



February 21, 2020

Dr. Bruce Eisenstein
ECE Department
Drexel University
Philadelphia, PA 19104-2875

Re: Union County College Wireless Application

Block 121 Lots 1, 2.01, 2.02, 3, 4, 5 and Block 122 Lot 5

1033 Springfield Avenue

Cranford, NJ

Dr. Eisenstein,

As per your request, below are the propagation tool parameters for the applicants for the wireless facility at Union County College.

The design threshold for the Cranford area for all 3 applicants is based on the 4G LTE equipment manufacturers specifications and recommendations, and on the 3GPP standards for LTE in the 1900/2100 MHZ frequency band. As depicted on the coverage plots provided in the application, the design threshold signal strength is -95 dBm RSRP as measured in the street. This threshold is intended to provide a reliable level of suburban in-building coverage to single family wood frame structures. It should be noted that a design threshold varies from area to area within the markets and is based on the local conditions, building densities, demographics, land-use, etc.

The propagation model takes into account the site parameters (such as antenna height, antenna gain, transmitter power, transmission line loss), terrain, and clutter based land-use data. The clutter data adds the assigned clutter height and loss value to each bin

calculation. Each of the 3 applicants (Verizon Wireless, AT&T Wireless and T-Mobile) have their own specific propagation tools and cell site parameters. The models used by each applicant are tuned models based on drive test data in the given morphology type for the Cranford area. Below are the specifics for each applicant.

The propagation parameters for Verizon Wireless are as follows:

Propagation Tool –	Atoll
Model Type Used –	WPM
Clutter Model used –	WPM_SU_IN_NJ_TALL_102414_NJ
Diffraction Calculation -	Ray Tracing
Clutter Types –	Core Urban, Dense Urban, Urban, Commercial Industrial, Suburban Few Trees, Suburban w/Trees, Residential Few Trees, Residential w/Trees, Major Stadium, Minor Stadium Theme Park_Fairgrounds, High School Building, University College Building, Open, Convention Center, Airport
Bin Size –	5m

Please reference Table 1 attached for the Verizon Wireless site parameters.

The propagation parameters for AT&T Wireless are as follows:

Propagation Tool –	Atoll
Model Type Used -	Aster - NYCE_NJ_MX_AST_AC_0700_113017
Clutter Model used –	NER_NYNJ_Clutter10m_2015_V1
Diffraction Calculation -	Ray Tracing
Clutter Types –	Core Urban, Dense Urban, Urban, Commercial Industrial, Suburban Few Trees, Suburban w/Trees, Residential Few Trees, Residential with Trees, Major Stadium, Minor Stadium Theme Park_Fairgrounds, High School Building, University College Building, Open, Convention Center, Airport
Bin Size –	10m

Please reference Table 2 attached for the AT&T Wireless site parameters.

The propagation parameters for T-Mobile are as follows:

Propagation Tool –	Asset 10.0
Model Type Used –	Myriad Model 500
Clutter Model used –	UTM18_Myriad V4 11 Clutter
Diffraction Calculation -	Deygout
Clutter Types –	Water, Forest, Open, Residential w/trees, Commercial, Core Urban, HD Urban, Urban, Residential w/few trees, Grass, Airport, Transportation, Rural, and Marsh
Bin Size –	25m

Please reference Table 3 attached for the T-Mobile site parameters.

If you have any questions regarding the enclosed information, please feel free to contact me. Thank you for your time in reviewing the application.

Regards,

A handwritten signature in black ink, appearing to read "G. Pierson".

