

2.4 GHz Planar Inverted F Antenna

Model AA-INVF-IN100 Keypad Variant

Table of Contents

1.	Introduction	2
2.	Antenna Trace Length Adjustment	3
2.1.	Tuned Antenna Dimensions	4
3.	Matching Circuit	5

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4.	VSWR	7
4.1.	Plastic Cover	7
4.2.	Plastic Cover with Metal Wings.....	8
5.	Radiation Patterns	8
5.1.	Plastic Cover	10
5.2.	Plastic Cover with Metal Wings.....	11
6.	Specifications.....	12
6.1.	Gain	12
6.2.	Efficiency.....	12
6.2.1.	Plastic cover	Error! Bookmark not defined.
6.2.2.	plastic cover with metal wings	Error! Bookmark not defined.

1. Introduction

This report presents necessary adjustments for the trace length for the internal IFA antenna that is integrated on the main PCB for the Assa Abloy Aperio IN100 V3 and antenna measurements (VSWR and radiation patterns).

The mechanical housing for the IN100 may be made of plastic as well as with metal wings. The antenna measurements have been done for both possible configurations of the mechanics.

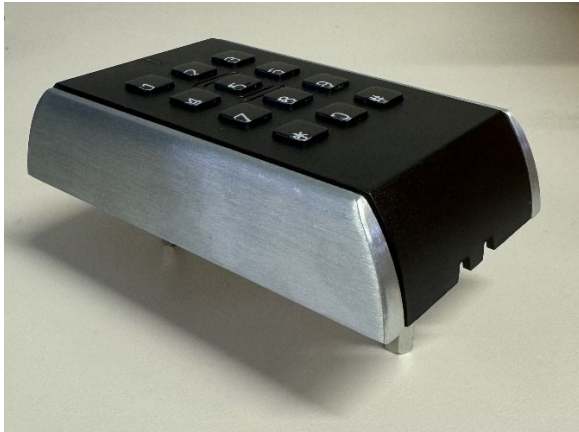


Fig 1: IN100 plastic cover with metal wings.



Fig 2: IN100 plastic cover.

2. Antenna Trace Length Adjustment

To get the internal IFA resonant for the frequency band 2405-2480MHz, the antenna trace length had to be modified (cut back) as shown in Fig 3 below.



