Guitar
Antenna Evaluation

Rev. 1.0
Date: 10/12/2023

Document Revision History

Date	Revision	Author	Description Of Changes
10/12/2023	1.0	Mats Lindstrom	First revision

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Introduction

The task at hand is to validate the radiated performance of the new guitar. Covering three fundamental frequencies with 2nd and 3rd harmonics. Deriving the effective antenna gain out of the radiated ERP minus the conducted TX power, as well as the FCC harmonics suppression.

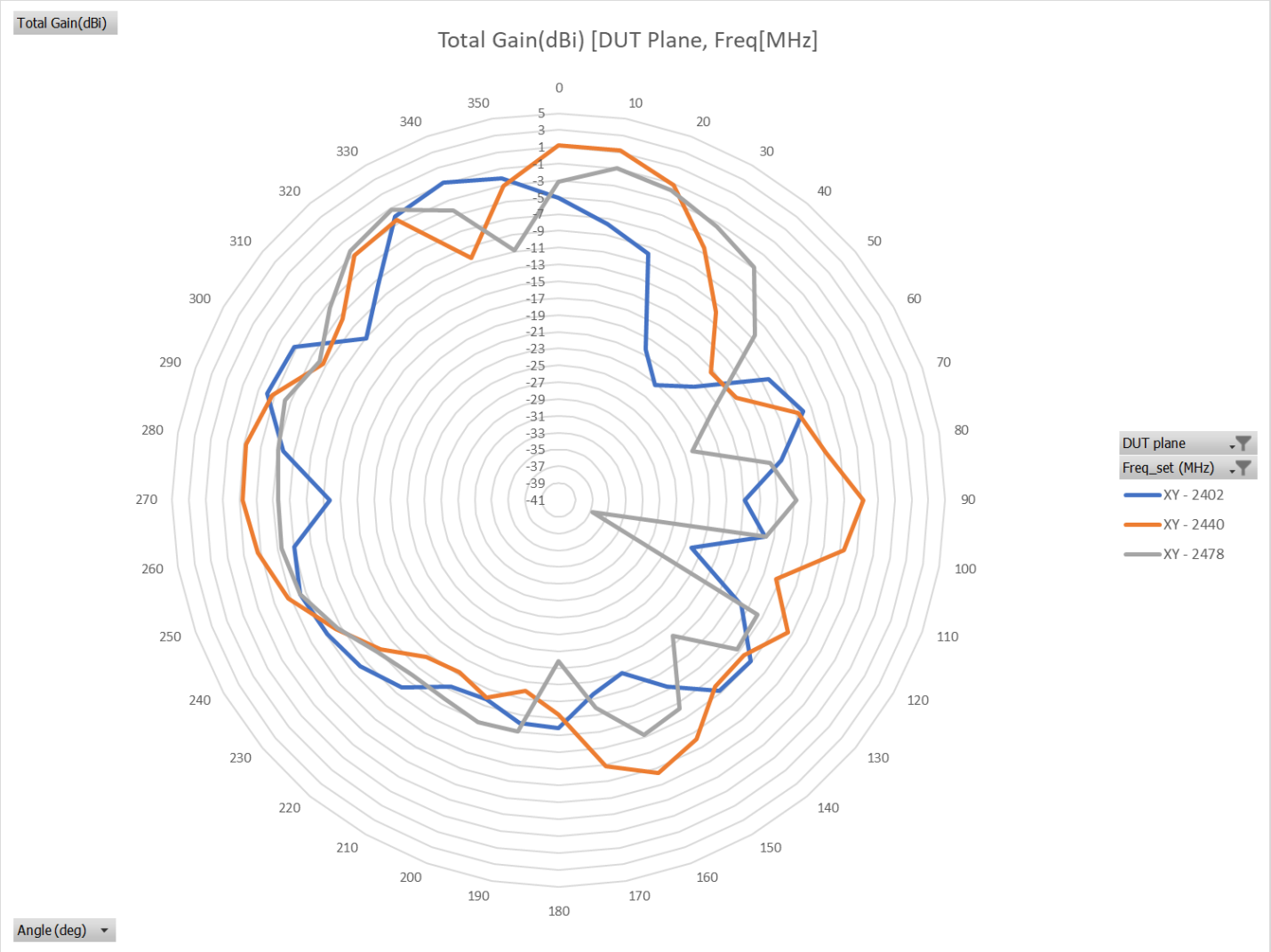
FW for CW mode and frequency adjustment provided by PDP
TX power setting was -11.6dBm out of the Implay transceiver.
The conducted TX power is:
2402MHz +5.2dBm
2440 MHz +5.0dBm
2478 MHz +4.3dBm