Glenn Pierson
Principal
Pier Four Enterprises LLC

Table 1

Verizon Wireless (2100 MHz) 4G LTE Site Parameters														
Site Name	Town	Structure Type	Ground Elevation AMSL (ft)	Antenna Centerline Height (ft)	Azimuth	Electrical Downtilt	Longitude NAD83	Latitude NAD83	RRH Power (watts)	MIMO	Antenna Model	Gain (dBi)	Line Loss	EIRP (dBm)
Springfield	Springfield	Monopole	141	117	75	4	-74.3334	40.6837	45	4x4	hex454cw0000x-t00	17.5	1	63
Springfield	Springfield	Monopole	141	117	170	2	-74.3334	40.6837	45	4x4	hex454cw0000x-t00	17.5	1	63
Springfield	Springfield	Monopole	141	117	320	3	-74.3334	40.6837	45	4x4	hex656cw0000x-t00	16.5	1	62
Kenilworth Water Tank	Kenilworth	Water Tank	161	87	95	3	-74.2932	40.6845	45	4x4	hex656cw0000x-t00	17.2	1	62.7
Kenilworth Water Tank	Kenilworth	Water Tank	161	87	230	3	-74.2932	40.6845	45	4x4	hex656cw0000x-t00	17.2	1	62.7
Kenilworth Water Tank	Kenilworth	Water Tank	161	87	0	3	-74.2932	40.6845	45	4x4	hex456cw0000x-t00	18.3	1	63.8
Kenilworth Blvd SC	Kenilworth	Rooftop	102	36	220/340	0	-74.291	40.6764	5	1x1	cyl-x7cap-2-h-0	11.5	3	45.5
Kenilworth GSP	Kenilworth	Monopole	95	110	110	4	-74.2791	40.6738	45	4x4	qs6656-5	17.7	1	63.2
Kenilworth GSP	Kenilworth	Monopole	95	110	235	2	-74.2791	40.6738	45	4x4	qs6656-5	17.7	1	63.2
Kenilworth GSP	Kenilworth	Monopole	95	110	10	2	-74.2791	40.6738	45	4x4	qs6656-5	17.7	1	63.2
Birchwood Ave SC	Cranford	Rooftop	75	43.5	340	0	-74.2934	40.6696	40	1x1	X7CAP-265	15.5	3	58.5
Cranford GSP	Cranford	Monopole	77	100	100	6	-74.2876	40.654	60	2x2	hex456cw0000x-t00	18.3	3	63.1
Cranford GSP	Cranford	Monopole	77	100	205	2	-74.2876	40.654	60	2x2	hex456cw0000x-t00	18.3	3	63.1
Cranford GSP	Cranford	Monopole	77	100	350	4	-74.2876	40.654	60	2x2	hex656cw0000x-t00	17.2	3	62
North Union Ave	Cranford	Rooftop	82	66	100	4	-74.3038	40.6578	45	4x4	sbnhh-1d65b	18.3	1	63.8
North Union Ave	Cranford	Rooftop	82	66	220	3	-74.3032	40.6298	45	4x4	sbnhh-1d65b	18.3	1	63.8
North Union Ave	Cranford	Rooftop	82	66	0	0	-74.3032	40.6298	45	4x4	sbnhh-1d65b	18.3	1	63.8
Garwood	Garwood	Monopole	88	98	150	2	-74.321803	40.653114	60	2x2	jahh-65b-r3b_2dt	18	3	62.8
Garwood	Garwood	Monopole	88	98	245	2	-74.321803	40.653114	60	2x2	jahh-65b-r3b_2dt	18	3	62.8
Garwood	Garwood	Monopole	88	98	240	2	-74.321803	40.653114	60	2x2	jahh-45b-r3b_2dt	20	3	64.8
Garwood	Garwood	Monopole	88	98	330	2	-74.321803	40.653114	60	2x2	jahh-65b-r3b_2dt	18	3	62.8
Route 28 SC	Westfield	Rooftop	108	38	0	0	-74.33645	40.650273	5	1x1	cyl-x7cap-2-p	11.3	3	46.1
East Broad SC	Westfield	Rooftop	118	51	310	0	-74.341992	40.656444	40	1x1	x7cap-465-vr0	17.2	3	60.2
North Ave	Westfield	Rooftop	126	54	120	2	-74.346825	40.650114	60	2x2	qs4658-5	16.5	3	61.3
North Ave	Westfield	Rooftop	126	54	230	1	-74.346825	40.650114	60	2x2	sbnhh-1d45a	19.2	3	64
North Ave	Westfield	Rooftop	126	54	10	2	-74.346825	40.650114	60	2x2	qs4658-5	16.5	3	61.3
Prospect Street	Westfield	Rooftop	150	75	120	4	-74.352843	40.653022	40	4x4	sbnhh-1d45b	20.5	1	65.5
Prospect Street	Westfield	Rooftop	150	75	260	3	-74.352843	40.653022	40	4x4	sbnhh-1d65b	18.3	1	63.3
Prospect Street	Westfield	Rooftop	150	75	340	3	-74.352843	40.653022	40	4x4	sbnhh-1d45b	20.5	1	65.5
Mountainside	Mountainside	Monopole	133	117	10	3	-74.355983	40.671769	60	2x2	hex656cw0000x-t00	17.2	3	62
Mountainside	Mountainside	Monopole	133	117	140	3	-74.355983	40.671769	60	2x2	hex656cw0000x-t00	17.2	3	62
Mountainside	Mountainside	Monopole	133	117	270	0	-74.355983	40.671769	60	2x2	hex656cw0000x-t00	17.2	3	62
Route 22 SC	Mountainside	Rooftop	147	37	0	0	-74.342333	40.680667	40	1x1	cyl-x7cap-2-c	9.7	3	52.7
Proposed Westfield 4	Cranford	Monopole	96	140	75	1	-74.3252	40.6661	40	4x4	QS6456-5	18.6	1	63.6
Proposed Westfield 4	Cranford	Monopole	96	140	140	2	-74.3252	40.6661	40	4x4	QS6656-5	17.7	1	62.7
Proposed Westfield 4	Cranford	Monopole	96	140	275	2	-74.3252	40.6661	40	4x4	QS6656-5	17.7	1	62.7
Proposed Westfield 4	Cranford	Monopole	96	140	5	2	-74.3252	40.6661	40	4x4	QS6656-5	17.7	1	62.7

