

3M

Serica (SR4W035) BT/WiFi Test



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Update

Date	Version	Content
23/Feb 2026	Rev.A 26006	Initial



Introduction

3M supplied one complete Rainer unit for 2.4GHz antenna performance testing. The DUT has Antenova's Serica (SR4W035) antenna implemented and its passive performance was evaluated.

Agenda

WiFi (2.4GHz) antenna performance : Baseline Serica vs. Tuned Serica

Test setup and measurement photos

RF performance results:

- Return Loss
- VSWR
- Efficiency
- Peak Gain
- Radiation Patterns

Conclusion and key takeaways

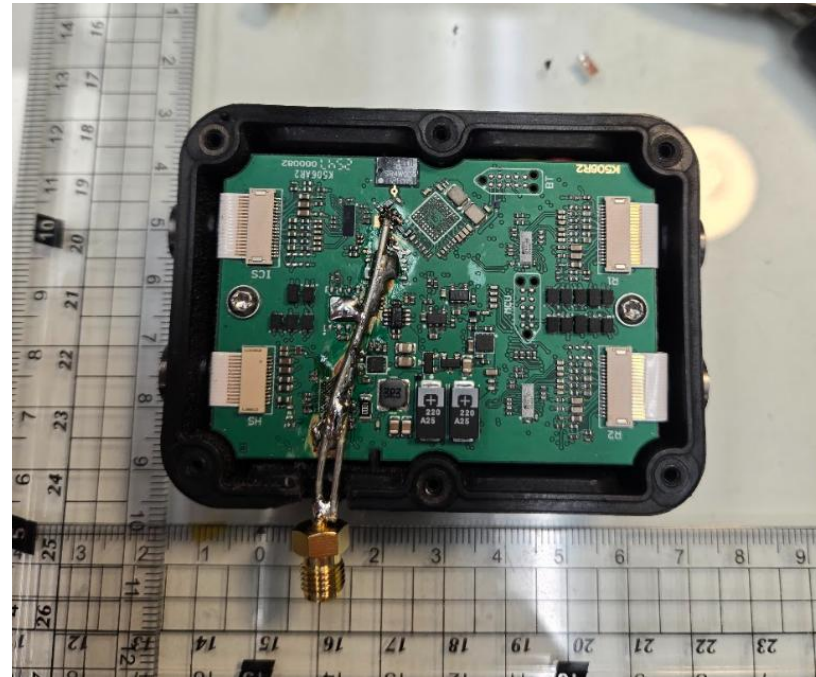
*Appendix comparison on Floating Flex

Test cable setup Serica (SR4W035)

Device front view



Antenna Cabling

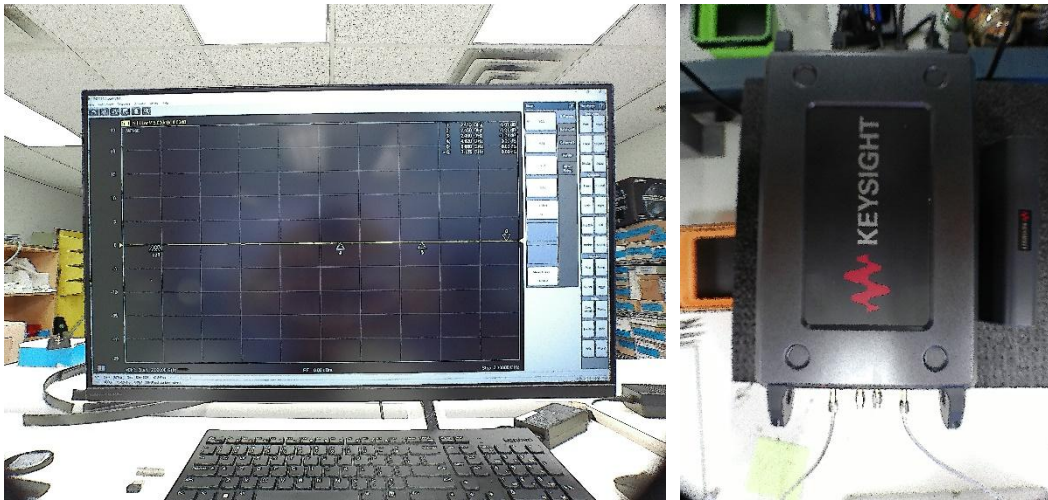


Device back view



Equipment Used

Return Loss/Isolation



Keysight P9372A-ATO-1852 (300 kHz to 9 GHz, 2-port)

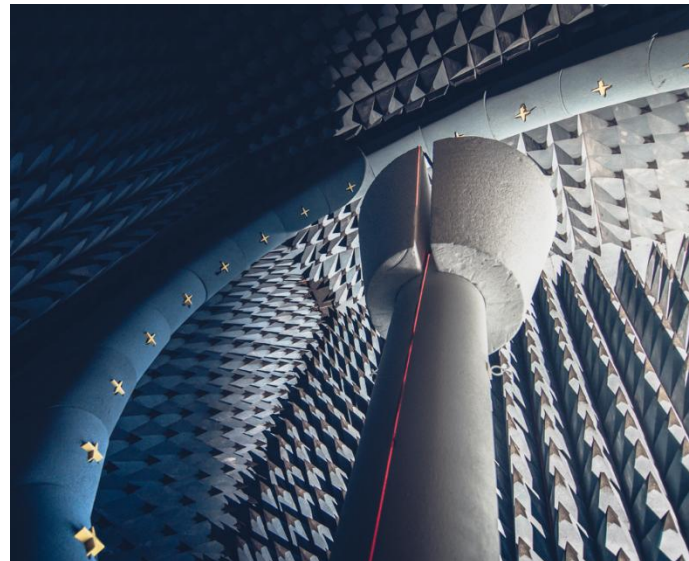
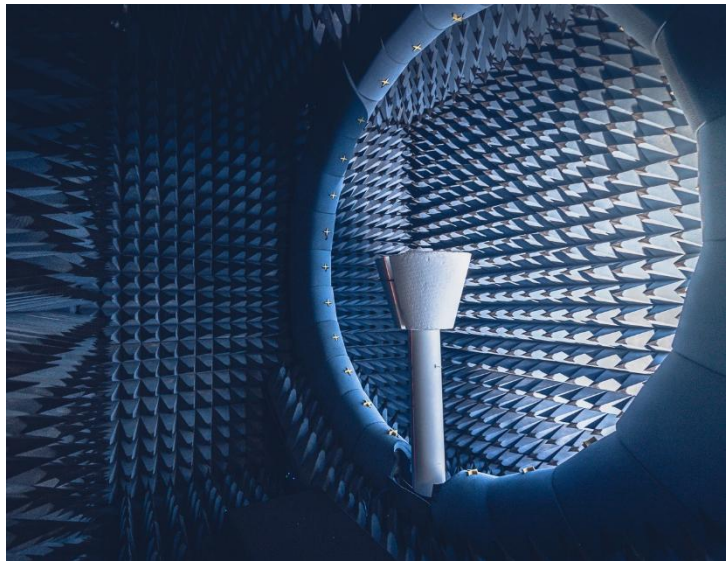
Passive Efficiency



