



PS5 Controller & Dongle Antennas Evaluation

Rev. 1.0
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Document Revision History

Date	Revision	Author	Description Of Changes
6/06/2022	1.0	Jacek Czajka	First revision

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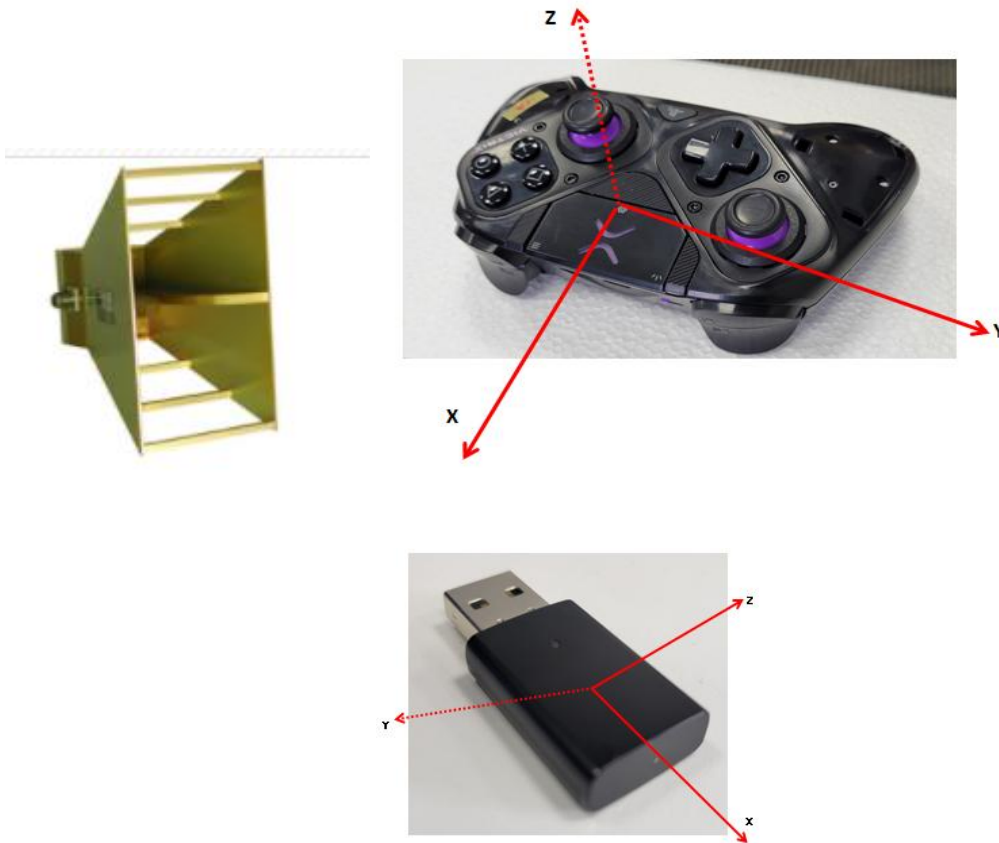
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Introduction

PS5 controller and dongle BT antennas are designed and fully simulated including required components (low pass filter and antenna impedance matching). LPF / antenna impedance matching circuits are "driven" by 8TR8211 (2.4GHz Bluetooth Smart Front End RFIC).

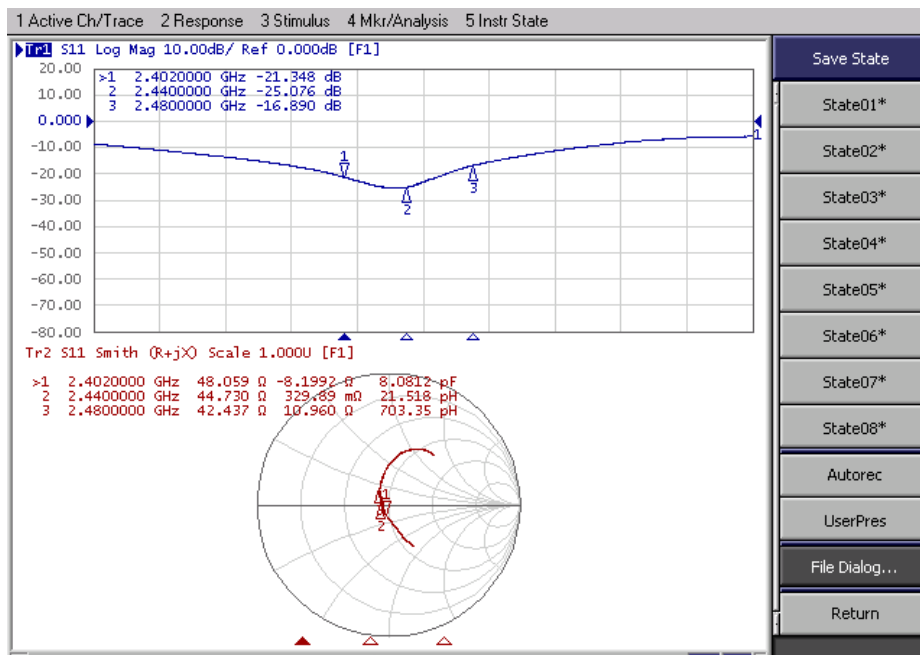
Antennas' S11 / gains were simulated and tested.

Visuals (planes definition)

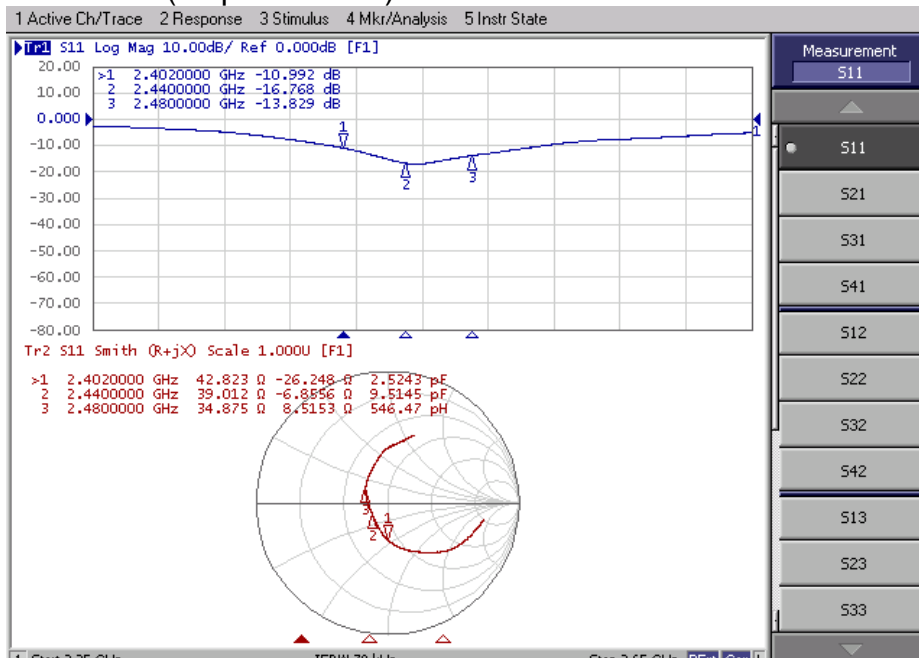


Measured Results BT Antennas - S11

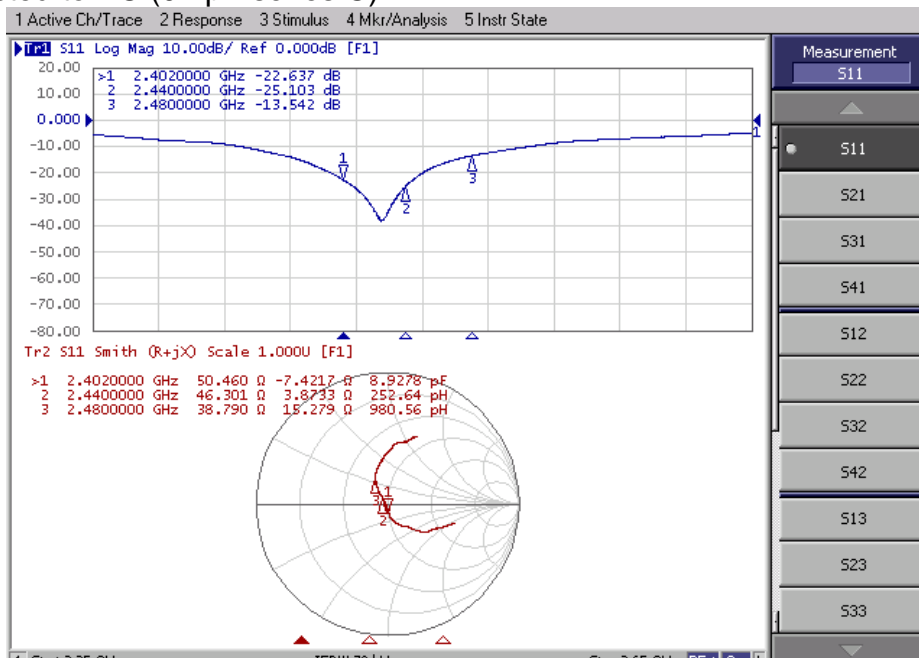
Fully Assembled PS5 controller (5pF series C)



