

Application Notes: 2195852-1 Antennas

Product Description

- Tab mount PCB antenna type (Dimension 55.0 x 20.0 x 1.6mm)
- Omnidirectional coverage
- Tab mount with plated through holes
- Covers 3G, LTE/Cellular,5G global region, BT/WiFi, GNSS spectrum
- Best performance with 110mm ground plane length

OVERVIEW

This application note describes the RF performance of the 2195852-1 (698-5875 MHz) antenna series in free space, and how the RF performance is impacted by some common factors when the antennas are integrated into a device.

The common factors discussed in this document include the size and the shape of the ground plane, and the clearance distance to some large metallic structures nearby the antennas. The large metallic structures can be the presentative of a different PCB ground plane, metallic enclosure of the device, a display, or any large metallic part inside the device.

This document covers many common installation scenarios. If you have a scenario that is not covered in this document, please contact us to discuss your design-in requirements.

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1. BASIC ANTENNA SPECIFICATIONS

1 a. Electrical, Mechanical & Environmental Performance*

Electrical						
Frequency Range (MHz)	698-960	1420-1630	1710-2700	3200-3800	4400-5000	5150-5875
VSWR	<7.8:1	< 2.4:1	< 5.3:1	< 3.8:1	<3.0:1	< 4.0:1
Average Efficiency	65 %	57 %	43 %	69 %	58 %	56 %
Peak Gain	2.92 dBi	2.03 dBi	0.55 dBi	3.37 dBi	3.22 dBi	4.86 dBi
Power Handling	10 Watt cw					
Polarization	Linear					
Mechanical						
Size mm (in.)	55.0 x 20.0 x 1.6 mm (2.17 x 0.79 x 0.063 in.)					
Weight g (oz.)	<3.5 g (<0.123 oz.)					
Mounting	Tab mounting with plated through holes					
Mating Connectors	Tab type					
Environmental						
Operating Temperature	-40 to +85°C					
Storage Temperature	-40 to +85°C					

* Electrical, Mechanical & Environmental Performance in this table is for the 2195852-1 antenna. For full 2195852-1 datasheet, drawing, CAD files and specifications please visit product landing page.

1 b. Frequency Bands

This antenna covers 3G, LTE/Cellular,5G global region, BT/WiFi, and GNSS spectrum (698 - 5875 MHz)

Band	Up Link (MHz)		Down Link (MHz)		Support	Band	Up Link (MHz)		Down Link (MHz)		Support
Band 1	1920	1980	2110	2170	✔	**Band 50**	1432		1517		✔
Band 2	1850	1910	1930	1990	✔	**Band 51**	1427		1432		✔
Band 3	1710	1785	1805	1880	✔	**Band 53**	2483.5		2495		✔
Band 4	1710	1755	2110	2155	✔	**Band 65**	1920	2010	2110	2200	✔
Band 5	824	849	869	894	✔	**Band 66**	1710	1780	2110	2200	✔
Band 7	2500	2570	2620	2690	✔	**Band 67**	N/A		738	758	✔
Band 8	880	915	925	960	✔	**Band 68**	698	728	753	783	✔
Band 12	699	716	729	746	✔	**Band 69**	N/A		2570	2620	✔
Band 13	777	787	746	756	✔	**Band 70**	1695	1710	1995	2020	✔
Band 14	788	798	758	768	✔	**Band 71**	663	698	617	652	X
Band 18	815	830	960	875	✔	**Band 74**	1427	1470	1475	1518	✔
Band 20	832	862	791	821	✔	**Band 75**	N/A		1432	1517	✔
Band 21	1447.9	1462.9	1495.5	1510.9	✔	**Band 76**	N/A		1427	1432	✔
Band 22	3410	3500	3510	3600	✔	**Band 77**	3300			4200	✔
Band 23	2000	2020	2180	2200	✔	**Band 78**	3300			3800	✔
Band 24	1626.5	1660.5	1525	1559	✔	**Band 79**	4400			5000	✔
Band 25	1850	1915	1930	1995	✔	**Band 80**	1710	1785	N/A		✔
Band 26	814	849	859	894	✔	**Band 81**	880	915	N/A		✔
Band 28	703	748	758	803	✔	**Band 82**	832	862	N/A		✔
Band 29	N/A		717	728	✔	**Band 83**	703	748	N/A		✔
Band 30	2305	2315	2350	2360	✔	**Band 84**	1920	1980	N/A		✔
Band 31	452.5	457.5	462.5	467.5	X	**Band 86**	1710	1780	N/A		✔
Band 32	N/A		1452	1496	✔	**Band 89**	824	849	N/A		✔
Band 34	2010			2025	✔	**Band 90**	2496			2690	✔
Band 38	2570			2620	✔	**Band 91**	832	862	1427	1432	✔
Band 39	1880			1920	✔	**Band 92**	832	862	1432	1517	✔
Band 40	2300			2400	✔	**Band 93**	880	915	1427	1432	✔
Band 41	2496			2690	✔	**Band 94**	880	915	1432	1517	✔
Band 42	3400			3600	✔	**Band 95**	2010	2025	N/A		✔
Band 43	3600			3800	✔	**Band 96**	5925			7125	X
Band 44	703			803	✔	**Band 97**	2300	2400	N/A		✔
Band 46	5150			5925	✔	**Band 98**	1880	1920	N/A		✔
Band 47	5855			5925	✔	**Band 99**	1626.5	1660.5	N/A		✔
Band 48	3550			3700	✔						

GNSS, BT and Wi-Fi Bands Coverage

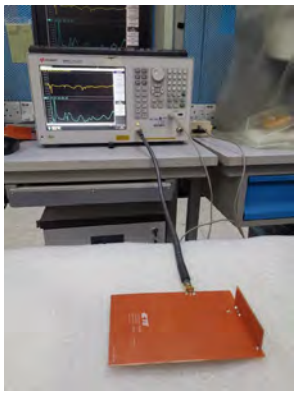
GNSS System	Band	Frequency (MHz)	Fc (MHz)	Support	GNSS System	Band	Frequency (MHz)	Fc (MHz)	Support	BT/ Wi-Fi Band	Frequency (MHz)	Fc (MHz)	Support
GPS	L1	1565 - 1586	1575.42	✔	**QZSS**	L1	1565 - 1586	1575.42	✔	**2.4 GHz**	2400 - 2485	2443	✔
	L2	1217 - 1238	1248.06	X		L2C	1217 - 1238	1227.6	X	**5 GHz**	5125 - 5875	5513	✔
	L5	1164 - 1189	1176.45	X		L5	1164 - 1189	1176.45	X	**6 GHz**	5925 - 7125	6525	X
BeiDou	B1	1559 - 1592	1575.42	✔		L6(LEX)	1258 - 1300	1278.75	X				
	B2a	1164 - 1189	1176.45	X	**IRNSS**	L5	1164 - 1189	1176.45	X				
	B2b	1186 - 1217	1207.14	X	**Other**	G1	1596 - 1610	1600.995	✔				
	B3	1258 - 1280	1268.52	X		G2	1241 - 1255	1248.06	X				
Galileo	E1	1563 - 1588	1575.42	✔		G3	1189 - 1212	1207.14	X				
	E5a	1164 - 1189	1176.45	X									
	E5b	1186 - 1217	1207.17	X									
	E6	1258 - 1300	1278.75	X									

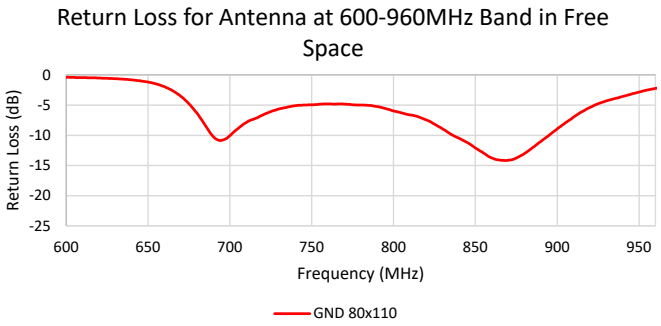
2. RF PERFORMANCE IN FREE SPACE

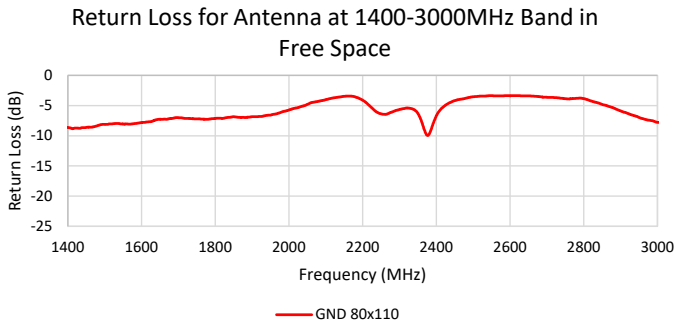
2 a. Return Loss

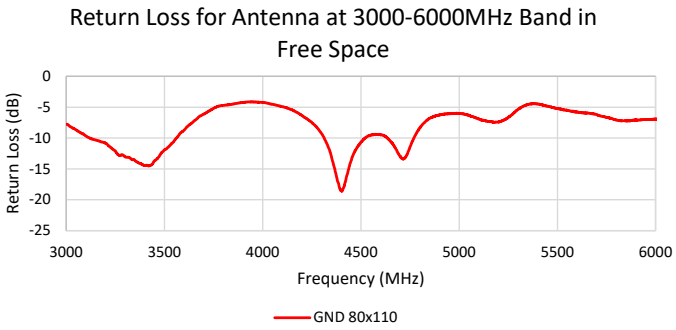
Test Setup

- VNA (9kHz-8.5GHz)
- The antenna is mounted on an 80mm X 110mm X 1.0mm ground plane.





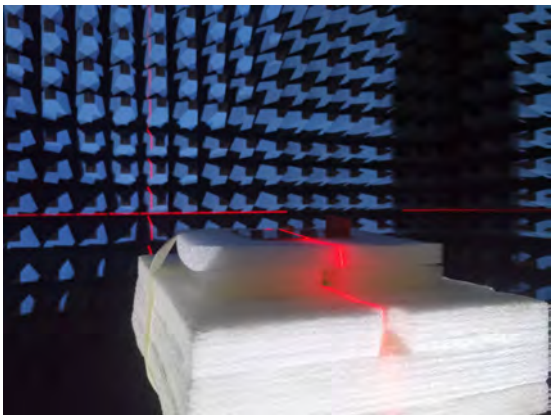


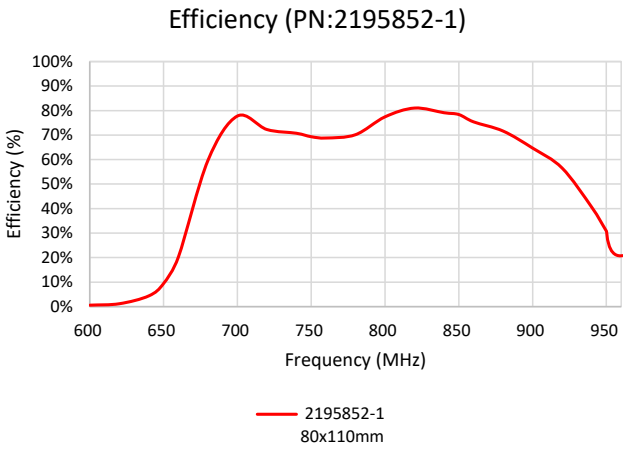


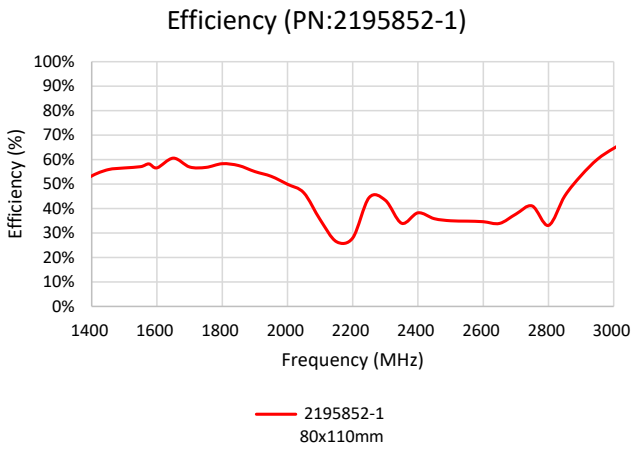
2 b. Total Efficiency

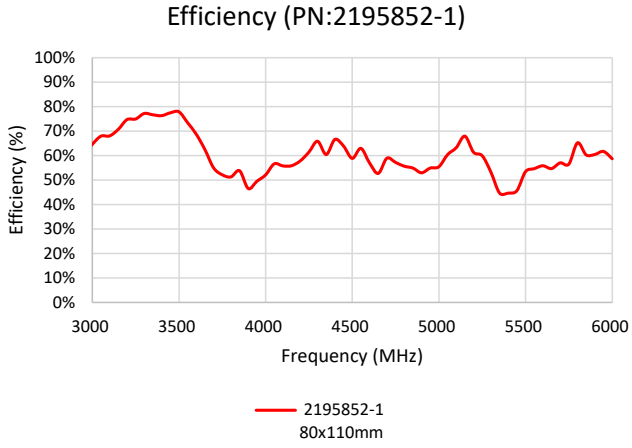
Test Setup

- Antenna Anechoic Chamber (400MHz-6GHz)
- The antenna is mounted on an 80mm X 110mm X 1.0mm ground plane.