Chamber equipment Rig

Equipment Used

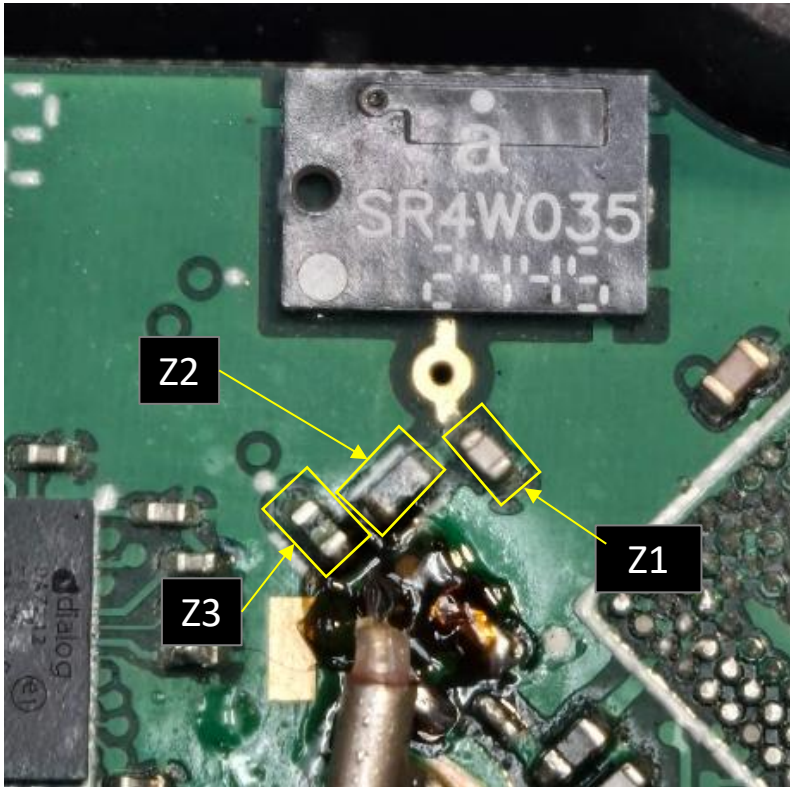
Anechoic chamber 400MHz – 6000MHz



All tests using this arrangement were performed in free space Calibrated 3D Anechoic Chamber Satimo StarGate 24 and a Network Analyzer E8357A Agilent Technologies. The return loss at the input of the matching circuit was measured using an Keysight P9372A-ATO-1852 Vector Network Analyser. For all measurements, the relevant sleeve choke was used to reduce the effect of the cable radiation.

Recommended Matching Circuit (Tuned)

Circuit diagram



Recommended matching circuit

Designator	Type	Value	Manufacturer*	Series
Z1	Capacitor	1.2pF	Murata	GRM18 Series
Z2	Capacitor	1.2pF	Murata	GRM18 Series
Z3	Inductor	15nH	Murata	LQG18 Series

The recommended matching circuit is valid only for the hardware configuration provided. Any changes to the PCB layout, hardware or relative position of the antenna, including microphones, speakers, batteries, cases, etc, may modify the antenna impedance and it would require a different matching circuit.

***Equivalent components can be used**

Results Summary



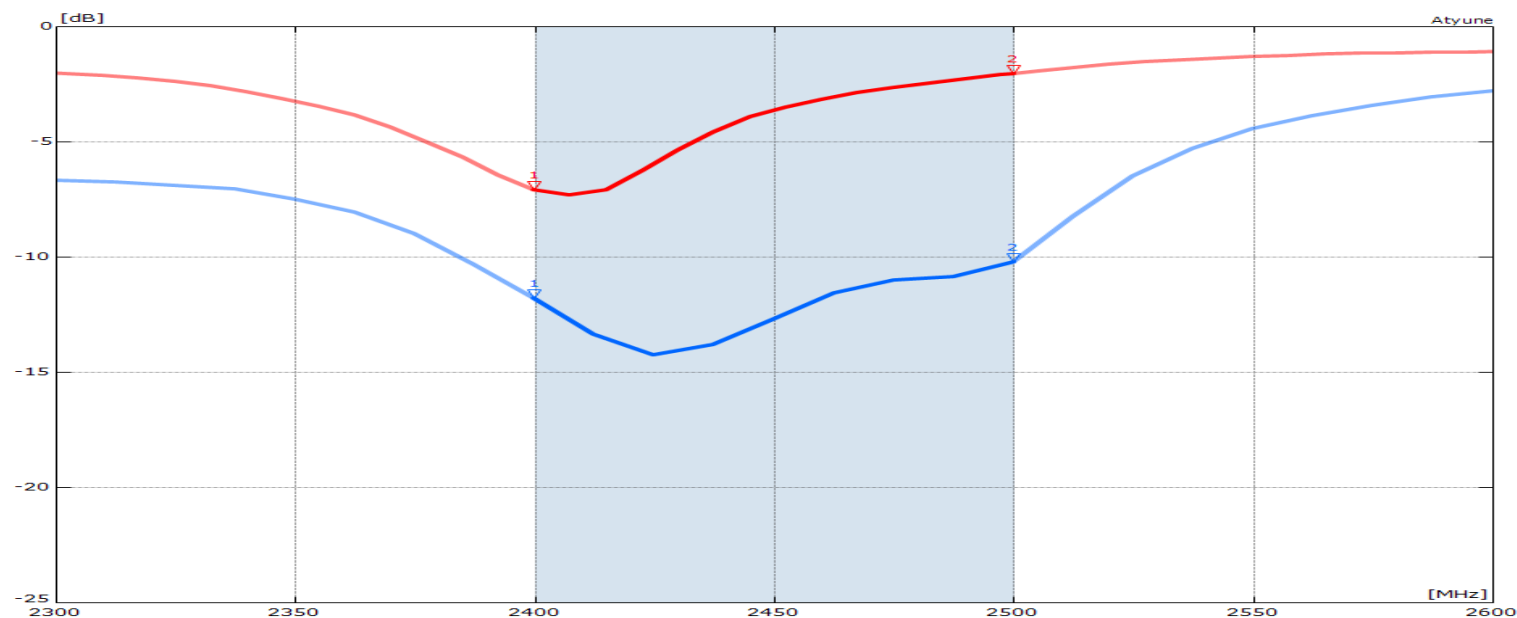
Test results using recommended matching circuits.

