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AN AVX GROUP COMPANY

**Job#1444 MUELLER FIRE HYDRANT
AVX Ethertronics Part#1004950 BLUETOOTH
Antenna Evaluation in TOP-STEM Cover**

Rev F.3

2022-10-13



Revision History

Antenna P/N	1004950	
Revision	Date	Description of changes
Rev A.1	January 08, 2019	AVX Ethertronics LTE Antenna Part# P822601, GPS Part#1002427 and BT antenna Studies inside the sample 3D printed housing from Mueller
Rev B.1	January 23, 2019	AVX Ethertronics Modified Part#1001932FT and Part#1000418 BLUETOOTH Antenna Study in TOP-STEM Cover
Rev C	February 06, 2019	AVX Ethertronics LTE Antenna Part# P822601, GPS Part#1002427 and BT antenna fine tuning with potting material in the main board plastic housing inside the sample metal case from Mueller
Rev D	May 20, 2019	AVX Ethertronics Modified Part#1000418 BLUETOOTH Antenna Evaluation in TOP-STEM Sample Cover
Rev E	May 28, 2019	Evaluation of New Sample Board with AVX Ethertronics LTE Antenna Part# P822601, GPS Part#1002427 and BT antenna fine tuning with potting material in the main board plastic housing inside the sample metal case from Mueller
Rev F	July 18, 2019	AVX Ethertronics Part#1004950 BLUETOOTH Antenna Evaluation in TOP-STEM Sample Cover
Rev F.1	Nov 06, 2019	AVX Ethertronics Part#1004950 BLUETOOTH Antenna Evaluation in TOP-STEM Sample Cover (New Complete Assembly)
Rev F.3	OCT 13, 2022	AVX Ethertronics Part#1004950 BLUETOOTH Antenna Evaluation in TOP-STEM Sample Cover (New Complete Assembly). Update the Peak gain and Antenna dimensions.

Content

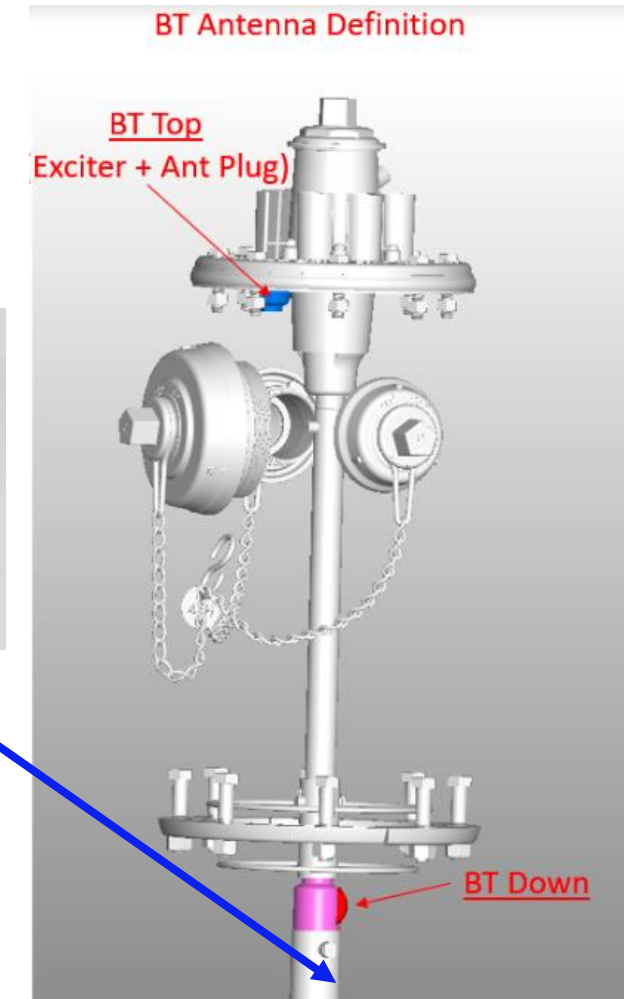
- Introduction
- Measurement Test Set Up
- Mockup description
- Antenna performances
 - Return Loss
 - Efficiency
 - Peak Gain
 - 2D Radiation Pattern
- Conclusions

Introduction

- This report presents the performance of AVX Ethertronics Part#1004950 Bluetooth Antenna mounted inside the NEW TOP STEM Sample Unit.
 - Bluetooth Antenna tested with 9.5 inches uFL cable, mounted in TOP STEM plug-in plastic cover, grounded to Sensor PCB and batteries in between according to CAD file