Table 2

AT&T (1900 MHz) 4G LTE Site Parameters														
Site Name	Town	Structure Type	Ground Elevation AMSL (ft)	Antenna Centerline Height (ft)	Azimuth	Electrical Downtilt	Longitude NAD83	Latitude NAD83	RRH Power (watts)	MIMO	Antenna Model	Gain (dBi)	Line Loss	EIRP (dBm)
Springfield	Springfield	Monopole	141	146	20	4	-74.3334	40.6837	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Springfield	Springfield	Monopole	141	146	140	4	-74.3334	40.6837	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Springfield	Springfield	Monopole	141	146	240	4	-74.3334	40.6837	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Kenilworth Water Tank	Kenilworth	Water Tank	161	89	30	0	-74.2932	40.6845	40	4x4	NNHH-65B-R4	16.7	1	61.7
Kenilworth Water Tank	Kenilworth	Water Tank	161	89	150	0	-74.2932	40.6845	40	4x4	NNHH-65B-R4	16.7	1	61.7
Kenilworth Water Tank	Kenilworth	Water Tank	161	89	270	0	-74.2932	40.6845	40	4x4	NNHH-65B-R4	16.7	1	61.7
Kenilworth Inn	Kenilworth	Sign	102	94	30	0	-74.2799	40.6768	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Kenilworth Inn	Kenilworth	Sign	102	94	120	0	-74.2799	40.6768	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Kenilworth Inn	Kenilworth	Sign	102	94	220	0	-74.2799	40.6768	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Roselle Water Tank	Roselle	Water Tank	69	104	30	2	-74.2814	40.6565	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Roselle Water Tank	Roselle	Water Tank	69	104	150	2	-74.2814	40.6565	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Roselle Water Tank	Roselle	Water Tank	69	104	270	2	-74.2814	40.6565	40	4x4	NNHH-65A-R4_	17.8	1	62.8
North Union Ave	Cranford	Rooftop	82	68	30	0	-74.3038	40.6578	40	4x4	NNHH-65A-R4_	17.8	3	59.8
North Union Ave	Cranford	Rooftop	82	68	150	0	-74.3032	40.6298	40	4x4	NNHH-65A-R4_	17.8	3	59.8
North Union Ave	Cranford	Rooftop	82	68	270	0	-74.3032	40.6298	40	4x4	NNHH-65A-R4_	17.8	3	59.8
Garwood	Garwood	Monopole	88	78	355	0	-74.321803	40.653114	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Garwood	Garwood	Monopole	88	78	120	0	-74.321803	40.653114	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Garwood	Garwood	Monopole	88	78	240	0	-74.321803	40.653114	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Elm Street	Westfield	Rooftop	122	53	10	0	-74.3476	40.6515	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Elm Street	Westfield	Rooftop	122	53	120	0	-74.3476	40.6515	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Elm Street	Westfield	Rooftop	122	53	230	0	-74.3476	40.6515	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Mountainside	Mountainside	Monopole	133	101	20	2	-74.355983	40.671769	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Mountainside	Mountainside	Monopole	133	101	140	3	-74.355983	40.671769	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Mountainside	Mountainside	Monopole	133	101	255	2	-74.355983	40.671769	40	4x4	NNHH-65A-R4_	17.8	1	62.8
Proposed Westfield 4	Cranford	Monopole	96	130	70	3	-74.3252	40.6661	40	4x4	NNHH-65B-R4	16.7	1	61.7
Proposed Westfield 4	Cranford	Monopole	96	130	150	3	-74.3252	40.6661	40	4x4	NNHH-65B-R4	16.7	1	61.7
Proposed Westfield 4	Cranford	Monopole	96	130	250	3	-74.3252	40.6661	40	4x4	NNHH-65B-R4	16.7	1	61.7
Proposed Westfield 4	Cranford	Monopole	96	130	340	3	-74.3252	40.6661	40	4x4	NNHH-65B-R4	16.7	1	61.7