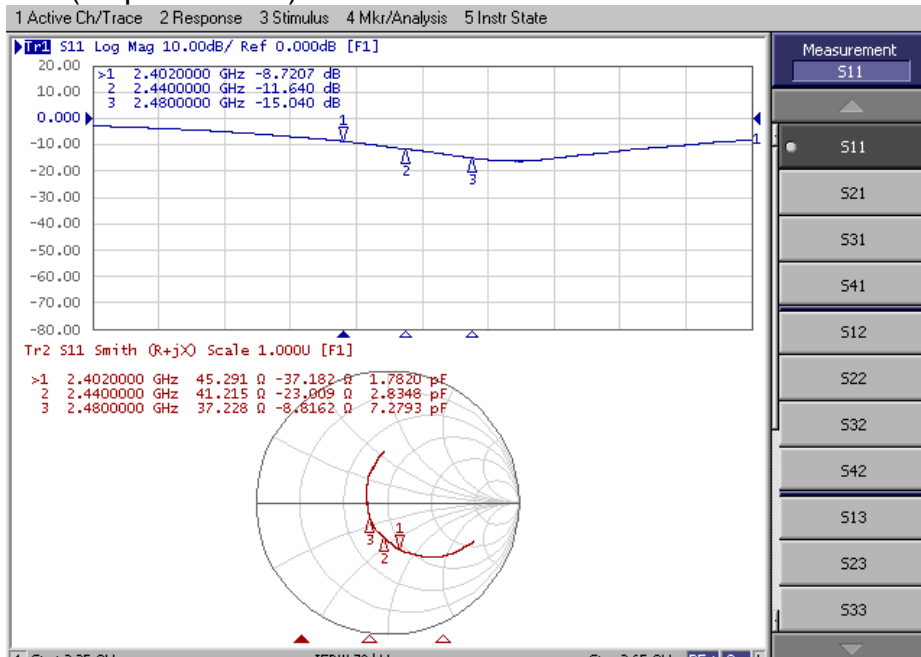
Dongle connected to PS5 (0.7pF series C)



Dongle connected to PC (0.7pF series C)

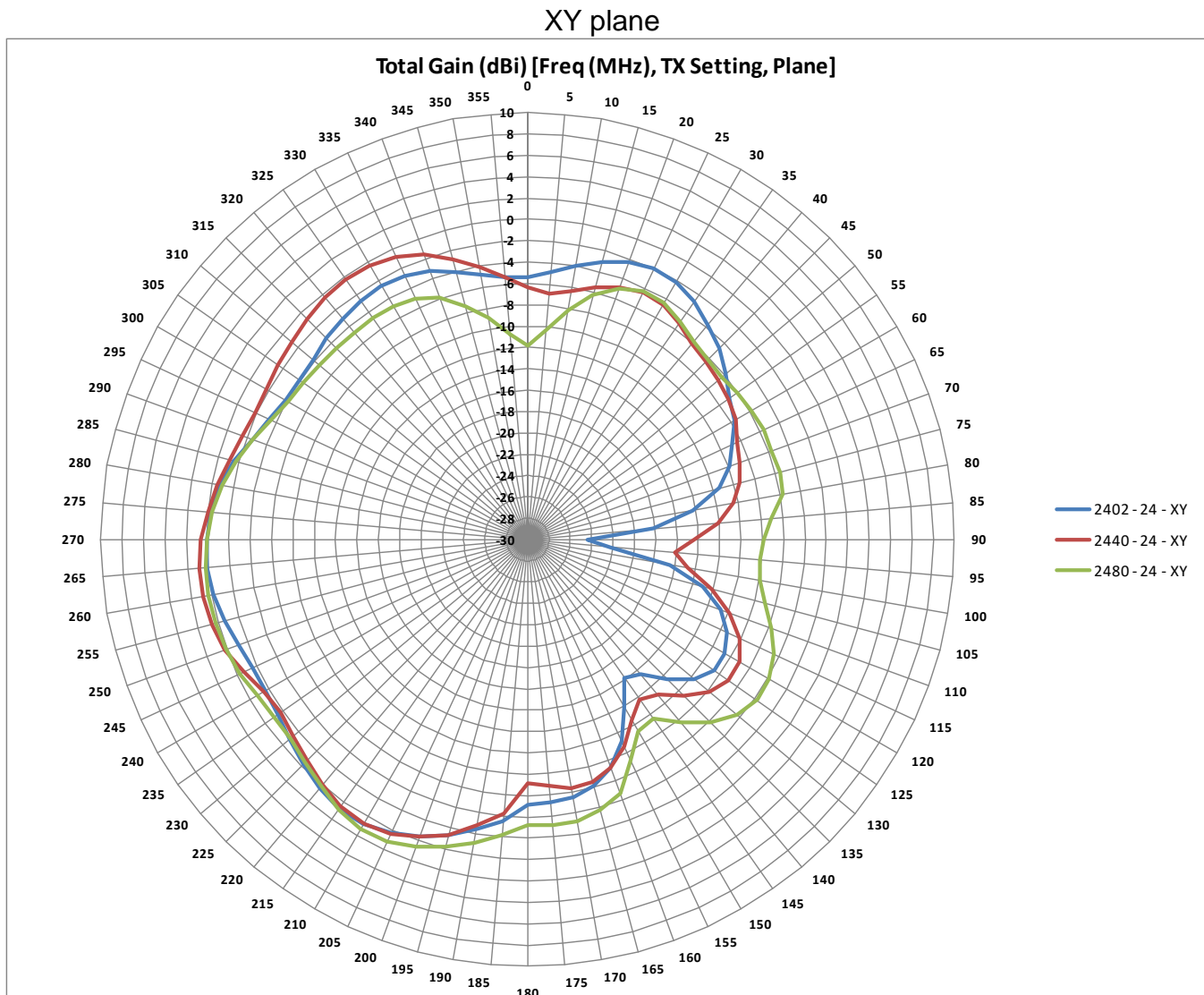


Dongle in "free air" (0.7pF series C)