Baseline	2410-2490MHz
Efficiency (Min.)	9.7%
Efficiency (Avg.)	16.5%
Gain (Peak)	-2.0dBi
Gain (Avg.)	-8.0dB

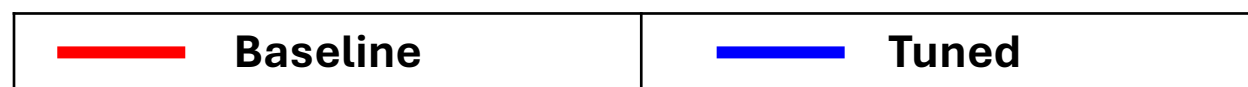
Tuned	2410-2490MHz
Efficiency (Min.)	27.2%
Efficiency (Avg.)	35.0%
Gain (Peak)	0.3dBi
Gain (Avg.)	-4.6dB

S-Parameter

The Return Loss at the input of the matching circuit was measured using an Keysight P9372A Vector Network Analyzer.

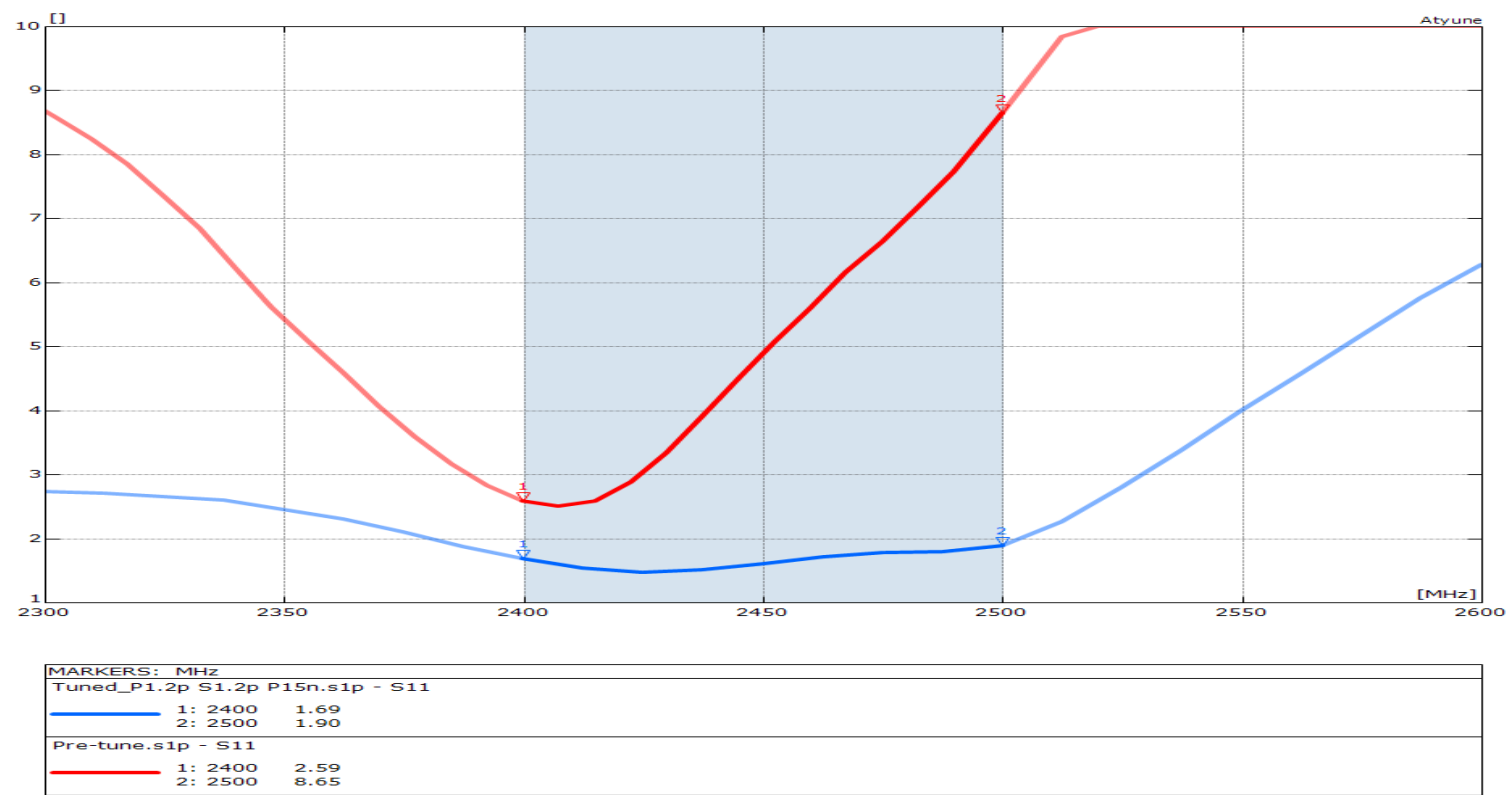


MARKERS: MHz		dB
Tuned_P1.2p S1.2p P15n.s1p - S11		
1:	2400	-11.77
2:	2500	-10.19
Pre-tune.s1p - S11		
1:	2400	-7.06
2:	2500	-2.02



VSWR

The VSWR at the input of the matching circuit was measured using an Keysight P9372A Vector Network Analyzer.



