Assa Sargent - Aurora

UHF antenna characterization

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Revision History

Date	Rev.	Author	Description
2024-06-26	A	Pär Berglund	Released after internal review

Table of Contents

1 Table of Figures

2 Table of Tables

3 Acronyms, Abbreviations and Definitions

Table 1. Acronyms

Acronym	Description
WSI	Wireless System Integration

4 Introduction

4.1 Scope

Thie report presents antenna measurements for the for the Assa Sargent Aurora UHF antenna.

4.2 Intended Audience

Project management, electronic engineers at ASSA Sargent and test personal at accredited test laboratories.

5 Antenna measurements

The antenna performance for the UHF antenna within the Assa Sargent Aurora device is characterized in terms of Voltage Standing Wave Ratio, antenna efficiency and radiation patterns including maximum antenna peak gain.

Figure 5-1 UHF antenna element used in Assa Sargen Aurora

All measurements have been carried out for the Aurora door lock with two setups of front cover: plastic and plastic with metallic wings. Antenna measurements have been performed with the Aurora door lock mounted on a part of a wooden and metal foiled door as well as stand-alone.

Figure 5-2 Door models; wood door to the left and foiled door to the right.

Figure 5-3 Aurora door lock front covers; left plastic cover, right plastic cover with metal wings.

5.1.1 Voltage Standing Wave Ratio

Aurora Stand-alone

Front Cover: Plastic

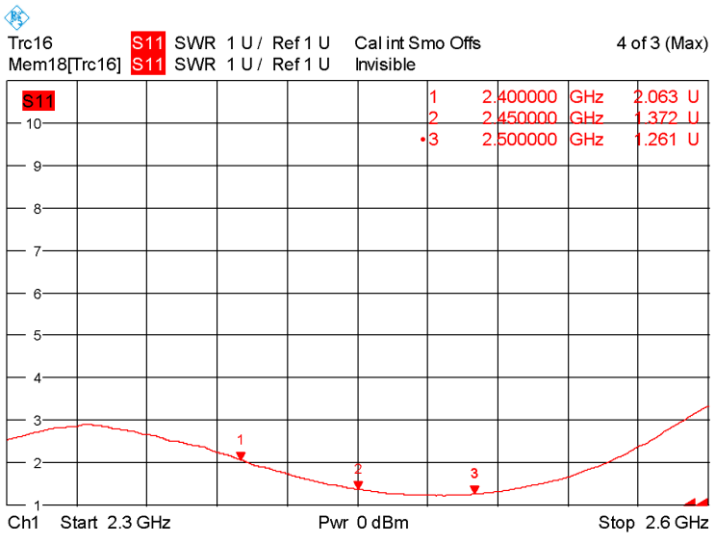


Figure 5-4 VSWR Aurora UHF antenna. Door lock stand-alone. Front cover plastic.

Front Cover: Plastic with metal wings

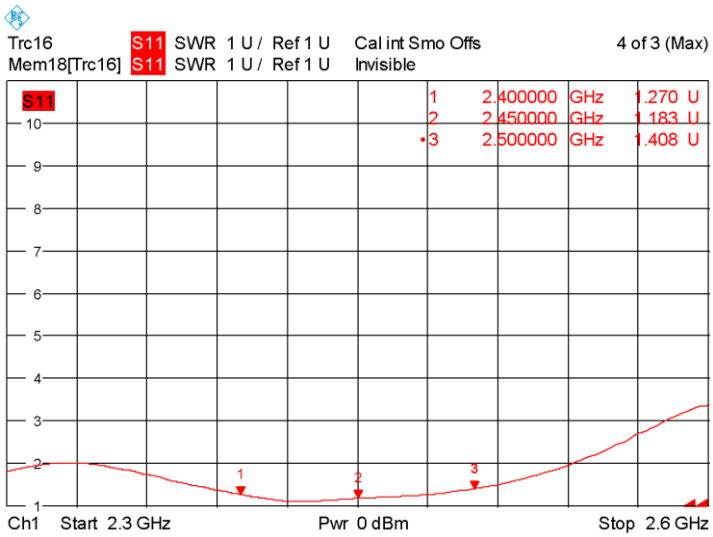


Figure 5-5 VSWR Aurora UHF antenna. Door lock stand-alone. Front cover plastic with metal wings.

Aurora mounted on wood door

Front Cover: Plastic

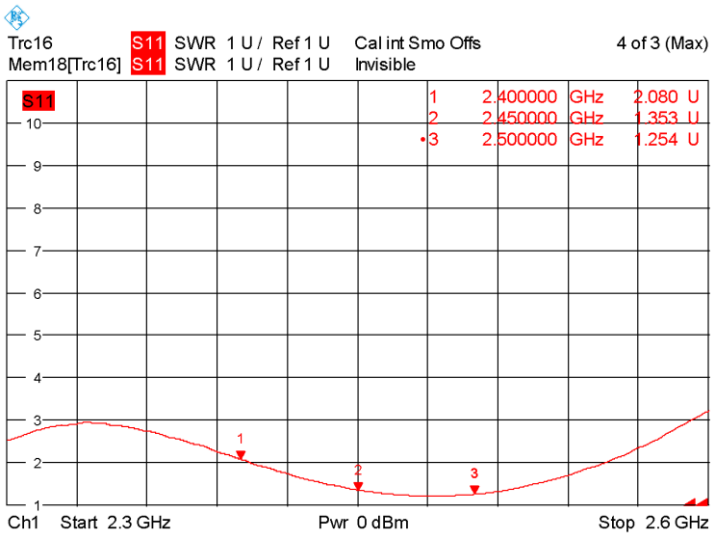


Figure 5-6 VSWR Aurora UHF antenna. Door lock mounted on wood door. Front cover plastic.

Front Cover: Plastic with metal wings

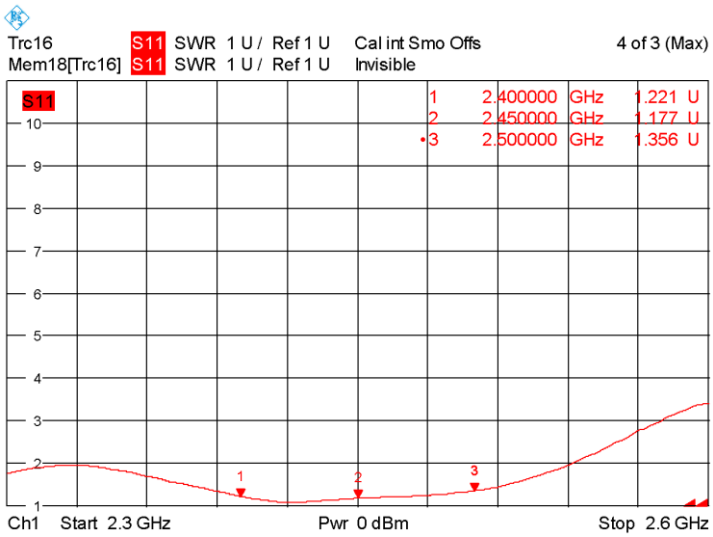


Figure 5-7 VSWR Aurora UHF antenna. Door lock mounted on wood door. Front cover plastic with metal wings.