Radiated fundamental and harmonics ERP.
Deduced antenna gain in dBi

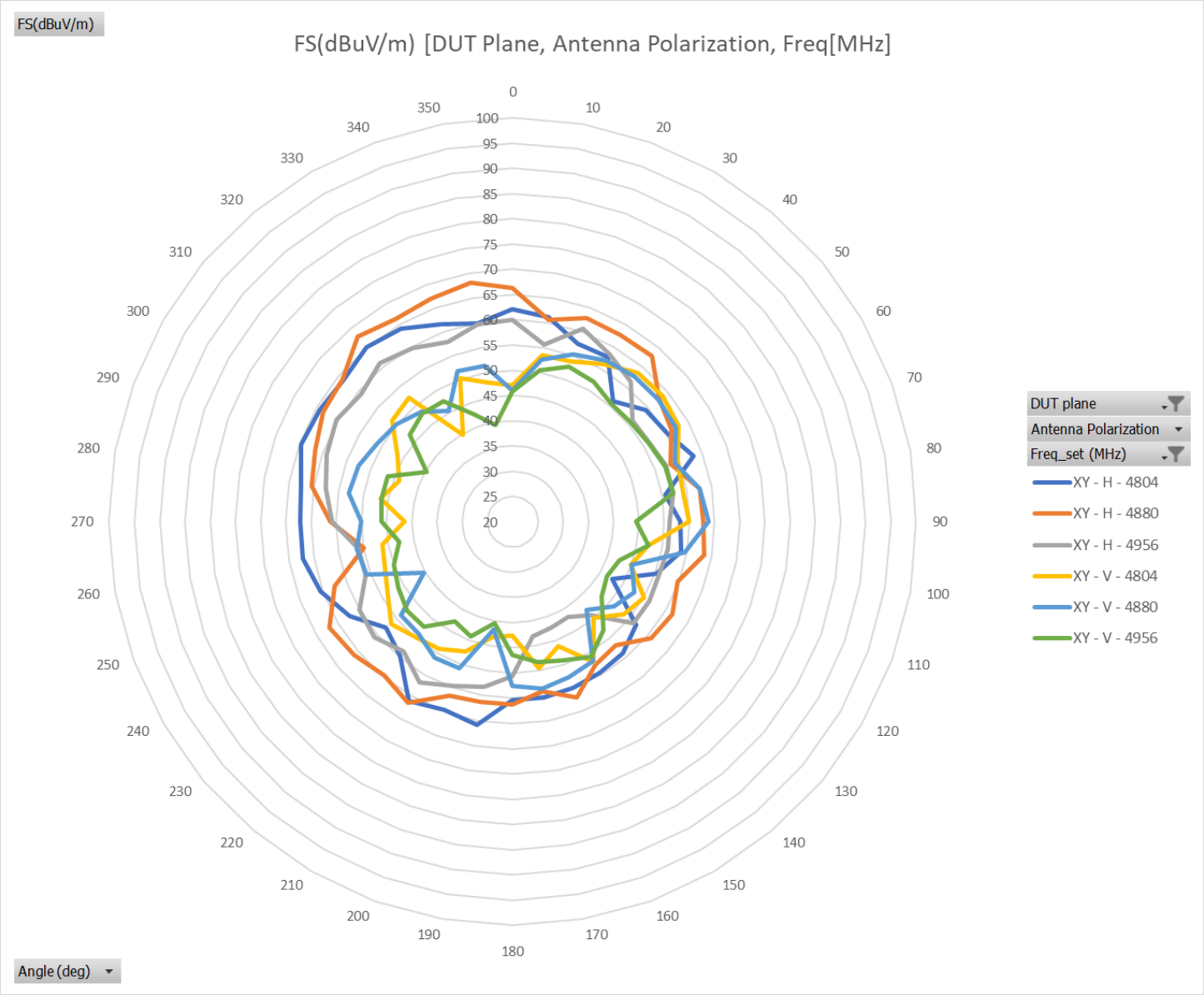
Two planes are covered.

