



TECHNICAL REPORT: Finalmouse, LLC Ultralight X Cheetah Antenna Analysis Report

Prepared for: [Finalmouse, LLC]

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1 Revision History

REV	Date	Author	Notes
[0.1]	[2024-03-21]	[Timothy Milam]	Images and Measurement Data Report for Ultralight X Cheetah


Finalmouse supplied an Ultralight X Cheetah sample for antenna impedance match and radiated pattern measurements and analysis. The data below represents the result of the measurements.

2 Test Equipment Used


 Vector Network Analyzer “VNA” used was a CMT (Copper Mountain Technologies) Model: S5085; a 50 Ohm, 2-Port, 2-Path, 9 kHz to 8.5 GHz, S/N: 20107496.


 A CIA custom designed and built, 13 ft. x 9 ft. x 9 ft. anechoic antenna measurement chamber fully lined with Cumming Microwave “C-RAM SFC-18”, 18 in. deep pyramidal absorber and associated Cumming Microwave corner treatments and walkway absorber, see image below.

 Chamber source antenna is a RF Spin Model: QRH11, Quad Ridged Horn Antenna, S/N: 200721Q11.


 Various Mini-Circuits “Flex Test” test cables and Precision Pasternack connectors and adapters were used in the closed system setup, as well as Teledyne Model: “CCR33S80T” SPDT coaxial switches.

 Calibrated 100 mm RG-178/MMCX DUT test cable.

 Calibrated 100 mm 1.37 mm /U.FL DUT test cable.

 Two Teledyne CCR33S80T coaxial switches, Lot #: TR 109-71-M.


 Two TrackLife Model MDC01 Variable Regulated (0 – 30 V / 5 A max) power supplies.


 CMT (Copper Mountain Technologies) Model: TW-SMA Torque Wrench (no S/N).

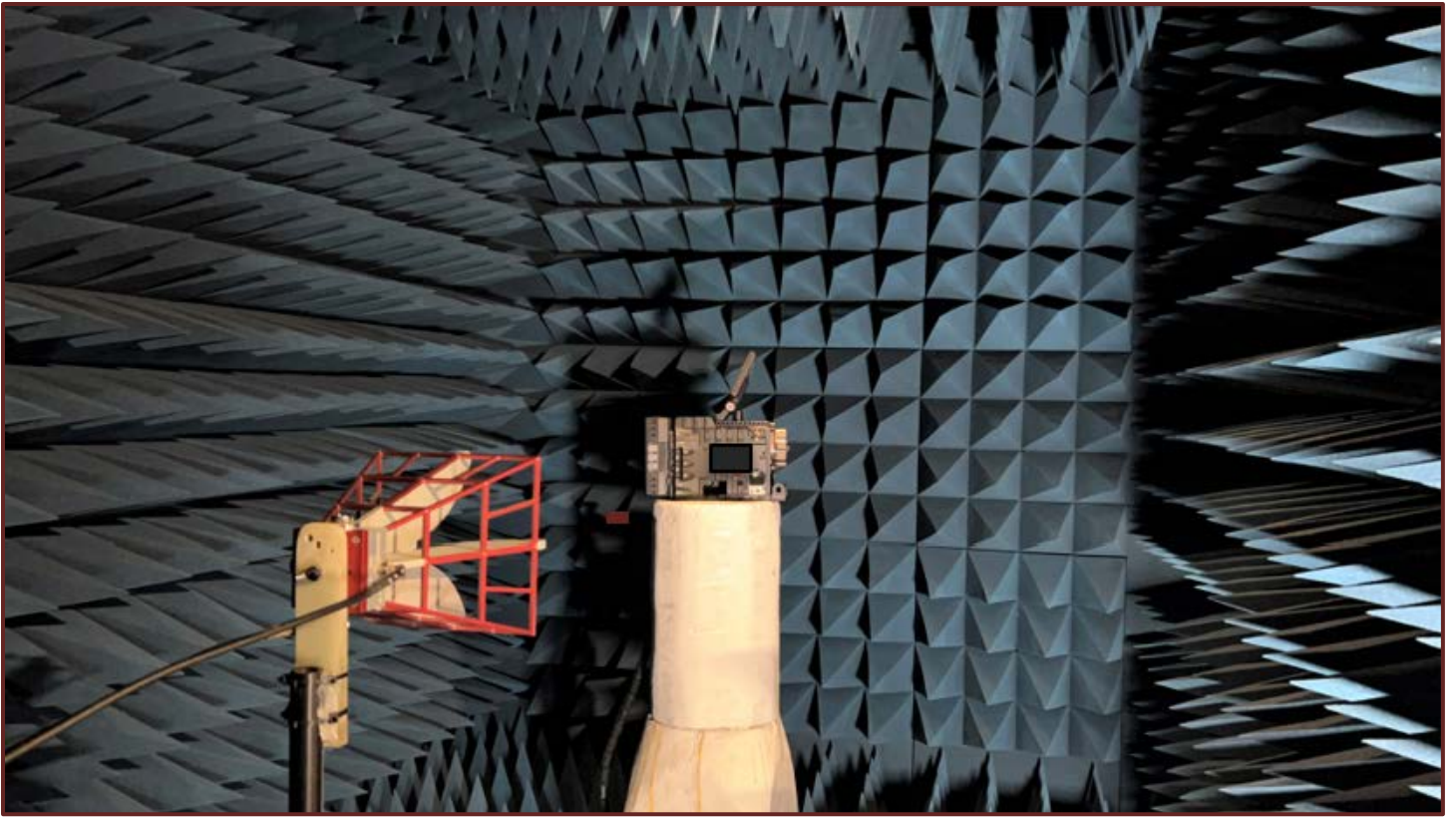
 CMT (Copper Mountain Technologies) Model: S911T 3.5 mm Calibration Kit, SN: A266049.