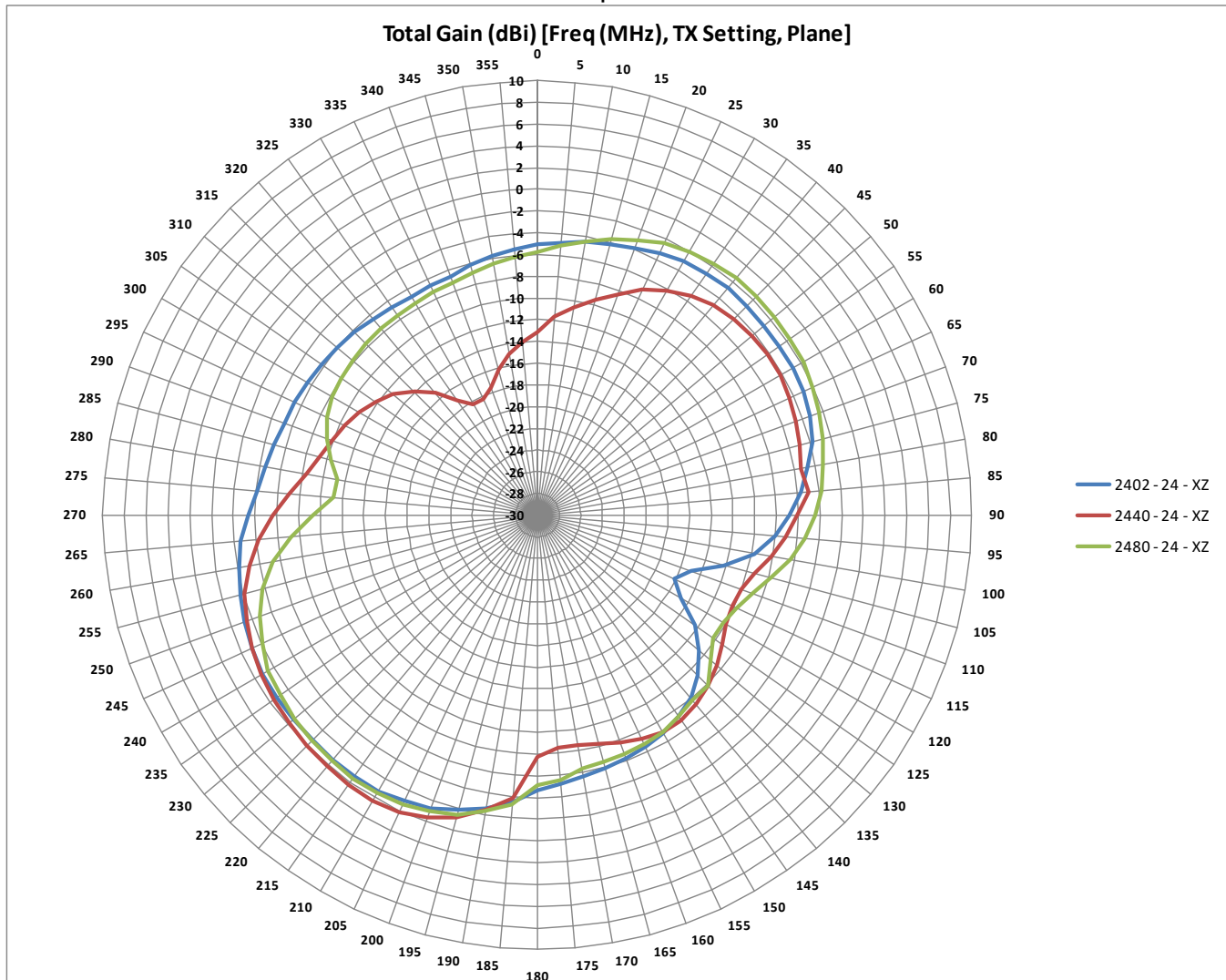


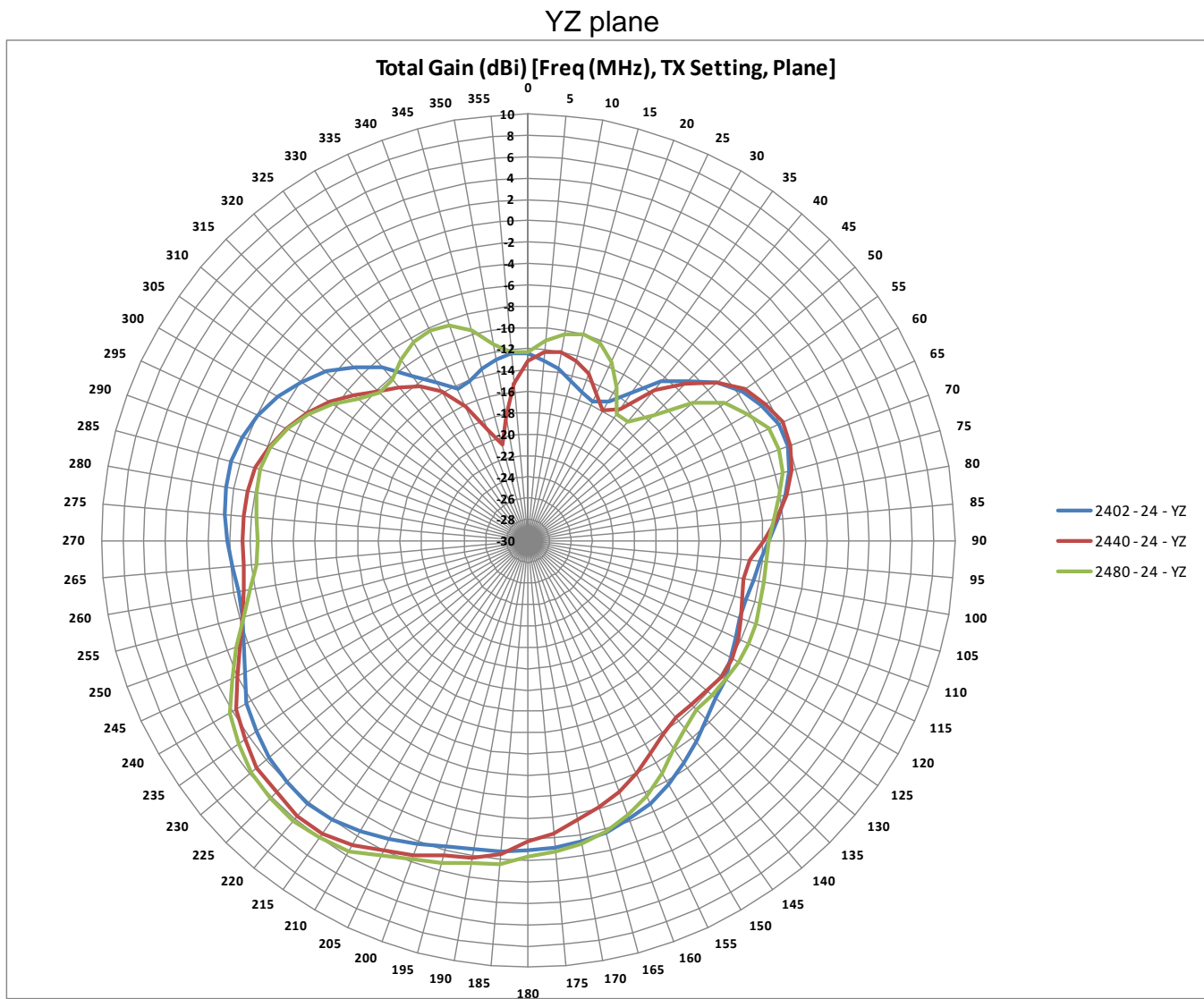
Measured Results BT Antennas - Gain

Antenna Gain of PS5 Controller



XZ plane

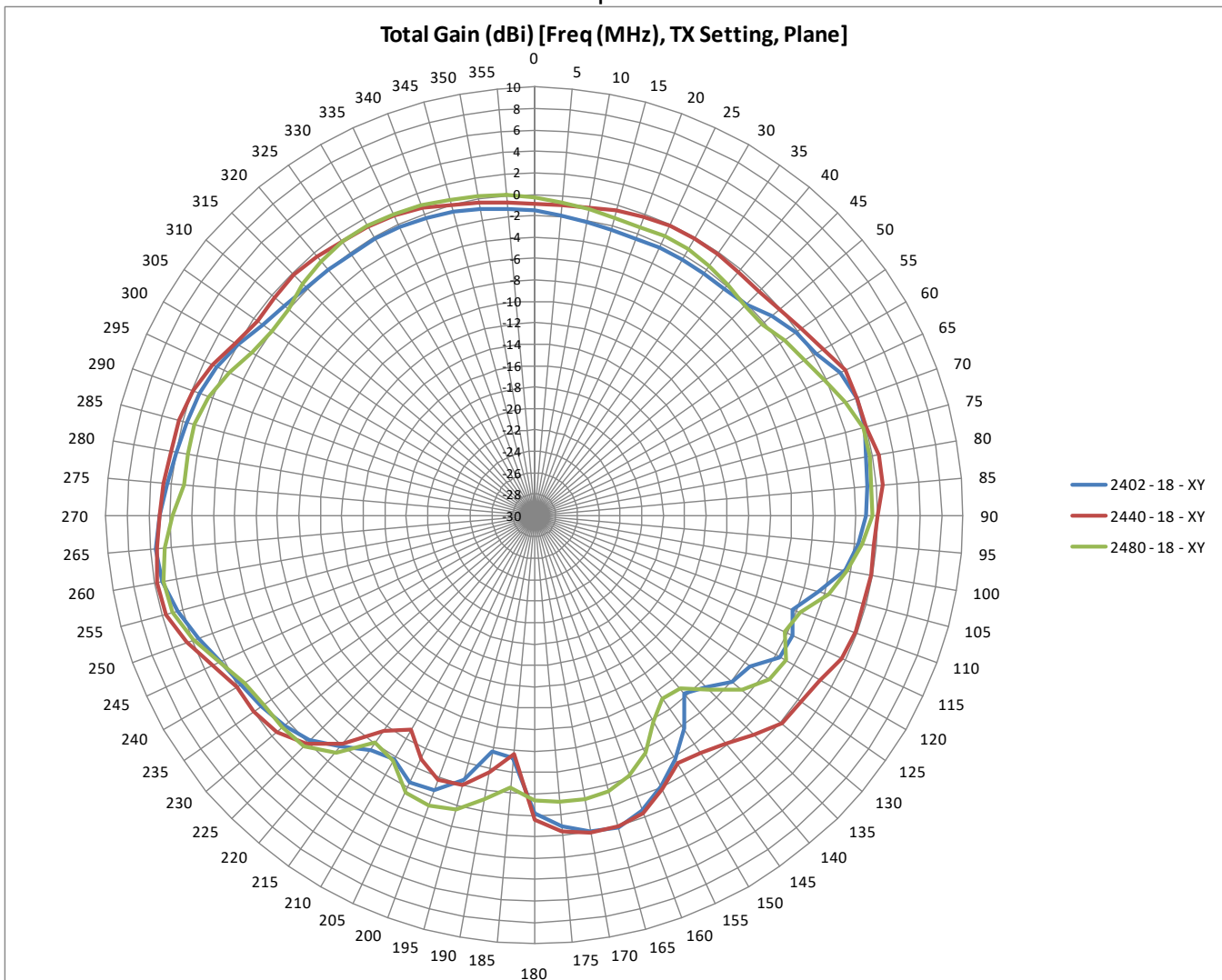




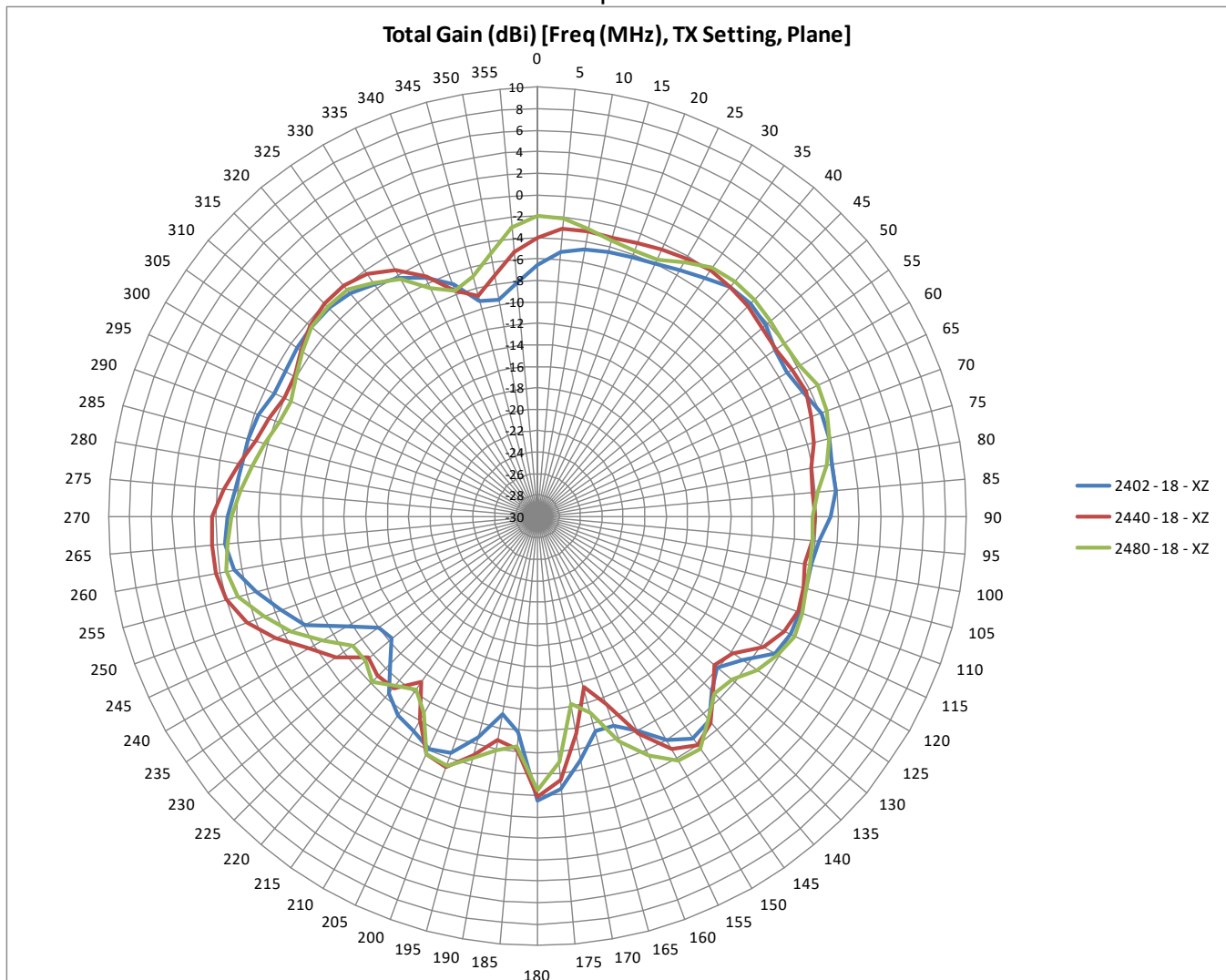
Controller antenna peak gain of ~4.3dBi (3 planes tested)