XY Plane

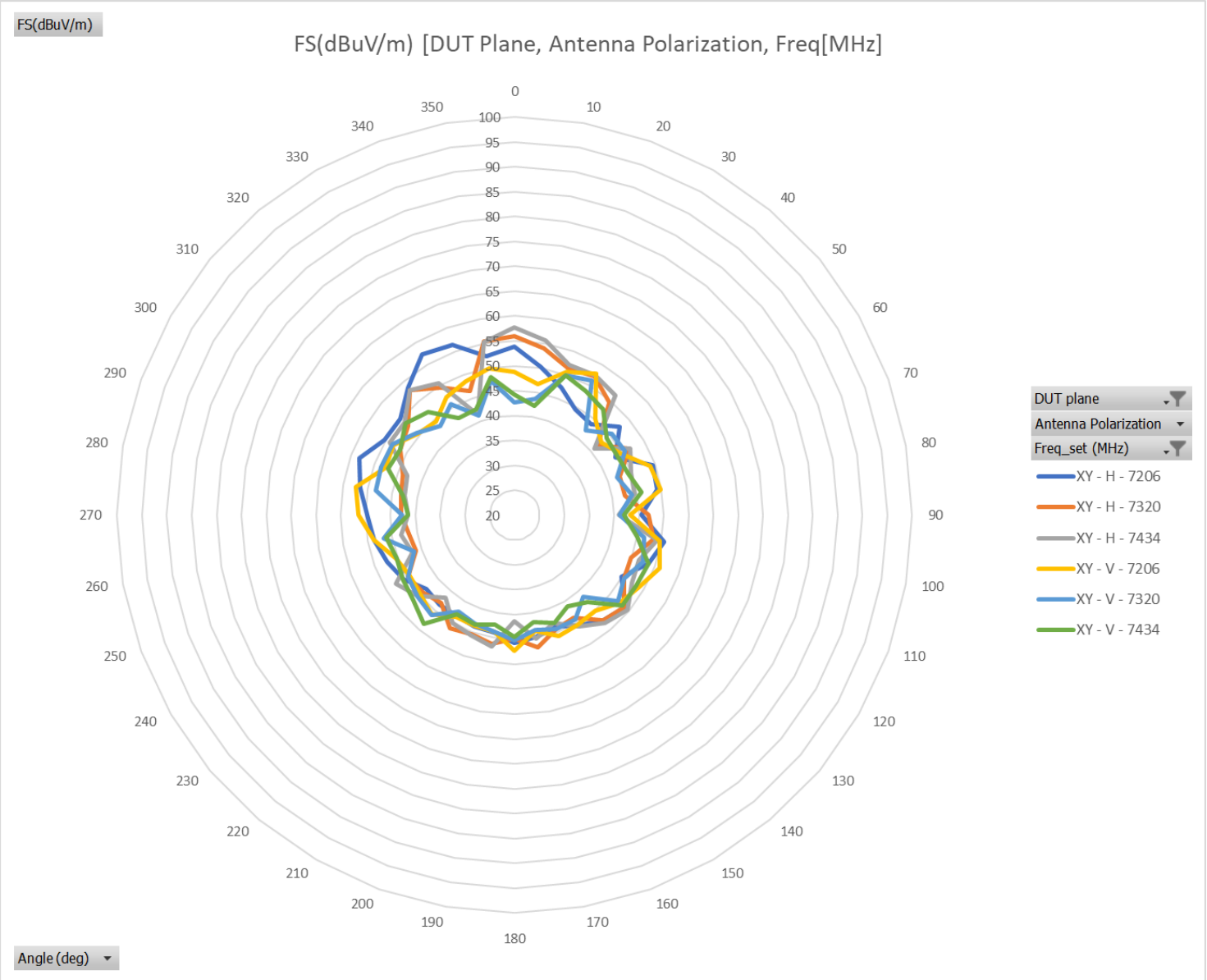
Realized Total Antenna gain (dBi)