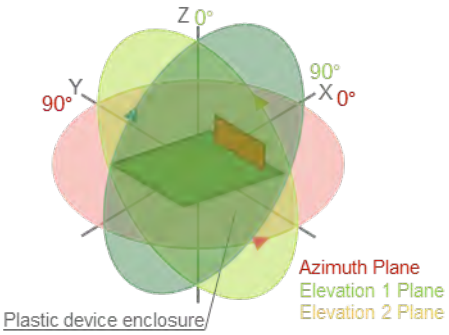




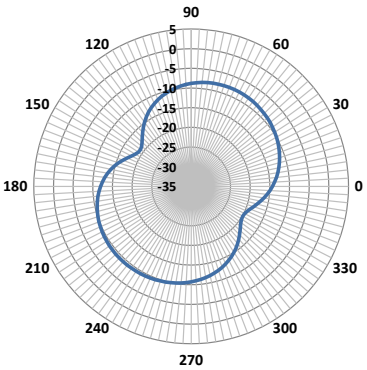


2 c. Gain Radiation Patterns 2D

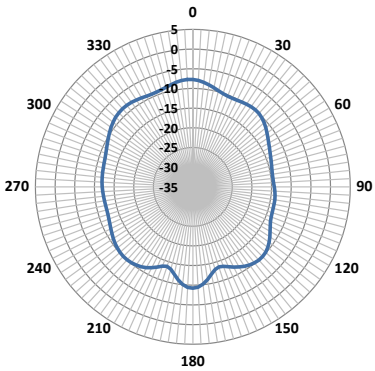
Total Gain Radiation Patterns (3D) of the Antenna with 80mm x 110mm Ground Plane (PN: 2195852-1)



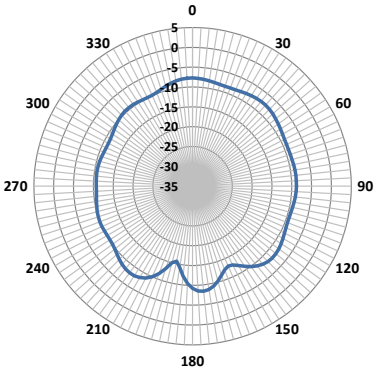
XY - 650MHz



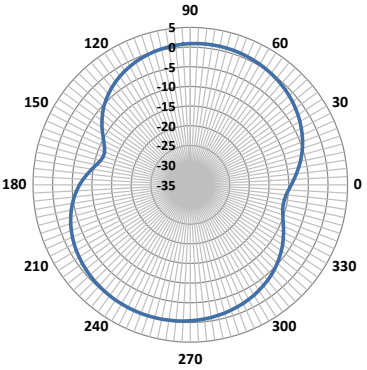
XZ - 650MHz



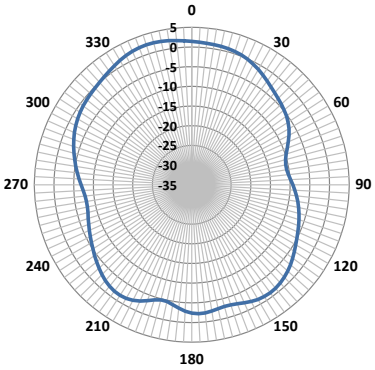
YZ - 650MHz



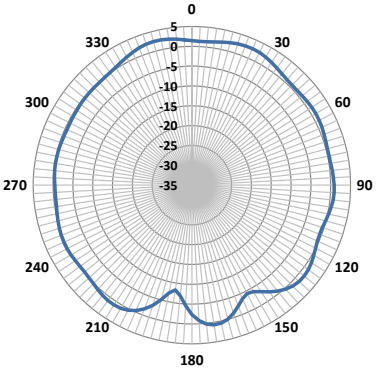
XY - 700MHz



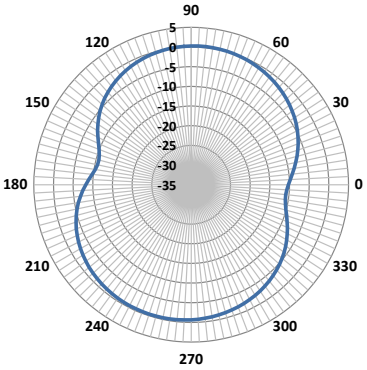
XZ - 700MHz



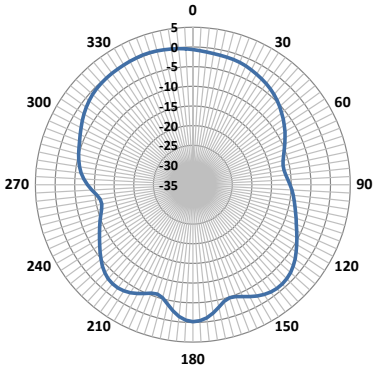
YZ - 700MHz



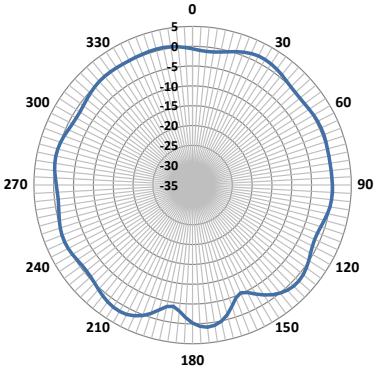
XY - 750MHz



XZ - 750MHz

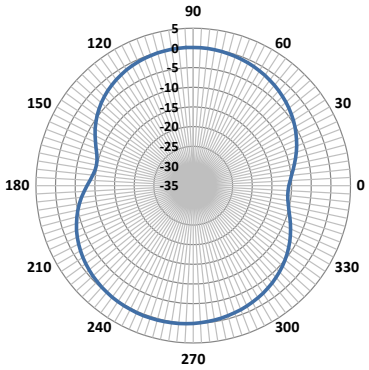


YZ - 750MHz

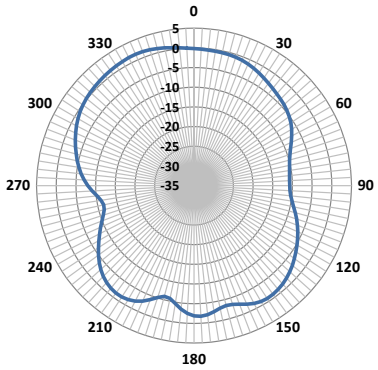


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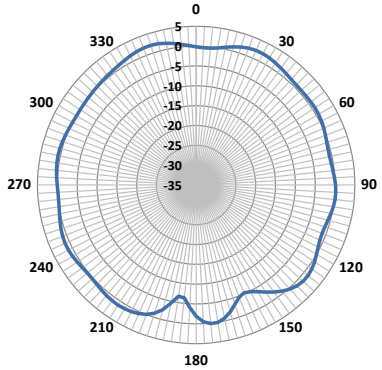
XY - 850MHz



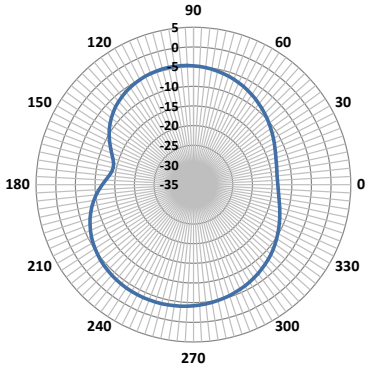
XZ - 850MHz



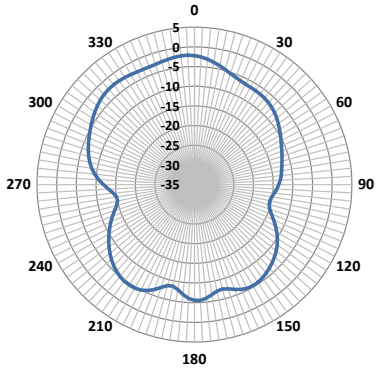
YZ - 850MHz



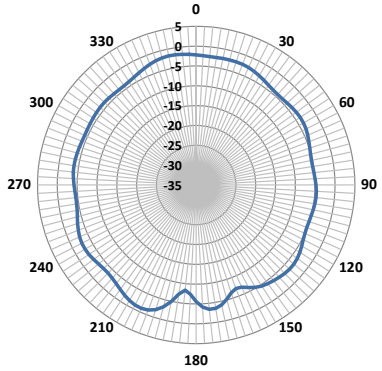
XY - 950MHz



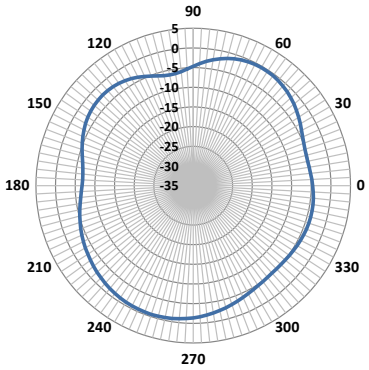
XZ - 950MHz



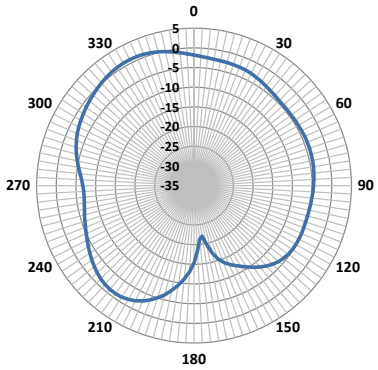
YZ - 950MHz



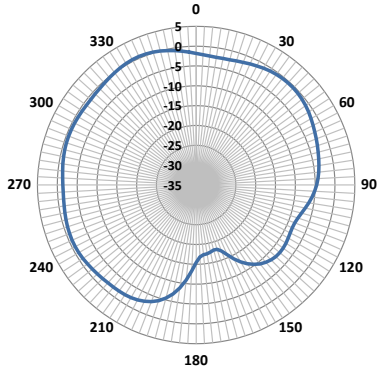
XY - 1575MHz



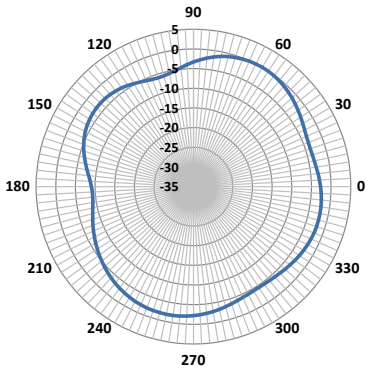
XZ - 1575MHz



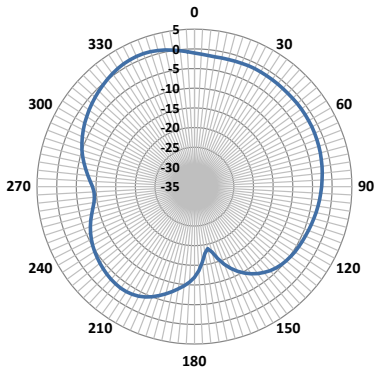
YZ - 1575MHz



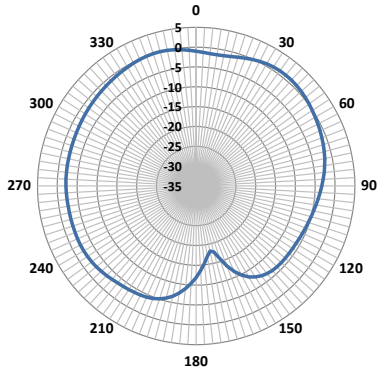
XY - 1700MHz



XZ - 1700MHz

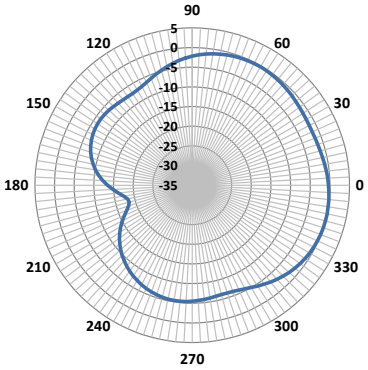


YZ - 1700MHz

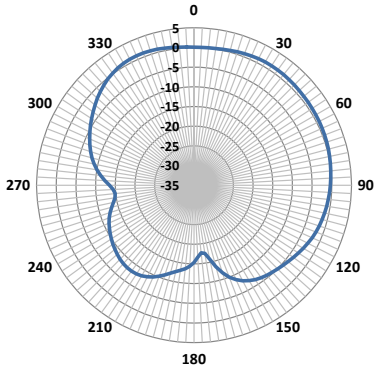


2 c. Gain Radiation Patterns 2D Contd.

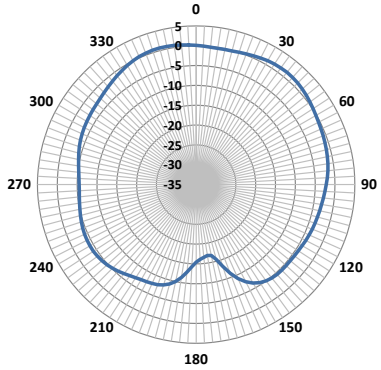
XY - 1900MHz



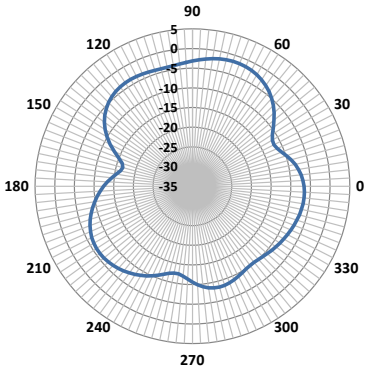
XZ - 1900MHz



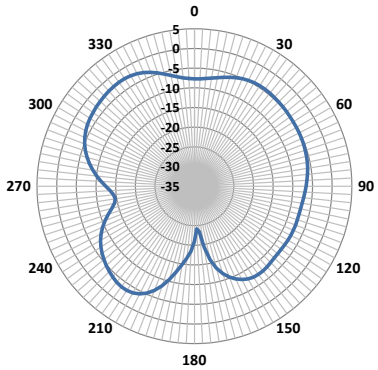
YZ - 1900MHz



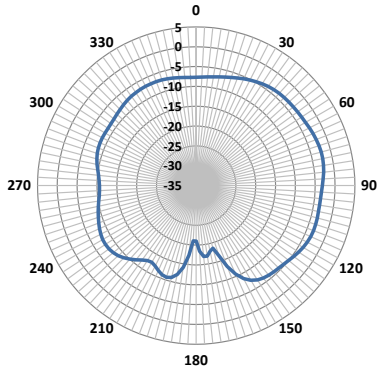
XY - 2200MHz



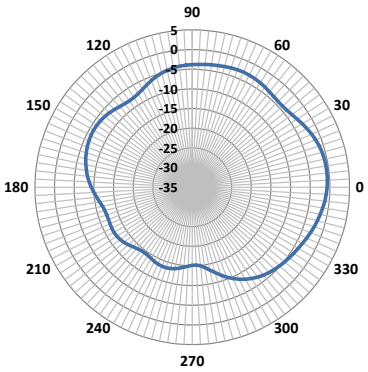
XZ - 2200MHz



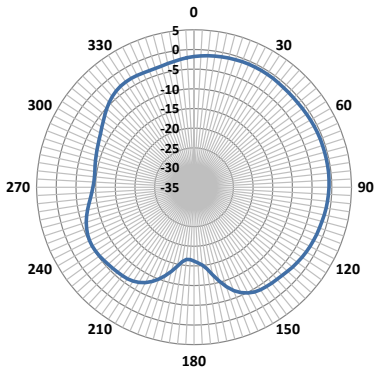
YZ - 2200MHz



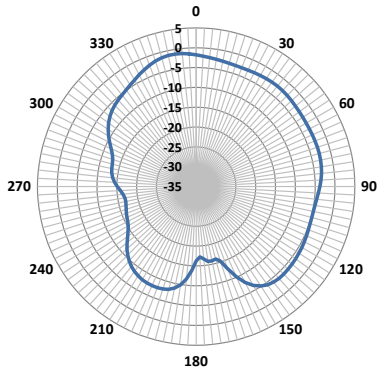
XY - 2450MHz



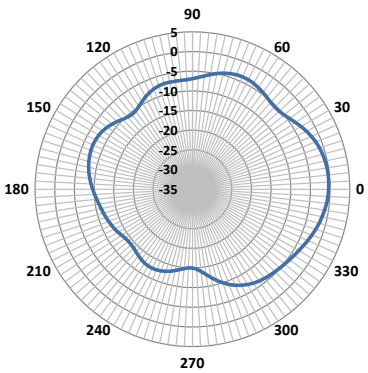
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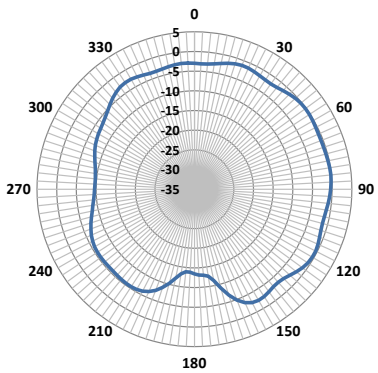
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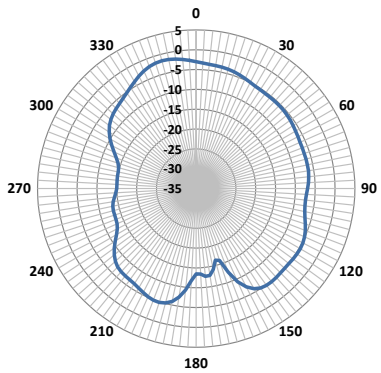
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XZ - 2600MHz

