Design Best Practices for NFL Stadiums

Qualcomm | MatSing | MobileNet

February 27th, 2020

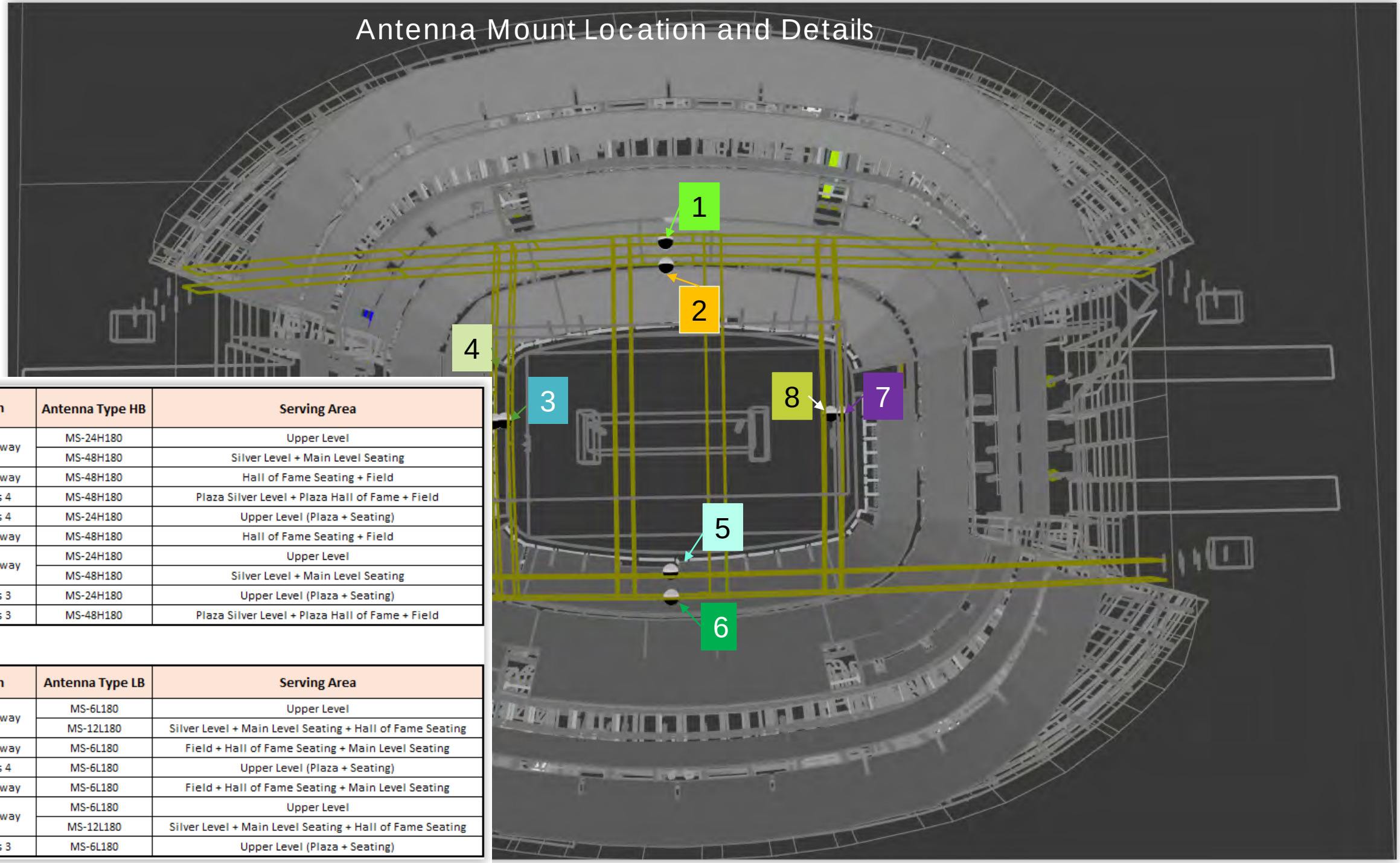
MobileNet Services

AT&T Stadium – Dallas Cowboys

Seating Area /Bowl Conceptual design

MobileNet Services

Antenna Mount Location and Details



Mount Location		Antenna Type HB	Serving Area
1	North Archway	MS-24H180	Upper Level
		MS-48H180	Silver Level + Main Level Seating
2	North Archway	MS-48H180	Hall of Fame Seating + Field
3	Box Truss 4	MS-48H180	Plaza Silver Level + Plaza Hall of Fame + Field
4	Box Truss 4	MS-24H180	Upper Level (Plaza + Seating)
5	South Archway	MS-48H180	Hall of Fame Seating + Field
6	South Archway	MS-24H180	Upper Level
		MS-48H180	Silver Level + Main Level Seating
7	Box Truss 3	MS-24H180	Upper Level (Plaza + Seating)
8	Box Truss 3	MS-48H180	Plaza Silver Level + Plaza Hall of Fame + Field

Mount Location		Antenna Type LB	Serving Area
1	North Archway	MS-6L180	Upper Level
		MS-12L180	Silver Level + Main Level Seating + Hall of Fame Seating
2	North Archway	MS-6L180	Field + Hall of Fame Seating + Main Level Seating
4	Box Truss 4	MS-6L180	Upper Level (Plaza + Seating)
5	South Archway	MS-6L180	Field + Hall of Fame Seating + Main Level Seating
6	South Archway	MS-6L180	Upper Level
		MS-12L180	Silver Level + Main Level Seating + Hall of Fame Seating
7	Box Truss 3	MS-6L180	Upper Level (Plaza + Seating)

Coverage Objective:

Cover entire bowl seating including field with Matsing Antennas mounted on stadium archways and truss-boxes

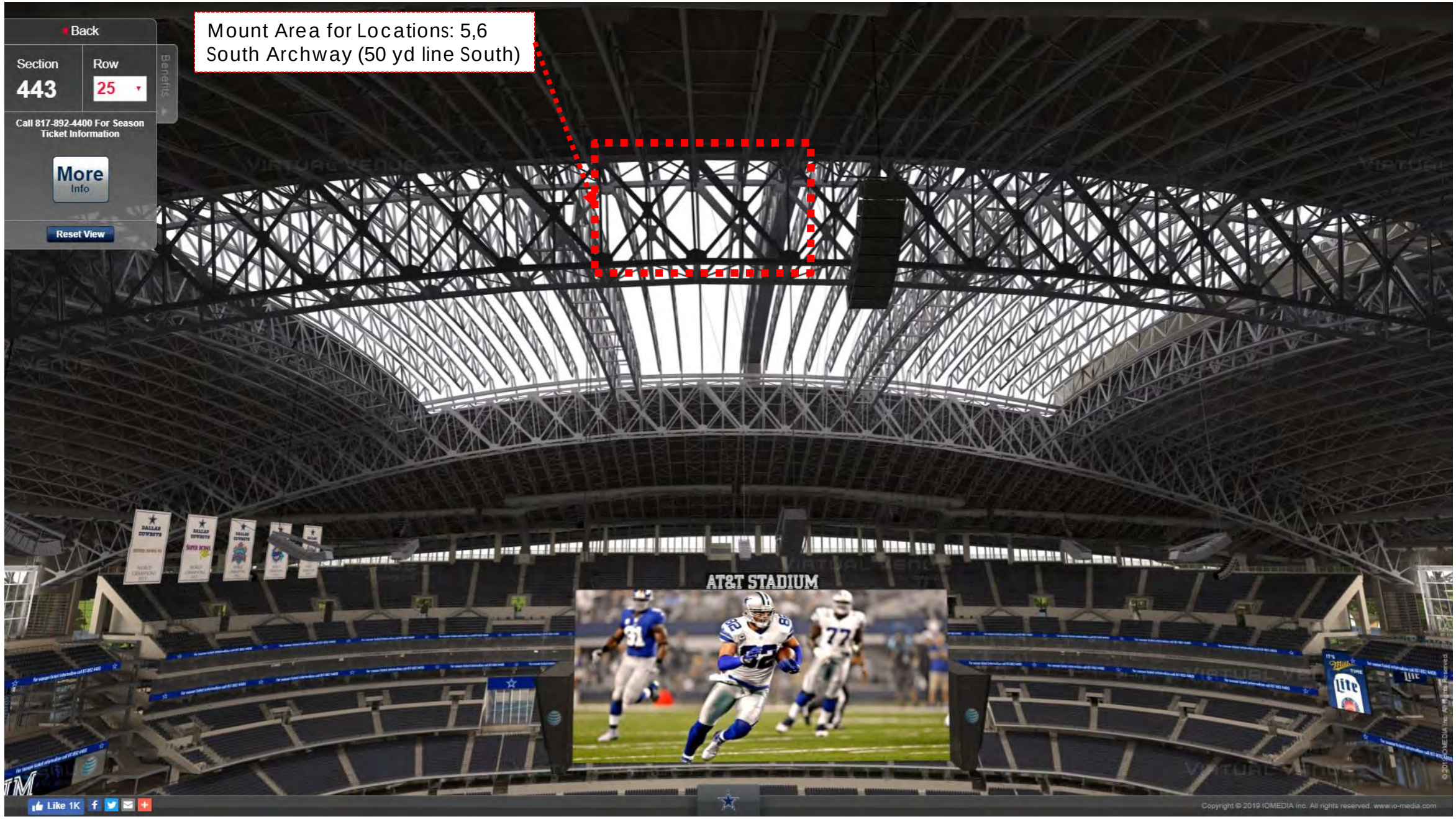
Mount Location		Antenna Type HB	Serving Area
1	North Archway	MS-24H180	Upper Level
		MS-48H180	Silver Level + Main Level Seating
2	North Archway	MS-48H180	Hall of Fame Seating + Field
3	Box Truss 4	MS-48H180	Plaza Silver Level + Plaza Hall of Fame + Field
4	Box Truss 4	MS-24H180	Upper Level (Plaza + Seating)
5	South Archway	MS-48H180	Hall of Fame Seating + Field
6	South Archway	MS-24H180	Upper Level
		MS-48H180	Silver Level + Main Level Seating
7	Box Truss 3	MS-24H180	Upper Level (Plaza + Seating)
8	Box Truss 3	MS-48H180	Plaza Silver Level + Plaza Hall of Fame + Field

Antenna Type	Band	Antenna Count (4x4 MIMO)
MS-24H180	Mid Bands	8
MS-48H180	Mid Bands	12
MS-12L180	Low Bands	4
MS-6L180	Low Bands	12

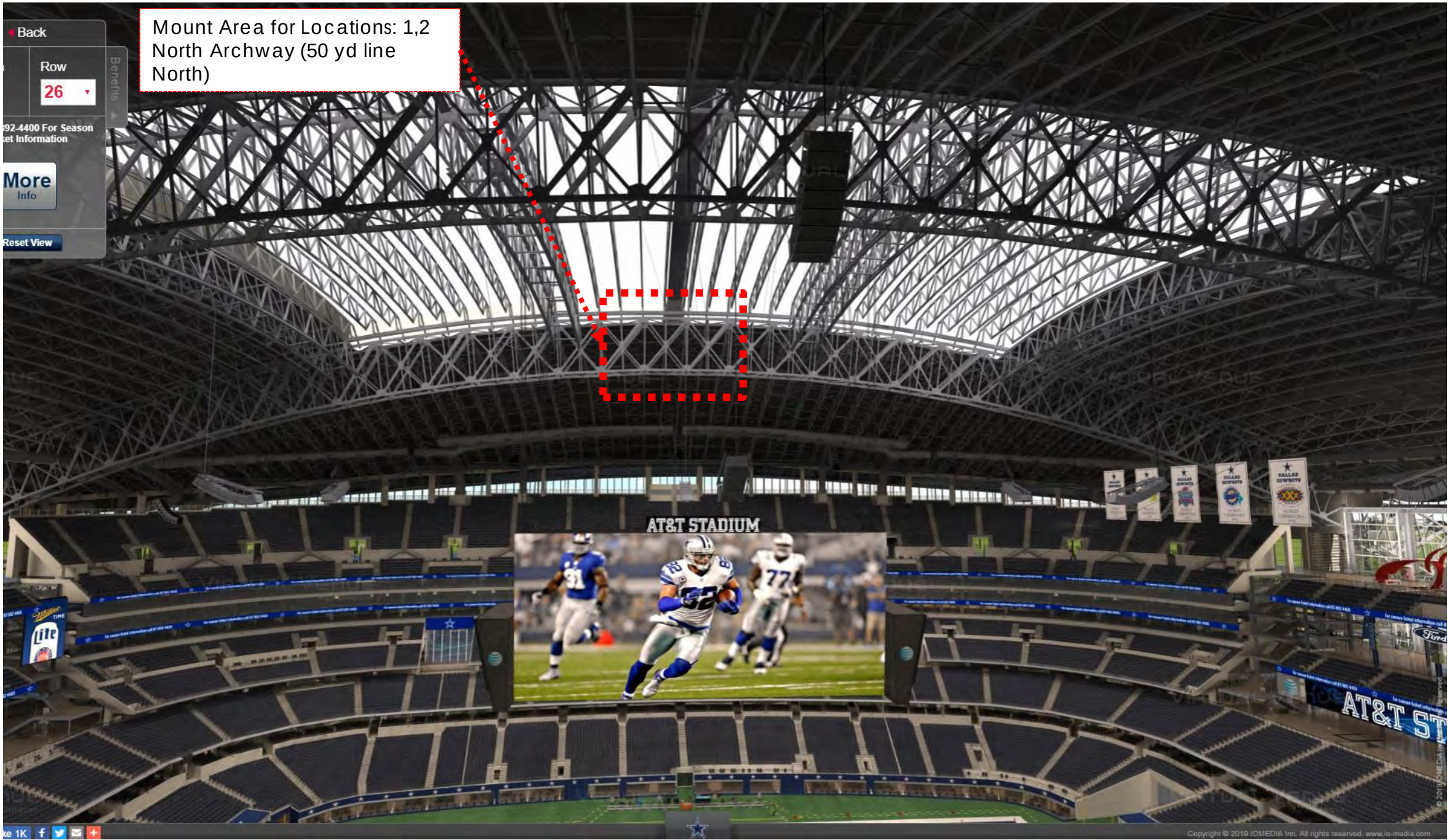
Band	Zones/Sectors
High Band	161
Low Band	60

Mount Location		Antenna Type LB	Serving Area
1	North Archway	MS-6L180	Upper Level
		MS-12L180	Silver Level + Main Level Seating + Hall of Fame Seating
2	North Archway	MS-6L180	Field + Hall of Fame Seating + Main Level Seating
4	Box Truss 4	MS-6L180	Upper Level (Plaza + Seating)
5	South Archway	MS-6L180	Field + Hall of Fame Seating + Main Level Seating
6	South Archway	MS-6L180	Upper Level
		MS-12L180	Silver Level + Main Level Seating + Hall of Fame Seating
7	Box Truss 3	MS-6L180	Upper Level (Plaza + Seating)

