

Verizon 3.5 GHz Experiment Proposal

1. Introduction

Verizon Communications Inc. (Verizon or the Company) is a holding company that, acting through its subsidiaries, is one of the world's leading providers of communications, information and entertainment products and services to consumers, businesses and governmental agencies. With a presence around the world, we offer voice, data and video services and solutions on our wireless and wireline networks that are designed to meet customers' demand for mobility, reliable network connectivity, security and control. We have two reportable segments, Wireless and Wireline. Our wireless business, operating as Verizon Wireless, provides voice and data services and equipment sales across the United States (U.S.) using one of the most extensive and reliable wireless networks.

2. Experiment Description

Verizon is working with partner companies to develop equipment that will use LTE technologies, using Citizens Band Radio Service (CBRS) spectrum [3550 – 3700 MHz], also known as Band 48, using 3GPP terminology. As part of the technology validation, Verizon plans to conduct a series of field tests with both category A and category B Citizen Band Service Devices (CBSDs) at one or more locations.

The purpose of the proposed tests is:

- 1) Evaluation of the radio propagation characteristics of 3.5 GHz for indoor and outdoor installations
- 2) Evaluation of end-to-end CBRS architecture
- 3) Evaluation of coexistence mechanisms with shared spectrum (GAA) spectrum
- 4) Evaluation of TDD-LTE using 3.5 GHz
- 5) Evaluation of inter-band carrier aggregation between 3.5 GHz and licensed bands using 3GPP Band 2 or 3GPP Band 4

Field tests will be conducted in a production network, in a highly controlled field environment, in order to assist in the development of commercial products. The testing will benefit the public interest by enabling the pre-commercial testing of new products outside of a lab environment but in a controlled and managed manner.

In addition to the product development testing described above, Verizon and partner companies intend to conduct separate and independent lab testing in a real-world environment at a Verizon facility or at a vendor's facility using specifications developed by the WINN Forum and CBRS Alliance.

This field trial will consist of an aggregate of up to **10** small cells (category A), and up to **5** category B CBSDs, for all the trial locations. The CBSDs will use the transmission parameters and operate inside the geographic regions defined below. Some of the tests will use solely base stations and user equipment operating in CBRS spectrum only. Some equipment however, includes 3GPP LTE base stations that operate on 3GPP Band 2 or 3GPP Band 4, also known respectively as the US 1900 MHz PCS and AWS bands operated under 47 CFR Part 24 and

Part 27. Transmission on PCS or AWS spectrum will occur only with authorization from the respective spectrum licensee.

Mobile devices will also operate within the RF coverage area of the small cell devices. Some of the tests with mobile stations will be using CBRS spectrum only. The majority of the tests, however, will include mobiles and base stations with LTE transmitters that operate on 3GPP Band 2, or 3GPP Band 4, in carrier aggregation mode (in both Downlink and Uplink) with Band 48.

Although the initial devices are prototypes and have not completed formal equipment authorization, the equipment used in these trials will be compliant with FCC rules. As time progresses, pre-commercial devices will be introduced. Equipment from multiple equipment manufacturers will be used in the evaluation testing. Verizon has the ability to shut down all transmissions operated under the experimental license in the unlikely event any interference occurs.

3. Hours of operation and equipment shut down

The intent is to operate the evaluation devices, both small cells and mobile units, 24 hours per day, 7 days per week, during the test period. Equipment can be shut down speedily, if the need arises, by contacting one or more of the interference coordinators identified in the section "Interference Coordination"

4. Interference Coordination

Immediate requests to stop transmissions under this STA can be communicated to Jaime Lugo, Verizon Senior Manager System Performance at 561-252-8338 or by email at jaime.lugo@verizonwireless.com or Rachid Fadlallah, Verizon Principal Engineer System Performance at 954-551-5538 or by email at rachid.fadlallah@verizonwireless.com.

5. Trial Duration

Approximately 6 months, beginning approximately from April 2nd, 2018

6. Evaluation Equipment Transmitter Information

Small cells supporting in Band 48 (3550-3700 MHz) will be operating in compliance with FCC Part 96 rules. Both directional and omni-directional antennas will be used with the small cell systems within the maximum EIRP and antenna gain constraints as specified in the rules.

LTE mobile devices support TDD-LTE operation with an LTE uplink in Band 48 (3550 – 3700 MHz) and receive in the same band. Upon availability of mobile devices supporting inter-band carrier aggregation, CBSD devices supporting one or more of Verizon's licensed bands will be used.

