

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 July 1, 2017, to test and evaluate coverage, capacity, and propagation characteristics in the 3550-3700 MHz band. While 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 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 the provided fixed location of 27° 58' 47" N, 82° 27' 18" W in Tampa, Florida.

Description of Testing

Charter will deploy the experimental fixed and mobile equipment in various configurations. The majority of devices will be attached to Charter's existing aerial cable strand, similar to how numerous cable operators, including Charter, have deployed outdoor WiFi access points to date. In addition, Charter will test some devices attached to existing buildings and poles, and some devices indoors. Specifically, Charter will use the following deployment approaches:

1. Strand mount deployment (Category A or B Radios)¹
2. Building/pole mount deployment (Category A or B Radios)
3. Indoors (Category A Radios)

Other equipment will be used by Charter to receive signals from the mounted devices and transmit back to those devices ("End User Equipment"). Charter will evaluate propagation characteristics, conduct connectivity and throughput testing in the vicinity of each device, as well as assess inter-cell interference, mobility characteristics, Spectrum Access System ("SAS") compatibility and individual performance of each vendor. Additionally, Charter will assess Citizens Broadband Radio Service ("CBRS") device co-existence with our own 3650 MHz devices deployed in the Tampa test area.

Radio Equipment Description

For the testing, Charter will use 16 different models of fixed equipment and 5 different models of mobile End User Equipment. The below technical information provides the greatest bandwidth and power levels that will be used for each piece of prototype equipment.

While Charter intends to install approximately 200 fixed transmitters and employ up to 10 mobile transmitters during the testing, less than 20% of the total devices will be operational at any given time, with the remainder in a non-transmitting status.

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.

Fixed Equipment (16 models):

Equipment	Category	Tx Power (mW)	EIRP (dBm)	ERP (watts)	Mean or Peak	Emission Designator	Frequency Tolerance	Modulation
Prototype 1	A	250	33	2	Mean	20M0W7W	0.00001	64QAM/16QAM/QPSK
Prototype 2	B	250	50	100	Mean	20M0W7W	0.00001	64QAM/16QAM/QPSK
Prototype 3	B	200	50	100	Peak	20M0W7W	0.00001	64QAM/16QAM/QPSK
Prototype 4	A	250 500	30 33	1 2	Peak	10M0W9W 20M0W9W	0.0005	64QAM/16QAM/QPSK
Prototype 5	A	1000	36	2	Peak	40M0W9W	0.0005	64QAM/16QAM/QPSK
Prototype 6	B	1000 2000 4000	47 50 53	50 100 200	Peak	10M0W9W 20M0W9W 40M0W9W	0.0005	64QAM/16QAM/QPSK
Prototype 7	B	2000	50	100	Peak	20M0W7D	0.00001	256 QAM/64 QAM/16QAM/QPSK
Prototype 8	A	250	33	2	Peak	20M0W7W	0.002	64 QAM/16QAM/QPSK
Prototype 9	B	500	50	100	Mean	20M0W7W	0.000005	64 QAM/16QAM/QPSK
Prototype 10	B	2000	50	100	Mean	20M0G7W	0.0005	64QAM/16QAM/QPSK
Prototype 11	A	125	33	2	Mean	20M0W7D	0.00001	64 QAM/16QAM/QPSK
Prototype 12	B	1000	50	100	Mean	20M0W7D	0.00001	64 QAM/16QAM/QPSK
Prototype 13	A	320	33	2	Mean	20M0W7D	0.00001	64 QAM/16QAM/QPSK
Prototype 14	B	1000	53	100	Mean	40M0WXW	0.000005	256QAM/64QAM/16QAM/QPSK
Prototype 15	B	350	50	100	Peak	18M5D7D	0.000005	64 QAM/16QAM/QPSK
Prototype 16	A	1000	30	1	Peak	3K00N	0.00015	None ²

² This device is a continuous wave device, which will be used to measure signal strength at a given position.

End User Equipment (5 models):

Equipment	Category	Tx Power (mW)	EIRP (dBm)	ERP (watts)	Mean or Peak	Emission Designator	Frequency Tolerance	Modulation
Prototype 17	EUD	200	23	0.2	Peak	20M0W7W	0.0001	64QAM/16QAM/QPSK
Prototype 18	EUD	200	23	0.2	Peak	40M0W9W	0.0005	64QAM/16QAM/QPSK
Prototype 19	EUD	200	23	0.2	Peak	40M0W9W	0.0005	64QAM/16QAM/QPSK
Prototype 20	EUD	200	23	0.2	Peak	40M0W9W	0.0005	64QAM/16QAM/QPSK
Prototype 21	EUD	200	23	0.2	Mean	20M0W7D	0.00001	64 QAM/16QAM/QPSK

All testing will be conducted within Charter's existing service areas, and employ power and backhaul from Charter's existing cable distribution plant. The fixed devices will be mounted on Charter's existing strand, as well as select street furniture and/or building facades, with equipment attached directly to the device or incorporated within the radio housing.

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 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 Tampa 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, available 24/7 during all testing identified below 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.

In the 3650-3700 MHz band, Charter is an existing Wireless Broadband Licensee (call sign WQVB849) with four registered locations within the Tampa test area. Charter will coordinate all testing with other 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 confirmed there are no Fixed Satellite Service (FSS) earth stations operating in the 3650-3700 MHz band in the areas in which Charter seeks to conduct testing.

Finally, given the low EIRP transmit levels of the proposed radios, coupled with their low installed elevation, we expect 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:

Greg McLaughlin
Sr. Director of Wireless Operations, R&D
(720) 482-4290
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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
Director of Wireless Operations
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Wireless Ops Hotline: (720) 536-9205