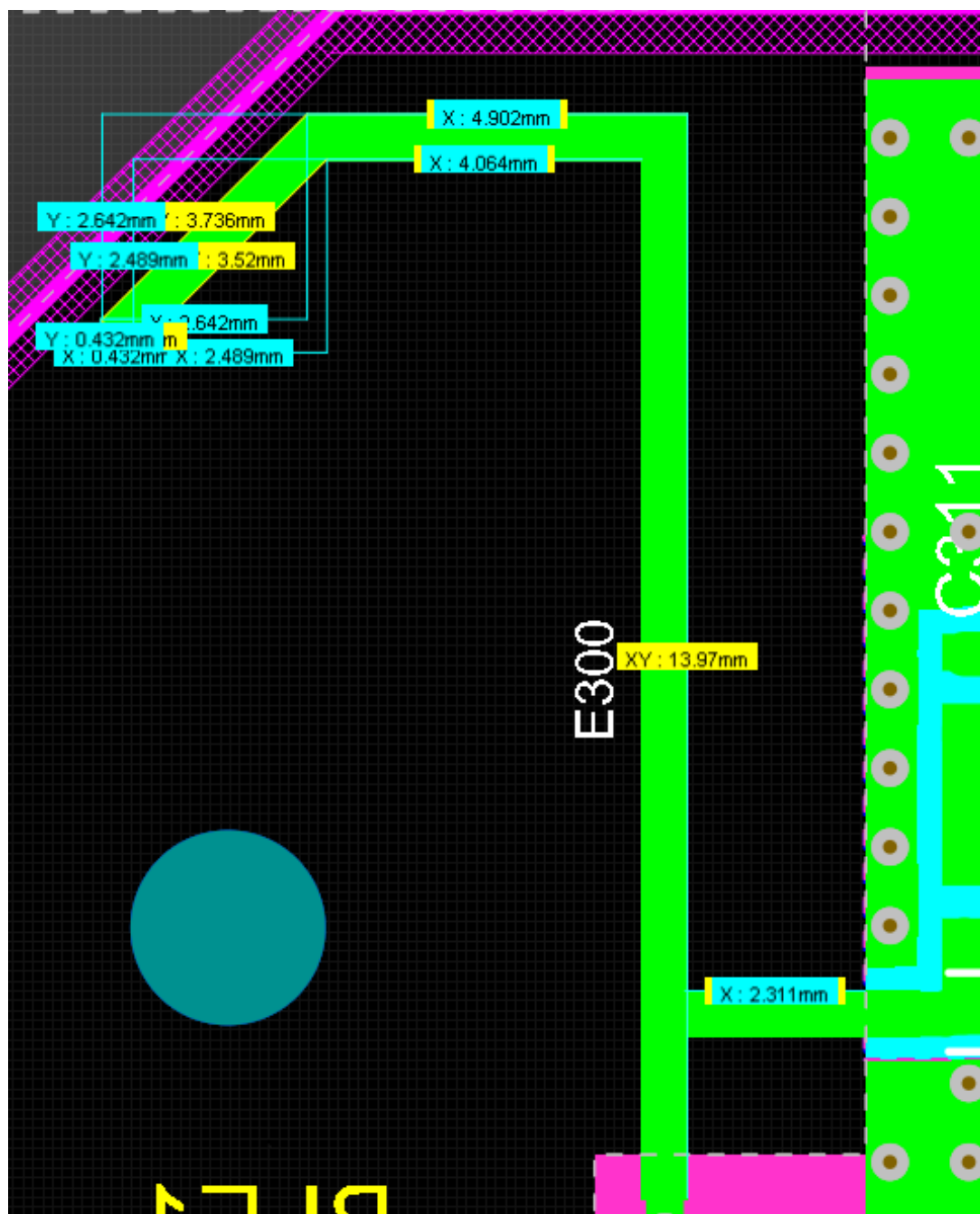
Fig 3: Antenna length adjustment.

The maximum deviations from nominal dimension are:

Trace length: Nominal $\pm 0.1\text{mm}$

Trace width: Nominal $\pm 0.05\text{mm}$

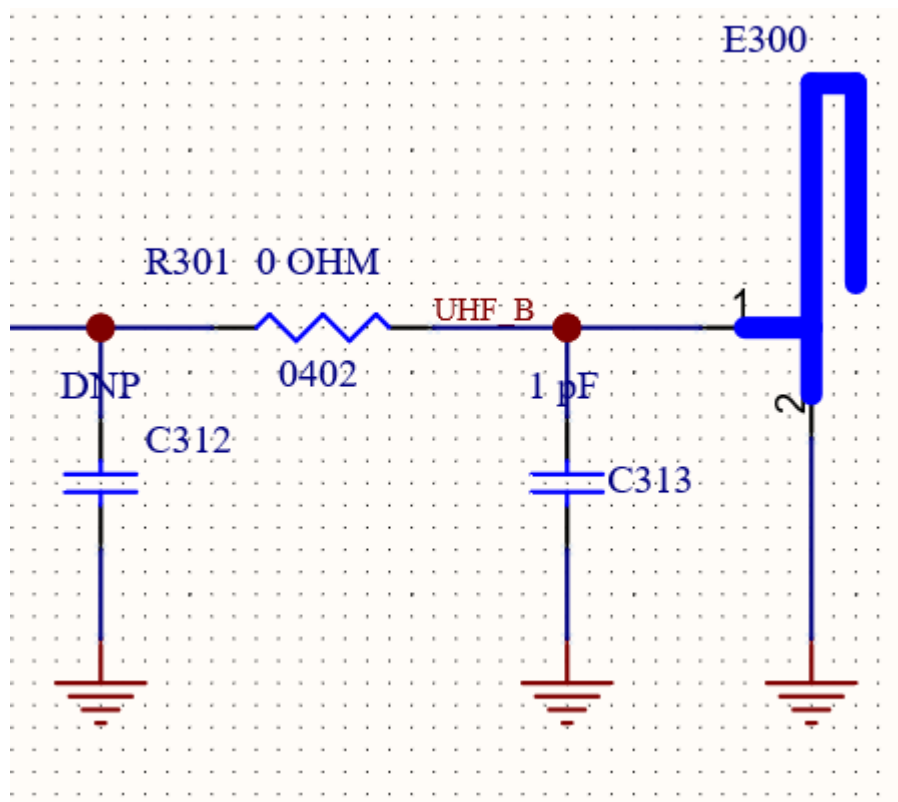
2.1. Tuned Antenna Dimensions



3. Matching Circuit

No need for matching components, see schematic below.

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4. VSWR

For a radio (transmitter or receiver) to deliver power to an antenna, the impedance of the radio and transmission line must be well matched to the antenna's impedance. The parameter VSWR (Voltage Standing Wave Ratio) is a measure that numerically describes how well the antenna is impedance matched to the radio or transmission line it is connected to.

4.1. Plastic Cover

Front cover: Plastic

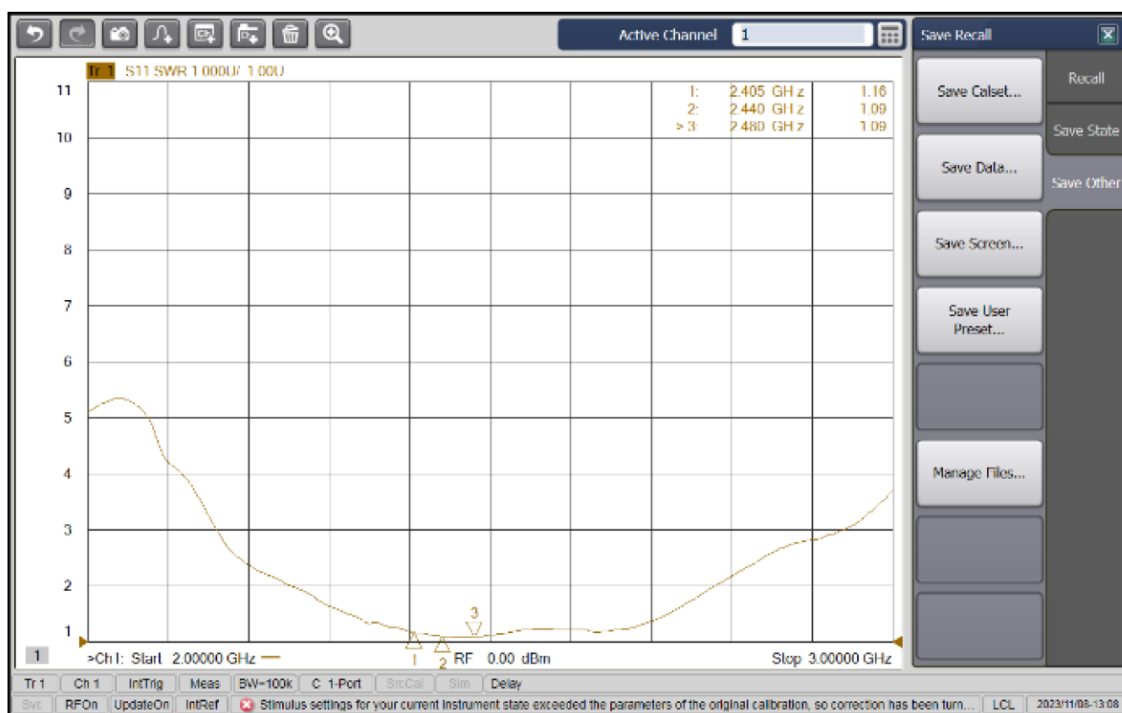


Fig 4: VSWR IN100 Keypad Variant` plastic cover.