Antenna Mount Location and Details

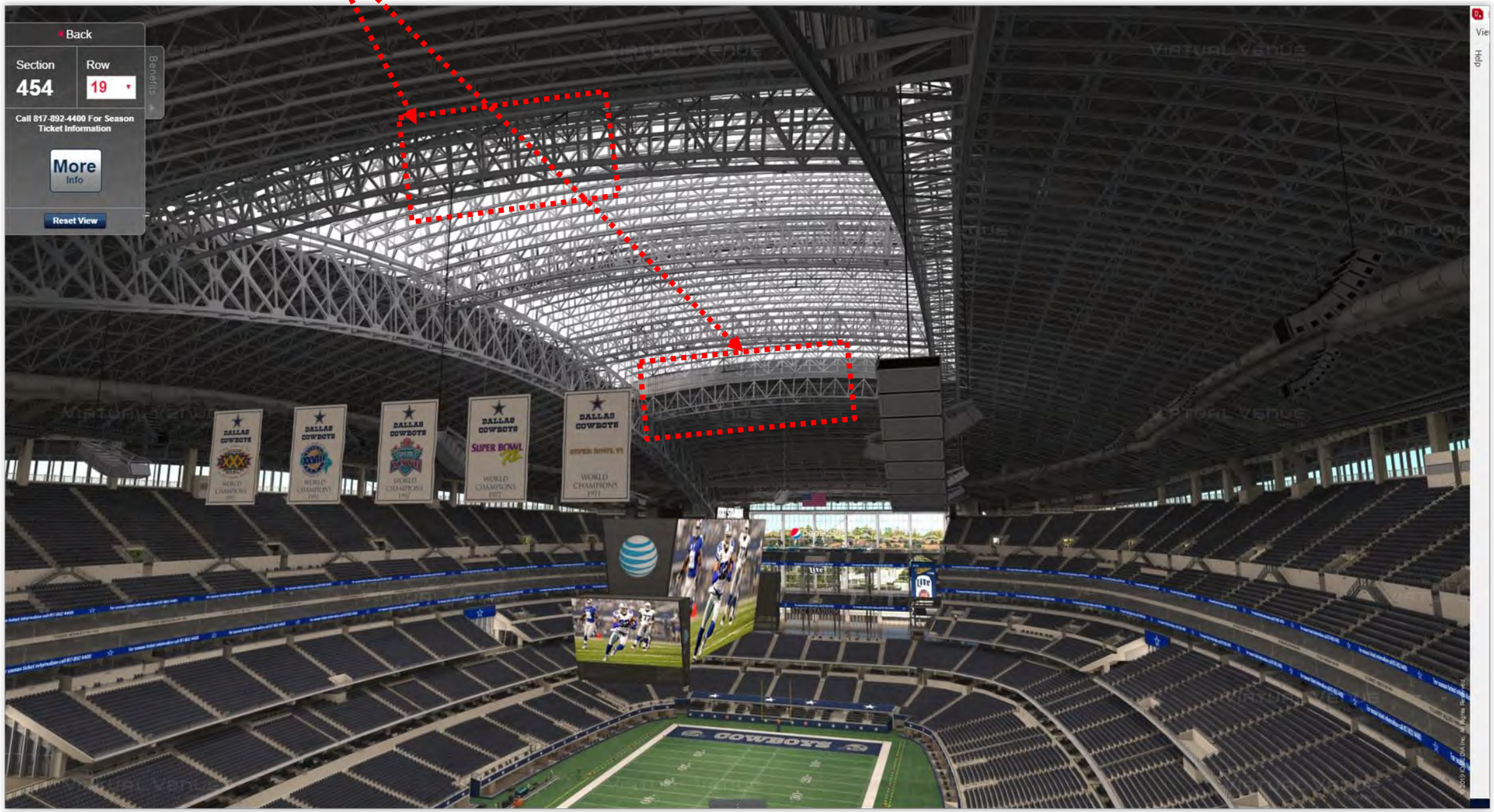


Antenna Mount Location and Details

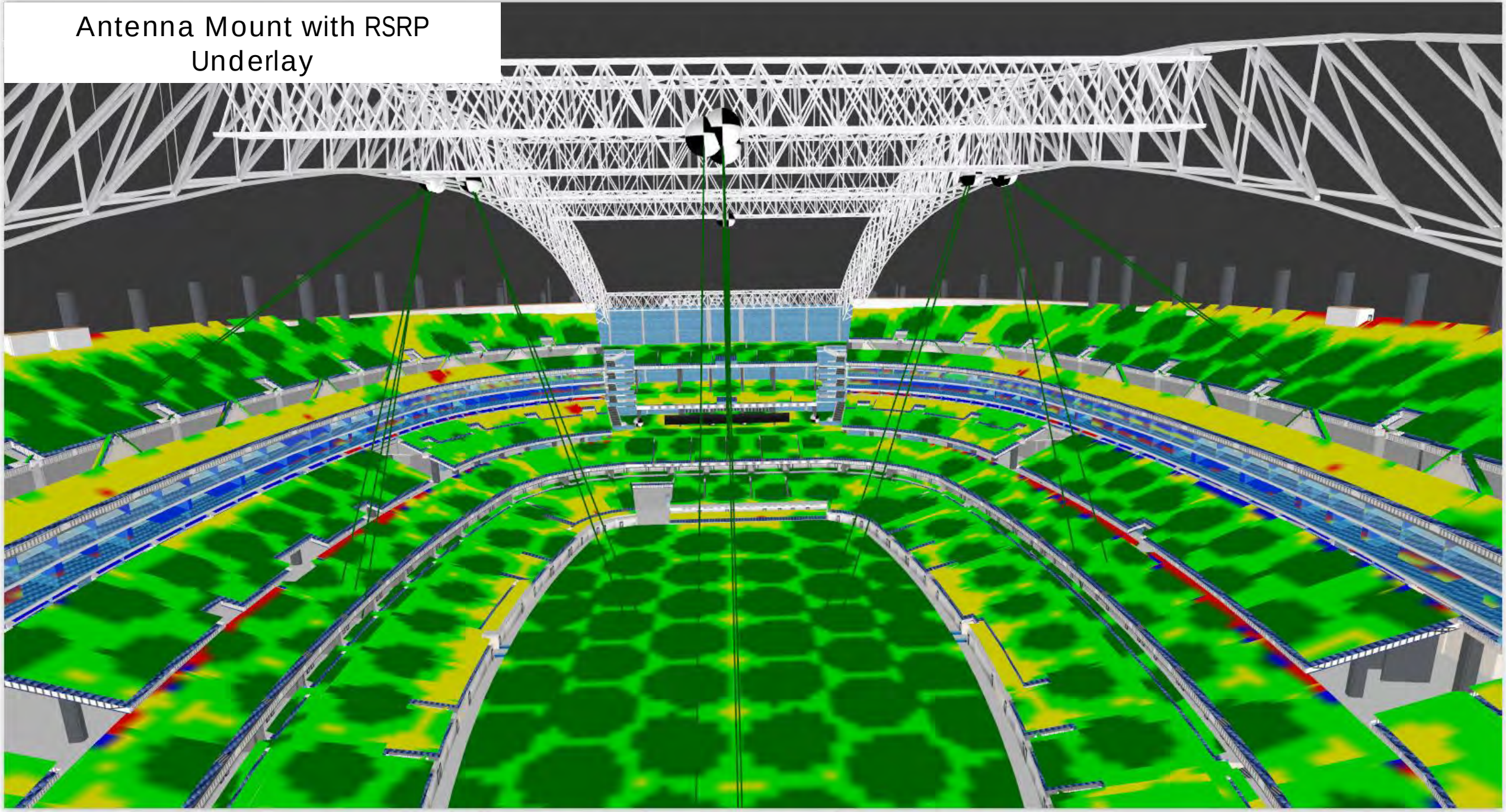


Antenna Mount Location and Details

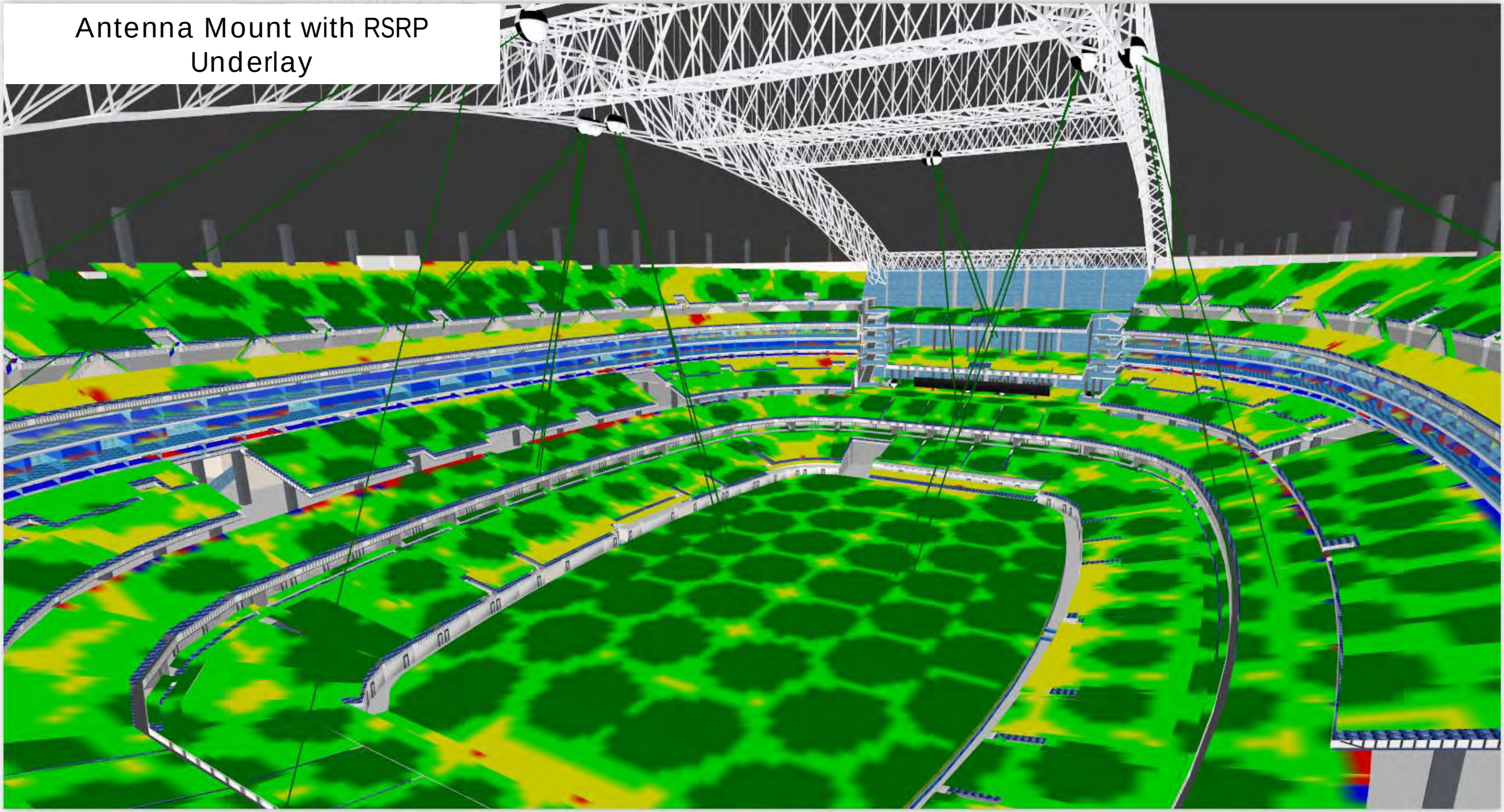
Mount Area for Locations:
3,4,7,8 (Box Truss 3 and 4)