Aurora mounted on foiled door

Front Cover: Plastic

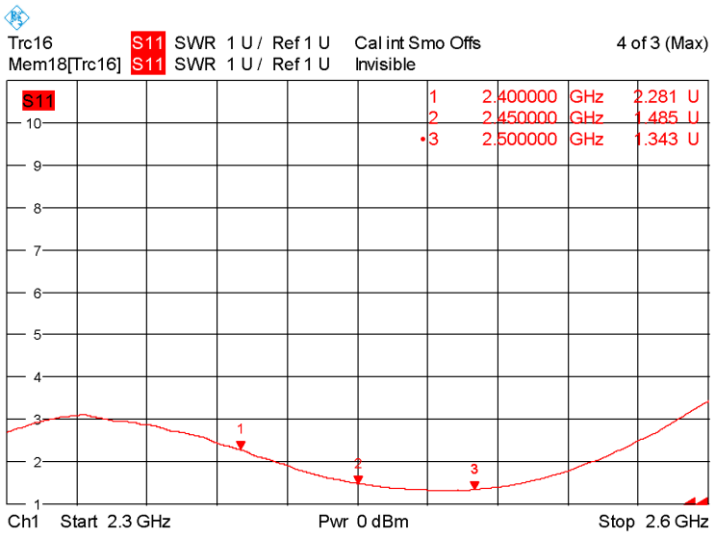


Figure 5-8 VSWR Aurora UHF antenna. Door lock mounted on foiled door. Front cover plastic.

Front Cover: Plastic with metal wings

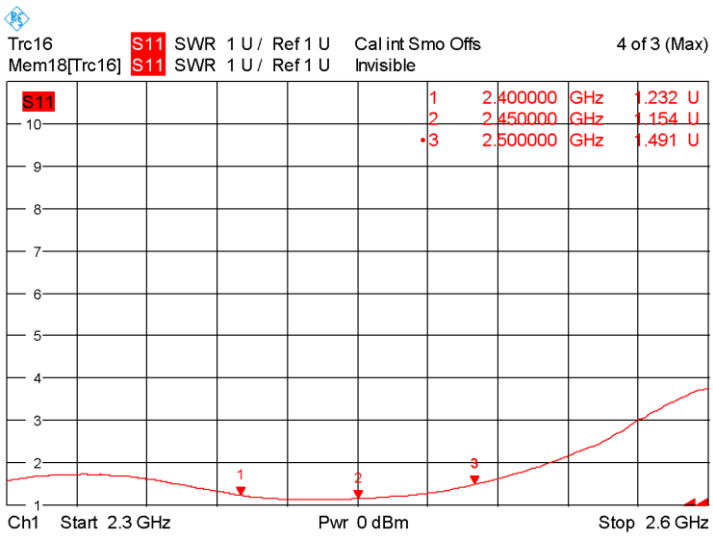


Figure 5-9 VSWR Aurora UHF antenna. Door lock mounted on foiled door. Front cover plastic with metal wings.

5.2 Antenna efficiency and 3D

The antenna efficiency measurements are carried out in a Satimo SG-23 6 GHz Stargate Antenna Test Chamber. The antenna efficiency, ε_T, is the ratio of the power delivered at the 50Ω antenna interface, P_t, relative to the power radiated from the antenna, $P_{radiated}$.

$$\varepsilon_T = \frac{P_{radiated}}{P_t}$$

The 3-D radiation diagram of the total power is presented in Figure 5-11 to Figure 5-16.

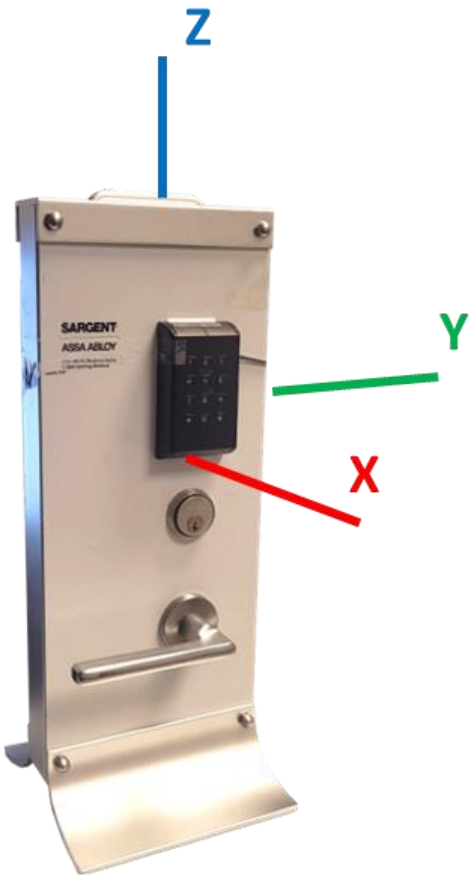


Figure 5-10 Measurement plane definitions

5.2.1 Front cover Plastic

Aurora stand-alone

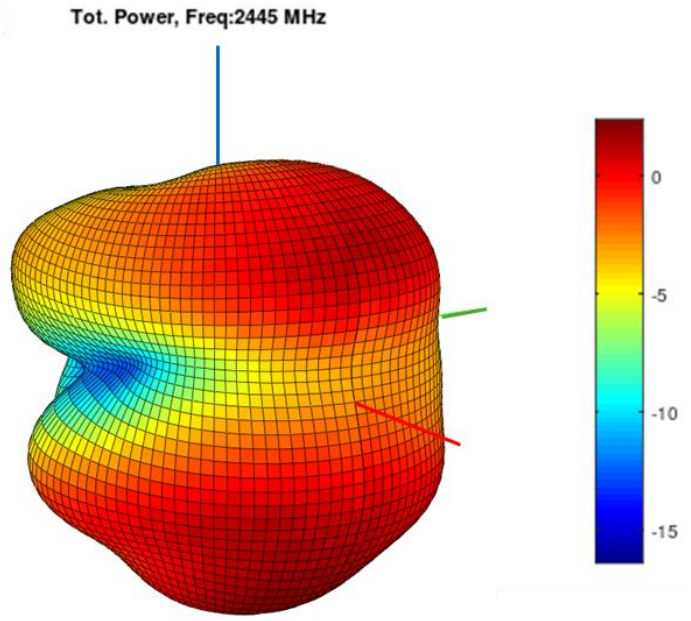


Figure 5-11 3D-radiation pattern Aurora UHF antenna. Door lock stand-alone. Front cover plastic.