- Measured return loss, efficiency, peak gain, and 2d radiation pattern



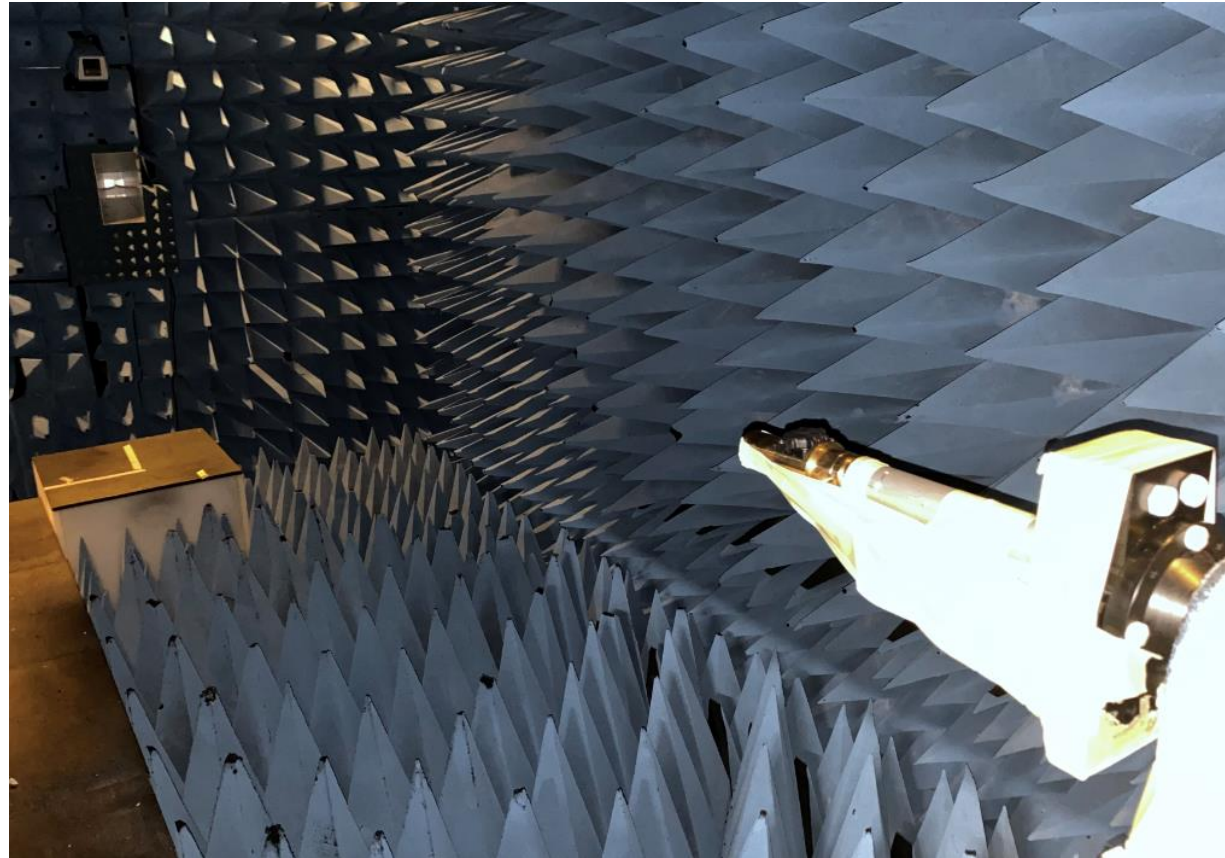
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Test Set Up

Radiation Patterns and Total Efficiency

Radiation pattern and Total Efficiency are measured in a Near Field measurement System



Test Set Up

S-Parameters



All S-parameters, Return Loss values and Isolations are measured with a Vector Network Analyzer covering 30 kHz to 6 GHz (HP 8753D)

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Mock Up Description

1004950 BT Antenna mounted in Top-Stem Cover

TOP VIEW

9.5 inches Long u.FL cable
(solder feed to other
end of u.FL connector)