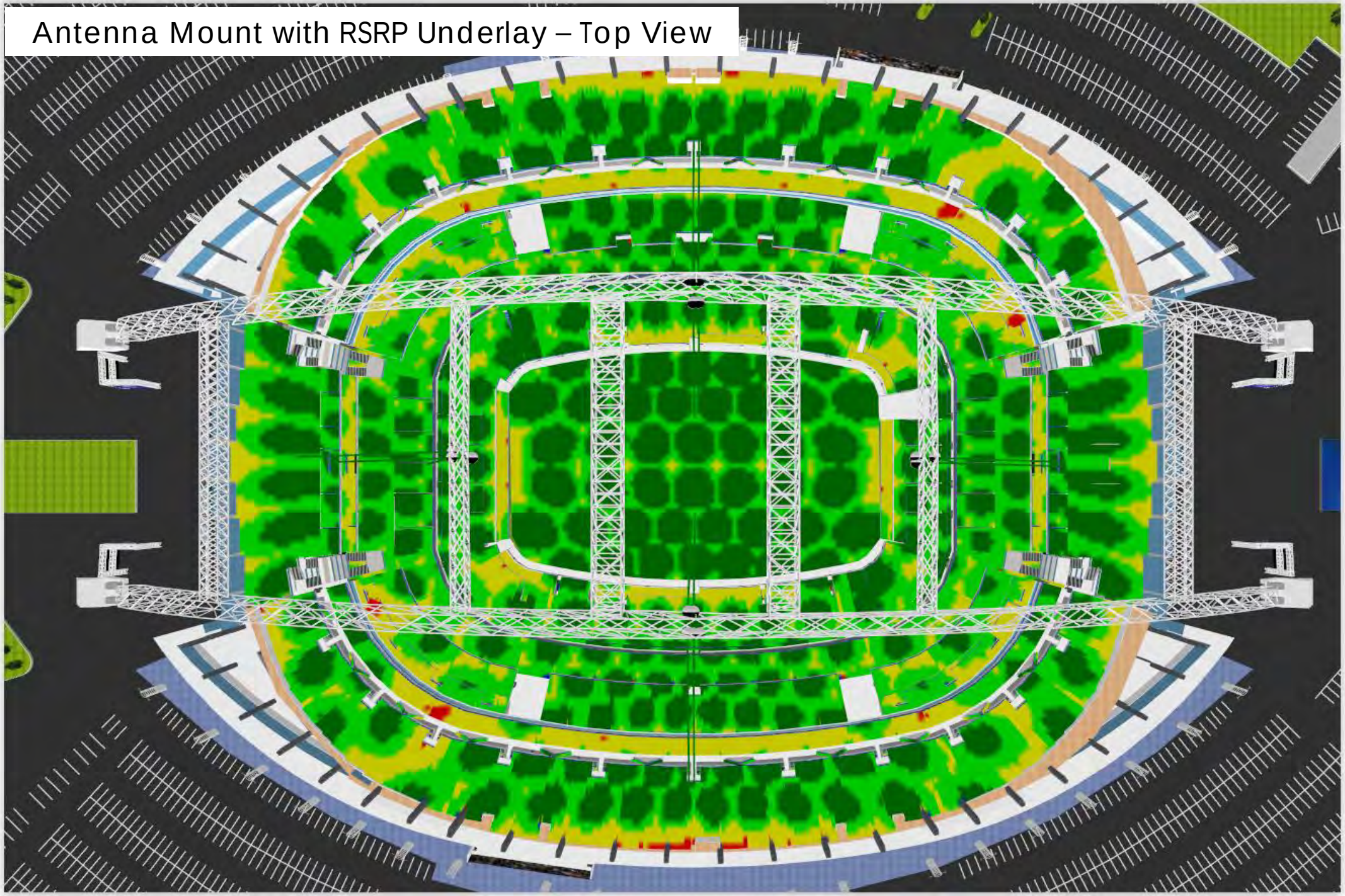
Antenna Mount with RSRP Underlay



Antenna Mount with RSRP Underlay

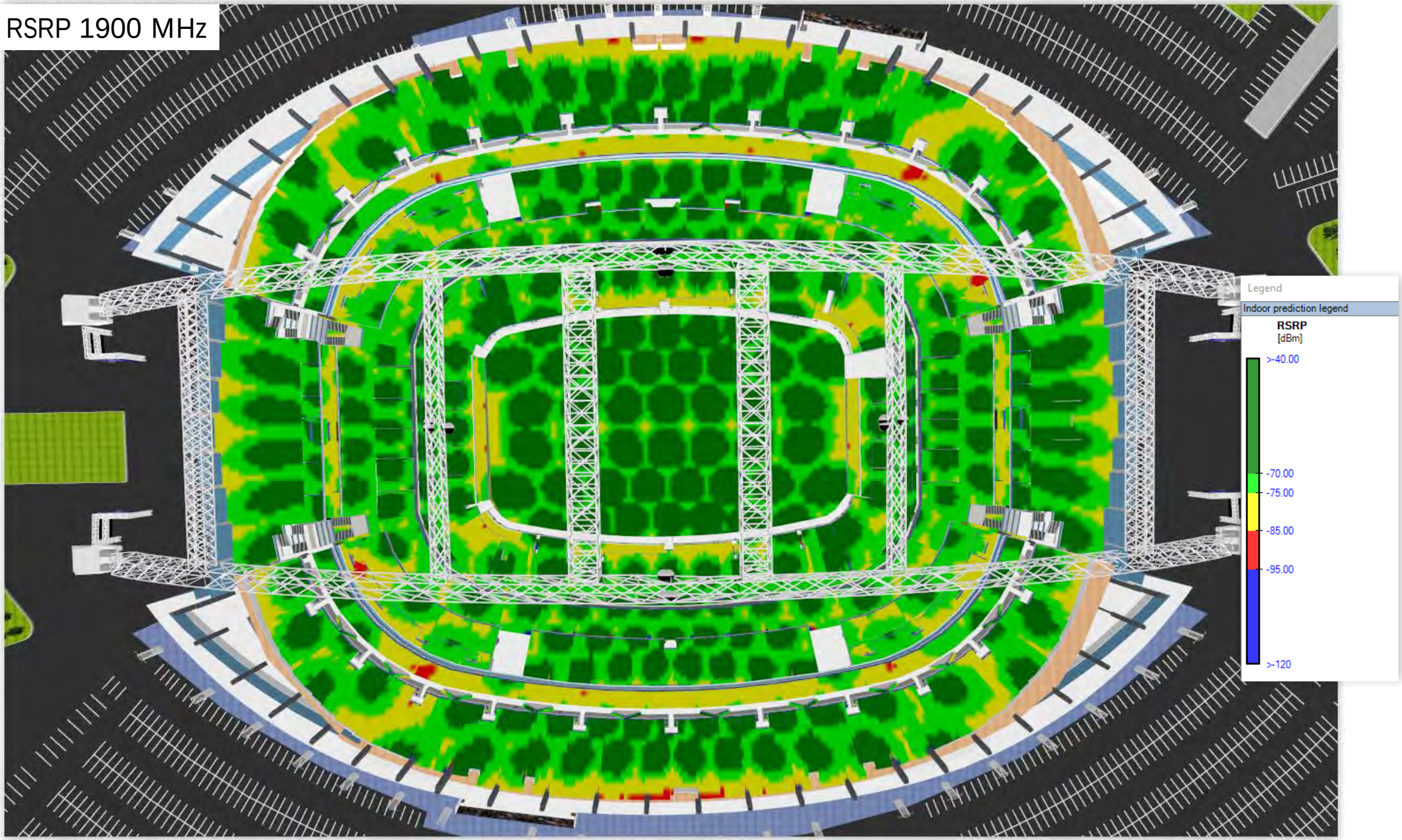


Antenna Mount with RSRP Underlay – Top View

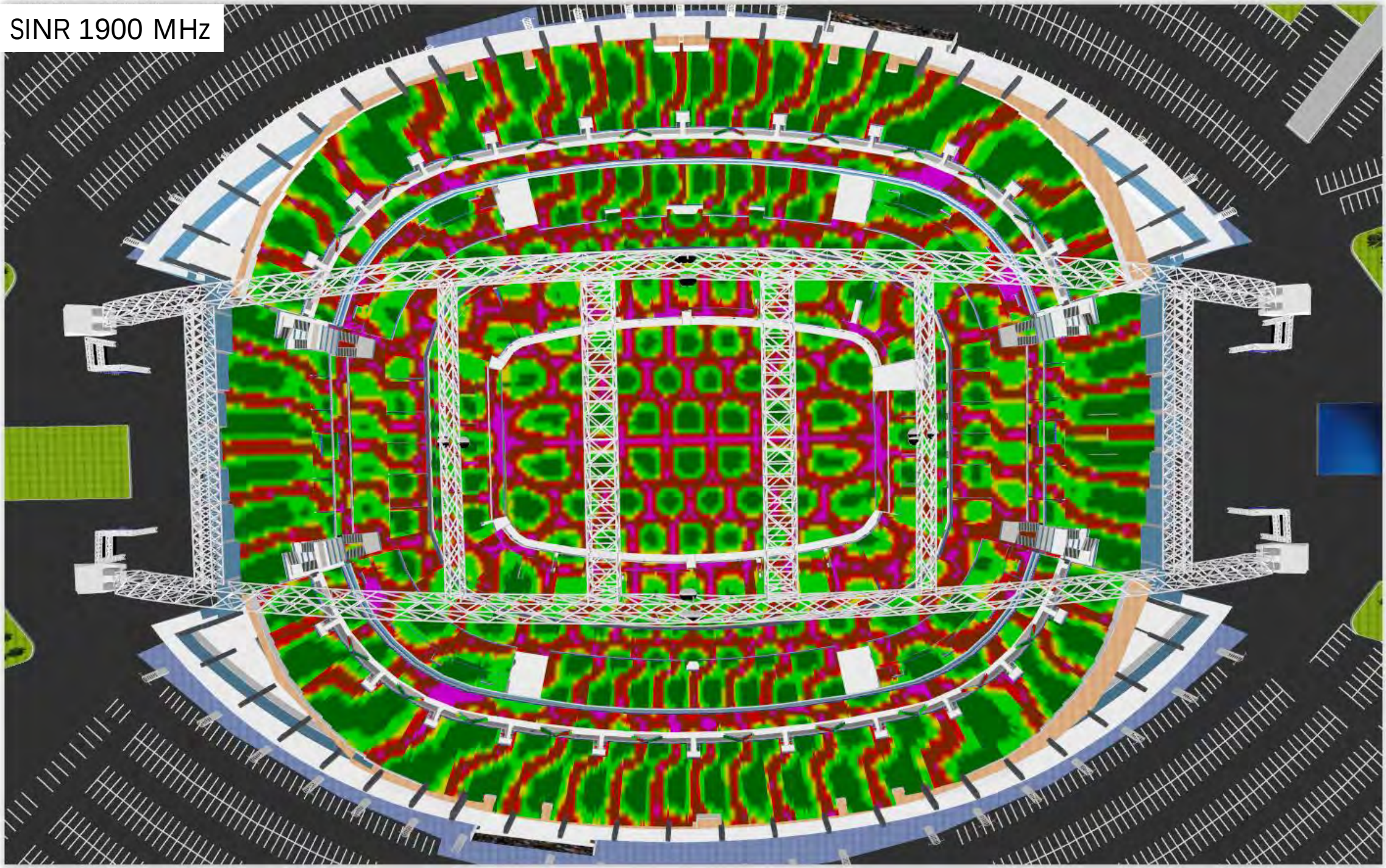


1900 MHz Coverage Plots

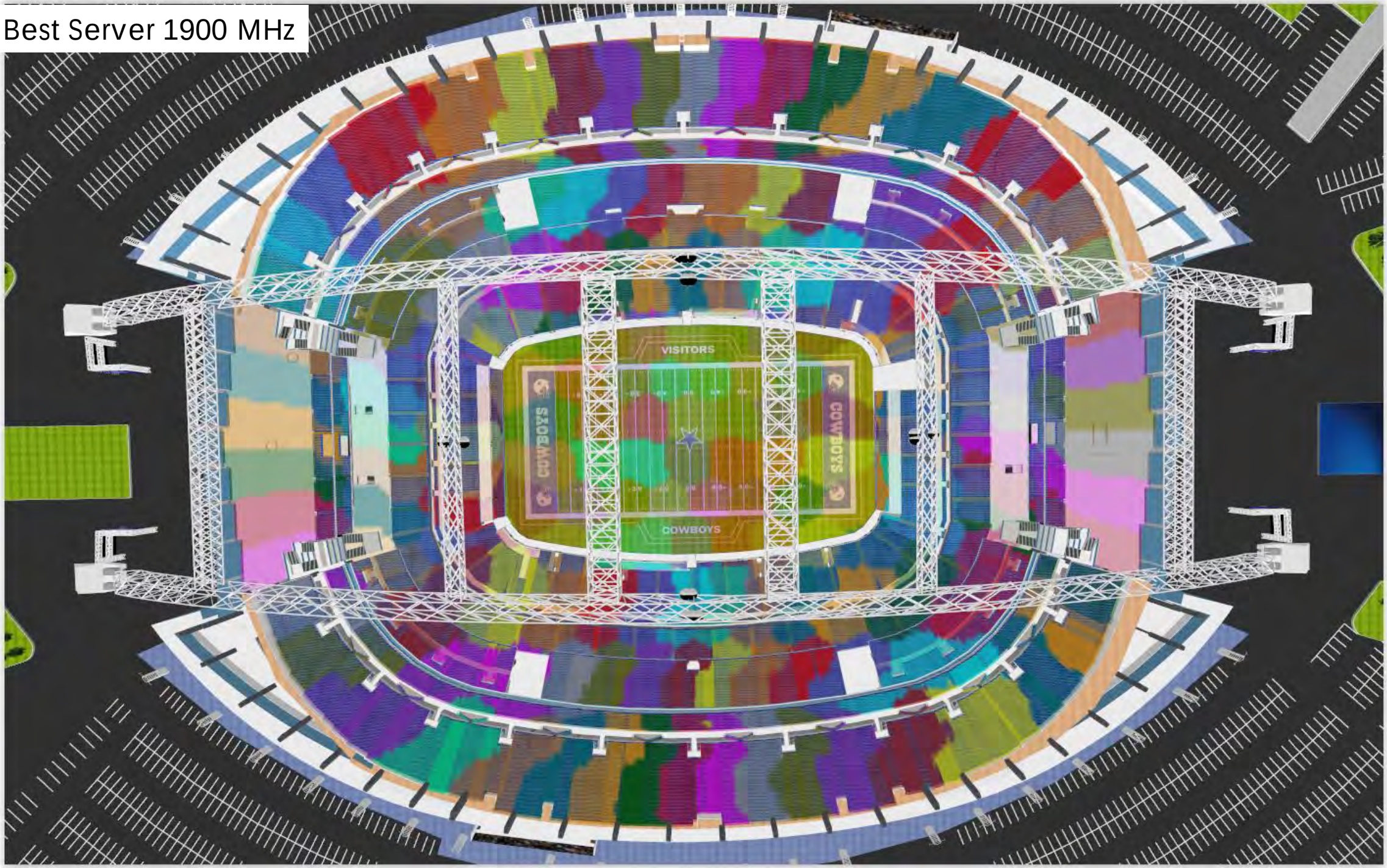
RSRP 1900 MHz



SINR 1900 MHz

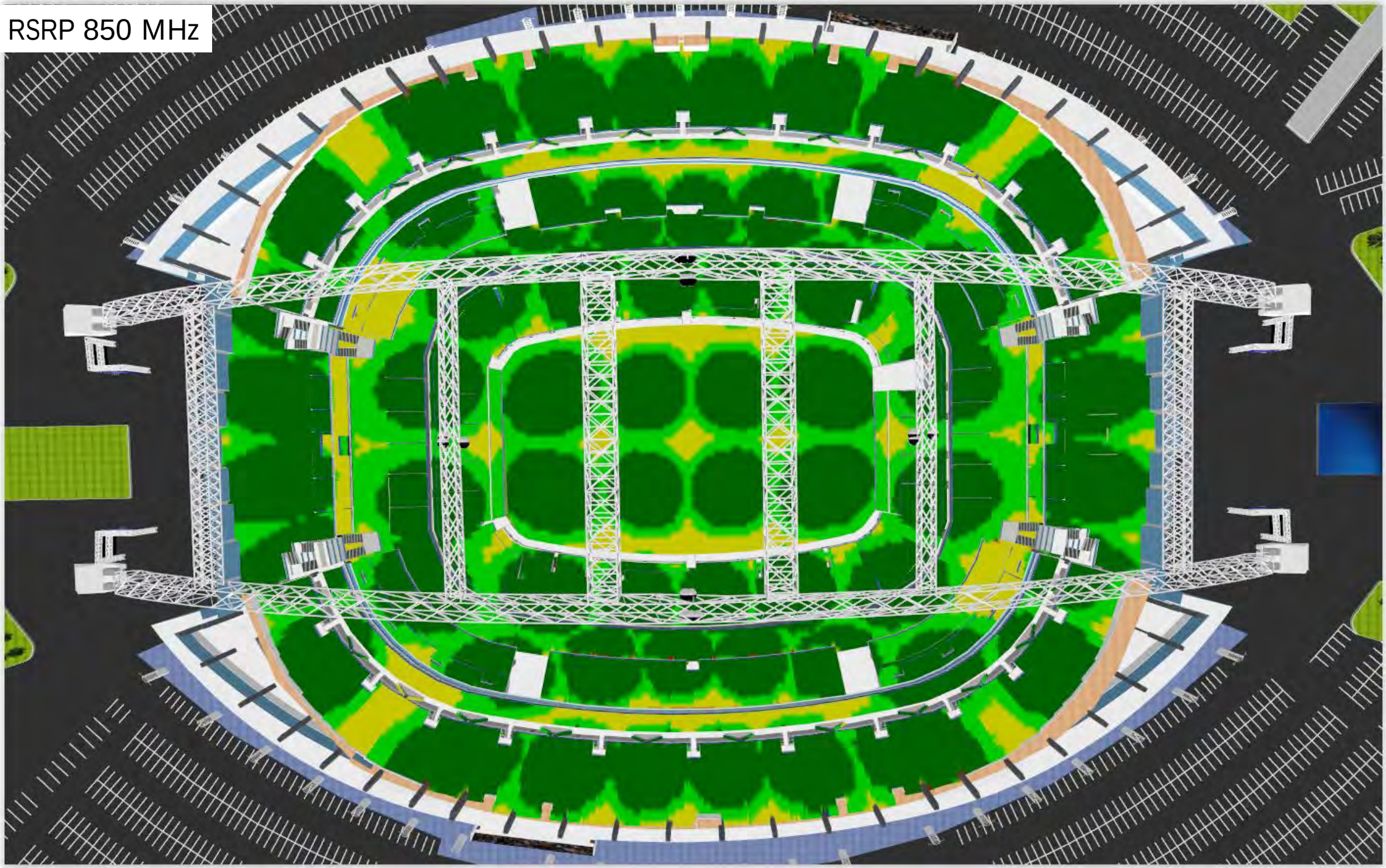


Best Server 1900 MHz

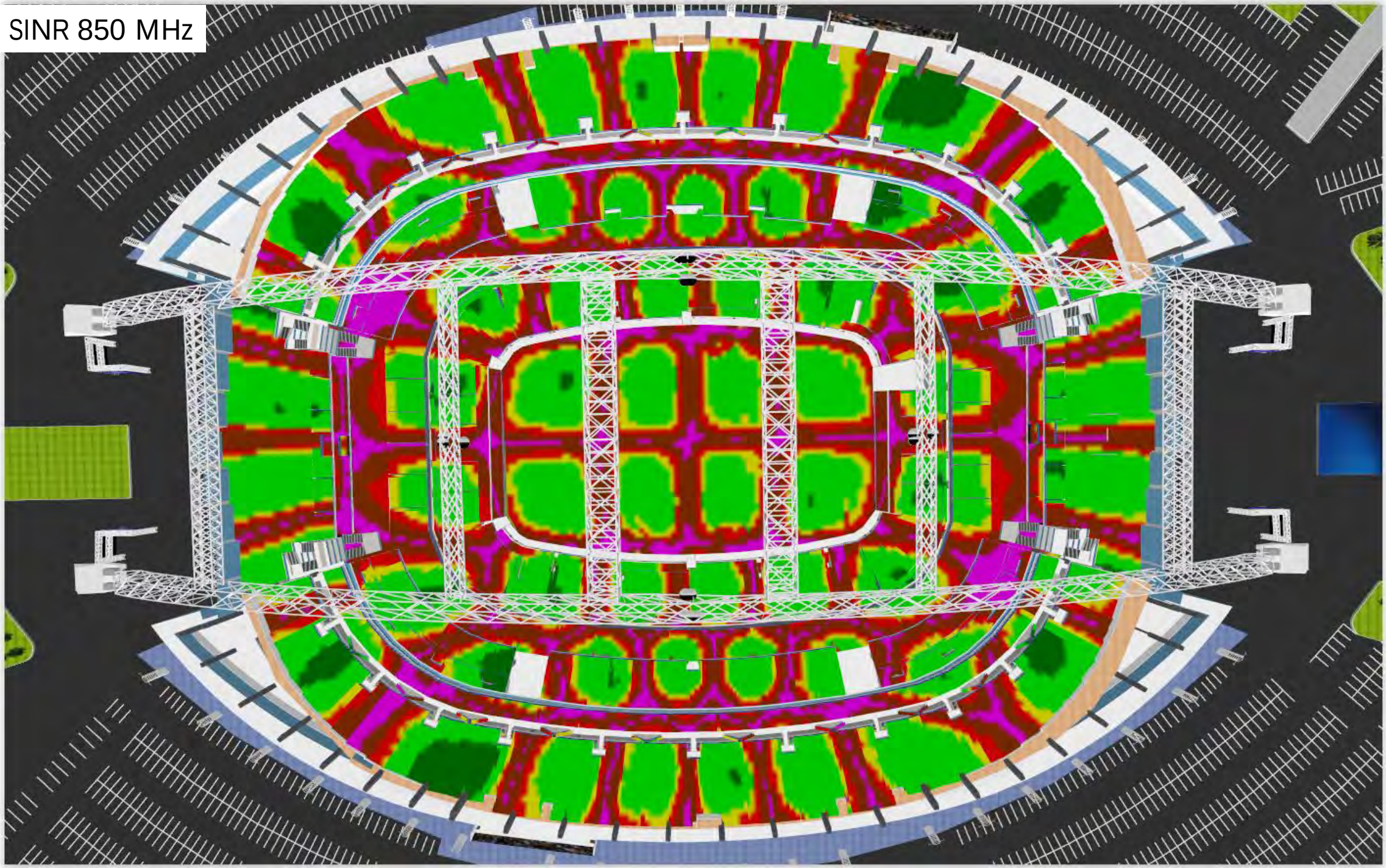


850 MHz Coverage Plots

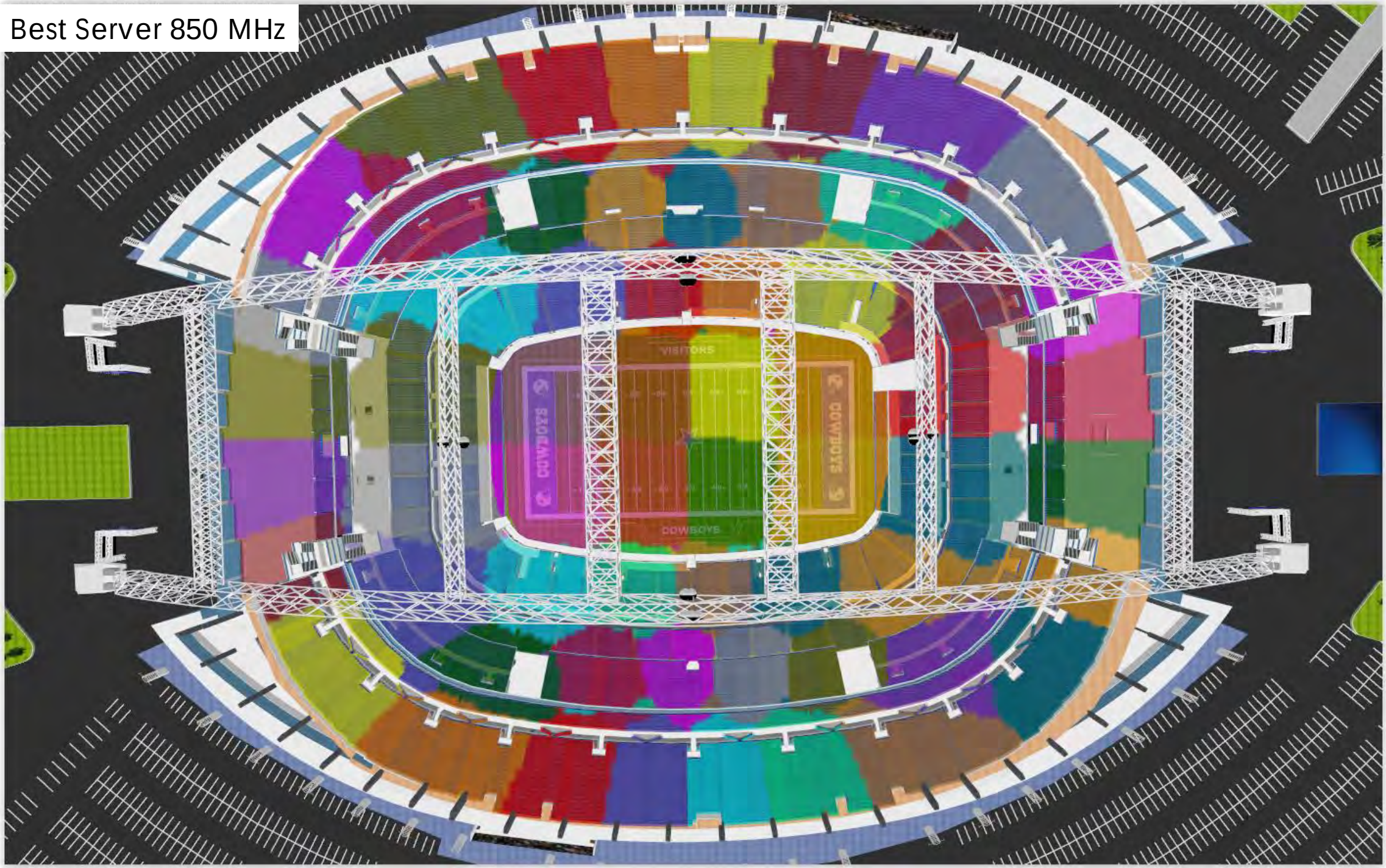
RSRP 850 MHz



SINR 850 MHz



Best Server 850 MHz



Arrowhead Stadium

Seating Area /Bowl Conceptual design

Summary

- Scope: Conceptual Design for Arrowhead Stadium Bowl area;
- Remote power:
  - CBRS Band: 20dBm @ antenna port;
  - High Band: 23dBm per band assuming 50% power share: 20dBm @ antenna port;
  - Low Band: 20dBm per band assuming 50% power share: 17dBm @ antenna port;
- Antenna Mounting points: Stadium Floodlights structure and pavilion roof;
- 6 antennas total (2 per band) to provide 2x2 MIMO CBRS+HB+LB coverage for Arrowhead Stadium bowl/seating area including field;
- Total 39 HB/CBRS sectors (can be increased to 44) and 11 LB sectors;
- Only two mounting locations needed;

Antenna Type	Band Served	Antenna Count, (2x2 MIMO)	Sector Count	Serving Area
MS-48F90	CBRS (3.5GHz)	2	39	Bowl seating areas and Field
Total Antenna Count for CBRS Band		2		

Antenna Type	Band Served	Antenna Count, (2x2 MIMO)	Sector Count	Serving Area
MS-48H180	High Band	2	39	Bowl seating areas and Field
Total Antenna Count for High Band		2		

Antenna Type	Band Served	Antenna Count (2x2 MIMO)		Serving Area
MS-12L180	Low Band	1	11	Bowl seating areas and Field
MS-6L180	Low Band	1		Bowl seating areas
Total Antenna Count for Low Band		2		

Antenna Type	2X2 MIMO -Total Antenna Count	Comment
MS-48F90	2	CBRS Band
MS-48H180	2	High Band
MS-12L180	1	Low Band
MS-6L180	1	Low Band

MobileNet Services

Antenna Mounting Locations

Antenna Locations – Top View

Antenna mounting location: The stadium floodlights poles and pavilion roof

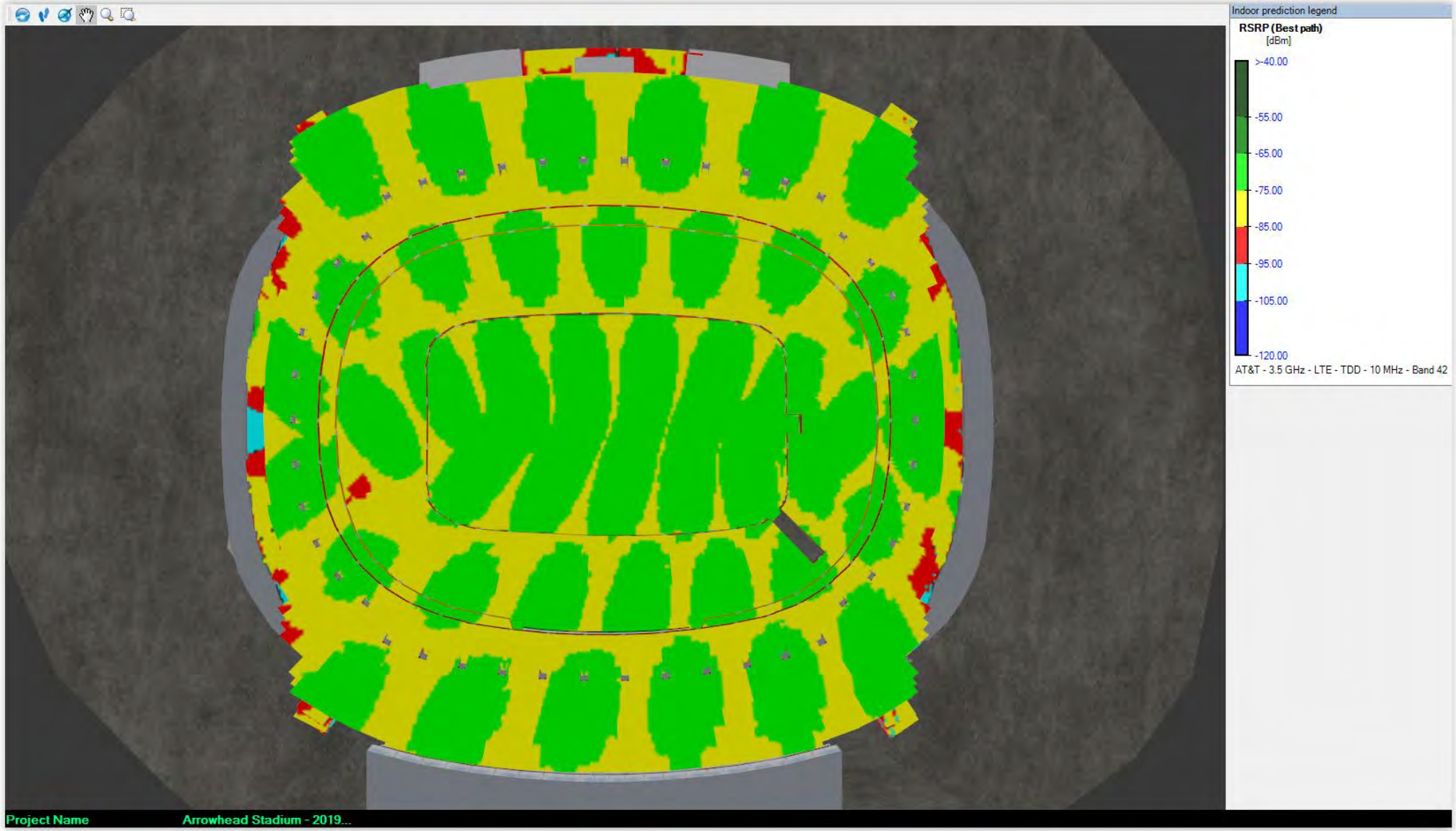
MobileNet Services

Antenna Locations on 3D Model

MobileNet Services

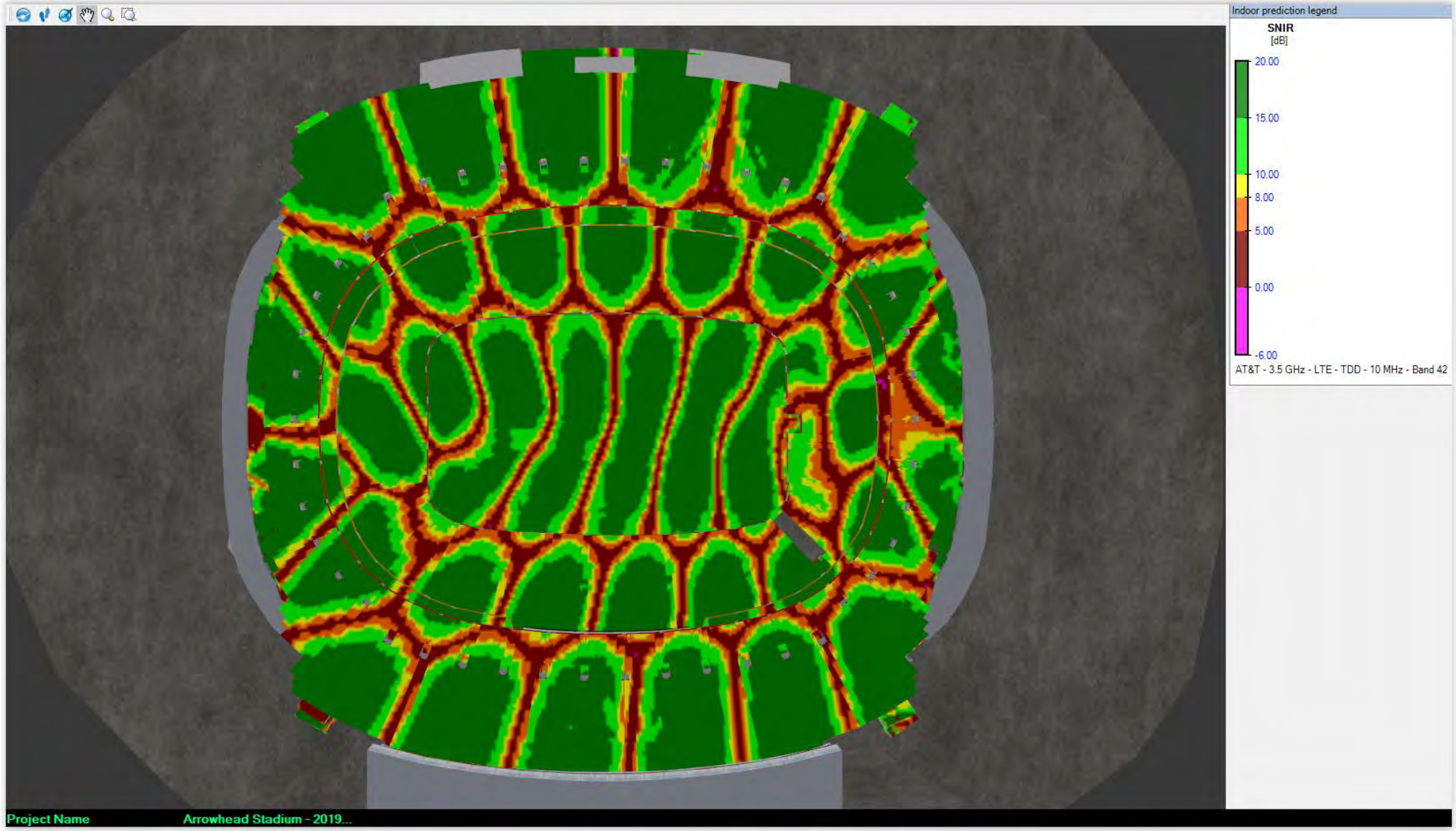
CBRS(3.5GHz) KPI Plots

RSRP Plot – CBRS (3.5GHz)



MobileNet Services

SINR Plot – CBRS (3.5GHz)