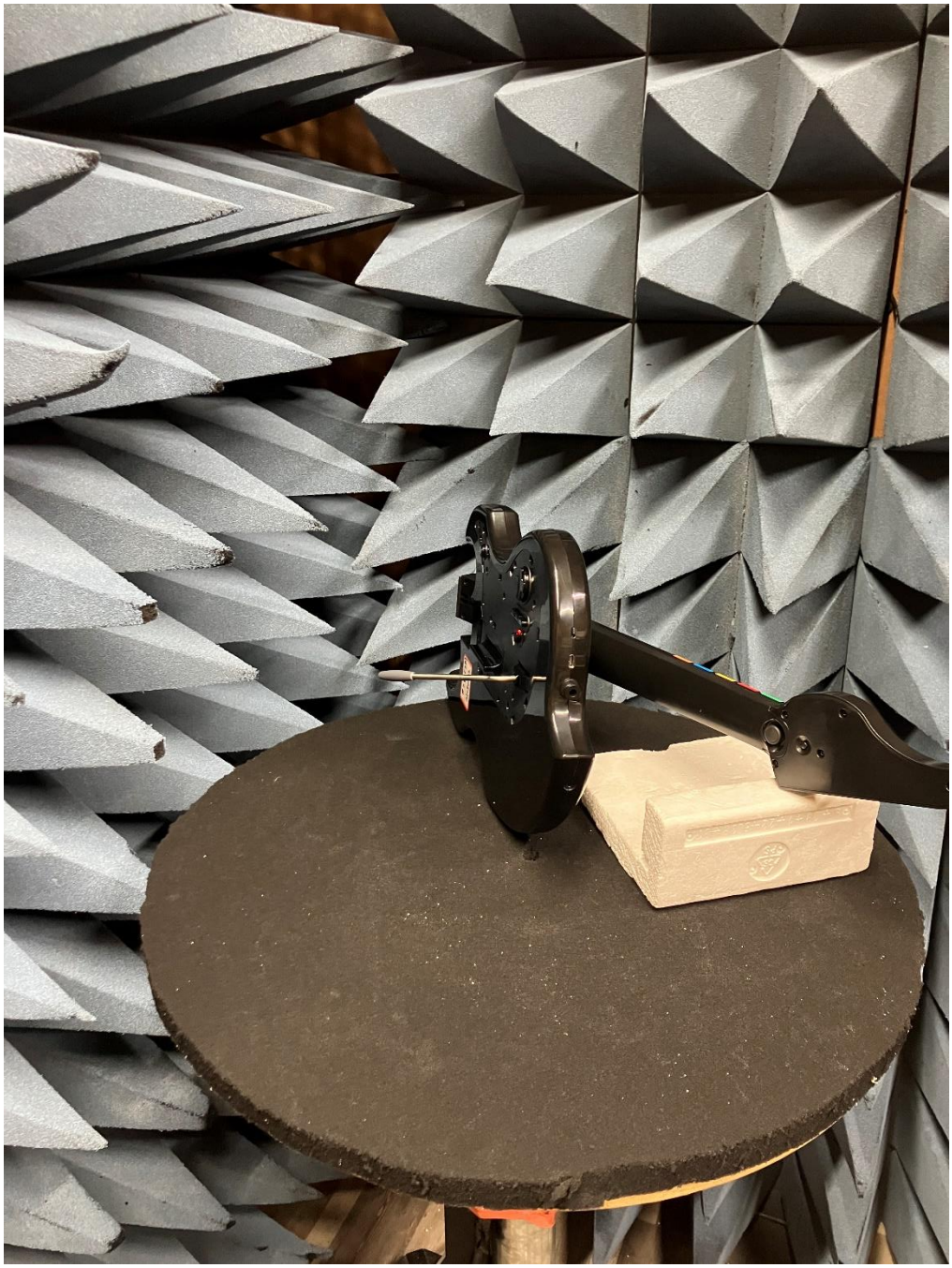
2’nd Harmonics levels (dBuV/m)



