

June 27, 2023

Burnham Holdings Engineering Company, LLC
2920 Old Tree Dr.
Lancaster, Pennsylvania
USA

Dear Peter Cloonan,

Enclosed is the radio test report for Passive Antenna testing of the USB-Connect Bluetooth antenna.

Thank you for using the services of Eurofins E&E North America. If you have any questions regarding these results or if we can be of further service to you, please feel free to contact me.

Sincerely yours,
Eurofins E&E North America



Eleazar Zuniga
Wireless Laboratory

Reference: (\Burnham Holdings Engineering Company, LLC\WIRS121164-PassiveAntennaTesting Rev. 1.0)



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Radio Test Report

For the

Manufacturer: Burnham Holdings Engineering Company, LLC

Model Name/Number: USB-Connect Bluetooth Trace Antenna

Device Type: Trace Antenna

Report: WIRS121164-PassiveAntennaTesting Rev. 1.0

June 27, 2023

Prepared For:

**Burnham Holdings Engineering Company, LLC
2920 Old Tree Dr.
Lancaster, Pennsylvania
USA.**

Prepared By:
Eurofins E&E North America
3162 Belick St,
Santa Clara CA, 95054

Radio Test Data

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Report Status Sheet

Revision	Report Date	Reason for Revision
1.0	June 27, 2023	Initial Issue.

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1. Executive Summary

Eurofins E&E North America was contracted by Burnham Holdings Engineering Company, LLC to perform Passive Antenna Testing on the USB-Connect Bluetooth trace antenna under the Burnham Holdings Engineering Company, LLC purchase order number 601119

The services performed will include:

- Testing the USB-Connect Bluetooth trace antenna in an accredited test environment, providing the characteristics of the antenna.

Deliverables:

- Report detailing the results of each antenna includes: Radiation Pattern, Efficiency and Peak Gain.

Requirements:

- Sample prototype to be tested

2. Equipment Configuration

2.1. Overview

This document describes the test setups, test methods, required test equipment used to perform Passive Antenna Testing of the USB-Connect Bluetooth trace antenna. The objective of the testing was to verify the antenna efficiency and peak gain of the trace antenna.

2.1.1. Equipment Under Test (EUT) Information

Manufacture:	Burnham Holdings Engineering Company, LLC	
Model:	USB-Connect Bluetooth trace antenna	
Serial number / ESN(s) / IMEI(s):	SN: N/A	
Primary Mechanical Mode:	Monoblock	
Device Type:	Trace Antenna	
Antenna Type:	Internal	
Radio Mode(s)	Antenna Characterization on the 2400-2500 MHz range.	
Band/Frequency Range	2400-2500 MHz	
EUT Specifications:	Device Code:	23469-1
	Primary Power:	N/A
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Eleazar Zuniga	
Report Date(s):	June 27, 2023	

2.1.2. References

ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories
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2.2. Test Site

All testing was performed in a limited access test laboratory facility located at Eurofins E&E North America, 3162 Belick St., Santa Clara, CA 95054. All testing performed at Eurofins E&E North America. Was conducted in the Environmental Simulation Lab. All equipment used in making physical determinations is accurate and bears recent traceability to the National Standards and Technology.

2.3. EUTs used for Testing

2.3.1. EUTs Used for Each Test

Serial Number/ ESN/IMEI	CATL and Chamber used	Radio Mode(s)	Band/Frequency Range(s)	Test Type(s)	Test Condition(s)
USB-Connect Bluetooth trace antenna	OTA4	Antenna Characterization on the 2400-2500 MHz range.	2400-2500 MHz	Passive Antenna Testing	FS

2.4. Test Equipment Used During Testing

2.4.1. Passive Antenna Testing

MET Asset #	Equipment	Manufacturer	Model Number	Last Cal Date	Cal Due Date
1S4853	Vector Network Analyzer	R&S	ZNB40	04/26/2023	04/26/2024
Note 1: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