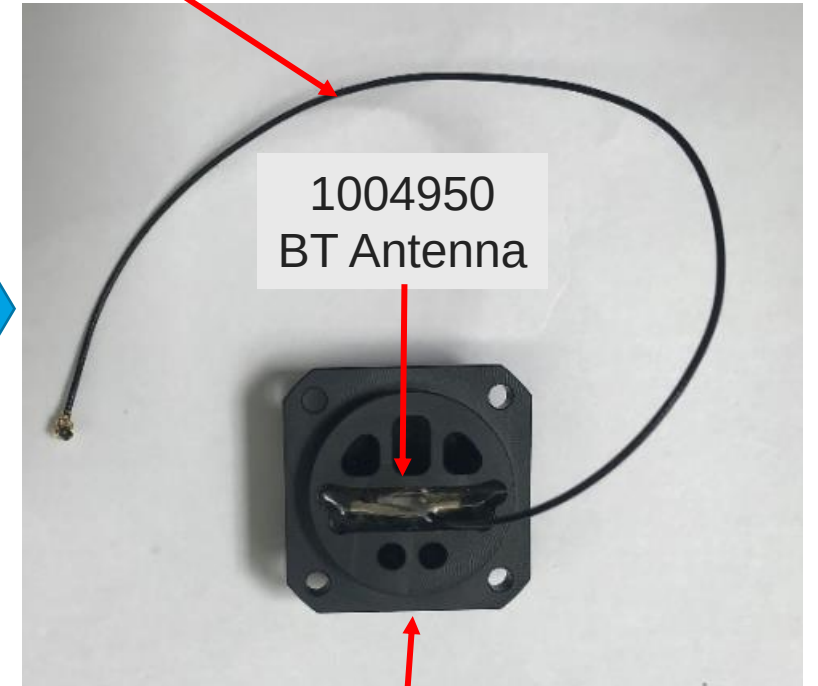


Sensor Board

Batteries



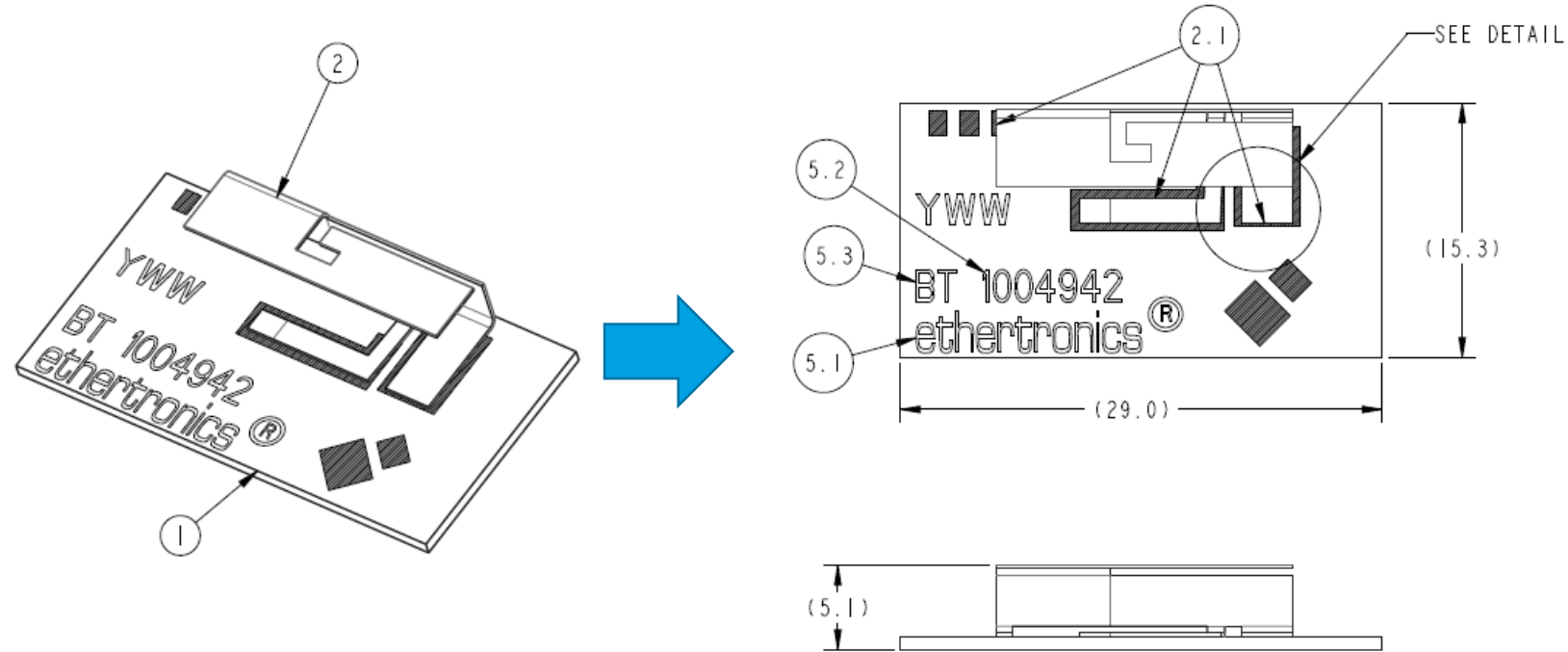
INSIDE VIEW



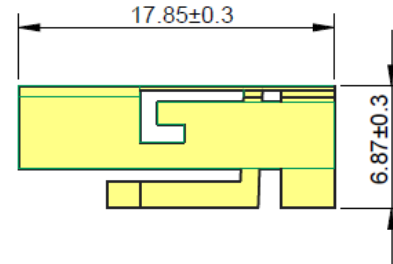
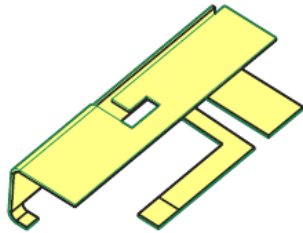
Potted Top-Stem Cover with BT Antenna