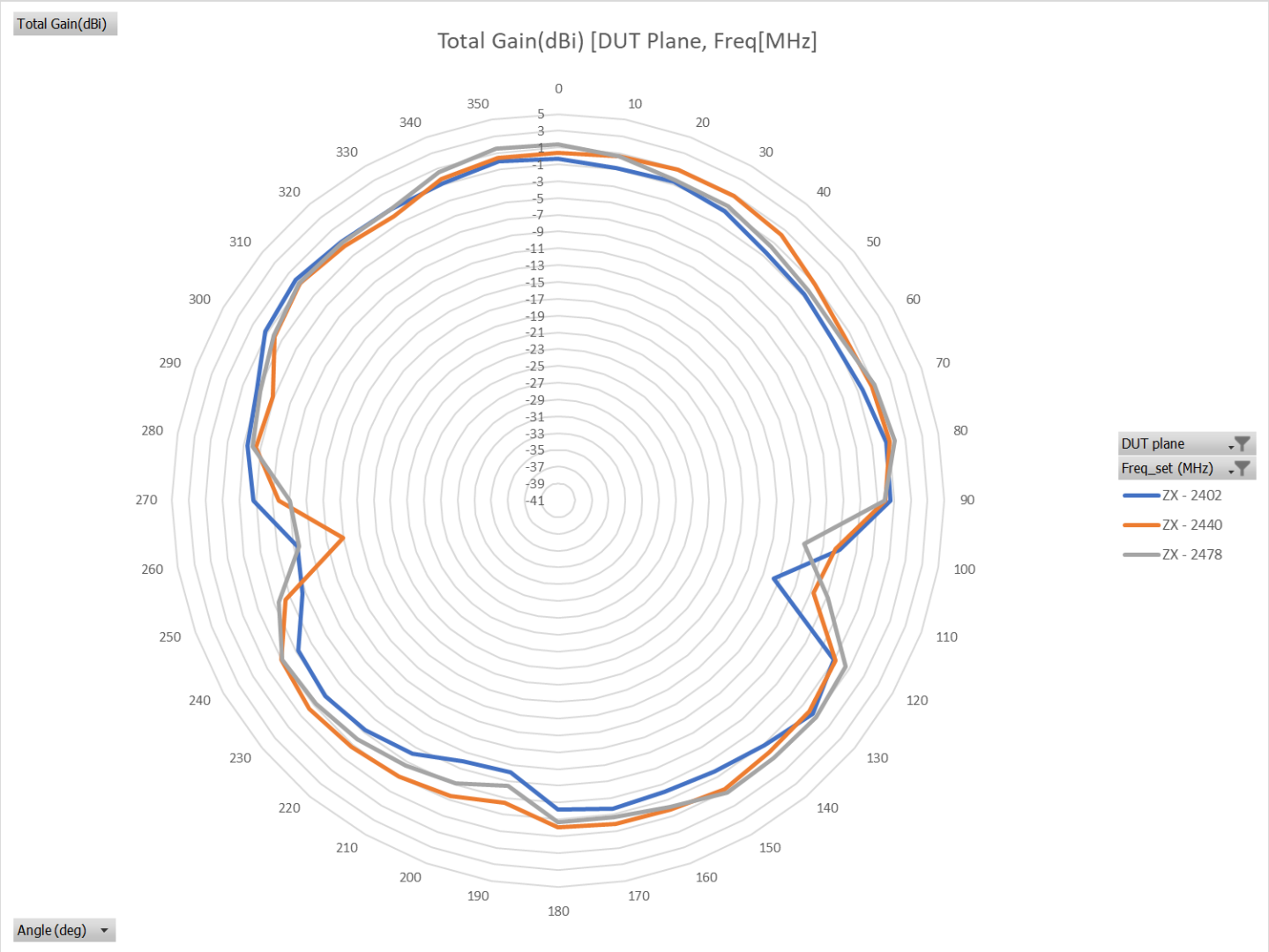
3’rd Harmonics levels (dBuV/m)