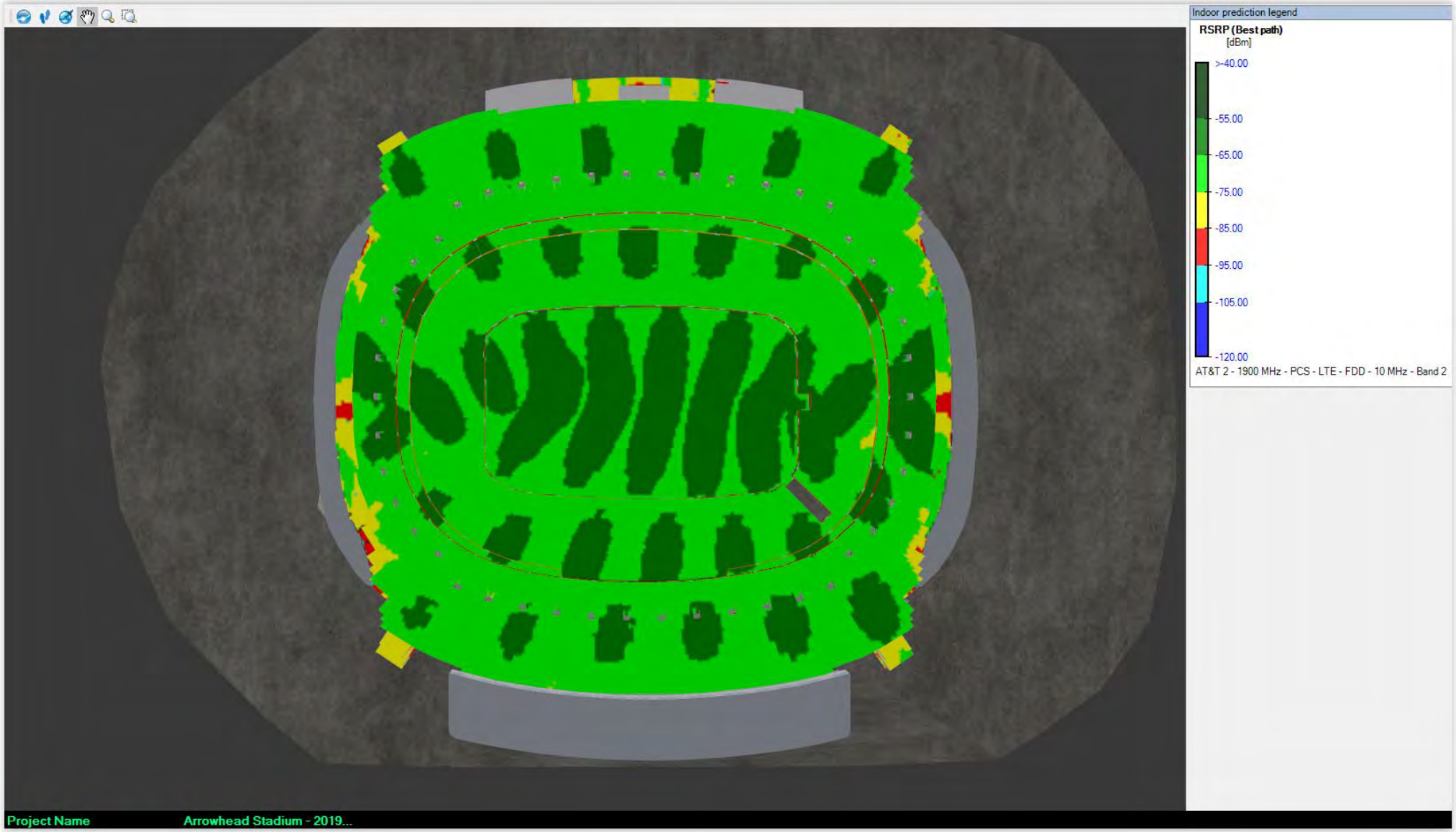
MobileNet Services

Best Server Plot – CBRS (3.5GHz) (total 39 zones)

MobileNet Services

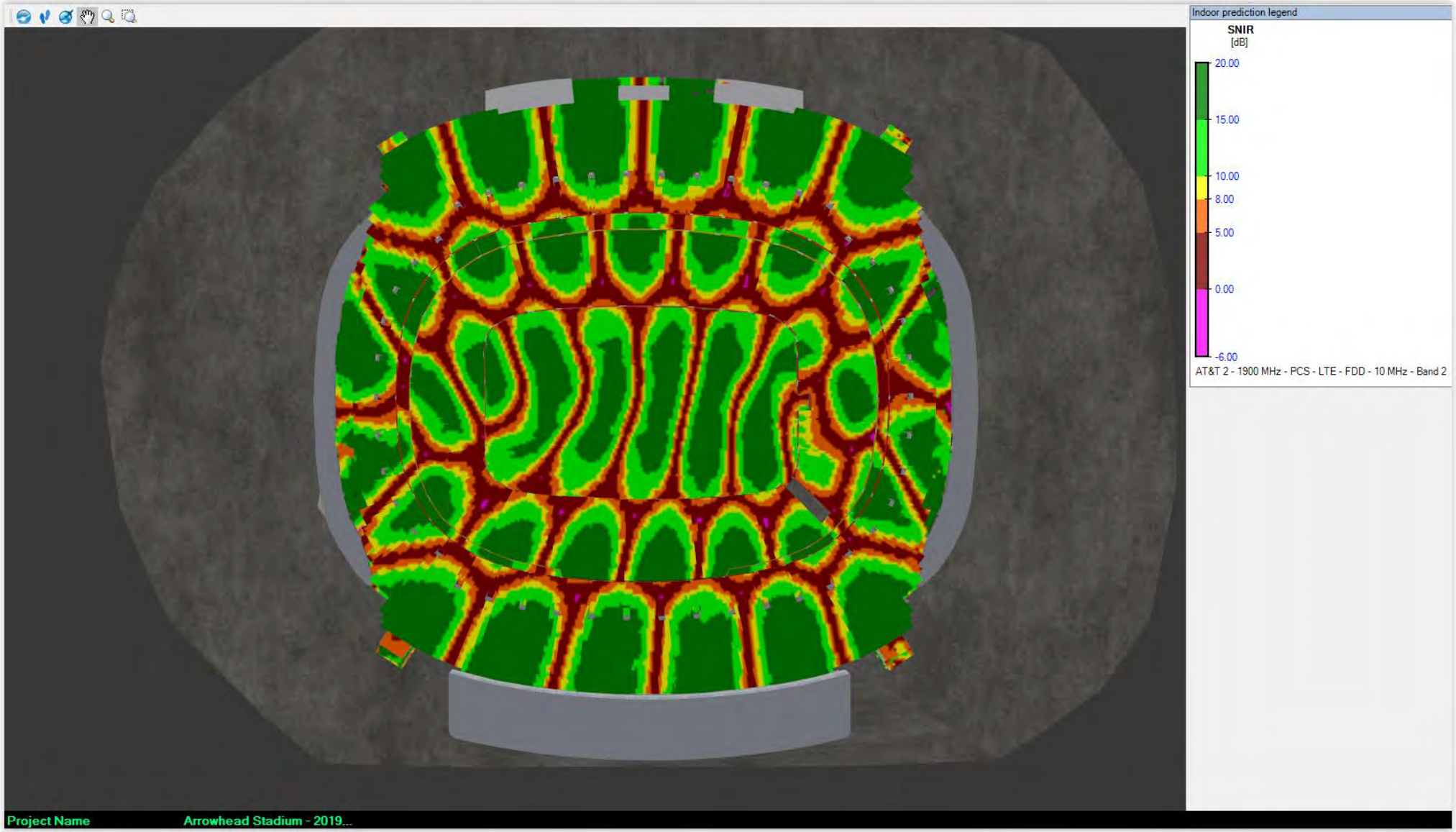
High Band (1900MHz) KPI Plots

RSRP Plot – High Band



MobileNet Services

SINR Plot – High Band

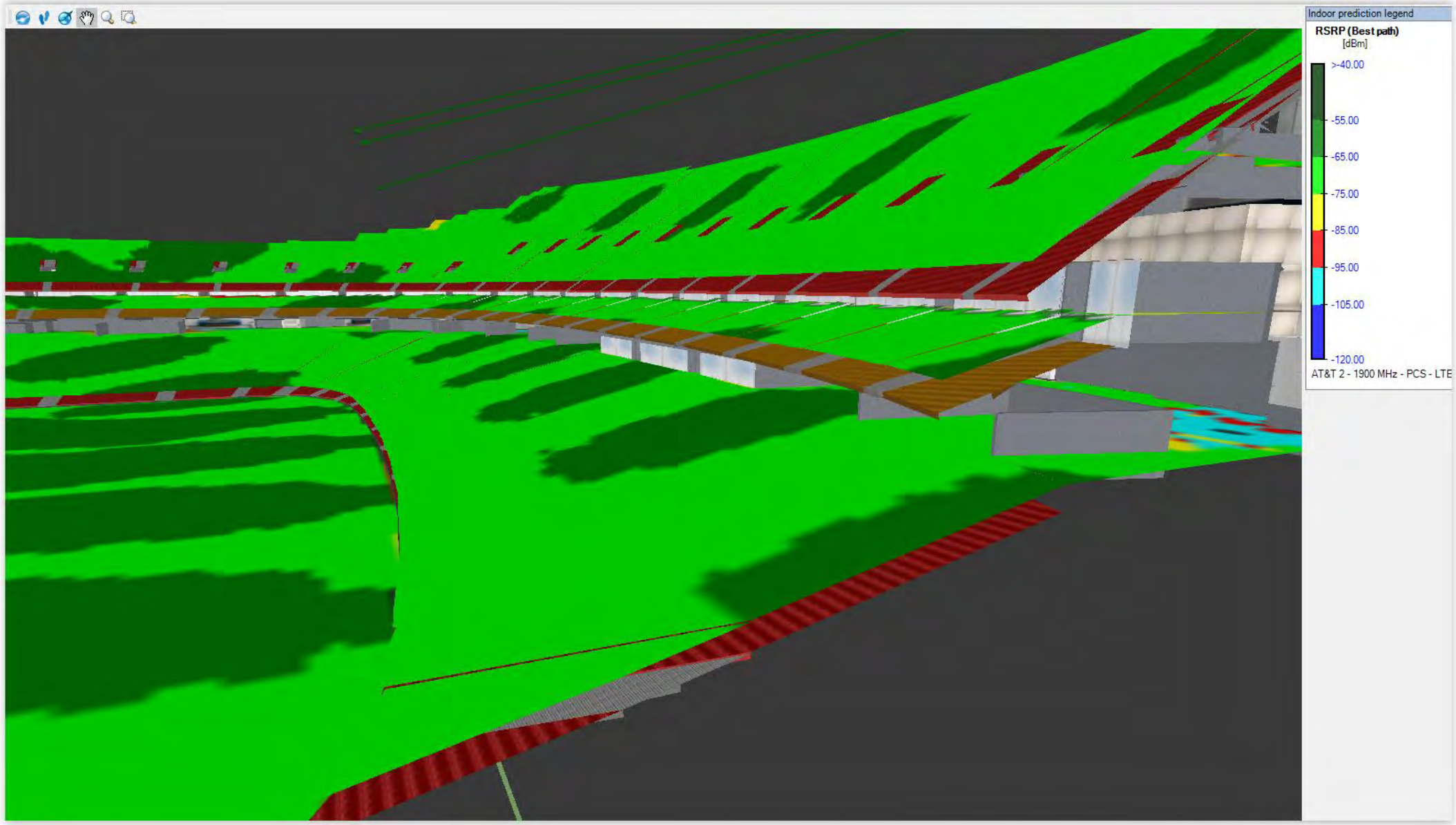


MobileNet Services

Best Server Plot – High Band (total 39 zones)

MobileNet Services

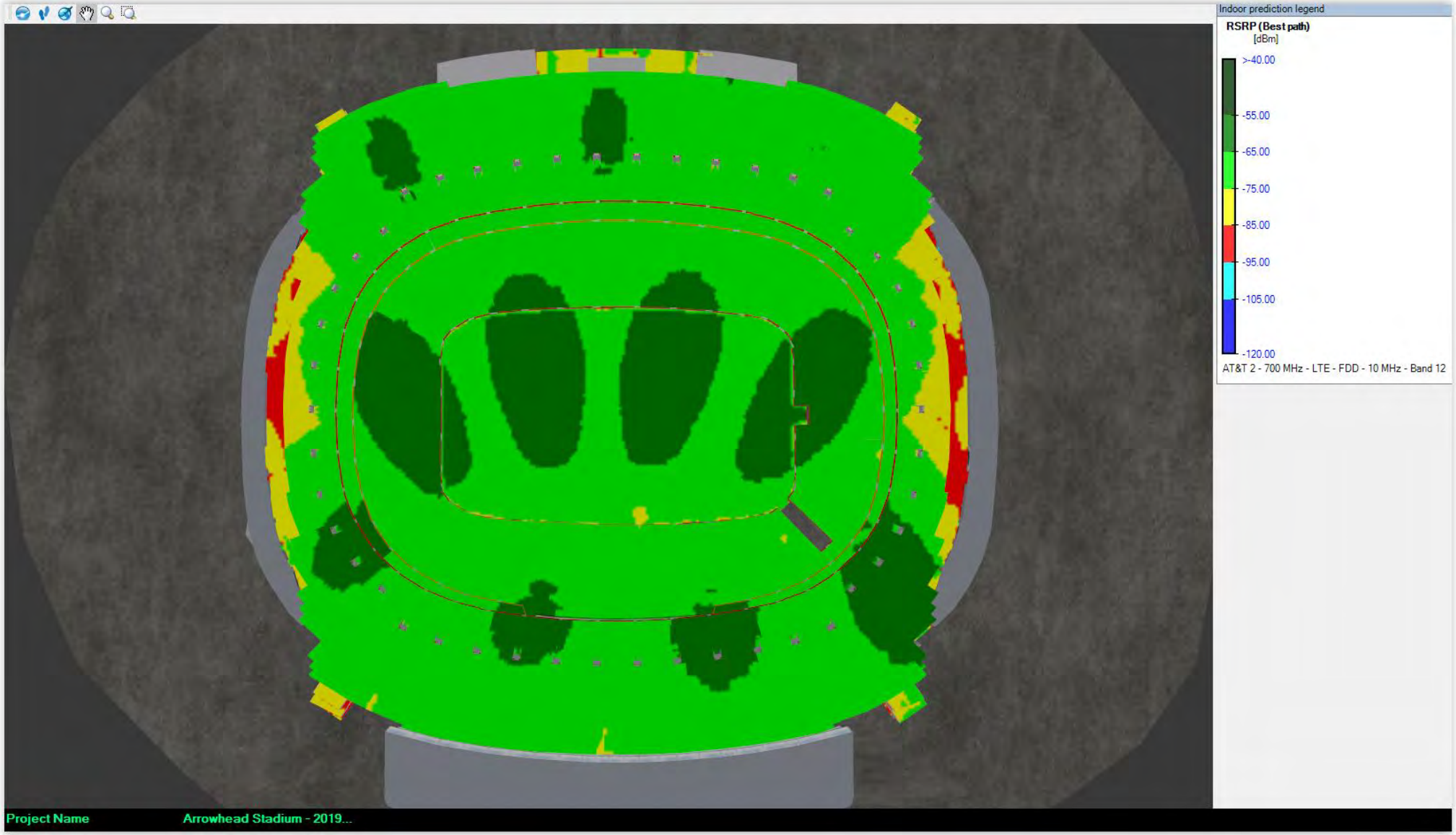
Overhang coverage example



Low Band (700MHz) KPI Plots

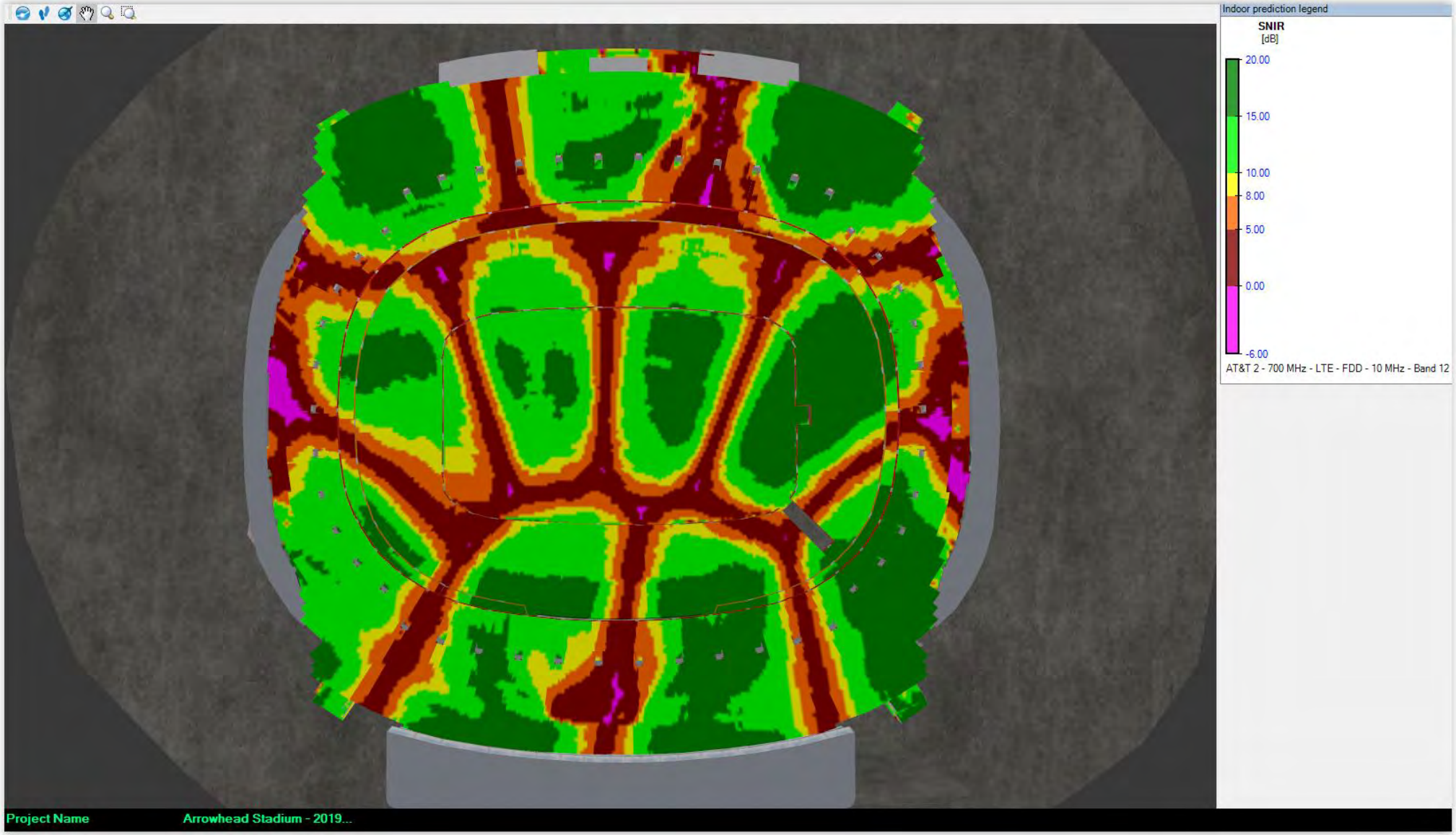
MobileNet Services

RSRP Plot – Low Band



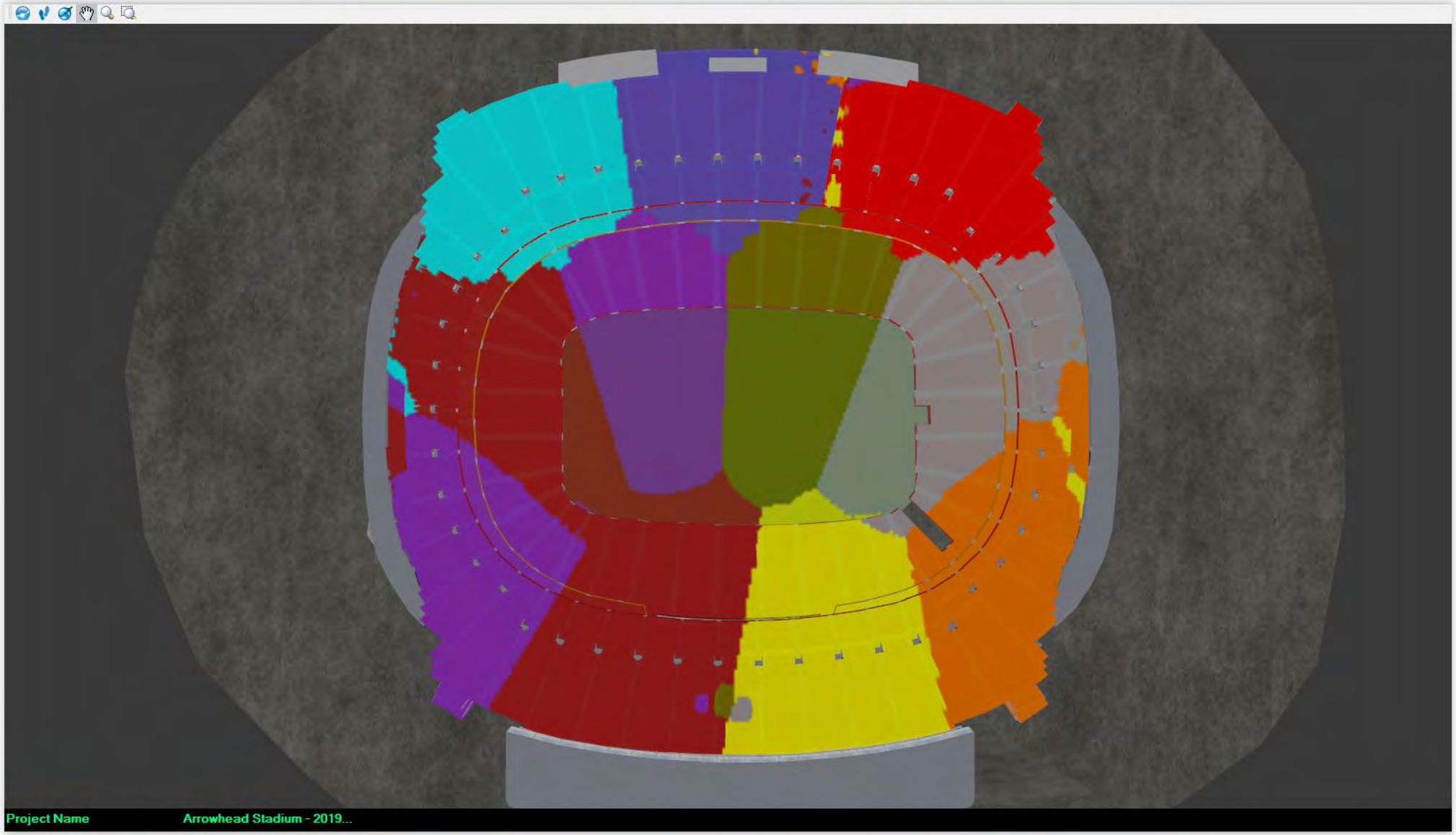
MobileNet Services

SINR Plot – Low Band



MobileNet Services

Best Server Plot – Low Band (total 11 zones)



MobileNet Services

Antenna Spec Sheets

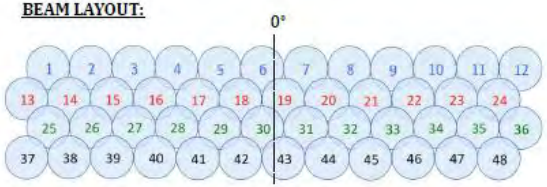
Antenna Spec Sheets: MS-48F90

MATSING
LENS TECHNOLOGY ENABLED

MS-48F90

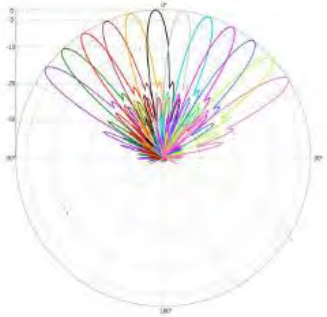
Multi-Beam Wide Band Spherical Lens Antenna: 4 rows of 12 independent high frequency (3300-4200MHz) full-band cross-polarized beams.