 Fluke Model 117 Digital Multimeter, S/N: 38480875WS.

 Omano 7x to 45 x trinocular microscope, with Hayear Model: HY-5099 (no S/N) Industrial Inspection Camera and SW.

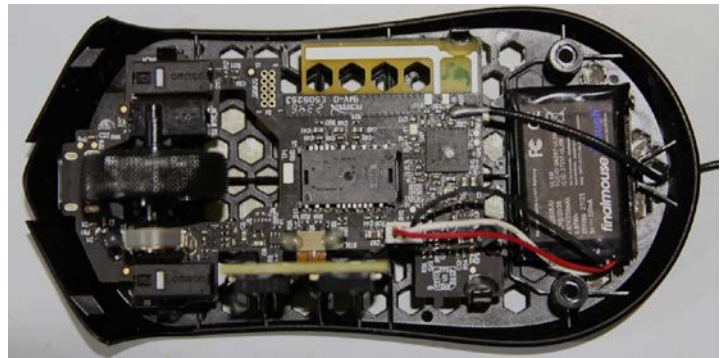
 Mitutoyo, 6 in. ± 0.001 in., Digital Caliper, Model: CD-6 CS, S/N: 0422822.

 Canon EOS 5D Camera, with numerous lenses, ranging from MP-E 65 extreme macro to EF 100 – 400 mm Zoom (as needed), numerous flash and lighting solutions, tripods, and numerous other accessories.