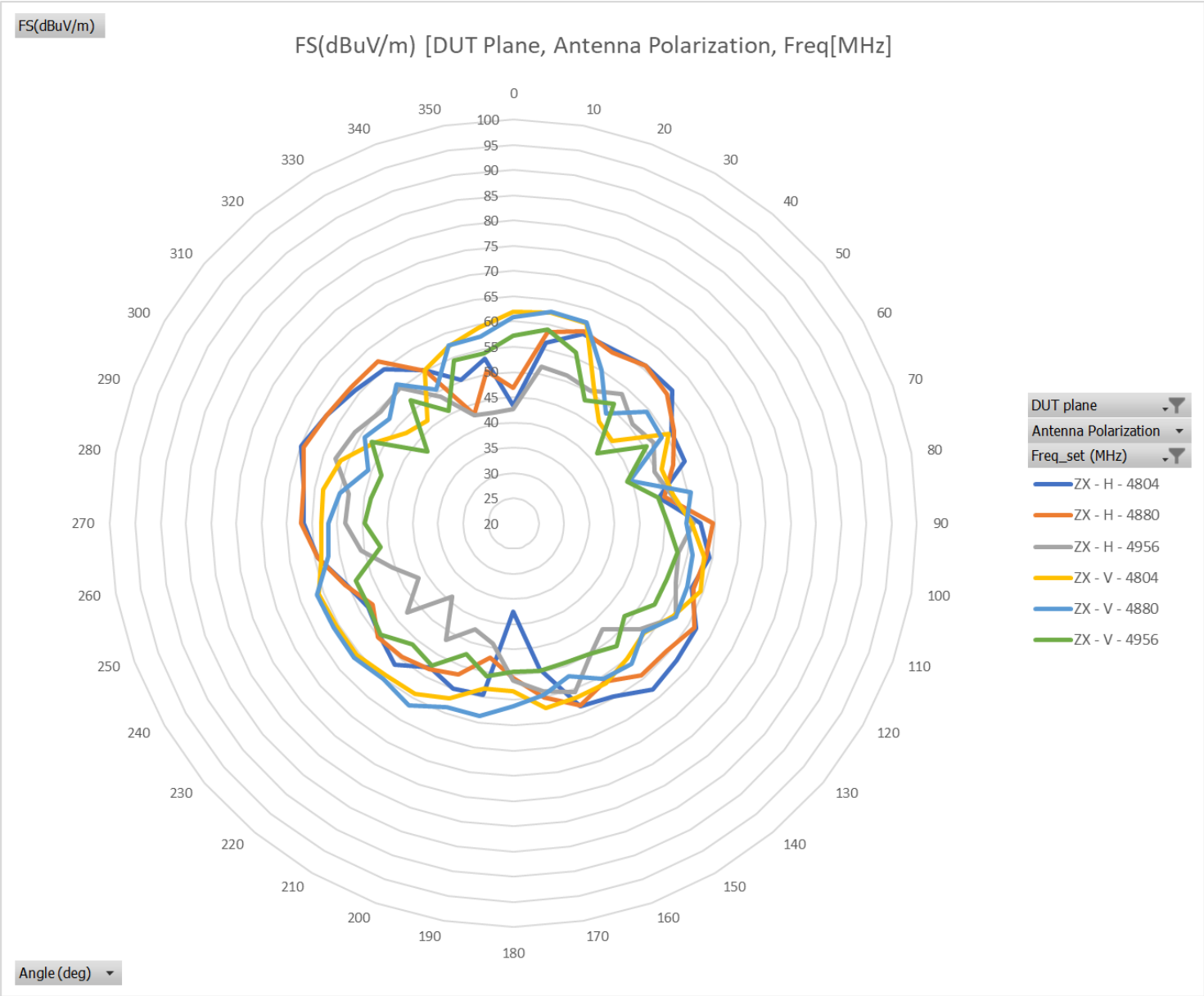
ZX Plane



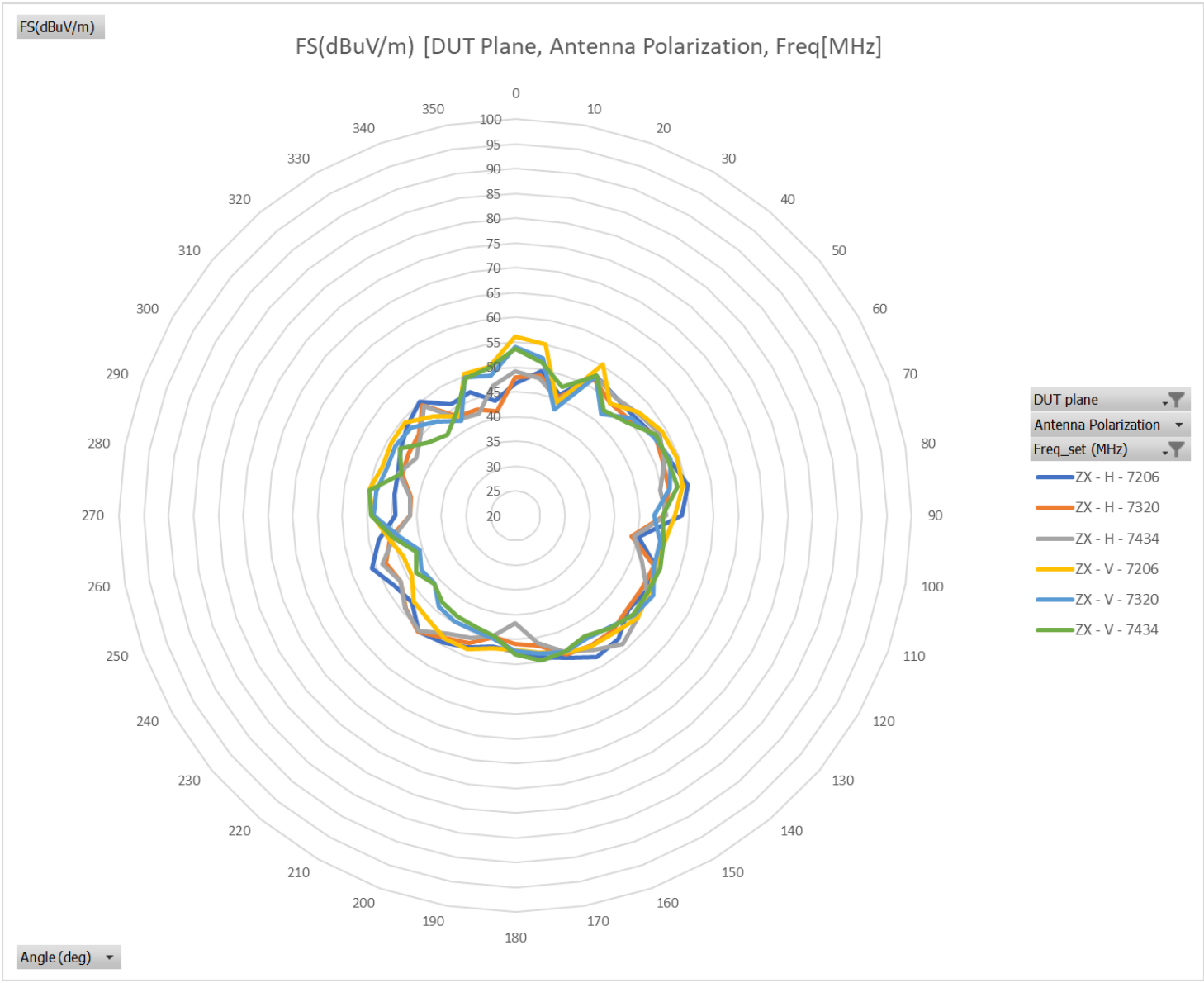
Realized Total Antenna gain (dBi)