BEAM LAYOUT:

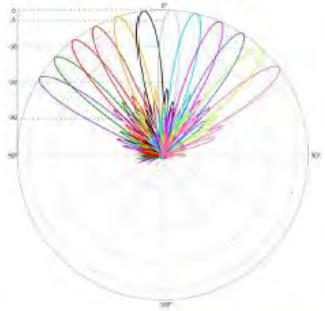


PATTERN DIAGRAMS @ 3.6GHz

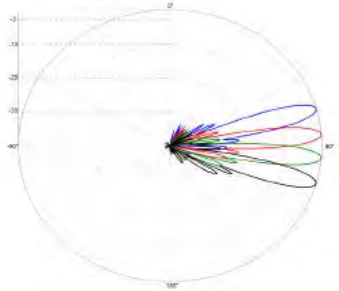
Horizontal pattern top/third



Horizontal pattern second/bottom



Vertical pattern



Top Row +12.9°
Second Row +4.3°
Third Row -4.3°
Fourth Row -12.9°

MATSING
LENS TECHNOLOGY ENABLED

TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	3300-4200 MHz
Gain	26dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45°
Horizontal Coverage	120°
Horizontal Beamwidth (10dB level) Horizontal Beamwidth (3dB level)	10° 6°
Vertical Beamwidth (10dB level) Vertical Beamwidth (3dB level)	10° 6°
Beam Cross-over	10dB typical
Total Number of Beams	48
Tilt (Factory Set)	Fixed
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>28dB
Power Rating	50W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	96 X 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 90cm/35inch Antenna dimensions: 100 x 119 x 121 cm 43 x 47 x 48 inch
Antenna Weight	60kg 132lbs
Radome Material	Fiber Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load	55N @ 160km/h 13lbf @ 160km/h

SAMPLE CONNECTOR LAYOUT:

MobileNet Services

Antenna Spec Sheets: MS-48H180

MATSING
LENS TECHNOLOGY ENABLED

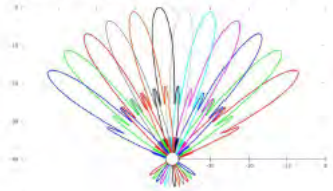
MS-48H180

Multi-Beam Wide Band Spherical Lens Antenna: 4 rows of 12 independent high frequency (1695-2690MHz) full-band cross-polarized beams.

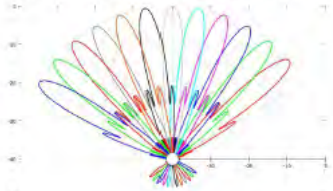
BEAM LAYOUT:

PATTERN DIAGRAMS @ 1.8 GHz:

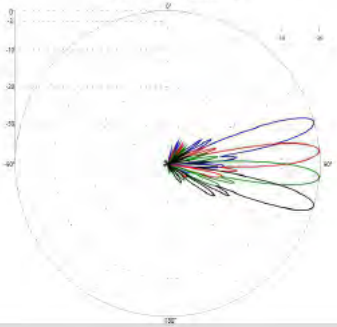
Horizontal Pattern 1st and 3rd Row



Horizontal Pattern 2nd and 4th Row



Vertical Pattern



MATSING
LENS TECHNOLOGY ENABLED

TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	1695-2690 MHz
Gain	27.5dBi
VSWR	<1.5:1
Polarization	Dual Slant±45°
Horizontal Coverage	120°
Horizontal Beamwidth (10dB level)	10°
Horizontal Beamwidth (3dB level)	6°
Vertical Beamwidth (10dB level)	10°
Vertical Beamwidth (3dB level)	6°
Beam Cross-over	10dB typical
Total Number of Beams	48
Tilt (Factory Set)	Fixed
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port-Polarization	>28dB
Isolation Port to Port-Beam	>28dB
Power Rating	200W per port
Intermodulation	<-150dBc
Impedance	50ohm
Connector Quantity and Type	96x4.3-10DIN female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 180cm/70inch Antenna dimensions: 182 x 205 x 207 cm 71 x 80 x 81 inch
Antenna Weight	258kg/568lbs
Radome Material	Fiber glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 - 11.4 cm 2.4 - 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH@+30°C
Temperature	-40°C to+70°C
Wind load	55 N@160 Km/hr 13 lbf@160 Km/hr

SAMPLE CONNECTOR LAYOUT:

MobileNet Services

Antenna Spec Sheets: MS-12L180

MATSING
LENS TECHNOLOGY ENABLED

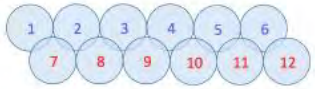
MS-12L180-A

Multi-Beam Wide Band Spherical Lens Antenna: 12 independent low frequency (698-896MHz) cross-polarized beams.

***Optional Packages:**

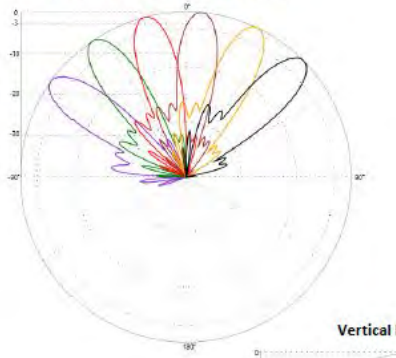
A) MS-12L180-B : Low-band frequency range 790-960MHz

Beam Layout:

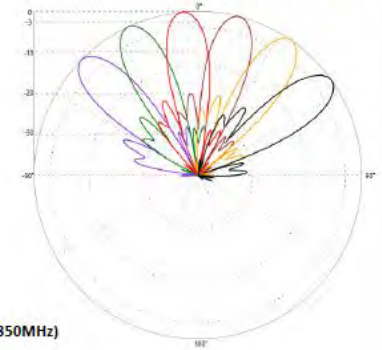


PATTERN RESULTS:

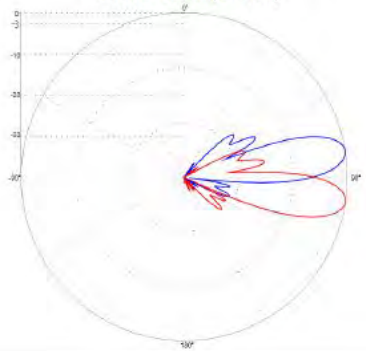
Horizontal Pattern Row 1 (850MHz)



Horizontal Pattern Row 2 (850MHz)



Vertical Pattern (850MHz)



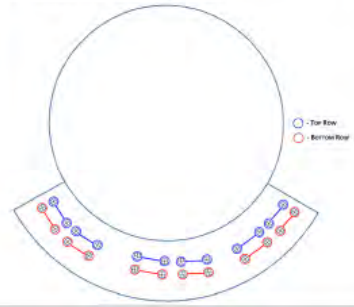
MATSING
LENS TECHNOLOGY ENABLED

ESTIMATED TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	698-896 MHz
Gain	22dBi
Return Loss	>15dB
Polarization	Dual Slant ±45°
Horizontal Coverage per row Total coverage	120° 130°
Horizontal Beamwidth (10dB level)	20° ± 1°
Vertical Beamwidth (10dB level)	22°
Beam Cross-over	10dB typical
Total Number of Beams	12
Tilt	Factory Set
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>28dB
Power Rating	250W per port
Intermodulation	<-150dBc
Impedance	50 ohm
Connector Quantity and Type	24 4.3-10 female

ESTIMATED MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 180cm/70inch Antenna dimensions: 182 x 205 x 207 cm 71 x 80 x 81 inch
Antenna Weight	220kg 485 lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ESTIMATED ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load (Front)	2516 N @ 160km/hr 520 lbf @ 160km/hr

SAMPLE CONNECTOR LAYOUT:



MobileNet Services

Antenna Spec Sheets: MS-6L180

MATSING
LENS TECHNOLOGY ENABLED

MS-6L180-A

Multi-Beam Spherical Lens Antenna: 6 independent low frequency (698-896MHz) cross-polarized beams with 5°-20° tilt for each beam and 2X2 MIMO support.

***Optional Packages:**

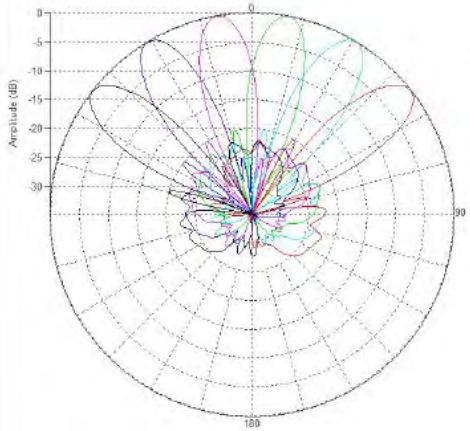
a) MS-6L180-A-M : AISG 2.0 Remote Electrical Tilt, multi RET configuration

a) MS-6L180-A-S : AISG 2.0 Remote Electrical Tilt, single RET configuration

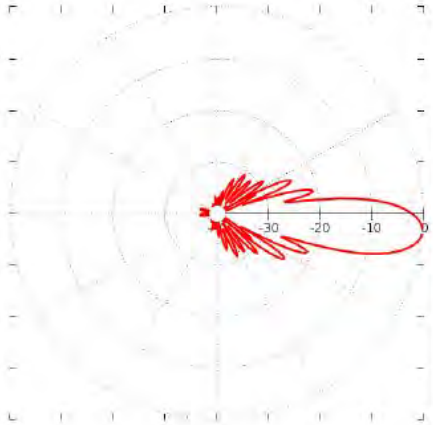
b) MS-6L180-B : Low-band frequency range 790-960MHz

PATTERN RESULTS:

Low-Band Horizontal Pattern (0.85GHz)



Low-Band Vertical Pattern (0.85GHz)



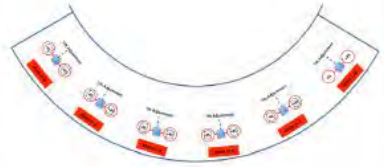
MATSING
LENS TECHNOLOGY ENABLED

ESTIMATED TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	698-896 MHz
Gain	22dBi
Return Loss	>15dB
Polarization	Dual Slant ±45
Horizontal Coverage	120°
Horizontal Beamwidth (10dB level)	20° ± 2°
Vertical Beamwidth (10dB level)	22°
Beam Cross-over	10dB typical
Total Number of Beams	6
Manual Adjustable Tilt per beam	5° to 20°
First Sidelobe Level	<-18dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>28dB
Power Rating	300W per port
Intermodulation	<-150dBc
Impedance	50 ohm
Connector Quantity and Type	12 4.3-10 female

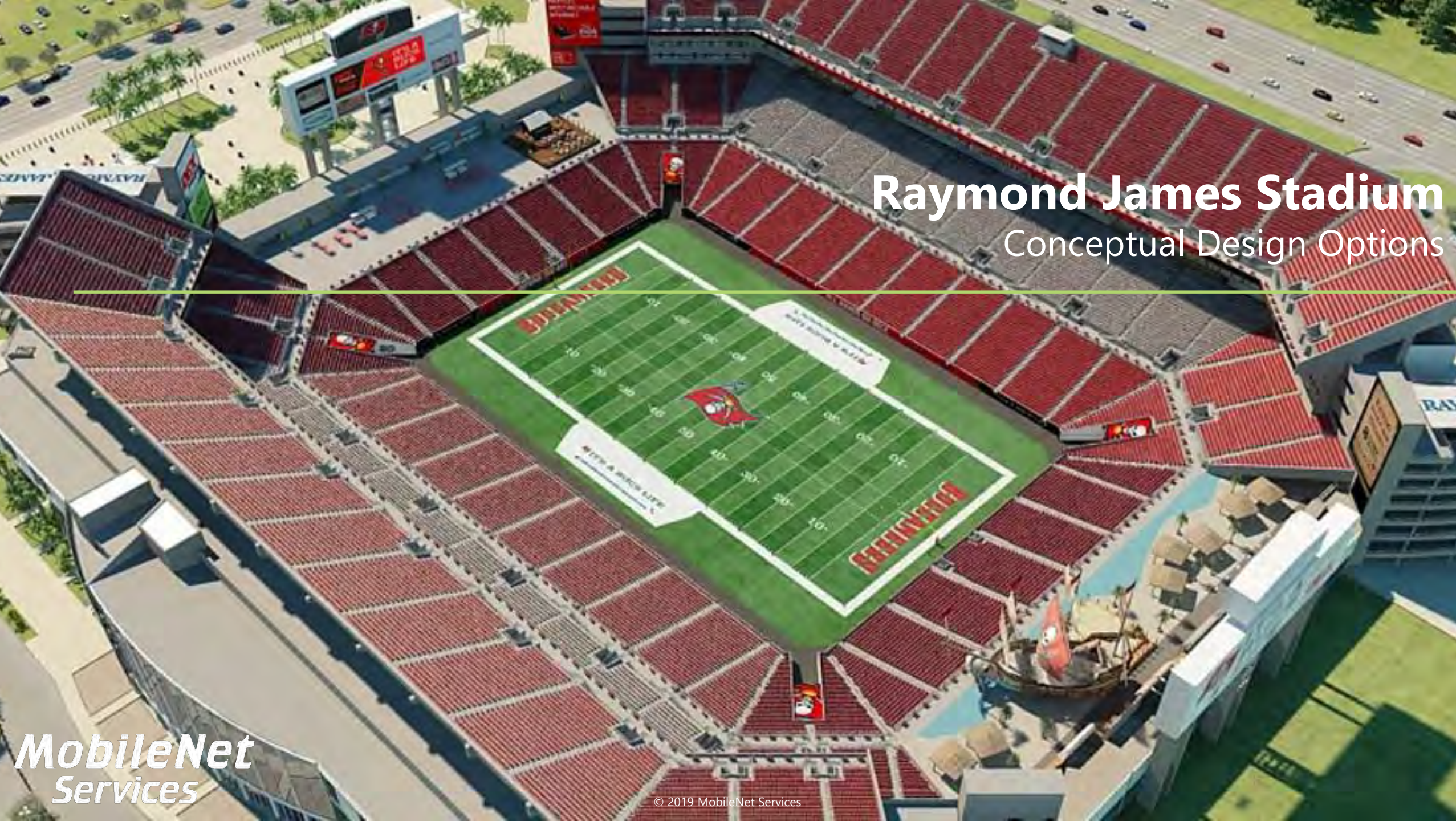
ESTIMATED MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 180cm/70inch Antenna dimensions: 182 x 205 x 207 cm 71 x 80 x 81 inch
Antenna Weight	220kg 485lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ESTIMATED ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +50°C
Temperature	-40°C to +70°C
Wind load (Front)	2516 N @ 160km/hr 520 lbf @ 160km/hr

Connector Layout



MobileNet Services



Raymond James Stadium

Conceptual Design Options

MobileNet Services

Raymond James Stadium
Conceptual Design – Option 1

MobileNet Services

Summary

- Scope: Conceptual Design for Raymond James Stadium Bowl area;
- Low power remote units assumed (remote radio unit power):
  - CBRS Band: 20dBm @ antenna port;
  - High Band: 23dBm per band assuming 50% power share: 20dBm @ antenna port;
  - Low Band: 20dBm per band assuming 50% power share: 17dBm @ antenna port;
- Antenna Mounting points: Stadium Floodlights structure ;
- 6 antennas total (2 per band) to provide 2x2 MIMO coverage (CBRS+HB+LB) for Raymond James Stadium bowl/seating area including field;
- Total 40 HB/CBRS sectors and 11 LB sectors;
- Only two mounting locations needed;

Antenna Type	Band Served	Antenna Count, (2x2 MIMO)	Sector Count	Serving Area
MS-48F90	CBRS (3.5GHz)	2	39	Bowl seating areas and Field
Total Antenna Count for CBRS Band		2		

Antenna Type	Band Served	Antenna Count, (2x2 MIMO)	Sector Count	Serving Area
MS-48H180	High Band	2	39	Bowl seating areas and Field
Total Antenna Count for High Band		2		

Antenna Type	Band Served	Antenna Count (2x2 MIMO)		Serving Area
MS-12L180	Low Band	1	11	Bowl seating areas and Field
MS-6L180	Low Band	1		Bowl seating areas
Total Antenna Count for Low Band		2		

Antenna Type	2X2 MIMO -Total Antenna Count	Comment
MS-48F90	2	CBRS Band
MS-48H180	2	High Band
MS-12L180	1	Low Band
MS-6L180	1	Low Band

MobileNet Services

Antenna mounting locations

Two antennas mounted on flood light structure, pointing across the field

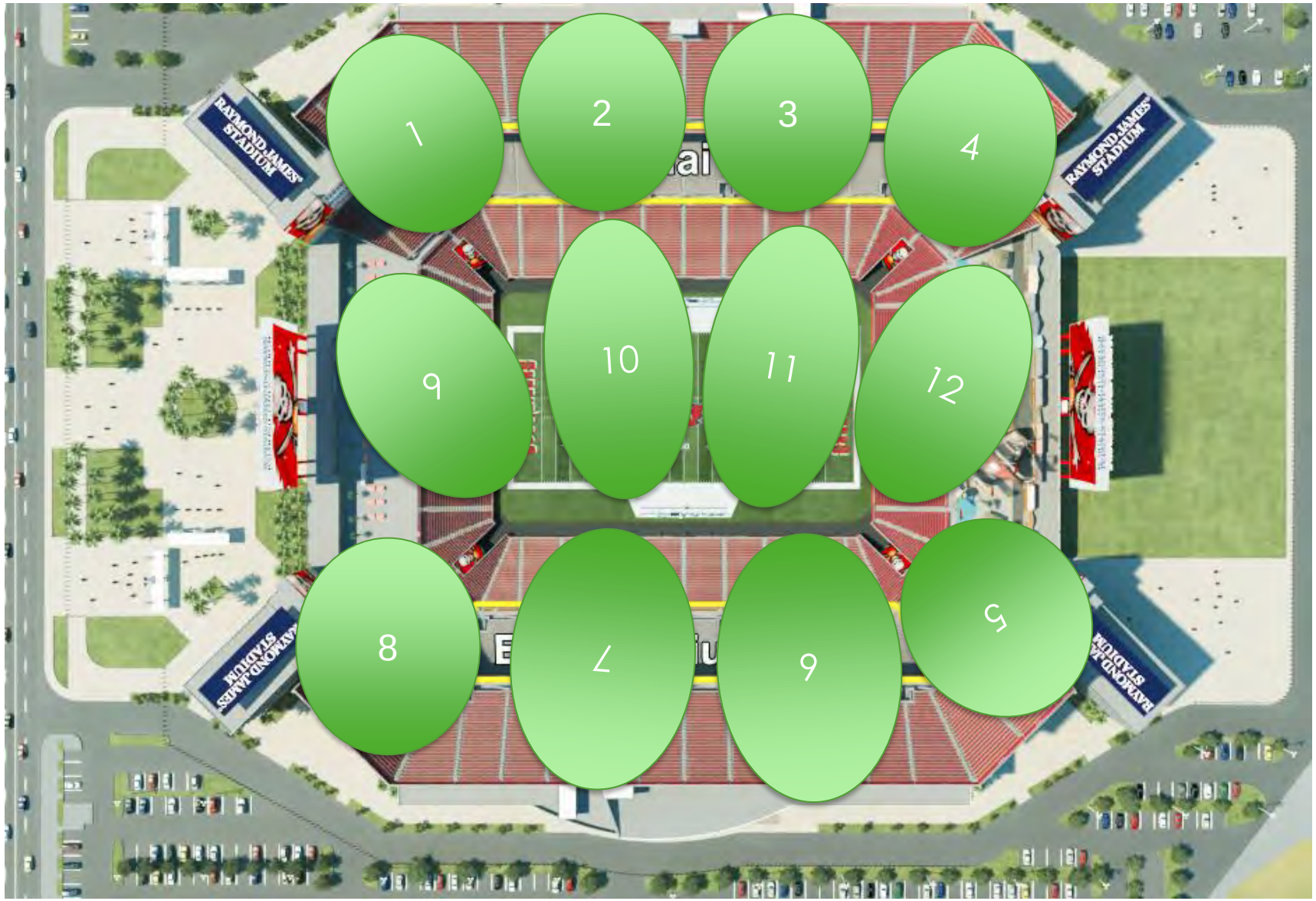
Antenna mounting locations (Contd.)