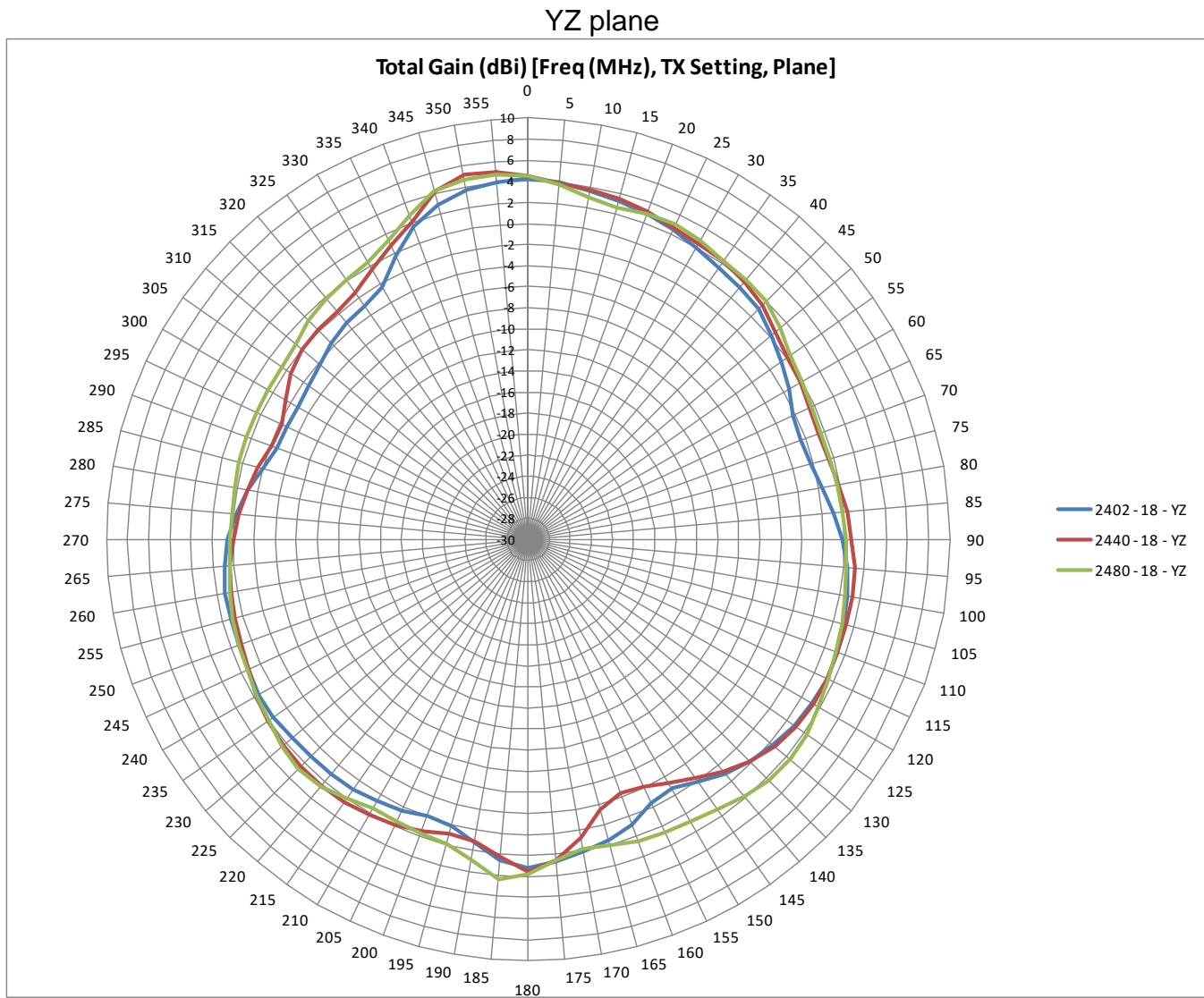
Antenna Gain of dongle connected to PS5

XY plane



XZ plane

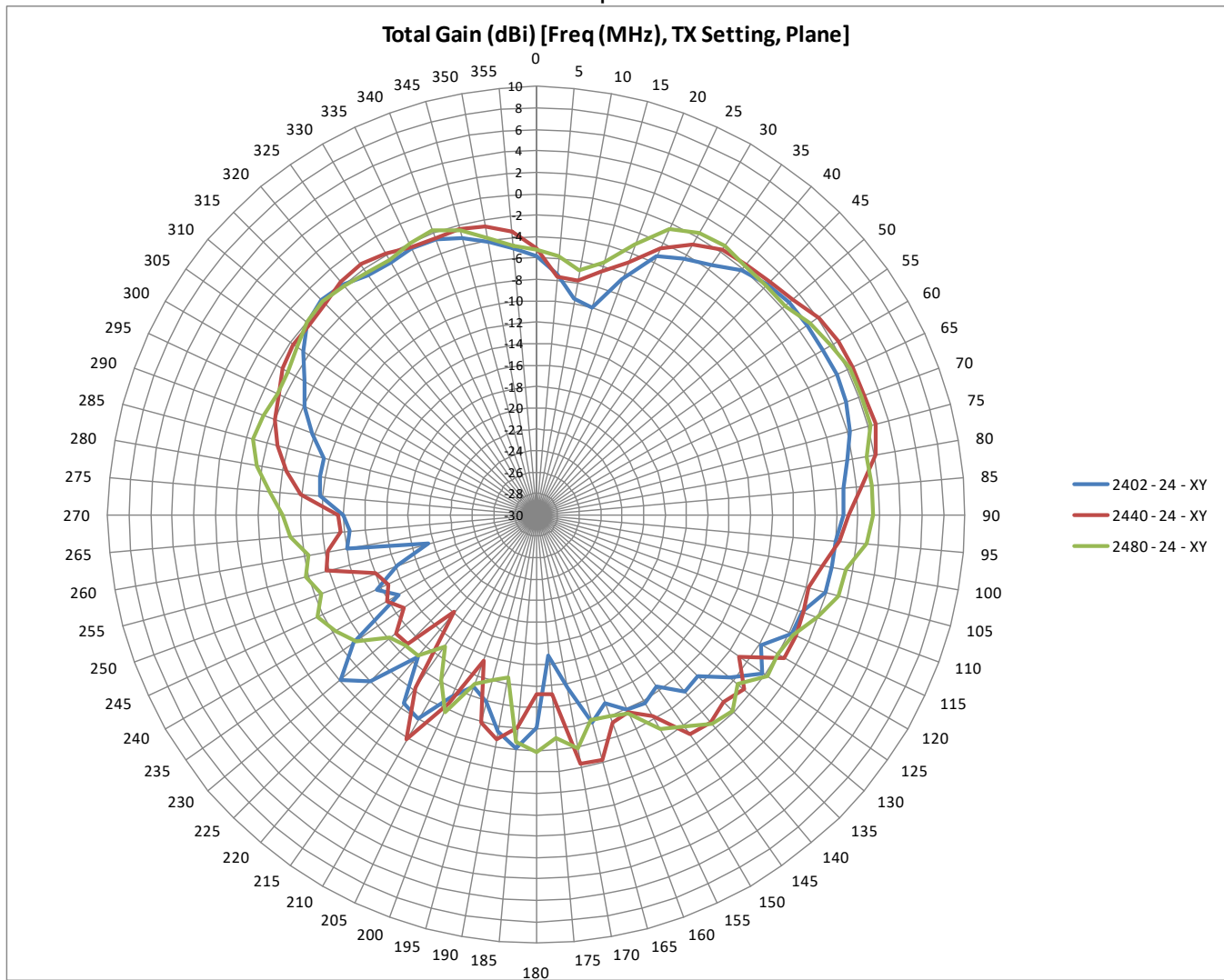