4.2. Plastic Cover with Metal Wings

Front cover: Plastic with Metal wings

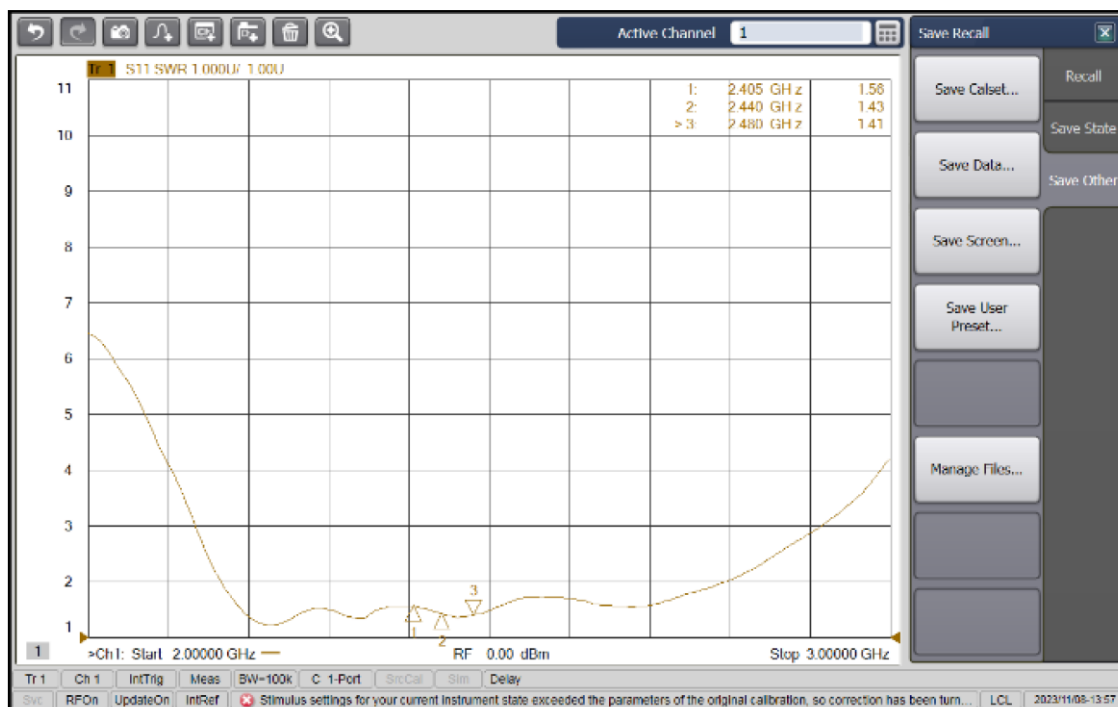


Fig 5: VSWR IN100 Keypad Variant plastic cover with metal wings.

5. Radiation Patterns

The radiation pattern measurements are done for three measurement planes; XY-plane, XZ-plane and YZ-plane (see Fig 7) with vertical and horizontal polarization of reference antenna. This section presents the total gain measurements (sum of the horizontal and the vertical gain).