2.4.2. Measurement Software

Description	Manufacturer	Name	Version
OTA software	ETS	EMQuest	1.16

3. Result Summary

3.1. Project Summary

Customer:	Burnham Holdings Engineering Company, LLC
EUT Name/Model:	USB-Connect Bluetooth trace antenna
Job Number	# 121164
Test Standard:	n/a
Test Name	OTA Passive Antenna Testing
Test Dates:	June 27, 2023
Laboratory	Eurofins E&E North America, 3162 Belick St., Santa Clara, CA 95054
Test Engineer:	Eleazar Zuniga
Test Results:	Completed
Additional Notes:	

4. Summation Test Report

4.1. Antenna Efficiency and Peak Gain Tables

4.1.1. USB-Connect Bluetooth trace antenna Efficiency and Peak Gain from 2400 MHz to 2500 MHz

Frequency [MHz]	Antenna Efficiency [%]	Antenna Peak Gain [dBi]
2400	14.0	-2.0
2405	13.7	-2.1
2410	13.8	-2.2
2415	13.6	-2.5
2420	13.0	-2.7
2425	13.3	-2.9
2430	13.3	-2.7
2435	13.9	-2.7
2440	13.8	-3.0
2445	13.3	-3.3
2450	13.6	-3.5
2455	13.1	-3.7
2460	12.9	-4.0
2465	13.0	-4.2
2470	12.0	-4.5
2475	12.2	-4.5
2480	11.5	-4.7
2485	11.1	-4.9
2490	11.2	-4.6
2495	10.8	-4.8
2500	11.0	-4.6

Frequency [MHz]	Antenna Efficiency [%] (24002MHz -2480 MHz)	Antenna Peak Gain [dBi] (24002MHz -2480 MHz)
2402-2480	13.2	-3.2