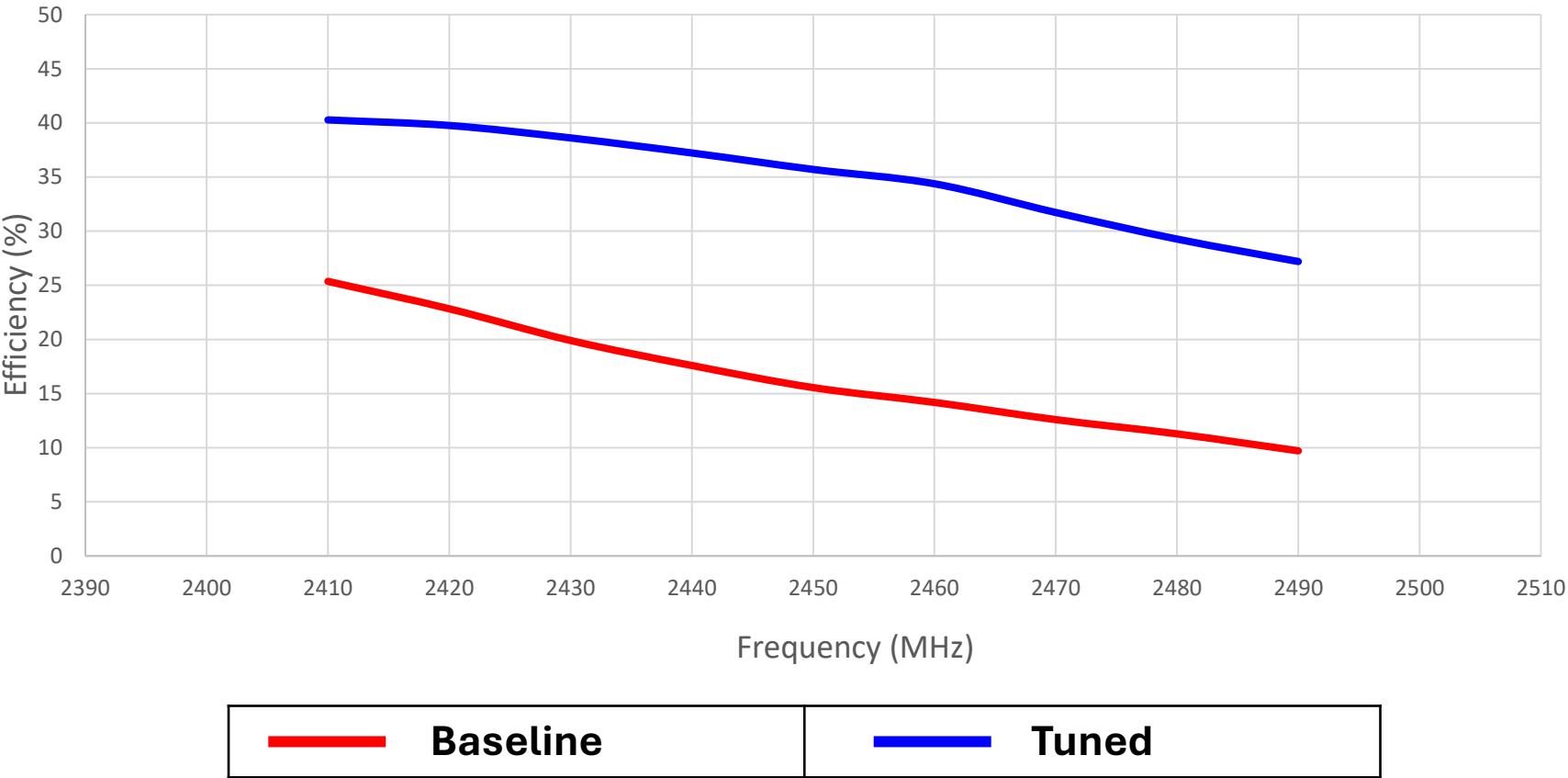
Baseline



Tuned

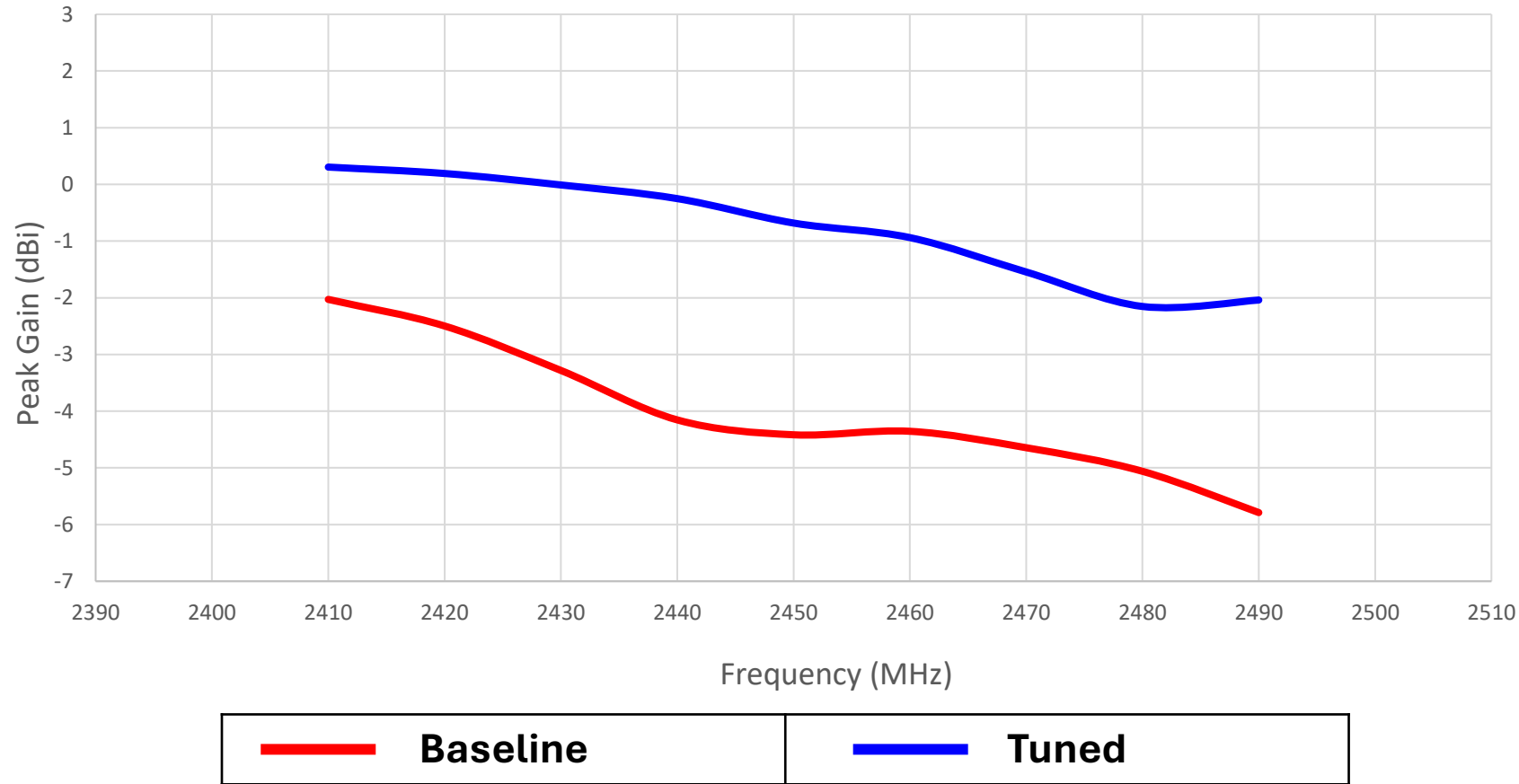
Efficiency

Antenna efficiency and peak gain of antenna using recommended matching circuits measured in anechoic chamber.