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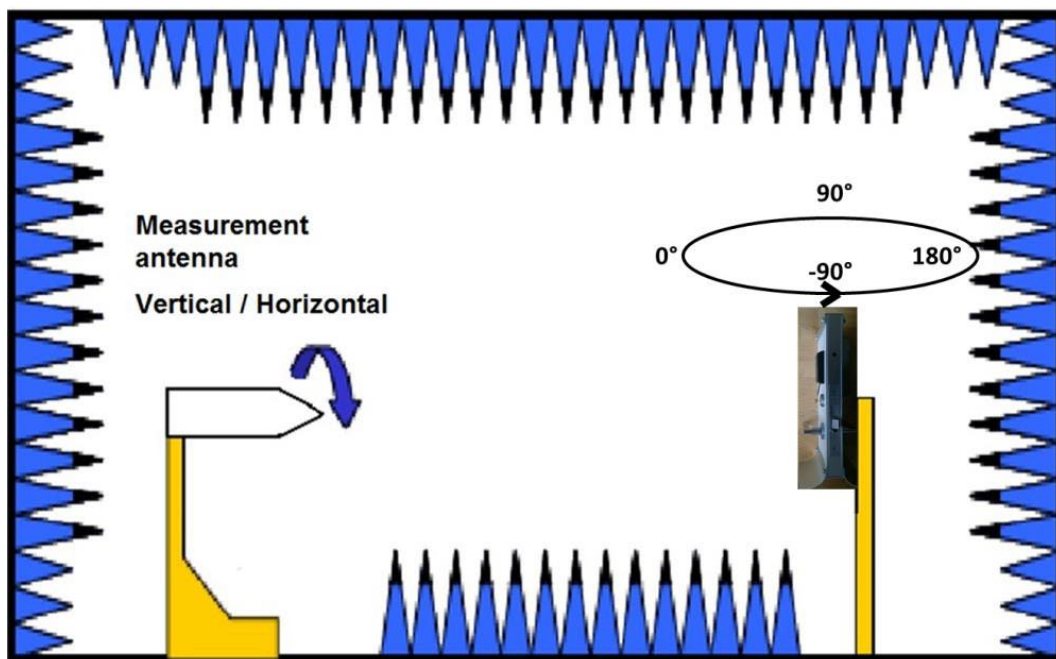
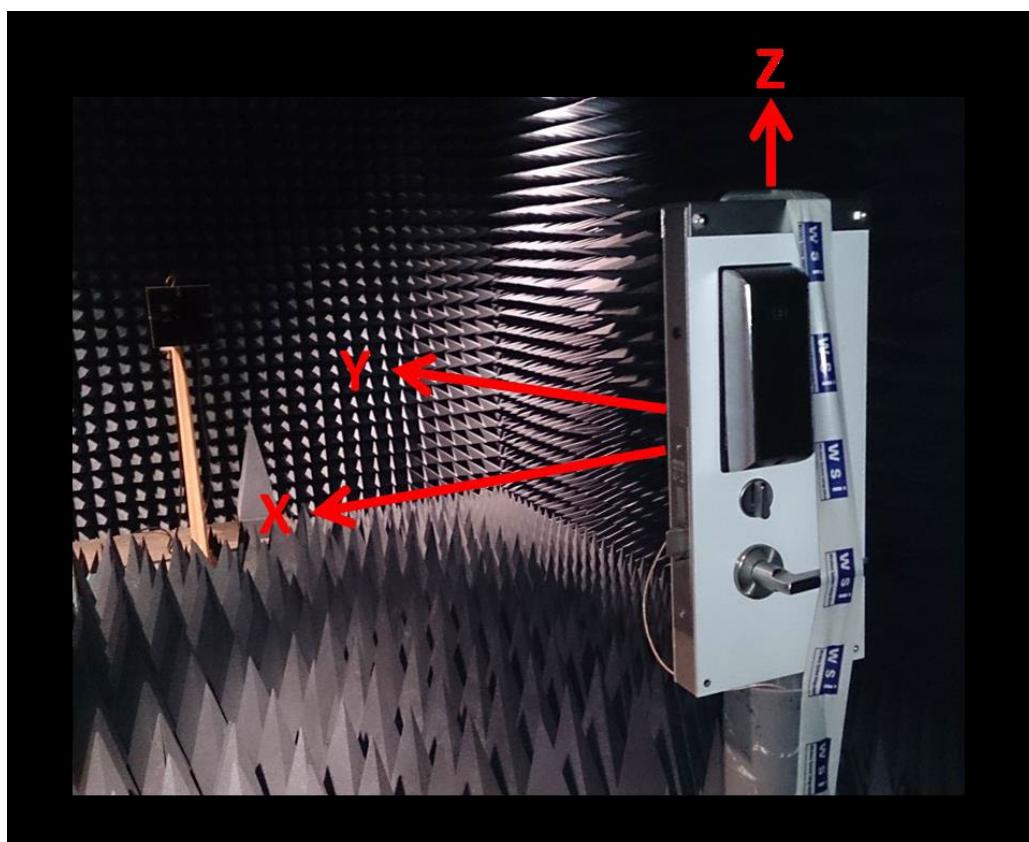


