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 23, 2018, to test and evaluate coverage, capacity, and propagation characteristics in the 3550-3700 MHz band. The proposed operations will occur only in the 3650-3700 MHz portion of the band to avoid Naval radar interference. The testing will advance Charter's understanding of technology and network potential in the full 3550-3700 MHz band and will advance the potential deployment of fixed and mobile wireless services.

Location of Testing

Charter will conduct outdoor and indoor fixed and mobile testing within 8 miles (12.87 km) of four fixed locations in Los Angeles, California:

1. 34° 5' 16.4" N, 118° 10' 58.7" W
2. 34° 11' 42.68" N, 118° 25' 34.6" W
3. 34° 0' 31.38" N, 118° 22' 54.3" W
4. 33° 47' 31.21" N, 117° 53' 40.9" W

Description of Testing

Charter will deploy experimental fixed and mobile equipment in various configurations. Depending on the testing scenario, devices will be deployed on existing aerial cable strand, on existing buildings/poles or indoors. Specifically, Charter will use the following deployment approaches:

1. Strand mount deployment (Category A or B Radios).[1] 18 ft height.
2. Building/pole mount deployment (Category A or B Radios). Up to 100 ft height.
3. Indoors (Category A Radios). Up to 40 ft height (3rd floor indoor).

Other equipment will be used by Charter to receive signals from the mounted devices and transmit back to those devices ("End User Devices" or "EUD"). Charter will evaluate propagation characteristics; conduct connectivity and throughput testing in the vicinity of each device; and assess inter-cell interference, mobility characteristics, Spectrum Access System ("SAS") compatibility and individual performance of each vendor.

Radio Equipment Description

For the testing, Charter will use 12 different models of fixed equipment and 6 different models of mobile End User Devices. The technical information below provides the greatest bandwidth and power levels that will be used for each piece of prototype equipment.

[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 200 fixed transmitters and employ up to 50 mobile transmitters during the testing. During most of the testing, approximately 20% of the mobile devices will be operational at any given time, with the remainder in a non-transmitting state. Charter also intends to conduct capacity testing. At those limited times, Charter would test a greater number of devices at the same time. Such capacity testing will be of limited duration (one week at a time, for 10 hours/day) and Charter will ensure that no interference with other users of the 3.5 GHz band will occur.

Fixed Equipment (12 models):

Equipment	Category	Tx Power (mW)	EIRP (dBm)	ERP (watts)	Mean or Peak	Emission Designator	Frequency Tolerance	Modulation
Prototype 1	A	320	30	0.6	Mean	20M0W7D	0.00001%	64/16 QAM & QPSK
Prototype 2	B	4000	41.5	8.6	Mean	20M0W7D	0.00001%	64/16 QAM & QPSK
Prototype 3	B	4000	50	61.0	Mean	20M0W7D	0.00001%	64/16 QAM & QPSK
Prototype 4	A	500	33	1.2	Peak	20M0W7W	0.00002%	64/16 QAM & QPSK
Prototype 5	B	2000	39	4.9	Peak	20M0W7W	0.00002%	64/16 QAM & QPSK
Prototype 6	B	2000	50	61.0	Peak	20M0W7W	0.00002%	64/16 QAM & QPSK
Prototype 7	A	350	33	1.2	Peak	40M0D7D	0.0005%	64/16 QAM & QPSK/BPSK
Prototype 8	A	890	36	2.4	Peak	40M0D7D	0.0005%	64/16 QAM & QPSK/BPSK
Prototype 9	B	4000	43	12.2	Peak	40M0D7D	0.0005%	64/16 QAM & QPSK/BPSK
Prototype 10	B	10000	53	121.6	Peak	40M0D7D	0.0005%	256/64/16QAM & BPSK/QPSK
Prototype 11	A	500	33	1.2	Peak	20M0W7D	0.00001%	64/16 QAM & QPSK/BPSK
Prototype 12	B	4000	42	9.7	Peak	20M0W7D	0.00001%	64/16 QAM & QPSK/BPSK

End User Equipment (6 models):

Equipment	Category	Tx Power (mW)	EIRP (dBm)	ERP (Watts)	Mean or Peak	Emission Designator	Frequency Tolerance	Modulation
Prototype 13	EUD	200	23	0.2	Peak	20M0W9W	0.0005%	64/16 QAM & QPSK/BPSK
Prototype 14	EUD	200	23	0.2	Peak	20M0W9W	0.0005%	64/16 QAM & QPSK/BPSK

Prototype 15	EUD	200	23	0.2	Peak	20M0W9W	0.0005%	64/16 QAM & QPSK/BPSK
Prototype 16	EUD	200	23	0.2	Mean	20M0W7D	0.00001%	64/16 QAM & QPSK
Prototype 17	EUD	200	23	0.2	Peak	20M0W9D	0.00001%	64/16 QAM & QPSK/BPSK
Prototype 18	EUD	200	23	0.2	Peak	20M0W7W	0.0001%	64/16 QAM & QPSK/BPSK

All testing will be conducted within Charter's existing service areas, and employ power and backhaul from Charter's existing cable distribution plant or an extension of this plant. The fixed devices will be mounted on Charter's existing strand, as well as select street furniture and/or building facades.

Based on the height of these facilities, the devices may be more than 6 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 1 meter above those facilities.

Protection Against Interference

Charter requests use of the 3650-3700 MHz band. Charter understands that it must accept interference from any federal and non-federal incumbent users of this band and that all Charter operations will be on a secondary basis.

Charter is conducting this testing in cooperation with Federated Wireless ("Federated"), and will employ Federated's developmental SAS database. Although Los Angeles is located within NTIA's coastal exclusion zone, this authorization seeks authority only to test in the 3650-3700 MHz frequencies. The following methods will be used to prevent harmful interference:

- Primary: Via the design process of a fully functional SAS combination, with the SAS commanding 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 will coordinate all testing with grandfathered Wireless Broadband Licensees with registered locations in the requested testing areas, 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.

Charter is aware of Fixed Satellite Service (FSS) earth stations operating in the 3650-3700 MHz band in the areas in which Charter seeks to conduct testing and will coordinate with these earth station operators to confirm Charter's testing will not cause harmful interference.

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:

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Vice President, Regulatory Affairs
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Point of contact for questions about testing operations:

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

Todd Herring
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