4.2. USB-Connect Bluetooth trace antenna Efficiency and Peak Gain Plot

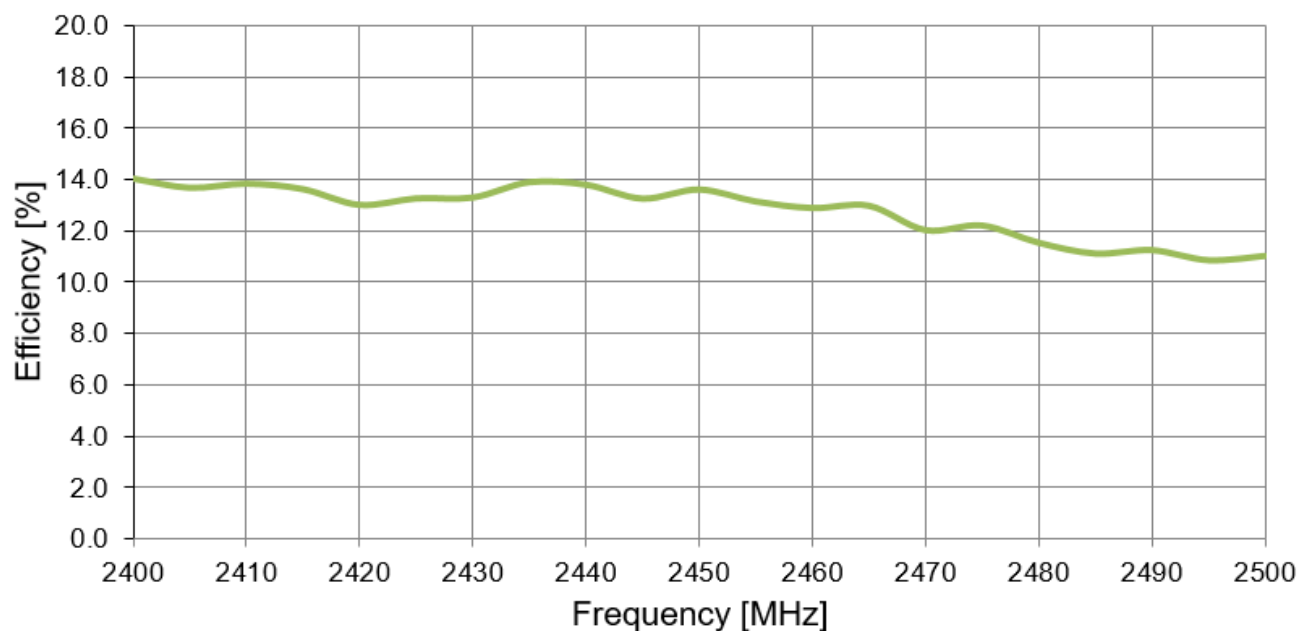


Figure 1; Antenna Efficiency from 2400MHz to 2500 MHz

