RYKA CONSULTING

NON-IONIZING ELECTROMAGNETIC RADIATION REPORT

Prepared For:

T-Mobile

19807 North Creek Parkway
Bothell, WA 98011

Project Name:

Washington State Fair - Light Pole
SE04823C

Project Address:

902 S. Meridian
Puyallup, WA 98371

Site Coordinates:

47.1814
-122.2965

Prepared By:

Ryan McDaniel, P.E.

June 28, 2022

PROJECT SUMMARY

PROJECT DESCRIPTION:

T-Mobile proposes the following: Replace (3) existing panel antennas (1 per sector) with (6) new panel antennas (2 per sector).

PROJECT SCOPE:

The scope of this report is to determine, using the recommended prediction methods outlined in the Federal Communications Commission OET Bulletin 65 Edition 97-01, if the radio facility in question will be in compliance with all appropriate Federal regulations in regards to Radio Frequency (RF) Exposure.

SUMMARY RESULTS:

Based on our review of the proposed RF configuration and applying worst-case scenario, **we have determined the proposed site will comply with current FCC and municipal guidelines for human exposure** to non-ionizing electromagnetic radiation for the Uncontrolled Condition / General Population and for the Controlled / Occupational Condition.

Total Calculated Maximum Power Density (mW/cm^2)			Results
Uncontrolled / General Population	MPE Limits (mW/cm2)	**0.467**	**PASS**
	MPE Limits (mW/cm2)	**0.61%**	
Controlled / Occupational	MPE Limits (mW/cm2)	**2.333**	**PASS**
	MPE Limits (mW/cm2)	**99.7%**	

For the Uncontrolled / General Population Condition, the MPE limit is not exceeded when at the base of the light pole. This site passes with the proposed installation and with the RF emission values provided to Ryka.

For the Uncontrolled / General Population, the MPE limit is reached at 25 feet from the face of the antennas.

For the Controlled / Occupational Condition, the MPE limit is not exceeded while working on the pole below the antennas.

See the Conclusions Section and calculations in Appendix A which verify these results.

CONTENTS:

1 Reference Documents

The following data was used to figure the RF exposure for the site.

Data	Document	Author
Limits for MPE	Table 1 OET Bulletin 65 Appendix A	FCC
Equipment Frequency Range	Equipment Specification Sheet	Manufacturer
Site Information	Construction Drawings	Ryka
1/13/2022	RFDS	T-Mobile

2 New and Existing Equipment Contributing to total MPE

Typical Sector Equipment

Elevation	Equipment	ERP (Watts)	Owner
73.5	Panel Antenna	1,000	T-Mobile
65.5	Panel Antenna	1,000	T-Mobile

Total:	2,000

Notes: The ERP of the panel antennas is assumed to be the maximum allowed by the FCC for any sector.

Only (1) sector will contribute to the overall MPE for any area near the light pole.

No other antennas were found in the area which would contribute to the MPE for the same sector as the T-Mobile antennas.

See calculations in Appendix A for a catalog of all antennas considered for this report.

3 Analysis

Section 2 of OET Bulletin 65 states that "for a truly worst-case prediction of power density at or near the surface, such as at ground-level or on a rooftop, 100% reflection of incoming radiation can be assumed, resulting in a potential doubling of predicted field strength and a four-fold increase in (far field equivalent) power density". Therefore, the following equation (6) is used:

$$S = EIRP/\pi R^2$$

Where: S = power density (mW/cm^2)
EIRP = equivalent isotropically radiated power
R = distance to the center of the radiation antenna (cm)

4 Conclusion

Uncontrolled / General Population

According to the information available at the time of this report, the worst-case RF emissions of the proposed antennas, existing antennas, and antennas located nearby will be in compliance with the requirements of the current FCC and municipal guidelines for human exposure to non-ionizing electromagnetic radiation.

Controlled / Occupational

According to the information available at the time of this report, the worst-case RF emissions of the proposed antennas, existing antennas, and antennas located nearby will be in compliance with the requirements of the current FCC and municipal guidelines for human exposure to non-ionizing electromagnetic radiation.

5 Environmental Evaluation

An environmental evaluation is required if the PCS broadband facility is less than 10m (32.81ft) AGL and has a total power of all channels in any given sector greater than 2,000 W ERP as referenced in "Table 2 Transmitters, Facilities, and Operations Subject to Routine Environmental Evaluation" in Appendix A of Bulletin 65.

As the proposed antennas lowest point above ground level is above the minimum elevation, an environmental evaluation is not required.

6 Disclaimers

1. This report is meant to show the level of conformance for the site with the codes and guidelines adopted by the agency with jurisdiction over the site. No other assessment is implied.