Aurora mounted on wood door

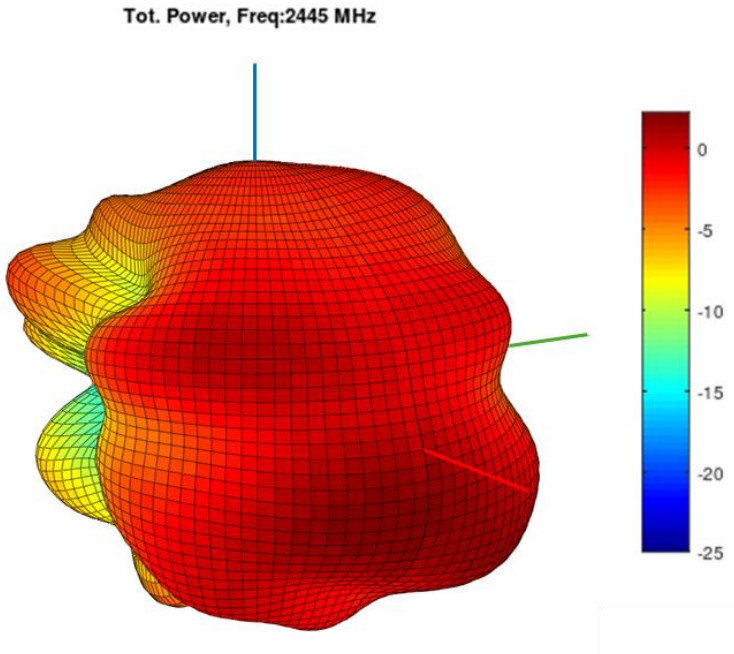


Figure 5-12 3D-radiation pattern Aurora UHF antenna. Door lock mounted on wood door. Front cover plastic.

Aurora mounted on foiled door

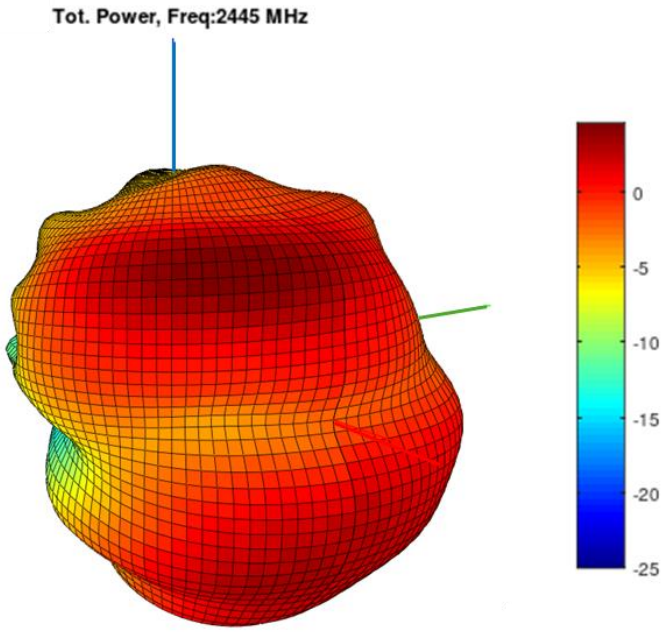
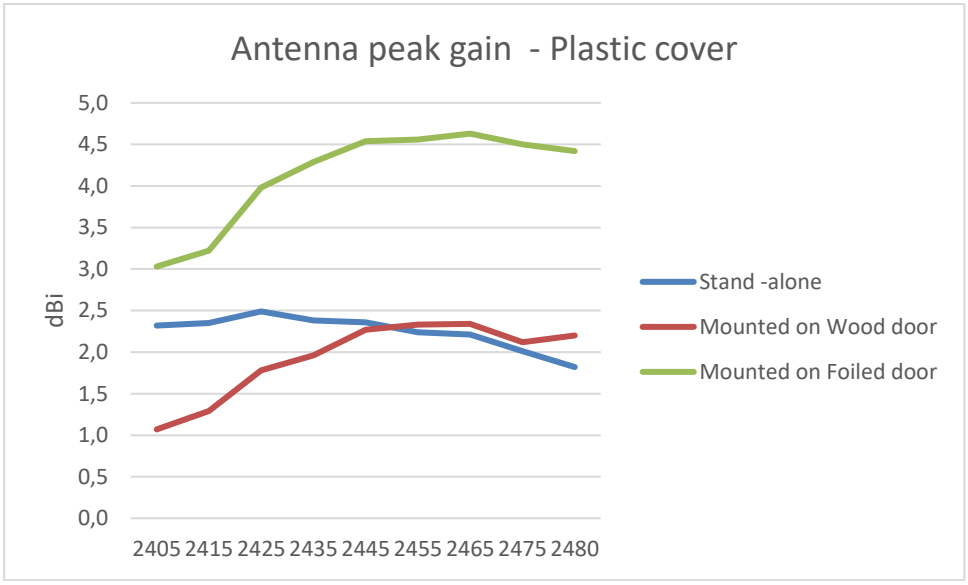
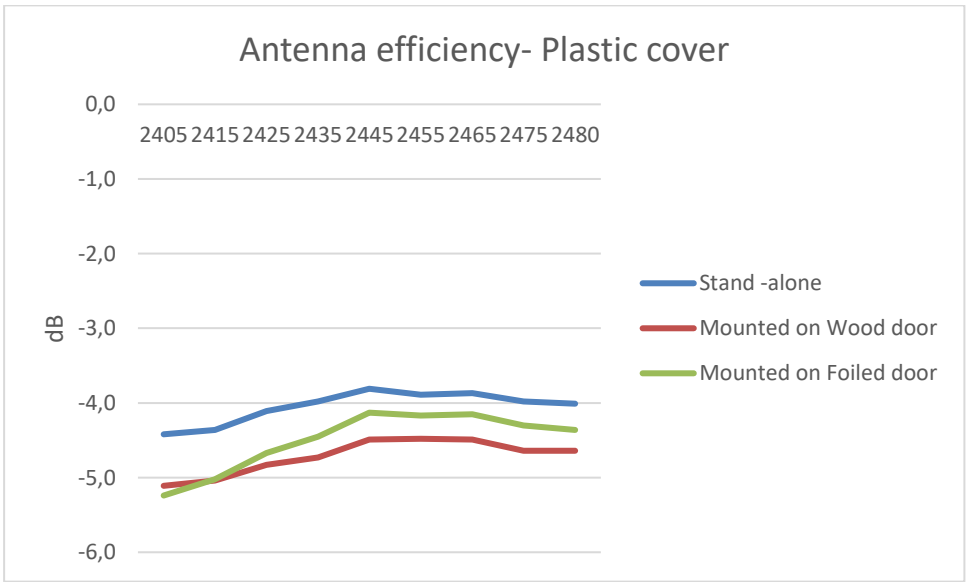


Figure 5-13 3D-radiation pattern Aurora UHF antenna. Door lock mounted on foiled door. Front cover plastic.

Table 2 Antenna peak gain and efficiency for Aurora door lock with plastic front cover.