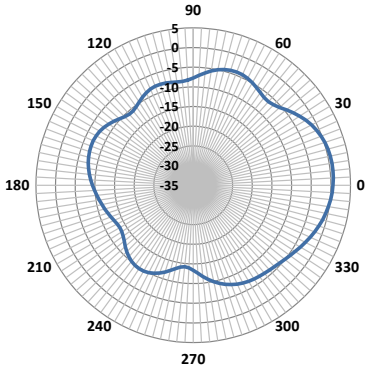


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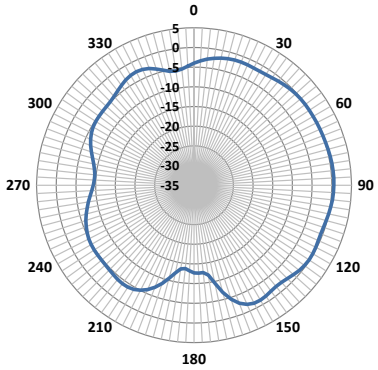


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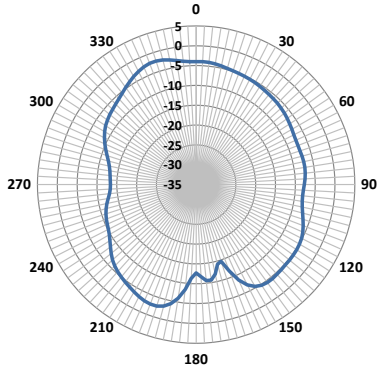
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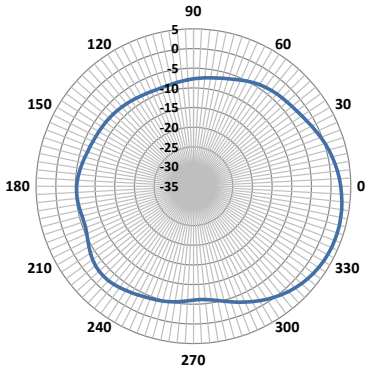
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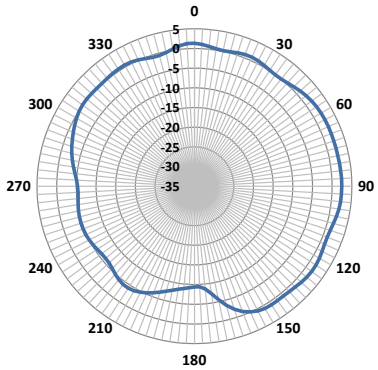
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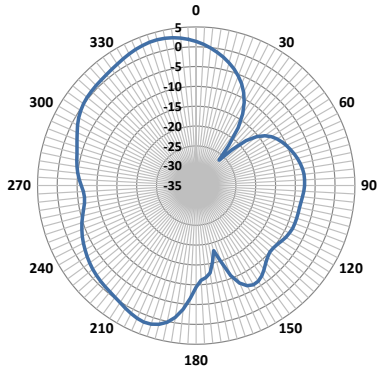
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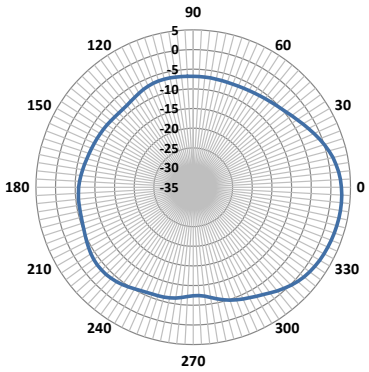
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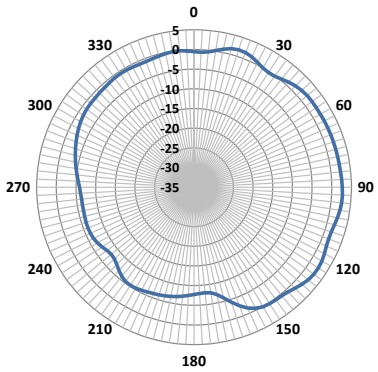
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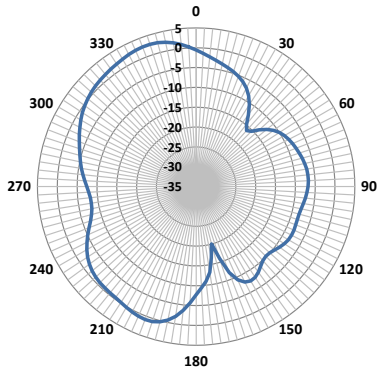
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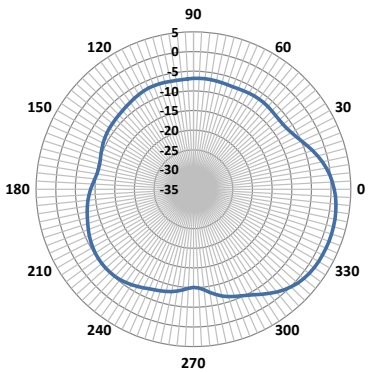
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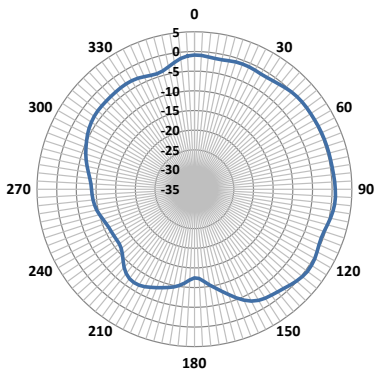
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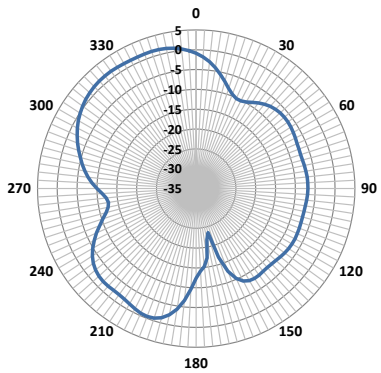
XY - 3800MHz



XZ - 3800MHz

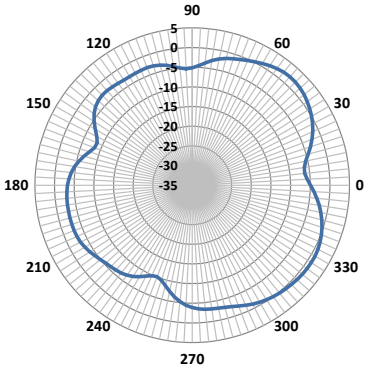


YZ - 3800MHz

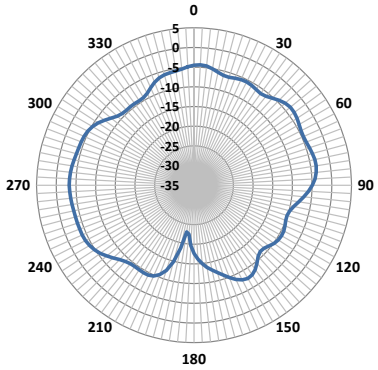


2 c. Gain Radiation Patterns 2D Contd.

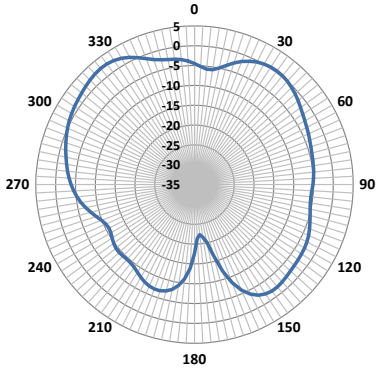
XY - 4500MHz



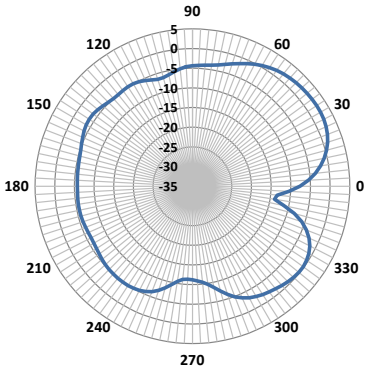
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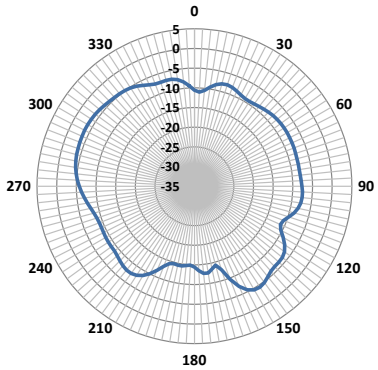
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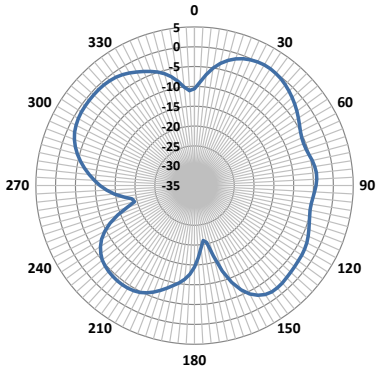
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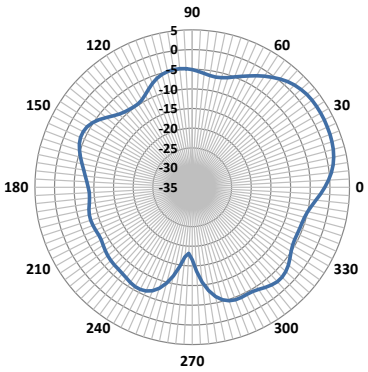
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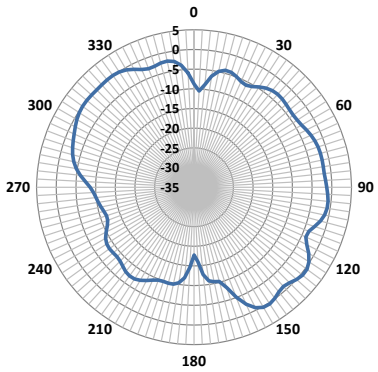
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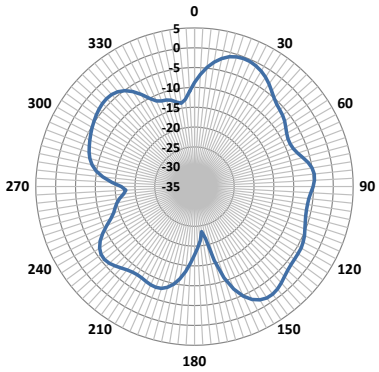
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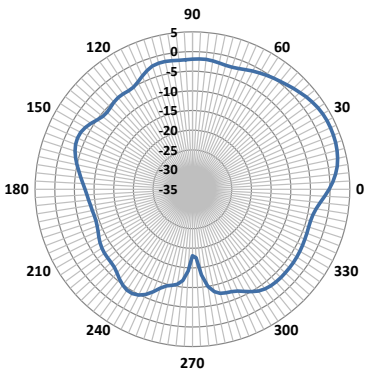
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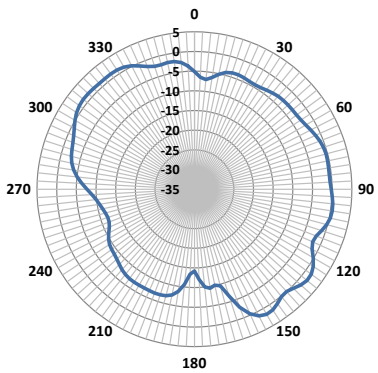
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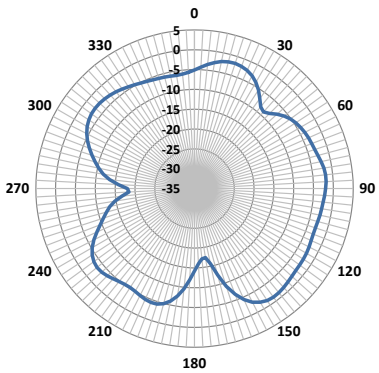
XY - 5800MHz