2. This report is prepared with the information furnished to Ryka by our client. If the conditions of the site change or if new information becomes available, the results of this report are not valid. Ryka should be notified so that the report can be updated and resubmitted.

3. Ryka is not responsible for the conclusions, opinions and recommendations made by others based on the information contained herein.

A Appendix – MPE Calculations

	Controlled / Occupational	Uncontrolled / Gen. Population
Min. Antenna Frequency (MHz)	700	700
Max. Power Density (mW/cm	2.3	0.5

Uncontrolled Calculations

(Worst Case Sector for the general population at the base of the light pole)

Any single Sector

Radial Center AGL (ft)	Eff. Height (ft)	Horiz. Dist. (ft)	Total Dist. (ft)	Total Dist. (cm)	ERP (watts)	ERP (dBm)	Eff. ERP (dBm)	Eff. EIRP (dBm)	Eff. EIRP (mW)	Power Density, S (mW/cm^2)
73.5	67.5	0	68	2,057	1,000	60.00	40.00	42.16	16,444	0.00124
65.5	59.5	0	60	1,814	1,000	60.00	40.00	42.16	16,444	0.00159

Total Power Density = 0.0028

Percentage of Uncontrolled Maximum Power Density = 0.61%

Assumptions:

1. One sector of panel antennas will contribute to the MPE for any area near the sector.
2. General population below the antenna array are between 70 and 90 degrees from the focus of the antennas.
3. Effective Antenna ERP conservatively assumes a 20 dB vertical radiation loss for panel antennas
4. Effective Height assumes an approximate head level of 6 ft.

Notes:

1. ERP (dBm) = 10 * log10[ERP (watts)] + 30
2. EIRP (dBm) = 1.64 * ERP (dBm)
3. EIRP (mW) = 10^[EIRP (dBm)/10]

A Appendix – MPE Calculations

	Controlled / Occupational	Uncontrolled / Gen. Population
Min. Antenna Frequency (MHz)	700	700
Max. Power Density (mW/cm	2.3	0.5

Uncontrolled Calculations

(Worst Case Sector for the general population at the same elevations of antennas on the light pole)

Radial Center AGL (ft)	Eff. Height (ft)	Horiz. Dist. (ft)	Total Dist. (ft)	Total Dist. (cm)	ERP (watts)	ERP (dBm)	Eff. ERP (dBm)	Eff. EIRP (dBm)	Eff. EIRP (mW)	Power Density, S (mW/cm^2)
73.5	0.0	24.6	25	749	1,000	60.00	60.00	62.16	1,644,372	0.23335
65.5	0.0	24.6	25	749	1,000	60.00	60.00	62.16	1,644,372	0.23335

A review of the site indicates that there is no opportunity for the general population to be near the antenna. To accommodate this metric, no reflectivity of the signal is assumed and equation (5) for field density is used instead of equation (6) from OET 65.

Total Power Density = 0.4667

Percentage of Uncontrolled Maximum Power Density = 100.0%

This calculation shows that the maximum MPE allowed by the FCC limits is reached at 25 feet from the face of the antennas.

Assumptions:

1. a 0 dB loss is assumed for effective height of 0 to 6 feet
   a 10 dB loss is assumed for effective height of 6 to 12 feet
   a 20db loss of emissions to reach a location below the antenna results in EIRP/100
2. Effective Antenna ERP conservatively assumes a 20 dB vertical radiation loss for panel antennas
3. Effective Height assumes an approximate head level of 6 ft.

Notes:

1. ERP (dBm) = 10 * log10[ERP (watts)] + 30
2. EIRP (dBm) = 1.64 * ERP (dBm)
3. EIRP (mW) = 10^[EIRP (dBm)/10]

A Appendix – MPE Calculations

	Controlled / Occupational	Uncontrolled / Gen. Population
Min. Antenna Frequency (MHz)	700	700
Max. Power Density (mW/cm	2.3	0.5

Controlled Calculations

(Worst Case Sector)

(Occupational Exposure at antenna installation level relative to active antennas)

Any single Sector

Radial Center AGL (ft)	Eff. Height (ft)	Horiz. Dist. (ft)	Total Dist. (ft)	Total Dist. (cm)	ERP (watts)	ERP (dBm)	Eff. ERP (dBm)	Eff. EIRP (dBm)	Eff. EIRP (mW)	Power Density, S (mW/cm^2)
73.5	8.8	0	9	268	1,000	60.00	40.00	42.16	16,444	0.01827
65.5	0.8	0	1	24	1,000	60.00	40.00	42.16	16,444	2.30918

Total Power Density = 2.3274

Percentage of Uncontrolled Maximum Power Density = 99.75%

For this scenario, a line worker is working on the pole below the antennas. This metric checks the safe distance from below the antenna while working on the pole. No reflectivity of the signal is assumed and equation (5) for field density is used instead of equation (6) from OET 65.