	Stand -alone		Mounted on Wood door		Mounted on Foiled door	
Frequency [MHz]	Peak gain [dBi]	Efficiency [dB]	Peak gain [dBi]	Efficiency [dB]	Peak gain [dBi]	Efficiency [dB]
2405	2,3	-4,4	1,1	-5,1	3,0	-5,2
2415	2,4	-4,4	1,3	-5,0	3,2	-5,0
2425	2,5	-4,1	1,8	-4,8	4,0	-4,7
2435	2,4	-4,0	2,0	-4,7	4,3	-4,5
2445	2,4	-3,8	2,3	-4,5	4,5	-4,1
2455	2,2	-3,9	2,3	-4,5	4,6	-4,2
2465	2,2	-3,9	2,3	-4,5	4,6	-4,2
2475	2,0	-4,0	2,1	-4,6	4,5	-4,3
2480	1,8	-4,0	2,2	-4,6	4,4	-4,4


Antenna peak gain - Plastic cover
5,0
4,5
4,0
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0,0
dBi
2405 2415 2425 2435 2445 2455 2465 2475 2480
Stand -alone
Mounted on Wood door
Mounted on Foiled door


Antenna efficiency- Plastic cover
0,0
-1,0
-2,0
-3,0
-4,0
-5,0
-6,0
dB
2405 2415 2425 2435 2445 2455 2465 2475 2480
Stand -alone
Mounted on Wood door
Mounted on Foiled door

5.2.2 Front cover Plastic with metal wings

Aurora stand-alone

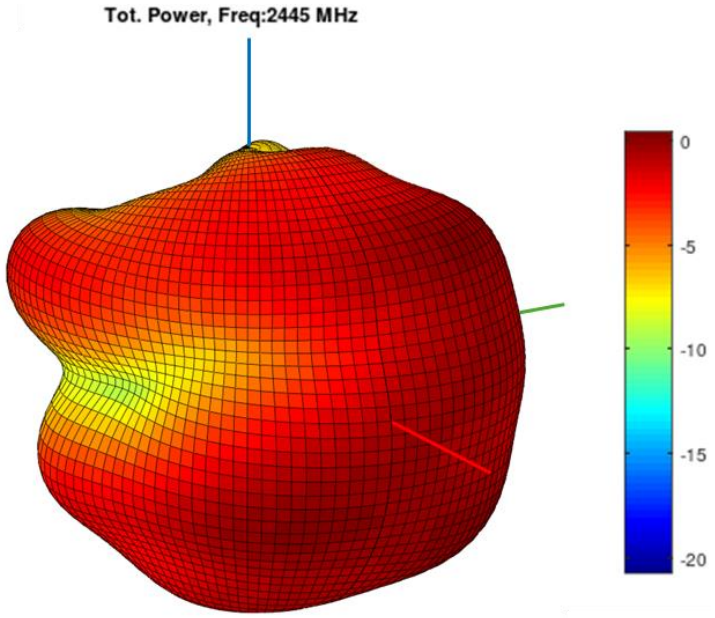


Figure 5-14 3D-radiation pattern Aurora UHF antenna. Door lock stand-alone. Front cover plastic with metal wings.

Aurora mounted on wood door

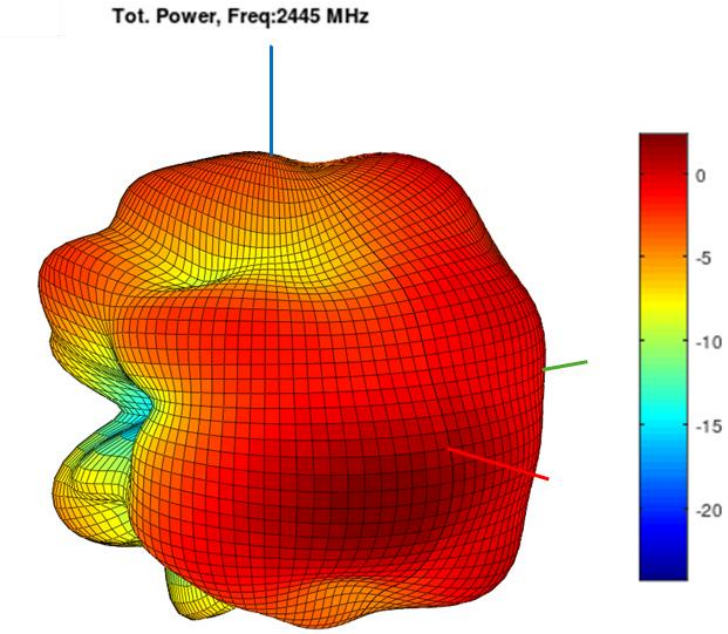


Figure 5-15 3D-radiation pattern Aurora UHF antenna. Door lock mounted on wood door. Front cover plastic with metal wings.