Fig 6: Measurement setup

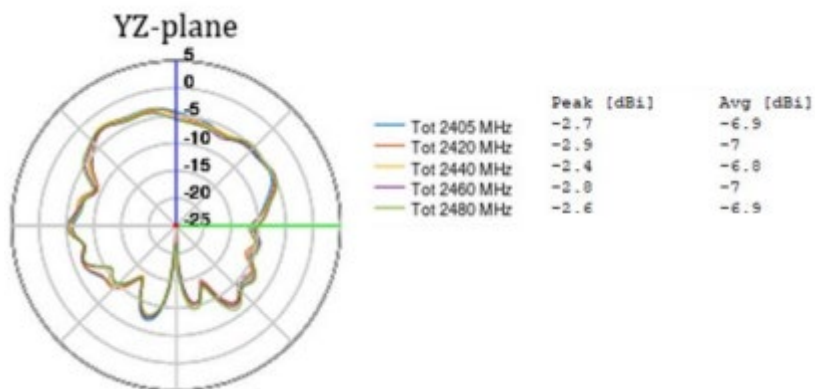
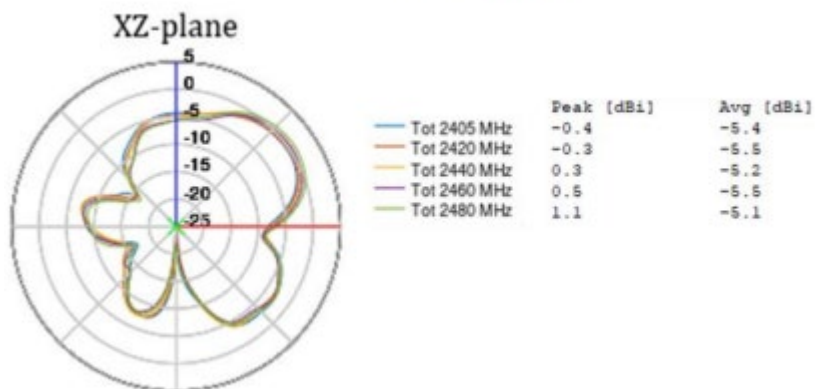
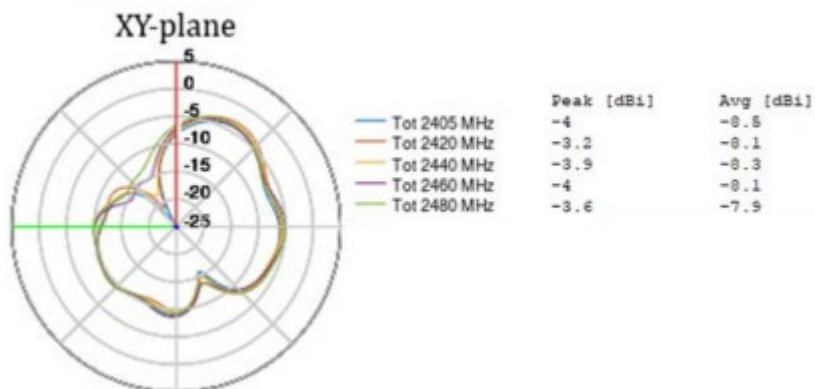


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Fig 7: Measurement plane definitions