1004942 Antenna PCB Dimensions



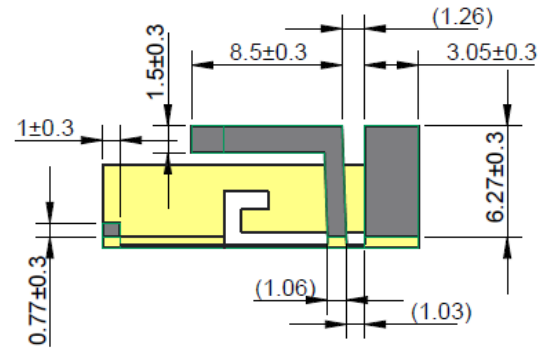
1000146 Antenna Dimensions



TOP VIEW



FRONT VIEW

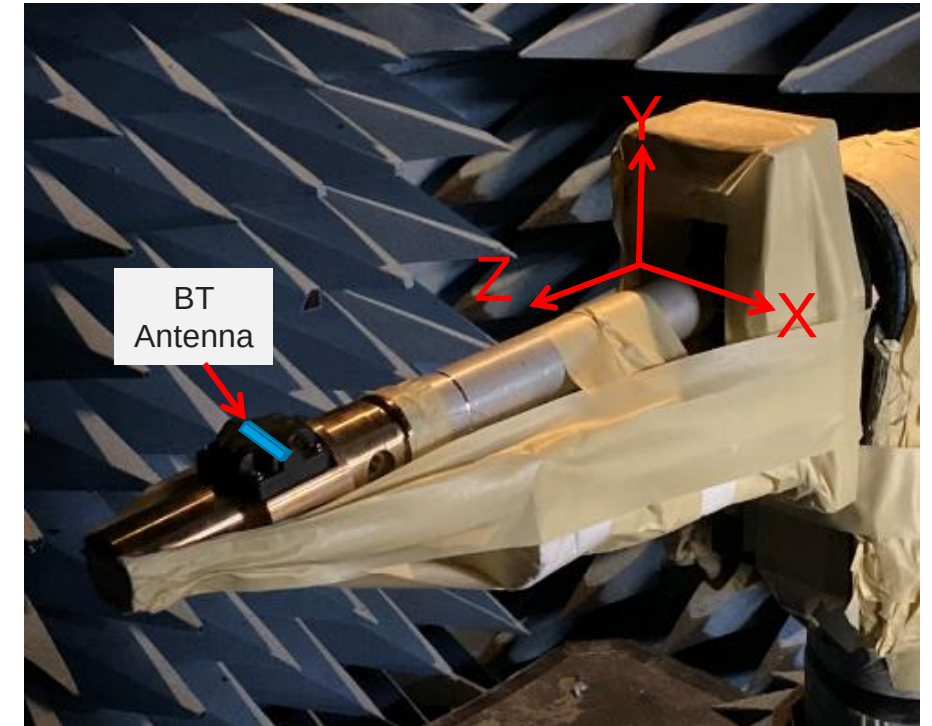
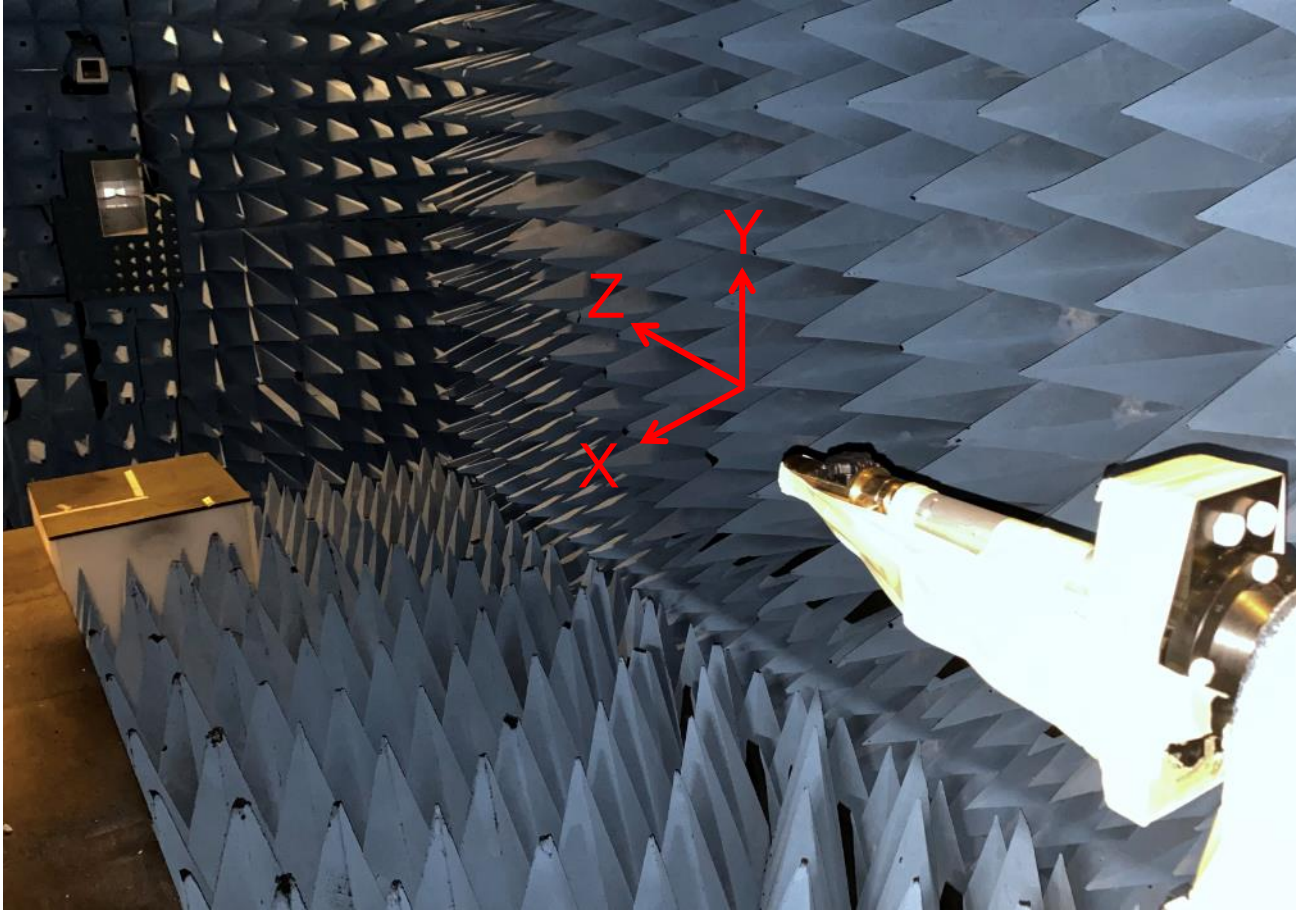