Aurora mounted on foiled door

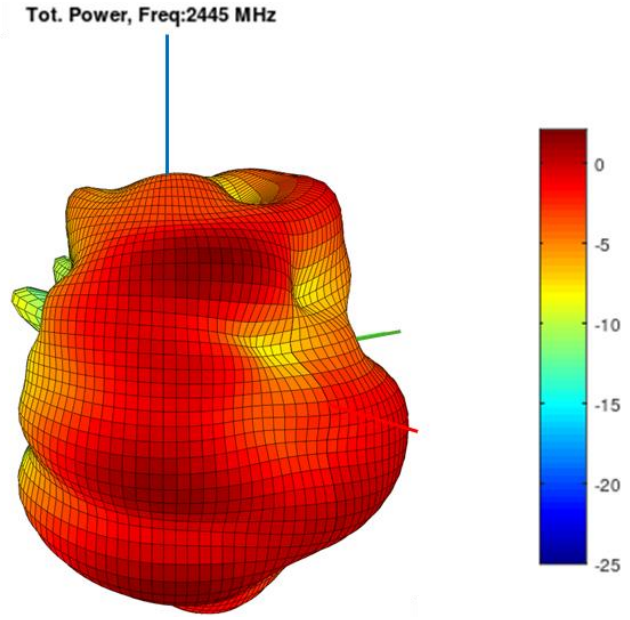
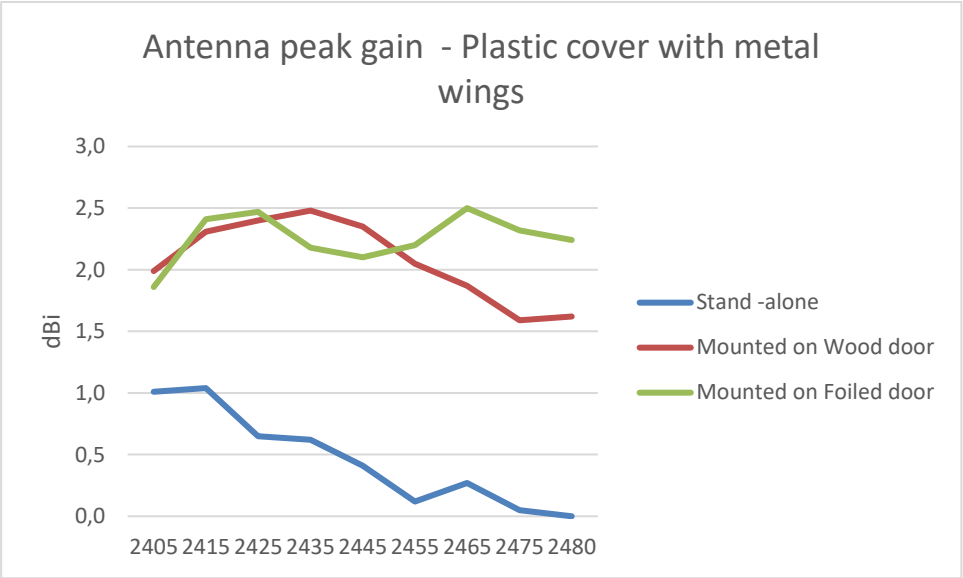
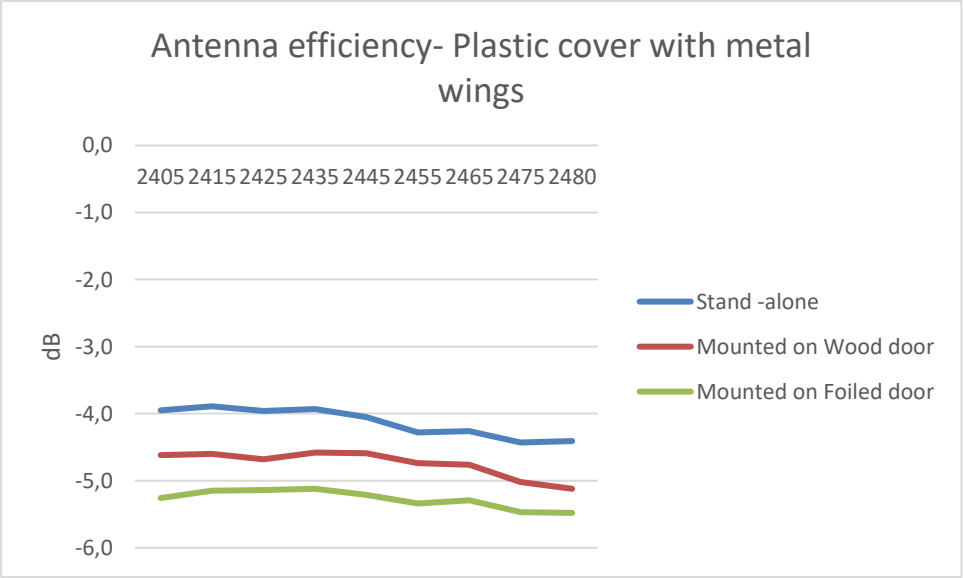


Figure 5-16 3D-radiation pattern Aurora UHF antenna. Door lock mounted on foiled door. Front cover plastic with metal wings.

Table 3 Antenna peak gain and efficiency for Aurora door lock with plastic front cover. With metal wings.

	Stand -alone		Mounted on Wood door		Mounted on Foiled door	
Frequency [MHz]	Peak gain [dBi]	Efficiency [dB]	Peak gain [dBi]	Efficiency [dB]	Peak gain [dBi]	Efficiency [dB]
2405	1,0	-4,0	2,0	-4,6	1,9	-5,3
2415	1,0	-3,9	2,3	-4,6	2,4	-5,2
2425	0,7	-4,0	2,4	-4,7	2,5	-5,1
2435	0,6	-3,9	2,5	-4,6	2,2	-5,1
2445	0,4	-4,1	2,4	-4,6	2,1	-5,2
2455	0,1	-4,3	2,1	-4,7	2,2	-5,3
2465	0,3	-4,3	1,9	-4,8	2,5	-5,3
2475	0,1	-4,4	1,6	-5,0	2,3	-5,5
2480	0,0	-4,4	1,6	-5,1	2,2	-5,5





5.3 Radiation patterns

The antenna radiation pattern measurements are carried out in a Satimo SG-23 6 GHz Stargate Antenna Test Chamber.

Radiation patterns are presented for three measurement planes: azimuth (XY-plane) and two elevation planes (XZ- and YZ-plane).

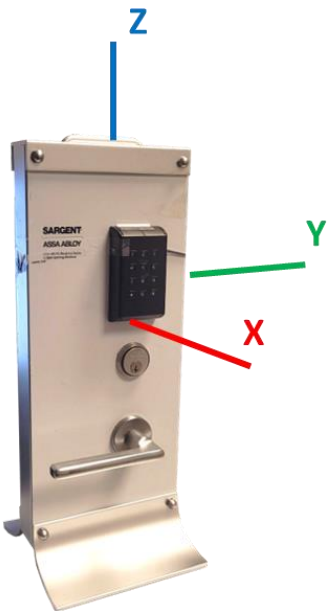


Figure 5-17 Measurement plane definitions

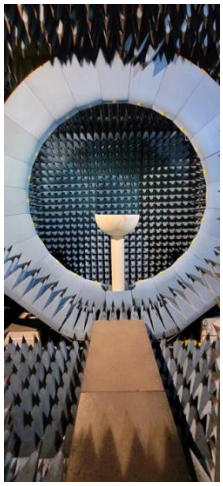


Figure 5-18 Satimo SG-23 6 GHz Stargate Antenna Test Chamber.