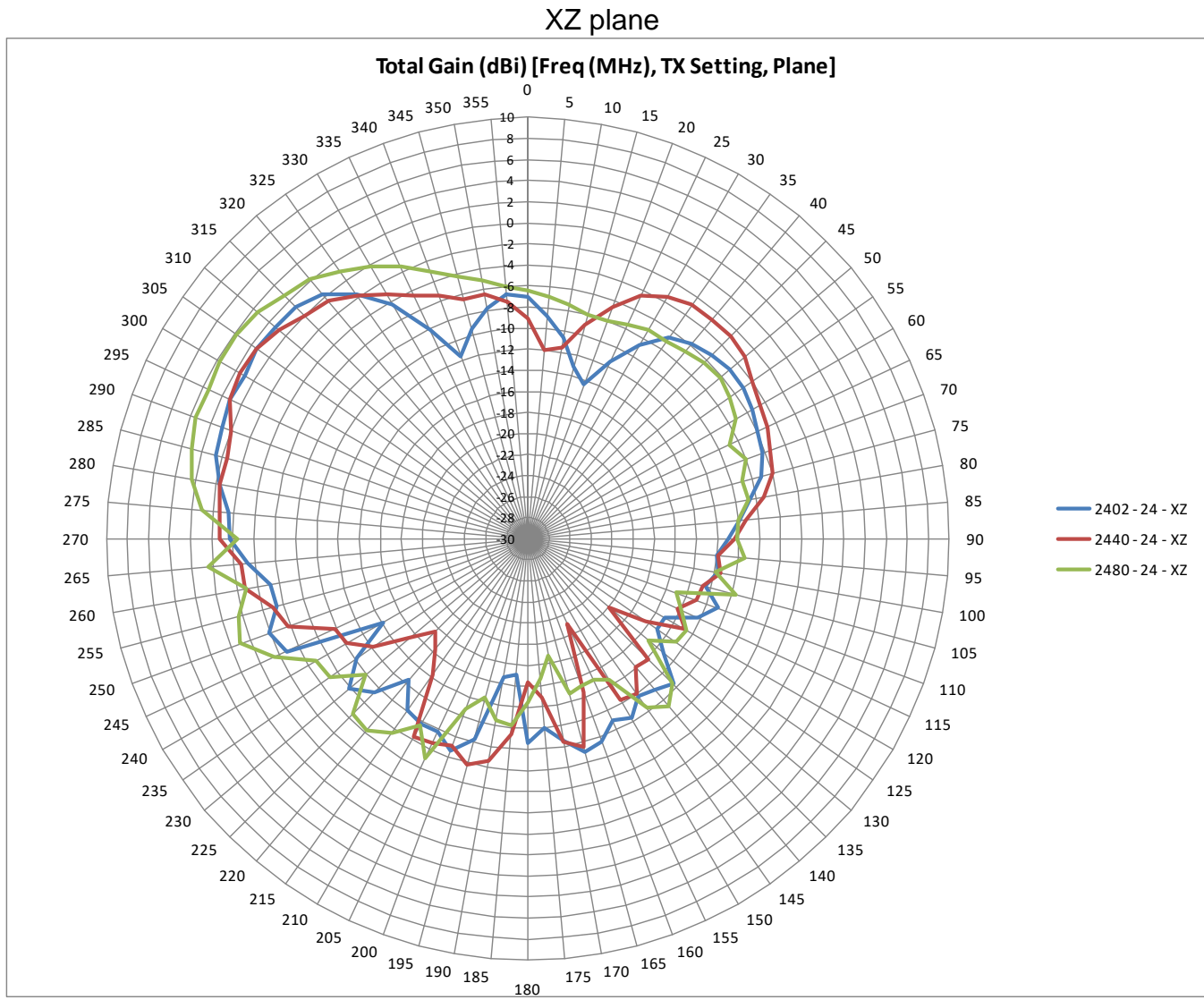


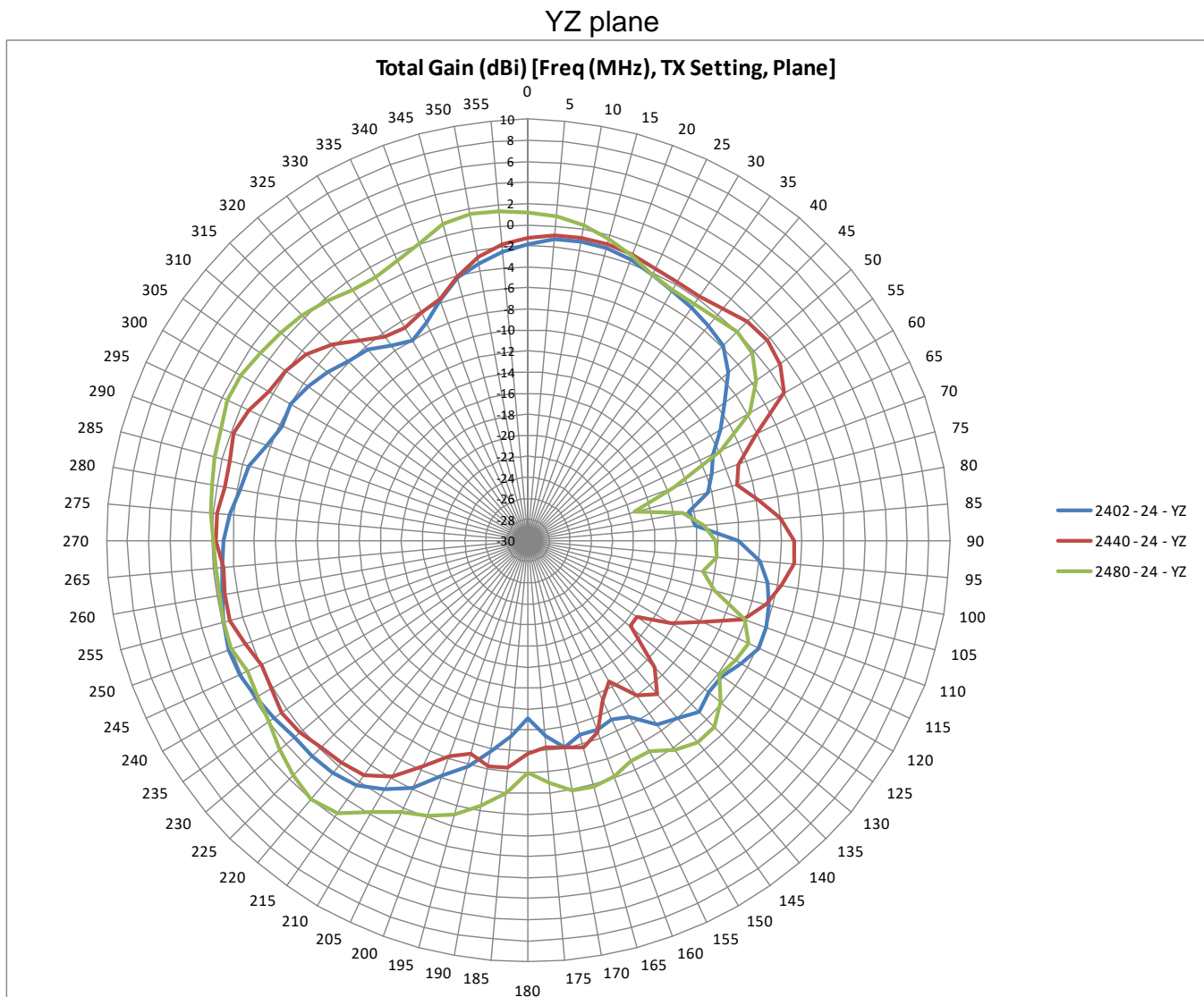
Dongle with PS5 antenna peak gain of ~5.8dBi (3 planes tested)