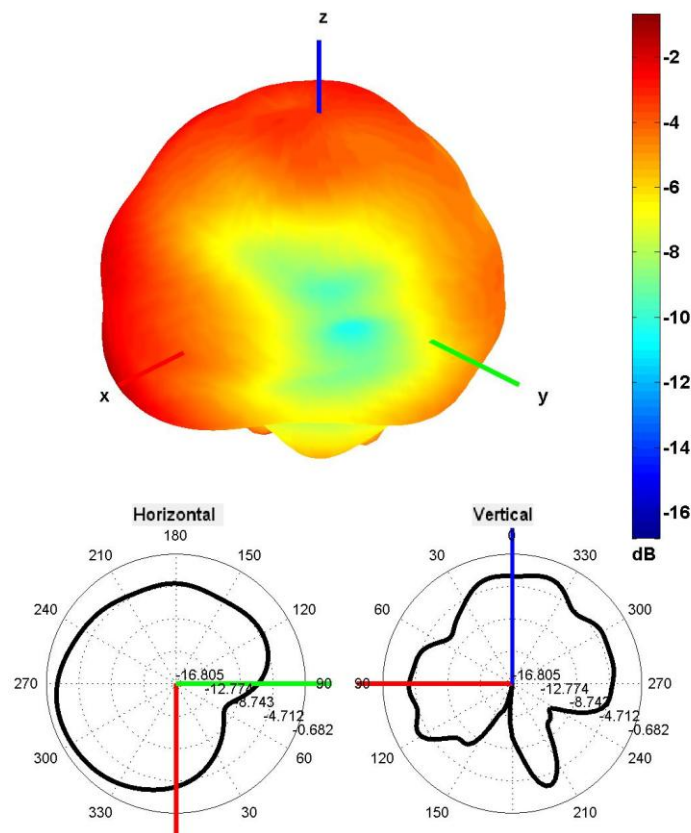
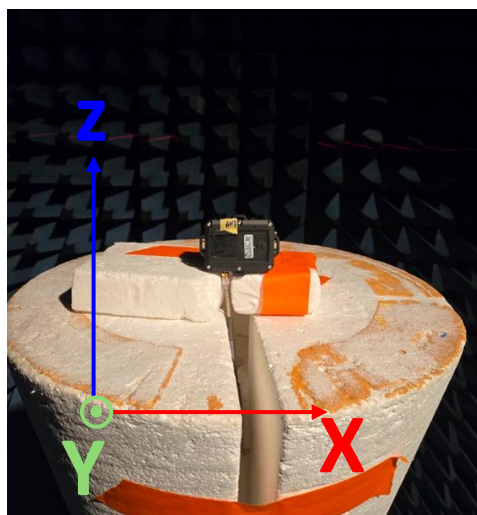
Peak Gain

Antenna efficiency and peak gain of antenna using recommended matching circuits measured in anechoic chamber.