CIA's Anechoic Chamber

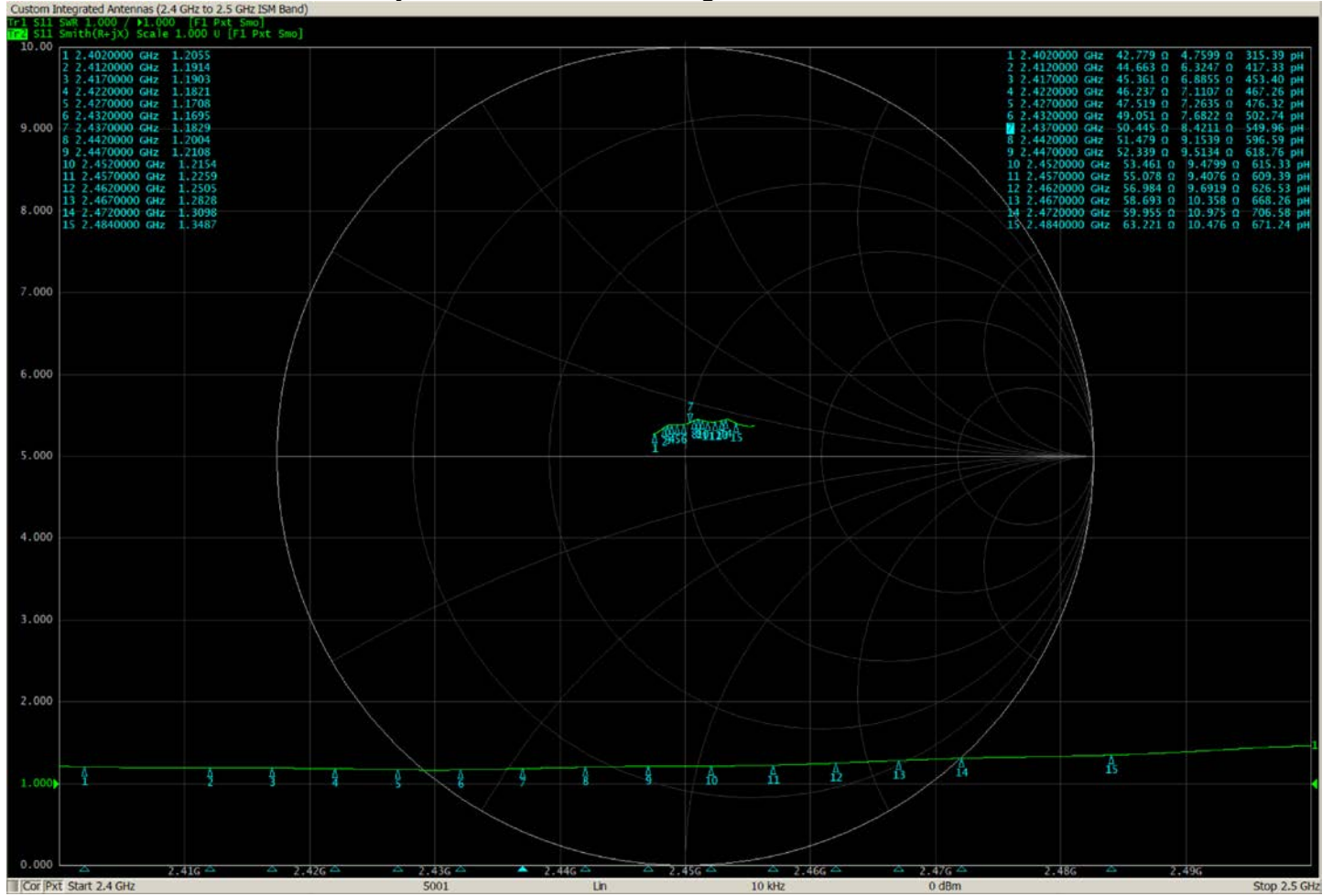
3 The DUT Tested was the Ultralight X Cheetah; also referred to in this report as "Small".



External and internal pictures of the Ultralight X Cheetah as tested.

