Bluetooth
Antenna Specification

By KKM

1 KEYWORDS

- *Bluetooth*
- *Antenna*

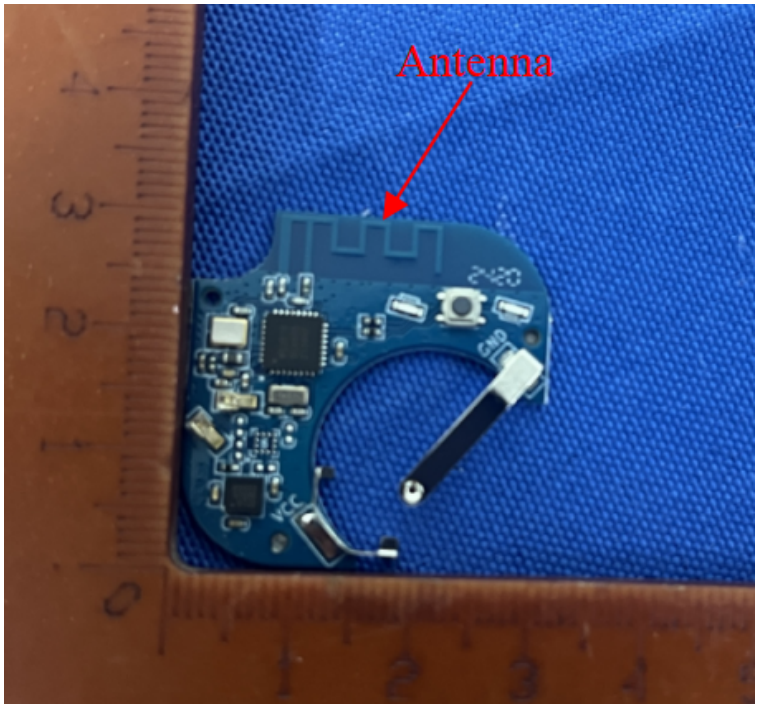
2 INTRODUCTION

The antenna used on the

reference design is described
in this application note.

This application note describes the antenna dimensions, the RF performance and considerations for complying with regulatory limits when using this design.

Size



3 Testing Conditions

Antenna Electrical Characteristics

Parameters	Value
Frequency Range	2400~2500MHz
Antenna Description	External Antenna
VSWR	<2.0
Impendence	50 ohm
Gain	0dBi
Polarization	Single
Azimuth	Omni-directional

Product Testing Conditions

Parameters	Value
Working Temp	-30℃ ~ +60℃

4 ANTENNA DESIGN

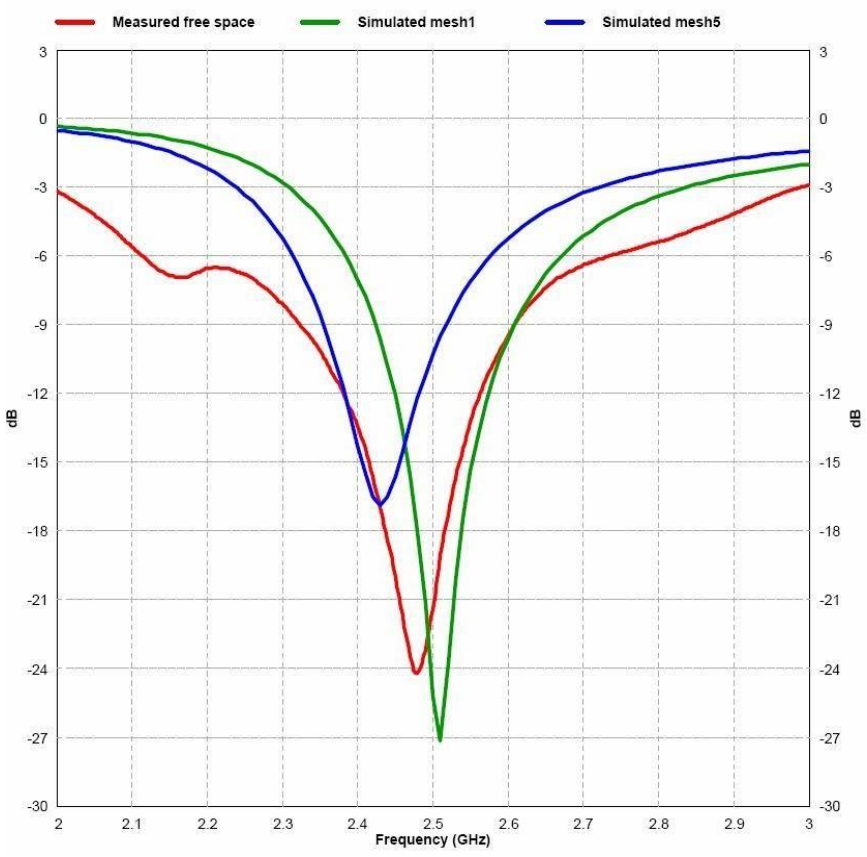
The antenna on the reference design is a meandered Inverted F Antenna (IFA). The IFA was designed to match an impedance of 50 ohm at 2.45 GHz. Thus no additional matching components are necessary.