Antenna Gain of dongle connected to PC (back side)

XY plane



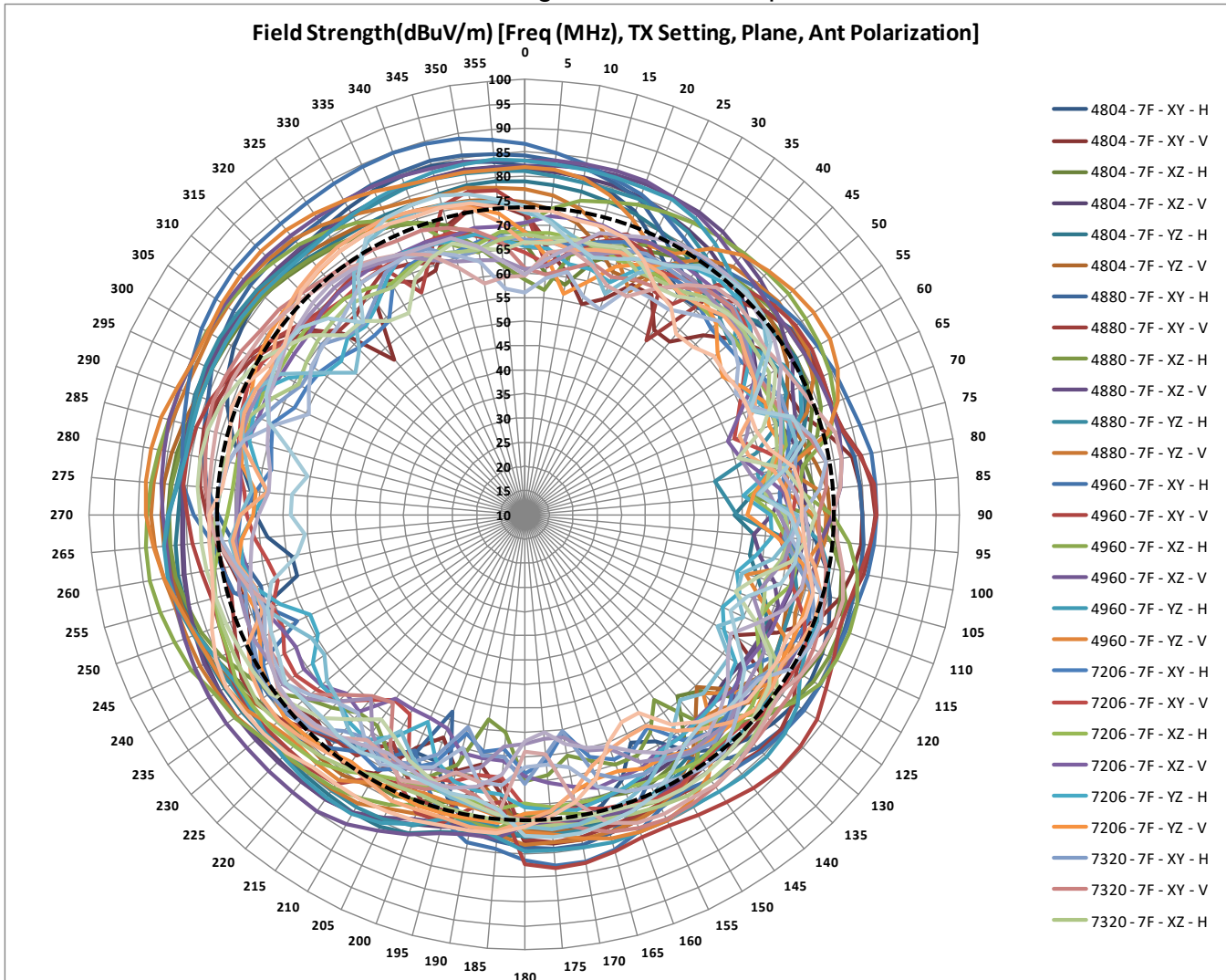




Dongle with PPC antenna peak gain of ~-3.7dBi (3 planes tested)

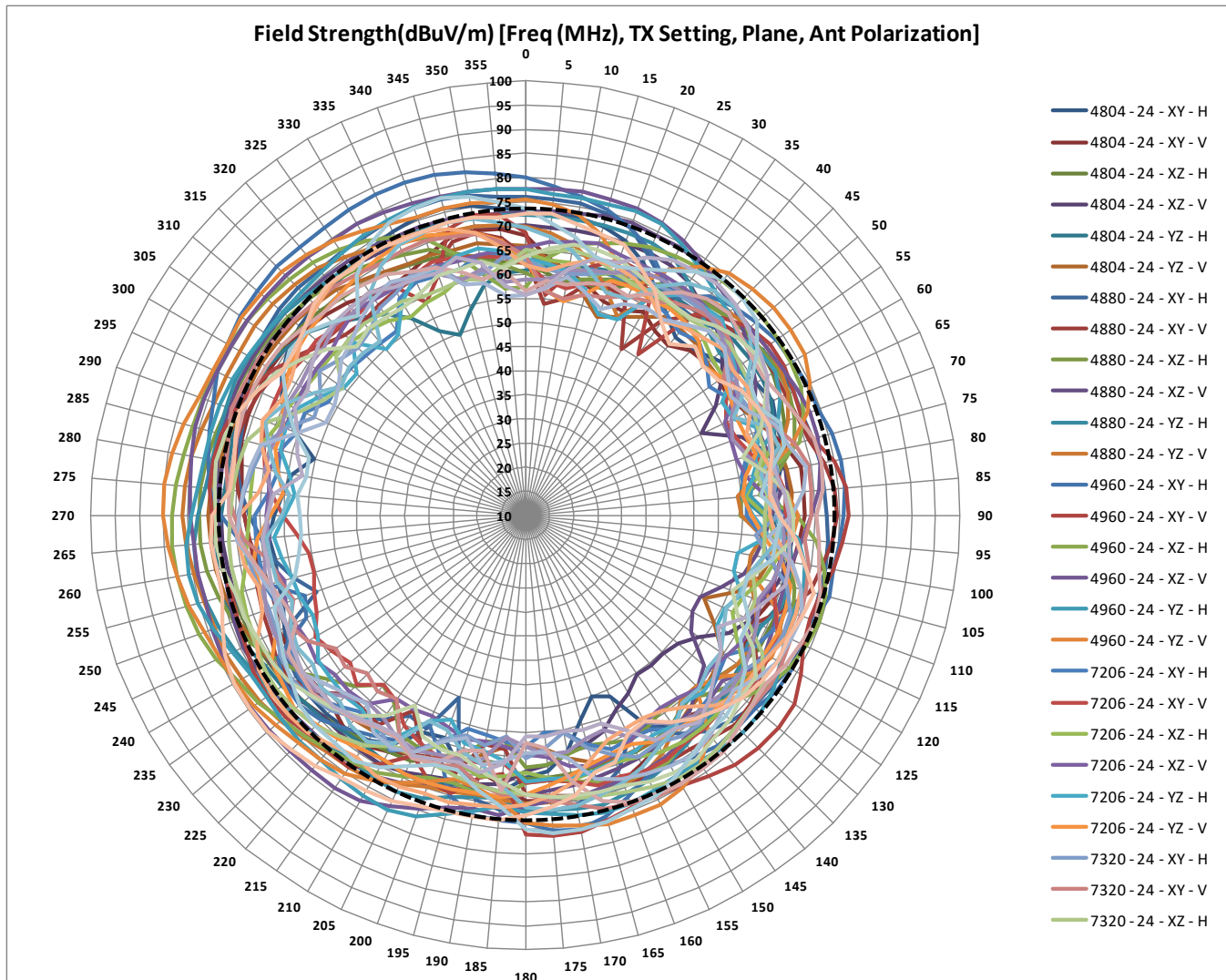
Measured Results BT Antennas - H2/H3 radiated

PS5 controller H2/H3 (3 planes, 3 frequencies, horizontal and vertical polarization)
 Power setting of "0x7F" - max power