This calculation shows that the maximum MPE allowed by the FCC limits is not reached when working in the vicinity of the scoped antennas.

Assumptions:

1. One sector of panel antennas will contribute to the MPE for any area near the utility pole.
2. Personnel on pole are 90 degrees from the focus of the antennas.
3. Effective Antenna ERP conservatively assumes a 20 dB vertical radiation loss for panel antennas
4. Effective Antenna ERP conservatively assumes a 45 dB vertical radiation loss for parabolic antennas

Notes:

1. ERP (dBm) = 10 * log10[ERP (watts)] + 30
2. EIRP (dBm) = 1.64 * ERP (dBm)
3. EIRP (mW) = 10^[EIRP (dBm)/10]

B Appendix – Supplemental Information

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Section 1 - Site Information

Site ID: SE04823C
Status: Final
Version: 2
Project Type: Anchor
Approved: 1/13/2022 12:5:16 PM
Approved By: LARRY.WEST16@T-MOBILE.COM
Last Modified: 1/13/2022 12:5:16 PM
Last Modified By: LARRY.WEST16@T-MOBILE.COM

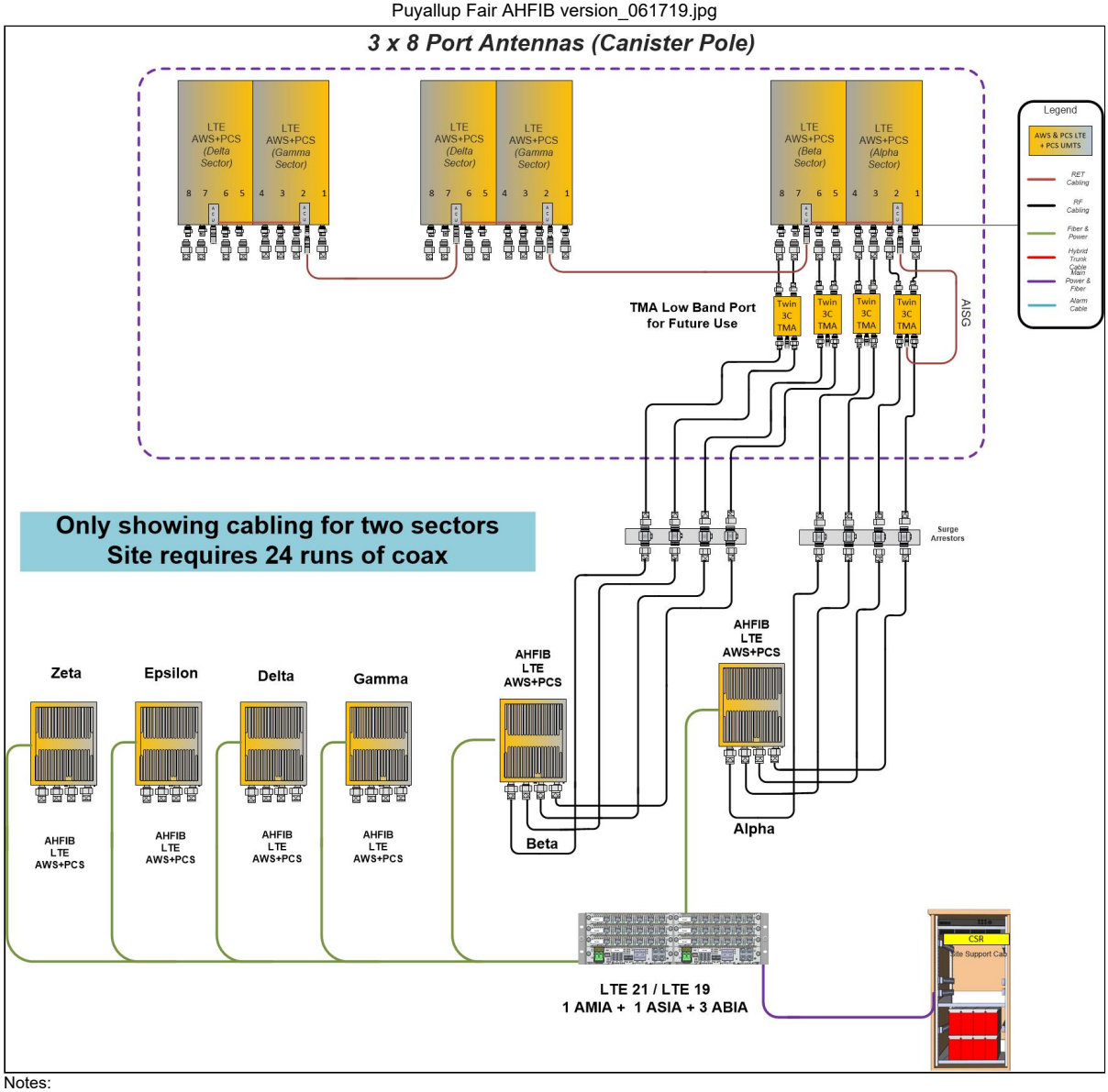
Site Name: Washington State Fair - Light Pole
Site Class: Light Pole
Site Type: Structure Non Building
Plan Year:
Market: SEATTLE WA
Vendor: Nokia
Landlord: Not Specified