4.1 Design Goals

The reflection at the feed point of the antenna determines how much of the applied power is delivered to the antenna. A reflection of less than -10 dB across the 2.4 GHz ISM band, when connected to a 50 ohm source, was a design goal. Reflection of less than -10 dB, or VSWR less than 2, ensures that more than 90% of the available power is delivered to the antenna. Bandwidth is in this document defined as the frequency band where more than 90% of the available power is delivered to the antenna. Another design goal was to fit the size of the antenna on a and to obtain good performance also when the is connected to a computer.

4.2 Simulation

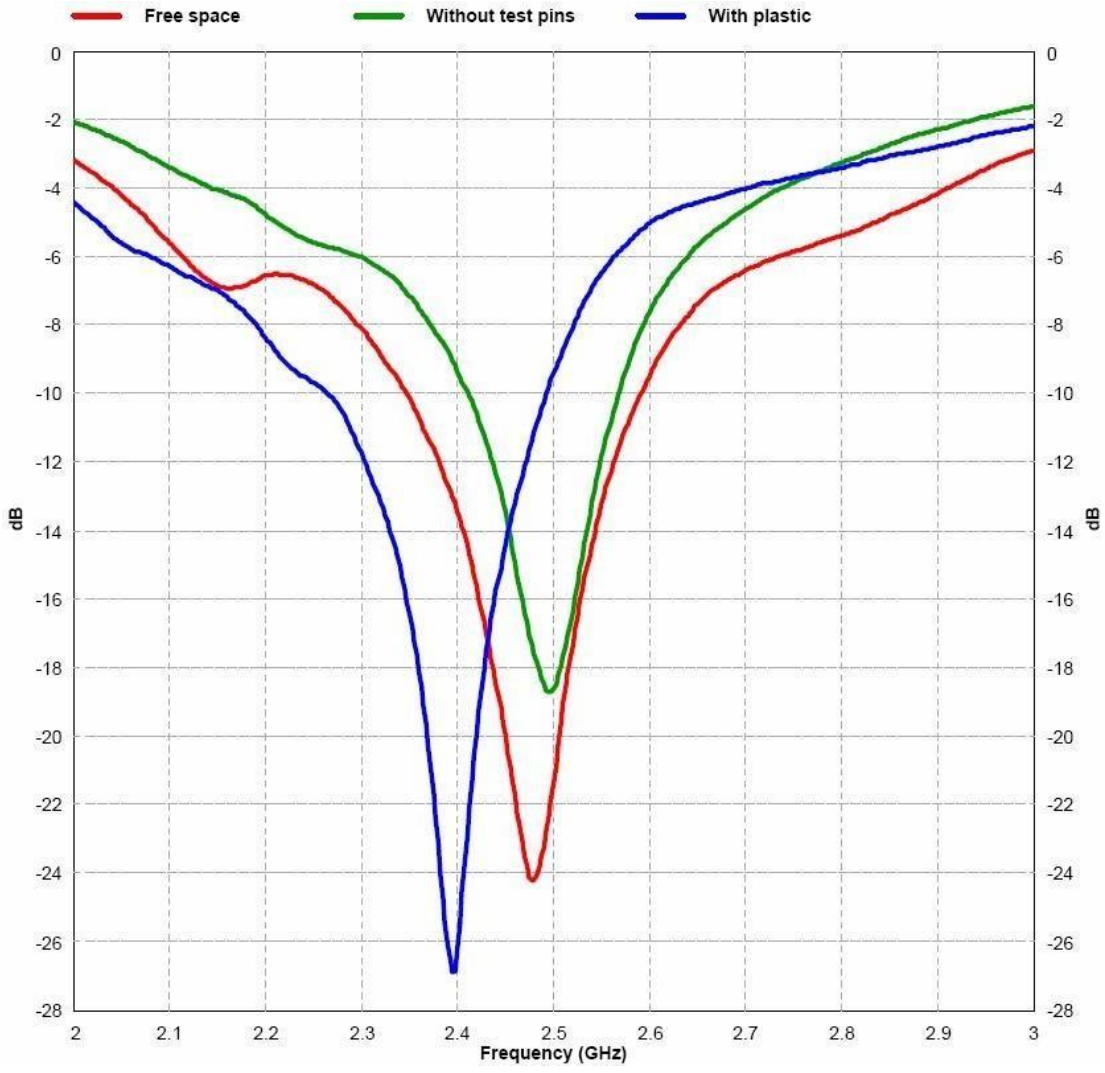
IE3D from Zeland, which is an electromagnetic simulation tool, was used to design the antenna. The accuracy of the simulation is controlled by the mesh. An increase of the mesh increases the simulation time. Thus, for initial simulations mesh = 1 should be used. When a fairly good result is achieved a higher mesh should be used to obtain more accurate results. Comparison of simulation and measurement results shows that the measured reflection is between the result obtained with mesh = 5 and mesh = 1; see Figure 2 for details.


Measured free space
Simulated mesh1
Simulated mesh5
3
0
-3
-6
-9
-12
-15
-18
-21
-24
-27
-30
dB
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
Frequency (GHz)

5 TEST RESULTS

5.1 Reflection

All the reflection measurements were performed with a network analyzer connected to a semi-rigid coax cable, which was soldered to the feed point of the antenna. Because of the small size antenna and the small ground plane this kind of measurements is heavily affected by the presence and placement of the coax cable. This influence can result in a small uncertainty in resonance frequency and measured reflection. Typically different placement of the semi-rigid coax cable could change the resonance frequency with 5 -10 MHz and the reflection with 3 - 4 dB.