BOTTOM VIEW

ANTENNA LAYOUT

MockUp Description

Mockup orientation: LTE Antenna in the Left Top Side Set-up



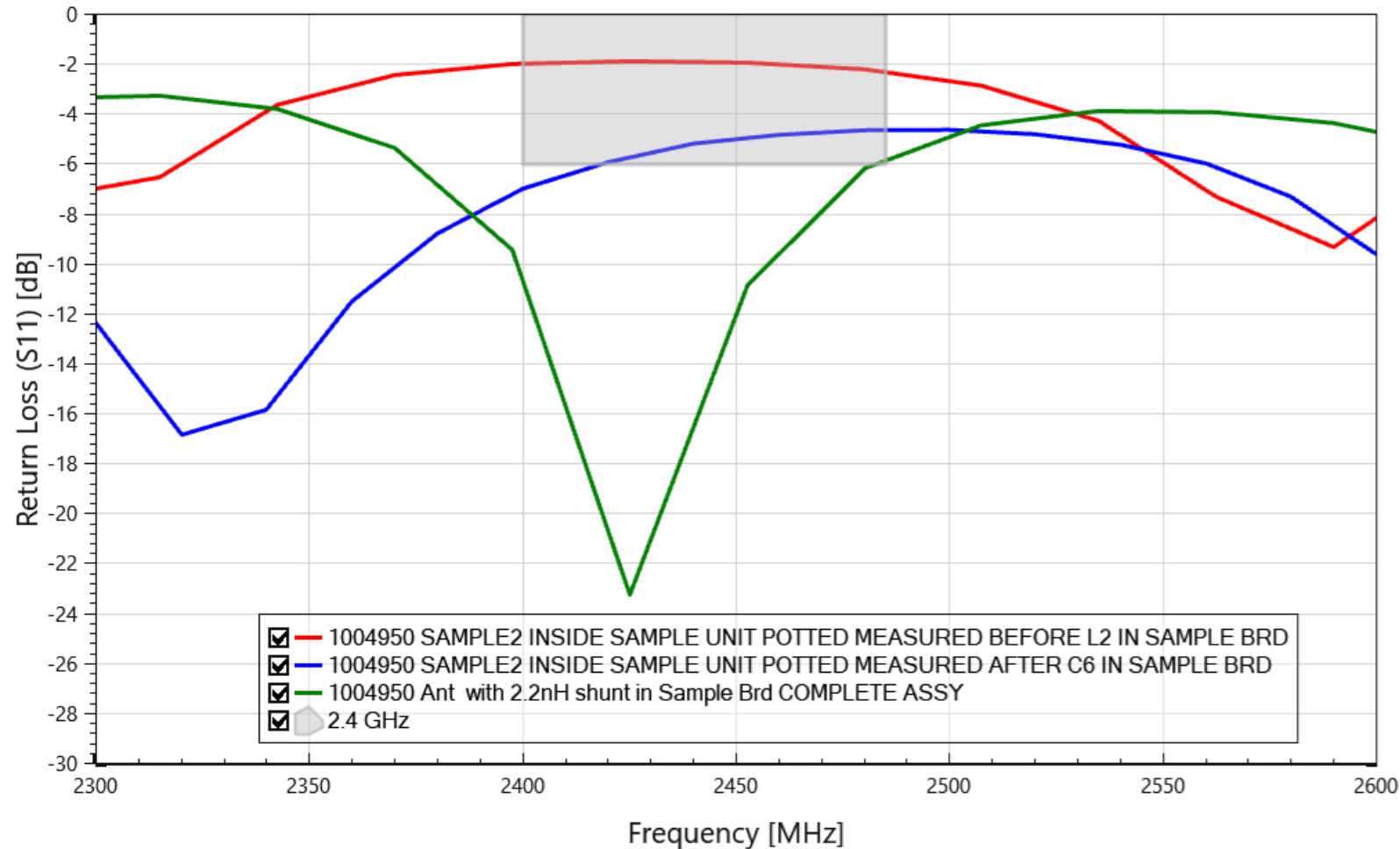
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BLUETOOTH ANTENNA