Two antennas mounted on flood light structure, pointing across the field

MobileNet Services

Raymond James Stadium – High Band Zone Count (option 1)

Raymond James Stadium – Low Band Zone Count (option 1)



MobileNet Services

Antenna Spec Sheets – Option 1

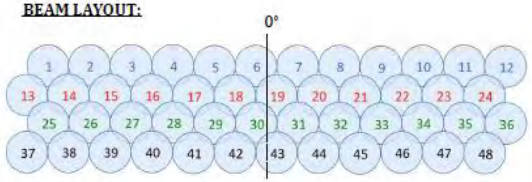
MS-48F90 (CBRS)

MATSING
LENS TECHNOLOGY ENABLED

MS-48F90

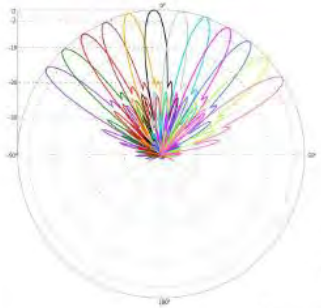
Multi-Beam Wide Band Spherical Lens Antenna: 4 rows of 12 independent high frequency (3300-4200MHz) full-band cross-polarized beams.

BEAM LAYOUT:

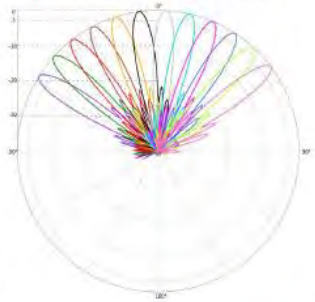


PATTERN DIAGRAMS @ 3.6GHz

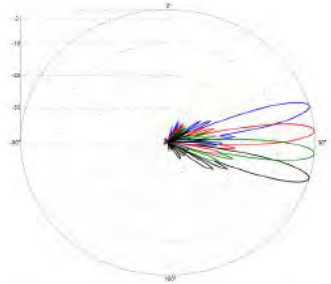
Horizontal pattern top/third



Horizontal pattern second/bottom



Vertical pattern



Top Row +12.9°
Second Row +4.3°
Third Row -4.3°
Fourth Row -12.9°

EMAIL: Info@matsing.com **WEBSITE:** www.matsing.com **PHONE:** (949) 585 5144

MATSING
LENS TECHNOLOGY ENABLED

TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	3300-4200 MHz
Gain	26dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45°
Horizontal Coverage	120°
Horizontal Beamwidth (10dB level) Horizontal Beamwidth (3dB level)	10° 6°
Vertical Beamwidth (10dB level) Vertical Beamwidth (3dB level)	10° 6°
Beam Cross-over	10dB typical
Total Number of Beams	48
Tilt (Factory Set)	Fixed
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>28dB
Power Rating	50W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	96 X 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 90cm/35inch Antenna dimensions: 100 x 119 x 121 cm 43 x 47 x 48 inch
Antenna Weight	60kg 132lbs
Radome Material	Fiber Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load	55N @ 160km/h 13lbf @ 160km/h

SAMPLE CONNECTOR LAYOUT:

EMAIL: Info@matsing.com **WEBSITE:** www.matsing.com **PHONE:** (949) 585 5144

MobileNet Services

MS-48H180 (HB)

MATSING
LENS TECHNOLOGY ENABLED

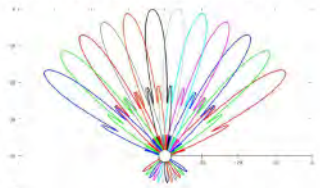
MS-48H180

Multi-Beam Wide Band Spherical Lens Antenna: 4 rows of 12 independent high frequency (1695-2690MHz) full-band cross-polarized beams.

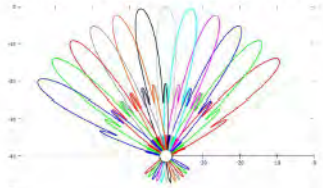
BEAM LAYOUT:

PATTERN DIAGRAMS @ 1.8 GHz:

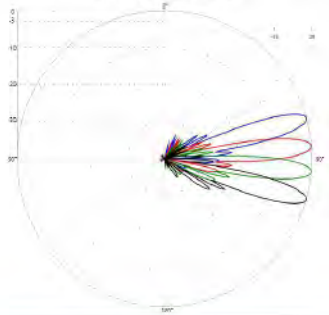
Horizontal Pattern 1st and 3rd Row



Horizontal Pattern 2nd and 4th Row



Vertical Pattern



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MATSING
LENS TECHNOLOGY ENABLED

TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	1695-2690 MHz
Gain	27.5dBi
VSWR	<1.5:1
Polarization	Dual Slant±45°
Horizontal Coverage	120°
Horizontal Beamwidth (10dB level)	10°
Horizontal Beamwidth (3dB level)	6°
Vertical Beamwidth (10dB level)	10°
Vertical Beamwidth (3dB level)	6°
Beam Cross-over	10dB typical
Total Number of Beams	48
Tilt (Factory Set)	Fixed
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port-Polarization	>28dB
Isolation Port to Port-Beam	>28dB
Power Rating	200W per port
Intermodulation	<-150dBc
Impedance	50ohm
Connector Quantity and Type	96x4.3-10DIN female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 180cm/70inch Antenna dimensions: 182 x 205 x 207 cm 71 x 80 x 81 inch
Antenna Weight	258kg/568lbs
Radome Material	Fiber glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 - 11.4 cm 2.4 - 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH@+30°C
Temperature	-40°C to+70°C
Wind load	55 N@160 Km/hr 13 lbf@160 Km/hr

SAMPLE CONNECTOR LAYOUT:

EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MobileNet Services

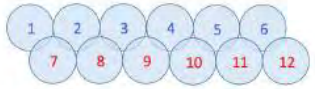
MS-12T180 (LB)

MATSING
LENS TECHNOLOGY ENABLED

MS-12T180

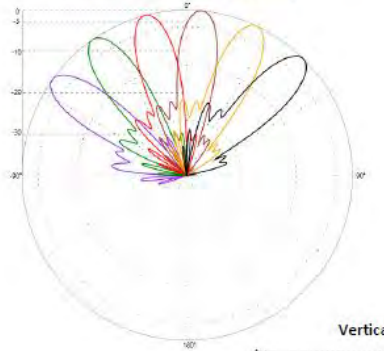
Multi-Beam Spherical Lens Antenna. Twelve independent low frequency (617-894MHz) cross-polarized beams.

Beam Layout:

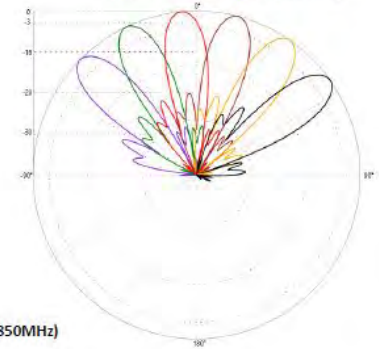


PATTERN RESULTS:

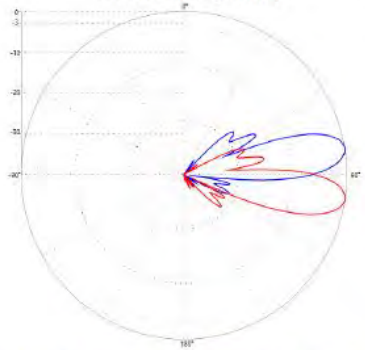
Horizontal Pattern Row 1 (850MHz)



Horizontal Pattern Row 2 (850MHz)



Vertical Pattern (850MHz)



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

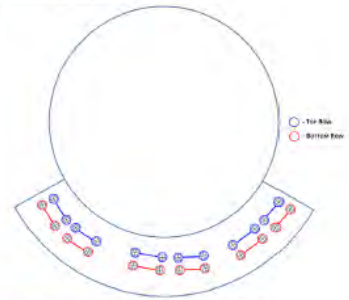
MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS PER BEAM	
Frequency	617-894MHz
Gain	20.5dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45°
Horizontal Coverage per row	120°
Total coverage	130°
Horizontal Beamwidth (10dB)	20°
Horizontal Beamwidth (3dB)	12°
Vertical Beamwidth (10dB)	20°
Vertical Beamwidth (3dB)	12°
Beam Cross-over	10dB typical
Total Number of Beams	12
Tilt	Factory Set
First Sidelobe Level	<-15dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>26dB
Power Rating	250W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	24 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 180cm/70inch Antenna dimensions: 182 x 205 x 207 cm 71 x 80 x 81 inch
Antenna Weight	220kg 485 lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load (Front)	2316 N @ 160km/hr 520 lbf @ 160km/hr

SAMPLE CONNECTOR LAYOUT:



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MobileNet Services

MS-6T180 (LB)

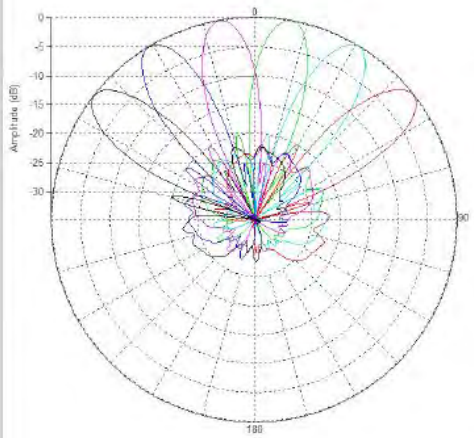
MATSING
LENS TECHNOLOGY ENABLED

MS-6T180

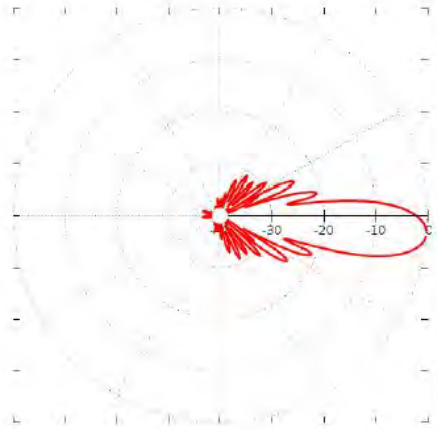
Multi-Beam Spherical Lens Antenna. Six independent low frequency (617-894MHz) cross-polarized beams with 0°-15° tilt for each beam and 2X2 MIMO support.

PATTERN RESULTS:

Low-Band Horizontal Pattern (0.85GHz)



Low-Band Vertical Pattern (0.85GHz)



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS PER BEAM	
Frequency	617-894 MHz
Gain	20.5dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45
Horizontal Coverage	120°
Horizontal Beamwidth (10dB)	20°
Horizontal Beamwidth (3dB)	12°
Vertical Beamwidth (10dB)	20°
Vertical Beamwidth (3dB)	12°
Beam Cross-over	10dB typical
Total Number of Beams	6
Manual Adjustable Tilt per beam	0° to 15°
First Sidelobe Level	<-15dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>26dB
Power Rating	250W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	12 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 180cm/70inch Antenna dimensions: 182 x 205 x 207 cm 71 x 80 x 81 inch
Antenna Weight	220kg 485lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load (Front)	2316 N @ 160km/hr 520 lbf @ 160km/hr

Connector Layout

EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MobileNet Services

Raymond James Stadium
Conceptual Design – Option 2

MobileNet Services

Summary

- Scope: Conceptual Design for Raymond James Stadium Bowl area – high capacity option;
- Low power remote units assumed (remote radio unit power):
  - CBRS Band: 20dBm @ antenna port;
  - High Band: 23dBm per band assuming 50% power share: 20dBm @ antenna port;
  - Low Band: 20dBm per band assuming 50% power share: 17dBm @ antenna port;
- Antenna Mounting points: Stadium Floodlights structure and Level 200 overhung concrete beams;
- Total 78 HB/CBRS sectors and 40 LB sectors;

Antenna Type	Band Served	Antenna Count, (2x2 MIMO)	Serving Area
MS-12F45	CBRS (3.5GHz)	16	Upper Seating
MS-12F45	CBRS (3.5GHz)	4	End Zones
MS-SB17-F	CBRS (3.5GHz)	28	100/200 Levels
Total Antenna Count for CBRS Band		48	

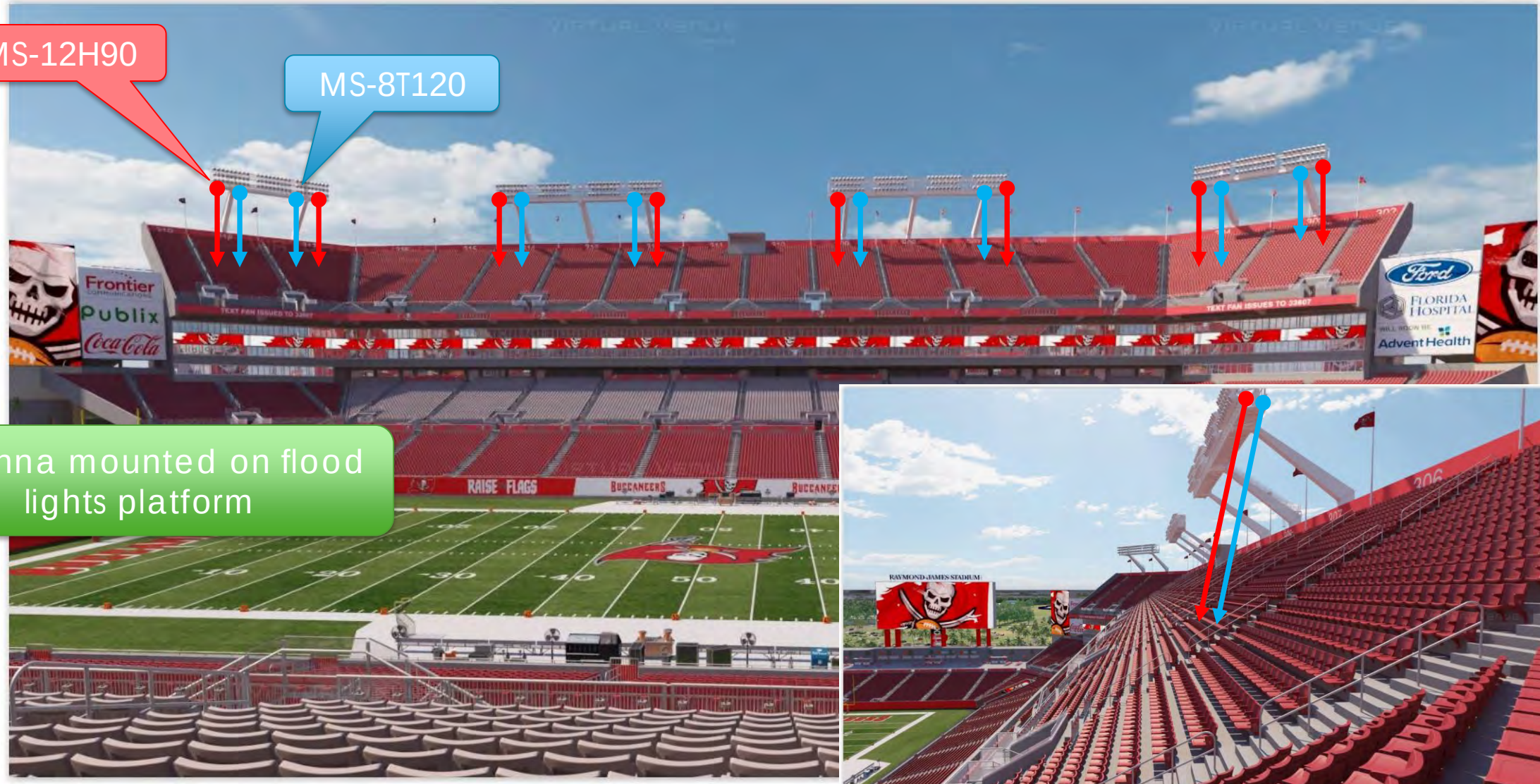
Antenna Type	Band Served	Antenna Count, (2x2 MIMO)	Serving Area
MS-12H90	High Band	16	Upper Seating
MS-12H90	High Band	4	End Zones
MS-SB23-H	High Band	28	100/200 Levels
Total Antenna Count for High Band		48	

Antenna Type	Band Served	Antenna Count (2x2 MIMO)	Serving Area
MS-8T120	Low Band	16	Upper Seating
MS-8T120	Low Band	4	End Zones
MS-SB43-T	Low Band	14	100/200 Levels
Total Antenna Count for Low Band		34	

Antenna Type	2X2 MIMO -Total Antenna Count	Comment
MS-12F45	20	CBRS Band
MS-SB17-F	28	
MS-12H90	20	High Band
MS-SB23-H	28	
MS-8T120	20	Low Band
MS-SB43-T	14	