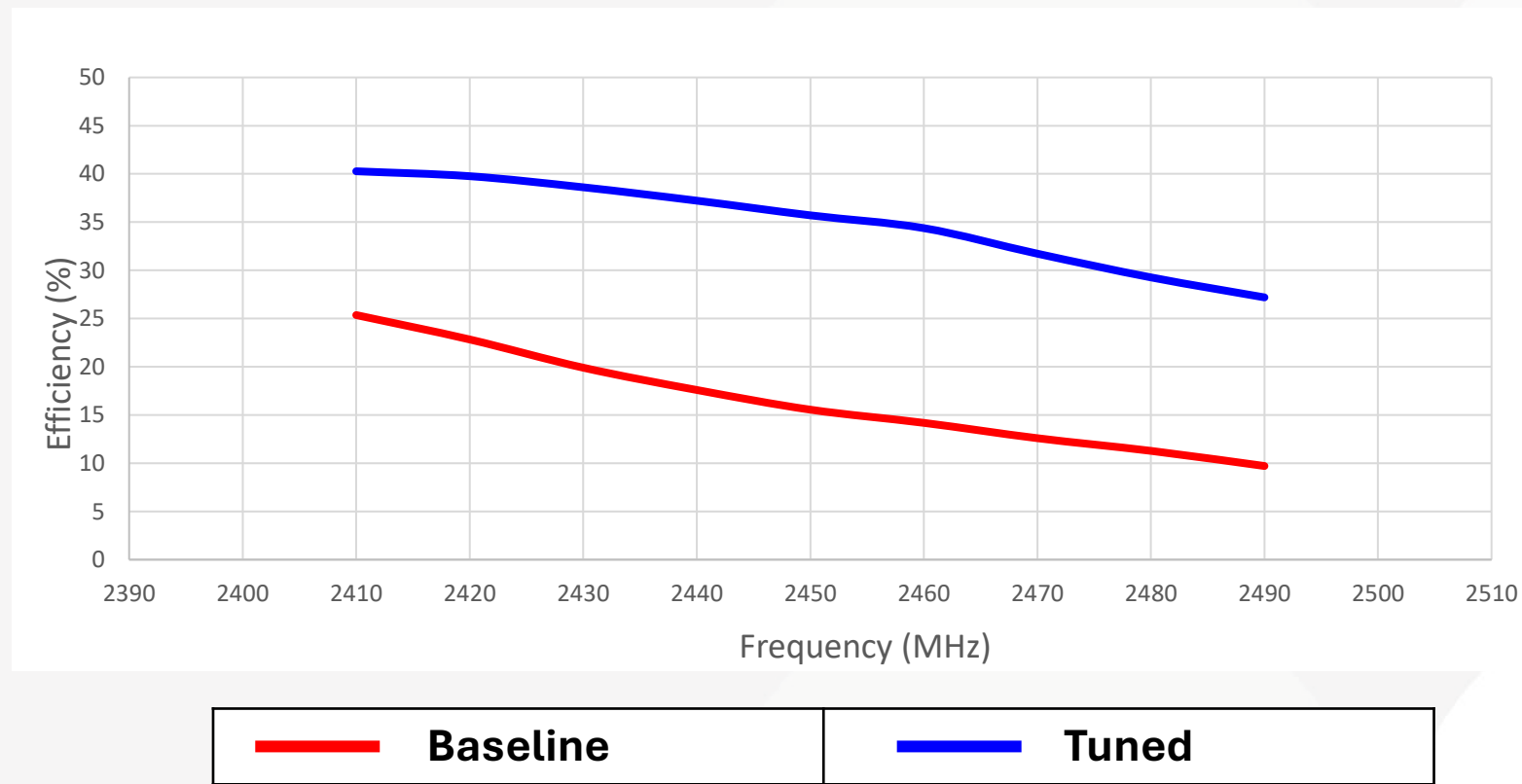
Radiation Patterns of Serica (SR4W035)

Antenna radiation pattern using recommended matching circuits measured in anechoic chamber.



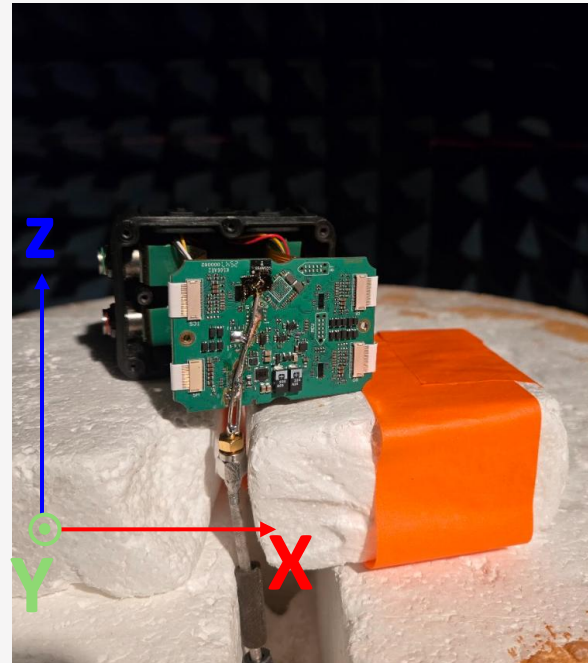
Conclusion

Performance of the Serica (SR4W035) is optimized in the tuned solution compared to the pre-tuned baseline. Specifically, the tuned matching network provides significant improvements in both return loss and overall efficiency. The appendix below illustrates the flex condition, comparing the floating flex and original flex stacking configuration.