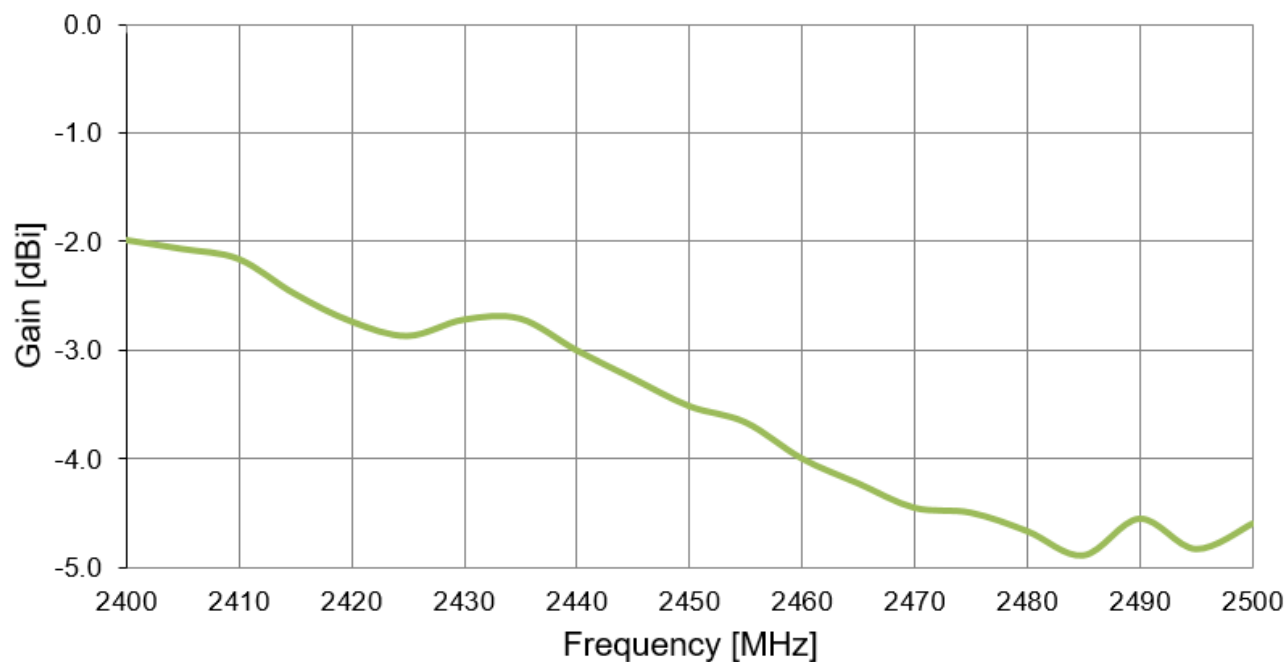


Figure 2; Antenna Peak Gain from 2400MHz to 2500MHz

4.3. 3D Antenna Patterns

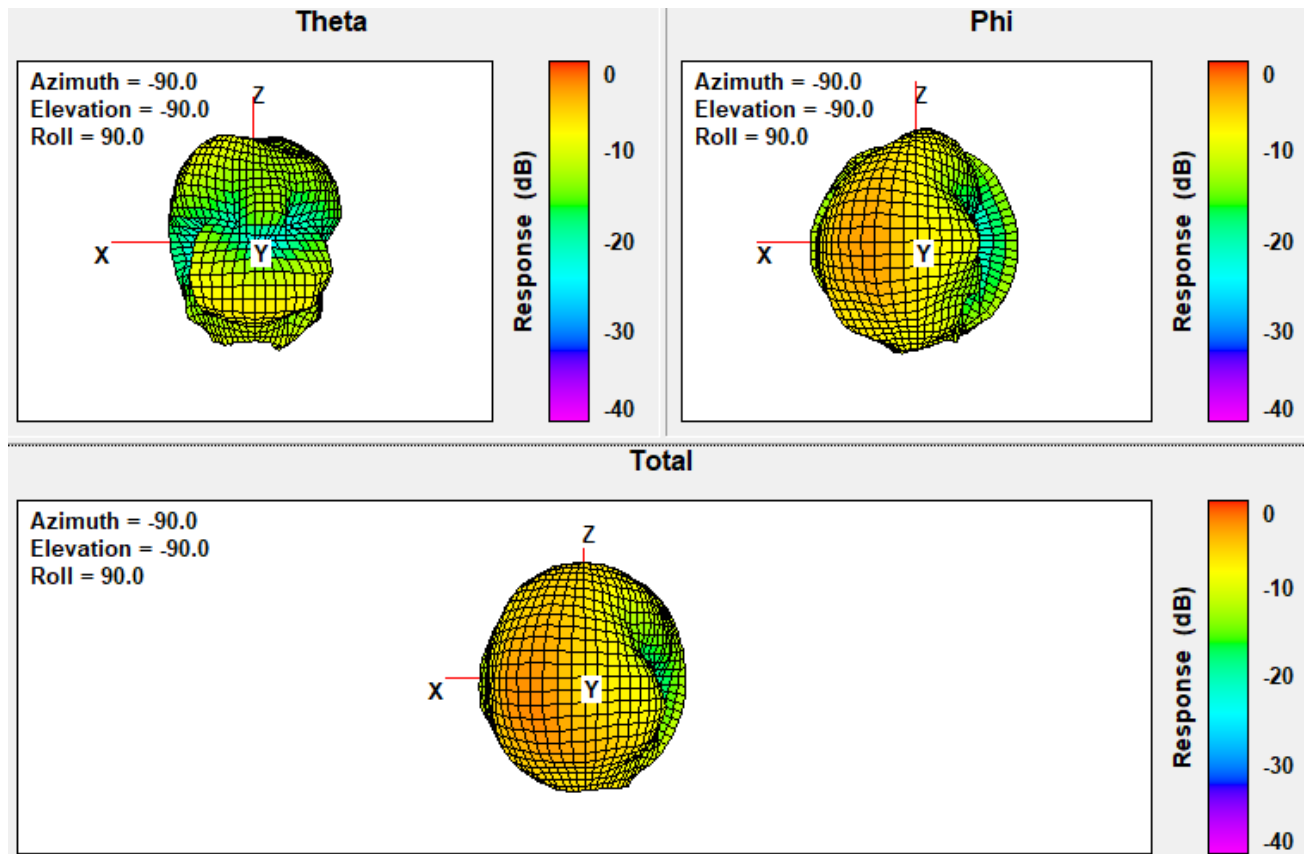