Latitude: 47.18194445
Longitude: -122.29569450
Address: 902 S. Meridian
City, State: Puyallup, WA
Region: WEST

RAN Template: 56761EK			AL Template: 56761EK	
Sector Count: 6	**Antenna Count:** 6	**Coax Line Count:** 0	**TMA Count:** 0	**RRU Count:** 9

Section 2 - Existing Template Images

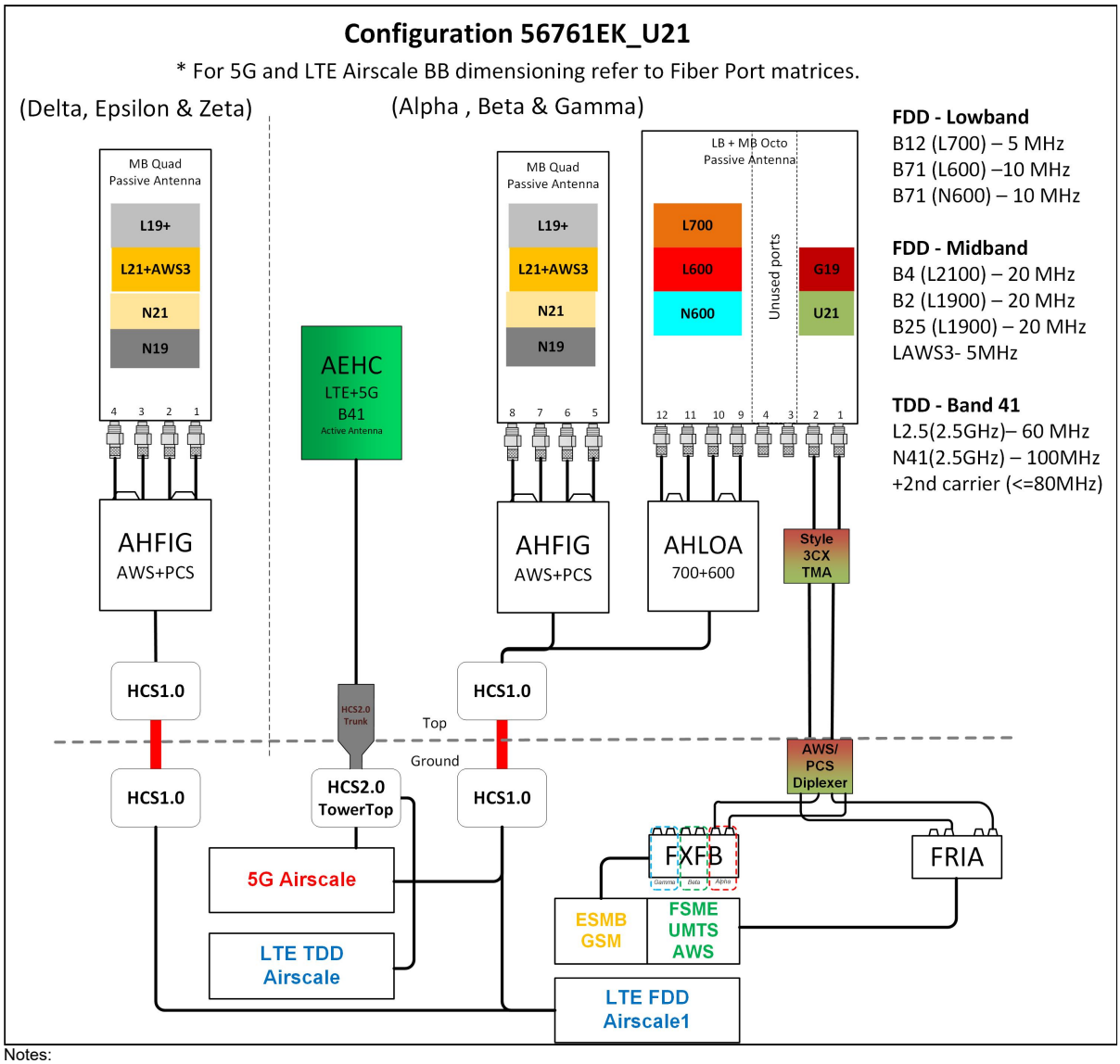
Puyallup Fair AHFIB version_061719.jpg



Notes:

Section 3 - Proposed Template Images

56761EK_U21.jpg



Notes:

Section 4 - Siteplan Images

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RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Section 5 - RAN Equipment

Existing RAN Equipment

Template: 93E_No U2100

Enclosure	1	2	3
Enclosure Type	FCOA Cabinet (Nokia)	Purcell HPL2 w/ 400A DC	H-Frame Mount (Nokia)
Baseband	ASIA L2100 L1900		
Baseband Submodule	ABIA **(x 3)** L2100 L1900		
Baseband Subrack	AMOB L2100 L1900		
Hybrid Cable System	15' HCS 2.0 Jumper Cable - 10AWG 2PR Airscale **(x 6)**		
Junction Box	Nokia HCS 2.0 Roof-Top Junction Box		
Power subsystem		Batteries *Select size* Breakers *Select size* Rectifier Shelf *Select size*	
Radio			AHFIB **(x 6)** L2100 L1900
Transport System		CSR 7210 SAS-Mxp L2100 L1900	

Proposed RAN Equipment

Template: 56761EK

Enclosure	1	2	3	4
Enclosure Type	Ancillary Equipment (Nokia)	Purcell HPL3 600A DC plant	Tower Top Mount (Nokia)	Purcell LB3 Battery Cabinet (4 strings)
Baseband		ASIB: L1900, L2100 ASIB: L700, L600, L1900, L2100 ASIB: L2500 ASIL: N600, N2500, N1900 (DARK), N2100 (DARK)		
Baseband Submodule		ABIA **(x 4)**: L1900, L2100 ABIC **(x 3)**: L2500 ABIO: N2500 ABIA: L700, L600 ABIO: N600, N1900 (DARK), N2100 (DARK) ABIO: N1900 (DARK), N2100 (DARK)		
Baseband Subrack		AMIA **(x 3)**		
Hybrid Cable System	200' HCS 2.0 Trunk - 12#6AWG 24 SM FIBER PR **(x 3)** Voltage Booster PowerPlus w/ 2 Amplifier Raycap 15' HCS 2.0 Jumper Cable - 10AWG 2PR Airscale **(x 3)** 15' HCS 2.0 Jumper Cable - 2x6AWG 2PR AHFIG **(x 3)** 15' HCS 2.0 Jumper Cable - 2x6AWG 4PR AEHC **(x 3)** Extra Amplifier for PowerPlus Voltage Booster			
Junction Box	Nokia HCS 2.0 Tower Junction Box **(x 3)**			
Power subsystem		Breakers *Select size* Rectifier Shelf *Select size*		Batteries *Select size*
Radio			AHFIG **(x 6)**: L1900, L2100, N1900 (DARK), N2100 (DARK) AHLOA **(x 3)**: L700, L600, N600	
Transport System		CSR IXRe V2 (Gen2)		

RAN Scope of Work:

1/12/22: LW - per redlines, added HCS cables and removed COVP equipment

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Section 6 - A&L Equipment

Existing Template: 93E_No U2100
Proposed Template: 56761EK

Sector 1 (Existing) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	CCI - BSA33R-U6A (+27°) (Multi-Beam)	
Azimuth	10	
M. Tilt	0	
Height	74	
Ports	**P1**	**P2**
Active Tech.	L2100, L1900	L2100, L1900
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	6	
Cables	1/2" Coax - 150 ft. **(x2)**	1/2" Coax - 150 ft. **(x2)**
TMAs	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 1 (Proposed) view from front (Note: the images show view from behind)					
Coverage Type	A - Outdoor Macro				
Antenna	1		2		3
Antenna Model	Rosenberger - 2D4WHE-21 (0°) (Multi-Beam)		Rosenberger - 2D4WHE-21 (+28°) (Multi-Beam)		AEHC (Active Antenna - Massive MIMO)
Azimuth	10		10		10
M. Tilt	0		0		0
Height	73		73		65
Ports	P1	P2	P3	P4	P5
Active Tech.	L700 L600 N600	L700 L600 N600	L1900 L2100	L1900 L2100	L2500 N2500
Dark Tech.			N1900 N2100	N1900 N2100	
Restricted Tech.					
Decomm. Tech.					
E. Tilt					
Cables					
TMAs					
Diplexers / Combiners					
Radio					
Sector Equipment					