5.3.1 Aurora door lock stand-alone

5.3.1.1 Front cover plastic

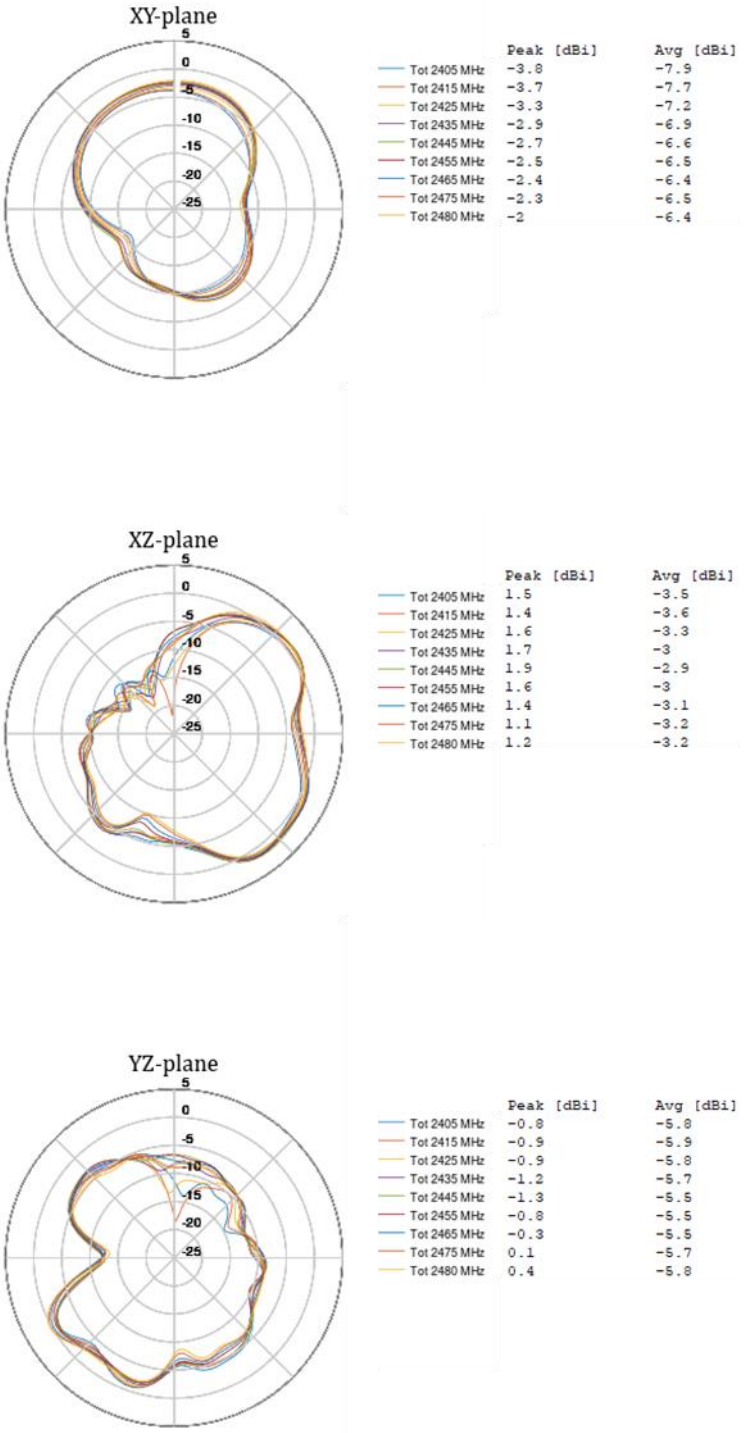


Figure 5-19 Radiation patterns for Aurora UHF antenna, Door lock stand-alone. Front cover plastic.

5.3.1.2 Front cover plastic with metal wings

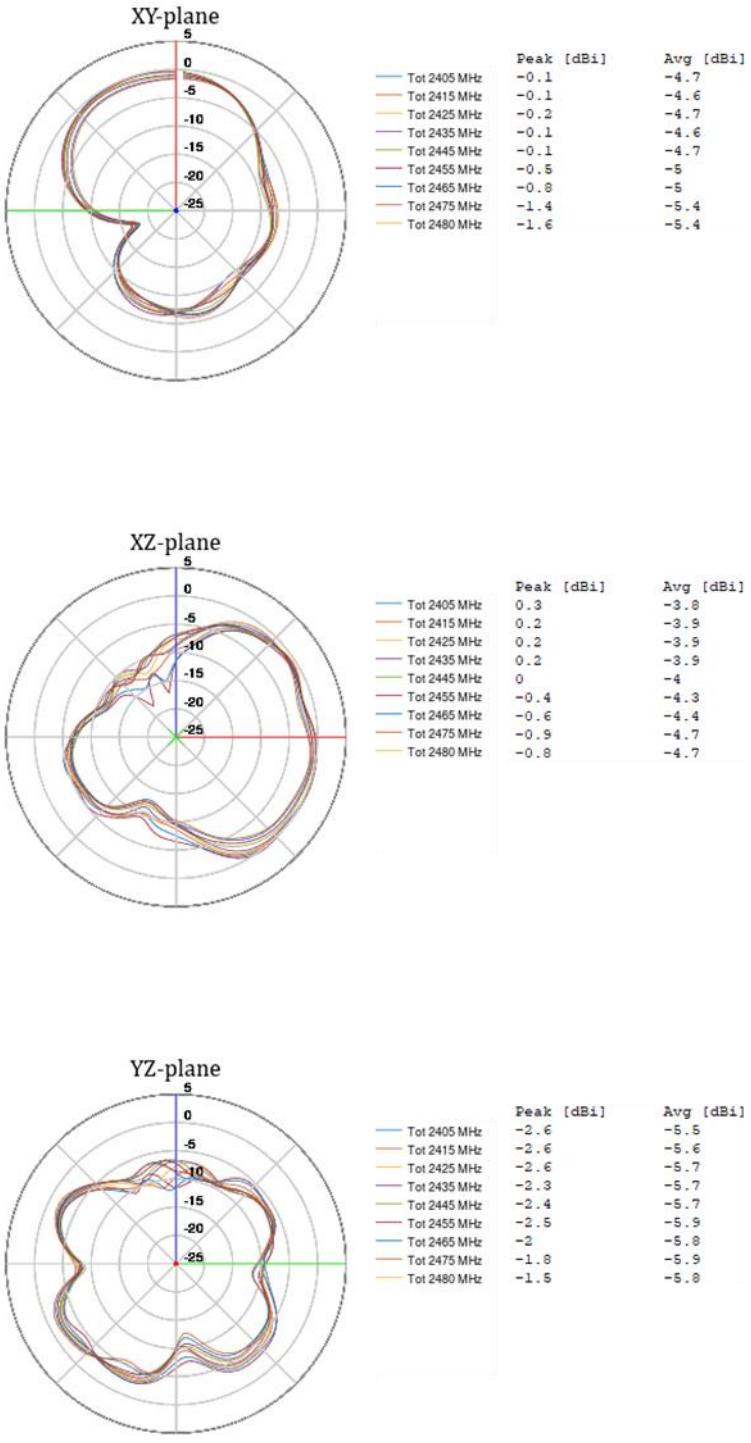


Figure 5-20 Radiation patterns for Aurora UHF antenna, Door lock stand-alone. Front cover plastic with metal wings.