Table 3

T-Mobile (2100 MHz) 4G LTE Site Parameters														
Site Name	Town	Structure Type	Ground Elevation AMSL (ft)	Antenna Centerline Height (ft)	Azimuth	Electrical Downtilt	Longitude NAD83	Latitude NAD83	RRH Power (watts)	MIMO	Antenna Model	Gain (dBi)	Line Loss	EIRP (dBm)
Springfield	Springfield	Monopole	141	107	30	3	-74.3334	40.6837	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Springfield	Springfield	Monopole	141	107	150	3	-74.3334	40.6837	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Springfield	Springfield	Monopole	141	107	270	3	-74.3334	40.6837	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Jefferson Ave	Union	Monopole	88	128	30	5	-74.3039	40.6856	5	32x32	AIR3246_B66	16.5	0	53.5
Jefferson Ave	Union	Monopole	88	128	170	3	-74.3039	40.6856	5	32x32	AIR3246_B66	16.5	0	53.5
Jefferson Ave	Union	Monopole	88	128	270	2	-74.3039	40.6856	5	32x32	AIR3246_B66	16.5	0	53.5
Jefferson Ave	Union	Monopole	88	128	330	6	-74.3039	40.6856	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Kenilworth Inn	Kenilworth	Sign	102	70	30	6	-74.2799	40.6768	40	2x2	KRC118023-1_B2A_B4P	17.5	1.8	63.5
Kenilworth Inn	Kenilworth	Sign	102	70	150	4	-74.2799	40.6768	40	2x2	KRC118023-1_B2A_B4P	17.5	1.8	63.5
Kenilworth Inn	Kenilworth	Sign	102	70	280	2	-74.2799	40.6768	40	2x2	KRC118023-1_B2A_B4P	17.5	1.8	63.5
Kenilworth GSP 31st street	Kenilworth	Monopole	95	140	10	5	-74.2791	40.6738	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Kenilworth GSP 31st street	Kenilworth	Monopole	95	140	120	5	-74.2791	40.6738	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Kenilworth GSP 31st street	Kenilworth	Monopole	95	140	230	5	-74.2791	40.6738	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Roselle Water Tank	Roselle	Water Tank	69	66	30	7	-74.2814	40.6565	40	2x2	KRC118023-1_B2P_B4A	18	0	64
Roselle Water Tank	Roselle	Water Tank	69	66	150	5	-74.2814	40.6565	40	2x2	KRC118023-1_B2P_B4A	18	0	64
Roselle Water Tank	Roselle	Water Tank	69	66	270	8	-74.2814	40.6565	40	2x2	KRC118023-1_B2P_B4A	18	0	64
Cranford GSP	Cranford	Monopole	77	90	20	4	-74.2876	40.654	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Cranford GSP	Cranford	Monopole	77	90	190	5	-74.2876	40.654	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Cranford GSP	Cranford	Monopole	77	90	320	4	-74.2876	40.654	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Union Ave South	Cranford	Rooftop	79	74	0	2	-74.3058	40.655	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Union Ave South	Cranford	Rooftop	79	74	110	2	-74.3058	40.655	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Union Ave South	Cranford	Rooftop	79	74	220	2	-74.3058	40.655	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Garwood	Garwood	Monopole	88	88	50	4	-74.321803	40.653114	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Garwood	Garwood	Monopole	88	88	190	2	-74.321803	40.653114	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Garwood	Garwood	Monopole	88	88	280	2	-74.321803	40.653114	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Prospect Street	Westfield	Rooftop	150	75	30	2	-74.352843	40.653022	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Prospect Street	Westfield	Rooftop	150	75	150	2	-74.352843	40.653022	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Prospect Street	Westfield	Rooftop	150	75	280	2	-74.352843	40.653022	30	4x4	KRD901146-1_B66A_B2A	18.4	0	63.2
Mountainside	Mountainside	Monopole	133	127	30	2	-74.355983	40.671769	40	2x2	KRC118023-1_B2P_B4A	18	0	64
Mountainside	Mountainside	Monopole	133	127	150	2	-74.355983	40.671769	40	2x2	KRC118023-1_B2P_B4A	18	0	64
Mountainside	Mountainside	Monopole	133	127	270	2	-74.355983	40.671769	40	2x2	KRC118023-1_B2P_B4A	18	0	64
Proposed Westfield 4	Cranford	Monopole	96	120	70	2	-74.3252	40.6661	30	4x4	AR32KRD901146B66_02	18.4	0	63.2
Proposed Westfield 4	Cranford	Monopole	96	120	190	2	-74.3252	40.6661	30	4x4	AR32KRD901146B66_02	18.4	0	63.2
Proposed Westfield 4	Cranford	Monopole	96	120	310	2	-74.3252	40.6661	30	4x4	AR32KRD901146B66_02	18.4	0	63.2