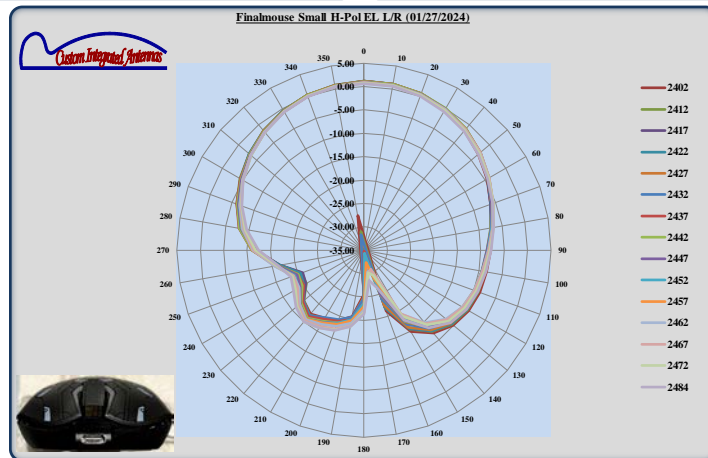
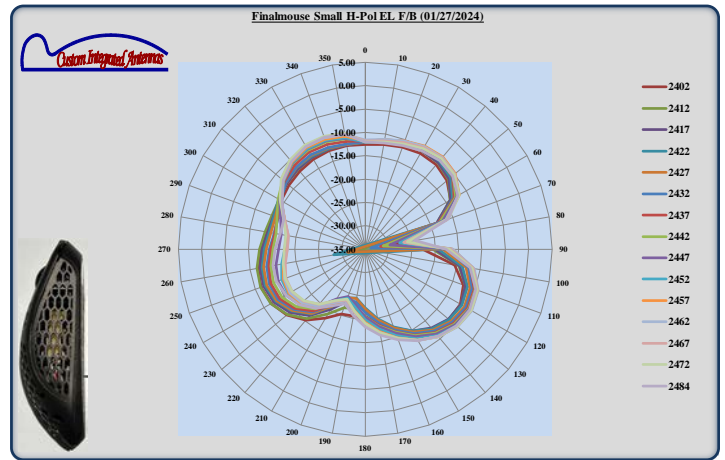
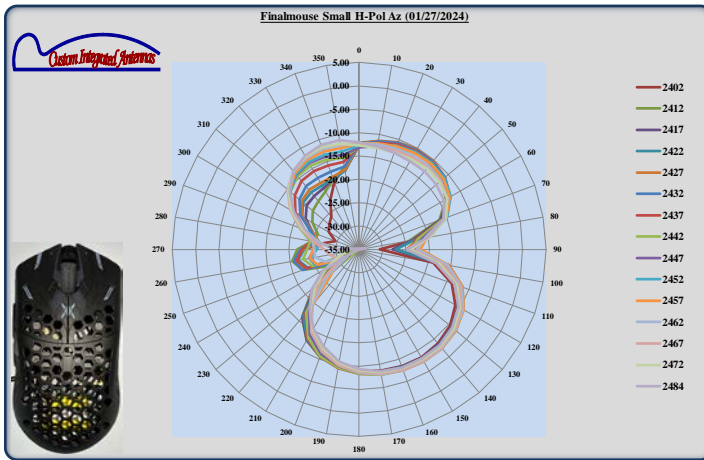
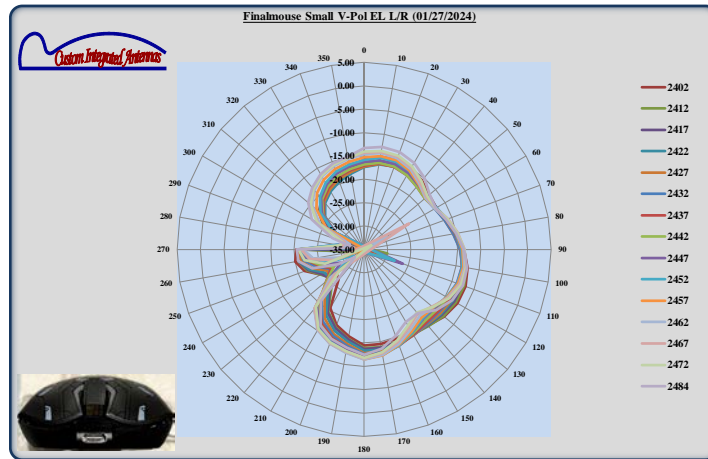
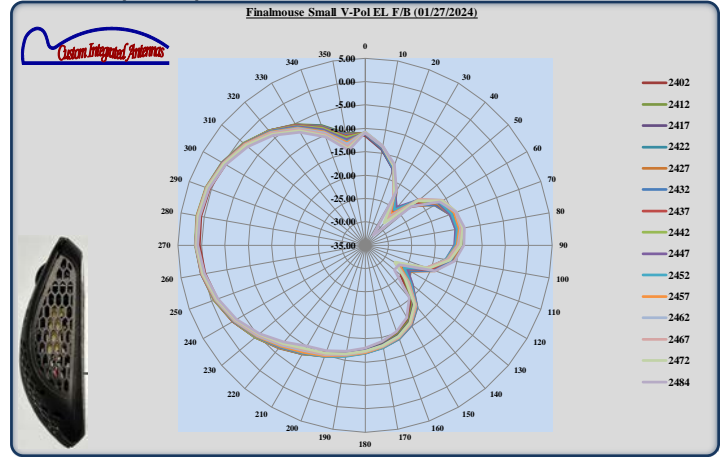
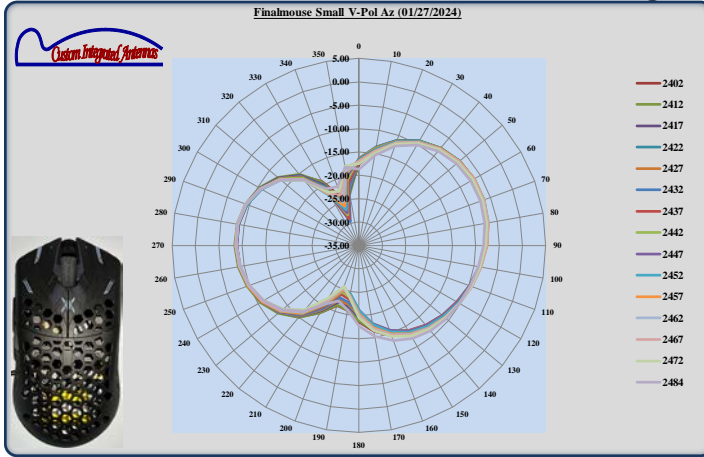
4 Measured Data