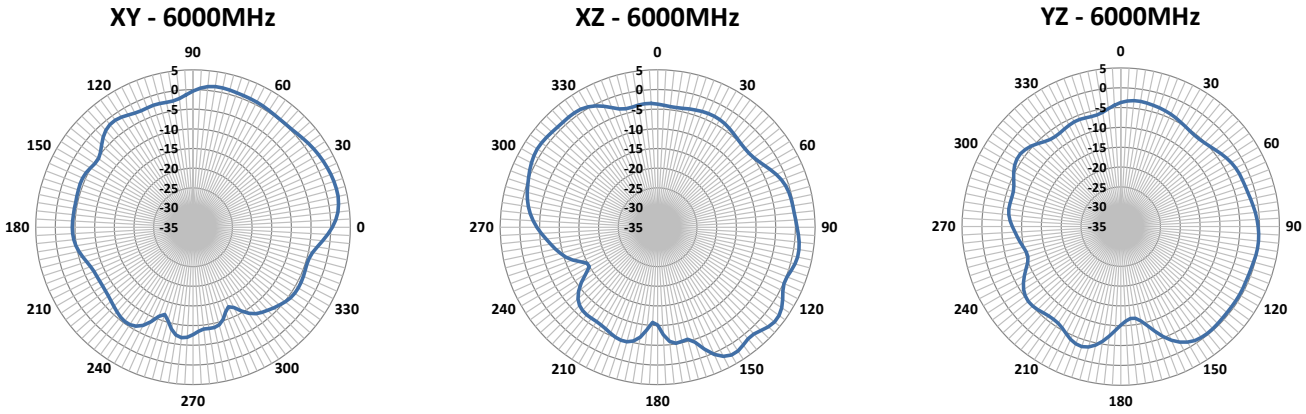
XZ - 5800MHz



YZ - 5800MHz

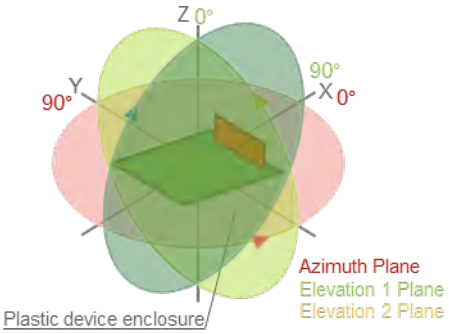


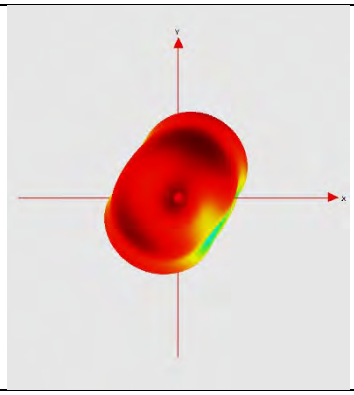
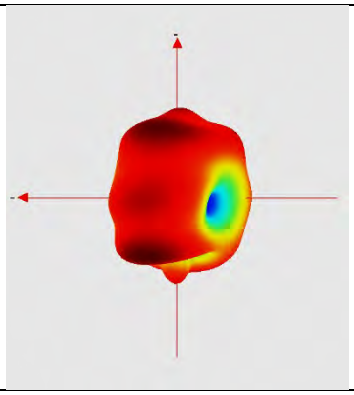
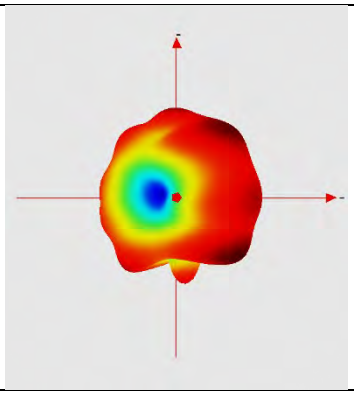
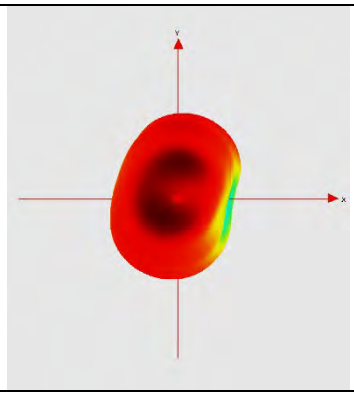
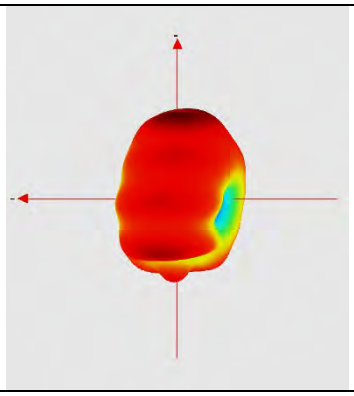
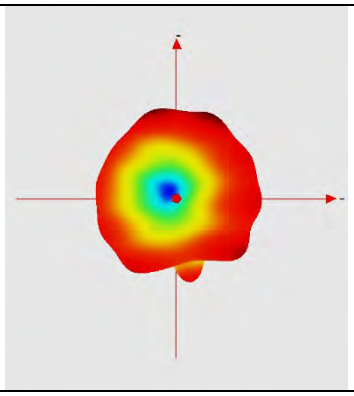
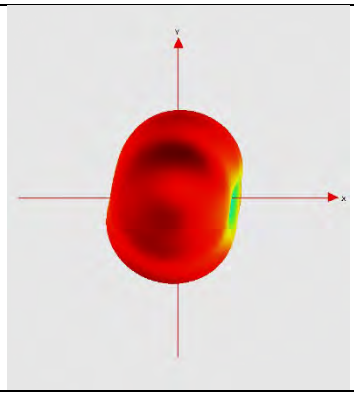
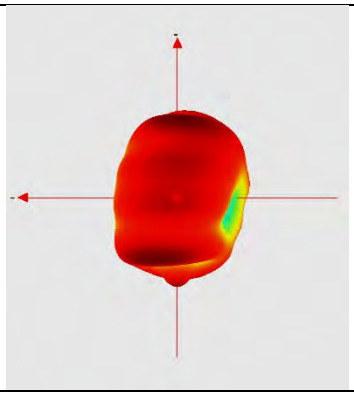
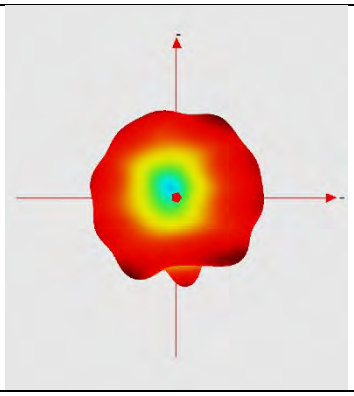
2 c. Gain Radiation Patterns 2D Contd.



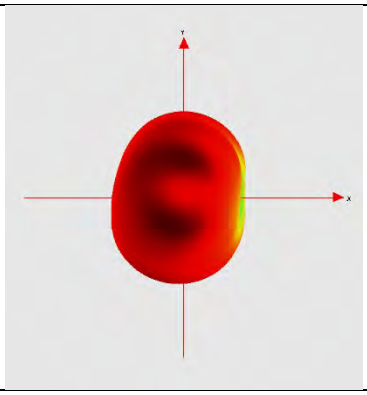
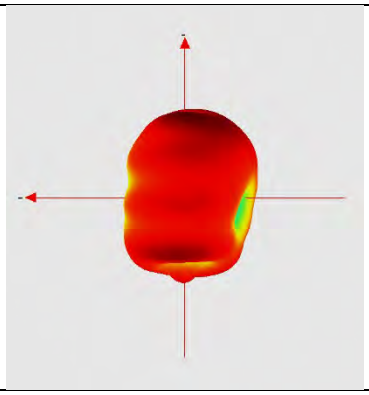
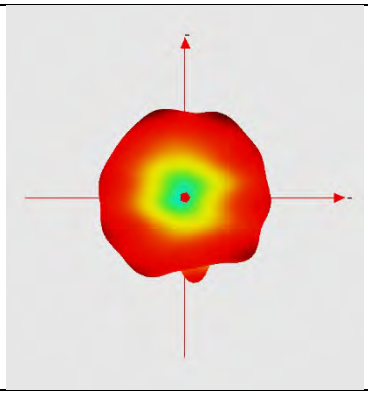
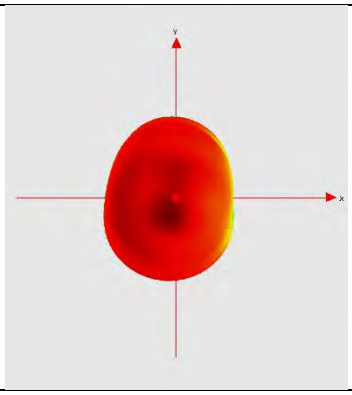
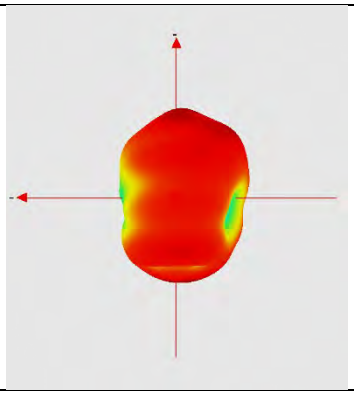
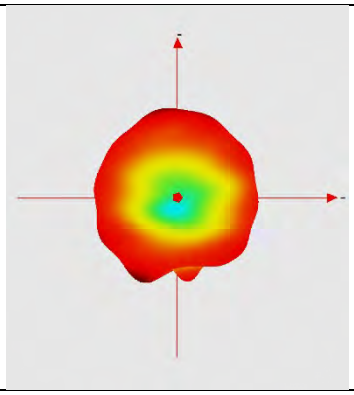
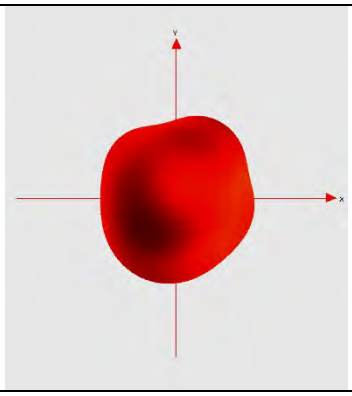
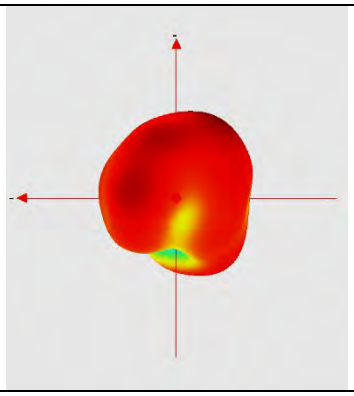
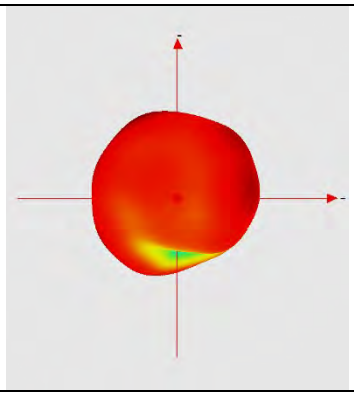
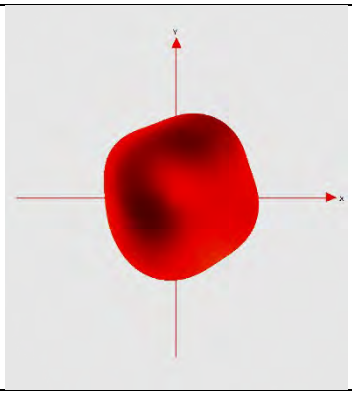
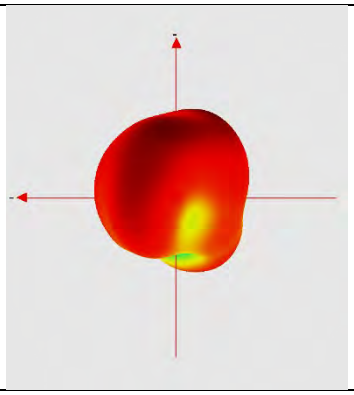
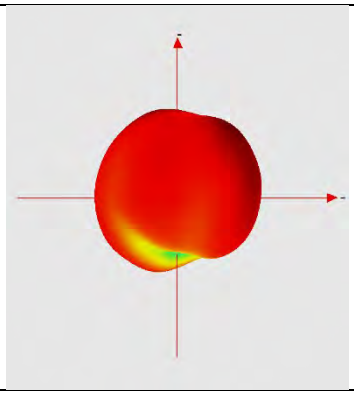
2 d. Gain Radiation Patterns 3D

Total Gain Radiation Patterns (3D) of the Antenna with 80mm x 110mm Ground Plane (PN: 2195852-1)

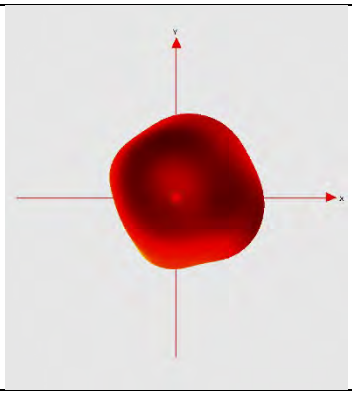
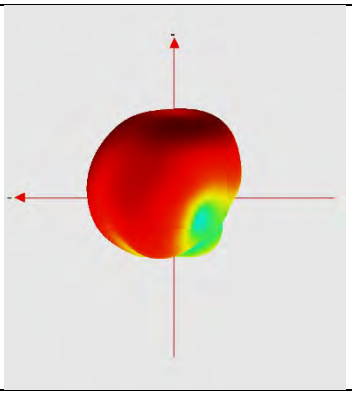
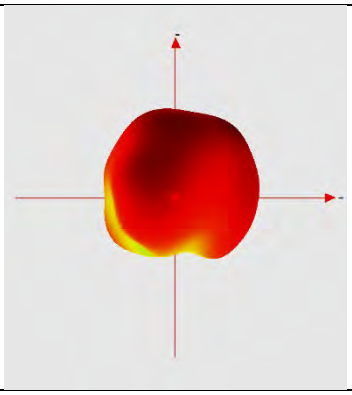
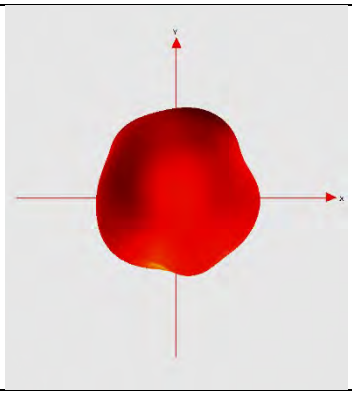
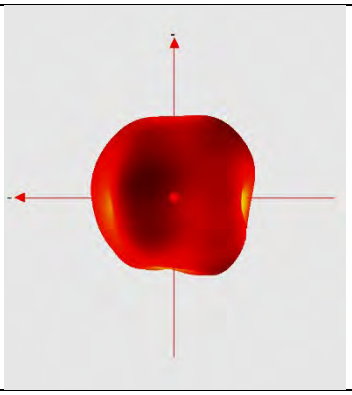
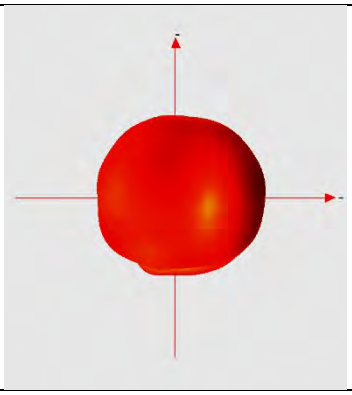
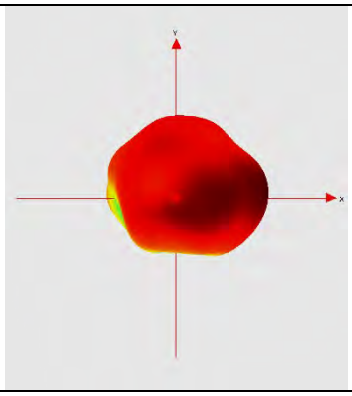
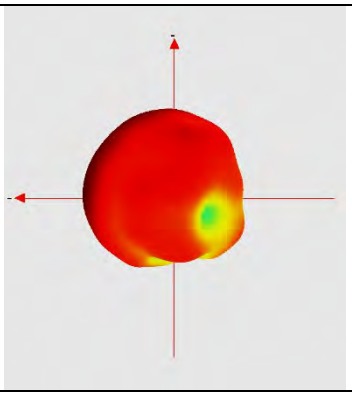
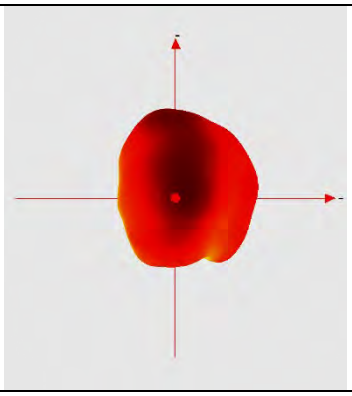
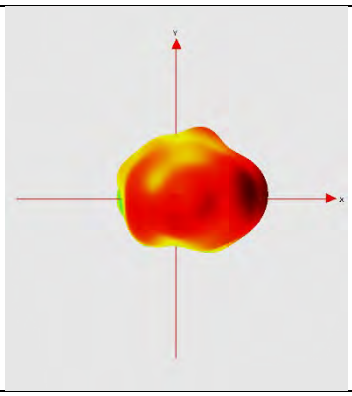
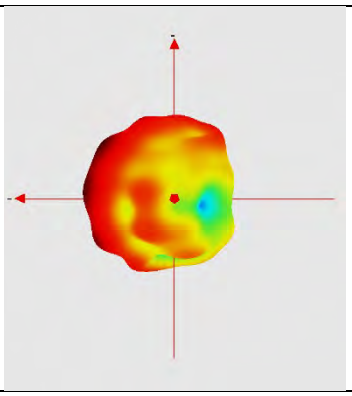
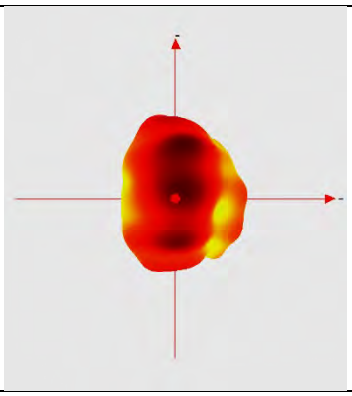