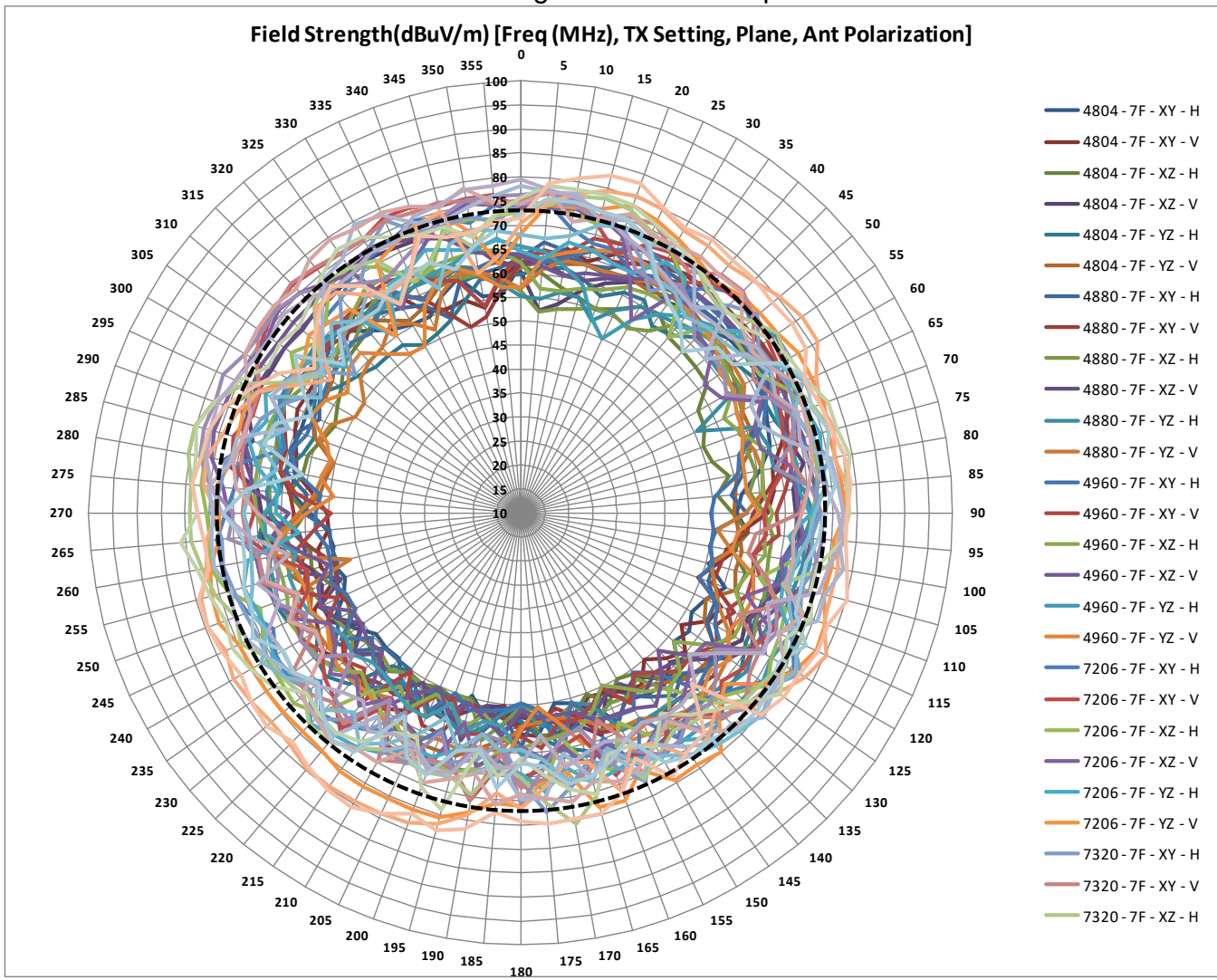


Note for all harmonics plots: "----" represents max peak emission level of 73.9dBuV/m

Power setting of "0x24" - TX power reduced by ~1dB

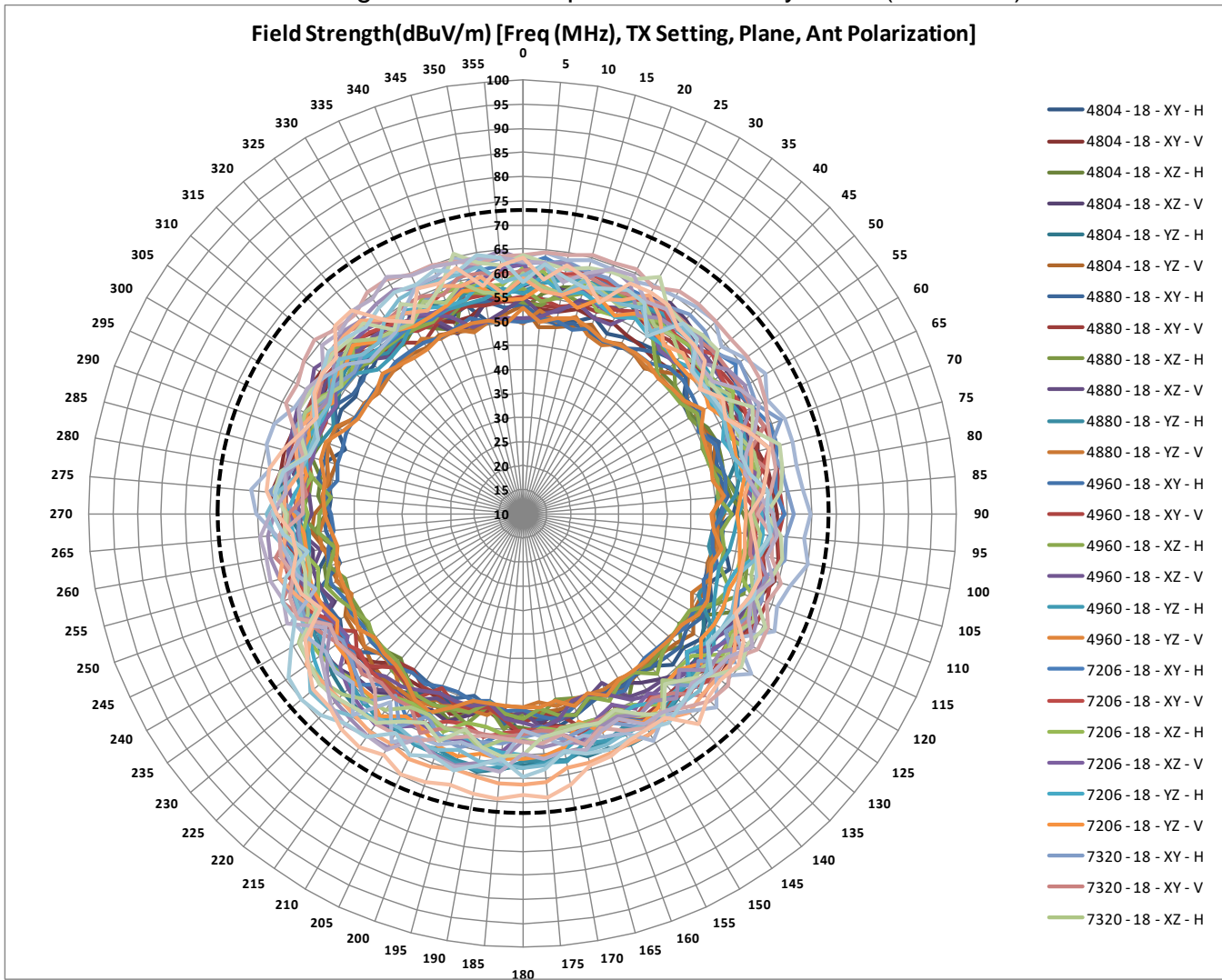


Dongle with PC - H2/H3 (3 planes, 3 frequencies, horizontal and vertical polarization)
Power setting of "0x7F" - max power

