

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) and PAL spectrum
- 4) Overall evaluation of TDD-LTE using 3.5 GHz

Field tests will be conducted in 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 trial will consist of an aggregate of up to **60** small cells (category A), and up to **6** category B CBSDs, for all the trial locations. The CBSDs will use the transmission parameters and operate inside the geographic regions defined below. Most of these tests will use solely base stations and user equipment operating in CBRS spectrum only. Some equipment however, includes a 3GPP LTE base station that operates on 3GPP Band 13, 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 700 MHz Upper C Block, PCS or AWS spectrum will occur only with authorization from the respective spectrum licensee

Mobile units will also operate within the RF coverage area of the small cell devices. The bulk of the tests with mobile stations will be using CBRS spectrum only. A subset of tests, however, will include mobiles with LTE transmitters that operate on 3GPP Band 13, 3GPP Band 2, or 3GPP Band 4, in carrier aggregation mode with Band 48.

Although the devices are prototypes and have not completed formal equipment authorization, the equipment used in these trials will be compliant with FCC rules, per 2nd Order Report and Order. 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 Sergio Aguirre, Verizon Network Planning at 682-831-6060 or by email at Sergio.aguirre@verizonwireless.com or Wai Shun Wilson Wong, Verizon Network Planning at (925) 279-6847 or by email at waishun.wong@verizonwireless.com

5. Trial Duration

Approximately one year, beginning approximately in September 1st, 2017

6. Evaluation Equipment Transmitter Information

Small cells supporting either TDD-LTE will be operating with the transmitter parameters defined in Table 1. Both directional and omni-directional antennas will be used with the small cell systems within the maximum EIRP and antenna gain constraints defined in Table 1.

Mobile devices will operate near the small cell sites with the transmitter parameters defined in Table 1. 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 legacy bands will be used.

- Up to **6** category B CBSDs (EIRP $\leq$ 50 dBm/20 MHz) using Band 48 initially and upgraded or replaced to support other licensed bands in Carrier Aggregation (CA) mode. Licensed bands include: B2, B4, and B13, or a subset of these – *Outdoor installations*
- Up to **60** category A CBSDs (EIRP $\leq$ 33 dBm/20 MHz) using Band 48 initially and upgraded to support other licensed bands in Carrier aggregation (CA) mode. Licensed bands include: B2, B4, B13 or a subset of these– *Mostly Indoor installation, a few outdoor installations with a height below 6 meters*
- Multiple mobile terminals (approximately 16/location), supporting band 48 (per 3GPP) only, using LTE-TDD. Maximum transmitted power = 27 dBm
- Multiple mobile terminals (approximately 16 per location) operating in Carrier Aggregation (CA) mode, using legacy licensed bands B2, B4 and B13 or a subset of these, in CA aggregation with B48, using LTE(FDD/TDD), with a maximum transmitter power = 27 dBm

Table 1 Transmitter Information

Device Type	Transmit Frequency Band (MHz)	Conducted TX Power (dBm)	Maximum Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	ERP (dBm)	ERP (W)	Maximum Transmission Bandwidth (MHz) ⁽¹⁾	Emissions Designator	Technology
Small cell (category A device)	3550 - 3700	29	4	33	2.0	30.85	1.2	20 20/20 (40) 20/20/20 (60) 20/20/20/20 (80)	20M00F7D 40M00F7D 60M00F7D 80M00F7D	LTE-TDD
Mobile (CBRS)	3550 - 3700	27	3	30	1.0	27.85	0.6	20 20/20 (40)	20M00F7D 40M00F7D	LTE-TDD
Small cell for indoor operation (Licensed band)	746-757	27	3	30	1.0	27.85	0.6	10	10M00F7D	LTE-FDD
Small cell for outdoor operation (Licensed band)	746-757	43	7	50	100	47.85	60.9	10	10M00F7D	LTE-FDD
Mobile (Licensed band)	776-787	27	3	30	1.0	27.85	0.6	10	10M00F7D	LTE-FDD
Small cell for indoor operation (Licensed band)	1930-1990	27	3	30	1.0	27.85	0.6	20 20/20 (40)	20M00F7D	LTE-FDD
Small cell for outdoor operation (Licensed band)	1930-1990	43	7	50	100	47.85	60.9	20 20/20 (40)	20M00F7D	LTE-FDD

Device Type	Transmit Frequency Band (MHz)	Conducted TX Power (dBm)	Maximum Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	ERP (dBm)	ERP (W)	Maximum Transmission Bandwidth (MHz) ⁽¹⁾	Emissions Designator	Technology
Mobile (Licensed band)	1850-1910	27	3	30	1.0	27.85	0.6	20 20/20 (40)	20M00F7D	LTE-FDD
Small cell for indoor operation (Licensed band)	2110-2155	27	3	30	1.0	27.85	0.6	20 20/20 (40)	20M00F7D	LTE-FDD
Small cell for outdoor operation (Licensed band)	2110-2155	43	7	50	100	47.85	60.9	20 20/20 (40)	20M00F7D	LTE-FDD
Mobile (Licensed band)	1710-1755	27	3	30	1.0	27.85	0.6	20 20/20 (40)	20M00F7D	LTE-FDD

(1) LTE-TDD with Carrier Aggregation of contiguous or non-contiguous carriers with an effective aggregate bandwidth shown in parenthesis

Station Location

City State Latitude Longitude Mobile Radius of Operation

Irving, TX, North 32 52 37 West 96 57 12 Radius of operation = 4.8 Km

Datum: NAD 83

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

Exhibit submitted: No

(a) Width of beam in degrees at the half-power point: 90

(b) Orientation in horizontal plane: 313, 83

(c) Orientation in vertical plane: 2

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: 20

(b) Elevation of ground at antenna site above mean sea level in meters: 146

Table 2 Transmitter Information

Device Type	Transmit Frequency Band (MHz)	Conducted TX Power (dBm)	Maximum Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	ERP (dBm)	ERP (W)	Maximum Transmission Bandwidth (MHz) ⁽¹⁾	Emissions Designator	Technology
Small cell (category B device)	3550 - 3700	46	4	50	100	47.85	60.5	20 20/20 (40) 20/20/20 (60) 20/20/20/20 (80)	20M00F7D 40M00F7D 60M00F7D 80M00F7D	LTE-TDD
Mobile (CBRS)	3550 - 3700	27	3	30	1.0	27.85	0.6	20 20/20 (40)	20M00F7D 40 M00F7D	LTE-TDD

Table 3 defines the deployment areas where small cell and access points will be located during the evaluation testing. The outdoor sites (category B CBSDs) are installed on rooftops. Indoor small cells (category A) will be deployed anywhere within the defined regions.

Table 3 Small Cell and Mobile Device Deployment Regions and Operational Radius

Location Number	Address	County	Operational Center Point		Fixed Site Location Radius	
			Lat.	Lon.	Miles	Km
1	600 Hidden Ridge Irving, TX 75038	Dallas	32 52 37 N	96 57 12 W	3 Miles	4.8 Km