XY-650MHz	XZ-650MHz	YZ-650MHz
		
XY-700MHz	**XZ-700MHz**	**YZ-700MHz**
		
XY-750MHz	**XZ-750MHz**	**YZ-750MHz**
		

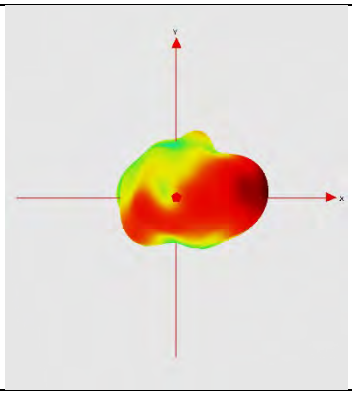
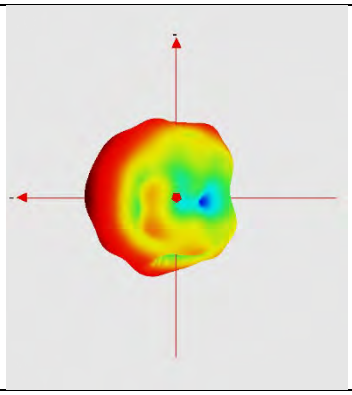
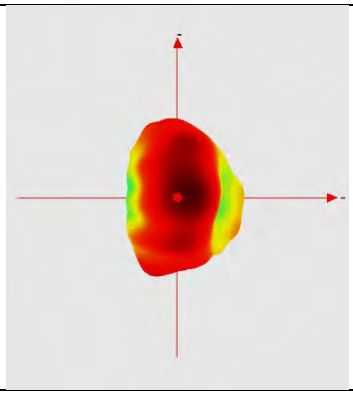
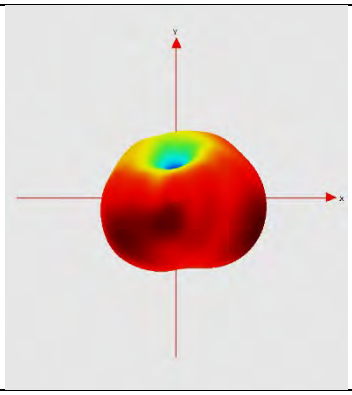
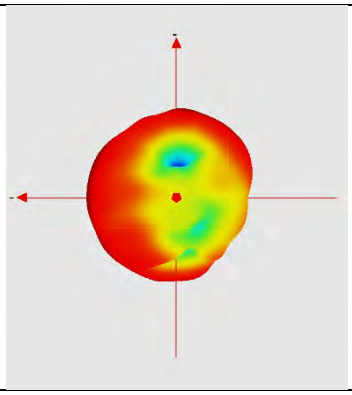
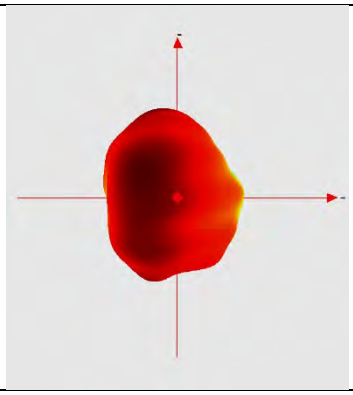
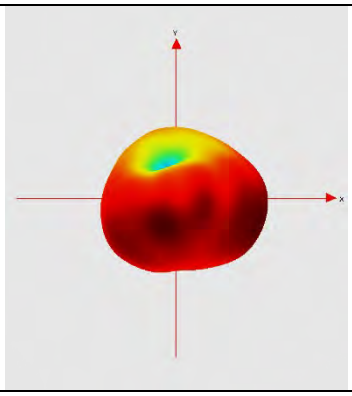
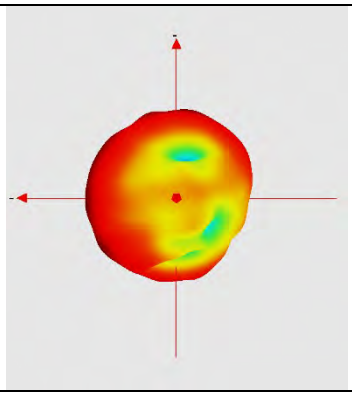
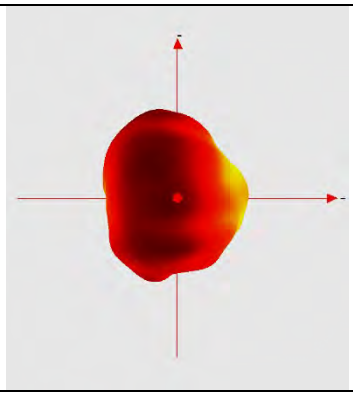
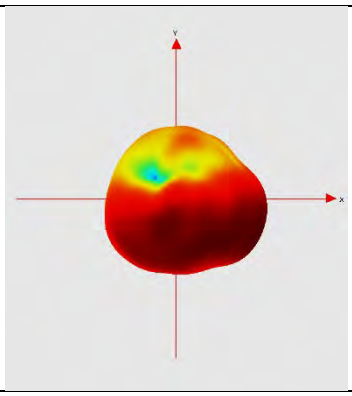
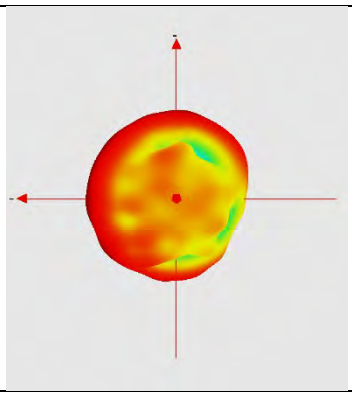
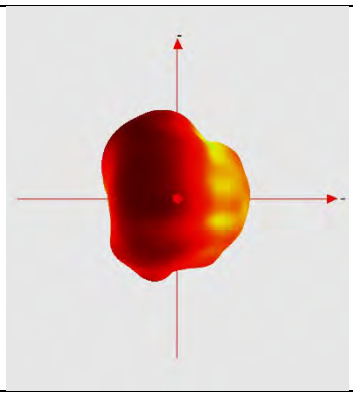
2 d. Gain Radiation Patterns 3D Contd.

XY-850MHz	XZ-850MHz	YZ-850MHz
		
XY-950MHz	XZ-950MHz	YZ-950MHz
		
XY-1575MHz	XZ-1575MHz	YZ-1575MHz
		
XY-1700MHz	XZ-1700MHz	YZ-1700MHz
		

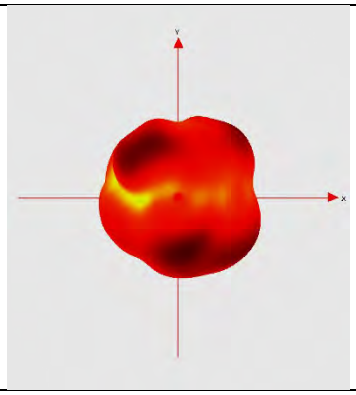
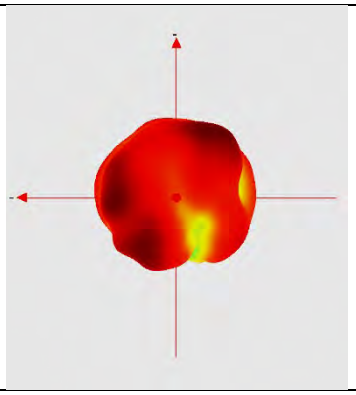
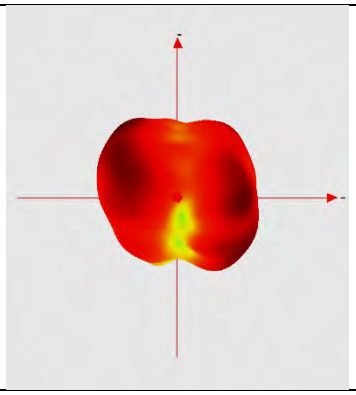
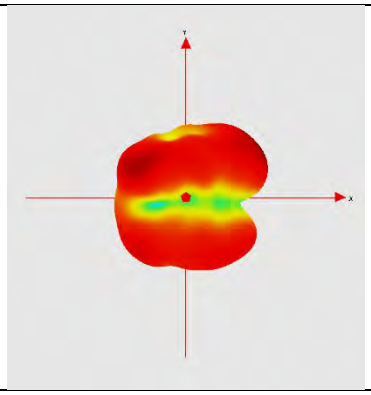
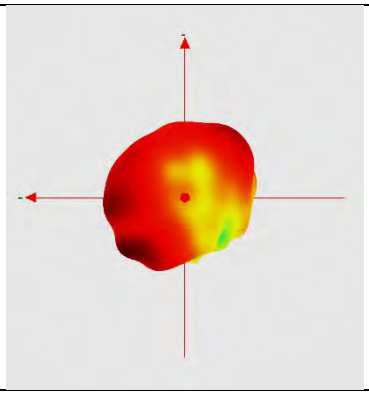
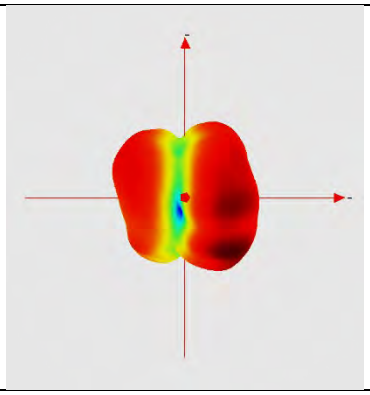
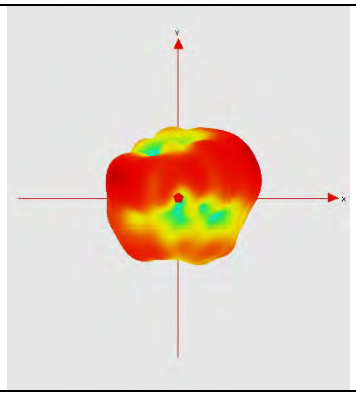
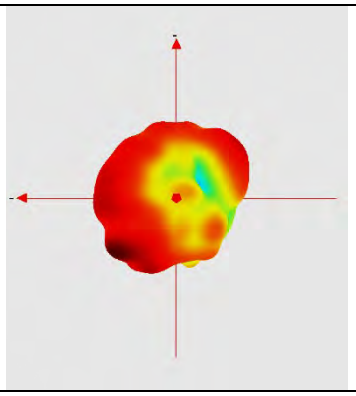
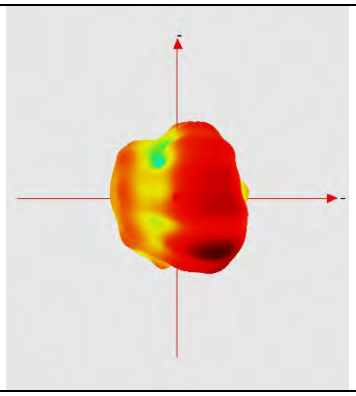
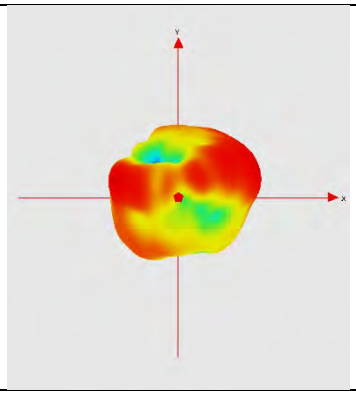
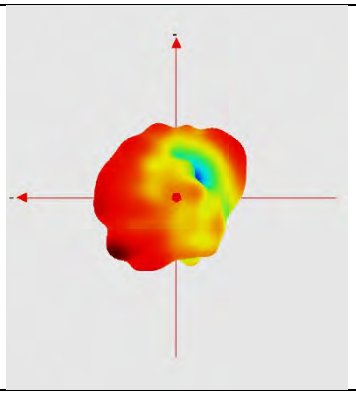
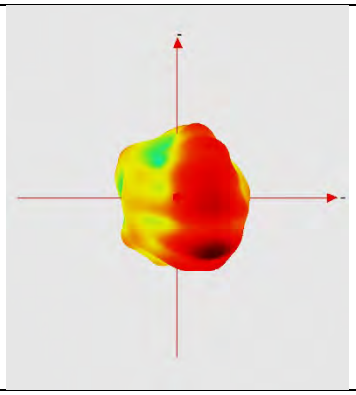
2 d. Gain Radiation Patterns 3D Contd.

XY-190MHz	XZ-190MHz	YZ-190MHz
		
XY-2200MHz	XZ-2200MHz	YZ-2200MHz
		
XY-2400MHz	XZ-2400MHz	YZ-2400MHz
		
XY-2600MHz	XZ-2600MHz	YZ-2600MHz
		

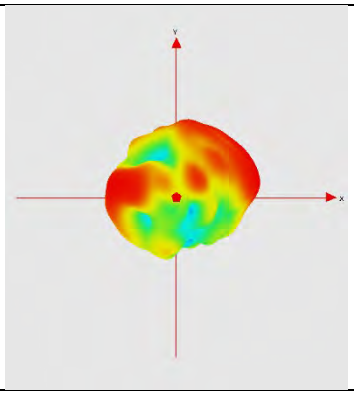
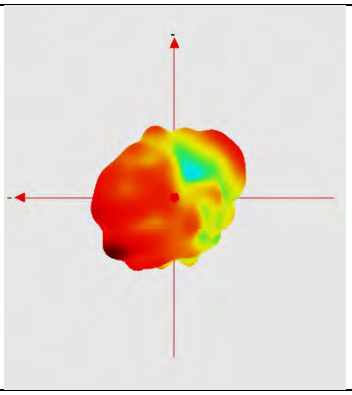
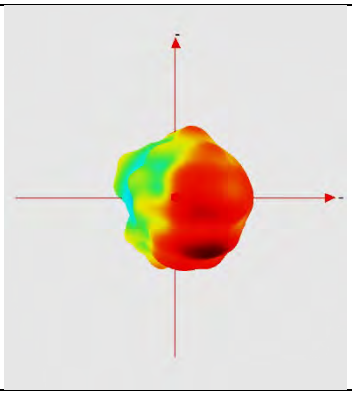
2 d. Gain Radiation Patterns 3D Contd.

XY-2700MHz	XZ-2700MHz	YZ-2700MHz
		
XY-3400MHz	XZ-3400MHz	YZ-3400MHz
		
XY-3600MHz	XZ-3600MHz	YZ-3600MHz
		
XY-3800MHz	XZ-3800MHz	YZ-3800MHz
		

2 d. Gain Radiation Patterns 3D Contd.