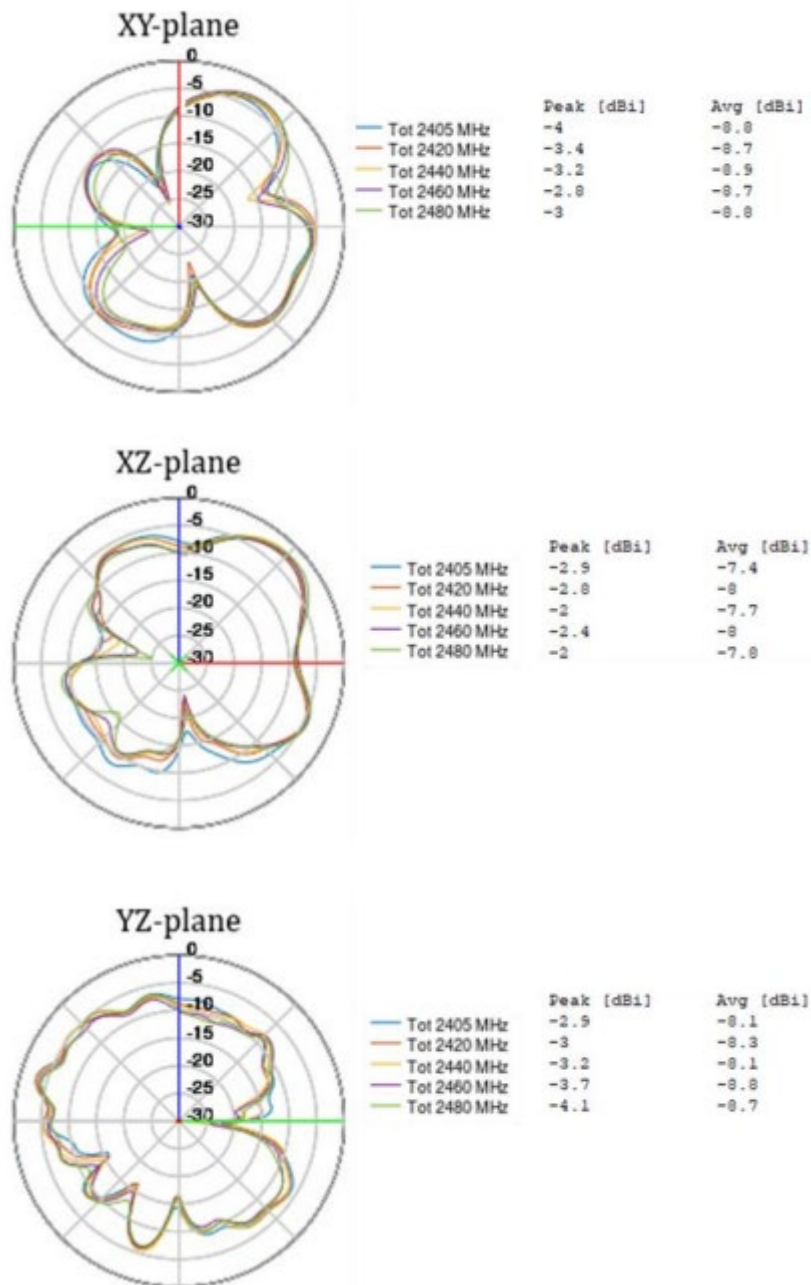
5.1. Plastic Cover

Front cover *Plastic*



5.2. Plastic Cover with Metal Wings

Front cover *plastic with Metal wings*



6. Specifications

6.1. Gain

Radio Technology	Antenna Gain (dBi)
ZigBee	3.7

6.2. Efficiency

Variable	Value
P_{tx} Downlink AH Gen 5	10 dBm
G_{ant} AH Gen 5	+3.7 dBi
Azimuth	
G_{ant} lock, plastic cover wood door	1.0 dBi (peak)
G_{ant} lock, wings wood door	-0.4 dBi (peak)
G_{ant} lock, plastic cover foiled door	2.1 dBi (peak)
G_{ant} lock, wings foiled door	0.8 dBi (peak)
P_{sens} lock	-97 dBm