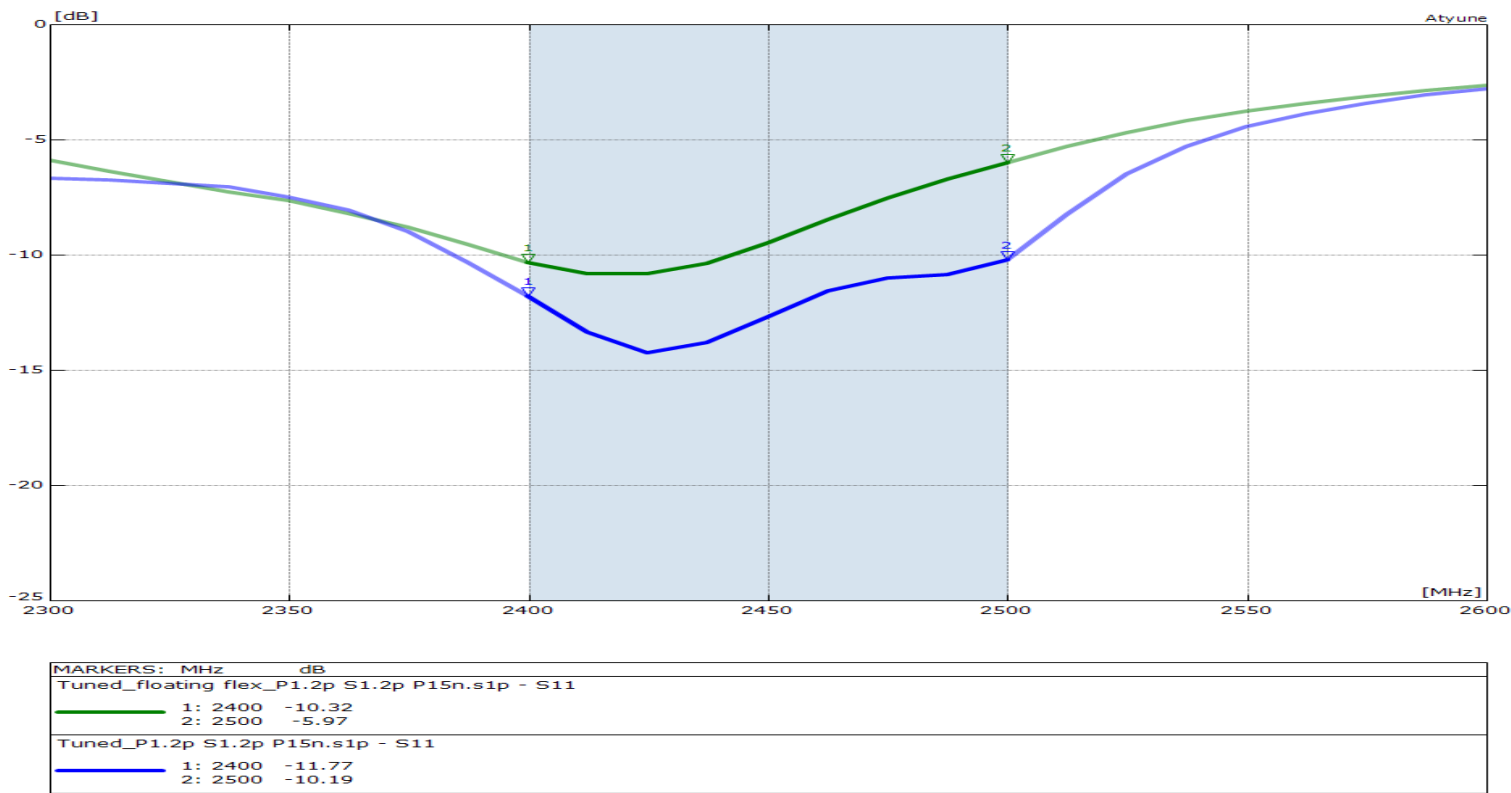
Appendix Comparison on Floating Flex

Test Setups



S-Parameter

The Return Loss at the input of the matching circuit was measured using an Keysight P9372A Vector Network Analyzer.



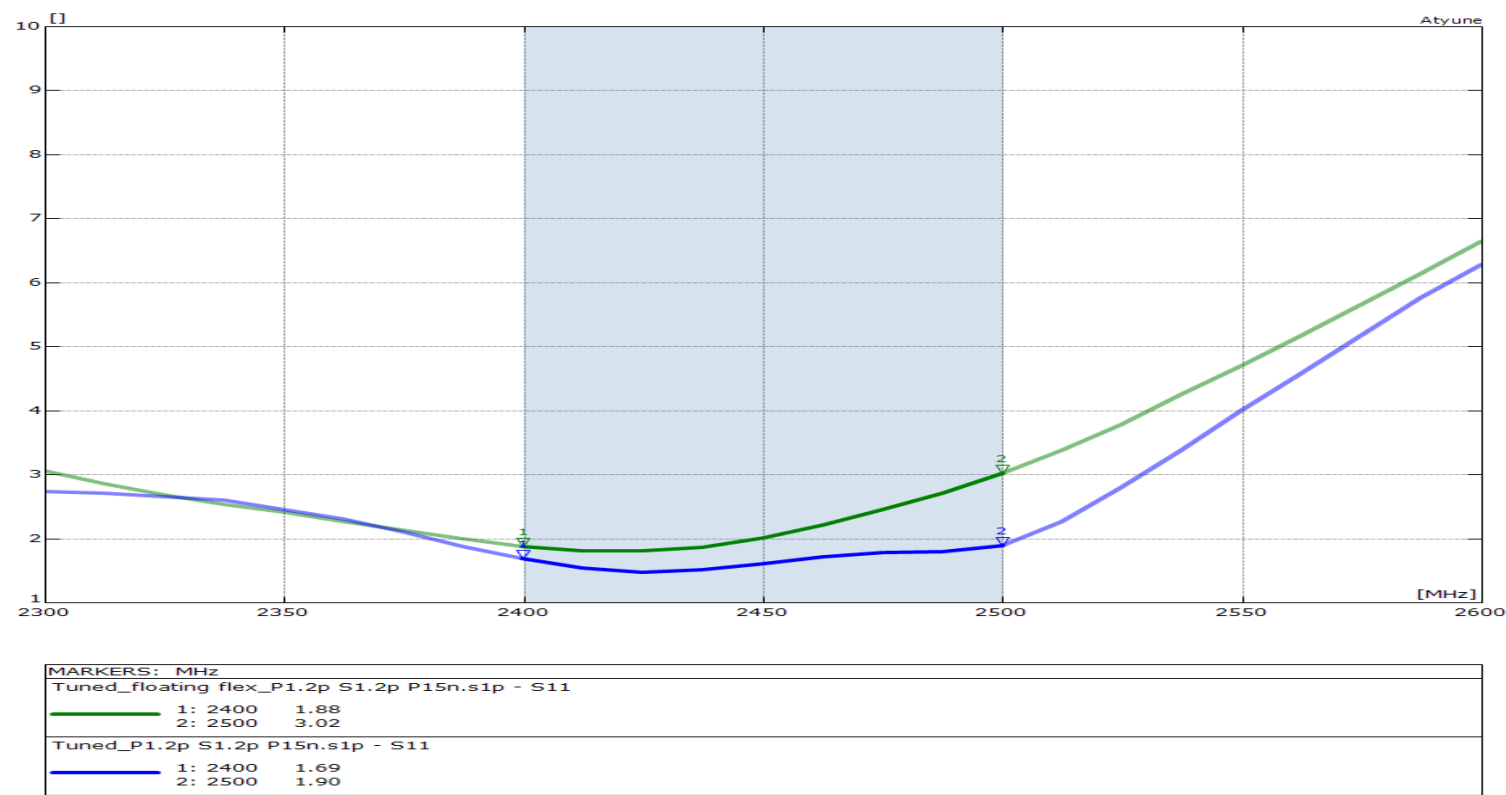
Tuned Flex



Floating Flex

VSWR

The VSWR at the input of the matching circuit was measured using an Keysight P9372A Vector Network Analyzer.