5.3.2 Aurora door lock mounted on wood door

5.3.2.1 Front cover plastic

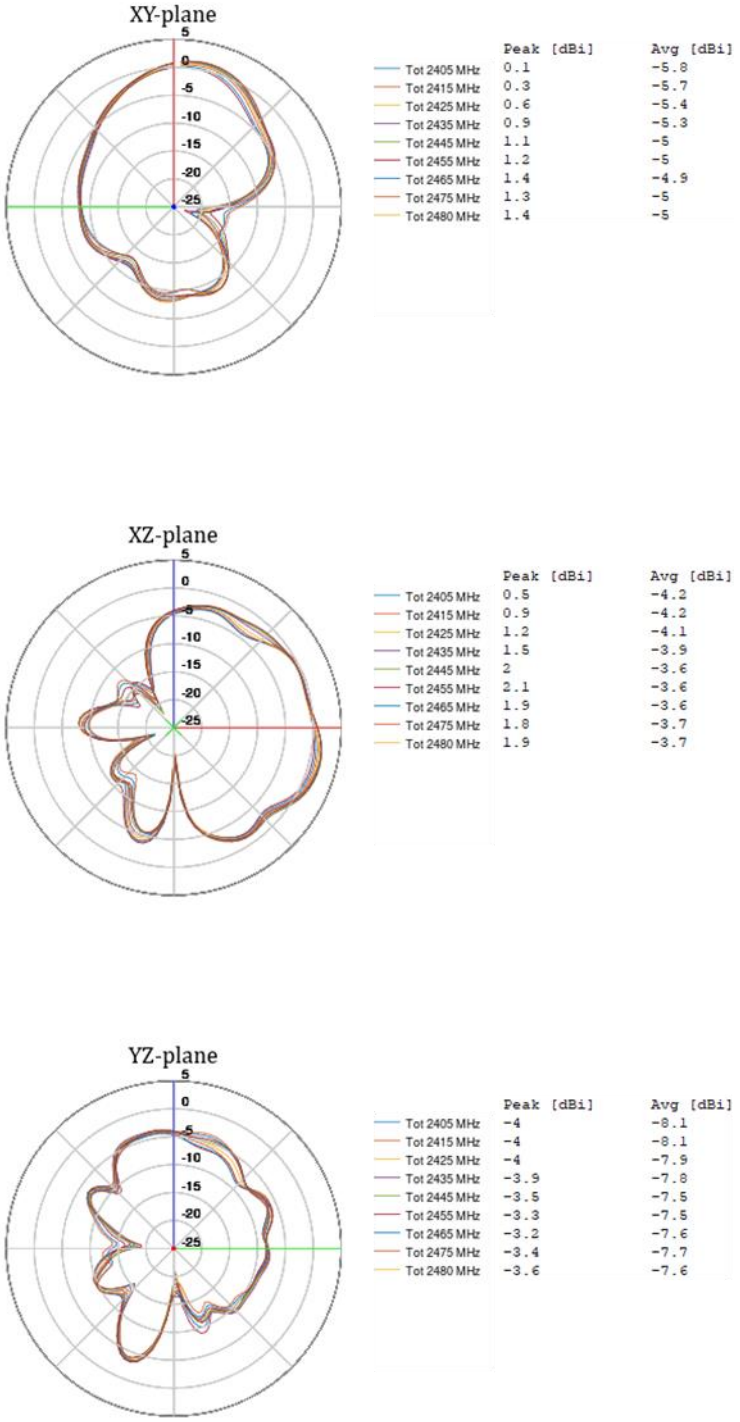


Figure 5-21 Radiation patterns for Aurora UHF antenna, Door lock mounted on wood door. Front cover plastic.

5.3.2.2 Front cover plastic with metal wings

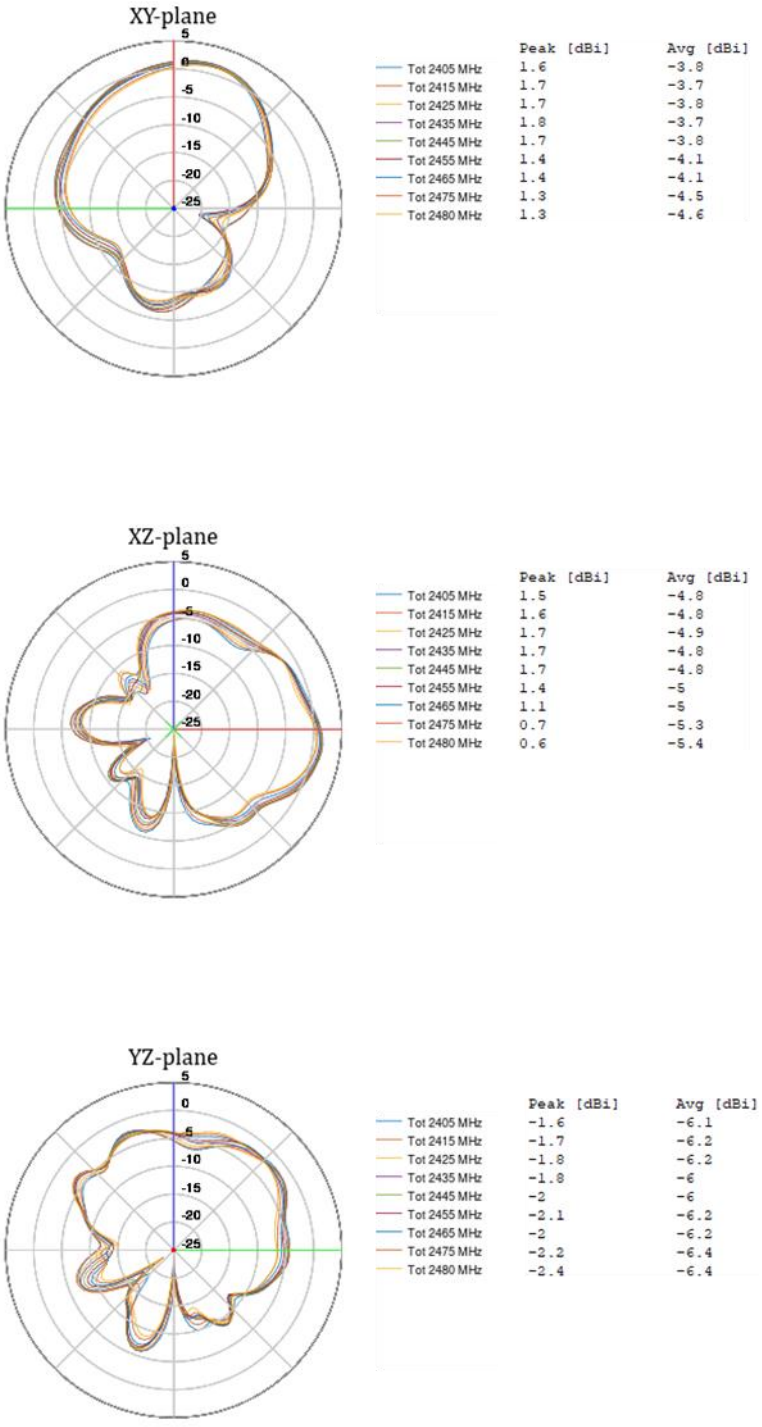


Figure 5-22 Radiation patterns for Aurora UHF antenna, Door lock mounted on wood door. Front cover plastic with metal wings.