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 2 (Existing) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	CCI - BSA33R-U6A (-27°) (Multi-Beam)	
Azimuth	10	
M. Tilt	0	
Height	74	
Ports	**P1**	**P2**
Active Tech.	L2100, L1900	L2100, L1900
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt		6
Cables	1/2" Coax - 150 ft. **(x2)**	1/2" Coax - 150 ft. **(x2)**
TMAs	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 2 (Proposed) view from front (Note: the images show view from behind)					
Coverage Type	A - Outdoor Macro				
Antenna	1		2		3
Antenna Model	Rosenberger - 2D4WHE-21 (0°) (Multi-Beam)		Rosenberger - 2D4WHE-21 (+28°) (Multi-Beam)		AEHC (Active Antenna - Massive MIMO)
Azimuth	130		130		130
M. Tilt	0		0		0
Height	73		73		65
Ports	P1	P2	P3	P4	P5
Active Tech.	L700 L600 N600	L700 L600 N600	L1900 L2100	L1900 L2100	L2500 N2500
Dark Tech.			N1900 N2100	N1900 N2100	
Restricted Tech.					
Decomm. Tech.					
E. Tilt					
Cables					
TMAs					
Diplexers / Combiners					
Radio					
Sector Equipment					

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 3 (Existing) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	CCI - BSA33R-U6A (+27°) (Multi-Beam)	
Azimuth	130	
M. Tilt	0	
Height	74	
Ports	P1	P2
Active Tech.	L2100 L1900	L2100 L1900
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	6	
Cables	1/2" Coax - 150 ft. **(x2)**	1/2" Coax - 150 ft. **(x2)**
TMAs	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 3 (Proposed) view from front (Note: the images show view from behind)

Coverage Type	A - Outdoor Macro				
Antenna	1		2		3
Antenna Model	Rosenberger - 2D4WHE-21 (0°) (Multi-Beam)		Rosenberger - 2D4WHE-21 (+28°) (Multi-Beam)		AEHC (Active Antenna - Massive MIMO)
Azimuth	250		250		250
M. Tilt	0		0		0
Height	73		73		65
Ports	P1	P2	P3	P4	P5
Active Tech.	L700 L600 N600	L700 L600 N600	L1900 L2100	L1900 L2100	L2500 N2500
Dark Tech.			N1900 N2100	N1900 N2100	
Restricted Tech.					
Decomm. Tech.					
E. Tilt					
Cables					
TMAs					
Diplexers / Combiners					
Radio					
Sector Equipment					

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 4 (Existing) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	CCI - BSA33R-U6A (-27°) (Multi-Beam)	
Azimuth	130	
M. Tilt	0	
Height	74	
Ports	**P1**	**P2**
Active Tech.	L2100 L1900	L2100 L1900
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt		6
Cables	1/2" Coax - 150 ft. **(x2)**	1/2" Coax - 150 ft. **(x2)**
TMAs	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 4 (Proposed) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	Rosenberger - 2D4WHE-21 (-28°) (Multi-Beam)	
Azimuth	10	
M. Tilt	0	
Height	73	
Ports	**P1**	**P2**
Active Tech.	L1900 L2100	L1900 L2100
Dark Tech.	N1900 N2100	N1900 N2100
Restricted Tech.		
Decomm. Tech.		
E. Tilt		
Cables		
TMAs		
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 5 (Existing) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	CCI - BSA33R-U6A (+27°) (Multi-Beam)	
Azimuth	250	
M. Tilt	0	
Height	74	
Ports	P1	P2
Active Tech.	L2100 L1900	L2100 L1900
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	6	
Cables	1/2" Coax - 150 ft. **(x2)**	1/2" Coax - 150 ft. **(x2)**
TMAs	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 5 (Proposed) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	Rosenberger - 2D4WHE-21 (-28°) (Multi-Beam)	
Azimuth	130	
M. Tilt	0	
Height	73	
Ports	**P1**	**P2**
Active Tech.	L1900 L2100	L1900 L2100
Dark Tech.	N1900 N2100	N1900 N2100
Restricted Tech.		
Decomm. Tech.		
E. Tilt		
Cables		
TMAs		
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 6 (Existing) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	**1**	
Antenna Model	CCI - BSA33R-U6A (-27°) (Multi-Beam)	
Azimuth	250	
M. Tilt	0	
Height	74	
Ports	**P1**	**P2**
Active Tech.	L2100, L1900	L2100, L1900
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt		6
Cables	1/2" Coax - 150 ft. **(x2)**	1/2" Coax - 150 ft. **(x2)**
TMAs	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)	CommScope Twin Style 3CX - TMAT1921B68-21-43 (E14R00P09) (AtAntenna)
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Sector 6 (Proposed) view from front (Note: the images show view from behind)		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	Rosenberger - 2D4WHE-21 (-28°) (Multi-Beam)	
Azimuth	250	
M. Tilt	0	
Height	73	
Ports	P1	P2
Active Tech.	L1900 L2100	L1900 L2100
Dark Tech.	N1900 N2100	N1900 N2100
Restricted Tech.		
Decomm. Tech.		
E. Tilt		
Cables		
TMAs		
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56761EK	56761EK