- Up to **5** category B CBSDs (EIRP $\leq$ 50 dBm/20 MHz) using Band 48
- Up to **10** category A CBSDs (EIRP $\leq$ 33 dBm/20 MHz) using Band 48
- Multiple mobile terminals (approximately up to 10 terminals), supporting band 48 (per 3GPP) only, using LTE-TDD. Maximum transmitted power = 24 dBm
- Multiple mobile terminals (approximately up to 10 terminals) operating in Carrier Aggregation (CA) mode, using licensed bands B2 or B4 or a subset of these, in CA

aggregation with B48, using LTE(FDD/TDD), with a maximum transmitter power = 24 dBm

Ft. Lauderdale, FL, North 26° 9' 28.6992" West 80° 7' 4.4292" Radius of operation = 0.5 km

Datum: **NAD 83**

Is a directional antenna (other than radar) used? No

Exhibit submitted:

(a) Width of beam in degrees at the half-power point:

(b) Orientation in horizontal plane:

(c) Orientation in vertical plane:

Will the antenna extend more than 6 meters above the ground, or if mounted on an existing building, will it extend more than 6 meters above the building, or will the proposed antenna be mounted on an existing structure other than a building? **None of the above**

(a) Overall height above ground to tip of antenna in meters: **4.26m**

(b) Elevation of ground at antenna site above mean sea level in meters: **0.3m**

(c) Distance to nearest aircraft landing area in kilometers: **6.9km**

(d) List any natural formations of existing man-made structures (hills, trees, water tanks, towers, etc.) which, in the opinion of the applicant, would tend to shield the antenna from aircraft: **None**

Device Type	Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
Small Cell	3550.00000000-3700.00000000 MHz	FX	0.1W / 0.06W	P	0.0004 %	20M00W7D 40M00W7D 60M00W7D 80M00W7D	LTE-TDD
Mobile	3550.00000000-3700.00000000 MHz	MO	0.25W / 0.3W	P	0.0004 %	20M00W7D 40M00W7D 60M00W7D 80M00W7D	LTE-TDD

Note: Emission designators assume transmission bandwidth involving intra-band carrier aggregation

Device Type	Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
Small Cell	2110-2155 MHz	FX	0.61 W	P	0.0004 %	20M00W7D	LTE-FDD
Mobile	1710-1755 MHz	MO	0.25W / 0.3W	P	0.0004 %	20M00W7D	LTE-FDD

Note: products operating in licensed band (B4) radiate in Verizon's licensed spectrum, operating under 47 CFR Part 24 and Part 27.

Ft. Lauderdale, FL, North 26° 9' 28.6992" West 80° 7' 4.4292" Radius of operation = 0.5km

Datum: NAD 83

Is a directional antenna (other than radar) used? Yes

Exhibit submitted:

(a) Width of beam in degrees at the half-power point: 64-deg

(b) Orientation in horizontal plane: 185-deg

(c) Orientation in vertical plane: No downtilt

Will the antenna extend more than 6 meters above the ground, or if mounted on an existing building, will it extend more than 6 meters above the building, or will the proposed antenna be mounted on an existing structure other than a building? No

(a) Overall height above ground to tip of antenna in meters: 10m

(b) Elevation of ground at antenna site above mean sea level in meters: 1.82m

(c) Distance to nearest aircraft landing area in kilometers: 6.9km

(d) List any natural formations of existing man-made structures (hills, trees, water tanks, towers, etc.) which, in the opinion of the applicant, would tend to shield the antenna from aircraft: None

Device Type	Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
Small Cell	3550.00000000-3700.00000000 MHz	FX	20W / 153W	P	0.0004 %	20M00W7D 40M00W7D 60M00W7D	LTE-TDD
Mobile	3550.00000000-3700.00000000 MHz	MO	0.25W / 0.3W	P	0.0004 %	20M00W7D 40M00W7D 60M00W7D	LTE-TDD

Note: Emission designators assume transmission bandwidth involving intra-band carrier aggregation

Device Type	Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
Small Cell	2110-2155 MHz	FX	465.75W	P	0.0004 %	20M00W7D	LTE-FDD
Mobile	1710-1755 MHz	MO	0.25W / 0.3W	P	0.0004 %	20M00W7D	LTE-FDD

Note: products operating in licensed band (B4) radiate in Verizon's licensed spectrum, operating under 47 CFR Part 24 and Part 27.