XY-4500MHz	XZ-4500MHz	YZ-4500MHz
		
XY-5000MHz	XZ-5000MHz	YZ-5000MHz
		
XY-5500MHz	XZ-5500MHz	YZ-5500MHz
		
XY-5800MHz	XZ-5800MHz	YZ-5800MHz
		

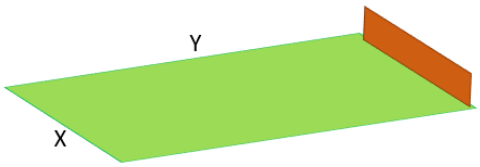
2 d. Gain Radiation Patterns 3D Contd.

XY-6000MHz	XZ-6000MHz	YZ-6000MHz
		

3. ANTENNA PERFORMANCE VARIATION WITH DIFFERENT ANTENNA DESIGN-IN IMPLEMENTATION

3 a. Performance Variation with Different Ground Plane Size

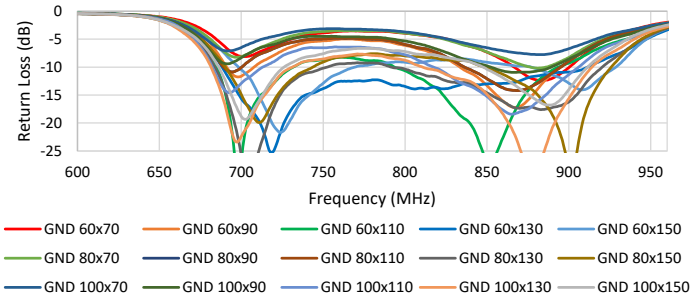
This section shows the effect on return loss of positioning the antenna in various sizes of orthogonally placed ground planes. The antenna is tab mounted with plated through holes and fed at the edge of the PCB ground plane.



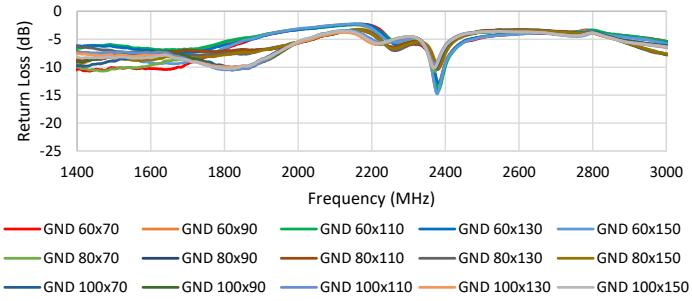
Variables:

Board Size (mm)	X	Y
Board 60x70	60mm	70mm
Board 60x90	60mm	90mm
Board 60x110	60mm	110mm
Board 60x130	60mm	130mm
Board 60x150	60mm	150mm
Board 80x70	80mm	70mm
Board 80x90	80mm	90mm
Board 80x110	80mm	110mm
Board 80x130	80mm	130mm
Board 80x150	80mm	150mm
Board 100x70	100mm	70mm
Board 100x90	100mm	90mm
Board 100x110	100mm	110mm
Board 100x130	100mm	130mm
Board 100x150	100mm	150mm

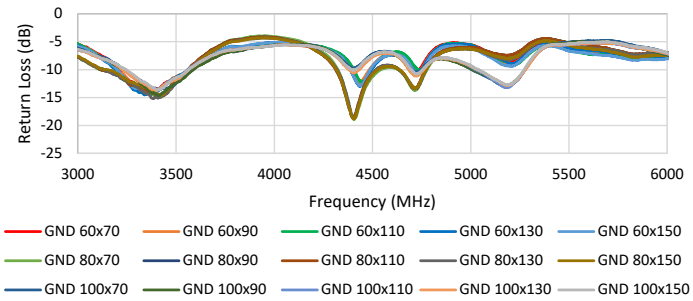
Return Loss for Antenna at 600-960MHz Band in Free Space



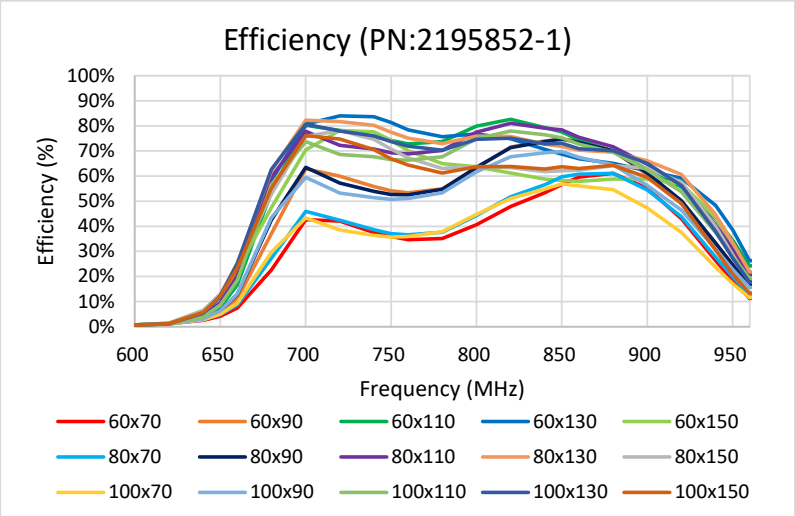
Return Loss for Antenna at 1400-3000MHz Band in Free Space

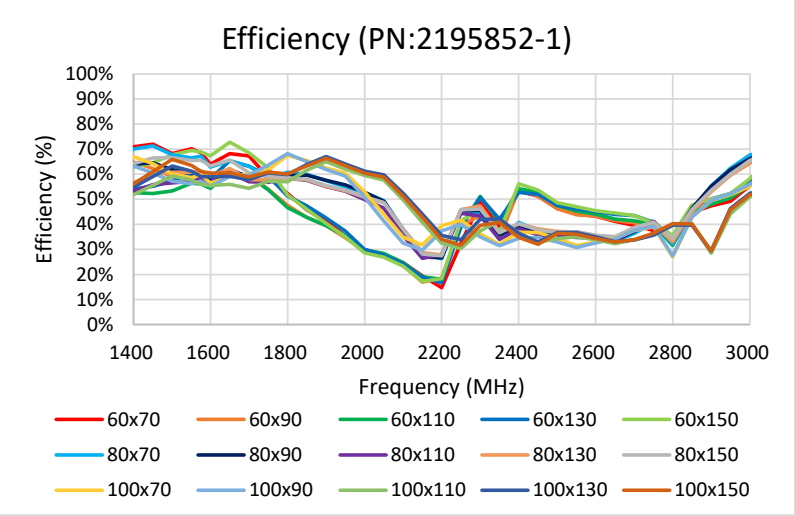


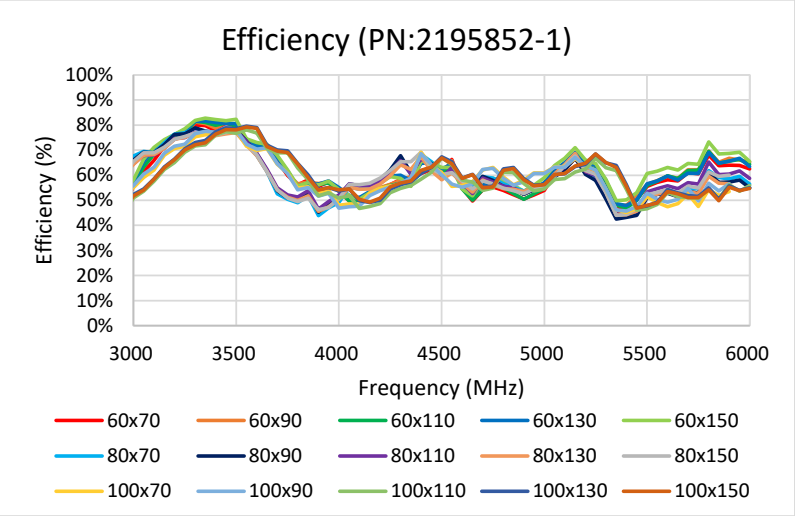
Return Loss for Antenna at 3000-6000MHz Band in Free Space



3 a. Performance Variation with Orthogonal Ground Plane Contd.



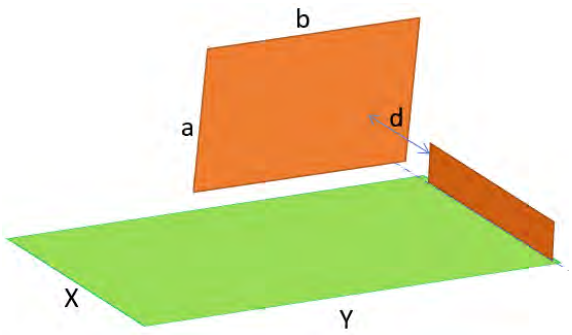


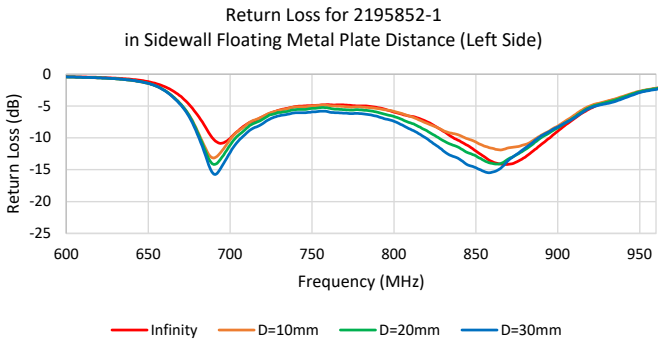


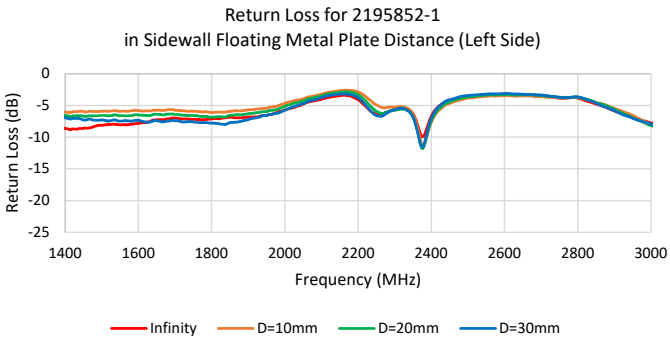
3 b. Performance Variation with Sidewall Floating Metal Plate Distance (Left Side)

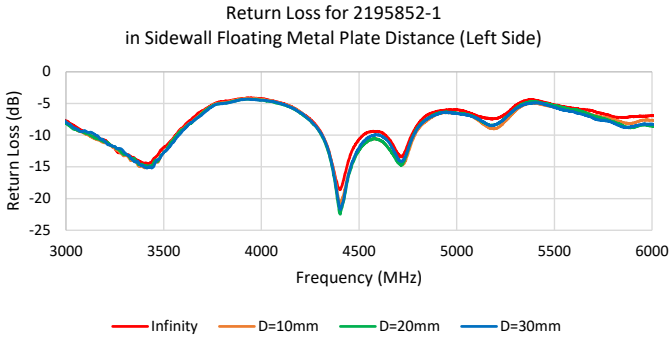
This section shows the effect on return loss of positioning the antenna in line with the ground plane (80x110mm). The antenna is tab mounted with plated through holes and fed at the edge of the PCB ground plane.

Variables:
X=80mm, Y=110mm
a=100mm, b=100mm
d = 10mm, 20mm, 30mm, infinity (without the floating metal plate)

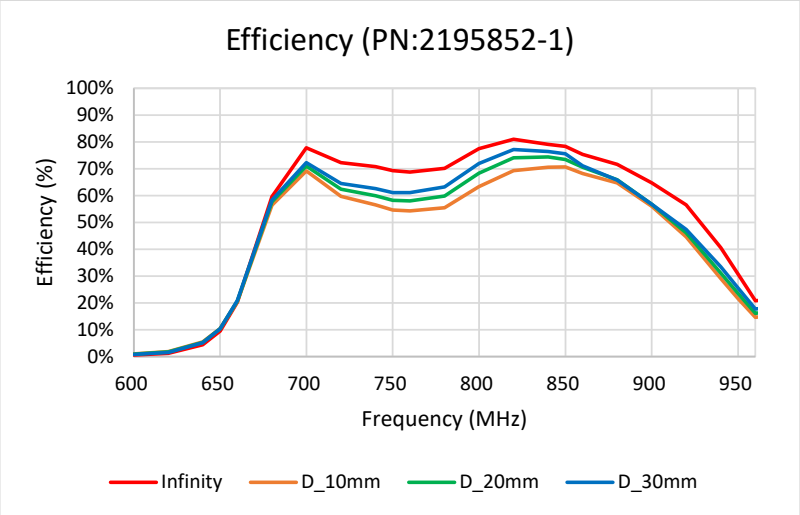


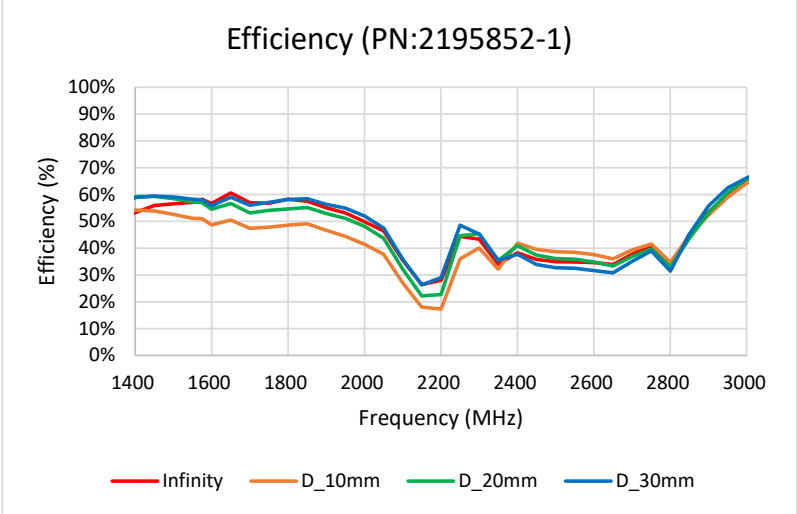


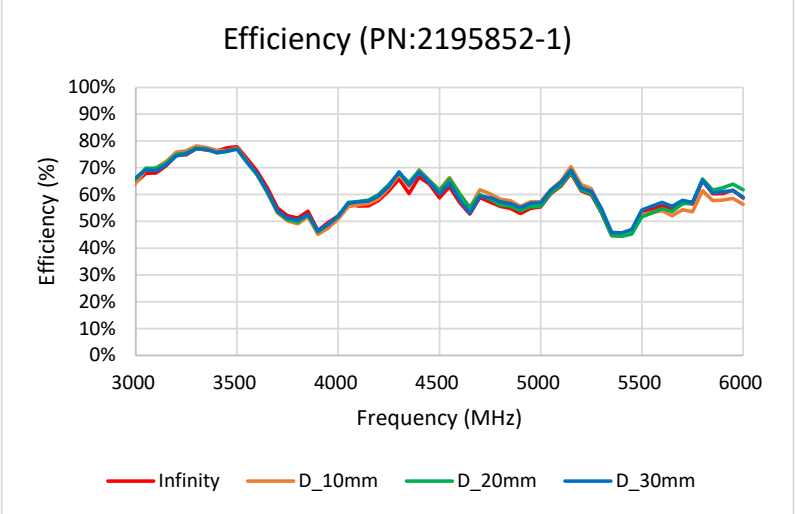




3 b. Performance Variation with Sidewall Floating Metal Plate Distance (Left Side) Contd.