Antenna 3D patterns

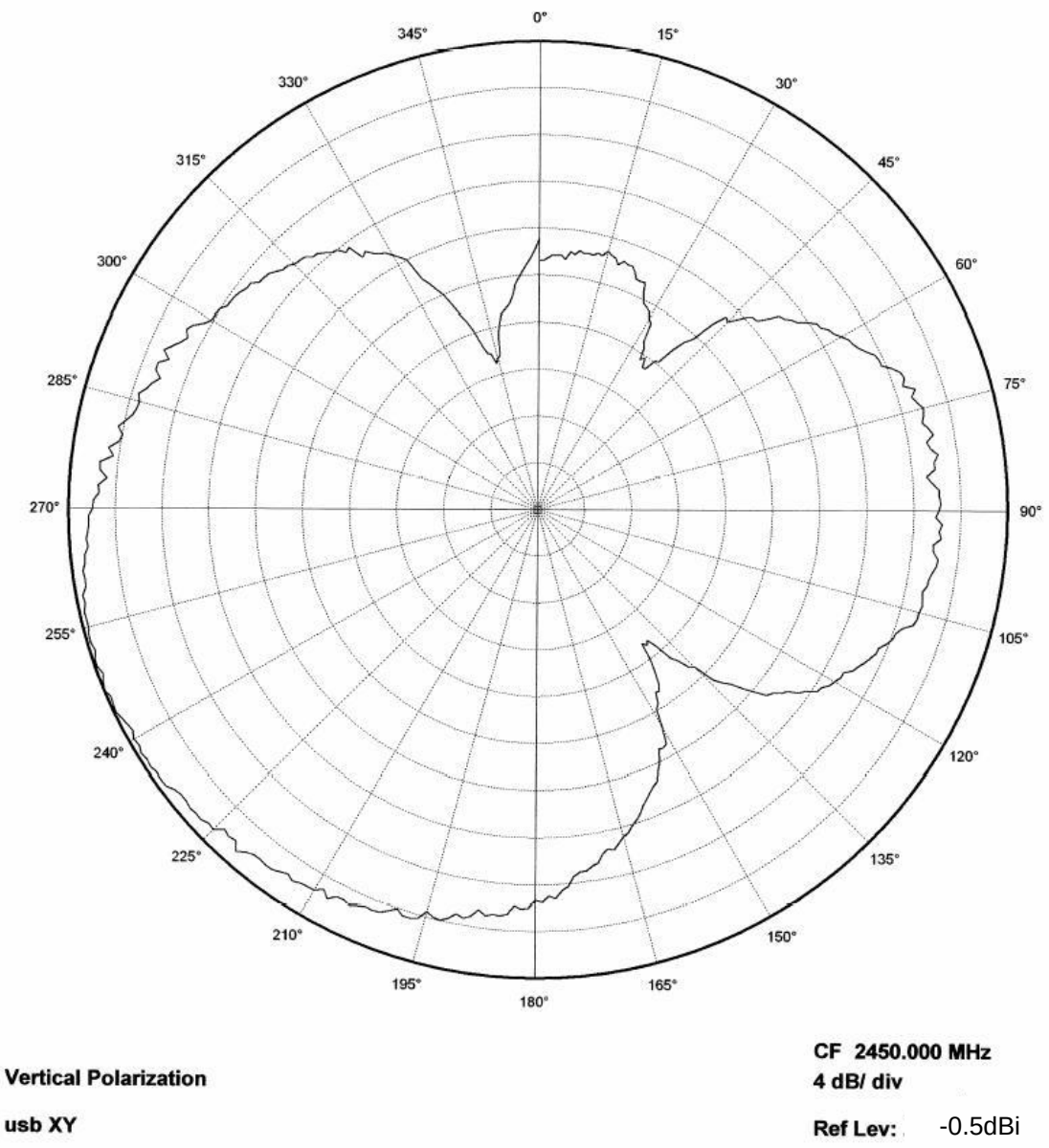


Figure : XY Plane