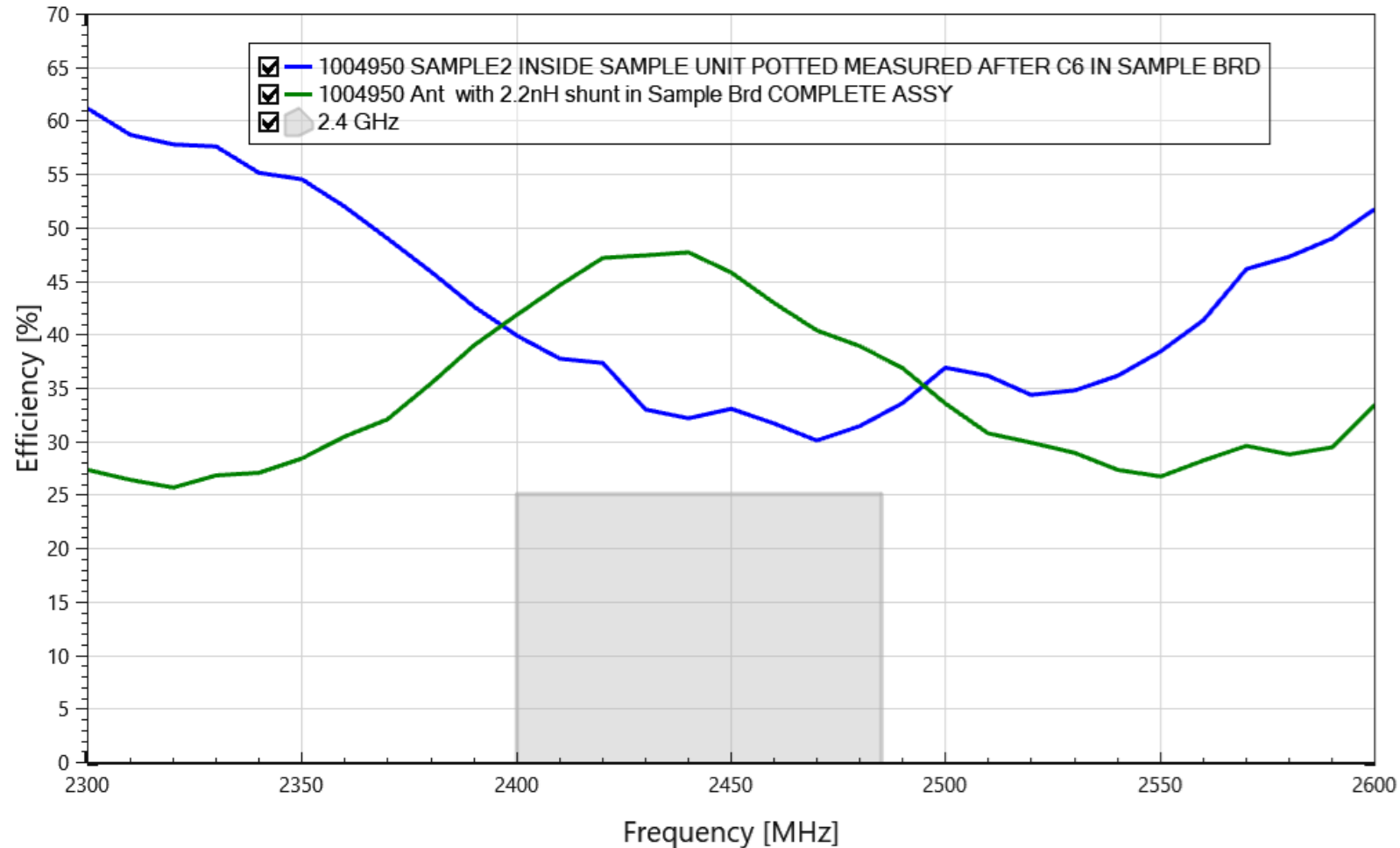
Antenna performances

Return Loss – BT Band



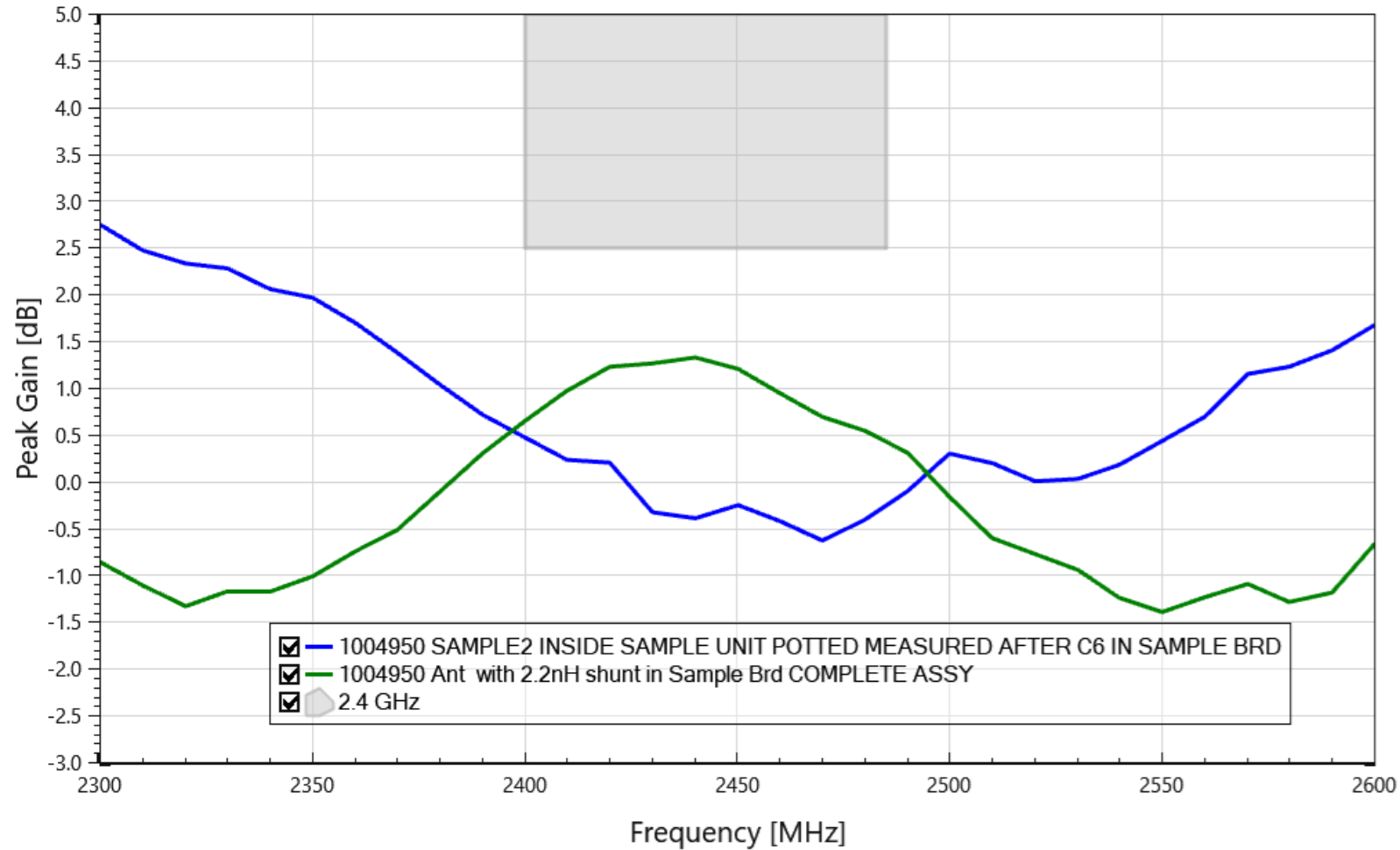
Antenna performances

Total Efficiency (%) – BT Band



Antenna performances

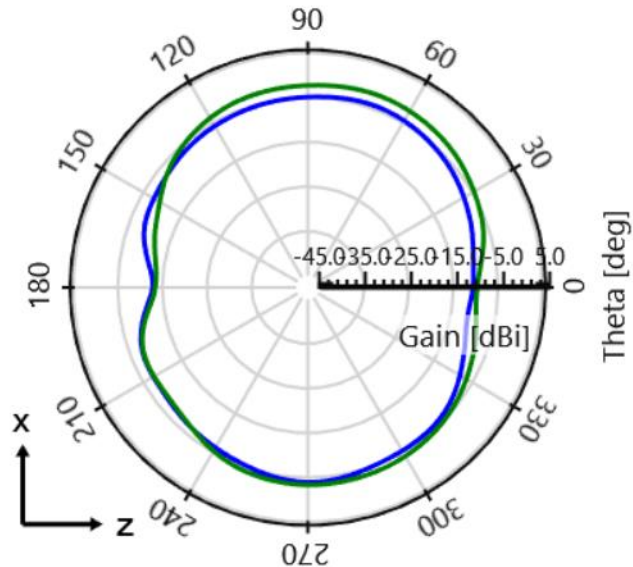
Peak Gain – BT Band



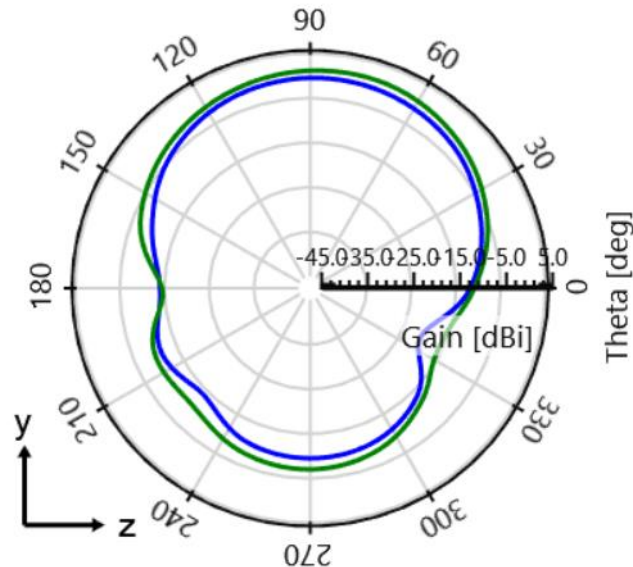
Antenna performances

Radiation pattern – Low Band – 2D Cuts at 2440 MHz band

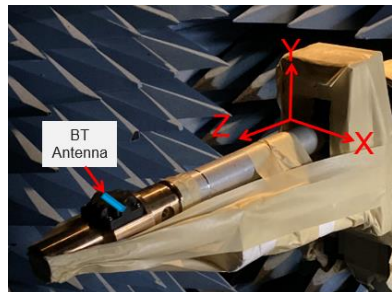
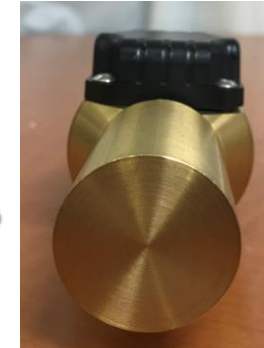
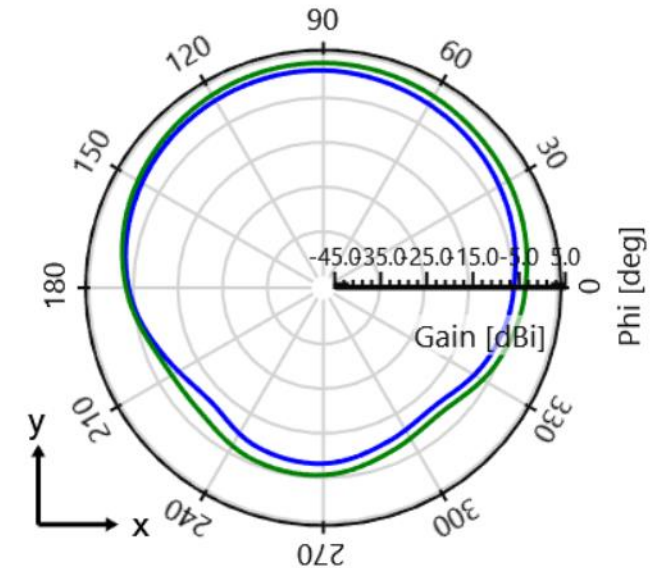
Gain (Total) - $\phi = 0$ deg - 2440 MHz [Plane XZ]