5.3.3 Aurora door lock mounted on foiled door

5.3.3.1 Front cover plastic

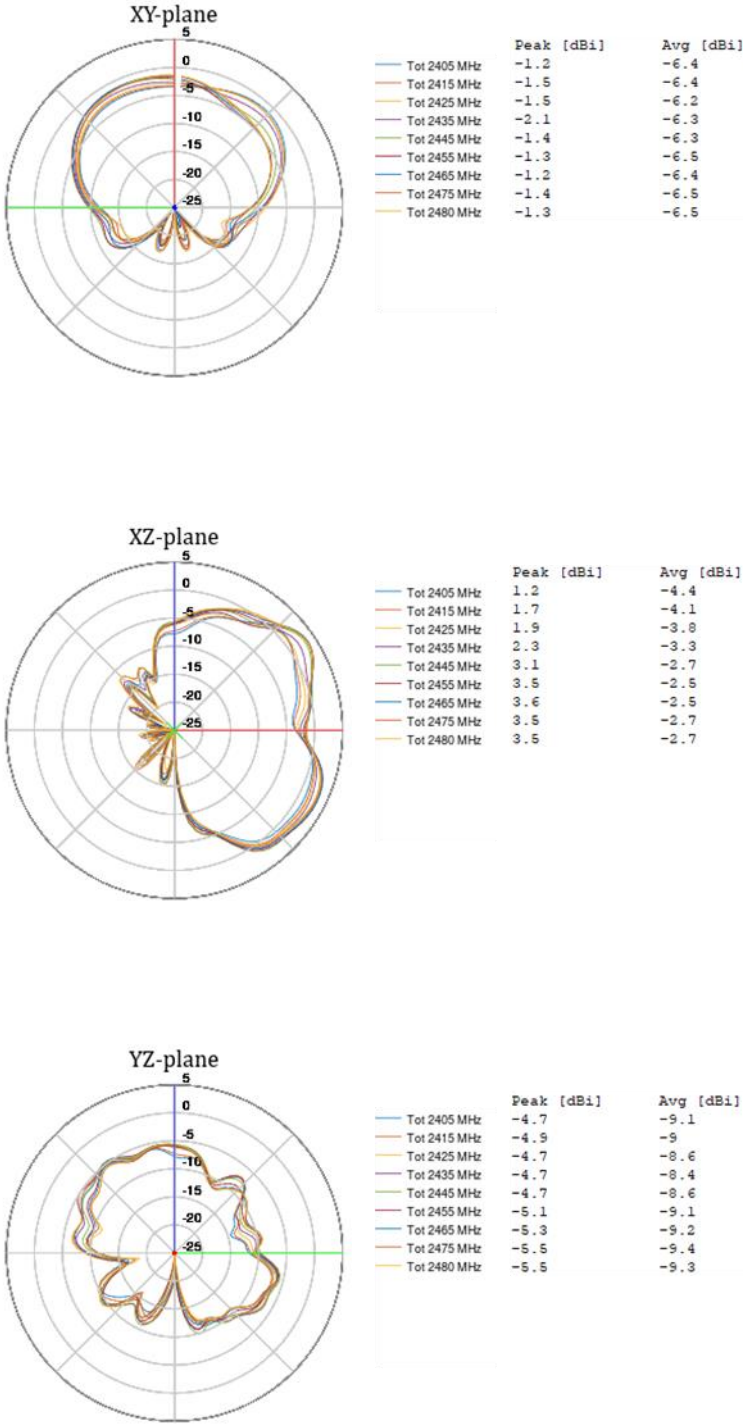


Figure 5-23 Radiation patterns for Aurora UHF antenna, Door lock mounted on foiled door. Front cover plastic.

5.3.3.2 Front cover plastic with metal wings

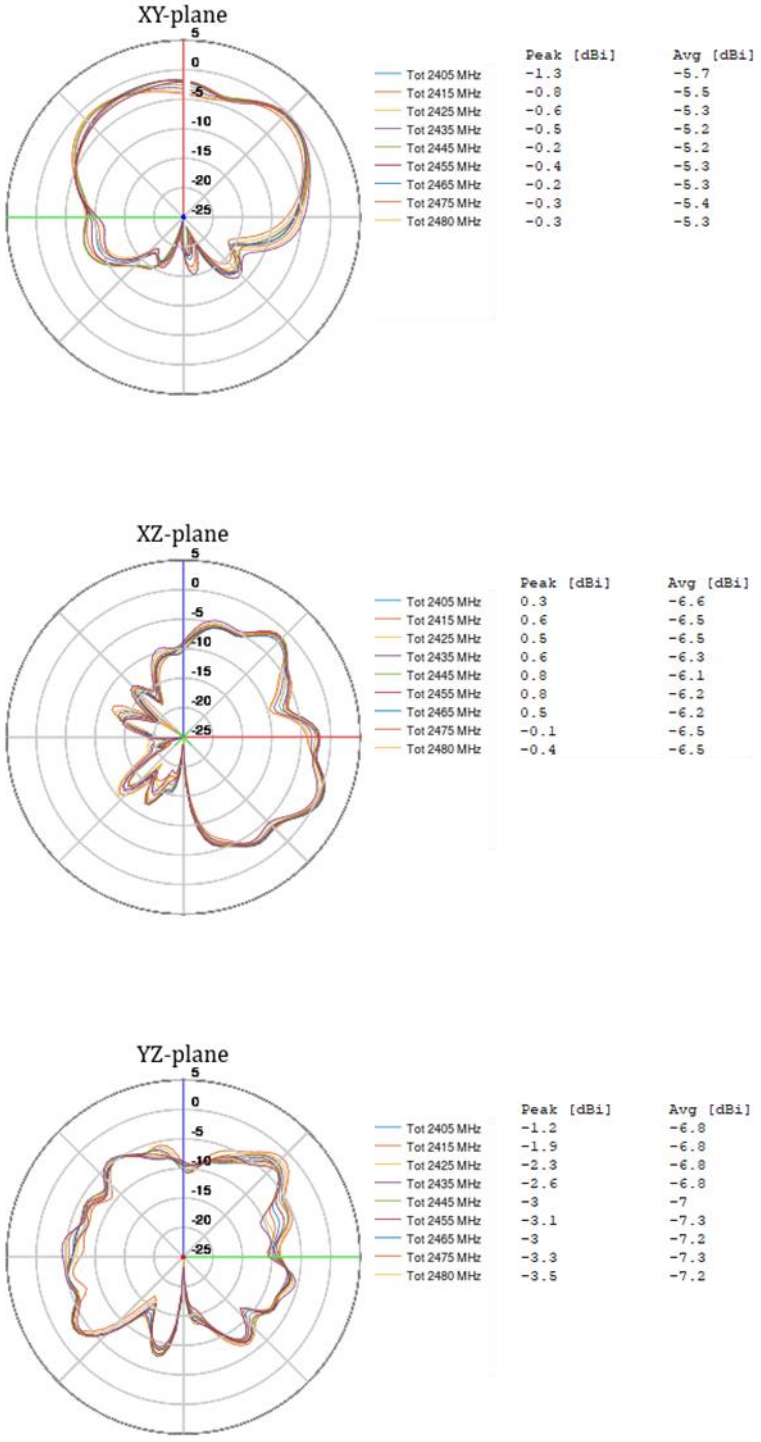


Figure 5-24 Radiation patterns for Aurora UHF antenna, Door lock mounted on foiled door. Front cover plastic with metal wings.

A. Antenna measurement system

All radiated measurements were performed using the measurement setup described in this appendix.

Table 5-4 List of equipment in antenna measurement system.

Item	Vendor	Model/Version
3D measurement chamber	Satimo	SG-23
Network Analyzer	Rohde & Schwarz	ZNB-8
Software	MVG	Wave Studio 22.5.6
Last calibration	MVG	2023-05