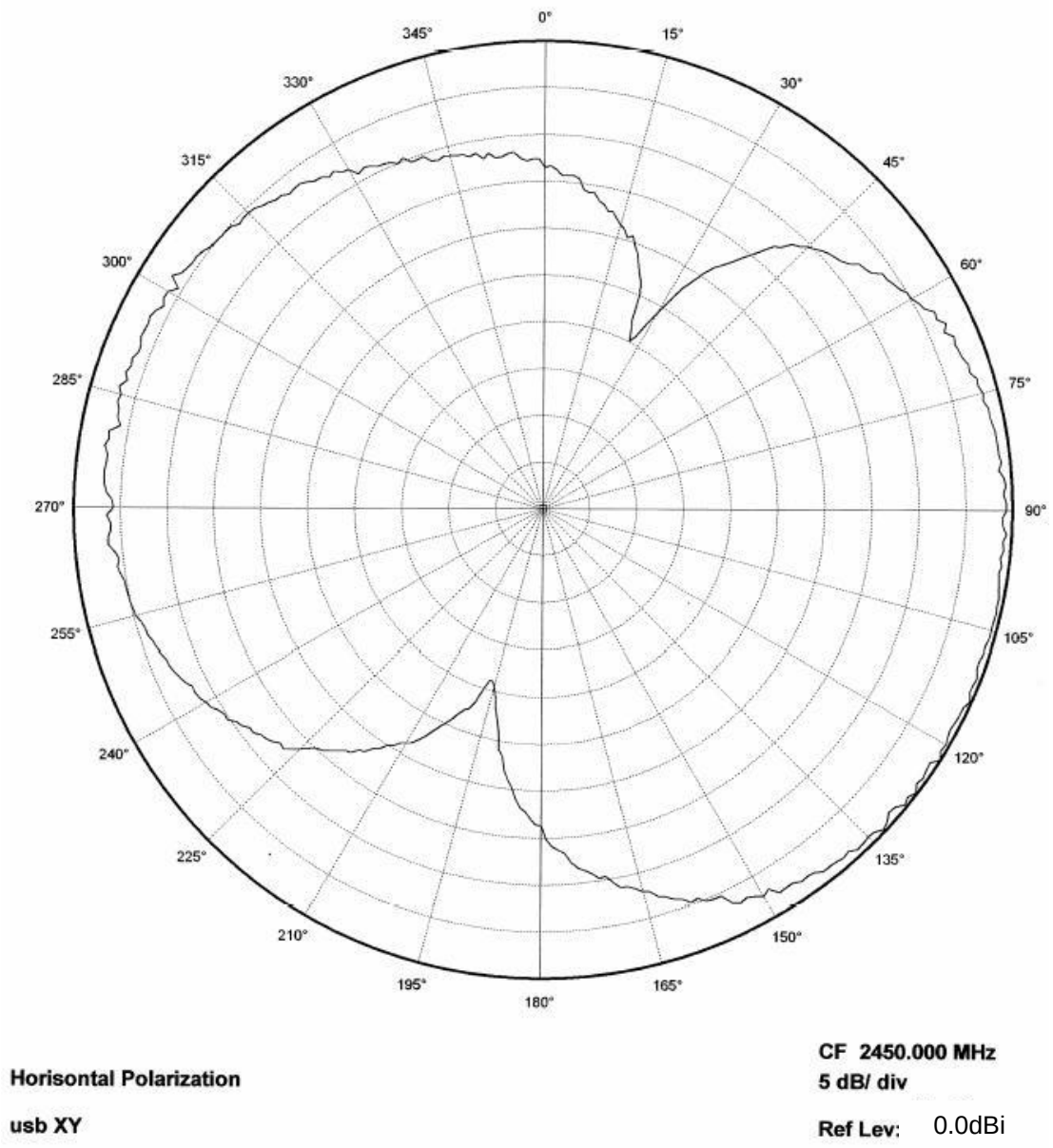


Figure :XY Plane

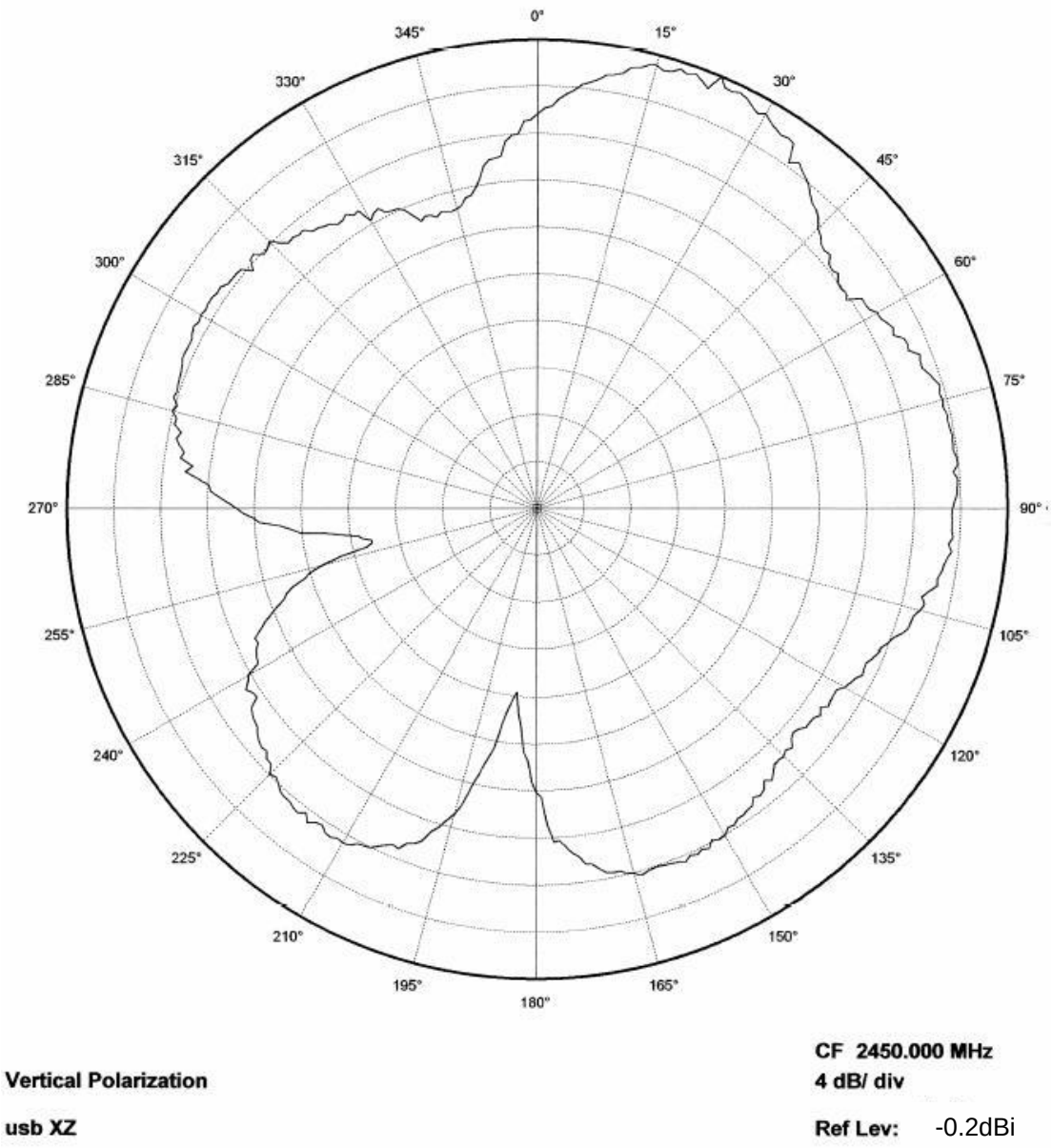