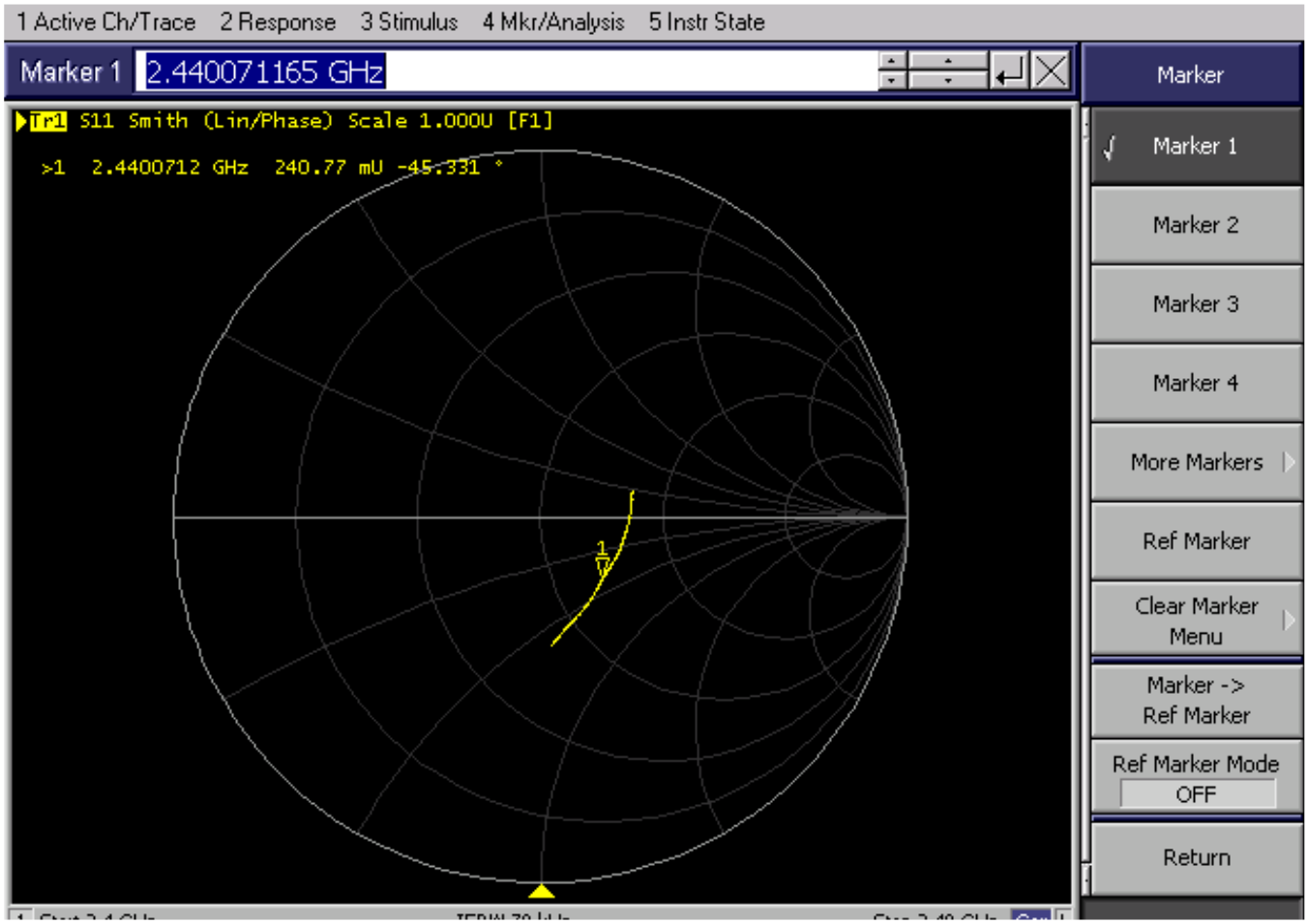
2’nd Harmonics levels (dBuV/m)