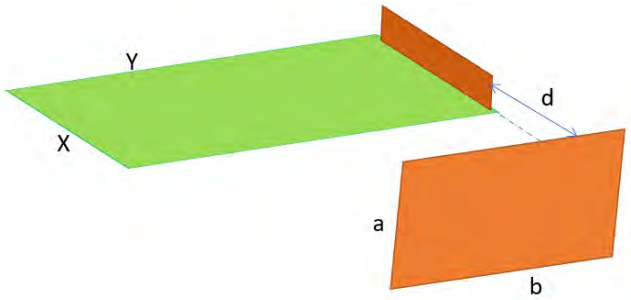




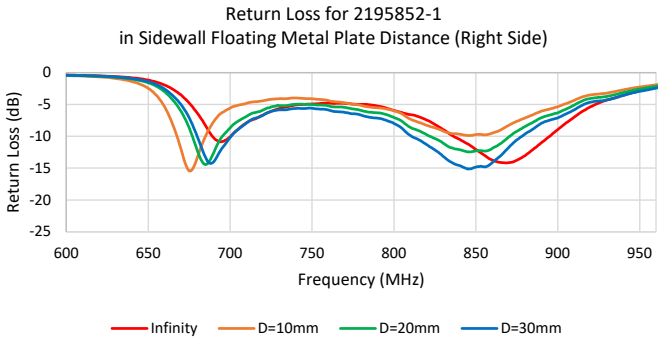


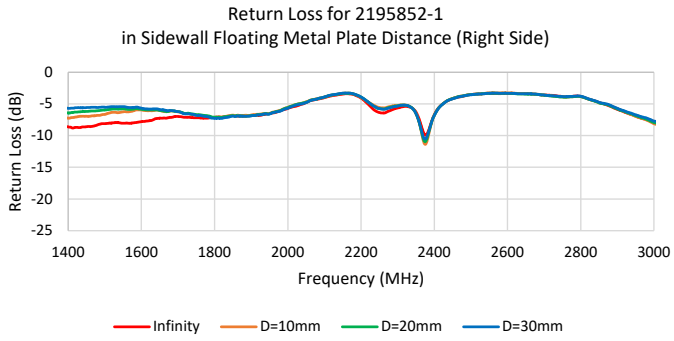
3 c. Performance Variation with Sidewall Floating Metal Plate Distance (Right Side)

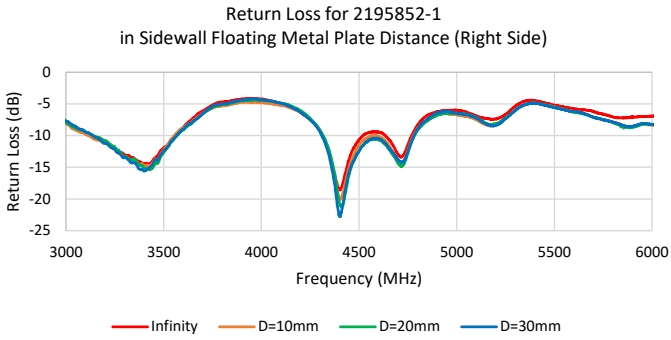
This section shows the effect on return loss of positioning the antenna in line with the ground plane (80x110mm). The antenna is tab mounted with plated through holes and fed at the edge of the PCB ground plane.



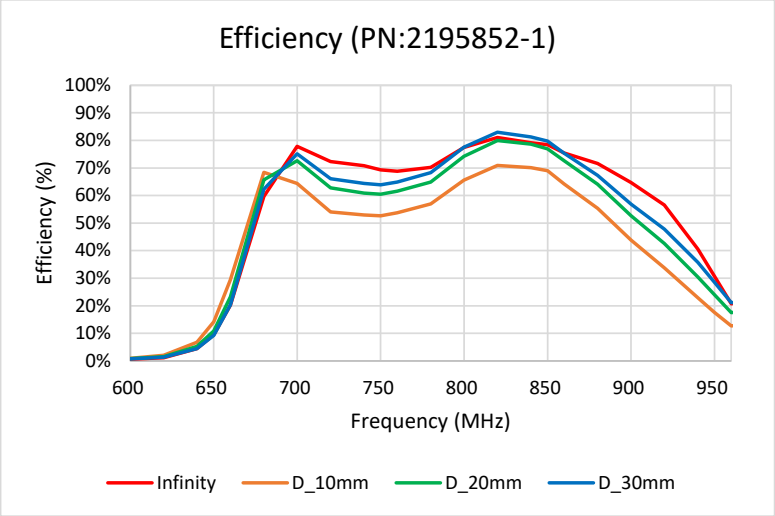
Variables:
X=80mm, Y=110mm
a=100mm, b=100mm
d = 10mm, 20mm, 30mm, infinity (without the floating metal plate)

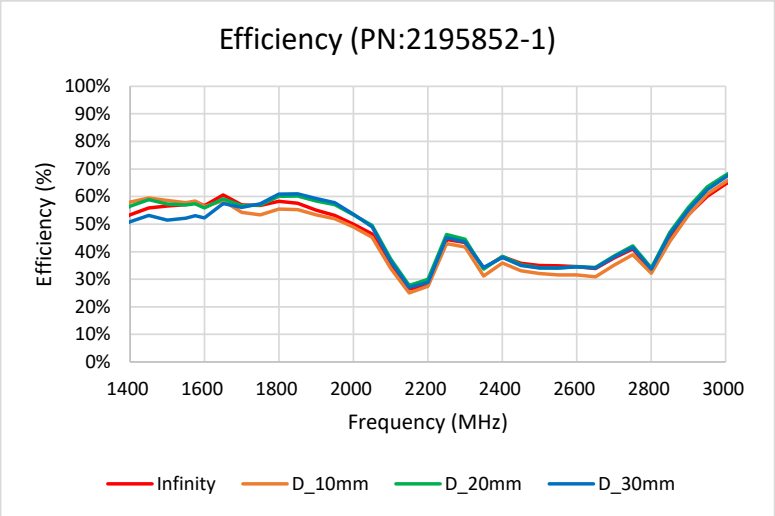


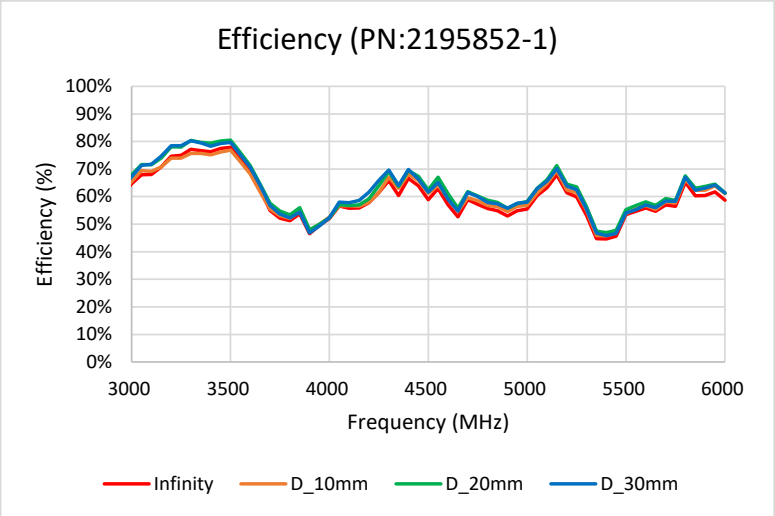




3 c. Performance Variation with Sidewall Floating Metal Plate Distance (Right Side) Contd.



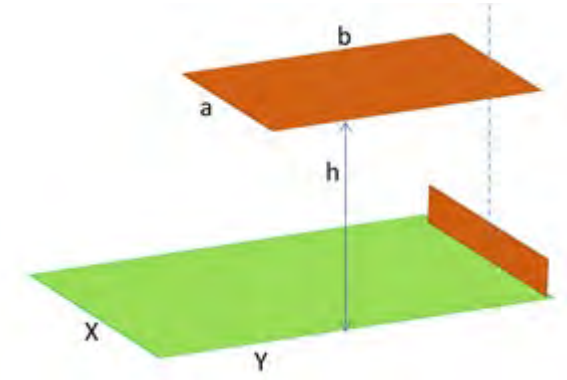


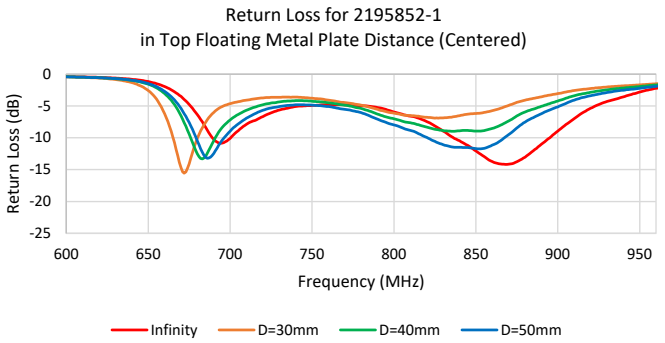


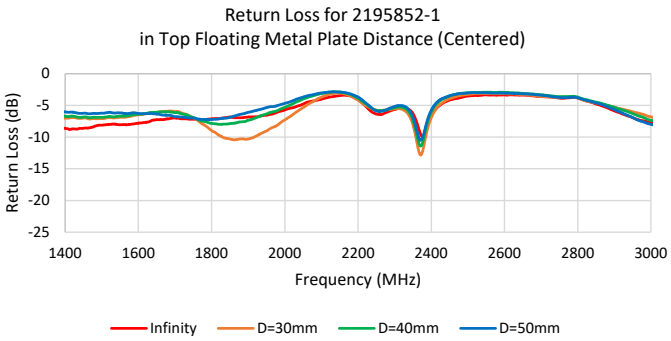
3 d. Performance Variation with Top Floating Metal Plate Distance (Centered)

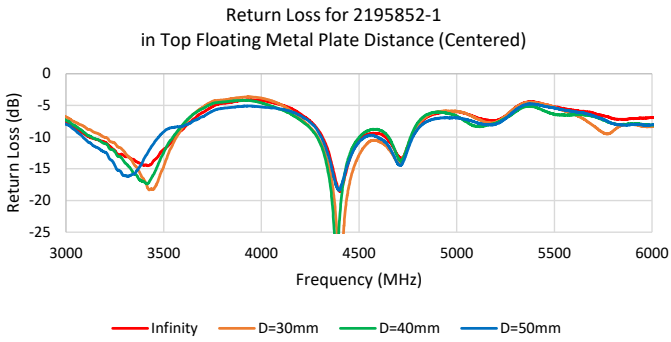
This section shows the effect on return loss of positioning the antenna parallel with a floating metal plate (100x100mm), at various distances to the left of the antenna. The antenna is tab mounted with plated through holes and fed at the edge of the PCB ground plane.

Variables:
X=80mm, Y=110mm
a=100mm, b=100mm
h = 30mm, 40mm, 50mm, infinity (without the floating metal plate)

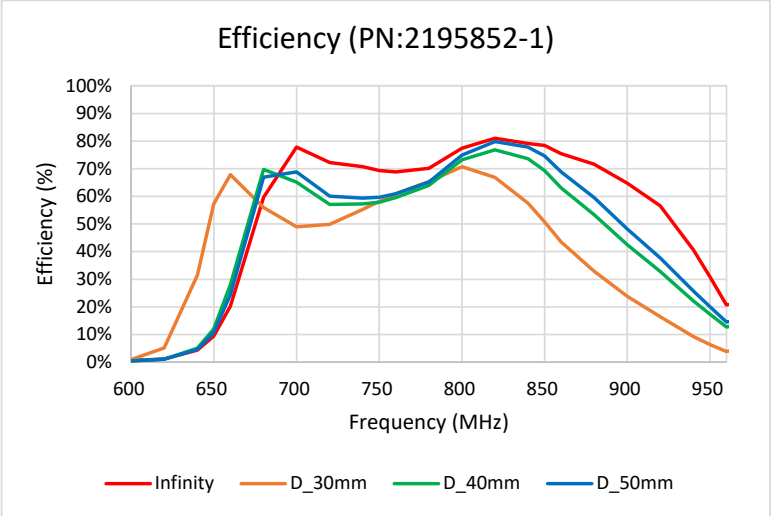


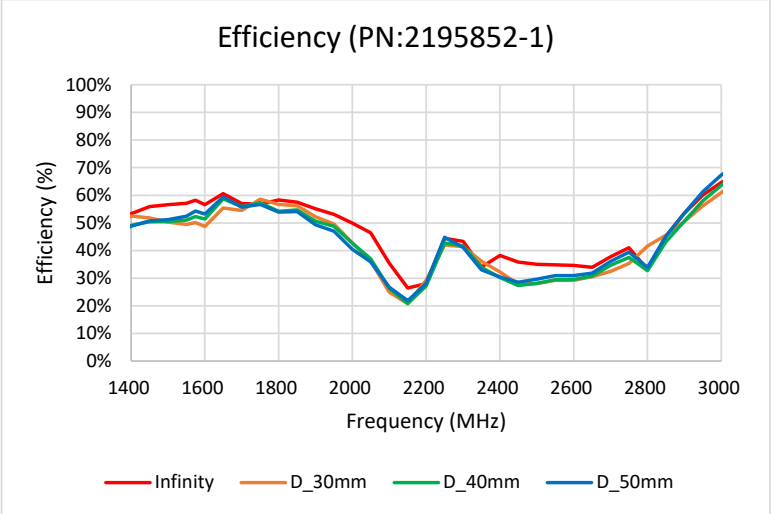


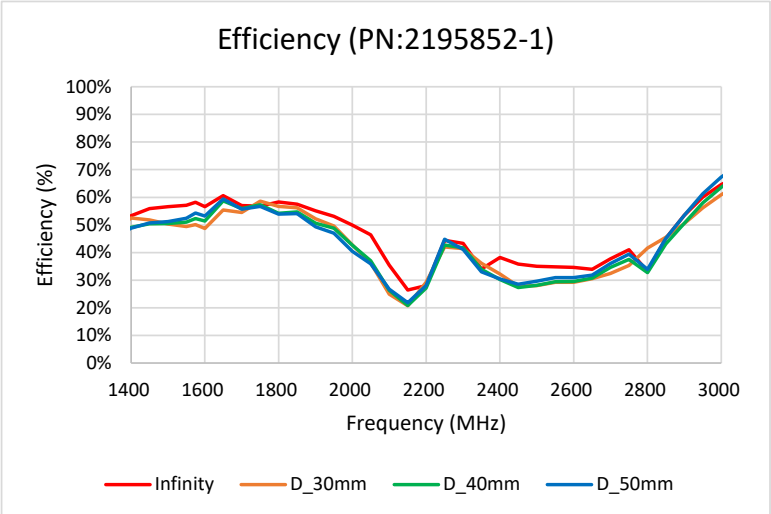




3 d. Performance Variation with Top Floating Metal Plate Distance (Centered) Contd.