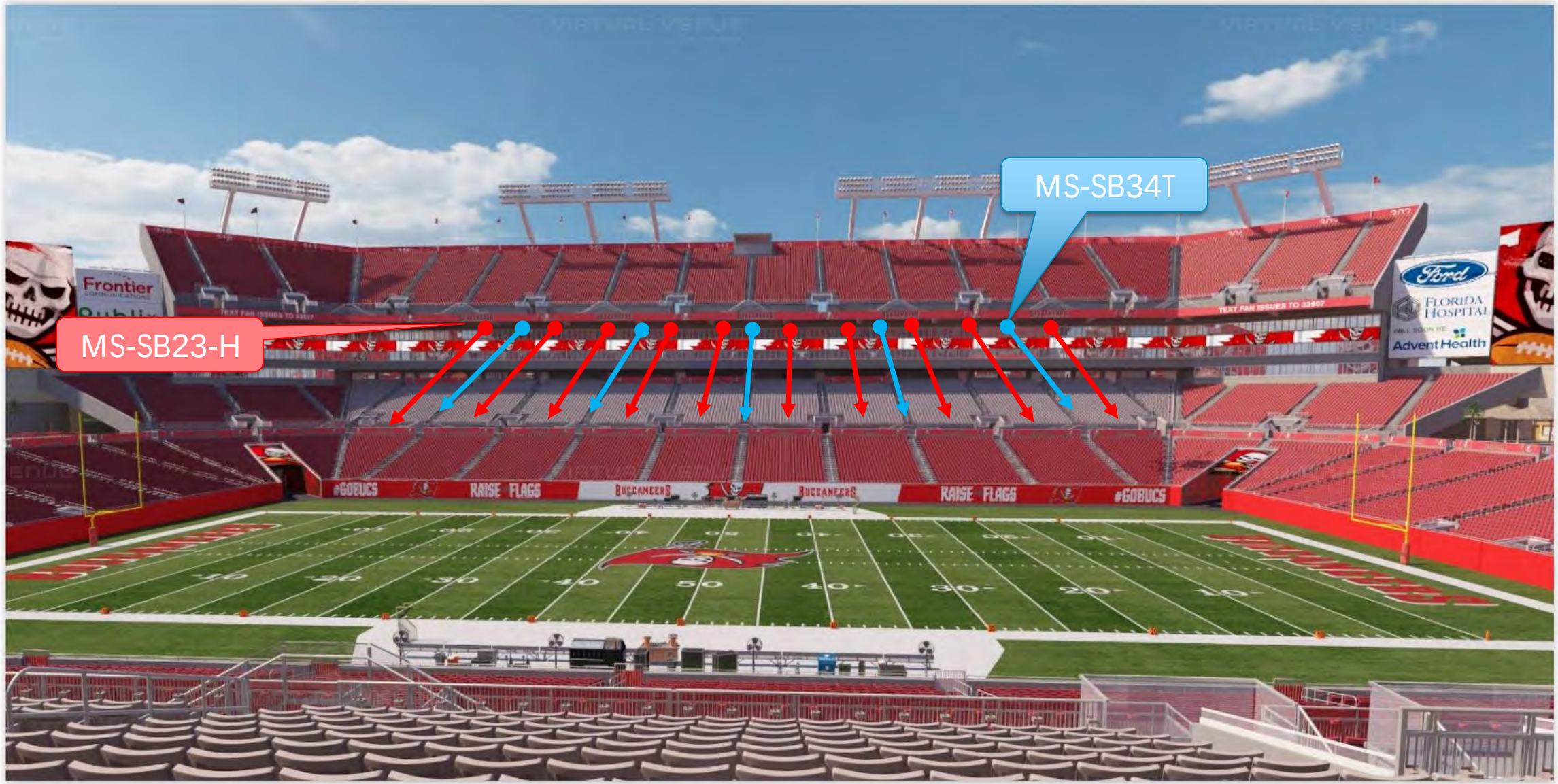
MobileNet Services

Antenna mounting locations – 300 Level Seating



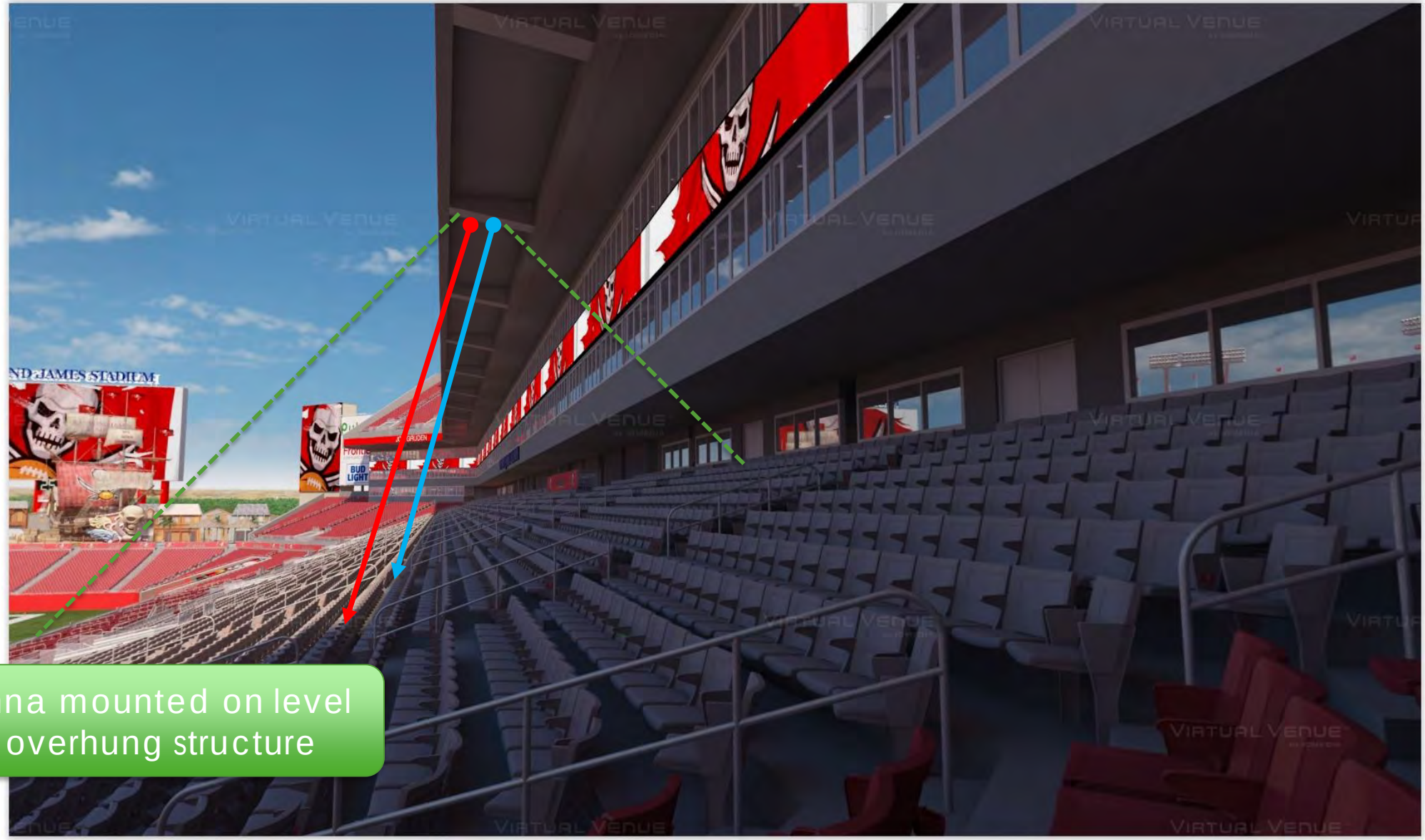
MobileNet Services

Antenna mounting locations – Levels 200/100 seating



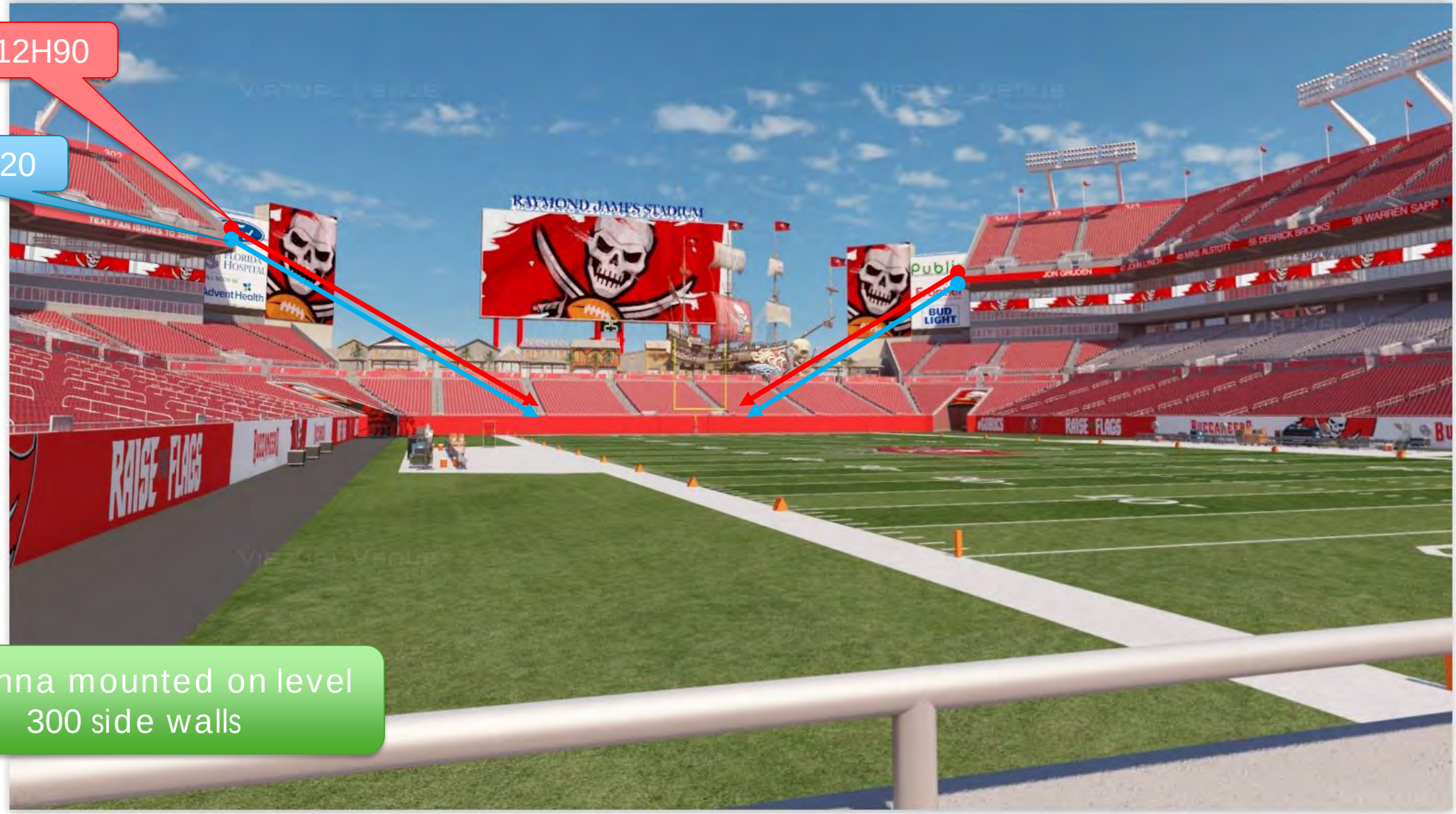
MobileNet Services

Antenna mounting locations – Levels 200/100 seating



MobileNet Services

Antenna mounting locations – End Zone seating area



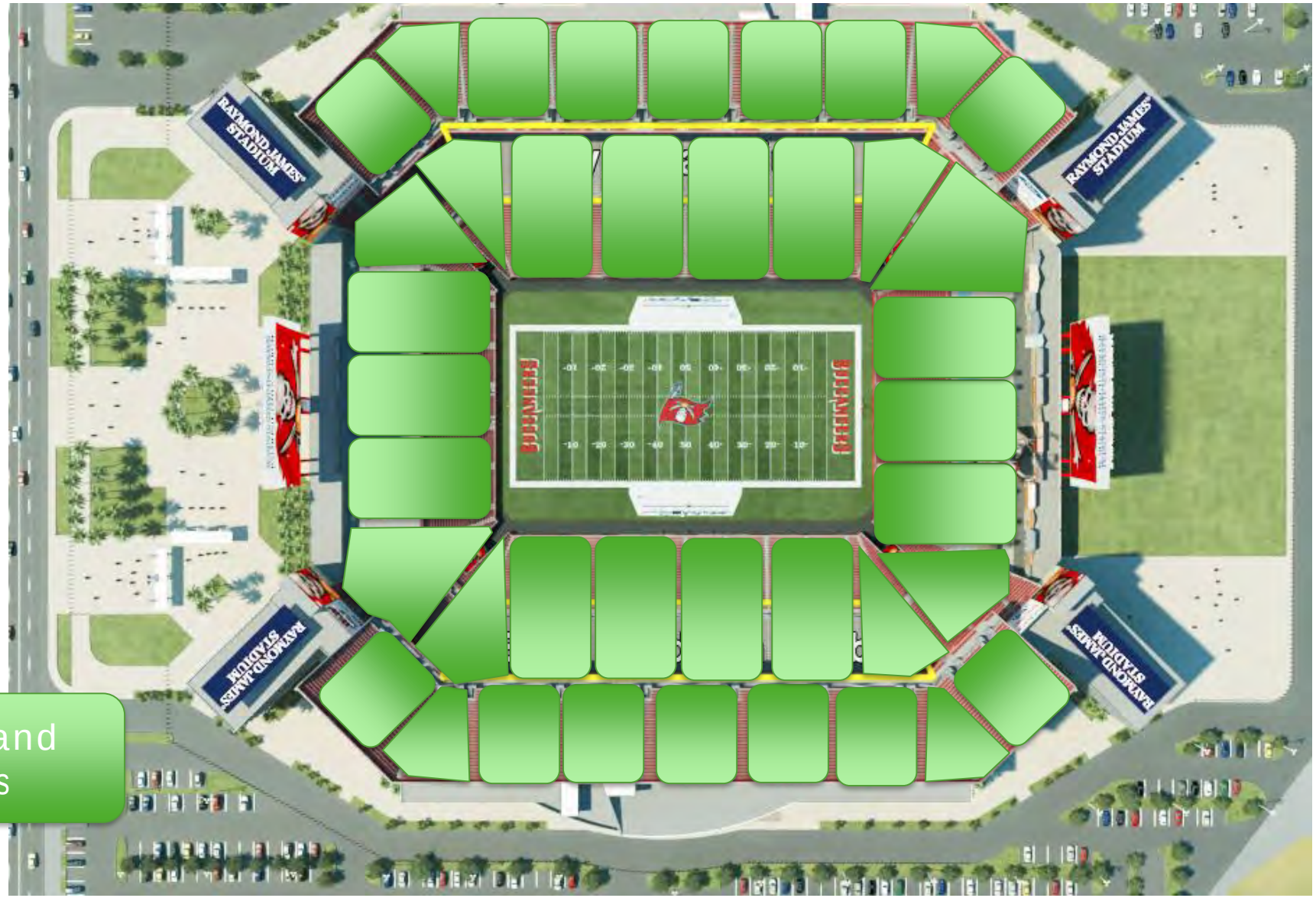
MobileNet Services

Raymond James Stadium – High Band Zone Count (option 2)

78 High Band Sectors

MobileNet Services

Raymond James Stadium – Low Band Zone Count (option 2)



40 Low Band Sectors

MobileNet Services

Antenna Spec Sheets – Option 2

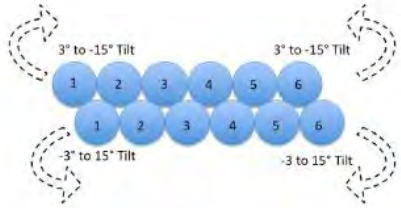
MS-12F45 (CBRS)

MATSING
LENS TECHNOLOGY ENABLED

MS-12F45

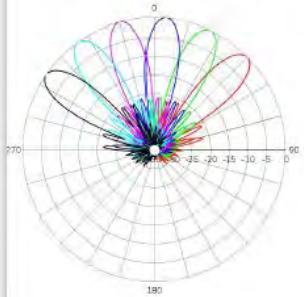
Multi-Beam Spherical Lens Antenna: Two rows of 6 independent CBRS frequency (3.3GHz – 4.2GHz) cross-polarized beams. Top and bottom rows have independent 15° tilt.

BEAM LAYOUT:

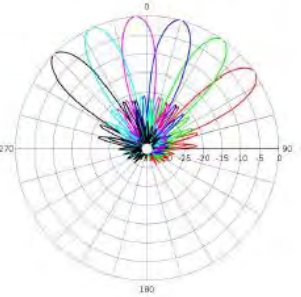


PATTERN RESULTS (3.6GHz):

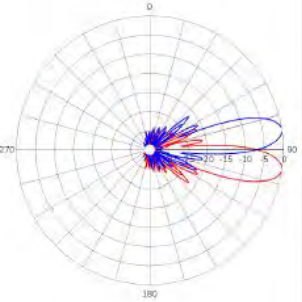
Horizontal Pattern top row



Horizontal Pattern bottom row



Vertical Pattern



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS PER BEAM	
Frequency	3.3GHz – 4.2GHz
Gain	22dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45°
Horizontal Coverage	120°
Horizontal Beamwidth (10dB)	20°
Horizontal Beamwidth (3dB)	12°
Vertical Beamwidth (10dB)	20°
Vertical Beamwidth (3dB)	12°
Beam Cross-over	10dB typical
Total Number of Beams	12
Tilt	3° to -15° upper row
≥12°beam separation required between the two rows	-3° to 15° lower row
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>28dB
Power Rating	100W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	24 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 45cm/18inch Antenna dimensions: 61 x 61 x 70 cm 24 x 24 x 27.5 inch
Antenna Weight	20kg 44lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C

EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MobileNet Services

MS-SB17-F (CBRS)

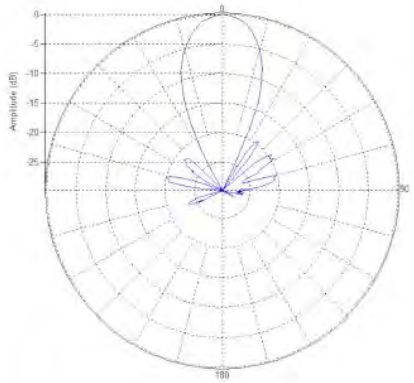
MATSING
LENS TECHNOLOGY ENABLED

MS-SB17-F

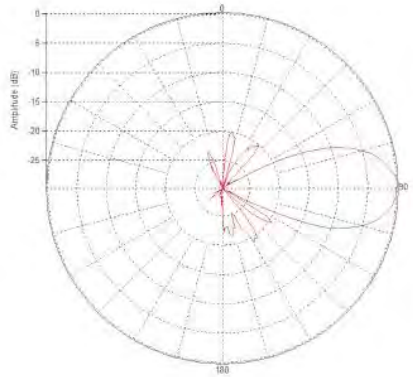
Lens Technology Enabled™ Base-Station Antenna perfect for stadium applications, utilizes a patented spherical lens design with 1 isolated CBRS-frequency (3300-4200MHz) cross-polarized beam. Beam has 2 cross-polarized ports for supporting 2X2 MIMO and low side-lobe levels.

PATTERN RESULTS (3.6GHz):

CBRS-Band Horizontal Pattern



CBRS-Band Vertical pattern



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

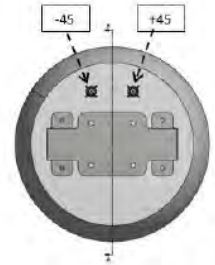
MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS	
Frequency	3300– 4200 MHz
Gain-U (United States)	18dBi
Gain	20dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45
Horizontal Coverage	40°
Horizontal Beamwidth (10dB)	30°
Vertical Beamwidth (10dB)	30°
Total Number of Beams	1
Number of Ports per Beam	2
First Sidelobe Level	<-20dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Power Rating	20W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	2 x 4.3-10 Female

MECHANICAL DATA	
Dimensions (H x W x D)	24 x 24 x 40 cm 9.5 x 9.5 x 16 inch
Antenna Weight	2 kg 4.4 lbs
Radome Material	Polycarbonate
Mounting	TBD

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load (Lateral)	TBD

Connector Layout



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MS-12H90 (HB)

MATSING
LENS TECHNOLOGY ENABLED

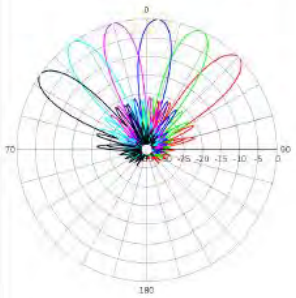
MS-12H90

Multi-Beam Wide Band Spherical Lens Antenna: 2 rows of 6 independent high frequency (1710-2690MHz) cross-polarized beams. Top and bottom row have independent 15° tilt.

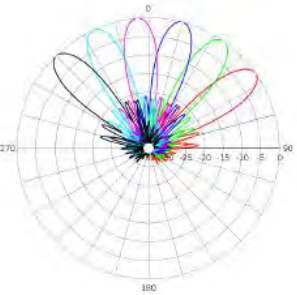
BEAM LAYOUT:

PATTERN RESULTS (1.8GHz):

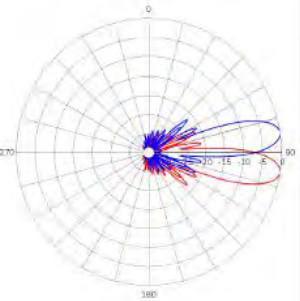
Horizontal Pattern top row



Horizontal Pattern bottom row



Vertical Pattern



EMAIL: Info@matsing.com **WEBSITE**: www.matsing.com **PHONE**: (949)585-5144

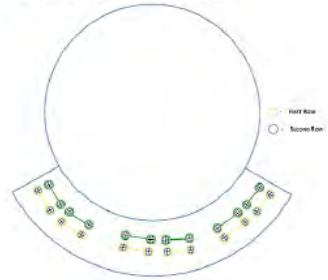
MATSING
LENS TECHNOLOGY ENABLED

TECHINCAL SPECIFICATIONS PER BEAM	
Frequency	1710-2690 MHz
Gain	22.5dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45°
Horizontal Coverage	120°
Horizontal Beamwidth (10dB)	20°
Horizontal Beamwidth (3dB)	12°
Vertical Beamwidth (10dB)	20°
Vertical Beamwidth (3dB)	12°
Beam Cross-over	10dB typical
Total Number of Beams	12
Tilt	9° upper row -9° lower row
First Sidelobe Level	<-16dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>28dB
Power Rating	200W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	24 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 90cm/35inch Antenna dimensions: 110 x 119 x 121 cm 43 x 47 x 48 inch
Antenna Weight	55kg 122lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load	754N @ 160km/h 170lbf @ 160km/h

SAMPLE CONNECTOR LAYOUT:



EMAIL: Info@matsing.com **WEBSITE**: www.matsing.com **PHONE**: (949)585-5144

MobileNet Services

MS-SB23-H (HB)

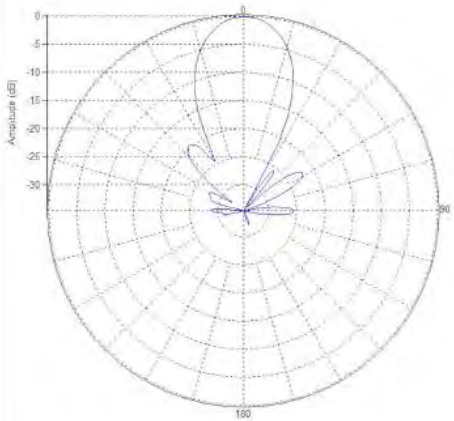
MATSING
LENS TECHNOLOGY ENABLED

MS-SB23-H

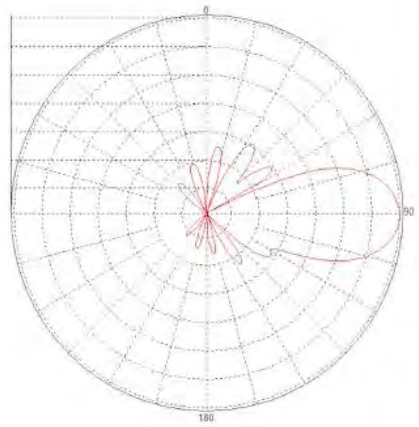
Lens Technology Enabled™ Base-Station Antenna perfect for stadium applications, utilizes a patented spherical lens design with 1 isolated high-frequency (1710-2690MHz) cross-polarized beam. Beam has 2 cross-polarized ports for supporting 2X2 MIMO and low side-lobes.

PATTERN RESULTS:

High-Band Horizontal Pattern (1.80GHz)



High-Band Vertical pattern (1.80GHz)



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

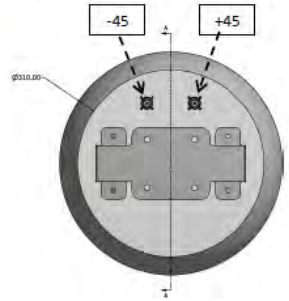
MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS	
Frequency	1710-2690 MHz
Gain	17.5dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45
Horizontal Coverage	40°
Horizontal Beamwidth (3dB)	23°
Vertical Beamwidth (3dB)	23°
Total Number of Beams	1
Number of Ports per Beam	2
First Sidelobe Level	<-20dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Power Rating	250W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	2 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	37 x 37 x 56 cm 14.5 x 14.5 x 22 inch
Antenna Weight	4 kg 9 lbs
Radome Material	Polycarbonate
Mounting	TBD

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load (Lateral)	TBD

Connector Layout



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

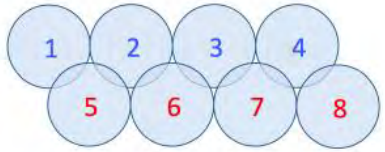
MS-8T120 (LB)

MATSING
LENS TECHNOLOGY ENABLED

MS-8T120

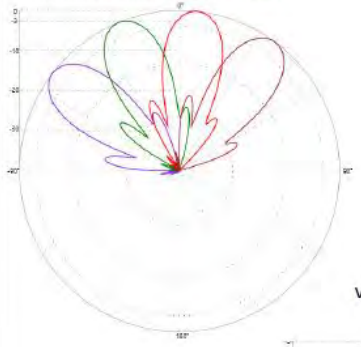
Multi-Beam Spherical Lens Antenna. Eight independent low-frequency (617-894MHz) cross-polarized beams with 2X2 MIMO support per beam.