SE04823C_Anchor_2

Print Name: Standard
PORs: L600_Regional Capacity Anchor_Phase 3

Section 7 - Power Systems Equipment

	Existing Power Systems Equipment
Enclosure	1
Enclosure Type	Purcell HPL2 w/ 400A DC
Power subsystem	Batteries *Select size* Breakers *Select size* Rectifier Shelf *Select size*
Transport System	CSR 7210 SAS-Mxp L2100 L1900

Proposed Power Systems Equipment

12-Port Antenna

Rosenberger

2D4WHE-21

4L 65deg + 8H dual twin beam / 8ft

- 4x (617-894)+ 8x (1695-2690)(Twin Beam)MHz
- Integrated RET (AISG 2.0 Compliant)
- 4.3-10 Connectors

Electrical Data (BASTA)

Frequency(MHz)			4x (617-894)			8x (1695-2690)(Twin Beam)			
			617-698	698-806	806-894	1695-1900	1900-2180	2300-2500	2500-2690
Gain		dBi	14.6±0.5	15.5±0.5	15.8±0.5	17.7±0.5	18.5±0.4	18.1±0.9	17.8±0.9
Polarization		°	±45						
Horizontal Pattern									
3dB Beamwidth		°	66±6	62±5	62±6	31±2	31±2	30±2	25±2
F/B Ratio Copolar(180°±30°)		dB	28	28	28	27	29	30	28
Cross-Polar Ratio	Boresight 0dB	dB	18	17	22	20	20	18	17
	Sector -10dB	dB	7	6	10	7	10	8	9
Vertical Pattern									
3dB Beamwidth		°	10.6±0.8	9.4±0.8	8.2±0.8	9.3±0.8	8.3±0.5	7.4±0.5	6.8±0.5
Electrical Downtilt		°	2-12			2-10			
1st Upper sidelobe Suppression		dB	15	17	17	16	17	17	16
RF Parameters									
VSWR			1.5:1						
Port Isolation		dB	25			25			
Band Isolation		dB	25						
3rd Order PIM		dBc	-153 @ 2 x 43 dBm						
Impedance		Ω	50						
Power Handing		W	300			200			

Mechanical Data (BASTA)

Input Connectors	12 x 4.3-10 Female	
Connector Position	Bottom	
Lighting Protection	DC Ground	
Radome Material	Fiberglass	
Antenna Weight	49.5 kg	109.1 lb
Antenna Dimensions (H x W x D)	2438 x 579 x 189 mm	96.0 x 22.8 x 7.4 in
Maximum Wind Velocity	241 km/h	150 mph
Max. Wind Load @150 km/h (Front/Rear/Side)	1851.1 / 2026.7 / 291.5 N	416.1 / 455.6 / 65.5 lbf
Mast Diameter Supported	50 - 110 mm	2.0 - 4.3 in
Relative Humidity	5% - 95%	
Operating Temperature Range	-40 ~ +70 °C	-40 ~ +158 °F

12-Port Antenna

Rosenberger

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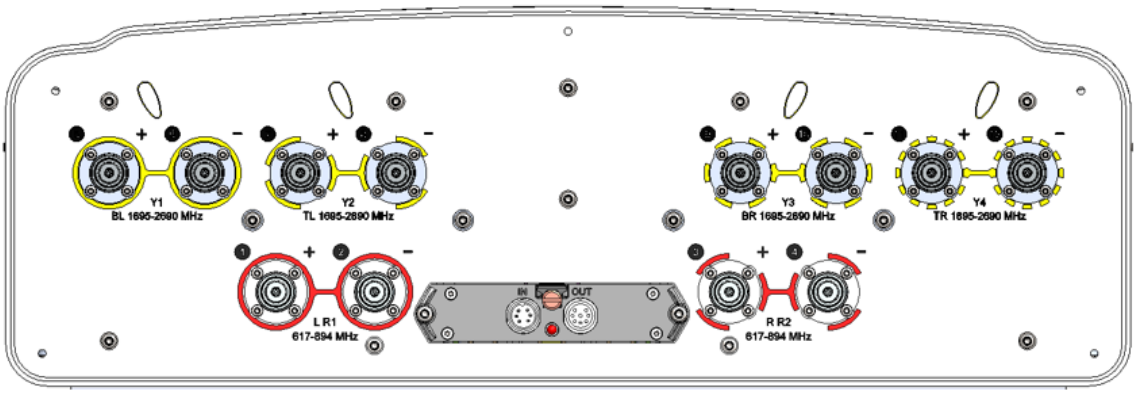
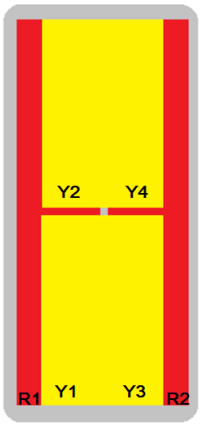
Layout