Figure : XZ Plane

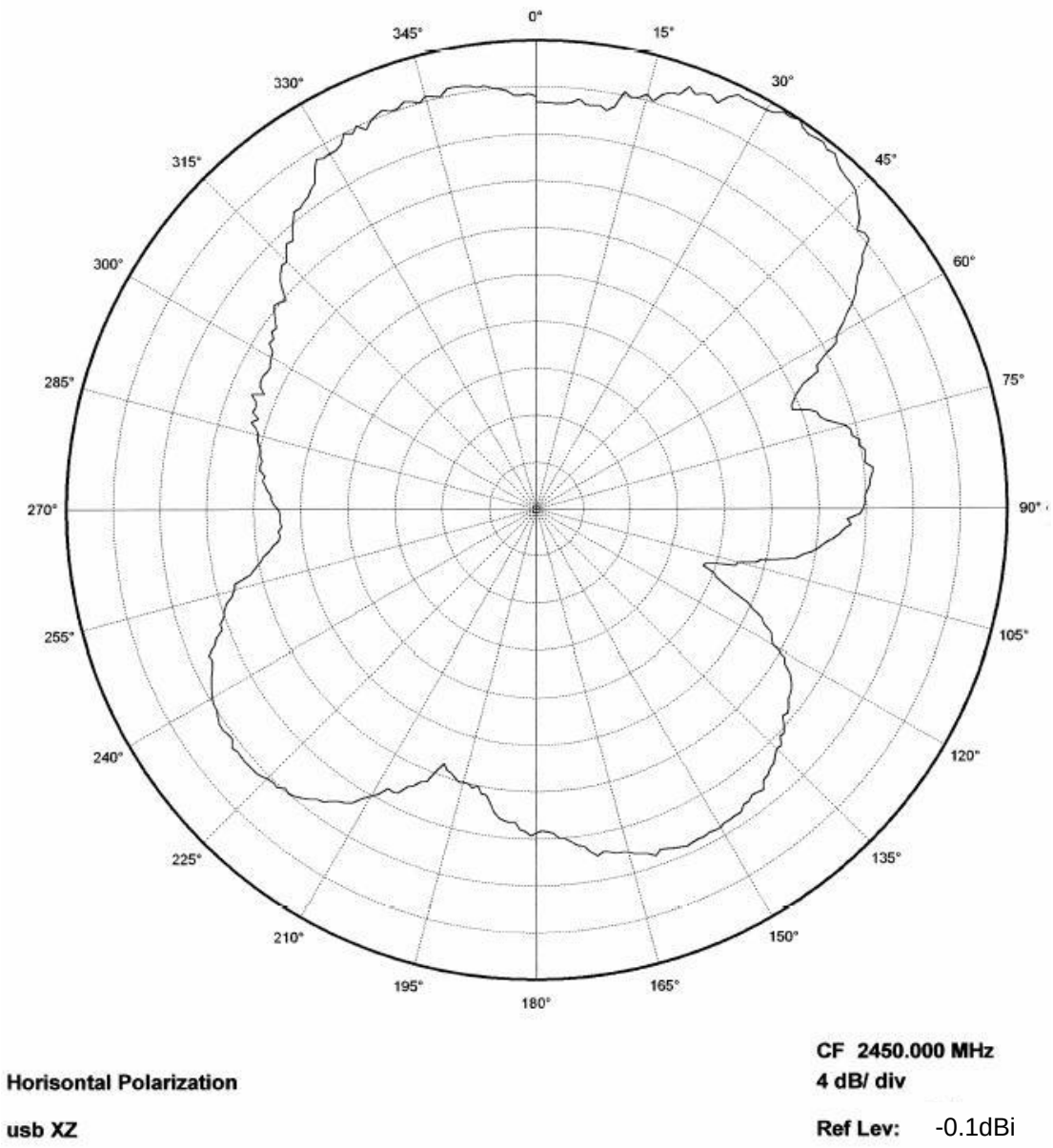


Figure : XZ Plane

