EXHIBIT 1 – 28 GHz BUILDOUT DEMONSTRATION & ENGINEERING EXHIBIT

WRBC488 & WRBC489
T-Mobile License LLC
New York, NY
1,052,819 out of 1,694,251 (62.1%)

This Engineering Exhibit has been prepared in accordance with Sections 30.104(a) and 30.104(f) of the Commission's Rules (the "Rules") to demonstrate satisfaction of the Upper Microwave Flexible Use Service performance requirements. The Rules require incumbent licensees to make a buildout showing by June 1, 2024. Among the ways that licensees may provide that demonstration is to show that they are providing reliable signal coverage and service to at least 40 percent of the population with the licensed service area. T-Mobile makes that demonstration here.

Propagation Model Utilized

Digital planning tools try to match a model of the propagation environment to known measurements in an area. If the model is successful, then the accuracy of the model will approach the slow fading levels encountered in the field. A good model will estimate the long-term average mean of the signal over the prediction square or bin (generally 2 meters square) considering the granularity of mm Wave signal propagation. The slow fading and any additional model errors will be a standard deviation of the tool when compared to known measurements. The planning tool that T-Mobile employs is ATOLL which uses industry leading digital terrain (2m resolution) and geodata such as clutter classes and clutter heights with 2m resolution and advanced calculations to produce an accurate estimation of the signal strength on the ground.

ATOLL uses the Ray Tracing model to capture the number of diffractions and reflections beyond first obstacle. The Aster mm Wave propagation model is a sophisticated and versatile propagation model which Atoll uses including Ray Tracing capabilities and vector data to be considered for different types of buildings and vegetation. These models have proven the successful result of several years of research in such domains as propagation, modelling, optimization and algorithms.

This model is able to automatically adapt itself to:

- All cell sizes (micro, mini, small, and macro cells)
- All radio environments (dense urban, urban, suburban, mountainous, maritime, open)
- All systems (CDMA2000, DVB-H, EV-DO, GSM, (E)GPRS, TETRA, UMTS, Wi-Fi, WiMAX, LTE, NR)
- FR2 frequencies, from 24GHz to 39 GHz

The model relies on highly realistic modelling of the propagation channel achieving synergy of 3 vital physical elements:

- Diffraction in the vertical plane
- Guided propagation in the horizontal plane
- Reflections from hilly or mountainous terrain

In addition, this model can produce Line of Sight and non-Line of Sight information for each predicted location.

Equipment Deployed, Technology Employed and Available Services

T-Mobile has deployed a mobile communication system utilizing 5th generation technology (5G New Radio) to provide services within the licensed area. The foundation in determining the coverage footprint is founded on the Maximum Allowable Path Loss ("MAPL") based on link budget calculation in which a user is assumed at the cell edge. The goal of this link budget is to get the maximum footprint of a cell by providing the required throughput at cell edge while maintaining that both forward and reverse link are balanced to keep the connection. Both forward and reverse link are calculated to determine the limiting path. Based on the calculation, it is determined that the limiting factor is the reverse link and thus used as the MAPL.

The calculated MAPL translates to the maximum cell coverage with a forward link data rate of 25Mbps and reverse link data rate of 500kbps at cell edge. With this MAPL, the required signal strength at cell edge is -111 dBm or higher (RSRP) 5G New Radio with the assumptions of UE power class 3. Customer Premise Equipment ("CPE" i.e. smartphones') capabilities and locations of the CPE such as Rooftop or Indoor or outside window mount would improve the signal at cell edge and widely expand our 28GHz coverage beyond the above target. Better and higher download and upload speeds are expected with CPE capabilities of the user and MIMO configuration.

T-Mobile has implemented systems manufactured by Ericsson

Link budget Calculations: 28GHz FR2 25Mbps DL/0.5Mbps UL at cell edge

BE Data 95% cell-edge reliability	n257 TDD, 100MHz 28000 MHz	Urban Macro-NLOS Frequency check: Valid

Link	Channel	Maximum allowable path-loss (dB)	Cell-radius (m)
DOWNLINK	**SSB DMRS**	**144.2**	**336**
	PBCH	142.5	363
	Unicast PDCCH	151.0	599
	PDSCH @ 25 Mbps at cell edge	146.5	458
UPLINK	PRACH	151.8	625
	PUCCH - ACK/NACK	159.4	981
	PUCCH - CSI Feedback	158.4	925
	PUSCH @ 500 kbps at cell edge	**144.2**	**465**
TDD GP	TDD DL-UL GP based maximum cell radius	4 OFDM symbols GP	5357
PRACH	PRACH Preamble Format CP & GP based maximum cell radius	Short C2 PRACH Preamble Format	1205

Assuming SSB EIRP = 42.8 dBm

Propagation and Rx Losses			
Cell Edge Reliability		95%	%
Log Normal Fading Standard Deviation		9.5	dB
Rain / Snow Loss		0.0	dB
Foliage Loss		0.0	dB
Body Loss		8.0	dB
Building Penetration Loss		0.0	dB
		0.0	dB
Total Propagation Margin		-17.5	dB
Final Path Loss to Cell Border(No Margin)	**SSB DMRS**	**144.2**	**dB**
RSRP	**SSB-RSRP(No Margin)**	**-128.2**	**dBm**
RSRP	**SSB-RSRP(With Margin)**	**-110.7**	**dBm**

Population Covered Calculation
The total population for T-Mobile's licensed area in New York, NY is 1,694,251. The total population is derived from the 2020 US Census Data.