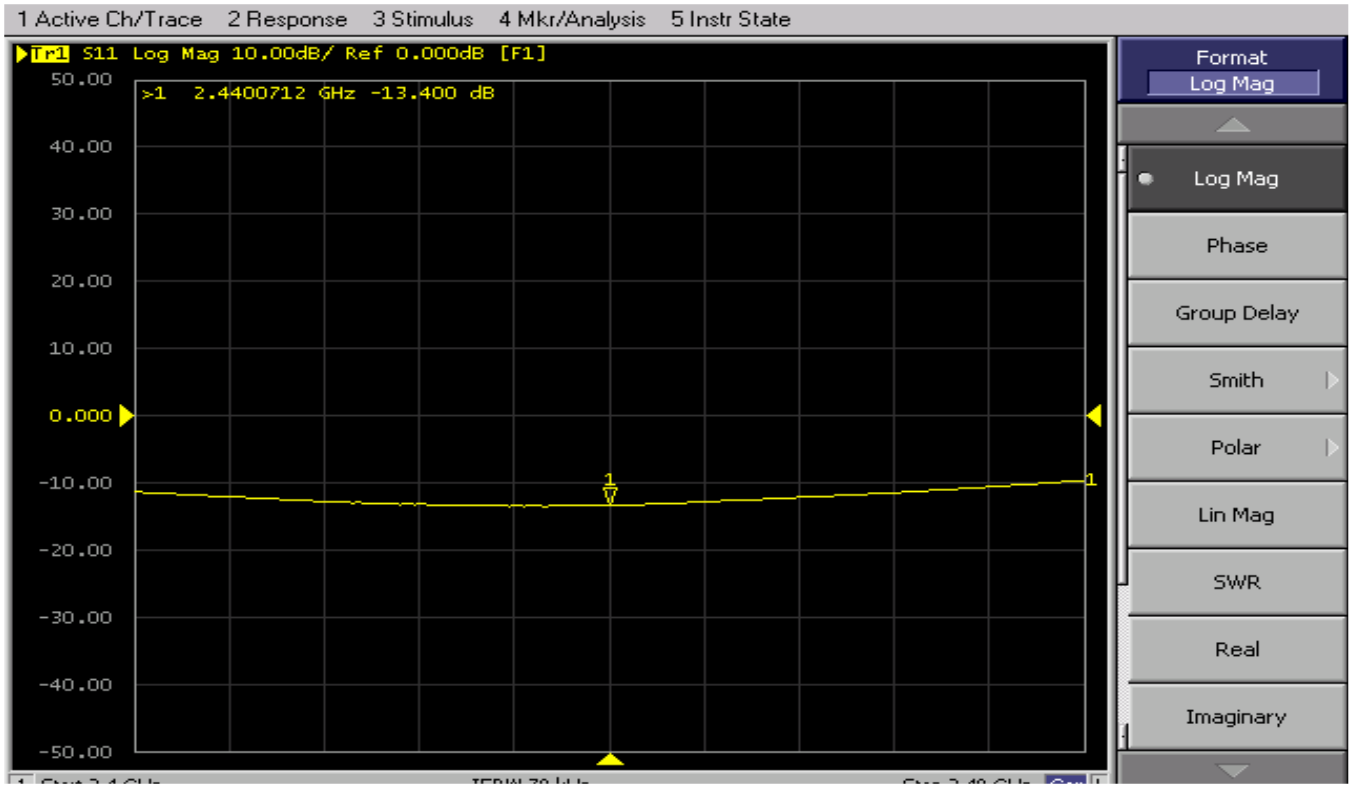


3’rd Harmonics levels (dBuV/m)



Antenna plus low pass filter S11





Conducted TX power

	Guitar2	Conducted CW TX power		
	Cable loss	2	dB	flat
TX setting	Frequency (MHz)	Reading (dBm)	Calibrated (dBm)	
-4.3dBm	2402	9.4	11.4	
	2440	8.3	10.3	
	2478	8.7	10.7	
-6.3dBm	2402	8.1	10.1	
	2440	7.1	9.1	
	2478	7.3	9.3	
-8.7dBm	2402	5.5	7.5	
	2440	5	7	
	2478	4.6	6.6	
-11.6dBm	2402	3.2	5.2	
	2440	3	5	
	2478	2.3	4.3	

Antenna gain and ERP summary

Freq/Plane	Max gain	Avg Gain	Max ERP (measured)
XY 2402	-0.8dBi	-8.5dBi	+4.3dBm
XY 2440	+1.2dBi	-5.9dBi	+6.2dBm
XY2478	-0.9dBi	-7.3dBi	+3.4dBm
ZX2402	0dBi	-2.8dBi	+5.1dBm
ZX2440	+0.9dBi	-1.9dBi	+5.9dBm
ZX2478	+1.5dBi	-1.9dBi	+5.8dBm

Conclusion

The antenna and low pass filter impedance meets the requirements and matches simulation well.
The realized peak total gain matches the simulation well.
The ZX radiation pattern matches simulation as well, but the XY has more notches probably due to the addition of the folded neck.
The neck couldn't be unfolded due to the limited rotational table size.
The 2'nd and 3'rd harmonic suppression has worst case 6dB of margin to the FCC limit (<73.9dBuV).