4.1.1 VSWR/Smith Chart Overlay of the Finalmouse Ultralight X Cheetah



The VSWR/Smith Chart overlay of the Ultralight X Cheetah indicates good impedance match.

4.1.2 Radiated Patterns of the Finalmouse Ultralight X Cheetah (small) model.



4.1.3 Tabular Data

Average Gain Comparison: All data points averaged for each frequency and all angles (dBi)									
Frequency (MHz)	2402	2412	2417	2422	2427	2432	2437	2442	2447
Finalmouse Small V-Pol Az (01/27/2024)	-10.95	-10.65	-10.81	-10.83	-10.85	-10.93	-10.94	-10.88	-10.98
Finalmouse Small H-Pol Az (01/27/2024)	-13.11	-12.78	-12.85	-12.70	-12.47	-12.29	-12.15	-12.09	-12.24
Finalmouse Small V-Pol EL F/B (01/27/2024)	-5.85	-5.43	-5.44	-5.32	-5.22	-5.26	-5.18	-5.16	-5.26
Finalmouse Small H-Pol EL F/B (01/27/2024)	-13.56	-13.36	-13.56	-13.47	-13.28	-13.22	-12.98	-12.85	-12.90
Finalmouse Small V-Pol EL L/R (01/27/2024)	-16.23	-16.36	-16.51	-16.57	-16.51	-16.47	-16.42	-16.42	-16.30
Finalmouse Small H-Pol EL L/R (01/27/2024)	-4.67	-4.48	-4.56	-4.50	-4.50	-4.59	-4.52	-4.53	-4.65

Average Gain Comparison: All data points averaged for each frequency and all angles (dBi)							Avg Gain (dBi)	Max Gain (dBi)
Frequency (MHz)	2452	2457	2462	2467	2472	2484	2.4 GHz ISM Band	
Finalmouse Small V-Pol Az (01/27/2024)	-10.91	-10.77	-10.82	-10.82	-10.98	-11.10	-10.88	-6.48
Finalmouse Small H-Pol Az (01/27/2024)	-12.18	-12.07	-12.19	-12.34	-12.61	-12.79	-12.45	-7.27
Finalmouse Small V-Pol EL F/B (01/27/2024)	-5.32	-5.35	-5.43	-5.55	-5.68	-5.97	-5.42	1.56
Finalmouse Small H-Pol EL F/B (01/27/2024)	-12.79	-12.59	-12.52	-12.58	-12.61	-12.73	-12.98	-8.69
Finalmouse Small V-Pol EL L/R (01/27/2024)	-16.11	-15.96	-15.80	-15.75	-15.75	-15.63	-16.18	-11.46
Finalmouse Small H-Pol EL L/R (01/27/2024)	-4.71	-4.70	-4.71	-4.74	-4.78	-4.87	-4.63	1.21

Overall Average Gain of All Frequencies and Orientations Tested (dBi)	
AUT	2.4 GHz ISM Band
Finalmouse Small V-Pol (01/27/2024)	-8.83
Finalmouse Small H-Pol (01/27/2024)	-8.22

Overall Average Gain	
AUT	2.4 GHz ISM Band
Finalmouse Small (01/27/2024)	-8.52

6 Conclusions

The gain data indicated the Ultralight X Cheetah meets the regulatory requirements specifically relative to the antenna performance.