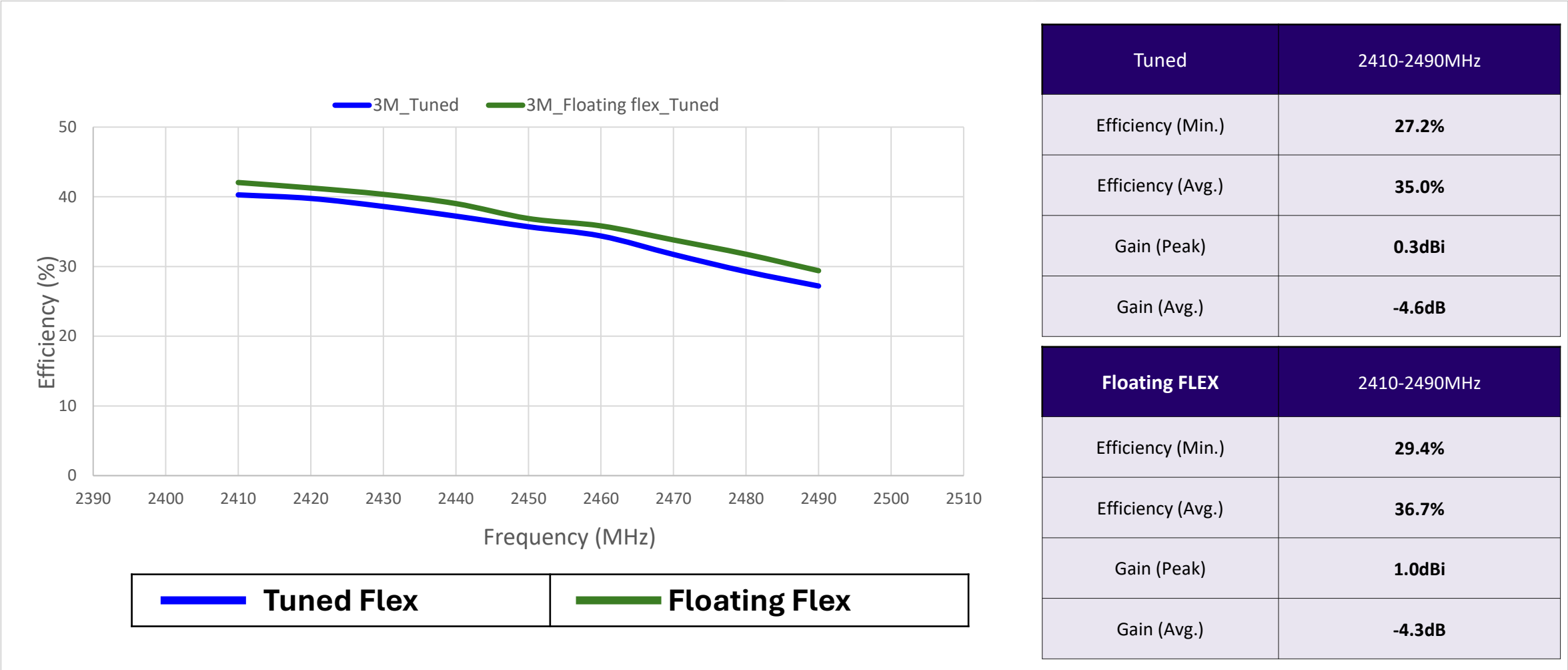
Tuned Flex



Floating Flex

Efficiency

Antenna efficiency in this device is slightly impacted by the flex, showing a variance of ~2%.



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TRP & Efficiency

The below table shows the relationship between the passive performance Gain and TRP (Total Radiated Power). This does not represent a certainty for the active performance but is to be used as a guide only. A device may still fail certification due to device issues not related to the antenna.

	Efficiency	Antenna Gain	2G 1800/1900	3G	LTE
*1	100%	0dB	33dBm	24dBm	23dBm
	50%	-3dB	30dBm	21dBm	20dBm
	30%	-5.2db	27.8dBm	18.8dBm	17.8dBm
*2	25%	-6dB	27dBm	18dBm	17dBm
	10%	-10dB	23dBm	14dBm	13dBm
	5%	-13dB	20dBm	11dBm	10dBm

Please note: This is to be used as a guide and may not represent how the antenna and radio system will perform as a unit. It is recommended to measure the Total Radiated Power (TRP) for actual results.

***1:** Typical minimum requirements for certification (Dependant on your required specification)

***2:** The performance could be self-defined depending on usage/application for those devices that certifications are not mandatory.

Glossary

Return Loss

It is the loss of signal power resulting from the reflection caused at a discontinuity in a transmission line.

Gain

It is a figure which combines the antenna's directivity and electrical efficiency and describes how well the antenna converts input power into radio wave headed in a specified direction and how well the antenna converts radio waves arriving from a specified direction into electrical power.

Efficiency

The ratio of the total power radiated by an antenna to the net power accepted by the antenna from the connected transmitter.

Radiation Pattern

A plot of the gain as a function of direction.

$$\frac{1}{\text{return loss}} \propto \text{Efficiency} \propto \frac{\text{Gain}_1 + \text{Gain}_2 + \text{Gain}_3 + \dots + \text{Gain}_N}{N}$$