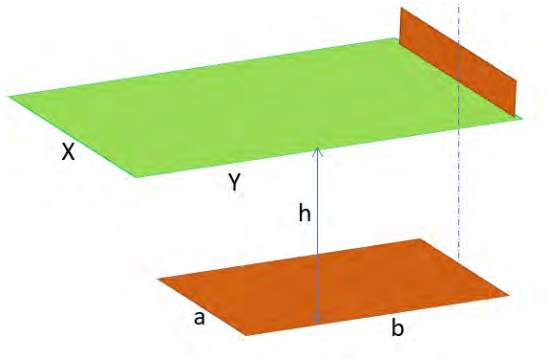


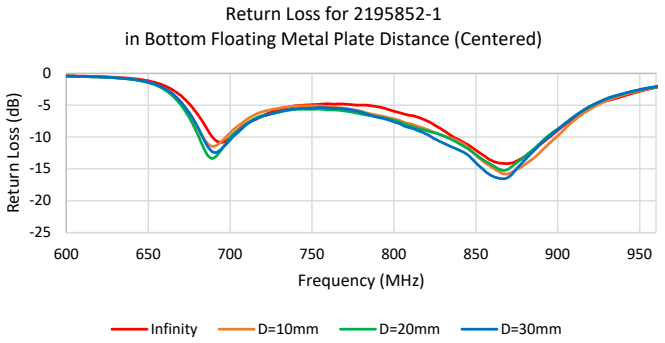


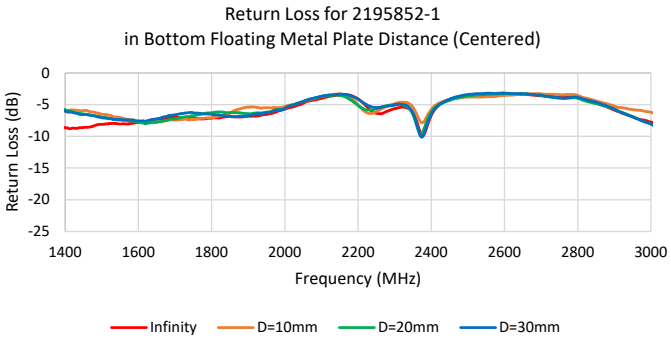
3 e. Performance Variation with Bottom Floating Metal Plate Distance (Centered)

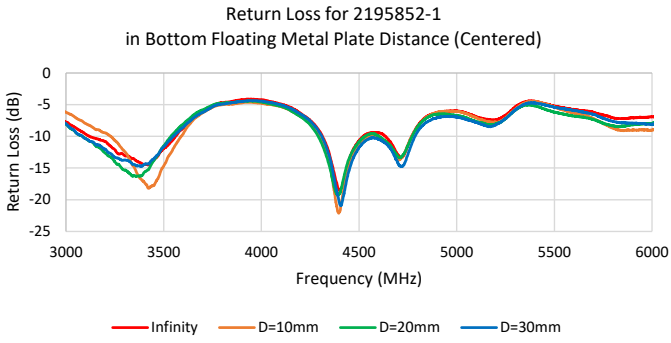
This section shows the effect on return loss of positioning the antenna centrally with a floating metal plate at various distances. The antenna is tab mounted with plated through holes and fed at the edge of the PCB ground plane.

Variables:
X=80mm, Y=110mm
a=100mm, b=100mm
h = 10mm, 20mm, 30mm, infinity (without the floating metal plate)

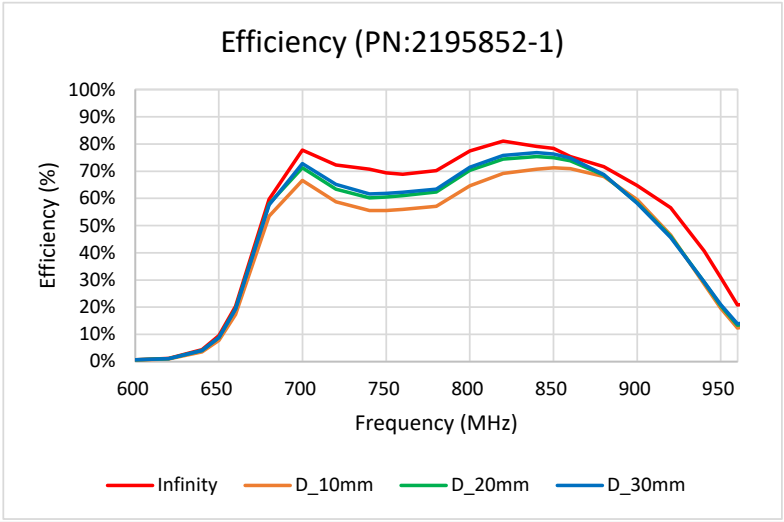


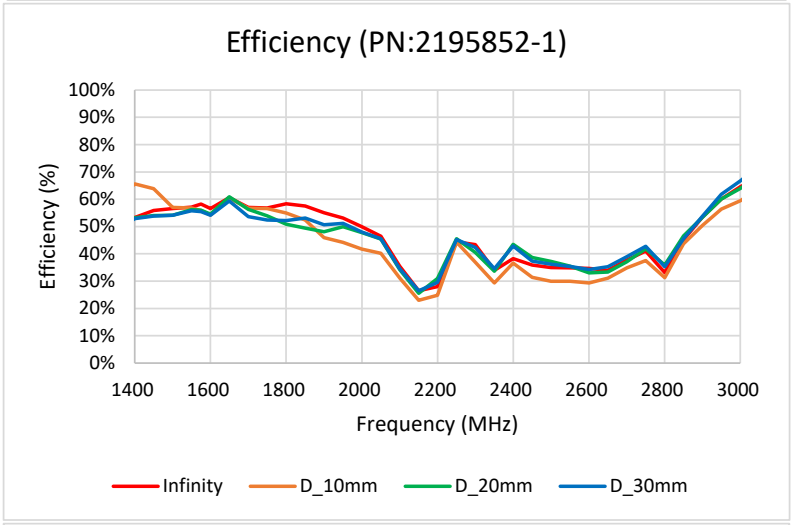


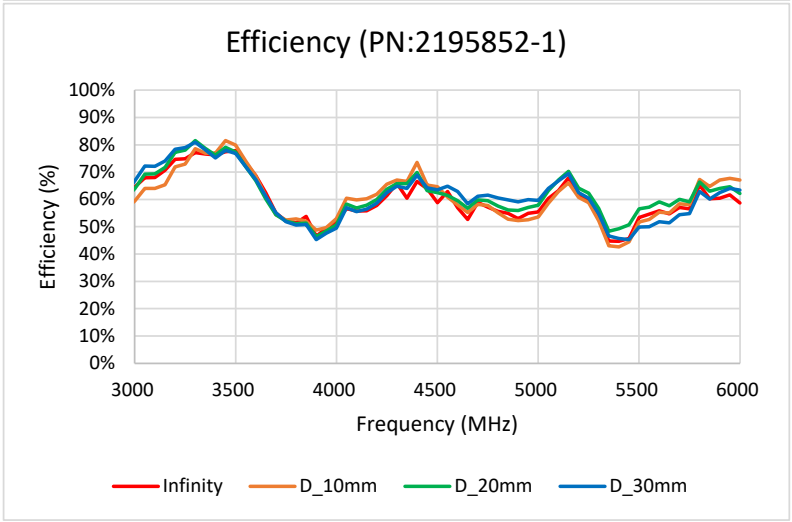




3 e. Performance Variation with Bottom Floating Metal Plate Distance (Centered) Contd.



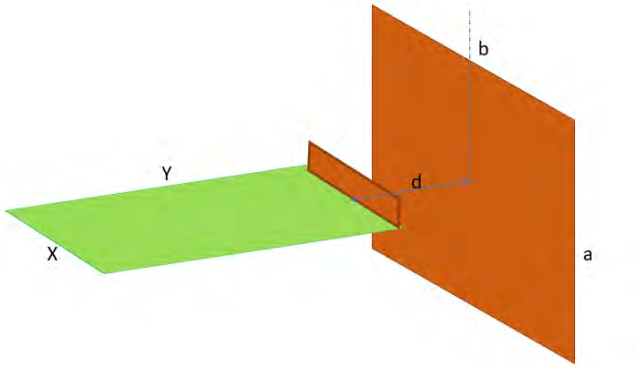


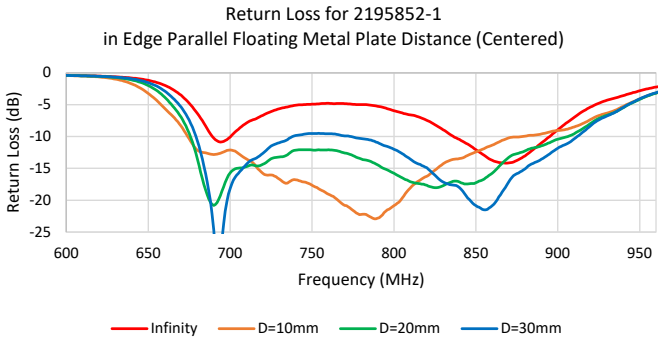


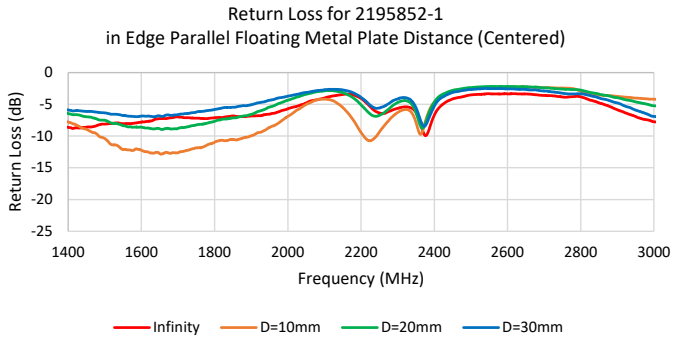
3 f. Performance Variation with Edge Parallel Floating Metal Plate Distance (Centered)

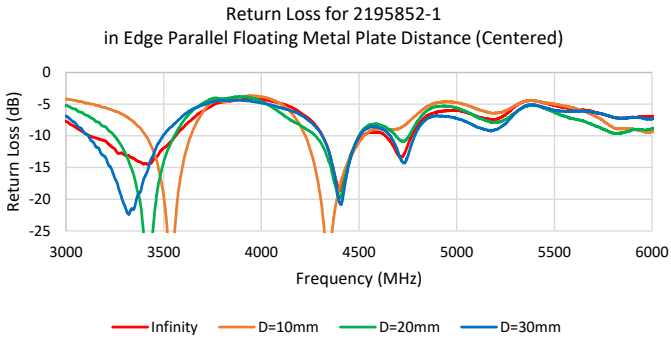
This section shows the effect on return loss of positioning the antenna parallel with a floating metal plate at various distances to the right of the antenna. The antenna is tab mounted with plated through holes and fed at the edge of the PCB ground plane.

Variables:
X=80mm, Y=100mm
a=100mm, b=100mm,
d = 10mm, 20mm, 30mm, infinity (without the floating metal plate)

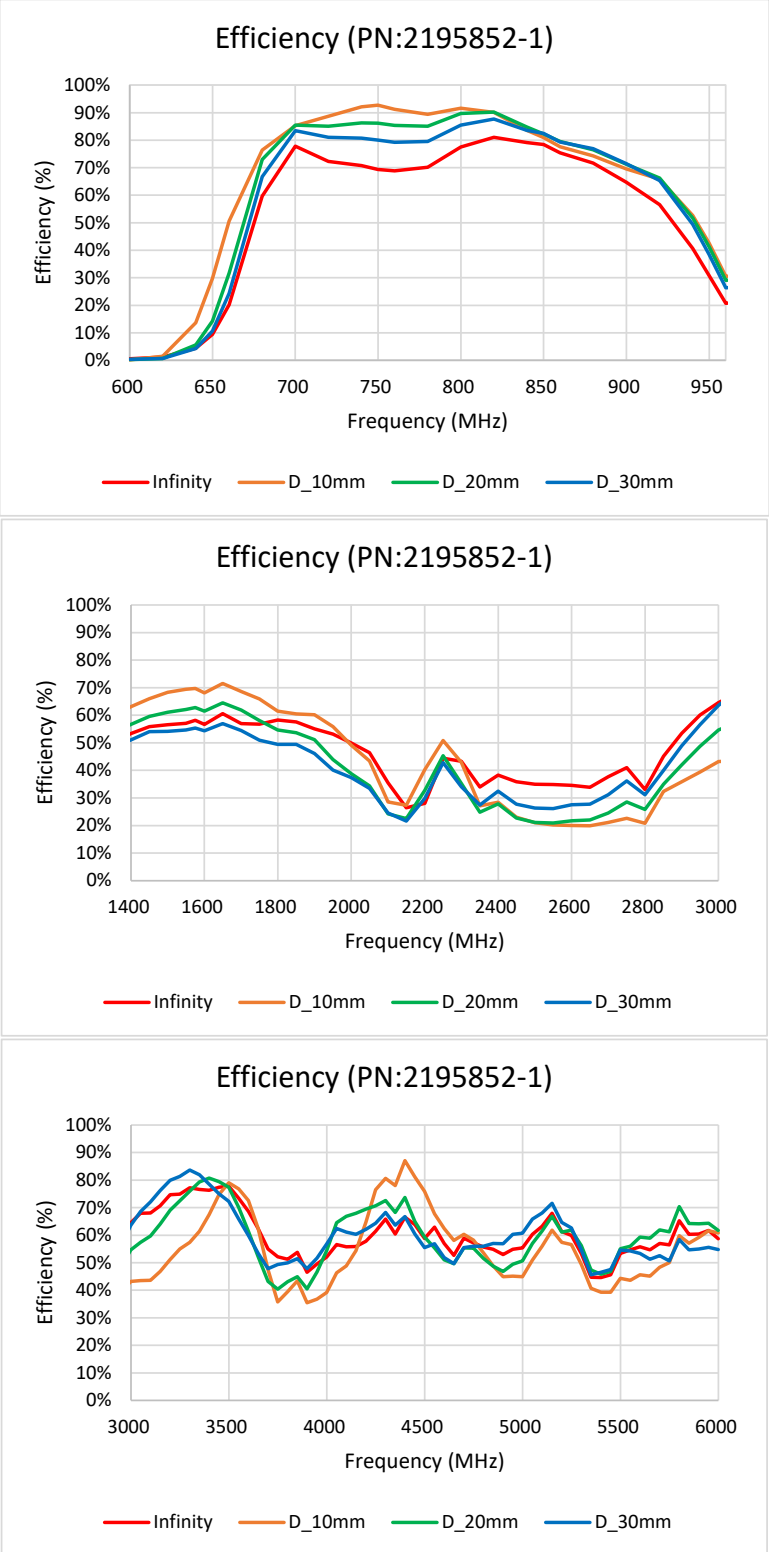








3 f. Performance Variation with Edge Parallel Floating Metal Plate Distance (Centered) Contd.



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