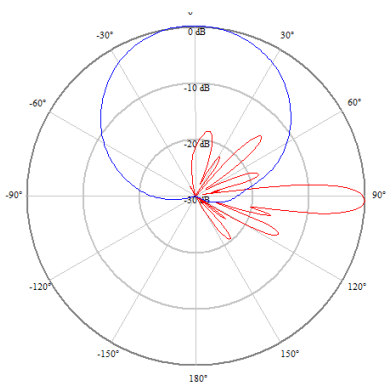


Array	Connector	Frequency (MHz)	Sub Unit #	RET Type	ICU Serial*
R1 ●	1 - 2	617-894	2	MRET	RB.....XXYYxxxxx-MM
R2 ●	3 - 4	617-894		MRET	RB.....XXYYxxxxx-MM
Y1 ●	5 - 6	1695-2690	1	MRET	RB.....XXYYxxxxx-MM
Y2 ●	7 - 8	1695-2690		MRET	RB.....XXYYxxxxx-MM
Y3 ●	9 – 10	1695-2690	3	MRET	RB.....XXYYxxxxx-MM
Y4 ●	11 – 12	1695-2690		MRET	RB.....XXYYxxxxx-MM

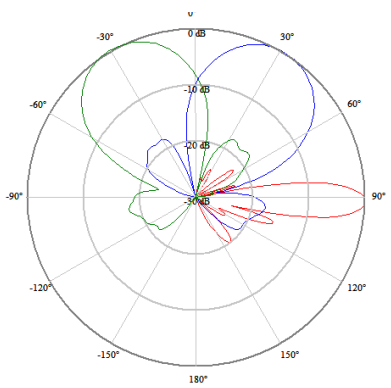
*Remark: XX – Year, YY – Week , xxxxx – Serial Number

Pattern

4x (617-894)



8x (1695-2690)



Accessories

Item	Model	Weight (kg)	Mechanical Tilt Range (°)
Mounting Kit	185-1	11.3	0-10

Compliance

- ETS 300 019-1-4 class 4.1 E, ETS 300 019-2-4
- DIN ISO 9001:2008

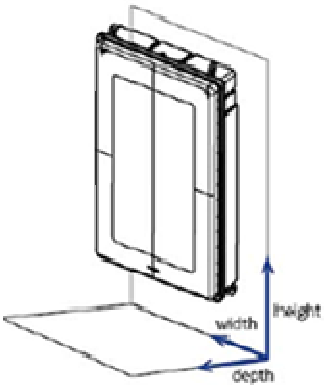
Product Introduction
AEHC 2.5GHz mMIMO Radio

PURPOSE
Nokia 2nd generation 2.5GHz mMIMO radio (AEHC) is high power enabling radio with concurrent mode (LTE+NR) capability to support complete 2.5GHz (194MHz) spectrum and total power of 320W. This radio removes limitations with current radio (AAHF) which can only enable 60MHz with each technology (LTE, NR) and total of 120MHz.

BACKGROUND
The AEHC is a new Massive MIMO Adaptive Antenna with integrated Radio product for 2.5GHz TDD Only from Nokia, capable of LTE and 5G with 16 streams of beamforming Massive MIMO function. The AEHC has 320W radio output power with 190MHz OBW using 64T64R.

AEHC will be used for all Anchor configurations for 2.5GHz deployment on New T-Mobile Anchor sites.

PRODUCT DESCRIPTION

Band	B41 – 2496-2690 MHz	
Supported Modulation schemes	(DL) BPSK, QPSK, 16 QAM, 64 QAM, 256 QAM (UL) BPSK, QPSK, 16 QAM, 64 QAM	
No. of TX/RX	64TX64RX	
MIMO Streams	16	
Instantaneous IBW	194 MHz	
Occupied Bandwidth OBW	190 MHz	
Total Avg EIRP	74.8 dBm	
Supported bandwidths	LTE: 3x20 MHz 5G: 40/60/80/100MHz	
Power Consumption	≤1330 W typical (75% DL duty cycle, 30% RF load) ≤1827 W max (75% DL duty cycle, 100% RF load)	
Optical Ports	4 x SFP28 (OCTIS), 25 Gbps, eCPRI	
Connector Type	APPG DC Pole connector	
Dimensions (H x W x D)	38.2 in x 21.5 in x 5.9 in	
Weight lbs	108.0 lb	
HW/SW Availability	SRAN20C/5G20A	
5G NR Support	Yes	
Material Description	Nokia AirScale MAA 64T64R 192AE B41 320W AEHC	AEHC 475124A