Figure 3; 3D Radiation Patterns at 2402MHz

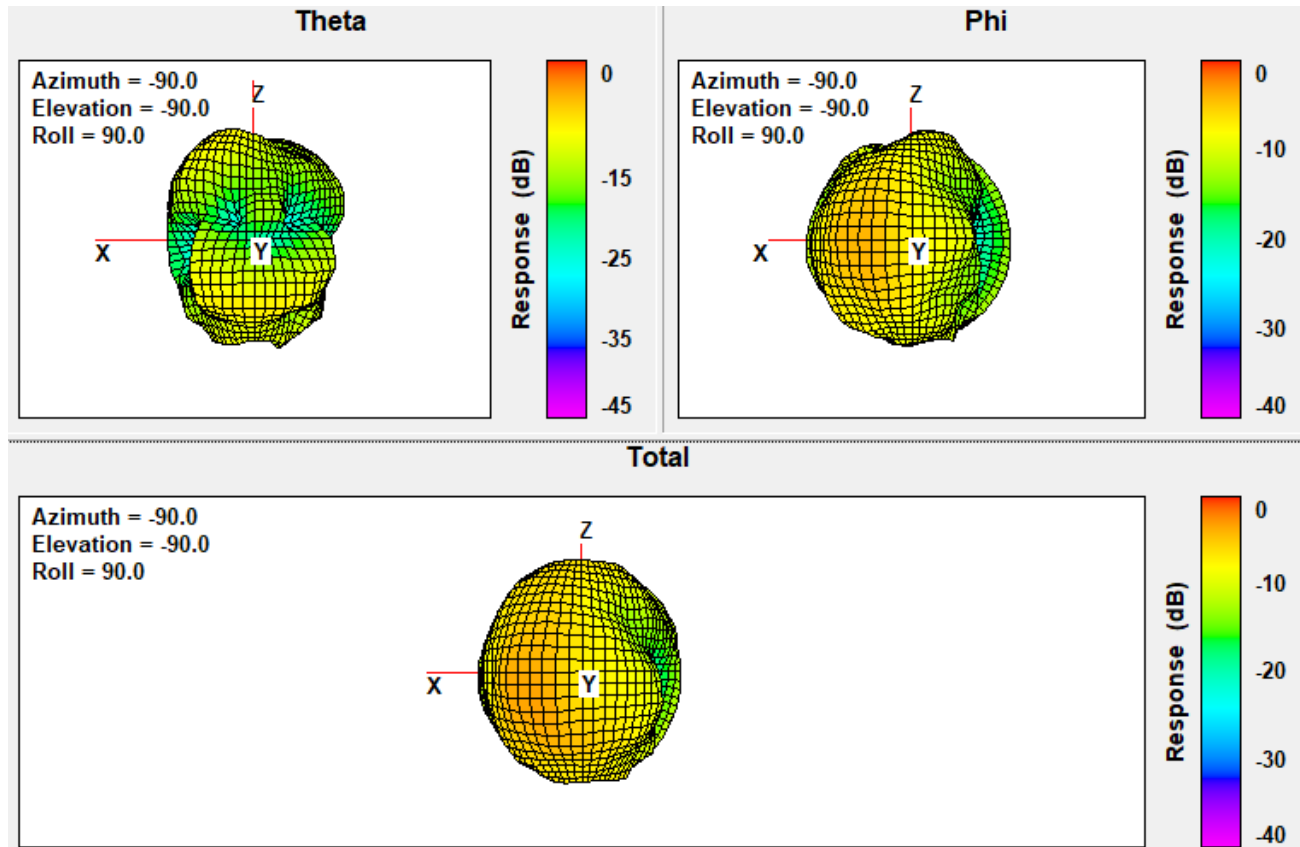


Figure 4; 3D Radiation Patterns from 2440MHz

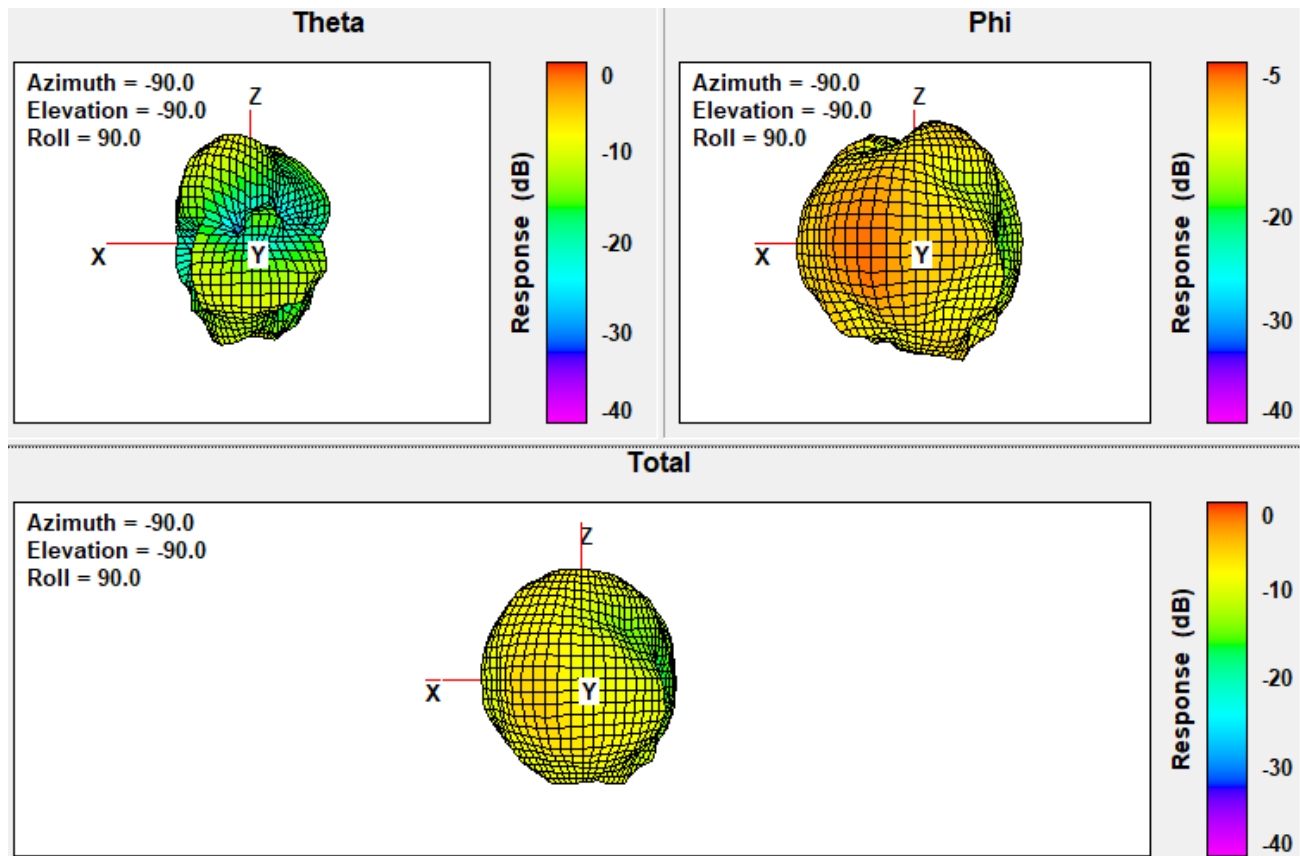


