

## **Experimental License Exhibit**

Applicant seeks an experimental license from the Federal Communications Commission to conduct experimental testing of services and equipment in the 28 GHz (27,500-28,350 MHz) spectrum band in Waco, TX, Kalamazoo, MI, and South Bend, IN for a period of 18 months.

The industry standards organization, 3rd Generation Partnership Project (“3GPP”), is developing fifth generation (“5G”) network standards, which are expected for release beginning in 2018. The testing performed under this experimental license will provide information for optimizing system parameters being discussed in 5G standard activities and provide data on coverage, capacity, latency, and other key performance indices. Applicant will use this data to study potential designs for its 5G systems, contribute to 3GPP 5G standards development, and gain insight into customer perception and use patterns. Applicant will examine data collected during testing to determine the viability of the millimeter wave bands to support 5G wireless communication systems and to validate 5G system designs operating in a non-simulated business and residential environment in the 28 GHz band. The propagation characteristics of the 28 GHz band in urban morphologies will also be studied and mathematical models will be developed.

The base station radio units and antennas will be deployed outdoors at up to five (5) locations in each of the Cities of Waco, Kalamazoo, and South Bend at the locations identified below. The testing will involve transmissions between fixed base stations and fixed user equipment (“UE”) operating within a 1 kilometer (“km”) radius in real-world metropolitan environments. The antennas will be mounted on existing structures. The total radiated power at each transmission point will not exceed 60 dBm EIRP, limiting the coverage to a less than 1 km radius. The maximum gain of any antenna deployed will not exceed 25 dBi. Furthermore, the center line of any antenna deployed will be pointed approximately to the horizon plus or minus 10 degrees, with a possible maximum of plus or minus 25 degrees when considering the beamforming capability of the advanced antenna systems. The azimuthal orientation of the main lobe of the antenna is to be determined based on UE location. The channel bandwidth will be in multiples of 100 MHz up to a maximum of 800 MHz, used in a Time Division Duplex (TDD) scheme for uplink and downlink transmission.

The air interface protocol will be vendor-specific prototypes based on long term evolution (“LTE”)-Advanced protocols as well as the required improvements and modifications for the 5G system. Transmissions will include common multi-media data as well as high speed internet access for on-demand video and on-line gaming.

5G systems utilize advanced antenna technologies with beamforming and multiple input multiple output (MIMO) techniques, as well as more efficient coding and modulation schemes. These technologies are expected to result in higher spectral efficiencies, reduce latency to 1-5 milliseconds, and enable gigabit per second (Gbps) mobile and fixed broadband services, significantly faster than today’s average 4G speeds using LTE.

Site	Address/ Coordinates	Structure Type	Width of Beam at Half Power Point	Orientation Horizontal Plane (degrees)	Orientation Vertical Plane (degrees)	Antenna Extend >6m Above Structure or Ground? (Y/N)	Antenna Height AGL (meters)	Elevation AMSL (meters)	Nearst Aircraft Landing Area (km)
<b>Waco, McLennan County, Texas Stations</b>									
1	500 Peach Street 31°33'50.2"N; 97°07'07.0"W	Monopole	120	tbid	+/- 25	Y	37.8	118.5	11.0
2	925 Washington Avenue 31°33'14.4"N; 97°08'14.3"W	Building	120	tbid	+/- 25	N	N/A	N/A	N/A
3	409 S. 8 <sup>th</sup> Street 31°33'04.2"N; 97°07'52.8"W	Self- Support	120	tbid	+/- 25	Y	29.3	125.1	10.7
4	425 Speight Avenue 31°32'47.0"N; 97°07'05.3"W	Building	120	tbid	+/- 25	N	N/A	N/A	N/A
5	700-A S. University Parks Dr. 31°33'20.2"N; 97°07'17.5"W	Building	120	tbid	+/- 25	N	N/A	N/A	N/A
<b>Kalamazoo, Kalamazoo County, Michigan Stations</b>									
1	2839 Millcork 42°15'45.3"N; 85°32'09.3"W	Monopole	120	tbid	+/- 25	Y	39.3	255.4	3.5
2	1500 Rockledge Street 42°18'13.0"N; 85°36'26.0"W	Self- Support	120	tbid	+/- 25	Y	41.8	285.5	9.2
3	900 Hatfield Avenue 42°16'57.7"N; 85°33'24.5"W	Monopole	120	tbid	+/- 25	Y	39.3	234.0	5.5
4	535 S. Burdick Street 42°17'12.1"N; 85°34'55.9"W	Building	120	tbid	+/- 25	N	N/A	N/A	N/A
5	590 W Maple Street 42°16'20.0"N; 85°35'28.0"W	Self- Support	120	tbid	+/- 25	Y	36.6	238.4	5.5
<b>South Bend, St. Joseph County, Indiana</b>									
1	1115-B Western Avenue 41°40'22.0"N; 86°16'00.0"W	Self- Support	120	tbid	+/- 25	Y	48.2	224.4	4.9
2	3108 Mishawaka Avenue 41°39'55.0"N; 86°12'12.0"W	Self- Support	120	tbid	+/- 25	Y	42.7	219.4	9.8
3	3115 Western Avenue 41°40'20.0"N; 86°17'34.9"W	Self- Support	120	tbid	+/- 25	Y	39.6	217.6	3.6
4	324 W. Garst Street 41°39'47.0"N; 86°15'15.0"W	Guyed	120	tbid	+/- 25	Y	44.8	222.5	6.4
5	2018-B Miami Road 41°39'11.6"N; 86°14'05.0"W	Monopole	120	tbid	+/- 25	Y	53.3	224.6	8.3