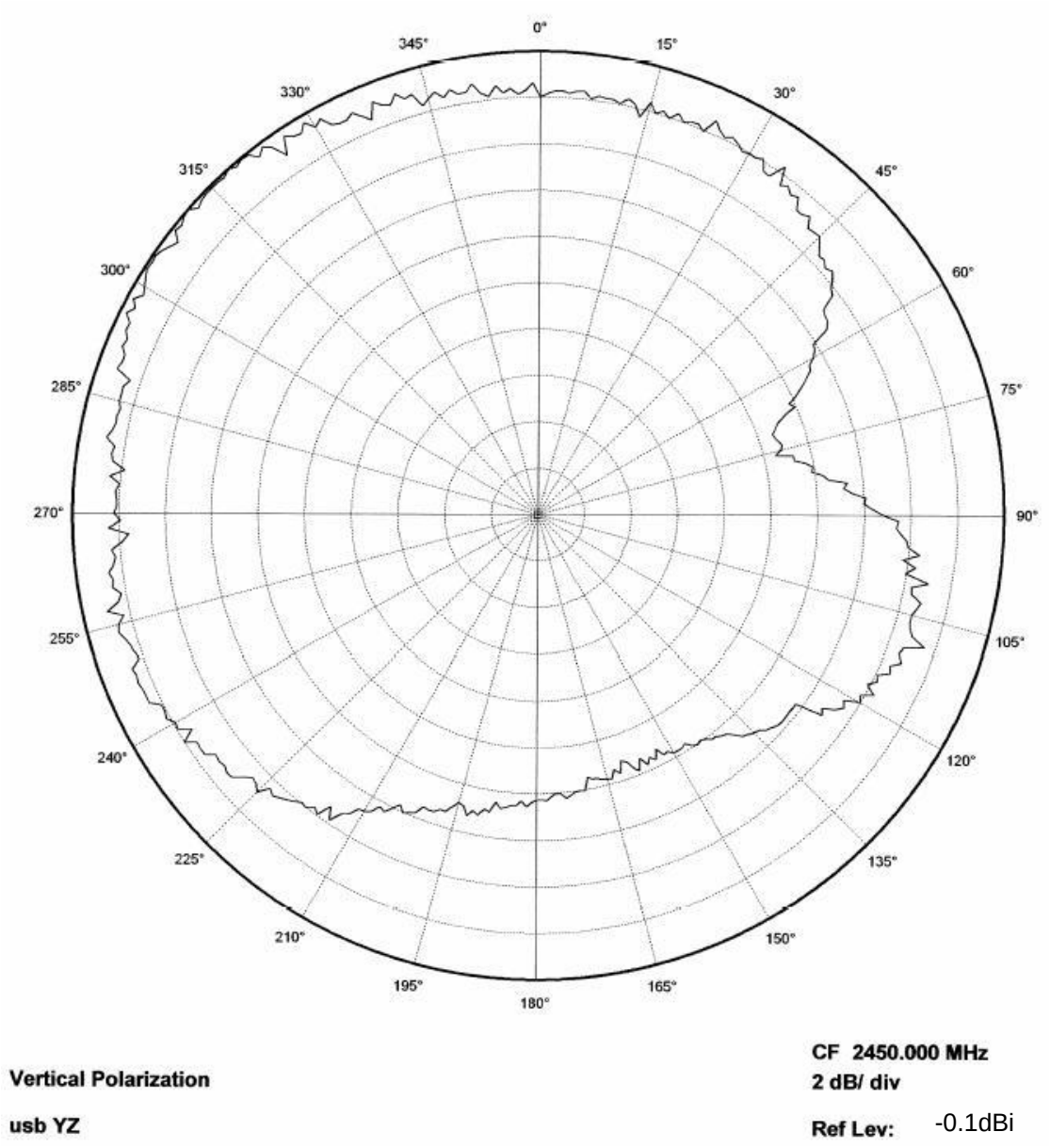


Figure : YZ Plane