Service Area Predictions
T-Mobile has used the ATOLL propagation prediction tool to determine areas of "adequate service" within its licensed area. T-Mobile utilizes this tool for system design and RF propagation modeling. The RF propagation model selected within the ATOLL tool uses industry leading digital terrain and environmental databases and uses advanced calculations to produce an accurate estimation of the signal strength on the ground.

Coverage Map
Included with this filing is a coverage map, reflecting the methodology discussed above, which was prepared consistent with industry practices for wireless communications. The map clearly and accurately displays the system coverage area and market boundaries.

Area Coverage and Population Calculation
The service area signal level coverage is overlaid on the population data of the license area using 2020 Census Tracts. A calculation is made to determine the percentage of the population in the licensed area where the subscriber may receive a signal of approximately -111 dBm for New Radio. As demonstrated herein, T-Mobile is currently providing coverage to a population of 1,052,819 out of the total licensed population of 1,694,251. Therefore, T-Mobile is providing sufficient service for 62.1% of the licensed area population.

Conclusion
In view of the above, T-Mobile has made the buildout showing required by Sections 30.104(a) and 30.104(f) of the Rules by demonstrating that it is providing reliable coverage and service to at least 40 percent of the population within the service area of the license.
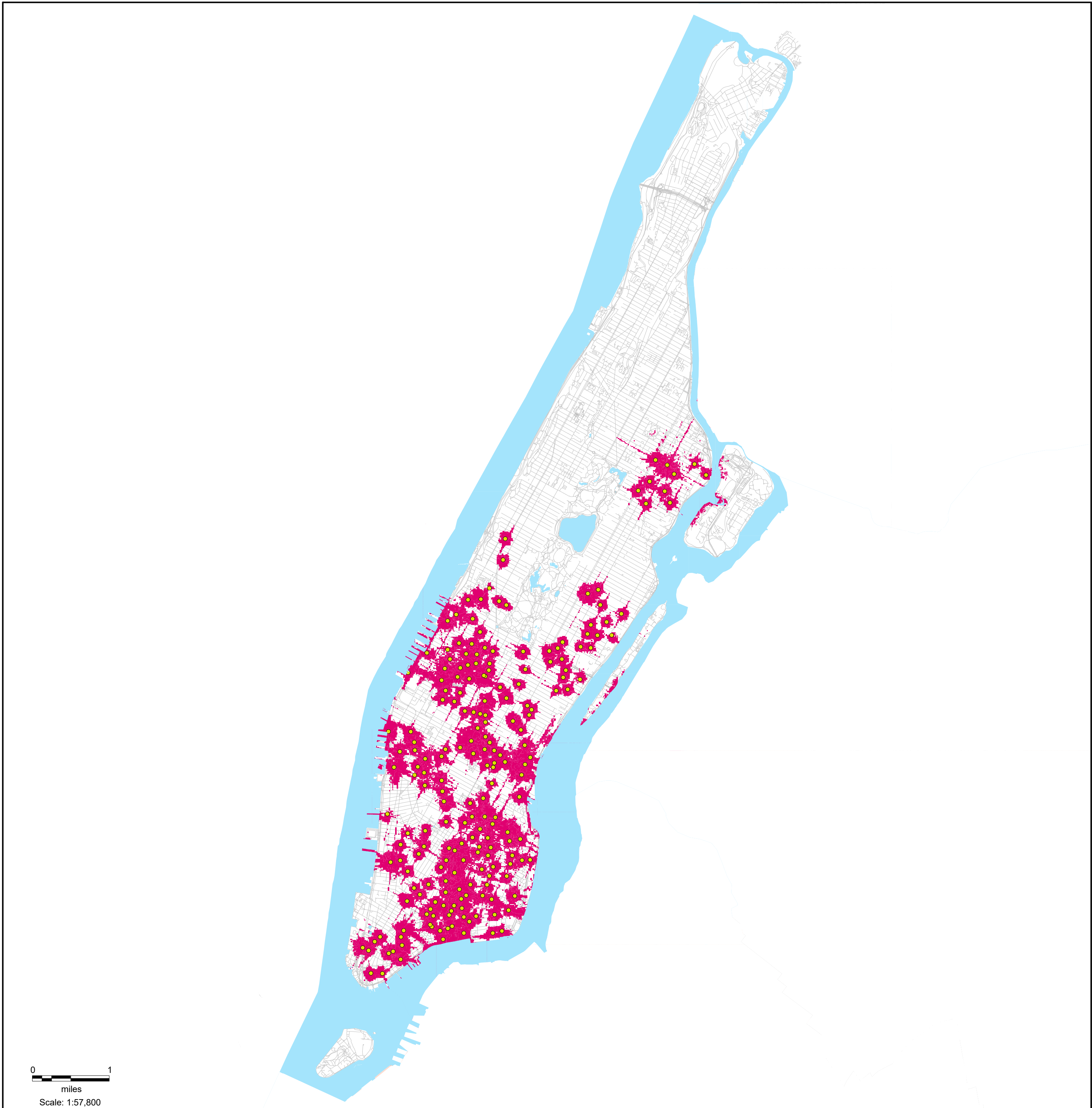
Call Signs:

WRBC488, WRBC489

T-Mobile License LLC

License Frequencies:

27600-27650 MHz
28050-28100 MHz

Frequency Block(s): L1, L2

State: NY
County: New York
County FIPS: 36061
License Pops:1,694,251
Covered Pops:1,052,819
Covered: 62.1%

■ 28GHz Coverage Area (-111dBm)

■ Water

▭ County Boundary

◉ Transmit Site

0   1
miles
Scale: 1:57,800