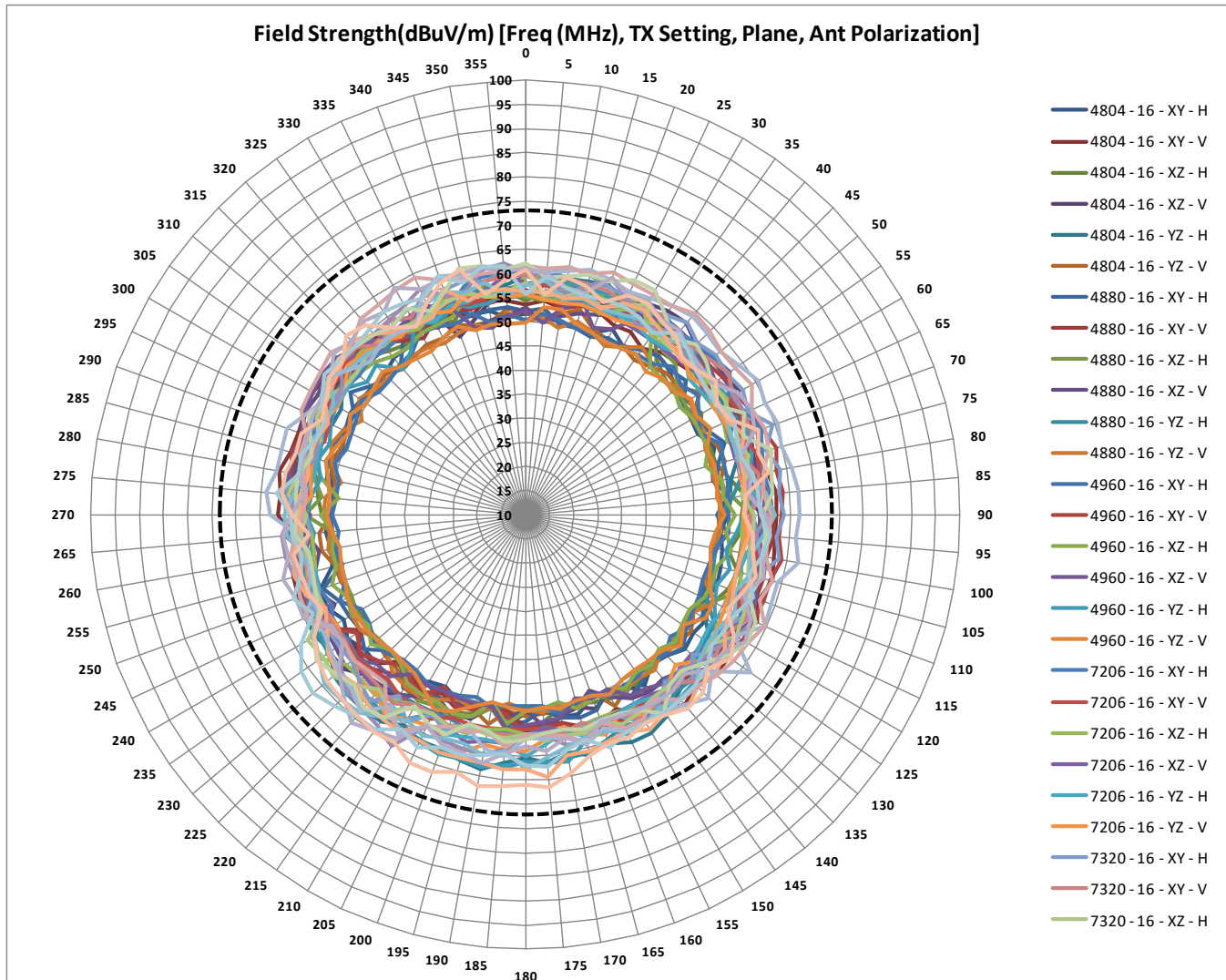


Dongle with PS5 - H2/H3 (3 planes, 3 frequencies, horizontal and vertical polarization)

Power setting of "0x18" - TX power reduced by ~2dB (from max)



Power setting of "0x16" - TX power reduced by ~2.5dB (from max)



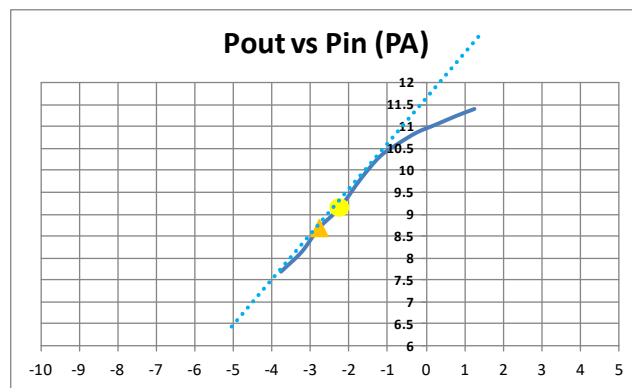
Summary

Antenna peak gain is close to the simulated value (controller and dongle with PS5). S11 with selected impedance matching C value correlates well to simulation. BT transmit power should be reduced to minimize radiated harmonics - recommended power setting of "0x16" or "0x18".

Appendix A

PS5 dongle conducted power (at antenna input including harmonics)

CH	FREQ (MHz)	Carrier Signal Setting (power)	Conducted TX power at antenna input				
			TX Power (dBm)	H2 (dBm)	H2 (dBc)	H3 (dBm)	H3 (dBc)
0	2402	7F	13	-32.2	45.2	-42.6	55.6
0	2402	36	12.6	-34.8	47.4	-45.5	58.1
0	2402	24	12.1	-37.2	49.3	-48.1	60.2
0	2402	18	10.6	-41.4	52	-51.5	62.1
19	2440	7F	12.9	-28.8	41.7	-44.5	57.4
19	2440	36	12.5	-31.7	44.2	-47	59.5
19	2440	24	12	-34.3	46.3	-49.2	61.2
19	2440	18	10.6	-38.4	49	-52.5	63.1
39	2480	7F	12.5	-27.6	40.1	-44.4	56.9
39	2480	36	12.2	-30.3	42.5	-47.1	59.3
39	2480	24	11.7	-33.2	44.9	-49.6	61.3
39	2480	18	10.4	-37.6	48	-52.8	63.2



PS5 controller conducted power (at antenna input including harmonics)

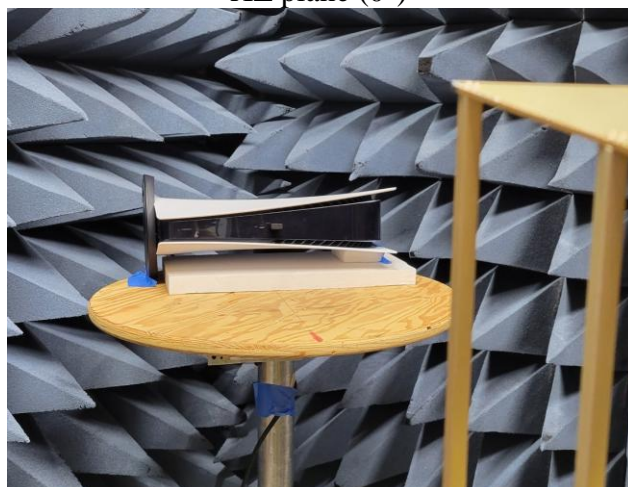
CH	FREQ (MHz)	Carrier Signal Setting (power)	Conducted TX power at antenna input				
			TX Power (dBm)	H2 (dBm)	H2 (dBc)	H3 (dBm)	H3 (dBc)
0	2402	7F	13.1	-28.5	41.6	-41.8	54.9
0	2402	36	12.8	-30.7	43.5	-44.6	57.4
0	2402	24	12.4	-33.4	45.8	-46.9	59.3
0	2402	18	11.2	-39.8	51	-50.1	61.3
19	2440	7F	13.3	-26.4	39.7	-44.7	58
19	2440	36	12.9	-28.9	41.8	-47.4	60.3
19	2440	24	12.4	-32.1	44.5	-49.3	61.7
19	2440	18	11.1	-38.3	49.4	-52.1	63.2
39	2480	7F	13.8	-26.8	40.6	-44.4	58.2
39	2480	36	13.4	-29.8	43.2	-46.4	59.8
39	2480	24	12.7	-33.8	46.5	-47.8	60.5
39	2480	18	11.4	-40.6	52	-50.7	62.1

Appendix B (Dongle with PS5)

XY plane (330°)



XZ plane (0°)



YZ plane (0°)



Appendix B (Dongle with PC)

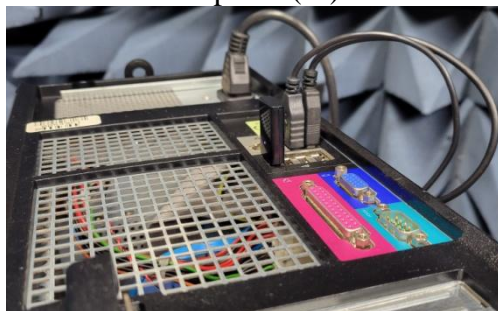
XY plane (0°)



XZ plane (0°)

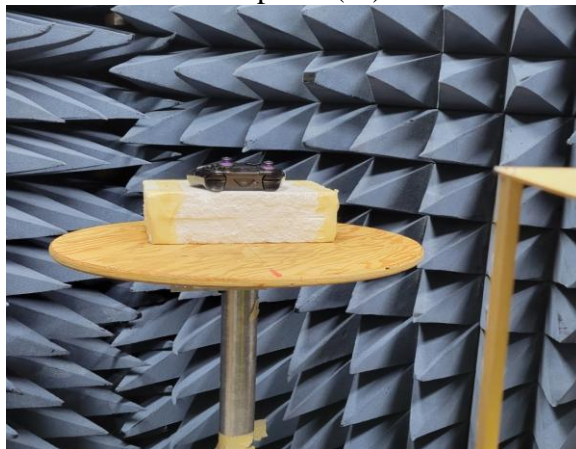


YZ plane (0°)

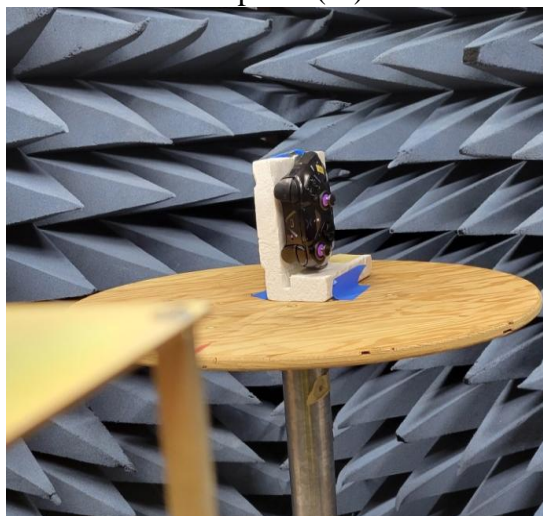


Appendix B (PS5 controller)

XY plane (0°)



XZ plane (0°)



YZ plane (0°)