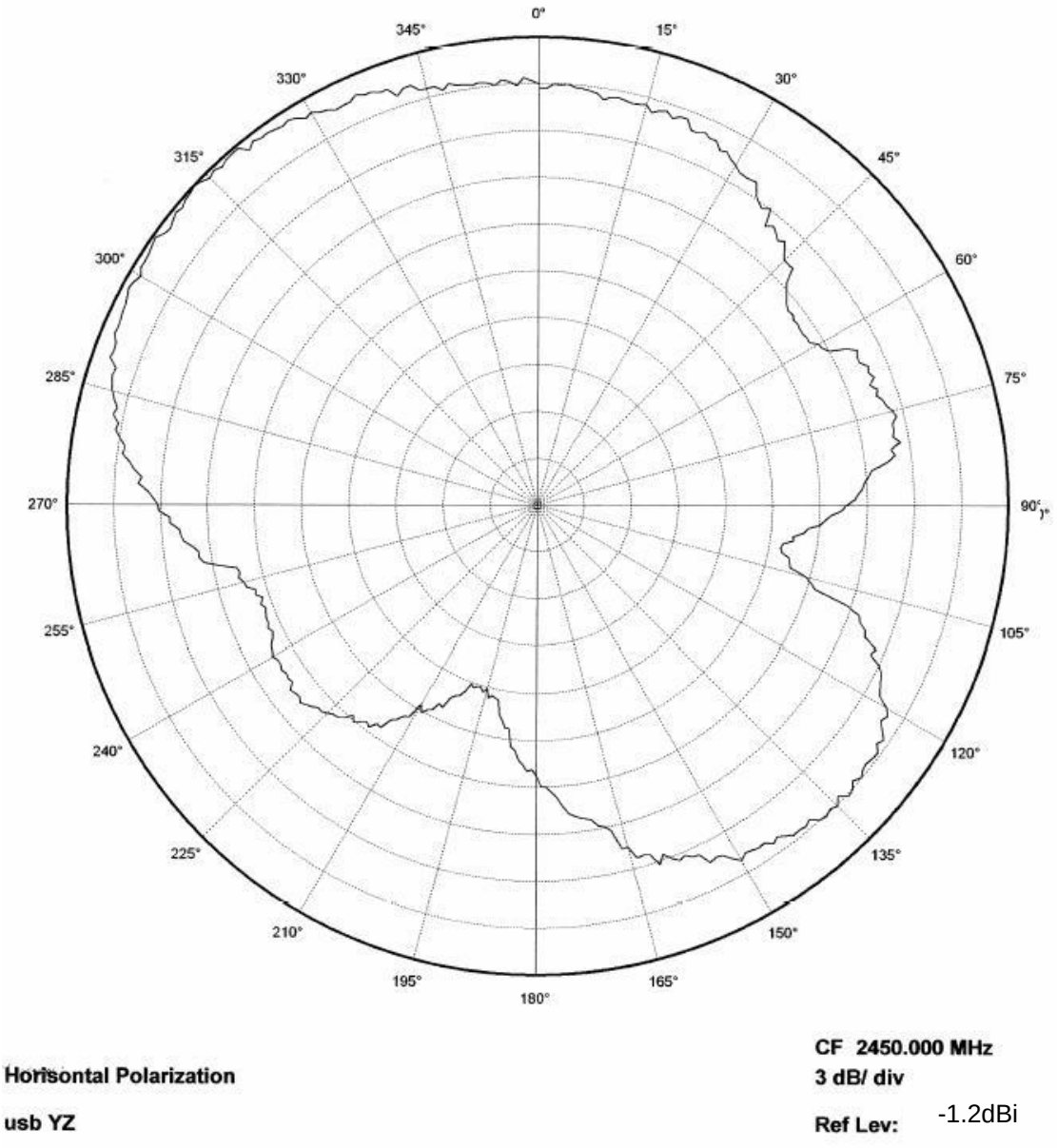


Figure YZ Plane

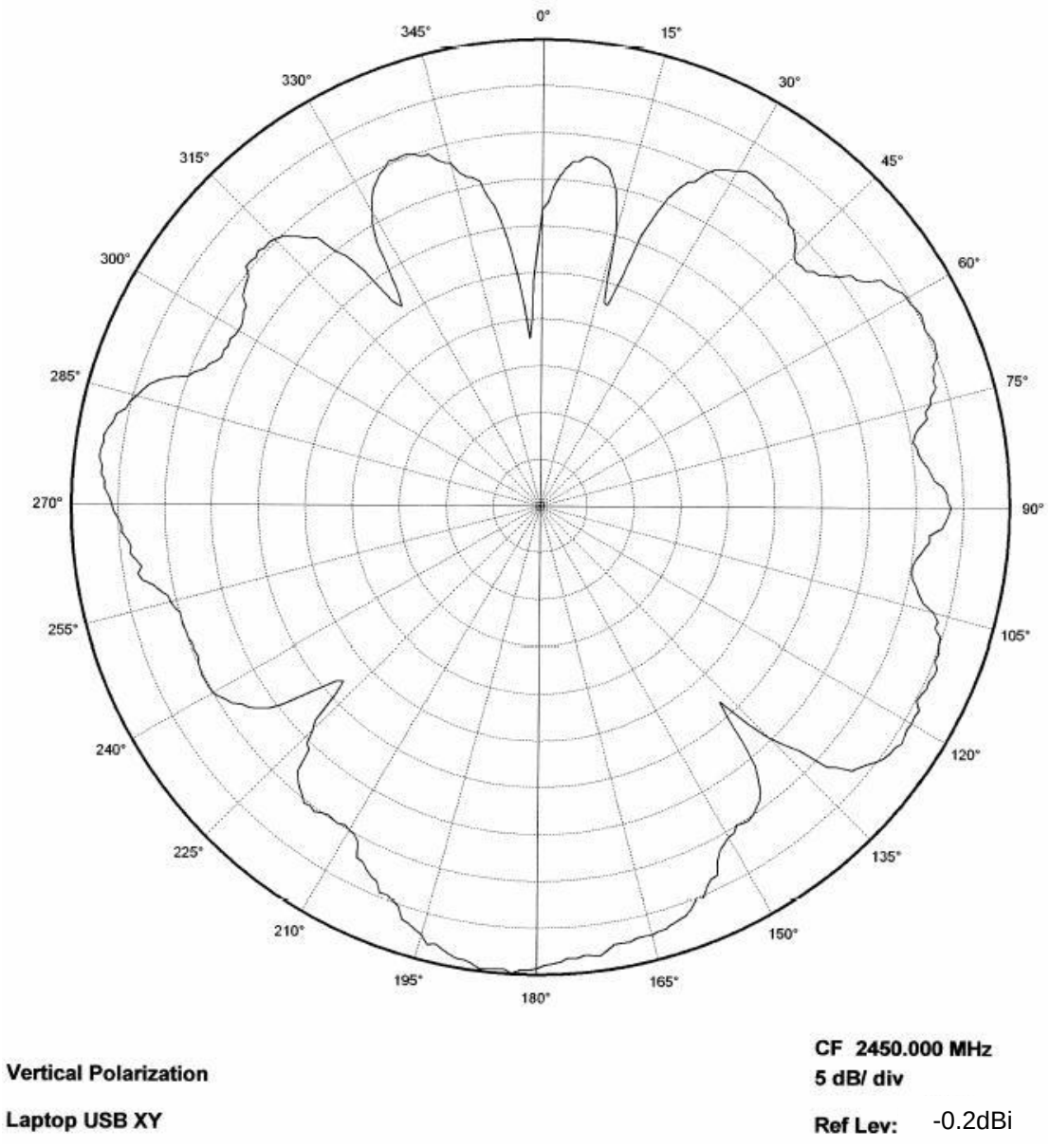