Figure 5; 3D Radiation Patterns from 2480MHz

4.4. Measurement Uncertainty

4.4.1. Measurement Uncertainty

OTA 4 Free Space	
Band	Expanded Uncertainty [dB]
WLAN 2400 – 2500 MHz	1.62

ANNEX A EUT photos

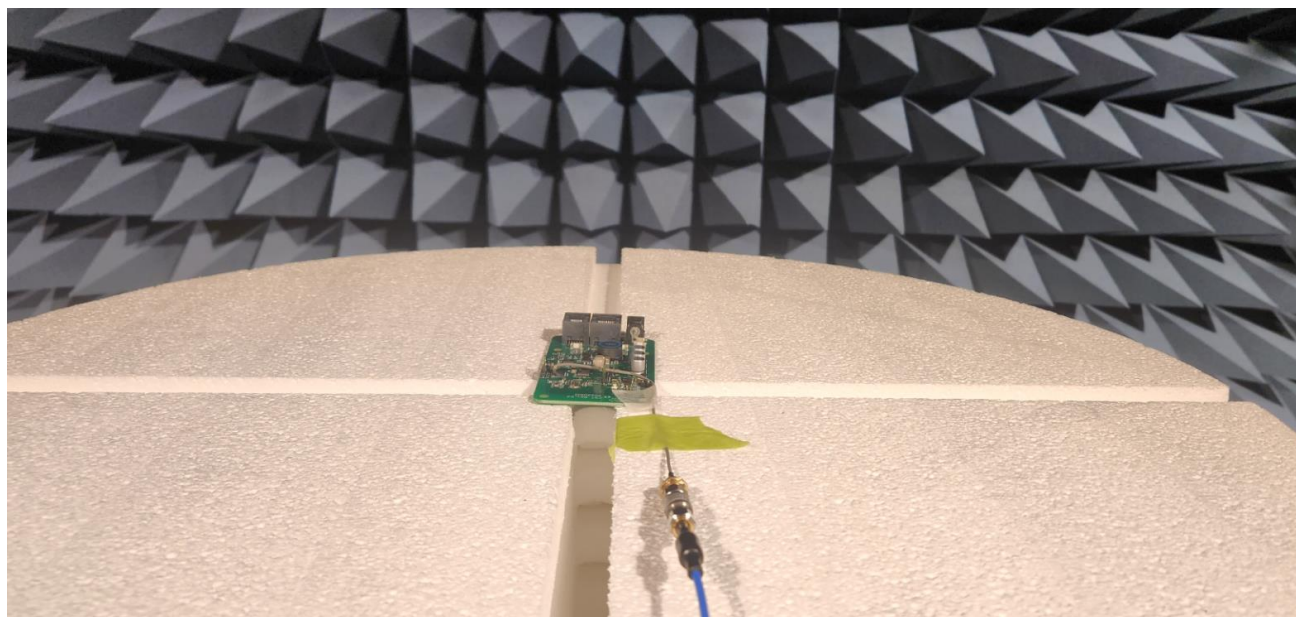
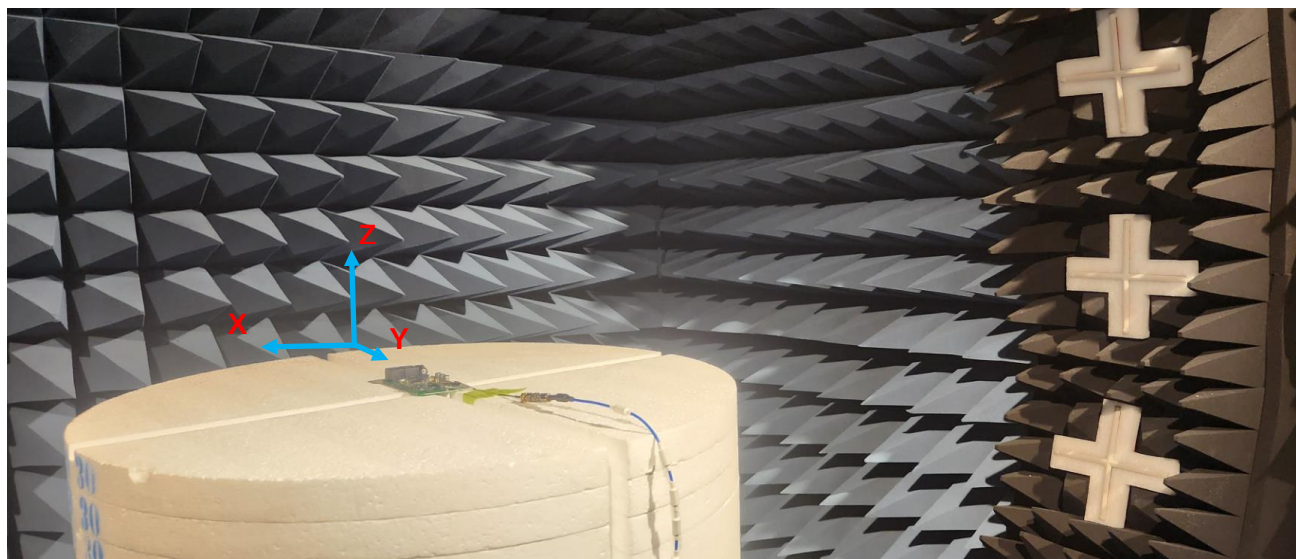


Figure 6; USB-Connect Bluetooth trace Antenna OTA setup

END OF REPORT