Beam Layout:

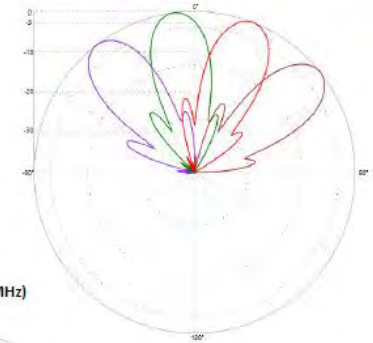


Pattern Results:

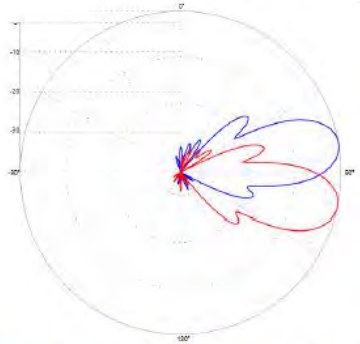
Horizontal Pattern Row 1 (850MHz)



Horizontal Pattern Row 2 (850MHz)



Vertical Pattern (850MHz)



EMAIL: Info@matsing.com **WEBSITE:** www.matsing.com **PHONE:** (949)585-5144

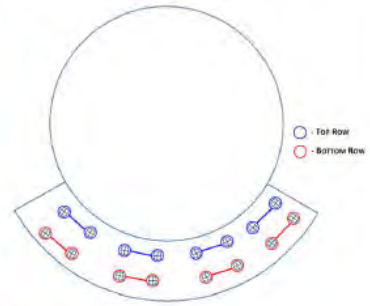
MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS PER BEAM	
Frequency	617-894 MHz
Gain	19dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45°
Horizontal Coverage per row	120°
Total coverage	135°
Horizontal Beamwidth (10dB)	30°
Horizontal Beamwidth (3dB)	17°
Vertical Beamwidth (10dB)	30°
Vertical Beamwidth (3dB)	17°
Beam Cross-over	10dB typical
Total Number of Beams	8
Tilt	Factory Set
First Sidelobe Level	<-15dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Isolation Port to Port – Beam	>26dB
Power Rating	250W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	16 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	Spherical Lens diameter: 120cm/47inch Antenna dimensions: 140 x 140 x 160 cm 55 x 55 x 62 inch
Antenna Weight	75kg/165lbs
Radome Material	Fibre Glass
Mounting	2 position pipe mount Compatible pipe diameter: 6.1 – 11.4 cm 2.4 – 4.5 inch

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load	TBD

SAMPLE CONNECTOR LAYOUT:



EMAIL: Info@matsing.com **WEBSITE:** www.matsing.com **PHONE:** (949)585-5144

MobileNet Services

MS-SB43-T (LB)

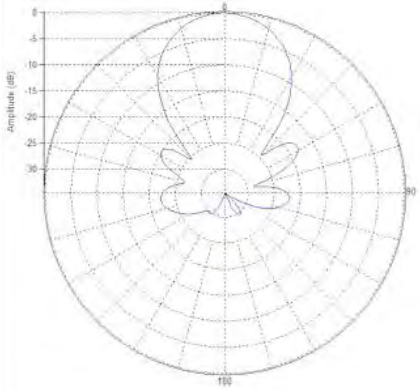
MATSING
LENS TECHNOLOGY ENABLED

MS-SB34-T

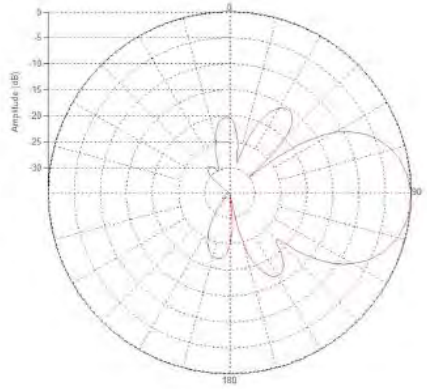
Lens Technology Enabled™ Base-Station Antenna perfect for stadium applications, utilizes a patented spherical lens design with 1 isolated low-frequency (617-894MHz) cross-polarized beam. Each Beam has 2 cross-polarized ports for supporting 2X2 MIMO and low side-lobes.

PATTERN RESULTS:

Low-Band Horizontal Pattern (800MHz)



Low-Band Vertical Pattern (800MHz)



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

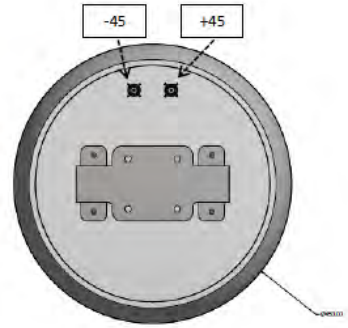
MATSING
LENS TECHNOLOGY ENABLED

TECHNICAL SPECIFICATIONS	
Frequency	617-894 MHz
Gain	14.2dBi
VSWR	<1.5:1
Polarization	Dual Slant ±45
Horizontal Coverage	60°
Horizontal Beamwidth (3dB)	34°
Vertical Beamwidth (3dB)	34°
Total Number of Beams	1
Number of Ports per Beam	2
Number of Ports Total	2
First Sidelobe Level	<-18dB
Front to Back Ratio	>28dB
Isolation Port to Port -Polarization	>28dB
Power Rating	250W per port
Intermodulation	<-153dBc
Impedance	50 ohm
Connector Quantity and Type	2 x 4.3-10 female

MECHANICAL DATA	
Dimensions (H x W x D)	45 x 45 x 66 cm 17 x 17 x 25 inch
Antenna Weight	6 kg 13 lbs
Radome Material	Polycarbonate
Mounting	TBD

ENVIRONMENTAL RATINGS	
Humidity	95% RH @ +30°C
Temperature	-40°C to +70°C
Wind load	TBD

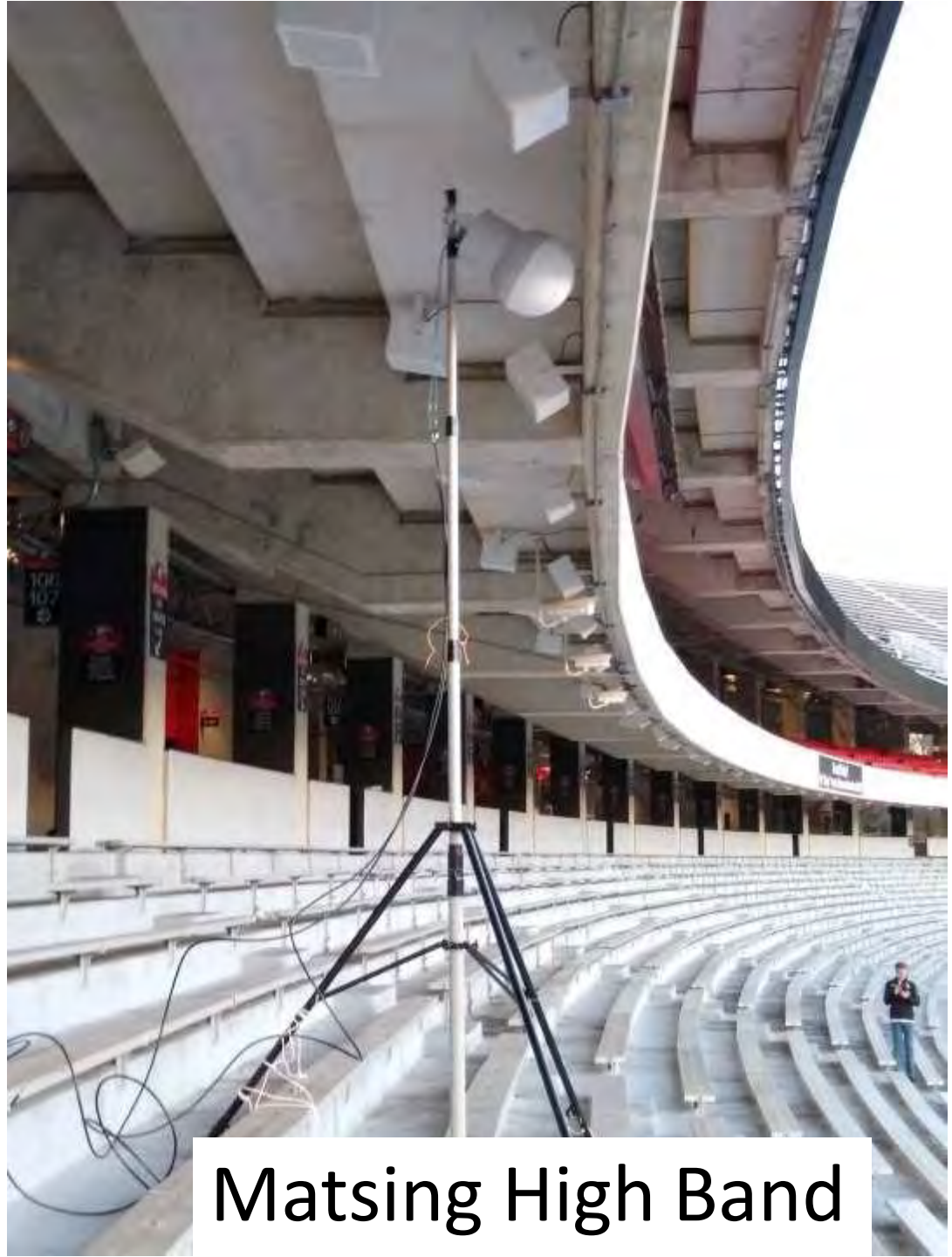
CONNECTOR LAYOUT:



EMAIL: Info@matsing.com WEBSITE: www.matsing.com PHONE: (949)585-5144

MobileNet Services

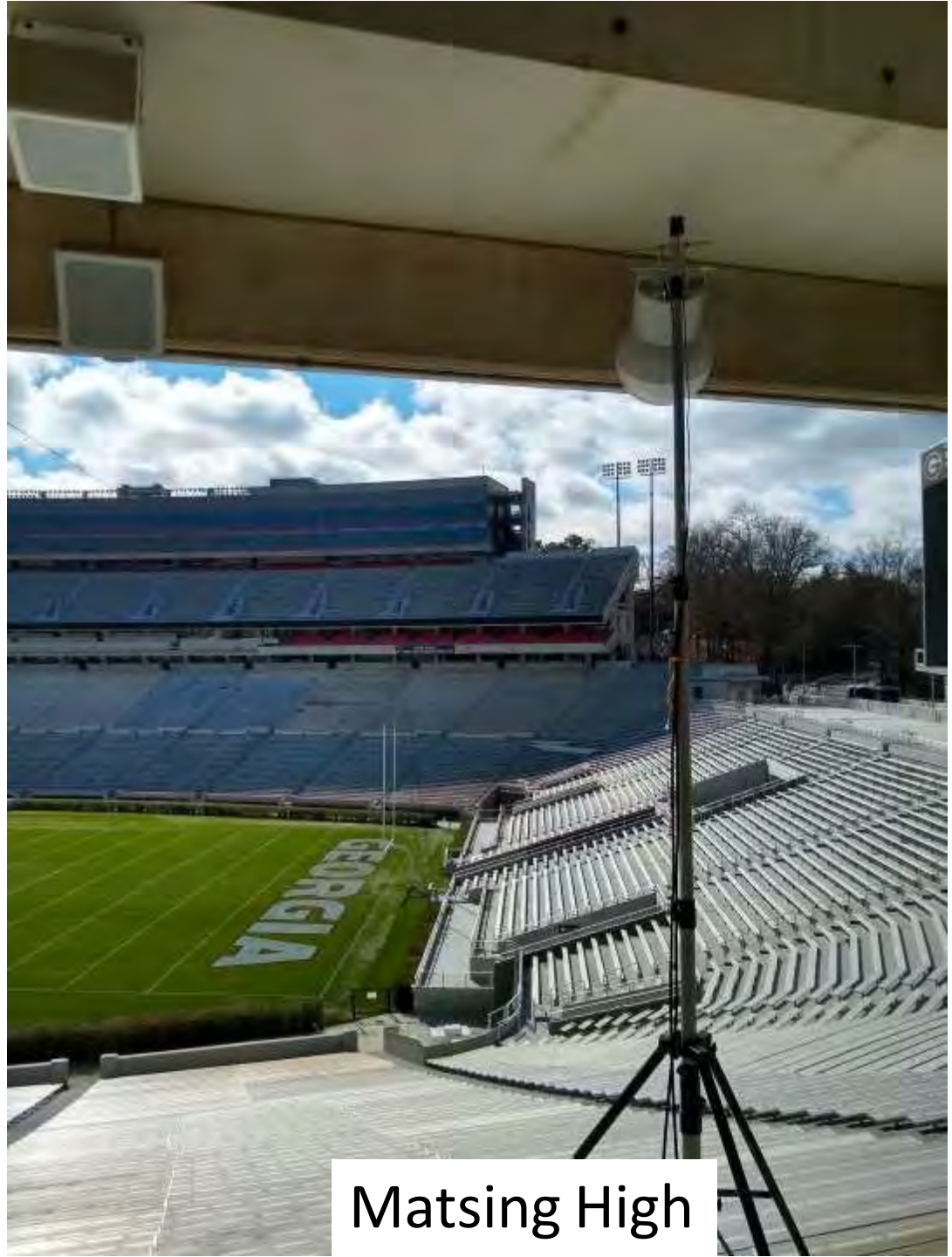
UGA CW Testing:
100 level



Matsing High Band

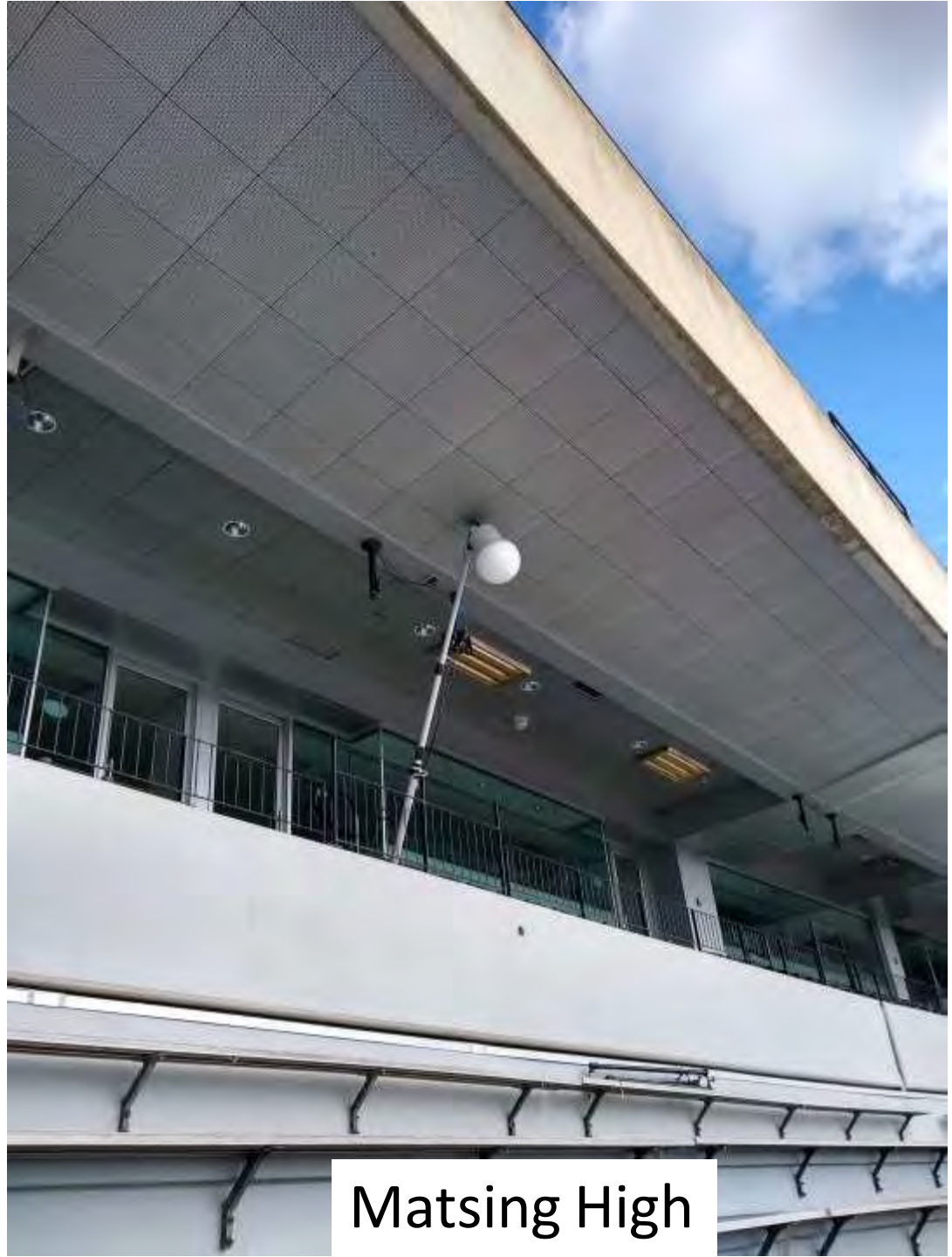
UGA CW Testing: 100 level

UGA CW Testing:
100 level Corner
Sec 102

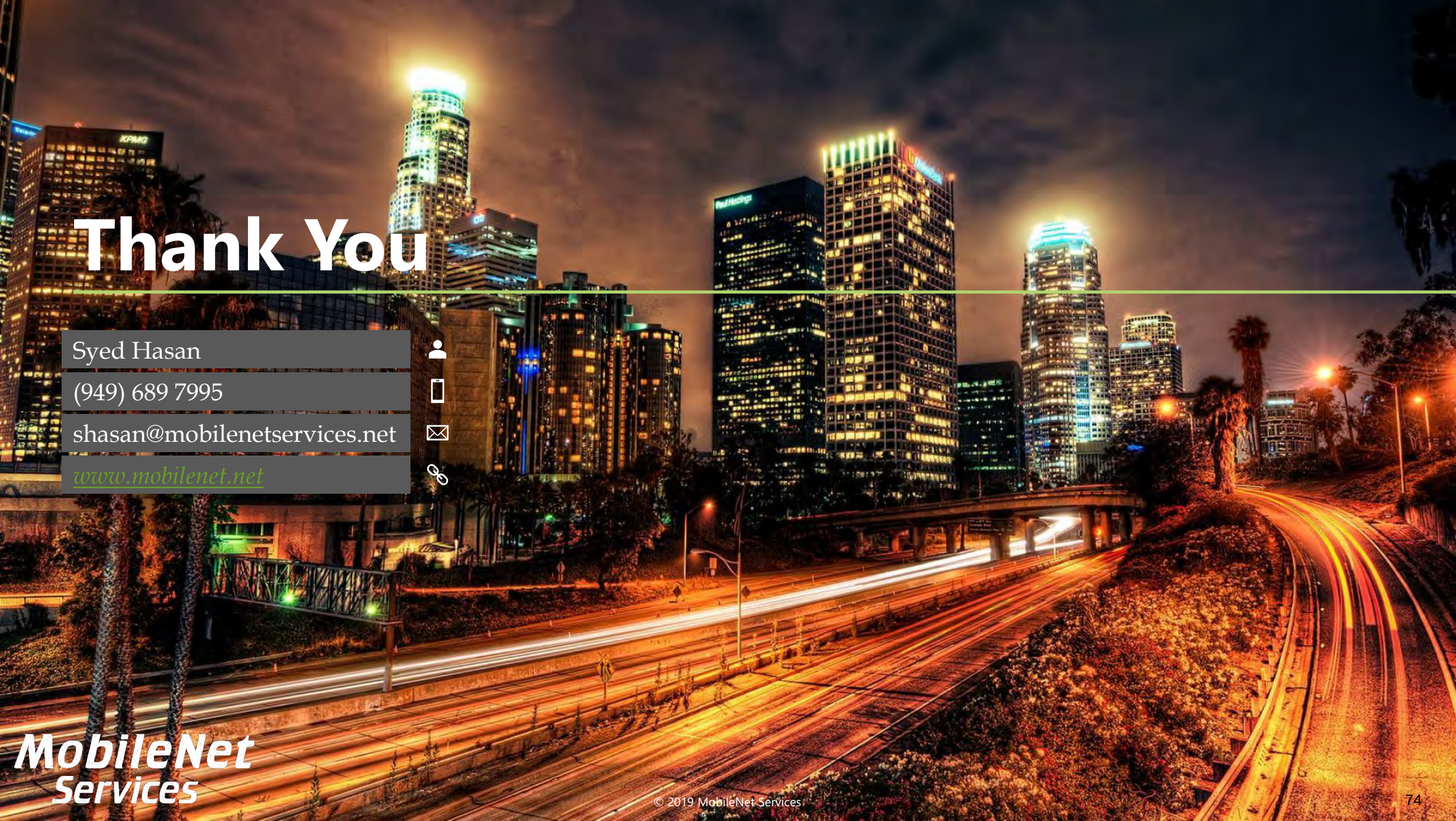


Matsing High

UGA CW Testing:
300 level End Zone



UGA CW Testing: 300 level End Zone



Thank You

Syed Hasan

(949) 689 7995

shasan@mobilenetservices.net

www.mobilenet.net

MobileNet Services