Figure: Laptop XY Plane

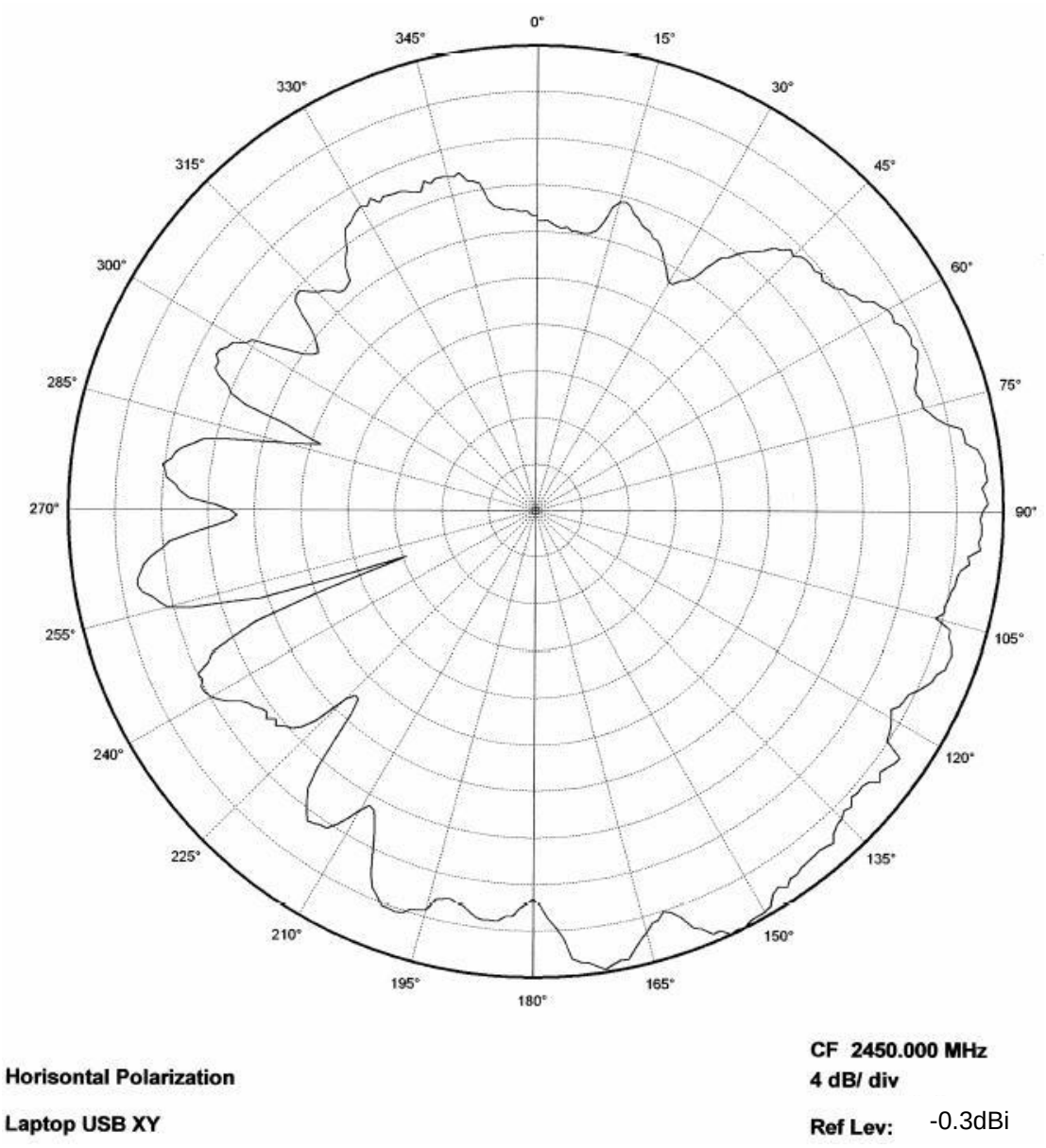


Figure: Laptop XY