypes	EUD	200	23	0.2	Peak	20M0W9W	0.0005%	256/64/16 QAM; QPSK; BPSK
Fixed wireless CPE	EUD	600	42.8	11.6	Peak	60M0W9W	0.00001%	256/64/16 QAM; QPSK; BPSK

Based on the height of these facilities, the devices may be more than six meters above ground level. However, there is no risk of physical interference because all devices will be mounted on existing facilities, and will not extend more than two meters above those facilities. Charter is aware of the presence of Centennial Airport (ICAO: KAPA) contained within the requested area of the experimental license. As all equipment will be either indoors, or operate no more than two meters above existing structures, none will pose an obstruction to aviation.

Protection Against Interference

Charter requests use of the 3550-3700 MHz band. Charter understands it must accept interference from any federal and non-federal incumbent users of this band and all Charter operations will be on a secondary basis.

With the exception of testing in our wireless laboratory, Charter is conducting this testing in cooperation with Federated Wireless (“Federated”), and will employ Federated’s developmental SAS. The test area is not located within the coastal exclusion zone. However, the following methods will be used to prevent harmful interference:

- Primary: Via the design process of a fully functional SAS, with the SAS commanding the test CBRS devices to non-interfering channels.
- Secondary: Federated will manually command the SAS to command CBRS test devices to shift to non-interfering channels.
- Tertiary: Charter has established a point of contact, identified below, available 24/7 during all testing with “kill switch” authority should any interference occur to primary licensed services. Should interference occur, Charter will take immediate steps to resolve the interference, including, as appropriate, channel shifting or discontinuing operations.

Charter has confirmed there are no Fixed Satellite Service (FSS) earth stations operating in the 3600-3650 MHz band in the areas in which Charter seeks to conduct testing.

Charter will coordinate all testing with grandfathered Wireless Broadband Licensees registered in the requested testing area, and intends to employ Federated’s developmental SAS to coordinate channel assignments. Where the SAS is not capable of doing so, Charter will manually coordinate operations, primarily by operating below 3650 MHz when so required.

Finally, given the low EIRP transmit levels of the proposed radios, coupled with their low installed elevation, Charter expects limited RF propagation distances as well as limited and localized aggregative contribution to the RF noise floor.

Restrictions on Operation

Charter does not seek authority to perform a market study under the requested license and will retain control over the equipment in the testing at all times.

Contact Information

Point of contact for FCC licensing issues:

Colleen King
Vice President, Regulatory Affairs
(202) 621-1921
colleen.king@charter.com

Point of contact for questions about testing operations:

Greg McLaughlin
Sr. Director of Wireless Operations, R&D
(720) 482-4290
greg.mclaughlin@charter.com

The following individual will be available 24/7 during all testing, and has authority and ability to immediately cease all operations:

Todd Herring
Director of Wireless Operations
(303) 345-7907
todd.herring@charter.com
Wireless Ops Hotline: (720) 536-9205