Gain (Total) - $\phi = 90$ deg - 2440 MHz [Plane YZ]



Gain (Total) - $\theta = 90$ deg - 2440 MHz [Plane XY]



- 1004950 SAMPLE2 INSIDE SAMPLE UNIT POTTED MEASURED AFTER C6 IN SAMPLE BRD
- 1004950 Ant with 2.2nH shunt in Sample Brd COMPLETE ASSY

Content

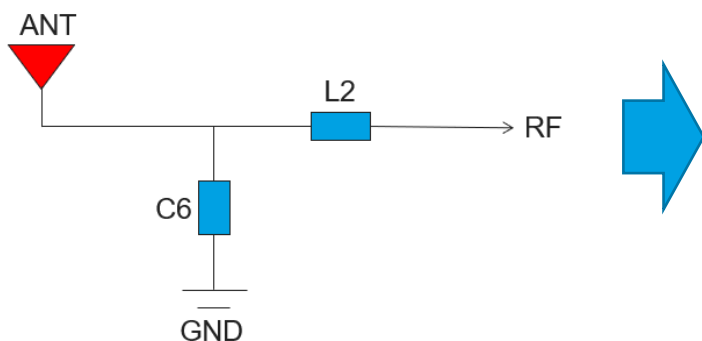
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Conclusions –

Summary – Average Efficiency & Maximum Peak Gain for AVX Ethertronics Part#1004950 Bluetooth Antenna mounted inside the NEW TOP STEM Sample Unit RF performances are summarize below :

Test Description	BLUETOOTH Average Efficiency	BLUETOOTH Max PK Gain
1004950 SAMPLE2 INSIDE SAMPLE UNIT POTTED MEASURED AFTER C6 IN SAMPLE BRD	34 %	0.47dB
1004950 Ant with 2.2nH shunt in Sample Brd COMPLETE ASSY	43 %	1.33 dB

NOTE: 1004950 ANTENNA PERFORMANCE IMPROVED by 9% Efficiency in REPLACING C6 WITH 2.2nH AND L2 WITH ZERO OHM.



Description	C6	L2
New Matching Components	2.2 nH	Zero Ohm
Digi-Key Part Number	478-6916-1-ND	P15979CT-ND
Tolerance	±0.1nH	Jumper
MANUFACTURER	AVX Corp	Panasonic
MANUFACTURER PART#	HL022R2BTTR	ERJ-1GN0R00C



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Thank you

